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(72) Inventors: **KUBES, Vitezslav**; Dukelska 514, 562 01 Usti nad Orlici, Hylvaty (CZ). **NOVAK, Stanislav**; Slunecna 235, 533 72 Moravany (CZ).

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(74) Agent: **MUSIL, Dobroslav**; Zabrdovicka 11, 615 00 Brno (CZ).

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(71) Applicant: **MASCHINENFABRIK RIETER AG**

[CH/CH]; Klosterstrasse 20, CH-8406 Winterthur (CH).

(54) Title: METHOD OF HANDLING YARN DURING REPLACEMENT OF A BOBBIN WITH AN EMPTY TUBE AT A SPINNING STATION OF A YARN MANUFACTURING TEXTILE MACHINE AND A DEVICE FOR PERFORMING IT

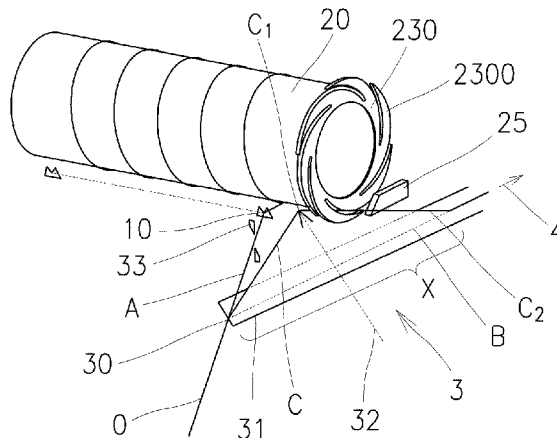


Fig. 3

(57) Abstract: The invention relates to a method of handling yarn (0) during replacement of a bobbin with an empty tube (20) at a spinning station of a yarn manufacturing textile machine. The yarn (0) continuously produced and sucked is deflected laterally by a handling arm (32) from the front internal portion of the suction tube (31) to a position in which the yarn (0) intersects the disc teeth path (2300). Peak (C₁) of this yarn deflection (0) lies opposite the extreme portion of the empty tube (20), whereupon the yarn (0) is caught on the toothed disc (230) in the portion (C₂) between the peak (C₁) and a vacuum channel (4) of the machine. Before winding yarn on the bobbin begins, yarn (0) reserve is formed on the tube (20) at a point opposite the peak (C₁). The invention also relates to a device and yarn (0) manufacturing textile machine.

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Method of handling yarn during replacement of a bobbin with an empty tube at a spinning station of a yarn manufacturing textile machine and a device for performing it

5 **Technical field**

The invention relates to a method of handling yarn during replacement of a bobbin with an empty tube at a spinning station of a yarn manufacturing textile machine, in which the spun yarn stops being wound on a bobbin and starts being sucked into a suction tube, whereupon after replacing the wound bobbin
10 with an empty tube the spun yarn is brought from the suction tube to a winding device, where the spun yarn is caught by a tooth of a disc of the winding device, by which means the yarn is interrupted, the yarn free end is sucked into the suction tube and the spun yarn starts to be wound onto a yarn reserve on the tube.

15 The invention also relates to a device for handling yarn during replacement of a bobbin with an empty tube at a spinning station of a yarn manufacturing textile machine, which comprises a suction tube connected to a vacuum channel of the machine.

In addition, the invention relates to a textile machine with a device for
20 handling yarn during replacement of a bobbin with an empty tube at a spinning station.

Background art

Spinning on high-performance spinning machines is characterized by an
25 effort to shorten or eliminate all unproductive times that generally reduce machine performance.

From this point of view, one of the possibilities of shortening the unproductive times of the machine is to shorten the time necessary to replace the wound bobbin with an empty tube. During such replacement, it is possible
30 either to interrupt spinning and, after performing the replacement of the bobbin with an empty tube, to resume the spinning process by the spinning-in

operation, or it is possible not to interrupt the spinning process, take over the yarn from a winding device to a suction device, suck the yarn produced during the exchange of the bobbin for an empty tube into the waste and, after replacing the bobbin with an empty tube, transfer the produced yarn back to the winding
5 device. Due to sucking the produced yarn to the waste while replacing the bobbin with an empty tube, some length of the yarn produced is lost, but the productivity of the machine increases because the time required to spin in the yarn is shortened, the presence of the piecer is removed and a risk of failure of any attempt to spin in the yarn is reduced.

10 Taking over the yarn being produced from the winding device to the suction device is possible either by using a service robot which is movable along a row of workstations and which is provided with i necessary working nodes and devices, including a handling device with a bobbin and a tube and a suction device, or it can be performed by a human operator using the so-called
15 doffing tube which can be connected by the operator to a vacuum channel of the machine at a respective spinning station.

The use of the service robot is demanding in terms of costs and operation, since the automatic elements of the robot are expensive and subject to wear and are exposed to environmental influences. Moreover, especially in
20 modern long machines, it is usually necessary to use several robots side by side and optimize their operation to avoid collisions, etc.

Using the human operator is described, e.g., in CZ PV 2014-344, according to which during replacement of the wound bobbin with an empty tube at a workstation of a spinning machine the winding device is stopped and the
25 spun yarn is interrupted upstream of the winding device, whereupon the spun yarn is sucked into a vacuum doffing tube which the operator has previously connected by to the vacuum channel of the machine at the given spinning station. After replacing the bobbin with an empty tube, the doffing tube is placed in a parking position at the respective spinning station and in this position the
30 spun yarn is guided through a rectifier outside a yarn traversing device, but through the path of a tooth of a disc of the winding device, by which the yarn is caught and interrupted, the free yarn end is sucked into the doffing tube and the next spun yarn begins to be wound on the tube as a yarn reserve. A signal is

sent to the control unit about the start of winding the yarn reserve. After a preset time has elapsed, the produced yarn is released from the rectifier, thereby terminating the winding of the yarn reserve, and subsequently the next yarn produced, which is now in the path of a traversing guide of a traversing device, begins to be wound along the entire width of the bobbin. The device used for performing this method comprises a hand-held vacuum doffing tube connectable to the vacuum channel of the machine at the workstation of the machine and further comprises a parking place for the vacuum doffing tube at the spinning station near the winding device. The parking place is provided with a sensor of the vacuum doffing tube presence and a controllable yarn rectifier is arranged upstream of the winding device to guide the yarn temporarily outside the traversing device during the winding of the yarn reserve on the empty tube. Both the sensor and the rectifier are connected to the control unit of the workstation of the machine.

The disadvantage of this solution is the need for a human operator, which still results in a certain error rate and inefficiency. Moreover, the operator must repeatedly connect and disconnect the doffing tube to the vacuum channel of the machine at each respective spinning station, etc.

The object of the invention is to eliminate or at least reduce the disadvantages of the background art.

Principle of the invention

The object of the invention is achieved by a method of handling yarn during replacement of a bobbin with an empty tube at a spinning station of a yarn manufacturing textile machine, whose principle consists in that after replacing the bobbin with an empty tube, the yarn continuously produced and sucked into the suction tube is deflected laterally from the front internal portion of the suction tube length to an outer position of the suction tube, in which the yarn intersects the path of teeth on a disc, the peak of this deflection of the yarn being situated opposite the extreme portion of the empty tube, whereupon the yarn in the section between the peak of the yarn deflection and the vacuum channel of the machine is caught by the toothed disc and a yarn reserve is

formed on the tube at a point opposite the peak of the yarn deflection before winding the yarn onto the bobbin is started.

For the safe and automatic removal of the unnecessary length of yarn, it is advantageous if the yarn is interrupted by a toothed disc during the formation
5 of the yarn reserve on the tube and the yarn end thus separated is sucked into the vacuum channel of the machine.

To resume the winding process, after the yarn reserve is formed on the tube, the yarn deflection to the top situated opposite the extreme portion of the empty tube is cancelled, the yarn running to the tube is caught by a traversing
10 guide of a traversing device and the standard process of winding the produced yarn onto the tube to form a bobbin is started.

To save energy, connection of the suction tube to the vacuum channel of the machine is interrupted after the separated end of the yarn has been sucked into the vacuum channel of the machine.

15 In order to create more space for the lateral deflection of the yarn by the lateral deflector, the lateral deflection of the yarn from the front portion of the suction tube length is performed by the temporarily opened portion of the suction tube on the side facing the winding device.

The principle of the device for handling yarn during replacement of a
20 bobbin with an empty tube at a spinning station of a yarn manufacturing textile machine consists in that to the suction tube is assigned a lateral deflector of yarn adapted to deflect the yarn from the inner space of the suction tube to the space next to the suction tube.

The advantage of this type of device is its reliability and low costs, and so
25 this device can be present at each spinning station of the machine.

For reasons of reliability and simplicity, it is advantageous if the lateral yarn deflector comprises a yarn handling arm whose working end is reciprocally movable between the inner space of the suction tube, where it is adapted to pick up the yarn sucked into the vacuum channel of the machine, and the outer
30 space next to the suction tube to a position corresponding to the peak of the yarn deflection.

So as to improve suction and at the same time to increase the space for the deflector, it is advantageous if the suction tube is from its suction mouth along its initial length provided with a longitudinal openable wall on the side of the suction tube facing the winding device.

5 For easy interruption of the yarn in the extreme position of the yarn in the traversing guide at the suction mouth of the suction tube, a yarn interrupter is assigned to the suction tube.

In order to control the suction tube and at least some parts of the process and the elements of the device, it is advantageous if the suction tube is
10 provided with a sensor of the yarn presence in the cavity of the suction tube.

The principle of the textile machine with the device for handling yarn during replacement of the bobbin with an empty tube at the spinning station consists in that the device for handling yarn according to any of claims 6 to 10 is mounted at each spinning station, the device is associated with a winding
15 device and is controllably connectable to the vacuum channel of the machine.

Description of the drawings

The invention is schematically represented in the drawings, wherein Fig. 1 shows a side view of an arrangement of a winding device, Fig. 2 shows a front
20 view of the arrangement of the winding device, Fig. 3 shows a diagram of overall yarn handling operation during replacement of the bobbin with an empty tube at a spinning station of a yarn manufacturing textile machine according to the invention, Fig. 4 represents an exemplary embodiment of a yarn handling device during replacement of the bobbin with an empty tube at the spinning
25 station of the yarn manufacturing textile machine in a state before the winding is completed and before suction of the produced yarn begins after the winding of yarn on the bobbin is interrupted according to the invention, Fig. 5 shows an exemplary embodiment of the yarn handling device during replacement of the bobbin with an empty tube at the spinning station of the yarn manufacturing
30 textile machine in a state after the winding is completed, after interrupting the yarn from the bobbin and after the suction of the produced yarn is started according to the invention, Fig. 6 shows an exemplary embodiment and of the

yarn handling device during replacement of the bobbin with an empty tube at the spinning station of the yarn manufacturing textile machine in a state after exchanging the bobbin for an empty tube and at the moment of passing the yarn to the bobbin according to the present invention.

5

Examples of embodiment

The invention will be described with reference to an exemplary embodiment at a spinning station of a yarn manufacturing spinning machine, e.g. a rotor spinning machine or an air-jet spinning machine. The invention can
10 also be adequately employed in other types of textile machines which use replacement of the wound bobbin with an empty tube.

A spinning machine comprises at least one row of identical spinning stations arranged next to each other. Each spinning station comprises a yarn forming spinning unit above which is arranged a draw-off mechanism of yarn
15 above which is arranged a device 1 for traversing yarn across the width of a yarn package 21 on a tube 20. The tube is mounted rotatably in arms 22, 23 of a winding device by means of rotary discs 220, 230 arranged on the arms 22, 23. One of the rotary discs 220, 230 is provided with known circumferential teeth 2300 for catching and/or interrupting yarn.

20 The bobbin, i.e. a tube 20 with a yarn package 21, or an empty tube 20 after replacing the wound bobbin, lies on a drive roller 24 during the spinning of yarn 0. The drive roller 24 has either an individual drive or it is mounted on a drive shaft running continuously along the entire length of the respective side of the machine.

25 On the side of the rotary disc 230 with the teeth 2300, a suction mouth 30 of a suction device 3 of yarn is arranged facing the winding device 2, or the side edge of the bobbin near the drive roller 24.

The suction device 3 comprises a suction tube 31, which is controllably connected to a vacuum channel 4 of the machine and which is from its suction
30 mouth 30 along its initial length provided with a longitudinal openable wall 310, which closes and opens a part X of the length of the wall of the suction tube 31 on the side of the suction tube 31 facing the winding device 2. In an

unillustrated example of embodiment, the suction tube **31** is from its suction mouth **30**, along its initial length, provided with a longitudinal cut-out, optionally with another means.

The suction device **3** further comprises a lateral deflector of yarn **0**, which
5 is adapted to deflect yarn **0** from the inner space of the suction tube **31** to the space next to the suction tube **31**. In an exemplary embodiment shown, the lateral deflector of yarn **0** comprises a handling arm **32** of yarn **0**, whose working end **320** is reciprocally movable between the inner space of the suction tube **31**, where it is adapted to pick up the yarn **0** sucked into the vacuum
10 channel **4** of the machine, and the outer space next to the suction tube **31** to a position corresponding to the peak **C₁** of the yarn **0** deflection, where the working end **320** is situated such that the yarn **0** caught on it intersects the path of the rotary disc **230** with the teeth **2300**. Assigned to the rotary disc **230** with the teeth **2300** is also an interrupter **25** of yarn **0** which serves to interrupt the
15 yarn **0** reliably if the yarn **0** was not interrupted by the mere action of the teeth **2300** on the rotary disc **230**.

The suction device **3** further comprises a cutting device **33** of yarn **0**, which is assigned to the extreme position of yarn **0** in the traversing guide **10** near the suction mouth **30** of the suction tube **31**.

20 In an unillustrated exemplary embodiment, the suction tube **31** is provided with a sensor of the presence of yarn **0** in the cavity of the suction tube **31**, ideally in the portion downstream of the openable wall **310** of the suction tube **31**.

The individual components and nodes are connected to energy sources,
25 or to appropriate drives, as well as to a control device (not shown).

During the normal spinning process, the yarn **0** is traversed along the width of the bobbin by the traversing guide **10** of yarn **0** in the path **A** and is continuously wound onto the bobbin. When the required bobbin size is obtained, i.e. after obtaining the required size of the yarn package **21** on the
30 tube **20**, or after the arrival of a doffer to the spinning station, or after pressing the operator button, the replacement of the wound bobbin with an empty tube **20** is started. At the same time, the mouth **30** of the suction tube **31** starts to

suck air into the vacuum channel 4 of the machine and the yarn 0 is interrupted by the cutting device 33 of yarn 0. The yarn 0 end leading to the bobbin is wound onto the bobbin which is now already prepared to be replaced with an empty tube 20. The yarn 0 end leading to the spinning unit, which is continuously producing the yarn 0, is sucked in path B into the suction device 30 of the suction tube 31. Preferably, the openable wall 310 of the suction tube 31 is at that moment closed, which increases the suction effect of the suction mouth 30 of the suction tube 31. The produced yarn 0 is now in path B taken by the suction tube 31 to the vacuum channel 4 of the machine.

Replacement of the bobbin with an empty tube 20 is performed by any of the known methods in which the bobbin is removed from the arms 22, 23 of the winding device 2 and an empty tube 20 is inserted between rotary discs 220 230 of the arms 22, 23. Specifically, this is done either automatically or semi-automatically or manually by the machine operator. In this case, it is ideal to replace the bobbin with an empty tube 20 automatically by tilting the arms 22, 23 to a rear position, where the arms open by means of an electric or pneumatic drive, wherein the bobbin falls out of the arms 22, 23 under its own weight onto a slide from which it then rolls further onto a conveyor belt, whereby during the backward movement of the arms 22, 23 to the front position, the empty tube 20 is inserted into the arms 22, 23. Another possibility of exchanging the bobbin for an empty tube 20 is to roll the bobbin onto the conveyor belt after opening the arms 22, 23 by means of a movable arm (not shown) of a doffer (not shown), by which the empty tube 20 is thereafter inserted between the arms. The bobbin can be also replaced with an empty tube 20 by the machine operator, who rolls out the bobbin 22, 23 onto the conveyor belt after the arms are opened and then inserts the empty tube 20 into the arms 22, 23, etc.

After replacing the bobbin with an empty tube 20, the empty tube 20 in the arms 22, 23 is lowered onto the drive roller 24 of the winding device 2 and starts rotating. The yarn 0 which is continuously produced and sucked into the suction tube 31 is deflected laterally in the direction of the arrow 34 in Fig. 3 from the front portion of the suction tube length 31 to a position in which the yarn 0 intersects the path of the teeth 2300 on the disc 230. In an exemplary embodiment shown in Fig. 6, the yarn is deflected by deflecting the working end

320 of the handling arm 32, while opening simultaneously the front portion of the suction tube length 31 by tilting off the openable wall 310, or the handling arm 32 passes through the longitudinal cut-out in the suction tube 31, etc. The yarn is now deflected to a curved path with arms C and C₂, whereby the peak C₁ of the yarn 0 deflection, or, in other words, the deflection of the working end 320 of the handling yarn 32, is situated opposite the extreme portion of the empty tube 20. The yarn 0, which now with its arm C₂ between the peak C₁ of the yarn 0 deflection and the vacuum channel 4 of the machine intersects the path of the teeth 3200 of the toothed disc 230 is caught by the toothed disc 230 and a yarn 0 reserve begins to form on the tube 20 at a point opposite the peak C₁, or against the working end 320 of the handling arm 32. Simultaneously, the deflected yarn 0 is caught by the toothed disc 230 in the arm C₂ between the peak C₁ of the yarn 0 deflection and the vacuum channel 4 of the machine, which results in the interruption of the yarn 0 between the toothed disc 230 and the vacuum channel 4 of the machine, and this separated yarn end is sucked into the vacuum channel 4 of the machine. The yarn 0 continuously produced now forms a yarn 0 reserve on the tube 20 and after its formation, the working end 320 of the handling yarn 32 returns to its initial position in the suction tube 31, the yarn 0 is caught by the traversing guide 10 of the traversing device 1 of the spinning station and the standard winding process of the produced yarn 0 onto the tube 20 is started to form a package. The openable wall 310 of the suction tube 31 closes the front portion X of the suction tube length 31 and interrupts the connection of the suction tube 31 to the vacuum channel 4 of the machine due to energy savings and reduction of pressure loss.

In an unillustrated example of embodiment, the handling arm 32 is mounted outside the suction tube 31 and only the working end 320 of the handling yarn 32, which deflects the yarn from the path B to the curved path with the arms C and C₂ extends into the suction tube 31.

In an exemplary embodiment shown, the suction tube 31 has a circular cross-section. In an unillustrated example of embodiment, the suction tube 31 has another suitable shape of the cross-section, such as prismatic or square or oval, etc.

Now the replacement of the bobbin with an empty tube 20 is finished by means of the suction device 3 arranged at each spinning station of the machine without interrupting the yarn production at the spinning station.

PATENT CLAIMS

1. A method of handling yarn (0) during replacement of a bobbin with an empty tube (20) at a spinning station of a yarn manufacturing textile machine, in which the spun yarn (0) stops being wound on the bobbin and starts being sucked into a suction tube (31), whereupon after replacing the wound bobbin with an empty tube (20), the spun yarn (0) is brought from the suction tube to a winding device (2), where the spun yarn is caught by a tooth (2300) of a disc (230) of a winding device (2), by which means the yarn (0) is interrupted, the free end of the yarn (0) is sucked into the suction tube (31) and the spun yarn (0) starts to be wound onto a yarn reserve on the tube (20), **characterized in that** after replacing the wound bobbin with an empty tube (20) the yarn (0) continuously produced and sucked into the suction tube (31) is deflected by a handling arm (32) laterally from the front internal portion of the suction tube length (31) to a position in which the yarn (0) intersects the path (2300) of the teeth on the disc, wherein the peak (C1) of this yarn deflection (0) lies against the extreme portion of the empty tube (20), whereupon the yarn (0) is caught on the toothed disc (230) in the portion (C2) between the yarn deflection peak (C1) and a vacuum channel (4) of the machine and before winding the yarn on the bobbin begins, a yarn reserve (0) is formed on the tube (20) at a point opposite the yarn deflection peak (C1).

2. The method according to Claim 1, **characterized in that** during the yarn (0) reserve formation on the tube (20), the yarn (0) is interrupted by the toothed disc (320) and the thus separated yarn (0) end is sucked into the vacuum channel (4) of the machine.

3. The method according to Claim 1 or 2, **characterized in that** after the yarn (0) reserve has been formed on the tube (20), the yarn (0) deflection to the peak (C1) against the end of the empty tube (20) is cancelled, the yarn (0) running to the tube (20) is caught by a traversing guide (10) of a traversing device and the standard winding of the produced yarn (0) onto the tube (20) is started to form a bobbin.

4. The method according to Claim 2, **characterized in that** after the separated yarn (0) end is sucked into the vacuum channel (4) of the machine,

the connection of the suction tube (31) to the vacuum channel (4) of the machine is interrupted.

5 5. The method according to any Claims 1 to 4, **characterized in that** the lateral deflection of the yarn (0) from the front portion of the suction tube length (31) is performed by a temporarily open portion of the suction tube length (31) on the side facing the winding device (2).

10 6. A device for handling yarn (0) during the replacement of a bobbin with an empty tube (20) at a spinning station of a yarn manufacturing textile machine (20), which comprises a suction tube (31) connected to a vacuum channel (4) of the machine, **characterized in that** the suction tube (31) is associated with a lateral yarn (0) deflector with reversibly displaceable handling arm (32) of yarn (0) adapted to deflect the sucked yarn (0) from the inner space of the suction tube (31) to the space next to the suction tube (31) into position corresponding to the peak (C₁).

15 7. The device according to Claim 6 7, **characterized in that** the suction tube (31) is provided at its initial length from its suction mouth (30) with a longitudinal openable wall (310) on the side of the suction tube (31) facing the winding device (2).

20 8. The device according to any of Claims 6 to 7, **characterized in that** a yarn (0) cutting device (33) is associated with the suction tube (31), the yarn (0) cutting device (33) being adapted to interrupt the yarn (0) in the extreme position of the yarn (0) in a traversing guide (10) at the suction mouth (30) of the suction tube (31).

25 9. The device according to any of Claims 6 to 8, **characterized in that** the suction tube (31) is provided with a sensor of the presence of yarn (0) in the cavity of the suction tube (31).

30 10. A yarn manufacturing textile machine with a device for handling yarn (0) during replacement of a bobbin with an empty tube (20) at a spinning station, **characterized in that** at each spinning station is arranged a winding device (2) with a device for handling yarn (0) according to any of Claims 6 to 9, which is controllably connected to the vacuum channel (4) of the machine.

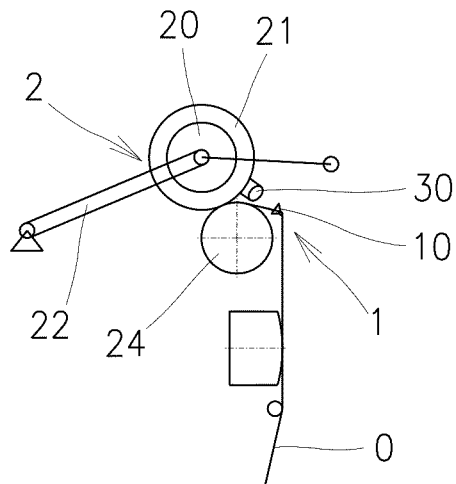


Fig. 1

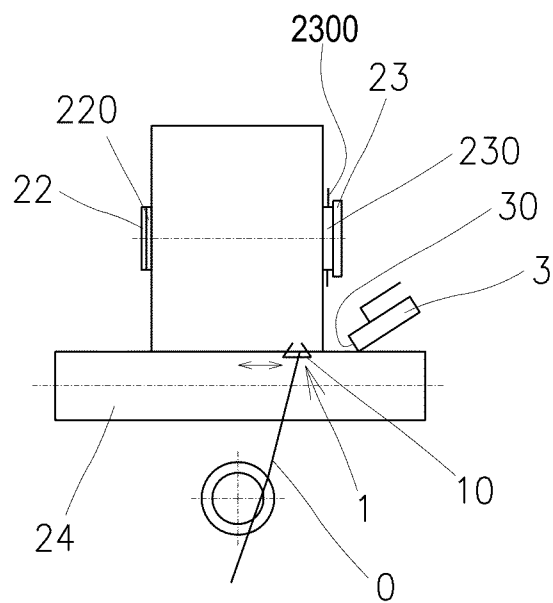


Fig. 2

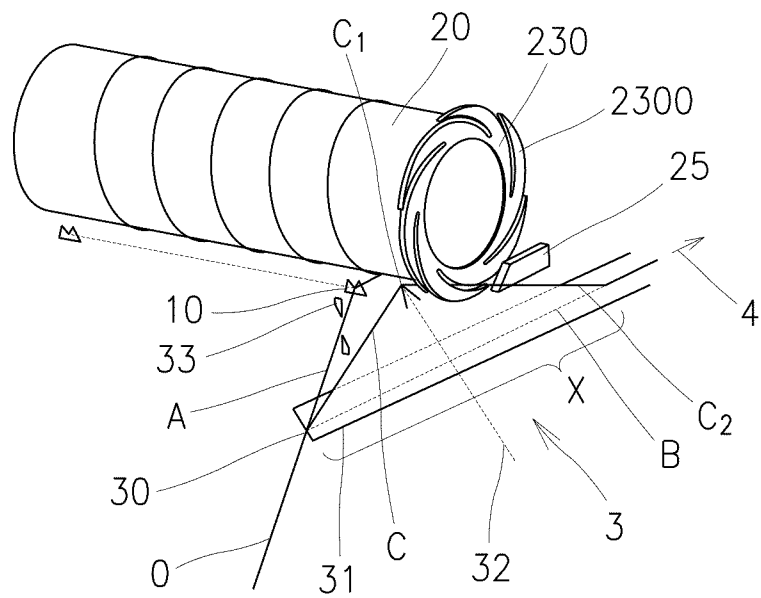


Fig. 3

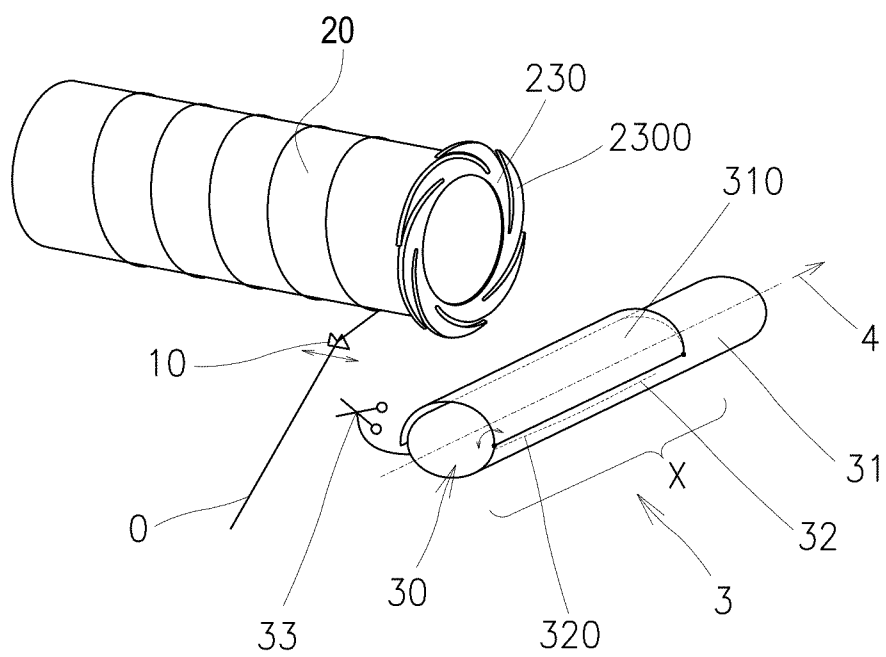


Fig. 4

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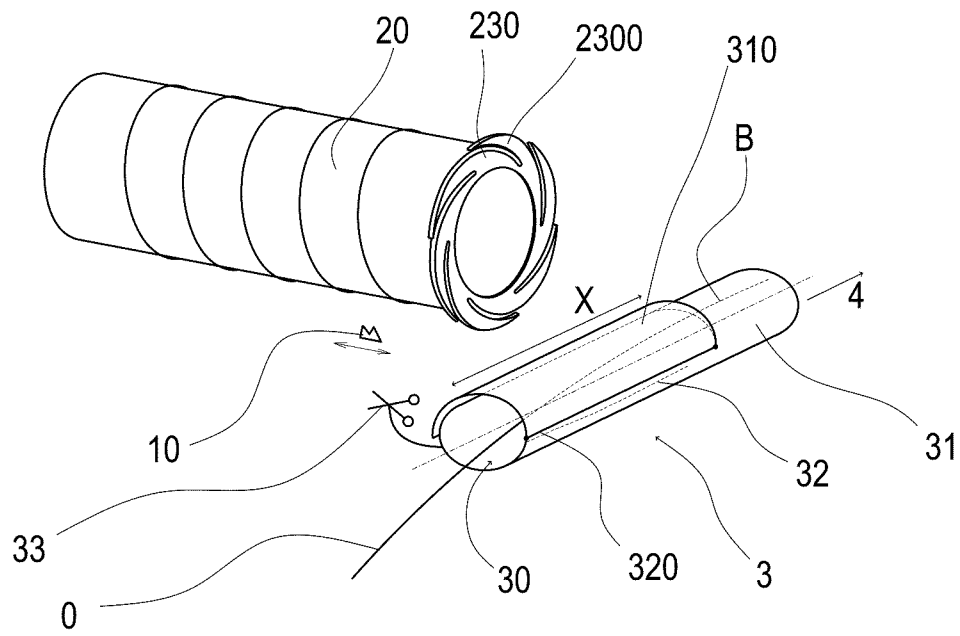


Fig. 5

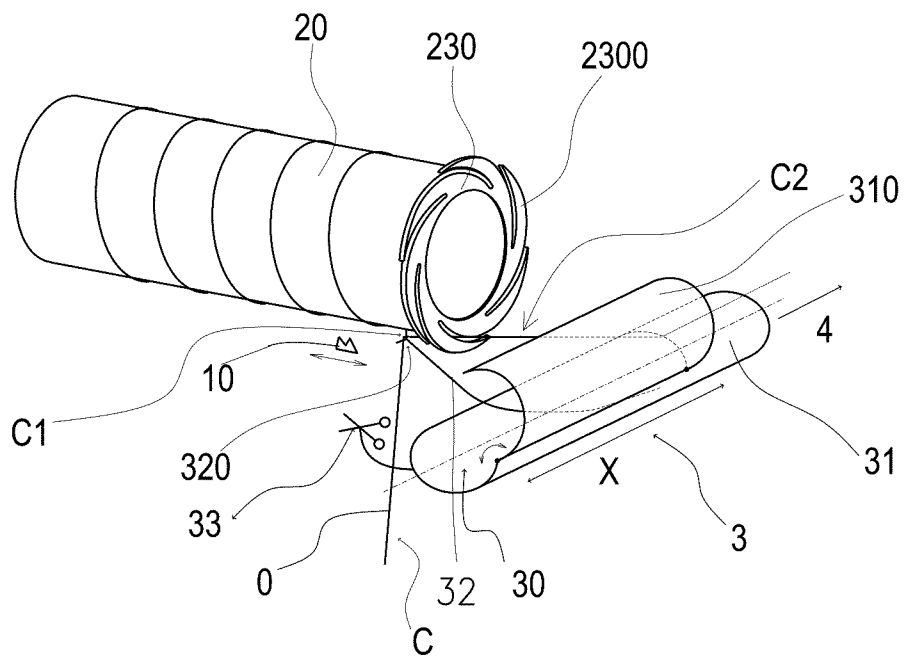


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/067135

A. CLASSIFICATION OF SUBJECT MATTER
INV. D01H9/02 B65H67/04 D01H1/38
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D01H B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	EP 3 144 257 A1 (RIETER INGOLSTADT GMBH [DE]) 22 March 2017 (2017-03-22) abstract paragraph [0043] - paragraph [0053] figures 2a-2f paragraph [0054] - paragraph [0065] figures 3a-3h -----	1-4,6,8, 10 9
Y	US 5 426 929 A (SCHWALM HANS-WERNER [DE] ET AL) 27 June 1995 (1995-06-27) abstract; figures 1-5 -----	9
A	EP 0 148 419 A1 (SCHUBERT & SALZER MASCHINEN [DE]) 17 July 1985 (1985-07-17) the whole document ----- -/-	1,6



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INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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