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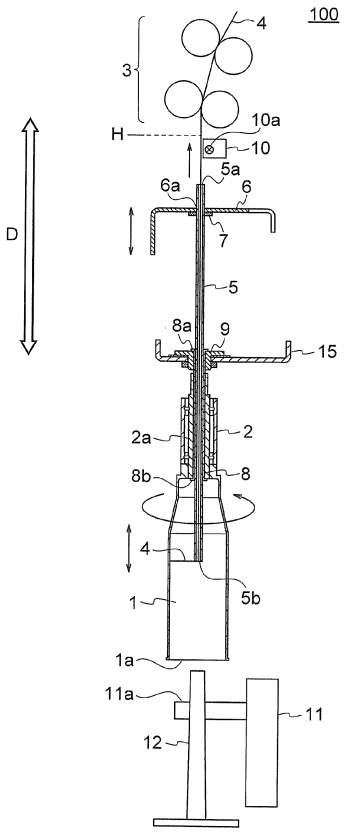
(54) POT SPINNING MACHINE

(57) A pot spinning machine includes a pot (1) that has a downward-facing opening (1a) and rotates, a yarn guide (5) that is inserted into the interior of the pot (1) through an attachment hole (1c) formed in an upper portion of the pot (1) in order to guide yarn (4) into the interior of the pot (1), and a yarn guide rail (6) that holds the yarn guide (5) and is capable of moving in an elevation direction, wherein the yarn guide (5) is held by the yarn guide rail (6) via a yarn guide holder (7), and a holding force (P1) of the yarn guide holder (7) is smaller than a resistance force (P2) that acts on the yarn guide (5) when a wound-up part (Y) formed as a result of the yarn (4) being wound around the yarn guide (5) contacts a non-elevating member (8, 2a). As a result, force generated when the yarn wound around the yarn guide (5) contacts another component can be alleviated even when the yarn (4) undergoes yarn guide wind-up.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a pot spinning machine.

2. Description of the Related Art

[0002] A pot spinning machine using a cylindrical pot is known as one type of spinning machine. In a pot spinning machine, a cake is formed by rotating the pot at a predetermined rotation frequency and guiding yarn drawn out to a predetermined thickness into the pot through a yarn guide so that the yarn is wound around an inner wall of the pot. Further, when cake formation is complete, the yarn is cut on the upstream side of the yarn guide, whereupon a bobbin is inserted into the pot and the yarn is rewound onto the bobbin from the inner wall of the pot.

[0003] In a conventional pot spinning machine, while a cake C is being formed by winding yarn 104 around the inner wall of a pot 101, as shown in FIG. 7A, the yarn 104 may be wound around a yarn guide 105, as shown in FIG. 7B. This phenomenon is known as "yarn guide wind-up". When the yarn 104 is wound around the yarn guide 105, a wound part Y of the yarn is formed on the outside of the yarn guide 105. Hence, when the bobbin is inserted into the pot following formation of the cake and the yarn guide 105 is moved in order to avoid contact between the yarn guide 105 and the bobbin, as shown in FIG. 7C, the wound part Y of the yarn that is wound around the yarn guide 105 may contact the rotating pot 101. When the wound part Y of the yarn contacts the pot 101, component damage such as bending of the yarn guide 105 may occur.

[0004] Hence, in a spinning machine described in Patent Document 1 (Japanese Examined Patent Publication No. S26-003129), air is ejected from a tip end portion of a yarn guide, and by controlling the airstream near the tip end portion of the yarn guide, yarn is prevented from being wound up around the yarn guide.

SUMMARY OF THE INVENTION

[0005] However, even when the airstream near the tip end portion of the yarn guide is controlled, as in the spinning machine described in Patent Document 1, yarn guide wind-up of the yarn cannot be completely prevented.

[0006] The present invention has been devised to solve the problem described above, and an object thereof is to provide a pot spinning machine with which component damage can be prevented when yarn undergoes yarn guide wind-up.

[0007] To solve the problem described above, a pot spinning machine according to the present invention includes a pot that has a downward-facing opening and rotates, a yarn guide that is inserted into the interior of the pot through an attachment hole formed in an upper portion of the pot in order to guide yarn into the interior of the pot, and a yarn guide rail that holds the yarn guide and is capable of moving in an elevation direction, wherein the yarn guide is held by the yarn guide rail via a yarn guide holder, and a holding force of the yarn guide holder is smaller than a resistance force that acts on the yarn guide when a wound-up part formed as a result of the yarn being wound around the yarn guide contacts a non-elevating member.

[0008] Thus, even when the yarn undergoes yarn guide wind-up, force generated when the yarn wound around the yarn guide contacts another component can be alleviated, and as a result, component damage can be prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a schematic view showing an overall structure of a spindle part of a pot spinning machine according to an embodiment of the present invention;
FIG. 2 is an enlarged sectional view showing the vicinity of a lower end portion of a yarn-guide guide of the pot spinning machine shown in FIG. 1;
FIG. 3 is an enlarged sectional view showing a contact location between a yarn guide holder and a yarn guide of the pot spinning machine shown in FIG. 1;
FIG. 4 is a flowchart showing the flow of an operation performed by the pot spinning machine shown in FIG. 1;
FIGS. 5A to 5C are views showing a process by which the yarn guide moves relative to a yarn guide rail so as to withdraw from the yarn guide rail;
FIG. 6 is an enlarged sectional view showing an engagement location between a yarn guide holder and a yarn guide of a pot spinning machine according to another embodiment of the present invention; and
FIGS. 7A to 7C are views showing a process by which yarn is wound around a yarn guide of a conventional pot spinning machine, wherein FIG. 7A is a view showing a state in which a cake is formed on an inner wall of a pot, FIG. 7B is a view showing a state in which the yarn undergoes yarn guide wind-up following formation of the cake, and FIG. 7C is a view showing a state in which the yarn guide, around which the yarn is wound, has moved upward.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] Embodiments of the present invention will be described below on the basis of the attached figures.

[0011] FIG. 1 is a schematic view showing a spindle part 100 of a pot spinning machine. Note that a plurality

of the spindle part 100 of the pot spinning machine are to be used when provided in a line on a machine base, not shown in the figure.

[0012] As shown in FIG. 1, the spindle part 100 of the pot spinning machine includes a substantially cylindrical pot 1. The pot 1 has a downward-facing opening 1a. A bobbin 12 is provided below the pot 1. The bobbin 12 is capable of ascending and descending in an elevation direction D, or in other words a vertical direction, and when the bobbin 12 ascends to a maximum point, the bobbin 12 is housed in the interior of the pot 1.

[0013] A pot support portion 2 is attached to the top of the pot 1. A bearing 2a is provided in the interior of the pot support portion 2. Further, a yarn-guide guide 8 is provided in a hollow portion in the interior of the bearing 2a. The yarn-guide guide 8 is provided so as not to contact the bearing 2a. The yarn-guide guide 8 is formed in a substantially cylindrical shape, and flanges 8a, 8b are formed respectively on an upper end and a lower end of the yarn-guide guide 8. As shown in FIG. 2, the flange 8b on the lower end of the yarn-guide guide 8 is disposed on the lower side of a lower end of the bearing 2a of the pot support portion 2 and an upper surface 1b of an interior space of the pot 1. Furthermore, the pot 1 is capable of rotating relative to the yarn-guide guide 8 via the bearing 2a. Moreover, a yarn guide 5 for guiding yarn 4 into the interior of the pot 1 is housed in the interior of the yarn-guide guide 8 to be capable of moving in the elevation direction D. Note that the bearing 2a and the yarn-guide guide 8 are inserted into the interior of the pot 1 through an attachment hole 1c formed in an upper portion of the pot 1, and therefore the bearing 2a and the yarn-guide guide 8 are provided between the yarn guide 5 and the pot 1. Furthermore, as shown in FIG. 1, a lower end of the yarn guide 5 projects into the interior of the pot 1. A yarn discharge port 5b for discharging the yarn 4 is formed in the lower end of the yarn guide 5. Moreover, the yarn guide 5 extends so as to project from an upper end of the pot support portion 2.

[0014] Further, a guide holder rail 15 is provided above the pot support portion 2. A guide holder 9 is attached to the guide holder rail 15. The flange 8a on the upper end of the yarn-guide guide 8 is engaged with the guide holder 9 such that the yarn-guide guide 8 is supported by the guide holder 9.

[0015] Furthermore, an upper end part of the yarn guide 5 is held by a yarn guide rail 6. A yarn guide holding hole 6a that is penetrated by the yarn guide 5 is formed in the yarn guide rail 6. Further, as shown in FIG. 3, a gap is present between the yarn guide 5 and the yarn guide holding hole 6a. An annular yarn guide holder 7 is attached to a lower side surface of the yarn guide rail 6 so as to extend around the yarn guide holding hole 6a. The yarn guide holder 7 is formed from resin. The yarn guide holder 7 holds the yarn guide 5 by a holding force P1. The holding force P1 is frictional force generated between the yarn guide 5 and the yarn guide holder 7. In other words, the yarn guide rail 6 holds the yarn guide 5 by the holding force P1 via the yarn guide holder 7. Note that by applying a larger force than the holding force P1 to the yarn guide 5, the yarn guide 5 can be moved in the elevation direction D relative to the yarn guide rail 6. Furthermore, as shown in FIG. 1, the yarn guide rail 6 is capable of moving in the elevation direction D while holding the yarn guide 5. Moreover, an upper limit of the height of an upper end 5a of the yarn guide 5 when the yarn guide 5 ascends together with the yarn guide rail 6 is set as an upper limit height H.

[0016] A drafting device 3 for drawing out the yarn to a predetermined thickness is provided on the upper side of the yarn guide rail 6. Further, a yarn guide sensor 10 is provided between the drafting device 3 and the yarn guide rail 6. The yarn guide sensor 10 is a reflective optical sensor. The yarn guide sensor 10 is provided such that an optical axis 10a thereof is positioned below the upper limit height H of the upper end 5a of the yarn guide 5.

[0017] Further, a wagon-type bobbin removal device 11 is provided on the machine base on which the plurality of spindle parts 100 of the pot spinning machine are arranged so as to be capable of moving in the arrangement direction of the spindle parts 100 of the pot spinning machine. The bobbin removal device 11 is capable of gripping and removing the bobbin 12 of each of the spindle parts 100 of the pot spinning machine using a robot arm 11a.

[0018] The bobbin removal device 11 constitutes a bobbin withdrawing mechanism.

[0019] Next, using FIG. 4, an operation of the spindle part 100 of the pot spinning machine will be described.

[0020] First, as shown in step S1 of FIG. 4, a cake is formed on an inner wall of the pot 1. More specifically, as shown in FIG. 1, as the pot 1 rotates at high speed, the yarn 4 is guided into the interior of the pot 1 by the yarn guide 5, whereupon the yarn 4 is discharged through the yarn discharge port 5b in the lower end of the yarn guide 5. Centrifugal force generated by the rotation of the pot 1 acts on the yarn 4 such that the yarn 4 is pressed against the inner wall of the pot 1, and as a result, a cake is formed. At this time, the yarn guide rail 6 reciprocates in the elevation direction D such that the yarn 4 is discharged and the cake is formed as the position of the yarn discharge port 5b in the lower end of the yarn guide 5 is moved.

[0021] Note that although the pot 1 rotates at high speed, the yarn-guide guide 8 remains stationary. Here, the yarn-guide guide 8 constitutes a non-rotating portion.

[0022] Next, as shown in step S2 of FIG. 4, following formation of the cake, the yarn guide rail 6 is raised. Then, as shown in step S3, a determination is made as to whether or not the yarn guide 5 has been detected by the yarn guide sensor 10. When the yarn guide sensor 10 detects that the yarn guide 5 is ascending together with the yarn guide rail 6, this means that the yarn guide 5 is held by the yarn guide rail 6, and accordingly, it is determined that the yarn 4 is not undergoing yarn guide wind-up. The

operation of the spindle part 100 of the pot spinning machine then advances as normal to a step (step S4) for rewinding the yarn 4 around the bobbin 12.

[0023] When the yarn guide 5 has not been detected by the yarn guide sensor 10, however, it is determined in step S3 that the yarn 4 is undergoing yarn guide wind-up. More specifically, as shown in FIG. 5A, the yarn 4 is wound around the yarn guide 5 such that a wound part Y of the yarn is formed on the outer periphery of the yarn guide 5. As shown in FIG. 5B, when the yarn guide rail 6 and the yarn guide 5 ascend, the wound part Y of the yarn contacts the flange 8b on the lower end of the yarn-guide guide 8 such that a downward resistance force P2 is generated in the yarn guide 5. When this resistance force P2 exceeds the holding force P1 by which the yarn guide rail 6 holds the yarn guide 5, the upper end of the yarn guide 5 moves in a downward direction relative to the yarn guide holding hole 6a of the yarn guide rail 6, as shown in FIG. 5C, so as to withdraw from the yarn guide holding hole 6a. Hence, when the yarn 4 is wound around the yarn guide 5, the yarn guide sensor 10 provided on the upper side of the yarn guide rail 6 cannot detect the presence of the yarn guide 5. In other words, the yarn guide sensor 10 detects that the yarn guide 5 is not held by the yarn guide rail 6.

[0024] Hence, when the yarn 4 undergoes yarn guide wind-up, the bobbin removal device 11 grips and removes the bobbin 12 using the robot arm 11a, as indicated by step S5 of FIG. 4.

[0025] Thus, in the pot spinning machine according to this embodiment, the holding force P1 by which the yarn guide holder 7 provided on the yarn guide rail 6 holds the yarn guide 5 is smaller than the resistance force P2 exerted on the yarn guide 5 when the wound part Y formed around the yarn guide 5 contacts a non-elevating member. Accordingly, when the resistance force P2 acts on the yarn guide 5, the yarn guide 5 then becomes able to move in the elevation direction D relative to the yarn guide rail 6, thereby alleviating a force generated when the wound part Y formed around the yarn guide 5 contacts another member. As a result, component damage to the spindle part 100 of the pot spinning machine is prevented from occurring even when the yarn 4 undergoes yarn guide wind-up around the yarn guide 5.

[0026] Note that in this embodiment, the pot 1, the bearing 2a, and the yarn-guide guide 8 are non-elevating members.

[0027] Further, the yarn guide 5 is held on the yarn guide rail 6 by the frictional force generated between the yarn guide 5 and the yarn guide holder 7. As a result, the yarn guide 5 can be held using a simple structure, and when the resistance force P2 is exerted on the yarn guide 5 in a predetermined amount or more, the yarn guide 5 can easily move in the elevation direction D relative to the yarn guide rail 6.

[0028] Furthermore, the yarn guide sensor 10 detects whether or not the yarn guide 5 is held by the yarn guide rail 6. Hence, by detecting that the yarn guide 5 has moved in the downward direction relative to the yarn guide rail 6 so as to withdraw from the yarn guide rail 6, it can be determined that the yarn 4 is undergoing yarn guide wind-up around the yarn guide 5.

[0029] Moreover, when the yarn 4 undergoes yarn guide wind-up around the yarn guide 5, the wound part Y of the yarn that is wound around the yarn guide 5 contacts the flange 8b on the lower end of the yarn-guide guide 8 serving as the non-rotating portion. Hence, even when the wound part Y of the yarn contacts a rotating member such as the pot 1, the force generated by the contact can be reduced.

[0030] Furthermore, when it is determined that the yarn 4 is undergoing yarn guide wind-up around the yarn guide 5, the yarn guide 5 is capable of moving in the elevation direction D relative to the yarn guide rail 6, and therefore contact may occur between the yarn guide 5 and the bobbin 12. Hence, the bobbin removal device 11 removes the bobbin 12 to prevent contact between the yarn guide 5 and the bobbin 12.

[0031] Note that the yarn guide sensor 10 may display an alarm after detecting that the yarn guide 5 has moved in the downward direction relative to the yarn guide rail 6 so as to withdraw from the yarn guide rail 6, whereupon the bobbin 12 may be removed manually. Further, instead of removing the bobbin 12, contact between the yarn guide 5 and the bobbin 12 can be prevented by laying the bobbin 12 down in a horizontal orientation so that the bobbin 12 is retracted.

[0032] Note that in this embodiment, the yarn guide 5 is held on the yarn guide rail 6 by the frictional force generated between the yarn guide 5 and the yarn guide holder 7, but the method of holding the yarn guide 5 is not limited thereto.

[0033] For example, as shown in FIG. 6, a recess 13 may be formed in the outer periphery of the yarn guide 5, and the yarn guide 5 may be held on the yarn guide rail 6 by engaging the recess 13 with a projection 14 formed on the yarn guide holder 7. Alternatively, the yarn guide 5 may be held on the yarn guide rail 6 by forming a projection on the outer periphery of the yarn guide 5 and a recess in the yarn guide holder 7, and engaging the projection formed on the yarn guide 5 with the recess formed in the yarn guide holder 7.

[0034] Further, the holding force P1 for holding the yarn guide 5 on the yarn guide rail 6 may be the magnetic force of a magnet or the elastic force of a spring member.

[0035] Furthermore, when the yarn guide holder is a spring member, the yarn guide sensor may determine whether or not the yarn guide 5 has moved in the downward direction so as to withdraw from the yarn guide rail 6 by detecting movement of the yarn guide holder.

[0036] Moreover, the yarn guide sensor 10 is not limited to a reflective optical sensor and may be a transmissive optical sensor or a contact-type sensor.

[0037] Furthermore, the yarn guide sensor 10 may be attached directly to the vicinity of the yarn guide holding hole 6a in the yarn guide rail 6.

[0038] Further, instead of providing the flange 8b on the lower end of the yarn-guide guide 8, the wound part Y of the yarn that is wound around the yarn guide 5 may directly contact the lower end of the yarn-guide guide 8 formed without a flange.

[0039] Furthermore, in a case where the bearing 2a includes an inner race that remains in a stationary state and an outer race that rotates relative to the inner race, the inner race of the bearing 2a may serve as the non-rotating portion that is contacted by the wound part Y of the yarn wound around the yarn guide 5.

[0040] Moreover, even when the yarn-guide guide 8 rotates together with the pot 1, the yarn guide 5 moves in the downward direction relative to the yarn guide rail 6, and therefore the force generated by the contact between the wound part Y of the yarn wound around the yarn guide 5 and the yarn-guide guide 8 is sufficiently alleviated.

[0041] Furthermore, in FIG. 5C, the yarn guide 5 withdraws from the yarn guide rail 6 so as to be separated therefrom, but the present invention is not limited thereto, and as long as the yarn guide 5 moves relative to the yarn guide rail 6 in the downward direction, the force generated by the contact between the wound part Y of the yarn and the yarn-guide guide 8 is alleviated even if the yarn guide 5 does not withdraw from the yarn guide rail 6.

[0042] A pot spinning machine includes a pot that has a downward-facing opening and rotates, a yarn guide that is inserted into the interior of the pot through an attachment hole formed in an upper portion of the pot in order to guide yarn into the interior of the pot, and a yarn guide rail that holds the yarn guide and is capable of moving in an elevation direction, wherein the yarn guide is held by the yarn guide rail via a yarn guide holder, and a holding force of the yarn guide holder is smaller than a resistance force that acts on the yarn guide when a wound-up part formed as a result of the yarn being wound around the yarn guide contacts a non-elevating member. As a result, force generated when the yarn wound around the yarn guide contacts another component can be alleviated even when the yarn undergoes yarn guide wind-up.

Claims

1. A pot spinning machine comprising:

   a pot (1) that has a downward-facing opening (1a) and rotates;
   a yarn guide (5) that is inserted into the interior of the pot (1) through an attachment hole (1c) formed in an upper portion of the pot (1) in order to guide yarn (4) into the interior of the pot (1); and
   a yarn guide rail (6) that holds the yarn guide (5) and is capable of moving in an elevation direction (D),
   the pot spinning machine being **characterized in that** the yarn guide (5) is held by the yarn guide rail (6) via a yarn guide holder (7), and
   a holding force (P1) of the yarn guide holder (7) is smaller than a resistance force (P2) that acts on the yarn guide (5) when a wound-up part (Y) formed as a result of the yarn (4) being wound around the yarn guide (5) contacts a non-elevating member (8, 2a).

2. The pot spinning machine according to claim 1, wherein the yarn guide rail (6) holds the yarn guide (5) using frictional force generated between the yarn guide (5) and the yarn guide holder (7).

3. The pot spinning machine according to claim 1, wherein the yarn guide (5) includes a recess (13),
   the yarn guide holder (7) includes a projection (14) that can be engaged with the recess (13) formed in the yarn guide (5), and
   the yarn guide rail (6) holds the yarn guide (5) by engaging the recess (13) formed in the yarn guide (5) with the projection (14) formed on the yarn guide holder (7).

4. The pot spinning machine according to any one of claims 1 to 3, further comprising a yarn guide sensor (10) that detects that the yarn guide (5) is held on the yarn guide rail (6).

5. The pot spinning machine according to any one of claims 1 to 4, wherein a non-rotating portion that does not rotate relative to the yarn guide (5) is provided between the pot (1) that rotates and the yarn guide (5), and
   when the yarn guide (5) is moved to an upper side by the yarn guide rail (6) in a state where the yarn (4) is wound around the yarn guide (5) due to yarn guide wind-up, the yarn (4) wound around the yarn guide (5) contacts the non-rotating portion.

6. The pot spinning machine according to claim 5, wherein the non-rotating portion (8) is a yarn-guide guide (8) having a cylindrical shape and provided between the pot (1) and the yarn guide (5),
   the yarn guide (5) is housed in the interior of the yarn-guide guide (8) so as to be capable of moving in the elevation direction (D),
   a flange (8a, 8b) is formed on an end of the yarn-guide guide (8), and
   when the yarn guide (5) is moved to the upper side by the yarn guide rail (6) in a state where the wound part (Y) is formed as a result of the yarn (4) being wound around the yarn guide (5), the wound part (Y) contacts the flange (8a, 8b) formed on the yarn-guide guide (8).

FIG. 1

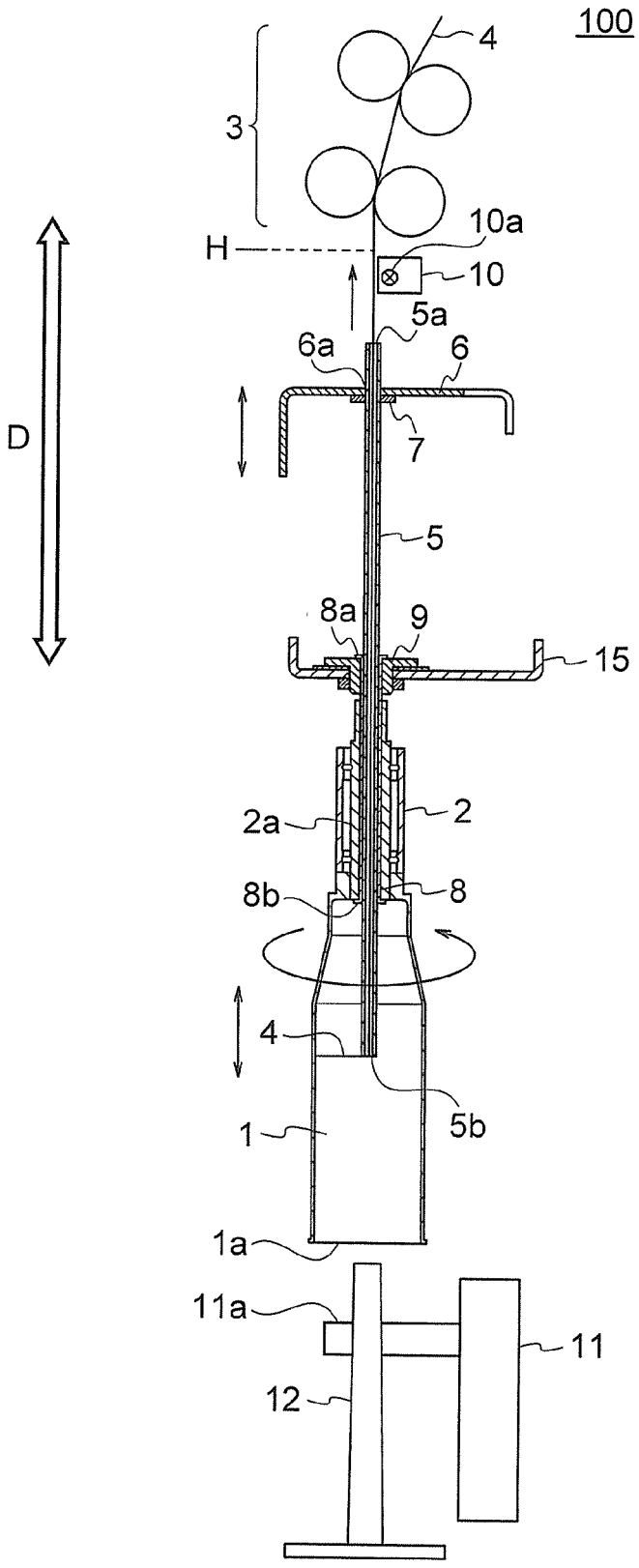


FIG. 2

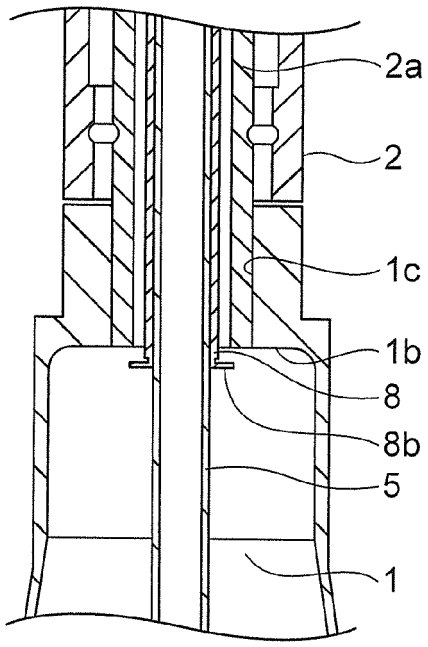


FIG. 3

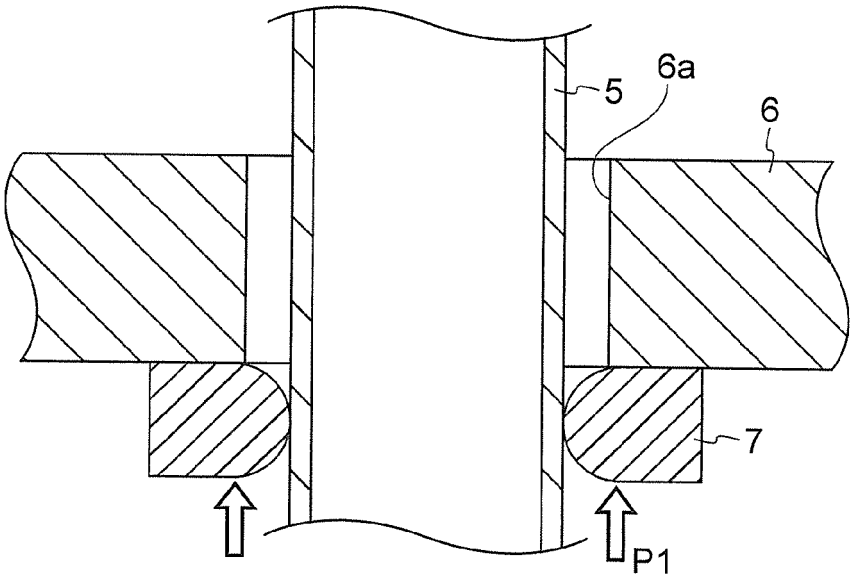


FIG. 4

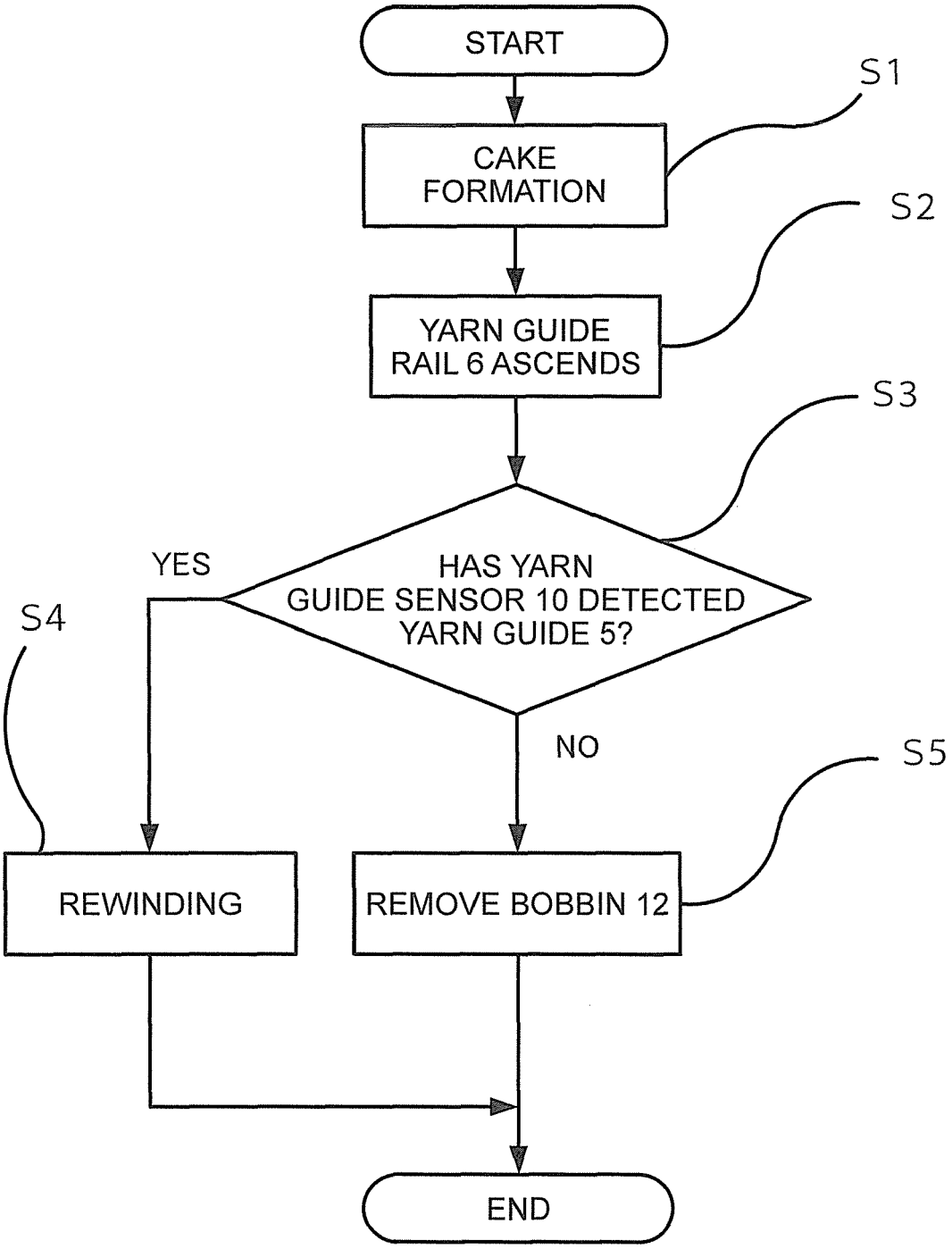

START
S1
CAKE FORMATION
S2
YARN GUIDE RAIL 6 ASCENDS
S3
HAS YARN GUIDE SENSOR 10 DETECTED YARN GUIDE 5?
YES
S4
NO
S5
REWINDING
REMOVE BOBBIN 12
END

FIG. 5A

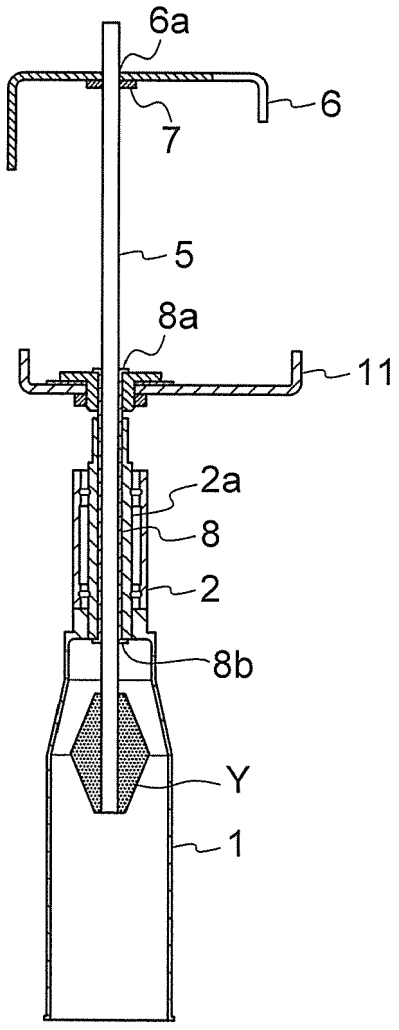


FIG. 5B

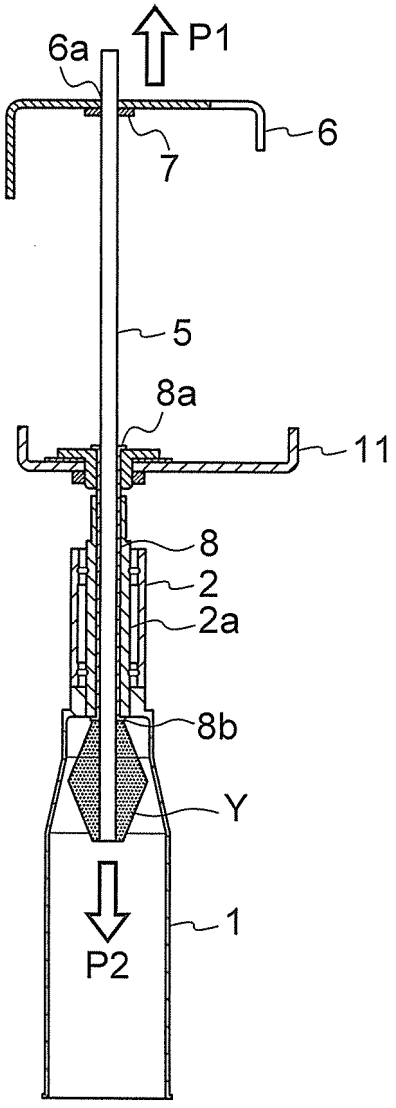


FIG. 5C

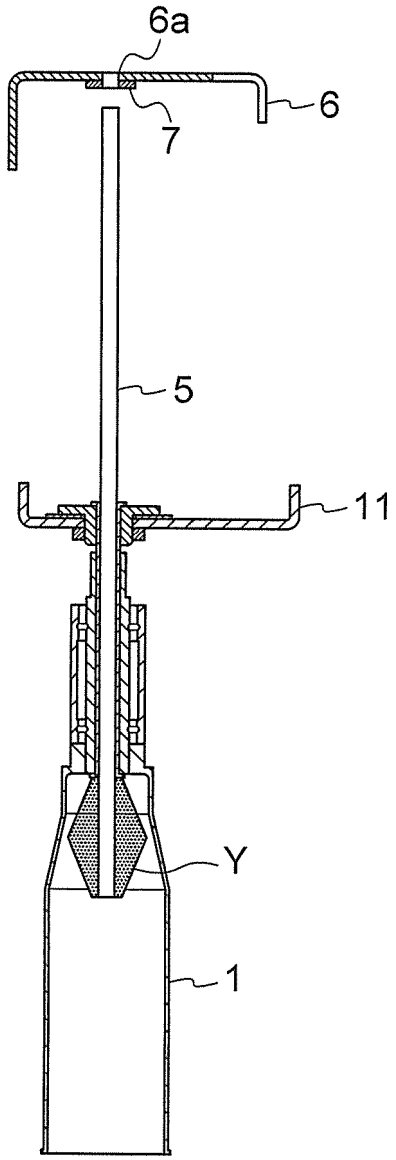


FIG. 6

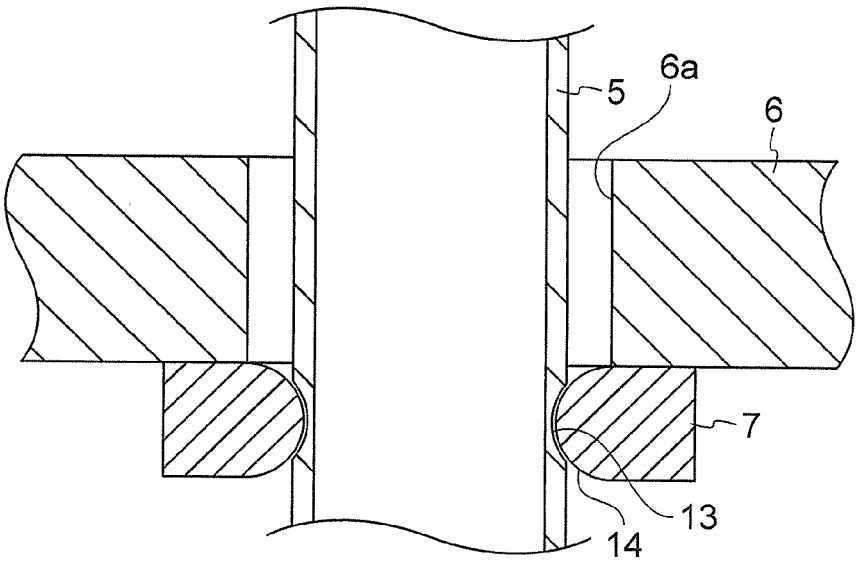
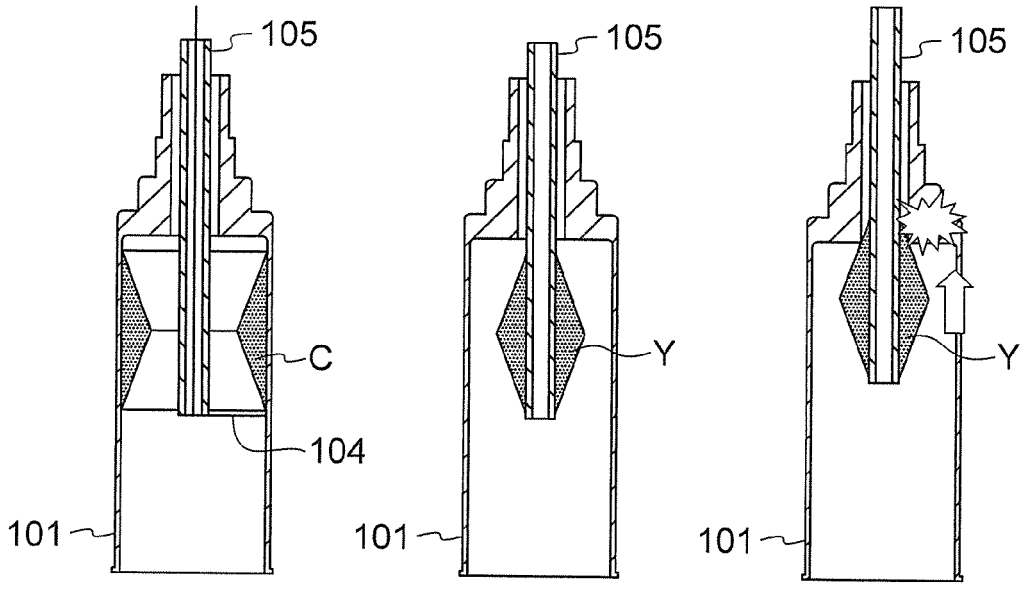


FIG. 7A FIG. 7B FIG. 7C



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EUROPEAN SEARCH REPORT

Application Number
EP 19 16 2138

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 2 232 491 A (WILLIAM PRINCE-SMITH) 18 February 1941 (1941-02-18) * column 1, line 1 - column 1, line 16 * * column 2, line 15 - column 3, line 22; figures 1-2 *	1,3 2,5,6	INV. D01H1/08 D01H7/78
Y	US 3 722 199 A (GARDELLA A) 27 March 1973 (1973-03-27) * column 3, line 63 - column 4, line 42; figures 1, 2 *	2	
Y	US 2 142 760 A (WILLIAM PRINCE-SMITH) 3 January 1939 (1939-01-03) * column 1, line 30 - column 2, line 12; figures 1, 3 *	5,6	
A	DE 44 26 897 A1 (SCHLAFHORST & CO W [DE]) 1 February 1996 (1996-02-01) * paragraph [0017] - paragraph [0021]; figure 1 *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			D01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 August 2019	Todarello, Giovanni

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 16 2138

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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02-08-2019

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