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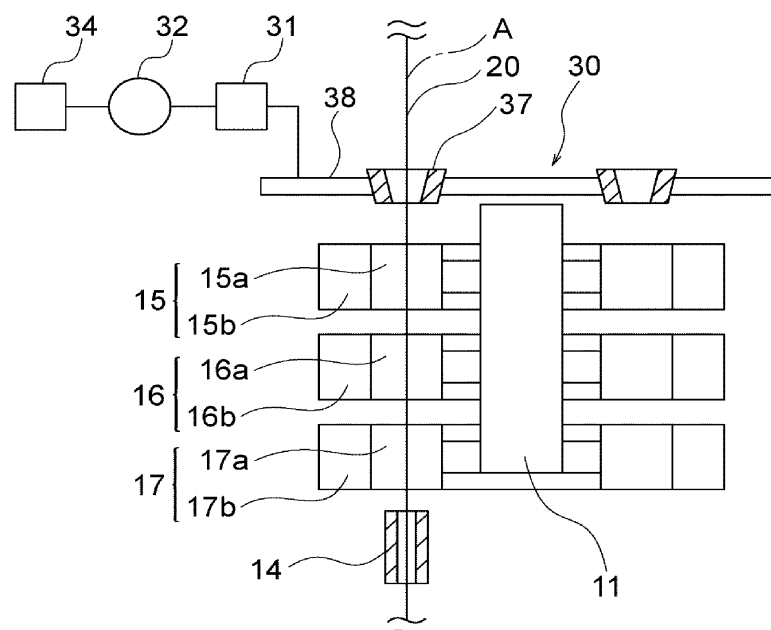
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(54) **POT SPINNING MACHINE**

(57) A pot spinning machine includes a drafting device (10), a traverse device (30), and a control part (34). The drafting device (10) includes a pair of rollers (15, 16, 17) and draws out a fiber bundle (20). The rollers (15, 16, 17) each have a rotary axis. The traverse device (30)

causes a fiber bundle (20) to traverse parallel to the rotary axis. The control part (34) controls the traverse device (30) such that a position of the fiber bundle (20) is aligned with a position of a yarn suction pipe (14) at a start of spinning at the latest.

FIG. 2



Description

[0001] The present disclosure relates to a pot spinning machine, and more particularly to, a pot spinning machine including a traverse device.

BACKGROUND ART

[0002] A pot spinning machine that uses a pot having a cylindrical shape is known as one of spinning machines. Japanese Patent Application Publication No. 10-168673 discloses a pot spinning machine including a drafting mechanism that includes multiple pairs of rollers and draws out roving into yarn and a yarn suction pipe that sucks in the yarn drawn out by the drafting mechanism.

[0003] A pot spinning machine generally includes a traverse mechanism that causes roving to reciprocate in a direction parallel to an axial direction of the rollers of the drafting mechanism to prevent the roving from keeping in contact with a certain part of the rollers.

[0004] However, providing the traverse mechanism to the pot spinning machine mentioned in Japanese Patent Application Publication No. 10-168673 may increase a distance between the yarn suction pipe and the roving depending on a traverse position at the stop of spinning. Accordingly, the pot spinning machine in the Publication No. 10-168673 has a problem that the yarn suction pipe may fail to suck in the roving at the restart of spinning.

[0005] The present disclosure, which has been made in light of the above-mentioned problem, is directed to providing a pot spinning machine capable of reducing the likelihood that a yarn suction pipe may fail to suck in a fiber bundle.

SUMMARY

[0006] In accordance with an aspect of the present disclosure, there is provided a pot spinning machine that includes a pot spinning machine including a drafting device, a traverse device, and a control part. The drafting device includes a pair of rollers and draws out a fiber bundle. The rollers each have a rotary axis. The traverse device causes a fiber bundle to traverse parallel to the rotary axis. The control part controls the traverse device such that a position of the fiber bundle is aligned with a position of a yarn suction pipe at a start of spinning at the latest.

[0007] Other aspects and advantages of the disclosure will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The disclosure, together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in

which:

FIG. 1 is a schematic view illustrating a drafting device of a pot spinning machine according to a first embodiment of the present disclosure;

FIG. 2 is a schematic view illustrating a traverse device of the pot spinning machine according to the first embodiment of the present disclosure;

FIG. 3 is a schematic view illustrating the traverse device of the pot spinning machine according to the first embodiment of the present disclosure;

FIG. 4 is a graph illustrating an exemplary traverse operation of a known pot spinning machine;

FIG. 5 is a graph illustrating a traverse operation of the pot spinning machine according to the first embodiment of the present disclosure;

FIG. 6 is a graph illustrating a traverse operation of a pot spinning machine according to a second embodiment of the present disclosure;

FIG. 7 is a graph illustrating the traverse operation of the pot spinning machine according to the second embodiment of the present disclosure;

FIG. 8 is a schematic view illustrating a traverse device of a pot spinning machine according to a third embodiment of the present disclosure; and

FIG. 9 is a schematic view illustrating a traverse device of a pot spinning machine according to a fourth embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS**First embodiment**

[0009] The following will describe a first embodiment of the present disclosure with reference to the accompanying drawings, and first describe a pot spinning machine according to the first embodiment of the present disclosure.

[0010] FIG. 1 is a schematic view illustrating an exemplary configuration of a drafting device of the pot spinning machine according to the first embodiment of the present disclosure. The pot spinning machine includes a drafting device 10 that is disposed in each of spindles of the pot spinning machine.

(Drafting device)

[0011] The drafting device 10 is a device for drawing out roving 20 to a predetermined thickness. The drafting device 10 includes multiple pairs of rollers that include

back top rollers 15a and back bottom rollers 15b paired with each other, middle top rollers 16a and middle bottom rollers 16b paired with each other, and front top rollers 17a and front bottom rollers 17b paired with each other. Each back top roller 15a cooperates with the back bottom roller 15b to form a pair of back rollers 15, each middle top roller 16a cooperates with the middle bottom roller 16b to form a pair of middle rollers 16, and each front top roller 17a cooperates with the front bottom roller 17b to form a pair of front rollers 17. The rollers 15, 16, and 17 each have a rotary axis. The roving 20 forms a fiber bundle.

[0012] The multiple pairs of rollers are arranged from upstream to downstream of a delivery direction of the roving 20 in the following order; the pairs of back rollers 15, the pairs of middle rollers 16, and the pairs of front rollers 17. The back top rollers 15a, the middle top rollers 16a, and the front top rollers 17a of the pairs of rollers are disposed above the roving 20. The back bottom rollers 15b, the middle bottom rollers 16b, and the front bottom rollers 17b of the pairs of rollers are disposed below the roving 20. The pairs of rollers are mounted to a roller arm 11.

[0013] The back top rollers 15a, the middle top rollers 16a, and the front top rollers 17a are made of metal and coated with rubber. The back bottom rollers 15b, the middle bottom rollers 16b, and the front bottom rollers 17b are made of metal.

[0014] When the revolutions per minute (rpm) of the pairs of rollers 15, 16, and 17 are compared with each other, the rpm of the pair of middle rollers 16 is greater than the rpm of the pair of back rollers 15, and the rpm of the pair of front rollers 17 is greater than the rpm of the pair of middle rollers 16. Accordingly, the rpm of the pairs of rollers 15, 16, and 17 are different from each other, and the drafting device 10 draws out a yarn material by using the difference in rpm among the rollers, that is, the difference in rotational speed among the rollers. In the following description, the rpm of each pair of rollers is also called a rotational speed of the pair of rollers. The rpm and the rotational speed of each pair of rollers bear a proportionate relationship to each other.

(Trumpet)

[0015] A plurality of trumpets 37 is disposed upstream from the drafting device 10. Each trumpet 37 has a tube shape that allows the roving 20 to pass through the trumpet 37. The trumpet 37 is attached to a traverse device, which will be described later, and allows traverse of the roving 20.

(Yarn suction pipe)

[0016] A yarn suction pipe 14 is disposed downstream from the drafting device 10. The yarn suction pipe 14 sucks in, together with air, the roving 20 that has been drawn out by the drafting device 10 into a predetermined

thickness. This suction operation is here called yarn suction. The sucked roving 20 is introduced into a pot through a yarn introduction pipe (not illustrated) that is arranged coaxially with the pot. Yarn detection sensors 19a, 19b are disposed between the yarn suction pipe 14 and the front top rollers 17a and the front bottom rollers 17b.

(Traverse device)

[0017] FIG. 2 illustrates an arrangement of the rollers and a traverse device 30 when the drafting device 10 is viewed from the roller arm 11 side illustrated in FIG. 1. The pair of the back top roller 15a and the back bottom roller 15b, the pair of the middle top roller 16a and the middle bottom roller 16b, and the pair of the front top roller 17a and the front bottom roller 17b are disposed on each of right and left sides of the roller arm 11 in FIG. 2.

[0018] The traverse device 30 includes a traverse bar 38 and the trumpets 37. The traverse bar 38 is disposed parallel to rotary axes of the back top roller 15a and the back bottom roller 15b, and reciprocable in a direction of each rotary axis. That is, the traverse bar 38 is reciprocable in a direction that intersects with the roving 20.

[0019] Each one trumpet 37 faces the pair of back rollers 15 located on either of right side or left side. The trumpet 37 is reciprocable together with the traverse bar 38 in the direction that intersects with the roving 20.

[0020] The traverse bar 38 is connected to a cam mechanism 31. The cam mechanism 31 is connected to a servomotor 32. The cam mechanism 31 converts rotary motion of an output shaft of the servomotor 32 into reciprocating motion, and this reciprocating motion causes the traverse bar 38 to reciprocate. The servomotor 32 is connected to a control part 34 that includes a servomotor driver and a controller (not illustrated) and controls operation of each part of the pot spinning machine.

[0021] Next, the following will describe the operation of the pot spinning machine according to the first embodiment. As illustrated in FIG. 1, when the pot spinning machine starts spinning, the back top roller 15a and the back bottom roller 15b, the middle top roller 16a and the middle bottom roller 16b, and the front top roller 17a and the front bottom roller 17b start rotating at a predetermined rotational speed. This causes the roving 20 to first pass through the trumpet 37, and then pass between the back top roller 15a and the back bottom roller 15b, between the middle top roller 16a and the middle bottom roller 16b, and between the front top roller 17a and the front bottom roller 17b sequentially. Then, the yarn suction pipe 14 takes in air to suck in the roving 20. This yarn suction operation causes the roving 20, which has been drawn out by the rollers, to be delivered into the pot through the yarn suction pipe 14.

[0022] The servomotor 32 operates after the start of the spinning. The rotary motion of the output shaft of the servomotor 32 is converted by the cam mechanism 31 into the reciprocating motion in the axial direction of the back top roller 15a to cause the traverse bar 38 to recip-

rocate in the axial direction of the back top roller 15a. This causes the trumpet 37 fixed to the traverse bar 38 to reciprocate in the axial direction of the back top roller 15a, and therefore causes the roving 20 to traverse (reciprocate) within the width of the back top roller 15a.

[0023] Since the roving 20 traverses (reciprocates) within the width of the back top roller 15a in the axial direction, the roving 20 is prevented from keeping in contact with a certain part of each pair of rollers, such as the pair of back rollers 15, the pair of middle rollers 16, and the pair of front rollers 17, for a long time. This prevents uneven abrasion of each roller. Particularly, this prevents uneven abrasion of the back top roller 15a, the middle top roller 16a, and the front top roller 17a coated with rubber.

[0024] The spinning is stopped in a case, such as when a full bobbin is formed in the pot (i.e., full bobbin stop), but the spinning may be stopped at a timing when the roving 20 traverses to a position far away from a central axis A of the yarn suction pipe 14 as illustrated in FIG. 3. This causes the roving 20 to be shifted from, that is, positioned away from the central axis A of the yarn suction pipe 14 at the start of the next spinning, which increases the likelihood of yarn suction failure.

[0025] FIG. 4 is a graph illustrating a relationship between a traverse position P of roving and a spinning time T in a known pot spinning machine. A position P1 and a position P2 respectively correspond to one end and the other end of the traverse position P of the roving. When the traverse position P is zero, the traverse position P corresponds to the position of the central axis A. A time T1 of the spinning time T corresponds to a time when spinning is stopped because a full bobbin is formed in the pot (i.e., full bobbin stop). In this example, when the continuous spinning is stopped at the time T1, the traverse position of the roving is the position P1. In this case, the roving is located away from the central axis A as illustrated in FIG. 3, which increases the likelihood of yarn suction failure at the start of the next spinning.

[0026] Accordingly, in the pot spinning machine according to the first embodiment, the control part 34 (see FIG. 3) monitors, during spinning, a current length of the spun yarn, a current spinning time T, and a current traverse position P based on information on the position of the servomotor 32, and the like. When the control part 34 determines that less than half a traverse cycle of the roving 20 is left to the time T1 of full bobbin stop as indicated by a broken line C in FIG. 5, the control part 34 stops the servomotor 32 at a timing (a time T2) when the traverse position P reaches zero as indicated by a line B. This stops reciprocation of the trumpet 37 of the traverse bar 38.

[0027] Since the reciprocation of the trumpet 37 is stopped at the time T2, the traverse position P of the roving 20 is zero at the stop of the spinning. Accordingly, the traverse position P of the roving 20 is zero at the start of the next spinning, so that the yarn suction pipe 14 is positioned close to the central axis A, which decreases

the likelihood of the yarn suction failure.

[0028] When the spinning is stopped by an operator pressing a spinning stop button during spinning operation, the control part 34 illustrated in FIG. 2 allows the spinning operation to continue until the traverse position P reaches zero, and then stops the servomotor 32 to stop the spinning when the traverse position P reaches zero. Accordingly, as in the full bobbin stop, the traverse position P of the roving 20 is zero at the start of the next spinning, so that the yarn suction pipe 14 is positioned close to the central axis A, which decreases the likelihood of yarn suction failure.

[0029] When the spinning is urgently stopped by an operator pressing the emergency stop button, the control part 34 immediately stops the servomotor 32 to stop the spinning. Then, at the start of the next spinning, the control part 34 drives the pair of back rollers 15, the pair of middle rollers 16, the pair of front rollers 17, and the servomotor 32 to remove the roving 20 (see FIG. 1), and performs the traverse. Further, the control part 34 stops the traverse when the traverse position P reaches zero, and starts yarn suction. This decreases the likelihood of yarn suction failure at the start of the next spinning even if the emergency stop is executed.

[0030] In this way, the pot spinning machine according to the embodiment of the present disclosure includes the traverse device 30 for causing the roving 20 to traverse parallel to the rotary axes of the pair of back rollers 15, the pair of middle rollers 16, and the pair of front rollers 17 of the drafting device 10 for drawing out the roving 20, and the control part 34 for controlling the traverse device 30 such that a position of a fiber bundle is aligned with the position of the yarn suction pipe 14 at the start of the spinning at the latest, thereby decreasing the likelihood that the yarn suction pipe 14 may fail to suck in the roving 20.

[0031] Further, the control part 34 controls the traverse device 30 such that the position of the roving 20 is aligned with the position of the yarn suction pipe 14 at the stop of the spinning. The roving 20 needs to be removed until the alignment is completed if the position of the roving 20 needs to be aligned with the position of the yarn suction pipe 14 at the start of the spinning; however, the pot spinning machine according to this embodiment eliminates the need for removal of the roving 20 at the start of the next spinning. Accordingly, this configuration reduces the consumption of the roving 20.

[0032] Further, the control part 34 stops the traverse of the roving 20 when aligning the position of the roving 20 with the position of the yarn suction pipe 14. This prevents a load from being applied on the roving 20 during the alignment.

Second embodiment

[0033] Next, the following will describe a second embodiment of the present disclosure. In the following embodiments, like reference numerals in FIGS. 1 to 5 des-

ignite identical or corresponding parts, and the detailed description thereof is not repeated. This second embodiment accelerates or decelerates a traverse speed relative to the first embodiment.

[0034] As illustrated in FIG. 6, when the control part 34 determines that less than half a traverse cycle of the roving 20 (see FIG. 2) is left to the time T1 of full bobbin stop, the control part 34 accelerates the traverse speed based on monitoring information such as a current length of the spun yarn, a current traverse position P, an elapsed time and the time T1 of the spinning time T.

[0035] Specifically, the control part 34 increases the rotational speed of the servomotor 32 from a time T3 at which the traverse position P reaches 0 immediately before less than half a traverse cycle is left to the time T1 of full bobbin stop. This accelerates the reciprocation of the traverse bar 38 and therefore the traverse speed of the roving 20, so that the traverse speed of the roving 20 is accelerated from the time T3 to a time T1 as indicated by a line D, and the spinning is stopped when the traverse position P reaches zero at the time T1. This decreases the likelihood of yarn suction failure at the start of the next spinning, as in the first embodiment.

[0036] The acceleration of the traverse speed is executed within a speed limit preliminarily input to the control part 34 to prevent the roving 20 from being broken or damaged.

[0037] Alternatively, when the control part 34 determines that less than half a traverse cycle of the roving 20 (FIG. 2) is left to the time T1 of full bobbin stop, the control part 34 may decelerate the traverse speed based on monitoring information such as a current length of the spun yarn, an elapsed time and the time T1 of the spinning time T. Specifically, the control part 34 decreases the rotational speed of the servomotor 32 from a time T4 at which the traverse position P reaches the traverse position P2 immediately before a half traverse cycle is left to the time T1 of full bobbin stop so that the traverse position P reaches zero at the time T1. This decelerates the traverse speed of the roving 20 from the time T4 to the time T1, thereby allowing the traverse position P to reach zero at the time T1 as indicated by a line E, as illustrated in FIG. 7. Accordingly, as in the first embodiment, the traverse position P is zero at the start of the next spinning, which decreases the likelihood of yarn suction failure.

[0038] In this way, the control part 34 accelerates or decelerates the traverse speed of the roving 20 when aligning the position of the roving 20 with the position of the yarn suction pipe 14. This allows the alignment to be performed while keeping the spinning operation until the full bobbin stop.

Third embodiment

[0039] Next, the following will describe a third embodiment of the present disclosure. The third embodiment adopts a stepping motor unlike the first embodiment and

the second embodiment.

[0040] FIG. 8 illustrates the traverse device 30 according to the third embodiment. The traverse bar 38 has thereon a mark 38a. An optical sensor 33, which is a mark sensor, is disposed facing the traverse bar 38 to detect the mark 38a. The optical sensor 33 is connected to the control part 34. The cam mechanism 31 is connected to a stepping motor 35. The stepping motor 35 is connected to the control part 34. The stepping motor 35 is adopted, instead of the servomotor 32 adopted in the first embodiment. Other configuration of this embodiment is the same as that of the first embodiment.

[0041] Next, the following will describe the operation of the pot spinning machine according to the third embodiment.

[0042] The optical sensor 33 detects the position of the mark 38a from the start of the spinning to the stop of the spinning. The control part 34 receives a detection result on the position of the mark 38a from the optical sensor 33 and detects the traverse position of the traverse bar 38 with the mark 38a.

[0043] In this way, the third embodiment allows the traverse position of the traverse bar 38, i.e., the traverse position of the roving 20, to be detected based on the detection result on the position of the mark 38a. Accordingly, the adoption of the stepping motor 35 enables the traverse control similar to that in the first embodiment and the second embodiment, without adopting a motor, such as the servomotor 32 (see FIG. 2), which obtains rotation position information.

[0044] The stepping motor 35 is adopted in the third embodiment; however, any other general-purpose motors may be adopted. Further, the optical sensor 33 for detecting the mark 38a on the traverse bar 38 is adopted in the third embodiment, but any other sensors such as a magnetic sensor may be adopted to detect the position of the traverse bar 38.

Fourth embodiment

[0045] Next, the following will describe a fourth embodiment of the present disclosure. FIG. 9 illustrates the traverse device 30 according to the fourth embodiment. The fourth embodiment adopts an electromagnetic clutch unlike the third embodiment.

[0046] Specifically, an electromagnetic clutch 36 is disposed between a general-purpose motor 39 and the cam mechanism 31 for disengaging power transmission from the general-purpose motor 39 to the cam mechanism 31. The electromagnetic clutch 36 is connected to the control part 34. Other configuration of the pot spinning machine of this embodiment is the same as that of the third embodiment.

[0047] Next, the following will describe the operation of the pot spinning machine according to the fourth embodiment. To stop the reciprocation of the traverse bar 38, the control part 34 disengages the electromagnetic clutch 36. This allows the traverse bar 38 and therefore

the traverse of the roving 20 to stop without stopping the general-purpose motor 39.

[0048] The stepping motor 35 is adopted as a power source for the traverse bar 38 in the fourth embodiment; however, instead of the stepping motor 35, a back-roller drive motor (not illustrated) for driving the back bottom roller 15b, the middle bottom roller 16b, and the front bottom roller 17b (see FIG. 1) may be adopted to serve as the power source. Specifically, the electromagnetic clutch 36 receives an output torque from the output shaft of the back-roller drive motor. Although the back-roller drive motor keeps driving during the spinning operation, the electromagnetic clutch 36 disengages the power transmission as necessary to stop the traverse of the roving 20.

[0049] The electromagnetic clutch 36 is adopted in the fourth embodiment, but any other clutches may be adopted as means for disengaging power transmission.

[0050] The roving 20 serves as the fiber bundle in the first to fourth embodiments, but any other types of fiber bundles may be adopted. Further, the cam mechanism 31 is adopted to convert the rotary motion into the linear motion in the first to fourth embodiments, but any other power transmitting mechanism such as a slider-crank mechanism may be adopted.

[0051] A pot spinning machine includes a drafting device (10), a traverse device (30), and a control part (34). The drafting device (10) includes a pair of rollers (15, 16, 17) and draws out a fiber bundle (20). The rollers (15, 16, 17) each have a rotary axis. The traverse device (30) causes a fiber bundle (20) to traverse parallel to the rotary axis. The control part (34) controls the traverse device (30) such that a position of the fiber bundle (20) is aligned with a position of a yarn suction pipe (14) at a start of spinning at the latest.

3. The pot spinning machine according to claim 1 or 2, **characterized in that** the control part (34) stops the traverse of the fiber bundle (20) when aligning the position of the fiber bundle (20) with the position of the yarn suction pipe (14).

4. The pot spinning machine according to claim 1 or 2, **characterized in that** the control part (34) accelerates or decelerates a traverse speed of the fiber bundle (20) when aligning the position of the fiber bundle (20) with the position of the yarn suction pipe (14).

Claims

1. A pot spinning machine comprising:
 - a drafting device (10) including a pair of rollers (15, 16, 17) and drawing out a fiber bundle (20), the rollers (15, 16, 17) each having a rotary axis; and
 - a traverse device (30) for causing the fiber bundle (20) to traverse parallel to the rotary axis; **characterized in that**
 - a control part (34) for controlling the traverse device (30) such that a position of the fiber bundle (20) is aligned with a position of a yarn suction pipe (14) at a start of spinning at the latest.
2. The pot spinning machine according to claim 1, **characterized in that** the control part (34) controls the traverse device (30) such that the position of the fiber bundle (20) is aligned with the position of the yarn suction pipe (14) at a stop of the spinning.

FIG. 1

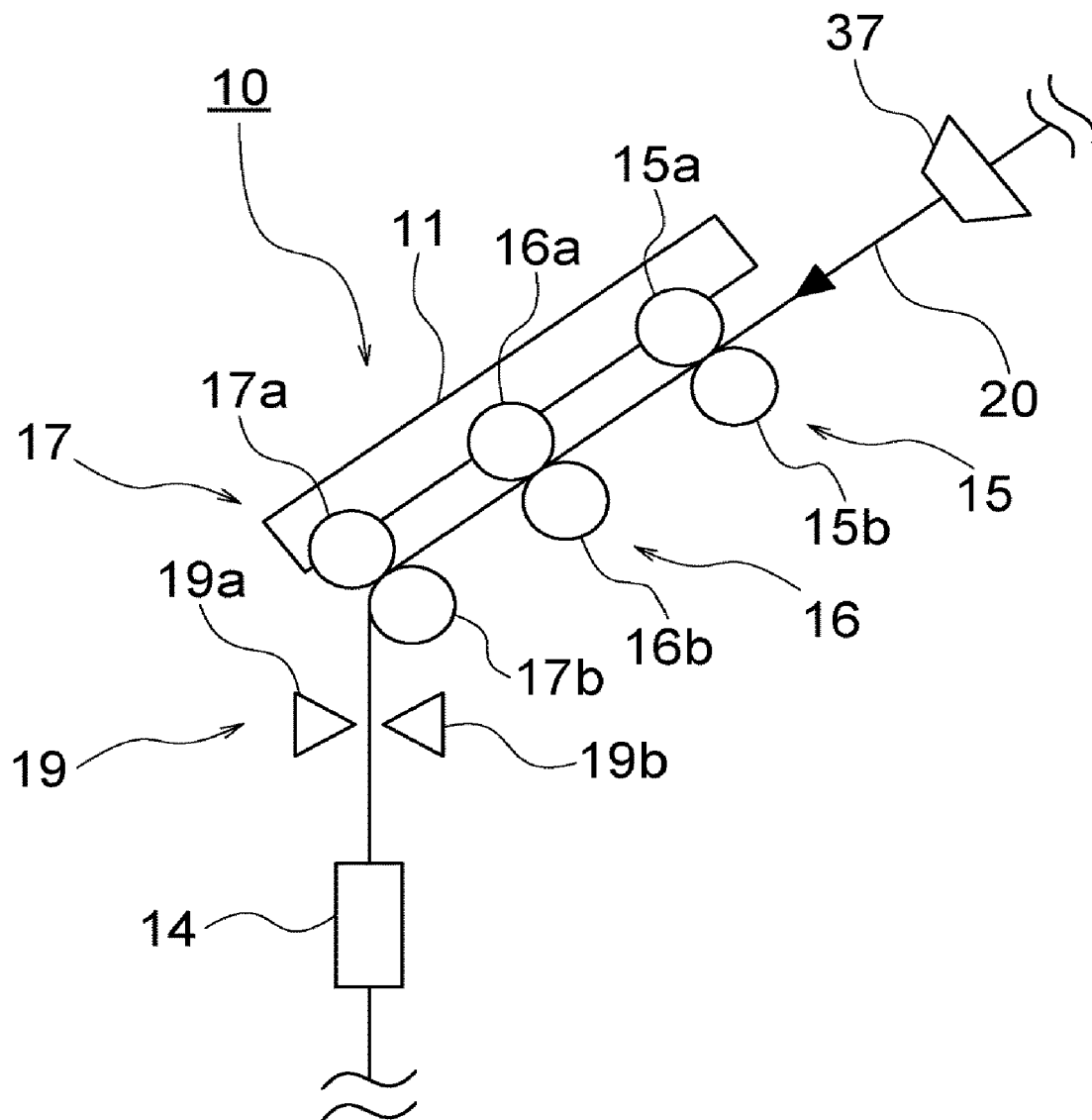


FIG. 2

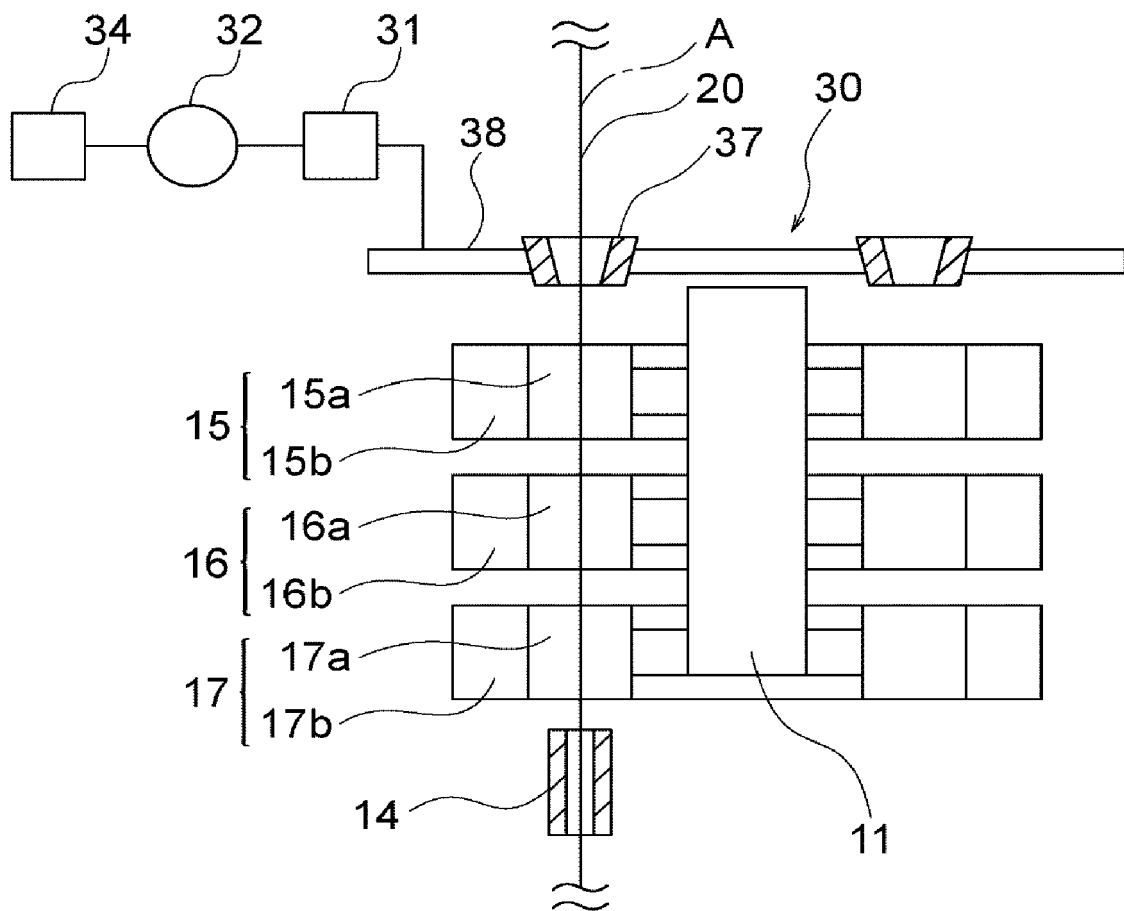


FIG. 3

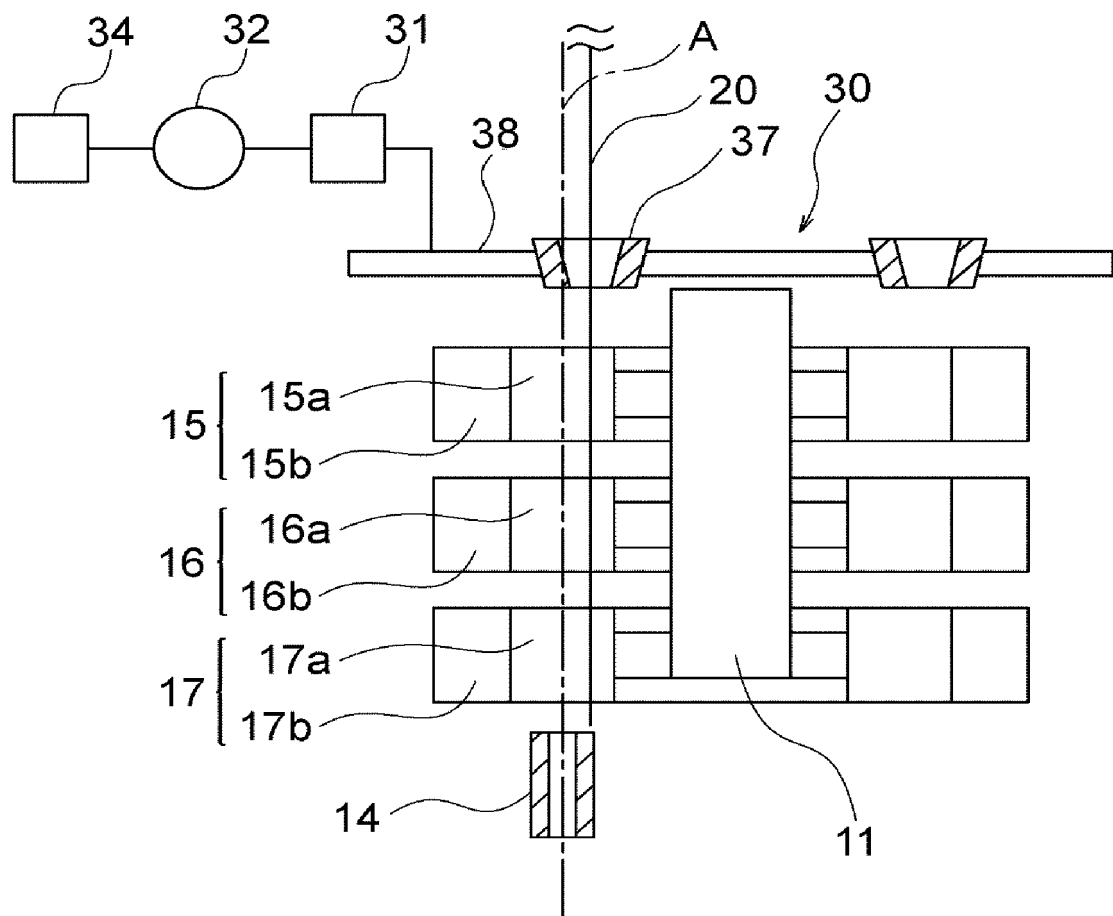


FIG. 4

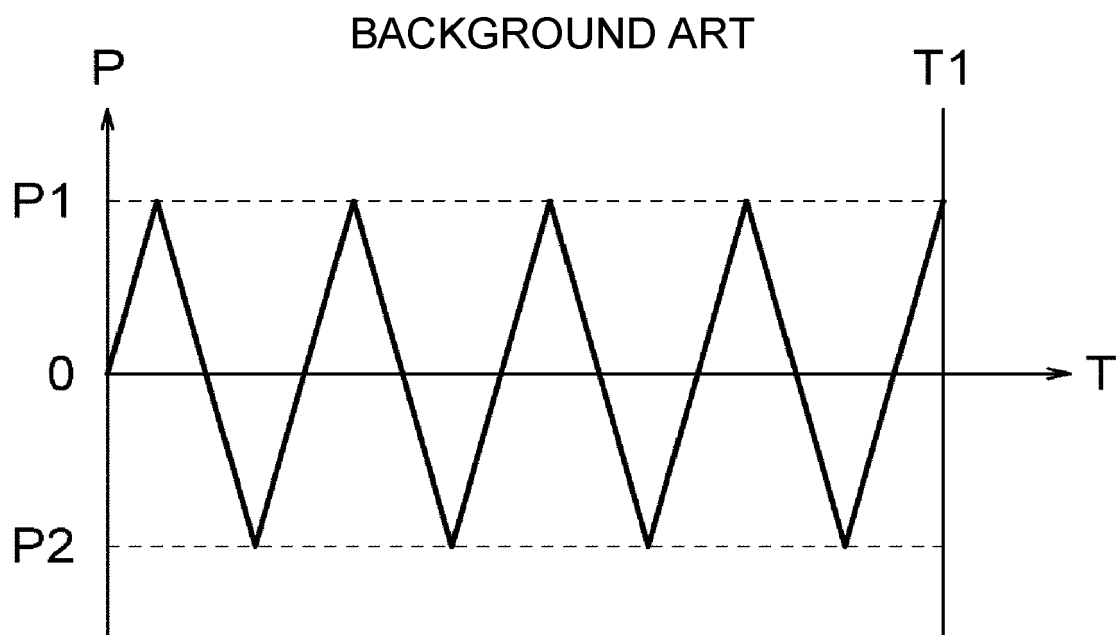


FIG. 5

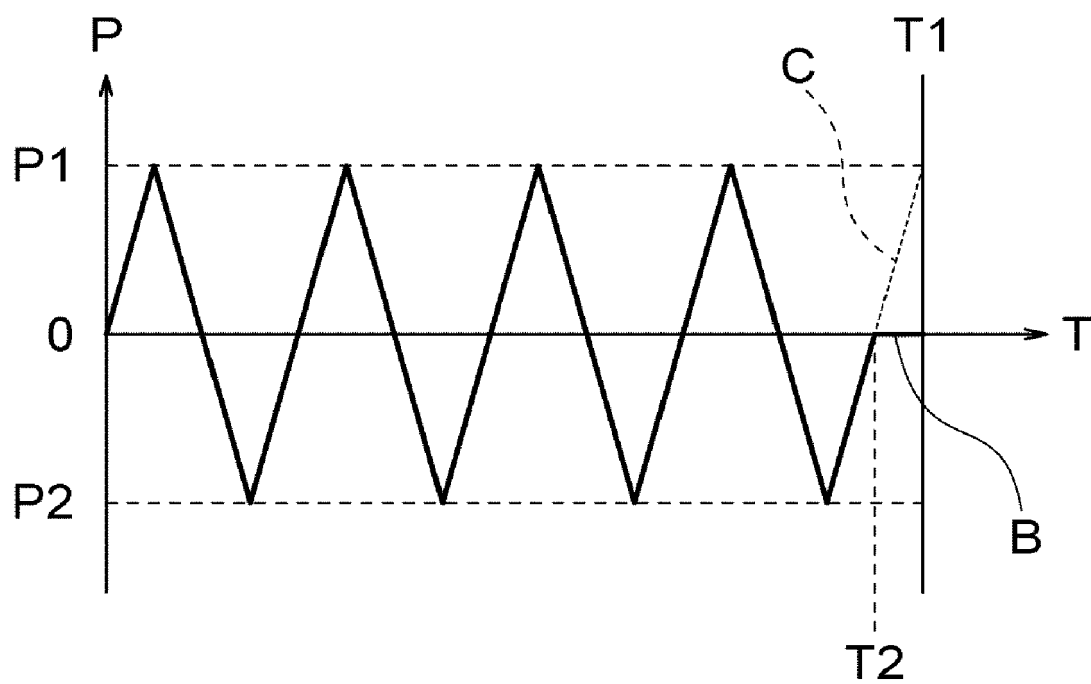


FIG. 6

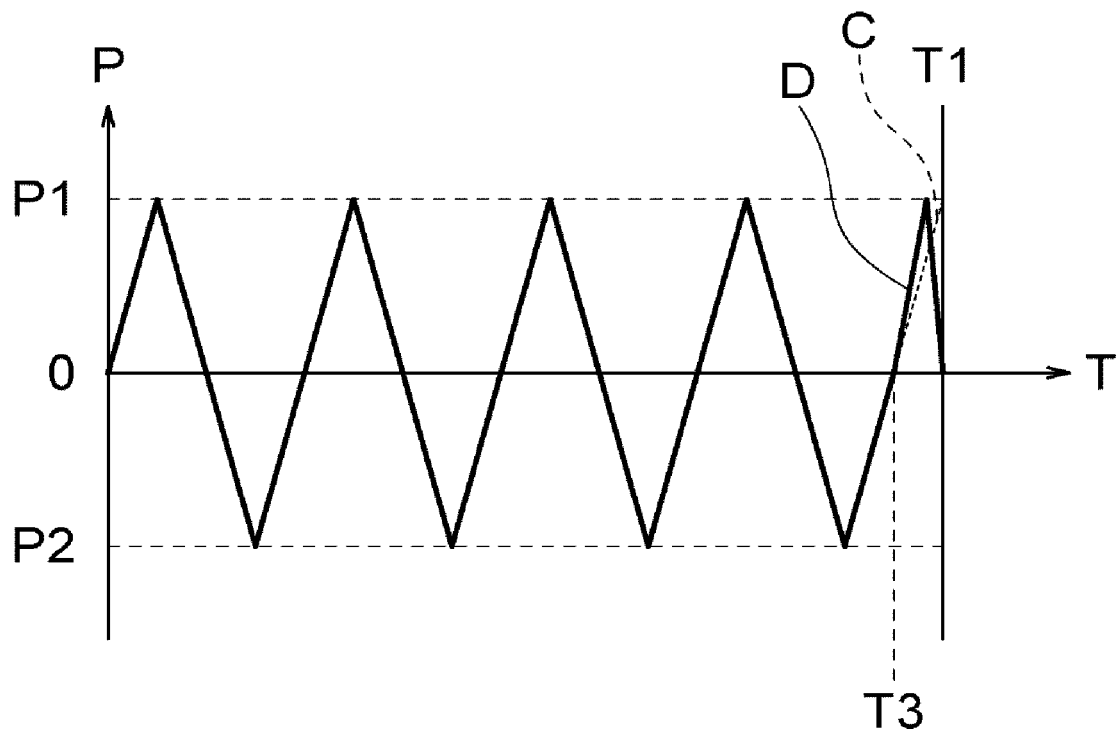


FIG. 7

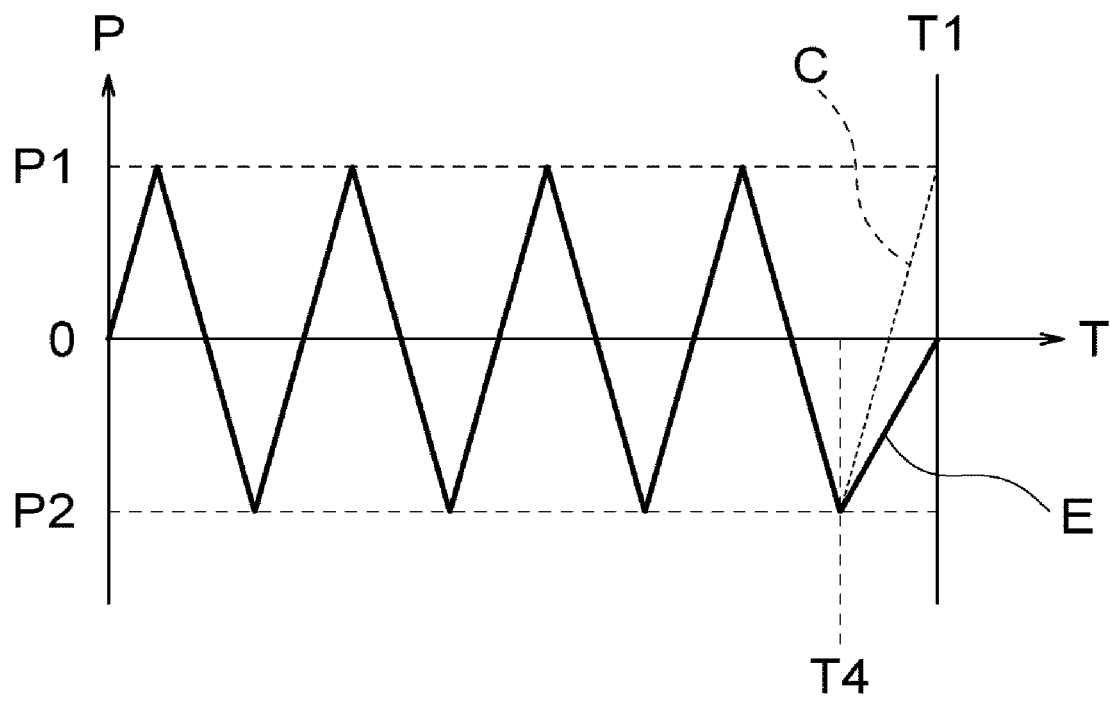


FIG. 8

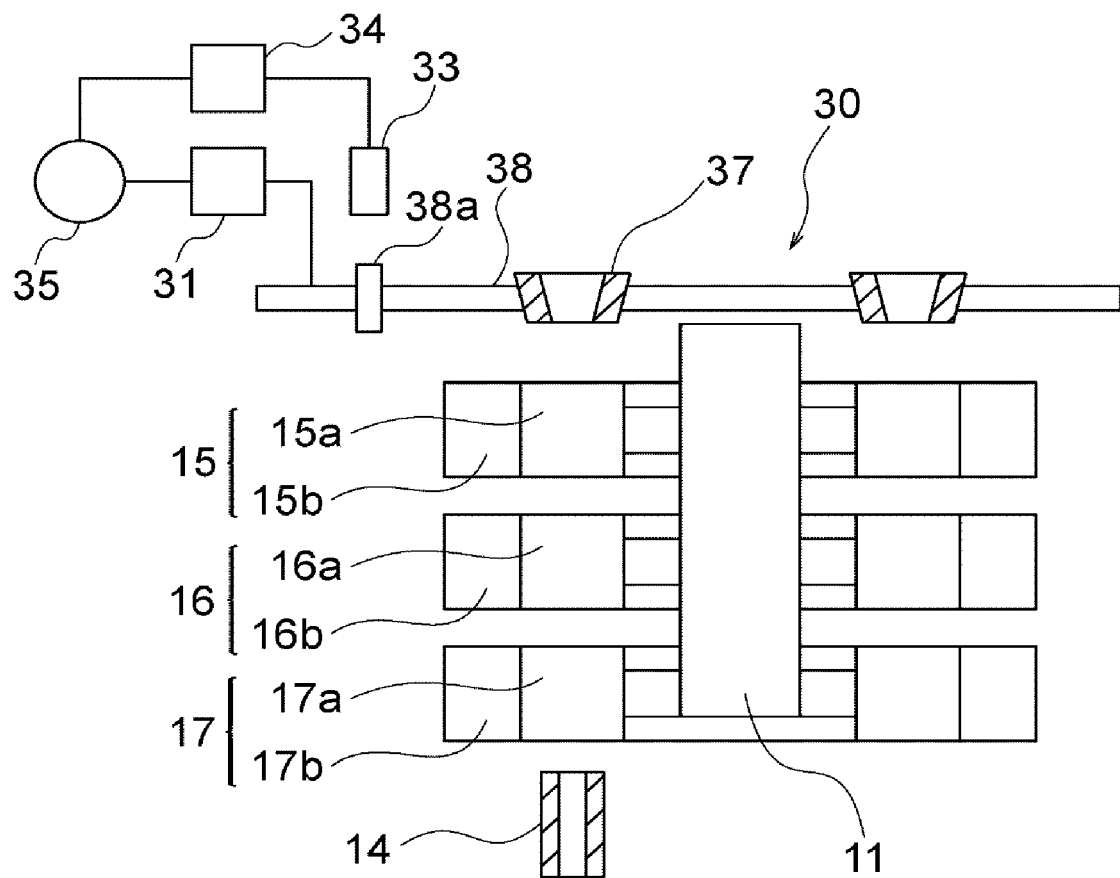
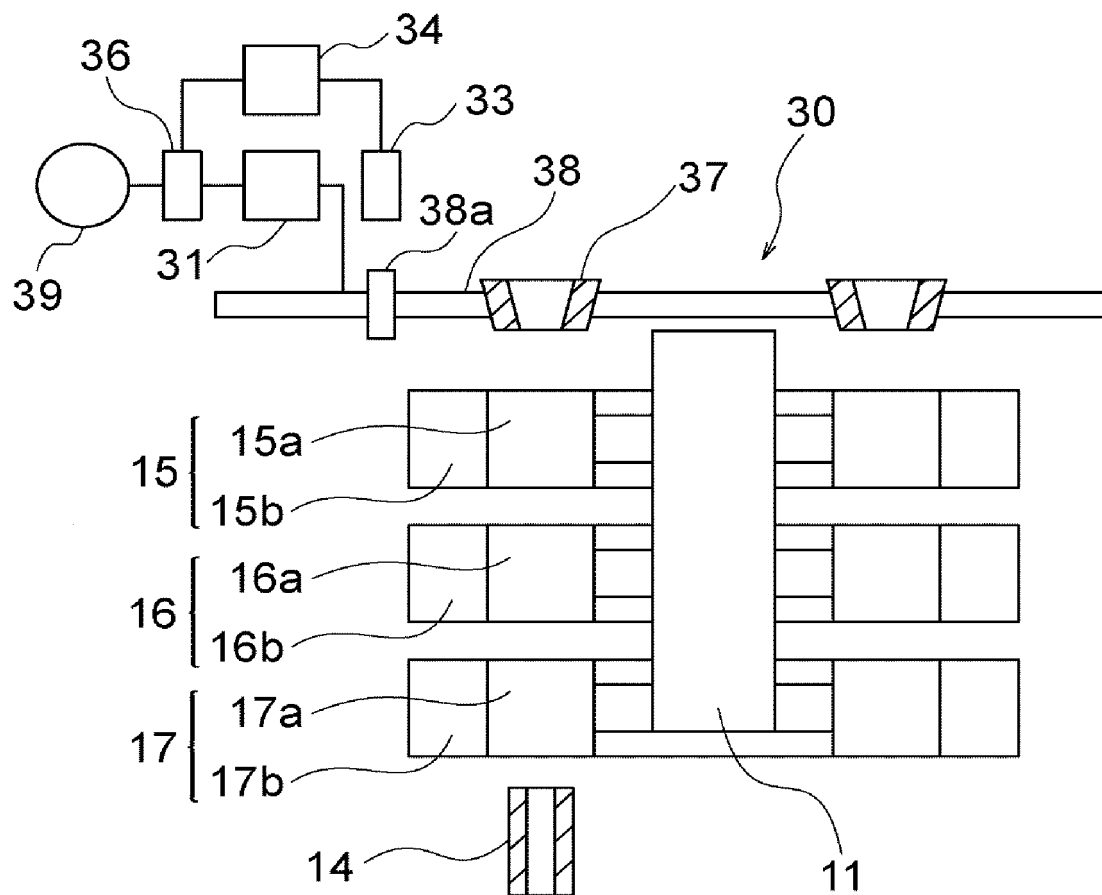


FIG. 9





EUROPEAN SEARCH REPORT

 Application Number
 EP 20 17 7330

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search Munich		Date of completion of the search 23 October 2020	Examiner Humbert, Thomas
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 20 17 7330

5 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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REFERENCES CITED IN THE DESCRIPTION

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