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(72) Inventor: **Nakagawa, Takashi**
Kyoto-shi
Kyoto 612-8686 (JP)

(74) Representative: **Vogeser, Werner et al**
Patent- und Rechtsanwälte,
Hansmann Vogeser Dr. Boecker Alber Dr. Strych,
Albert-Rosshaupter-Strasse 65
D-81369 München (DE)

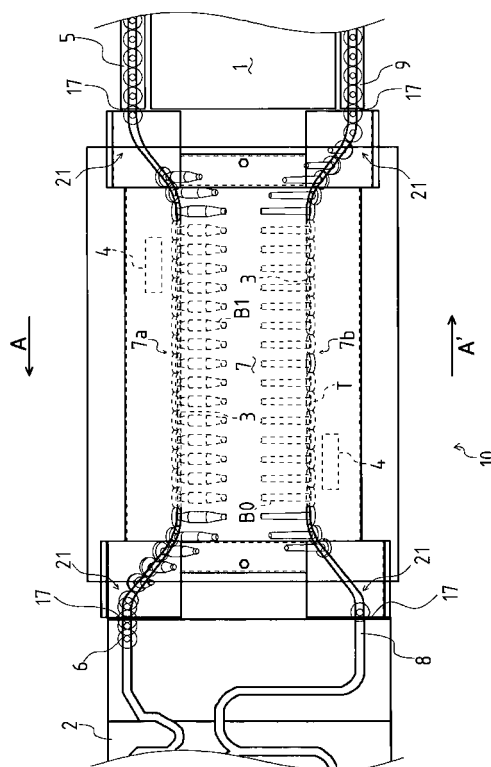
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(71) Applicant: **Murata Machinery, Ltd.**
Kyoto 601 (JP)

(54) **Bobbin transport system**

(57) A bobbin transport system composed of an automatic winder, a fine spinning frame and a transport device is provided in such that a tray equipped with a bobbin can be efficiently transported by increasing or decreasing a speed to transport bobbins (or the amount of bobbins transported per unit time) in accordance with circumstances without increasing a burden to feeding means. In the bobbin transport system composed of the automatic winder 2, the fine spinning frame 1, and the bobbin transport device 10 having the bobbin transport path 7 for connecting the automatic winder 2 and the fine spinning frame 1, the bobbin transport device 10 includes transport guide means 3 for guiding the tray T equipped with the bobbin B along the bobbin transport path 7, and the feeding means 4 having the movable member 24 for moving the tray T by reciprocating, wherein a speed to transport bobbins on the bobbin transport path 7 can be changed in accordance with a process capability of the automatic winder 2 by changing the transport amount of bobbins in the feeding means 4 (Fig. 1).

Fig.1



Description

[0001] The present invention relates to a bobbin transport system composed of an automatic winder, a fine spinning frame, and a transport device.

[0002] In conventional bobbin transport systems composed of an automatic winder, a fine spinning frame and a transport device, spun bobbins produced in the fine spinning frame are transported to the automatic winder, which creates winding packages with a large diameter by rewinding the spun bobbins, by the transport device using an air cylinder as feeding means of bobbins (for example Patent Document 1).

The amount of spun bobbins to be fed per one stroke of the air cylinder has also been fixed (e.g. to one or two) in transporting spun bobbins. In transport devices using such an air cylinder, a technique has been proposed in relation to a pitch feeder of a tray in which a rod made to reciprocate by a fixed stroke includes an engagement member engaged with and pressed to a side surface of a tray substrate the along a transport path of the tray, as disclosed in Patent Document 2 for example.

Since the amount spun bobbins to be fed by the air cylinder is fixed in the aforementioned transport device, if the amount of spun bobbins to be fed to a side of the automatic winder needs to be increased, it is necessary to increase a driving speed and shorten a stroke interval in the air cylinder.

Patent Document 1: Japanese Unexamined Utility Model Publication No. 1991-110071

Patent Document 2: Japanese Unexamined Utility Model Publication No. 1988-41069

[0003] However, a shorter stroke interval set in the air cylinder in order to improve a transport capability increases a burden to the air cylinder, causing the air cylinder to face problems of reduced lifetime of sliders or other elements and damages in an early stage in the worst case.

[0004] The present invention has been achieved in view of the above problems and provides a bobbin transport system composed of an automatic winder, a fine spinning frame and a transport device, wherein a tray equipped with a bobbin can be efficiently transported by increasing or decreasing a speed to transport bobbins (or the amount of bobbins transported per unit time) in accordance with circumstances without increasing a burden to feeding means.

[0005] A bobbin transport system according to the present invention includes: an automatic winder (2); a fine spinning frame (1); and a bobbin transport device (10) having a bobbin transport path (7) to connect the automatic winder (2) and the fine spinning frame (1), the bobbin transport device (10) being composed of a transport guide member (3) for guiding a tray (T) equipped with a bobbin (B) along the bobbin transport path (7), and feeding means (4) having a movable member (24) which is made to reciprocate to move the tray (T). A speed to transport bobbins on the bobbin transport path (7) can

be changed in accordance with a process capability of the automatic winder (2) by changing the amount of bobbins transported in the feeding means (4).

[0006] In the bobbin transport system according to the present invention, the amount of bobbins transported in the feeding means (4) is changed on a one-stroke basis.

[0007] In the bobbin transport system according to the present invention, the amount of bobbins transported in the feeding means (4) is changed on a basis of the amount of trays (T).

[0008] In the bobbin transport system according to the present invention, the feeding means (4) is provided in a spun bobbin transport path (7a) which is included in the bobbin transport path (7) so as to transport the bobbin (B) subjected to spinning from the fine spinning frame (1) to the automatic winder (2).

[0009] In the bobbin transport system according to the present invention, the feeding means (4) is provided in an empty bobbin transport path (7b) which is included in the bobbin transport path (7) so as to transport the bobbin (B) in an empty state from the automatic winder (2) to the fine spinning frame (1).

[0010] In the bobbin transport system according to the present invention, the feeding means (4) includes position detection means for detecting a position to feed the tray (T) transported by the feeding means (4) on the bobbin transport path (7).

[0011] In the bobbin transport system according to the present invention, the position detection means is composed of an origin sensor (31) for detecting the origin of a position to feed the tray (T), and position sensors (32) and (33) for detecting a position to feed the tray (T).

[0012] In the bobbin transport system according to the present invention, a driving source of the feeding means (4) is an air cylinder (22).

[0013] Advantages of the present invention include extended lifetime of the feeding means resulting from a changeable amount of bobbins transported in the feeding means without requiring a shorter transport interval of the feeding means to increase a speed to transport bobbins (or the amount of bobbins transported per unit time) on the bobbin transport path. It is also made possible to efficiently transport bobbins by changing a speed to transport bobbins in accordance with a process capability and conditions of the automatic winder.

[0014] The transport speed can also be changed by changing the amount of bobbins transported on a one-stroke basis in the feeding means without changing a speed of the movable member.

[0015] The transport amount of bobbins can also be easily changed.

[0016] It is also made possible to efficiently transport bobbins to the automatic winder.

[0017] Bobbins can also be efficiently transported to the fine spinning frame.

[0018] Moreover, the amount of bobbins transported by the feeding means can be confirmed by position detection means. As a result, a speed to transport bobbins

(i.e. the amount of bobbins transported per unit time) can be certainly changed in accordance with a process capability of the automatic winder or entire conditions of the system, so that the entire system can be efficiently activated.

[0019] In addition, the structure of the position detection means can be simplified. It is also made possible to accurately confirm a position to feed the tray.

[0020] Furthermore, simplified maintenance can be realized by using the air cylinder without requiring a complicated driving mechanism. Since the air cylinder is unable to output a pressure exceeding a specified value, the driving mechanism is not damaged.

[0021]

Fig. 1 is a plan view showing a bobbin transport system according to the present invention.

Fig. 2 is a side surface view showing the bobbin transport system of Fig. 1.

Fig. 3 is a plan view showing feeding means of one-piece feeding.

Fig. 4 is a plan view showing feeding means of two-piece feeding.

Fig. 5 is a block diagram showing control means of the bobbin transport system.

Fig. 6 is a schematic view showing a push lever for pushing an external side surface of a tray.

Fig. 7 is a schematic view showing another example of the feeding means having a push lever arranged on a timing belt.

Fig. 8 is a schematic view showing yet another example of the feeding means having a push lever arranged on a ball screw.

Fig. 9 is a plan view showing an automatic winder.

Fig. 10 is a plan view showing a bobbin process part in the automatic winder.

Fig. 11 is a cross-sectional view showing a guide plate.

[0022] Next, embodiments of the present invention will be explained.

Fig. 1 is a plan view showing a bobbin transport system according to the present invention; Fig. 2 is a side surface view showing the bobbin transport system of Fig. 1; Fig. 3 is a plan view showing feeding means of one-piece feeding; Fig. 4 is a plan view showing feeding means of two-piece feeding; Fig. 5 is a block diagram showing control means of the bobbin transport system; Fig. 6 is a schematic view showing a push lever for pushing an external side surface of a tray; Fig. 7 is a schematic view showing another embodiment of the feeding means having a push lever arranged on a timing belt; Fig. 8 is a schematic view showing yet another embodiment of the feeding means having a push lever arranged on a ball screw; Fig. 9 is a plan view showing an automatic winder; Fig. 10 is a plan view showing a bobbin process part of the automatic winder; and Fig. 11 is a cross-sectional view showing a guide plate.

[0023] Referring to Fig. 1, explanation will be made for an example of applying the present invention to an embodiment of the bobbin transport system which is a connection system disposed between a fine spinning frame 1 and an automatic winder 2.

First, the bobbin transport system is composed of the automatic winder 2, the fine spinning frame 1, and a bobbin transport device 10. A space between the fine spinning frame 1 and the automatic winder 2 is connected by two bobbin transport paths 7 including a forward path and a return path, in which bobbins B are mounted onto trays T being a bobbin transport medium so as to be transported through the fine spinning frame 1, the automatic winder 2 and the bobbin transport path 7 (i.e. 7a and 7b).

[0024] A carry-out conveyer 5 for carrying out from the fine spinning frame 1 spun bobbins (referred to as completed bobbins hereinafter) B1 produced by the fine spinning frame 1 is connected to a carry-in conveyer 6 for carrying the completed bobbins B1 into the automatic winder 2 via a spun bobbin transport path (referred to as a completed bobbin transport path hereinafter) 7a being a forward path of the bobbin transport path 7. A carry-out conveyer 8 for carrying out empty bobbins B0 from the automatic winder 2 is also connected to a carry-in conveyer 9 for carrying the empty bobbin B0 into the fine spinning frame 1 via an empty bobbin transport path 7b being a return path of the bobbin transport path 7.

[0025] The bobbins B mounted onto the trays T are then transported on a route from a main body of the fine spinning frame 1 to the carry-out conveyer 5 to the completed bobbin transport path 7a to the carry-in conveyer 6 to a main body of the automatic winder 2 to the carry-out conveyer 8 to the empty bobbin transport path 7b to the carry-in conveyer 9 to the main body of the fine spinning frame 1, in which the route constitutes a circulation path.

[0026] The fine spinning frame 1 is provided with a plurality of spindles (not shown) and a controller 1a (refer to Fig. 5) used as control means of the fine spinning frame 1, in which yarn is spun and simultaneously wound followed by simultaneous doffing to eject it as the completed bobbins B1 to the completed bobbin transport path 7a being a forward path of the bobbin transport path 7. In the bobbin transport device 10, the completed bobbins B1 ejected to the completed bobbin transport path 7a are transported to the automatic winder 2.

[0027] A bobbin process part 2b having an end picking device or other devices (refer to Fig. 10) is provided on a tip of the completed bobbin transport path 7a leading to the automatic winder 2. The completed bobbins B1 are subjected to an end picking process in the end picking device in which a yarn end is trapped and inserted into a tube of each of the completed bobbins B1, whereby processes such as automatic end picking can be carried out in the automatic winder 2 without manual operation. The automatic winder 2 is provided with a plurality of winding units (not shown) for creating packages with a

large diameter by rewinding yarn transported from the completed bobbins B1.

[0028] The empty bobbins B0 generated after rewinding spun yarn of the completed bobbins B1 into packages (not shown) in the automatic winder 2 are returned to the fine spinning frame 1 by passing through the carry-out conveyor 8, the empty bobbin transport path 7b being a return path of the bobbin transport path 7, and the carry-in conveyor 9 in this order. In the vicinity of the fine spinning frame 1 in the empty bobbin transport path 7b provided to return the empty bobbins B0 to the fine spinning frame 1, the empty bobbins B0 are continuously aligned in one line along the empty bobbin transport path 7b in a state of being mounted onto the trays. The bobbin transport device 10 simultaneously transports a predetermined number of the bobbins B0 to the fine spinning frame 1.

The fine spinning frame 1 is then activated as stated above to produce the completed bobbins B1 by winding spun yarn to the empty bobbins B0.

There are cases that aforementioned transport device 10 transports only the trays T without mounting the bobbins B thereon.

[0029] Next, the bobbin transport device 10 provided between the fine spinning frame 1 and the automatic winder 2 will be explained referring to Figs. 1 and 2.

The bobbin transport device 10 is composed mainly of a transport guide member 3 being guide means for movably guiding the trays T on which the bobbins B are mounted along the bobbin transport path 7 (i.e. 7a and 7b), feeding means 4 for pushing the trays T to a transport direction A and a transport direction A', and a controller 34 (refer to Fig. 5) being control means of the bobbin transport device 10. The bobbin transport path 7 is also formed into a shape of making a downward detour.

Also formed between the automatic winder 2 and the fine spinning frame 1 is an underground transport path 12 excavated down below a floor plane 11 as shown in Fig. 2 in a form of containing a detour 13 created in the middle of the transport paths 7a and 7b. The underground transport path 12 is provided with a cover plate 15 attachably/detachably with an entrance 14 opened for the transport paths 7a and 7b, and an upper surface side of the cover plate 15 is used to secure a path 16 for operators and carts or the like.

The detour 13 is composed of inclined sections 18 extending to an oblique downward direction from connectors 17 disposed in the automatic winder 2 and the fine spinning frame 1, and a base section 19 being a horizontal transport section for horizontally connecting the inclined sections 18 to one another, in which these sections are connected with a smooth curve.

Here, the automatic winder 2 and the fine spinning frame 1 serving as a beginning edge and an ending edge of the transport paths 7a and 7b are set to be equal or different in the height position. Moreover, a transport plane height being a height of a transport plane of the conveyers 6 and 8 in the automatic winder 2 from the floor plane 11,

and a transport plane height of the conveyers 5 and 9 in the fine spinning frame 1 are made to differ from a transport plane height of the base section being the aforementioned horizontal transport plane. The transport plane height here refers to a height obtained by using the floor plane 11 as a reference plane. The transport guide member 3 is also formed by being appropriately bent in accordance with such a shape of the transport paths 7a and 7b.

[0030] Moreover, the transport guide member 3 is formed by guide plates 20 each of which is partitioned to surround the tray T as shown in Fig. 11, including a bottom guide plate 20a (refer to Fig. 3), a side guide plate 20b (refer to Fig. 2), and an upper guide plate 20c (refer to Fig. 3), in which the guide plates 20 are continuously extended to the transport direction A and the transport direction A'. The guide plate 20 is then formed to convert a posture of the tray T in a bent portion 21 which smoothly connects a connection part 17 to the inclined section 18 as shown in Fig. 1 and Fig. 2 respectively.

That is, the guide plate 20 is twisted and bent at an angle of 90 degrees by using the transport direction A and the transport direction A' as an axis in the bent portion 21, in which the tray T having the completed bobbin B1 disposed in a standing posture in the connection part 17 being a connecting portion between the fine spinning frame 1 and the completed bobbin transport path 7a is tilted to a transport transverse direction in the inclined section 18 so as to horizontally dispose the completed bobbin B1. That is, the bobbin B whose axis is directed upright in the completed bobbin transport path 7a and the empty bobbin transport path 7b is twisted downward from the connection part 17 and horizontally transported in the underground transport path 12 while transporting the bobbins B to the transport direction A on the completed bobbin transport path 7a and to the transport direction A' on the empty bobbin transport path 7b. The bobbin B whose axial direction is pulled down horizontally is gradually twisted and returned into an upright posture in raising it from the underground transport path 12.

In the present embodiment, the completed bobbins B1 and the empty bobbins B0 on the both transport paths 7a and 7b are tilted to a central side so that a tip end of each of the bobbins faces to one another. Also, a tilted posture of the tray T is continuously maintained in the horizontal base section 19 so as to be transported in a tilted state across the entire detour 13.

The detour 13 in the present embodiment is exemplified as being composed of the inclined sections 18 extending to an oblique downward direction from the connectors 17 belonging to the automatic winder 2 and the fine spinning frame 1, and the base section 19 for horizontally connecting the inclined sections 18 to one another, in which these sections are connected to one another with a smooth curve, but a structure may also be provided in such that the detour 13 is created steeply to a substantially vertical downward direction from the vicinity of the connection part 17, creating a vertical section in a sub-

stantially vertical state to a horizontal direction in the transport path, so as to be connected to the base section 19 in a shortest path, whereby the base section 19 can be secured more widely. Such a structure makes it possible to ensure further expansion of a width of the path 16. Moreover, the present embodiment is provided with, but not limited to, the bobbin transport paths 7a and 7b arranged in the underground to connect the automatic winder 2 and the fine spinning frame 1, and may also be provided with a transport path arranged upward to connect the automatic winder 2 and the fine spinning frame 1. For example, a bobbin transport path (not shown) may be arranged to have a detour transport path making a detour in the vicinity of a ceiling or within a ceiling, in which an axial direction of the bobbins B is tilted from an upright direction to a horizontal direction by twisting and raising the tray T, while transporting the bobbin B in a tilted state in the horizontal transport section, followed by returning an axial direction of the tilted bobbin B from a horizontal direction to an upright direction, whereby the bobbin B can be transported.

[0031] The feeding means 4 is arranged in the completed bobbin transport path 7a in the vicinity of the edge of the base section 19 on a side of the fine spinning frame 1 and in the empty bobbin transport path 7b in the vicinity of the edge of the base section 19 on a side of the automatic winder 2, while being disposed in substantially parallel to each of the transport direction A and the transport direction A'.

Although the feeding means 4 is provided in the base section 19 of the transport path 7 in the present embodiment, it may be provided in a position in the middle of the transport path 7 other than the base section 19.

[0032] Explained next will be the feeding means 4 referring to Figs. 3 and 4.

Explanation is made below for, but not limited to, the case of disposing the feeding means 4 to a transport direction to the transport direction A, and effects obtained therein are similar to those of the transport path A' used as a transport direction of the feeding means 4.

The feeding means 4 is made to be switchable between the case of transporting one piece of the tray T (which is referred to as "one-piece feeding" hereinafter) as shown in Fig. 3 and the case of transporting two pieces of the trays T (which is referred to as "two-piece feeding" hereinafter) as shown in Fig. 4 by driving the air cylinder 22 for one time (i.e. reciprocating movement in the transport direction A) as will be described later. That is, the feeding means 4 is allowed to change the amount of the bobbins B transported on a one-stroke basis or on a tray basis. The feeding means 4 includes: an air cylinder 22 being a driving source expanded and contracted along the transport direction A; a movable member 24 fixed via a bracket to a piston rod 23 belonging to the air cylinder 22 and made to reciprocate to move (or transport) the tray T; a guide part 26 slidably inserted in the movable member 24 so as to guide reciprocating motion along the transport direction A; a stopper 27 for restraining move-

ment of the mobile member 24 in a predetermined position; and a push lever 25 supported by the movable member 24 and engaged with the tray T.

The air cylinder 22 is fixed to the bottom guide plate 20a via a support member 22a.

[0033] The push lever 25 is supported by the movable member 24 on the guide plate 26 so as to be rotatable around a vertical axis 25a. The movable member 24 is also provided with a spring 28 exemplified as an elastic body to urge a tip end of the push lever 25 to a side of the guide plate 20a. The push lever 25 is therefore disposed to an oblique sideward direction toward the transport direction A, and the tip end of the push lever 25 protrudes to a central side between the transport paths 7a and 7b through an opening 35 created in the bottom guide plate 20a.

The tip end of the push lever 25 is then made to enter a recessed chamber 29 created to blow up a yarn end or for other purposes in the bottom of the tray T. That is, the push lever 25 pushes an internal wall 30 of the recessed chamber 29 to move the tray T to the transport direction A when the air cylinder 22 is degenerated to the transport direction A. In contrast, when the air cylinder 22 is expanded, the push lever 25 is pressed against the bottom of the tray T and detached from the recessed chamber 29 without pushing the tray T to the transport direction A. In addition, the tray T is engaged with subsequent trays T continuously disposed on a rear side of the tray T in the transport direction A (or the push lever 25 enters the recessed chamber 29).

The air cylinder 22 is also formed to demonstrate a sufficient pushing force so as to push any one of the trays T to move sequent trays T continuously transported in a row while resisting a total weight thereof.

The push lever 25 is made, but not limited, to push the internal wall 30 of the recessed chamber 29 so as to move the tray T to the transport direction A when the air cylinder 22 is degenerated to the transport direction A, and the push lever 25 may also be made to push the internal wall 30 of the recessed chamber 29 so as to move the tray T to the transport direction A when the air cylinder 22 is expanded to the transport direction A, by arranging the front and back of the air cylinder 22 in an opposite direction.

[0034] As shown in Figs. 3 and 4, the air cylinder 22 is also provided with a position detection means including an origin sensor 31, a position sensor 32 and a position sensor 33. Moreover, as shown in Fig. 5, the aforementioned detection means including three of the sensors is connected to the controller 34 being control means of the bobbin transport device 10. The position detection means is then structured to detect an origin position and a predetermined feeding position in each of expanded/contracted positions of the air cylinder 22.

Furthermore, the stopper 27 is provided as movement stop means. That is, a position to stop movement of the movable member 24 can be set by the stopper 27 in accordance with setting changes in the amount of the

trays T transported on a one-stroke basis in the air cylinder 22 (i.e. setting changes to one-piece feeding or two-piece feeding in the present embodiment). Figs. 3 and 4 show the same feeding means 4, and Fig. 3 exhibits the case of one-piece feeding while Fig. 4 exhibits the case of two-piece feeding. Fig. 3 exhibits the case of setting the transport amount to one-piece feeding, a setting position of the stopper 27 on the guide part 26 is set to be capable of corresponding to both cases switched between one-piece feeding and two-piece feeding, in which the movable means 24 is not stopped in sliding to the transport direction A with a width of one piece of the tray T, while it is restrained in sliding to the transport direction A with a width of two pieces of the trays T.

Fig. 4 also exhibits the case of setting the transport amount to two-piece feeding, in which a position of the stopper 27 on the guide part 26 is set so as to restrain the movable member 24 sliding to the transport direction A with a width of two pieces of the trays T in the same manner with the case of the aforementioned one-piece feeding.

If it is considered to use only one-piece feeding for the time being, the stopper 27 may be arranged in a position as shown in a two-dot chain line of Fig. 3.

[0035] The origin sensor 31 and the position sensor 32 as shown in Fig. 3 are then arranged to detect a feeding position in transporting one piece of the tray T. For example, the origin sensor 31 detects an origin position when the air cylinder 22 is expanded to the maximum to a rear side thereof in the transport direction A. The position sensor 32 detects completion of feeding one piece of the tray T when the air cylinder 22 is degenerated by a width of one piece of the tray T to push the tray T in the transport direction A.

In the example of switching setting to one-piece feeding as shown in Fig. 3, driving the air cylinder 22 is controlled on the basis of positions detected mainly by the origin sensor 31 and the position sensor 32.

[0036] More specifically, an origin position of the air cylinder 22 is obtained when the air cylinder 22 is expanded to the maximum to a rear side thereof in the transport direction A. The origin sensor 31 detects whether or not the air cylinder 22 falls in the origin position.

Moreover, a position of the air cylinder 22 in one-piece feeding is obtained when the air cylinder 22 is degenerated by a width of one piece of the tray T in the transport direction A from the origin position. The position sensor 32 detects whether or not the air cylinder 22 falls in the one-piece feeding position.

In the case of one-piece feeding, the air cylinder 22 disposed in the origin position is degenerated to the transport direction A to feed the tray T, and the controller 34 controls to stop driving the air cylinder 22 when the position sensor 32 detects that the air cylinder 22 reaches the one-piece feeding position.

If it is considered to use only one-piece feeding for the time being as stated above, the stopper 27 is disposed in a position as shown in a two-dot chain line of Fig. 3 so

as to prevent the air cylinder 22 from moving beyond a position of one-piece feeding.

[0037] Moreover, the origin sensor 31 and the position sensor 33 as shown in Fig. 4 are arranged to detect a feeding position in transporting two pieces of the trays T. The origin sensor 31 detects an origin position when the air cylinder 22 is expanded to the maximum to a rear side thereof in the transport direction A. The position sensor 33 detects completion of feeding two pieces of the trays T when the air cylinder 22 is degenerated by a width of two pieces of the trays T to the transport direction A in order to push the trays T.

In Fig. 4 exhibiting the case of setting the transport amount to two-piece feeding in the feeding means 4, a position of the stopper 27 on the guide part 26 is set to be capable of corresponding to both cases switched between one-piece feeding and two-piece feeding, in which the stopper 27 restrains the movable member 24 only in sliding toward the transport direction A by a width of two pieces of the trays T. If setting of the transport amount is changed to one-piece feeding in accordance with circumstances, or if setting is changed to slide the movable member 24 with a width of one piece of the tray T toward the transport direction A, the stopper 27 does not restrain the movable member 24.

Then, in an example of switching setting to two-piece feeding as shown in Fig. 4, driving the air cylinder 22 is controlled on the basis of positions detected by the origin sensor 31 and the position sensor 33.

[0038] More specifically, the origin position of the air cylinder 22 is obtained when the air cylinder 22 is expanded to the maximum to a rear side thereof in the transport direction A. The origin sensor 31 detects whether or not the air cylinder 22 falls in the origin position.

A position of the air cylinder 22 in two-piece feeding is also obtained when the air cylinder 22 is degenerated by a width of two pieces of the trays T to the transport direction A from the origin position. The position sensor 33 detects whether or not the air cylinder 22 falls in the two-piece feeding position.

In the case of two-piece feeding, the air cylinder 22 disposed in the origin position is degenerated to the transport direction A to feed the trays T, and the controller 34 controls to stop driving the air cylinder when the position sensor 33 detects that the air cylinder 22 reaches the two-piece feeding position.

The stopper 27 is also provided to prevent the air cylinder 22 from moving beyond the two-piece feeding position.

The present embodiment is exemplified to have, but not limited to, the arrangement of the position sensors to detect a feeding position of up to two pieces of the trays T, and it is also possible to feed two or more pieces of the trays T by appropriately setting an arrangement position and number of the sensors. For example, the position sensors may be arranged to detect a feeding position in a width of three or any more pieces of the trays T.

Instead of indirectly confirming a feeding amount of the trays T by providing the position detection means in the

feeding means 4 as exhibited in the present embodiment, the position detection means (e.g. such as optical sensors) may be arranged on the transport paths to directly detect a position of the tray T.

Although the push lever 25 is engaged with the internal wall 30 being an internal bottom side of the tray T to push and transport the tray T in the present embodiment, a push lever 41 may be connected to an external bottom side surface of the tray T to push and transport the tray T from the external side as shown in a plan schematic view of Fig. 6a and a side surface view of Fig. 6b.

Moreover, the structure of the feeding means 4 is not limited to the above structure, and any structures of known means can be employed. Other embodiments of the feeding means will be explained below in detail.

[0039] Explained next will be other embodiments of the feeding means referring to Figs. 7 and 8.

Fig. 7 shows another embodiment of the feeding means, in which a push lever is arranged on a timing belt as shown in a plan view of Fig. 7a, and the push lever, the timing belt and a motor portion to be included in the feeding means are shown in a side surface view of Fig. 7b. Fig. 8 shows yet another embodiment of the feeding means, in which the push lever is arranged on a ball screw as shown in a plan view of Fig. 8a, and the push lever, the ball screw and a motor portion to be included in the feeding means are shown in a side surface view of Fig. 8b.

For example, instead of using the air cylinder as a driving source as stated above, a driving mechanism of the feeding means may be realized in a system in which a movable member 43 for supporting a push lever 45 is arranged on a timing belt 44 which is driven to exhibit reciprocating motion along the transport direction A by driving the motor 42 as a driving source as shown in Fig. 7. Moreover, according to a system provided with a motor 52 as a driving source to convert rotational movement to reciprocating movement as shown in Fig. 8, a movable member 53 may exhibit reciprocating motion along the transport direction A by driving the motor 52 in an arrangement of disposing the movable member 53 for supporting a push lever 55 on a ball screw 56.

Furthermore, according to a system to convert rotational movement to reciprocating movement by a rack pinion mechanism or other mechanisms provided with a motor as a driving source not shown, a pinion may perform reciprocating motion along the transport direction A by driving the aforementioned motor in an arrangement of disposing a movable member for supporting a push lever on the pinion.

Although the aforementioned other embodiments of the feed member use the motors as a driving source, the motor can also be subjected to a servo control or a pulse control to execute a rotational control. For example, if rotation is controlled by a pulse control, that is, if a stepping motor is used, feeding means can be structured less expensively than using a servo motor. Controlling rotation by a pulse control also makes it possible to accurately

control a position to feed the tray T in the same manner with an example of providing the position detection means in the air cylinder 22 for use in the present embodiment.

In the aforementioned other embodiments of the feed means without using the air cylinder as the driving source, one stroke is defined by one reciprocating motion with a predetermined interval along the transport direction A in the push lever by driving the motor.

[0040] In such structures, the tray T of, for example, the completed bobbin B1 produced by the fine spinning frame 1 is sent from the carry-out conveyer 5 to the connection part 17 of the completed bobbin transport path 7a and enters the bottom section 19 via the inclined section 18. When the air cylinder 22 of the feeding means 4 arranged in this portion is degenerated, the push lever 25 pushes the bottom of the tray T, whereby entire trays T disposed to a front side of the tray T in the transport direction A are moved forward by a predetermined stroke length.

More specifically, the air cylinder 22 is driven until a position sensor 32 or the position sensor 33 detects that the air cylinder 22 is moved from a state of positioning the push lever 25 and the movable member 24 as shown in Fig. 3 or Fig. 4 (origin position), to a position of one-piece feeding or two-piece feeding.

The air cylinder 22 is thus driven until the position sensor 32 or the position sensor 33 detects movement of the air cylinder 22 to a position of one-piece feeding or two-piece feeding.

If the transport amount can be changed as needed, the stopper 27 is fixed to a position corresponding to two-piece feeding as stated above, and a position of the movable member 24 is restrained so as not to deviate from the position only in the case of two-piece feeding. If setting of the transport amount is then changed to one-piece feeding, the positional restraint is not carried out.

[0041] Explained next will be a method to control the bobbin transport device 10 referring to Fig. 5.

As stated above, the fine spinning frame 1 has the controller 1a to confirm process conditions such as production conditions of the completed bobbins B1 in the fine spinning frame 1. The automatic winder 2 also has the controller 2a which is connected to a bobbin detection sensor 36, a full sensor 37, a bobbin stopper 38 and a supply amount detection sensor 40 to be described later. The controller 2a confirms process conditions of the automatic winder 2 as needed on the basis of detection signals from the bobbin detection sensor 36, the full sensor 37 and other sensors.

The bobbin transport device 10 also has the controller 34 which is connected to the air cylinder 22 and the position detection means including the origin sensor 31, the position sensor 32 and the position sensor 33 for detecting movement of the air cylinder 22 to an origin position or a position of one-piece feeding or two-piece feeding. These sensors transmit expanded/contracted positions of the air cylinder 22 to the controller 34. Owing to each

of the sensors, the controller 34 is further allowed to confirm the amount of the bobbins B transported to the automatic winder 2 or the fine spinning frame 1.

Moreover, the controller 1a of the fine spinning frame 1 and the controller 2a of the automatic winder 2 are connected to the controller 34 of the bobbin transport device 10.

Process conditions in the automatic winder 2 are thus transmitted to the controller 34 of the bobbin transport device 10 by the controller 2a of the automatic winder 2. Process conditions in the fine spinning frame 1 are also transmitted to the controller 34 of the bobbin transport device 1 by the controller 1a of the fine spinning frame 1.

[0042] Explained next will be a method to detect process conditions of the automatic winder 2 referring to Figs. 9 and 10.

As shown in Fig. 9, the automatic winder 2 is composed of the bobbin process part 2b and a winding unit part 2e. The bobbin process part 2b has a circulation path 39, in which the carry-in conveyor 6 connected to the completed bobbin transport path 7a is merged into the circulation path 39 and branched from the middle of the circulation path 39 to be connected to a completed bobbin supply path 2c in the bobbin process part 2b. An empty bobbin transport path 2d continued from the winding unit part 2e is also merged into the circulation path 39 in the bobbin process part 2b and branched from the middle of the circulation path 39 to be connected to the carry-out conveyor 8. The winding unit part 2e is composed of a plurality of spinning units (not shown) connected in parallel. Each of the winding units included in the winding unit part 2e has a path 2g which connects the completed bobbin supply path 2c and the empty bobbin transport path 2d. The supply amount detection sensor 40 for detecting the supply amount of the completed bobbins B1 is arranged on a tip end of the completed bobbin supply path 2c in the winding unit part 2e, and a completed bobbin circulation path 2f is formed in a loop shape from a tip end side of the completed bobbin supply path 2c.

Moreover, as shown in Fig. 10, the empty bobbin transport path 2d is provided with a bobbin detection sensor 36 for detecting the empty bobbins B0 and a bobbin stopper 38 for restraining a flow rate of the bobbins B0 to the circulation path 39 in a position disposed immediately before the empty bobbin transport path 2d is merged into the circulation path 39.

The full sensor 37 is also provided in an upstream of the bobbin stopper 38 in order to detect a predetermined amount of accumulated empty bobbins B0. The full sensor 37 is actuated when the empty bobbins B0 or the completed bobbins B1 with remaining yarn are detected continuously for a predetermined period of time or longer.

[0043] According to such a structure of the automatic winder 2, if there is an open space in the path 2g of the winding unit part 2e when the completed bobbins B1 are transported from the completed bobbin supply path 2c of the bobbin process part 2b (refer to Fig. 10) to the completed bobbin supply path 2c of the winding unit part

2e, the completed bobbins B1 are supplied to the path 2g. If the path 2g is fully filled without having an open space, subsequent completed bobbins are made to flow on the completed bobbin supply path 2c and transported without entering the path 2g until the path 2g has an open space. When the completed bobbins B1 thus pass through without entering the path 2g disposed at the tip end, they are made to flow into the completed bobbin circulation path 2f. If the supply amount detection sensor 40 of the winding unit part 2e detects the completed bobbins B1 ejected into the completed bobbin circulation path 2f, or more specifically if the completed bobbins B1 are detected more than a predetermined frequency within a predetermined period of time, it means that the path 2g is fully filled with the completed bobbins B1 and a predetermined amount of the completed bobbins B1 is made to flow in the completed bobbin circulation path 2f, whereby the controller 2a determines the completed bobbins B1 are excessively supplied in the winding unit part 2e. If the completed bobbins B1 are detected less than a predetermined amount of times within a predetermined period, it means that an appropriate amount of the completed bobbins B1 is supplied to the winding unit part 2e. Therefore, if it is determined that the completed bobbins B1 are excessively supplied, the controller 34 controls the feeding means 4 provided in the completed bobbin transport path 7a to reduce the feeding amount of the completed bobbins B1.

In contrast, if the supply amount detection sensor 40 detects none of the completed bobbins B1, it means that the completed bobbins B1 are insufficiently supplied, so that the controller 34 controls the feeding means 4 provided in the completed bobbin transport path 7a to increase the feeding amount of the completed bobbins B1.

[0044] The empty bobbins B0 generated after rewinding spun yarn of the completed bobbins B1 into packages in the winding unit part 2e are transported to the empty bobbin transport path 2d in the winding unit part 2e. The completed bobbins B1 with remaining yarn are occasionally transported to the empty bobbin transport path 2d. The controller 2a then controls the bobbin stopper 38 to actuate opening/closing thereof so as to send the empty bobbins B0 with a predetermined interval in a position disposed immediately before the empty bobbin transport path 2d continued from the winding unit 2e is merged into the circulation path 39. If the amount of the empty bobbins B0 transported from the winding unit part 2e is increased more than the amount of the empty bobbins B0 transported in the bobbin stopper 38 in accordance with advancement in the process of the winding unit part 2e, the empty bobbins B0 are accumulated on the empty bobbin transport path 2d of the bobbin process part 2d as shown in Fig. 10. When the empty bobbins B0 are accumulated for a predetermined amount, the full sensor 37 detects a state of being fully filled with the empty bobbins B0 and sends a detection signal to the controller 2a. Based on the detection signal, the controller 2a controls the bobbin stopper 38 to increase a frequency to actuate

opening thereof within a predetermined period of time in order to increase the feeding amount, whereas the controller 34 controls the feeding means 4 provided in the empty bobbin transport path 7b to increase the feeding amount (or the transport amount of bobbins). That is, the controller 2a captures a current process capability of the automatic winder 2 by the amount of accumulated empty bobbins B0 detected by the full sensor 37. In accordance with a process capability of the automatic winder 2, the controller 34 determines the feeding amount in the feeding means 4, i.e. the amount of bobbins transported on a one-stroke basis in the air cylinder 22. Furthermore, the amount of bobbins transported on a one-stroke basis in the air cylinder 22 may also be determined in accordance with not only a process capability of the automatic winder 2 but also entire conditions of the system (i.e. conditions obtained after adding process conditions of the fine spinning frame).

[0045] Position detection signals outputted from the respective position sensors are then used to control the air cylinder 22 to be driven in accordance with a determined transport amount of bobbins, (the air cylinder 22 is controlled to reciprocate in a stroke width corresponding to a specified transport amount). That is, the controller 34 determines a position (i.e. one-piece feeding position or two-piece feeding position) to stop driving the air cylinder 22 in addition to a position of the origin in accordance with the transport amount of bobbins (the amount of bobbins transported by one-piece feeding or two-piece feeding).

More specifically, the controller 34 determines whether or not to increase/decrease a speed required to transport the bobbins B by determining process conditions of the automatic winder 2 or other elements, in which the amount of the trays T transported on a one-stroke basis in the air cylinder 22 can be changed accordingly. If it is necessary to increase a speed to transport the bobbins B, the controller 34 increases the transport amount by switching setting of the tray T to two-pieces feeding. On the contrary, if it is necessary to decrease a speed to transport the bobbins B, the controller 34 reduces the transport amount by switching setting of the tray T to one-piece feeding.

Moreover, according to the arrangement of the position sensors in feeding positions with different stroke lengths (i.e. one-piece feeding position or two-piece feeding position in the present embodiment) in the air cylinder 22 as show in the present embodiment, a position to feed the tray T can be detected by a simple device structure. Furthermore, since the position sensors are provided in the feeding means 4 in the present embodiment, a position to feed the tray T can be electrically detected and a feeding position can be restrained by the controller 34 which controls to drive or stop the air cylinder 22 being a driving device. Therefore, in comparison with a feeding position determined by mechanically restraining only a position of the stopper 27, transport accuracy is enhance without having deviation in the feeding amount of the

trays T or the like. That is, half-feeding or other phenomena observed in controlling a feeding position exclusively depending on the stopper 27 can be avoided.

The present embodiment is configured, but not limited, to automatically control a speed to transport the bobbins B by the controller 34, and may also be configured to manually control a speed to transport the bobbins B as needed by operators who confirmed process conditions of the automatic winder 2 and the fine spinning frame 1. The present embodiment is also configured to improve a speed to transport the bobbins B by increasing the amount of bobbins transported on a one-stroke basis, and a concrete reason why a speed to transport the bobbins B is improved is that frequency of switching the moving directions of the movable member 24 per unit time by driving the air cylinder 22 to reciprocate is reduced when bobbins are transported by two-piece feeding in comparison with one-piece feeding, and a period of time required to control the switching is accordingly reduced. Moreover, if the origin sensor and the position sensor are both provided, the origin sensor and the position sensor detect the trays T less frequently per unit time with a reduced period of time for the detection. Owing to such reasons, a transport speed is improved by about twenty percent in the present embodiment if setting of the transport amount of bobbins is changed from one-piece feeding to two-piece feeding. In contrast, if the transport amount of bobbins is reduced, a transport speed is decreased because of effects opposite to those of the aforementioned reasons.

[0046] The tray T moved forward by a length of one stroke of the air cylinder 22 is thus horizontally transported in the base section 19, followed by being raised in the inclined section 18 on a side of the automatic winder 2 and passed onto the carry-in conveyer 6 of the automatic winder 2 while the bobbin B1 is again converted into a standing posture in the bent portion 21 disposed in front of the connection part 17 on the opposite side.

The tray T equipped with the empty bobbin B0 which was subjected to rewinding in the automatic winder 2 is quite similarly pulled down from the carry-out conveyer 8 of the automatic winder 2 while a posture thereof is converted in the detour 13, and the tray T is sent to the transport direction A by degeneration of the air cylinder 22 with a length of one stroke in the feeding means 4, followed by being returned to an original posture in the bent portion 21 and transported to the carry-in conveyer 9 of the fine spinning frame 1.

[0047] In the bobbin transport system having the automatic winder 2, the fine spinning frame 1, and the bobbin transport device 10 having the bobbin transport path 7 for connecting the automatic winder 2 and the fine spinning frame 1, the bobbin transport device 10 is composed of the transport guide member 3 for guiding the tray T equipped with the bobbin B along the bobbin transport path 7 and the feeding means 4 having the movable member 24 for moving the tray T by reciprocating, in which a speed to transport bobbins (i.e. the amount of

bobbins transported per unit time) on the bobbin transport path 7 can be changed in accordance with a process capability of the automatic winder 2 by changing the amount of bobbins transported on a one-stroke basis in the feeding means 4, whereby it is not necessary to shorten a stroke interval (or increase a moving speed of the movable member 24) in order to increase a speed to transport the bobbin B, and lifetime of the feeding means 4 can be extended. Moreover, a speed of reciprocating movement of the movable member 24 does not need to be changed, and the bobbins B can be efficiently transported in accordance with a process capability or conditions of the automatic winder 2 by changing a bobbin transport speed. Furthermore, if the transport amount is changed on a basis of the number of the trays T (i.e. one-piece feeding or two-piece feeding in the present embodiment), it is made easier to change the transport amount, in which the controller 34 is certainly and easily capable of confirming the amount of the bobbins B transported to the automatic winder 2 or the fine spinning frame 1.

[0048] Also, because the bobbin transport path 7 has the base section 19 being a horizontal transport section and a transport plane height in the base section 19 differs from a transport plane height in the conveyer of the automatic winder 2 or the fine spinning frame 1, a height of the bobbin transports path 7 can be appropriately set in accordance with circumstances in a installation site of the automatic winder 2 and the fine spinning frame 1.

[0049] Moreover, the bobbin transport path 7 is not considered as an obstacle disposed between the automatic winder 2 and the fine spinning frame 1 because the base section 19 being a horizontal transport section of the bobbin transport path 7 is arranged in the underground. Effective space usage can also be realized by providing a path or the like on the horizontal transport section.

[0050] In the inclined section 18 being a bobbin transport path to connect the base section 19 being a horizontal transport section of the bobbin transport path 7 and the conveyer disposed in the automatic winder 2 or the fine spinning frame 1, the tray T is transported while being twisted so as to bring an axial direction of the bobbin B from an upright direction to a horizontal direction or from a horizontal direction to an upright direction, while an axial direction of the bobbin B is disposed horizontally in the base section 19 being a horizontal transport section of the bobbin transport path 7, whereby a transport path can be installed in a shallow underground space.

[0051] In addition, because the feeding means 4 is provided in the spun bobbin transport path 7a included in the bobbin transport path 7 so as to transport the bobbin B subjected to spinning from the fine spinning frame 1 to the automatic winder 2, the completed bobbin B1 can be efficiently transported to the automatic winder 2. Since the feeding means 4 is further provided in the empty bobbin transport path 7b included in the bobbin transport path 7 so as to transport the empty bobbin B0 from the automatic winder 2 to the fine spinning frame 1, a trans-

port capability is increased and the empty bobbin B0 can be efficiently transported to the fine spinning frame 1.

The present embodiment is configured, but not limited to, arrange the feeding means 4 in two positions of the forward path 7a and the return path 7b in the transport path 7, and may also be configured to arrange the feeding means 4 in only one position or a plurality of positions on the transport path 7 by taking a transport capability or others into consideration.

[0052] Moreover, owing to an arrangement of the position detection means for detecting a position to feed the tray T transported by the feeding means 4 on the bobbin transport path 7, the amount of bobbins transported by the feeding means 4 can be confirmed by the position detection means. As a result, a bobbin transport speed (or the transport amount of bobbins per unit time) can be accurately changed in accordance with a process capability of the automatic winder 2 or entire conditions of the bobbin transport system, whereby the entire bobbin transport system can be efficiently activated.

[0053] Furthermore, the position detection means is composed of the origin sensor 31 for detecting the origin of a position to feed the tray T, and the position sensors 32 and 33 for detecting a position to feed the tray T, so that the position detection means can be simplified in the structure. It is also made possible to accurately confirm a position to feed the tray T.

[0054] The air cylinder 22 used as a driving source of the feeding means 4 also realizes simplified maintenance without requiring complicated driving mechanisms. Since the air cylinder 22 is unable to output a pressure equal to or more than a defined value, the driving mechanism is not damaged even in circumstances of generating an unreasonable load.

[0055] The present invention is applicable to a wide range of bobbin transport devices, bobbin transport systems or the like including means to transport a tray equipped with a bobbin.

Claims

1. A bobbin transport system comprising: an automatic winder (2); a fine spinning frame (1); and a bobbin transport device (10) having a bobbin transport path (7) for connecting the automatic winder (2) and the fine spinning frame (1), the bobbin transport device (10) being composed of a transport guide member (3) for guiding a tray (T) equipped with a bobbin (B) along the bobbin transport path (7); and feeding means (4) having a movable member (24) which is made to reciprocate to move the tray (T),
characterized in that

speed to transport bobbins on the bobbin transport path (7) can be changed in accordance with a process capability of the automatic winder (2) by changing the amount of bobbins transported

in the feed member (4).

2. The bobbin transport system according to claim 1, **characterized in that** setting of the amount of bobbins transported in the feeding means (4) is changed on a one-stroke basis. 5

3. The bobbin transport system according to claim 2, **characterized in that** setting of the amount of bobbins transported in the feeding means (4) is changed on a basis of the amount of trays (T). 10

4. The bobbin transport system according to any one of claims 1 to 3, **characterized in that** the feeding means (4) is provided in a spun bobbin transport path (7a) included in the bobbin transport path (7) so as to transport the bobbin (B) subjected to spinning from the fine spinning frame (1) to the automatic winder (2). 15
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5. The bobbin transport system according to any one of claims 1 to 3, **characterized in that** the feeding means (4) is provided in an empty bobbin transport path (7b) included in the bobbin transport path (7) so as to transport the bobbin (B) in an empty state from the automatic winder (2) to the fine spinning frame (1). 25

6. The bobbin transport system according to any one of claims 1 to 5, **characterized in that** the feeding means (4) comprises position detection means for detecting a position to feed the tray (T) transported by the feeding means (4) on the bobbin transport path (7). 30
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7. The bobbin transport system according to claim 6, **characterized in that** the position detection means is composed of an origin sensor (31) for detecting the origin of a position to feed the tray (T) and position sensors (32 and 33) for detecting a position to feed the tray (T). 40

8. The bobbin transport system according to any one of claims 1 to 7, **characterized in that** a driving source of the feeding means (4) is an air cylinder (22). 45

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Fig.1

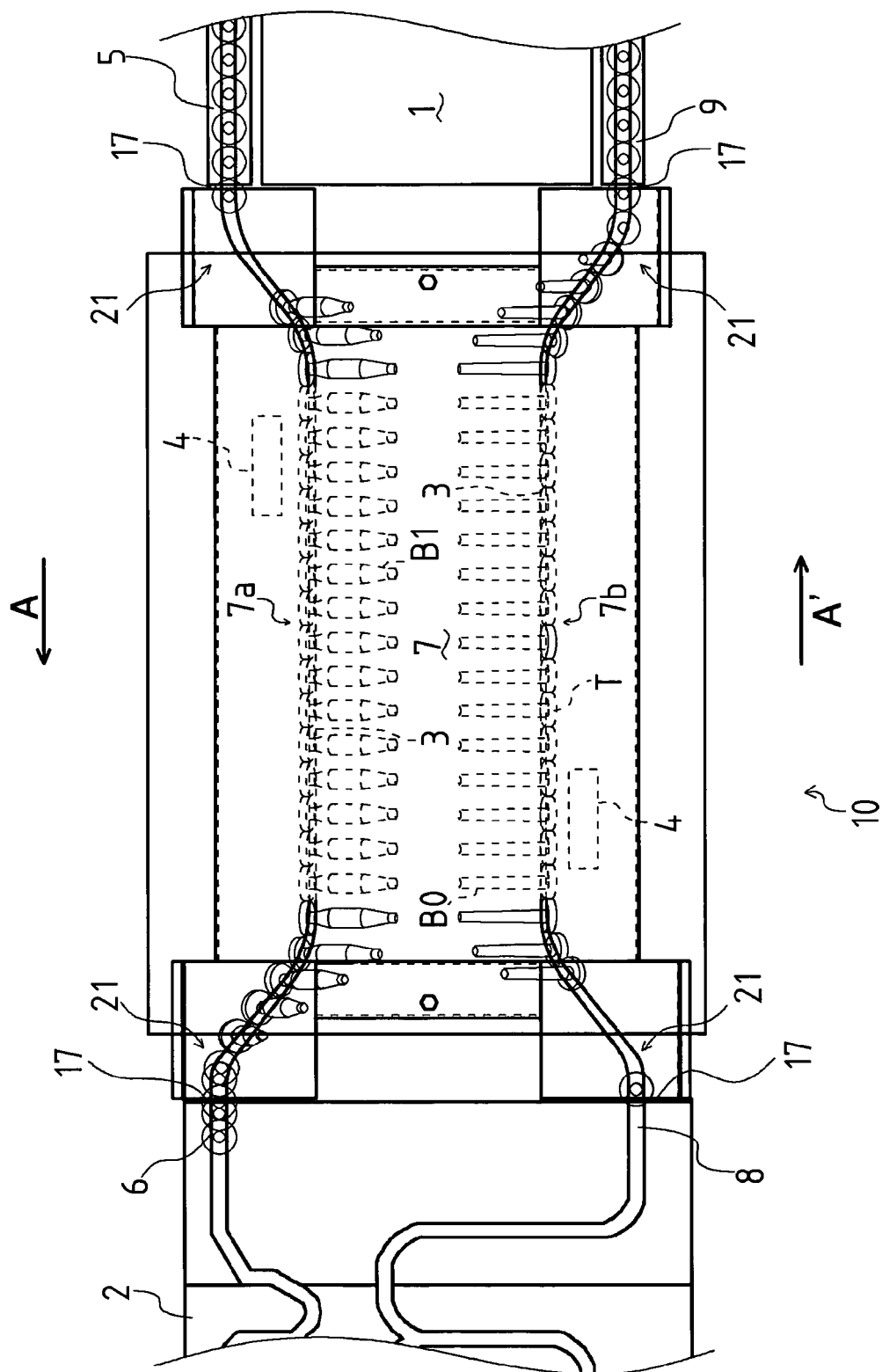


Fig.2

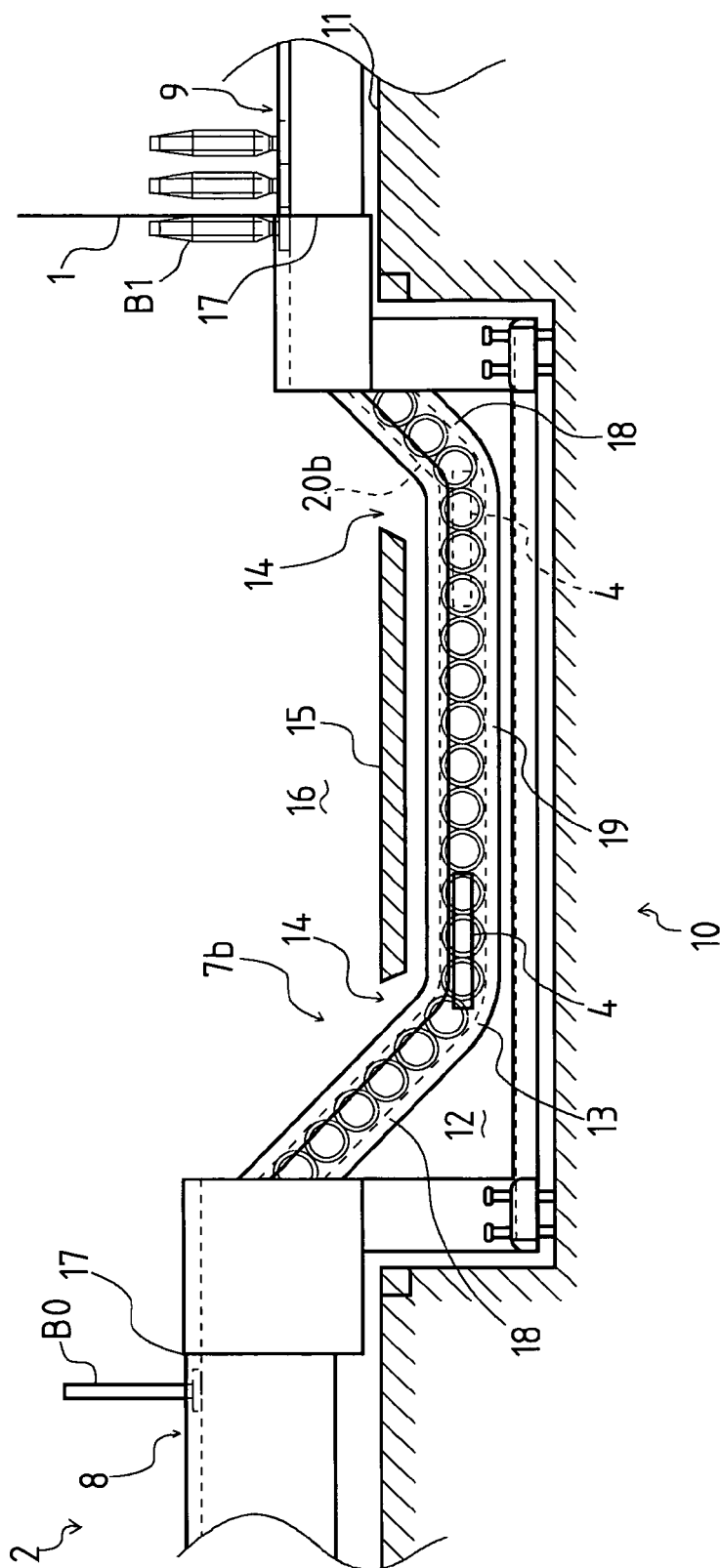


Fig.3

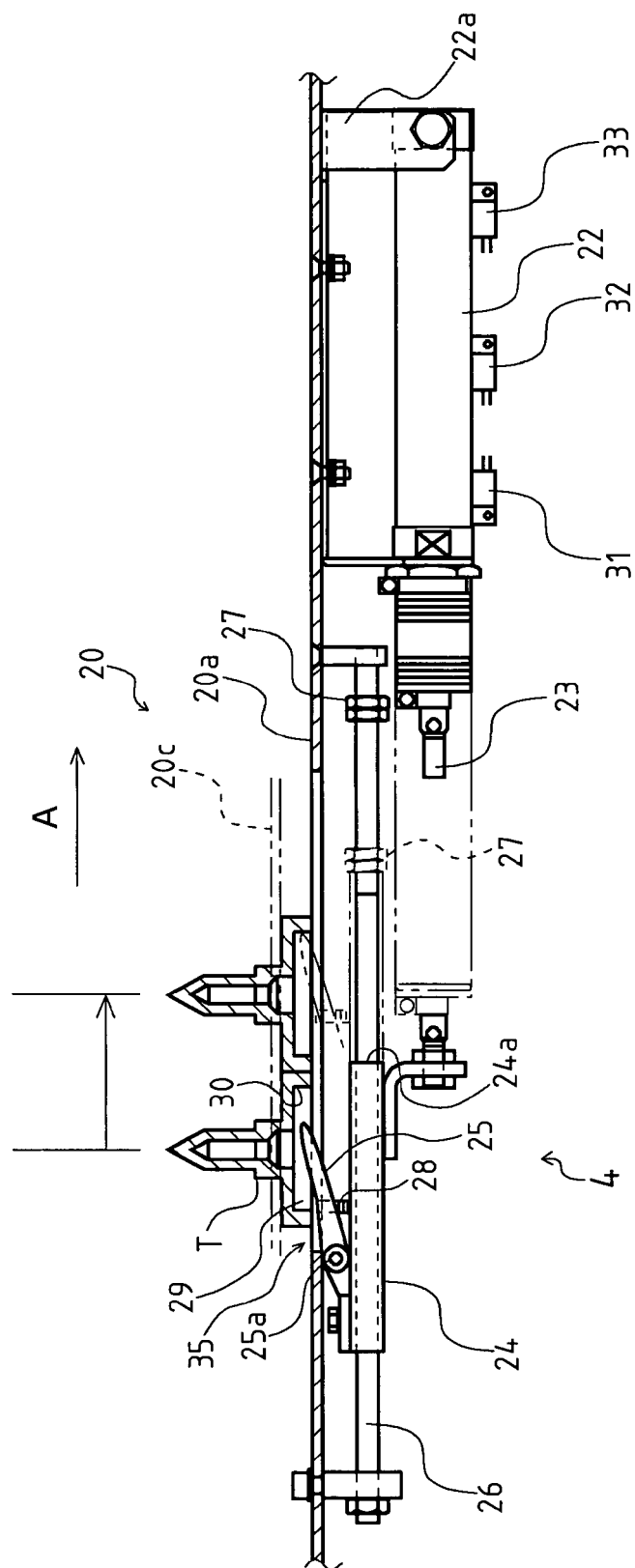


Fig.4

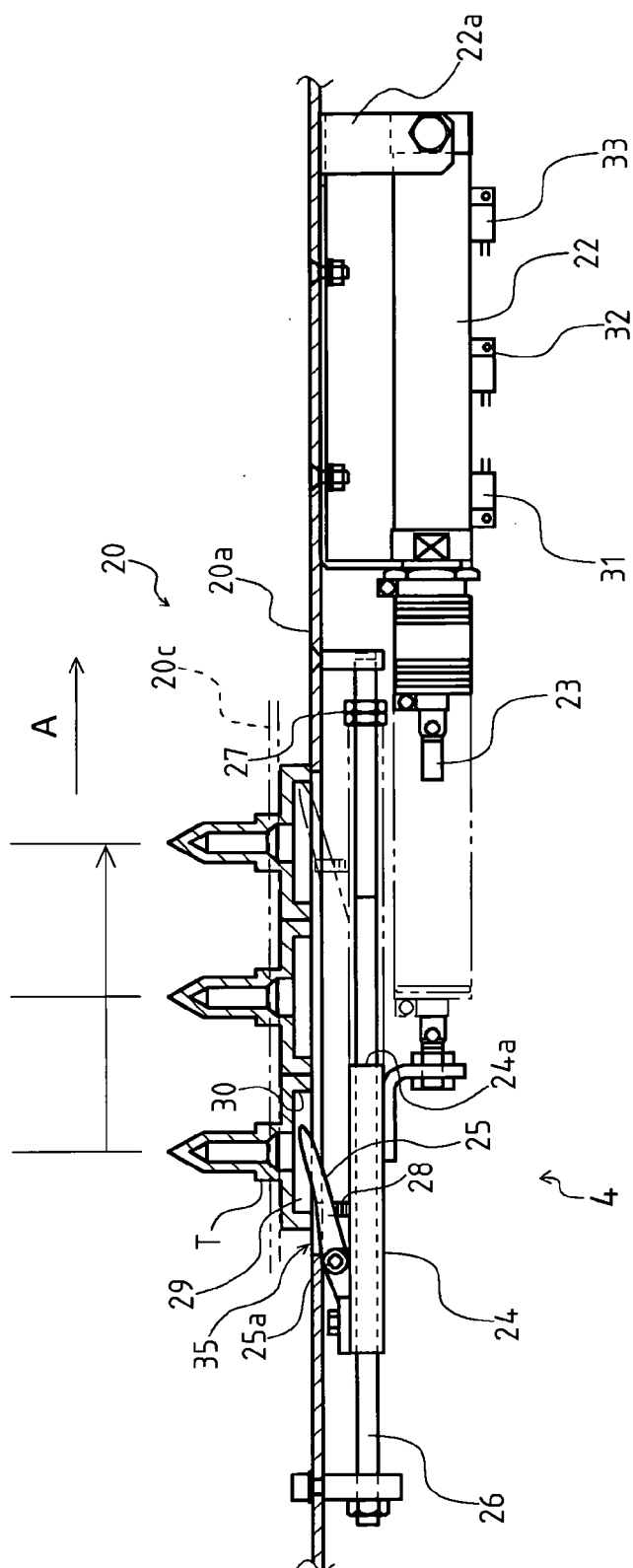


Fig.5

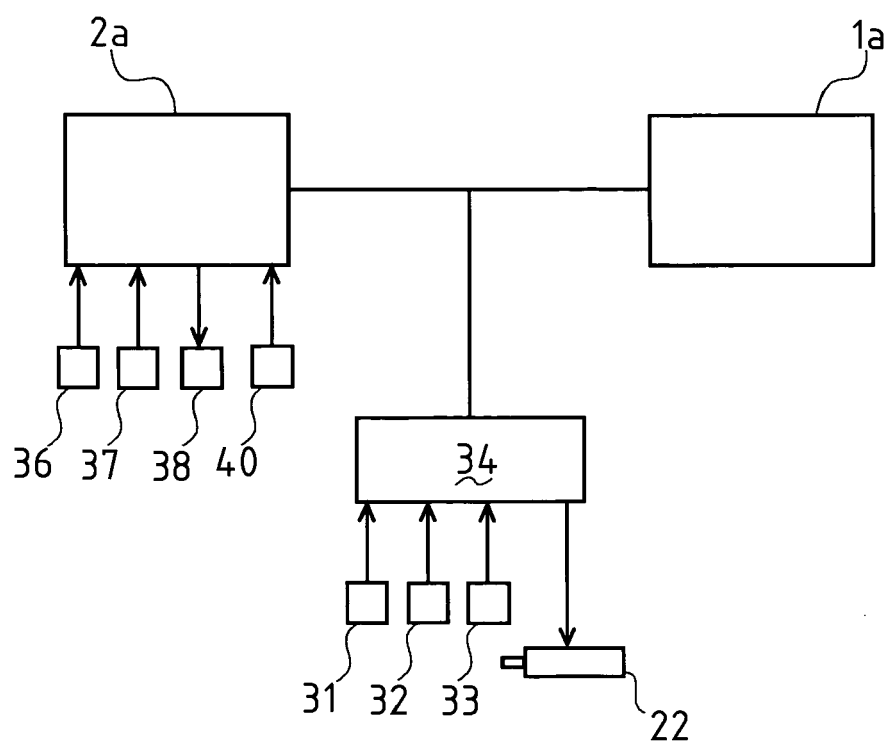


Fig.6

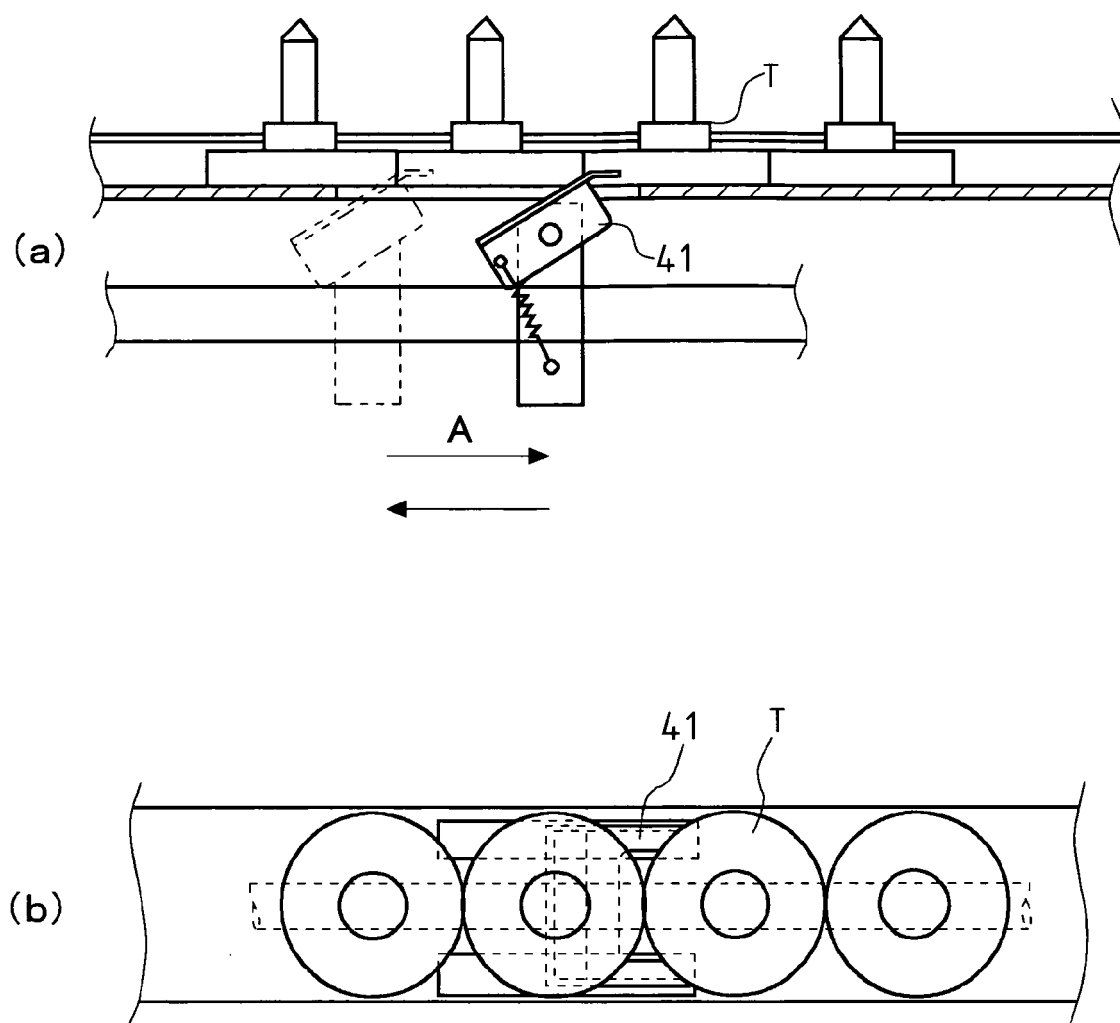


Fig.7

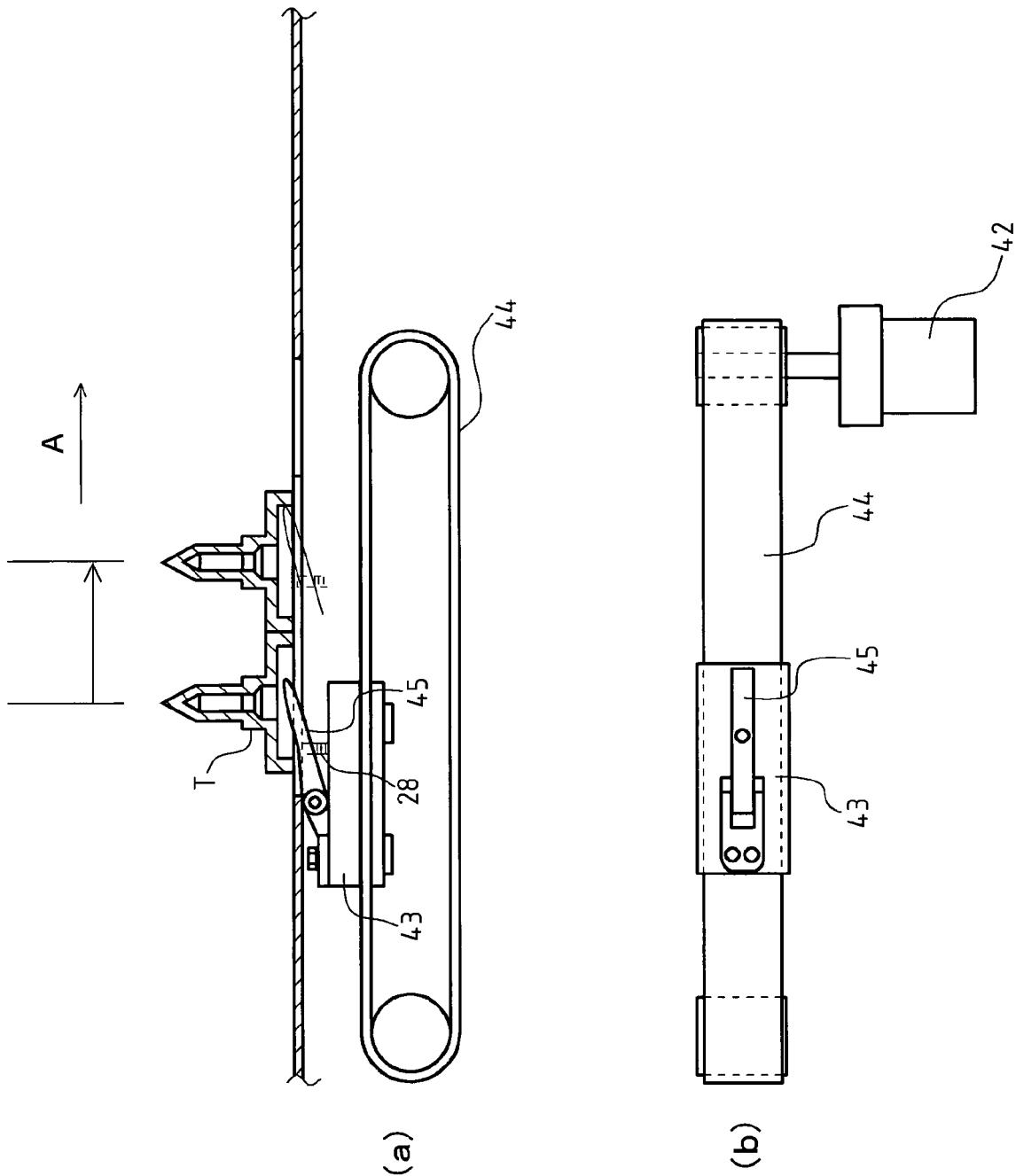


Fig.8

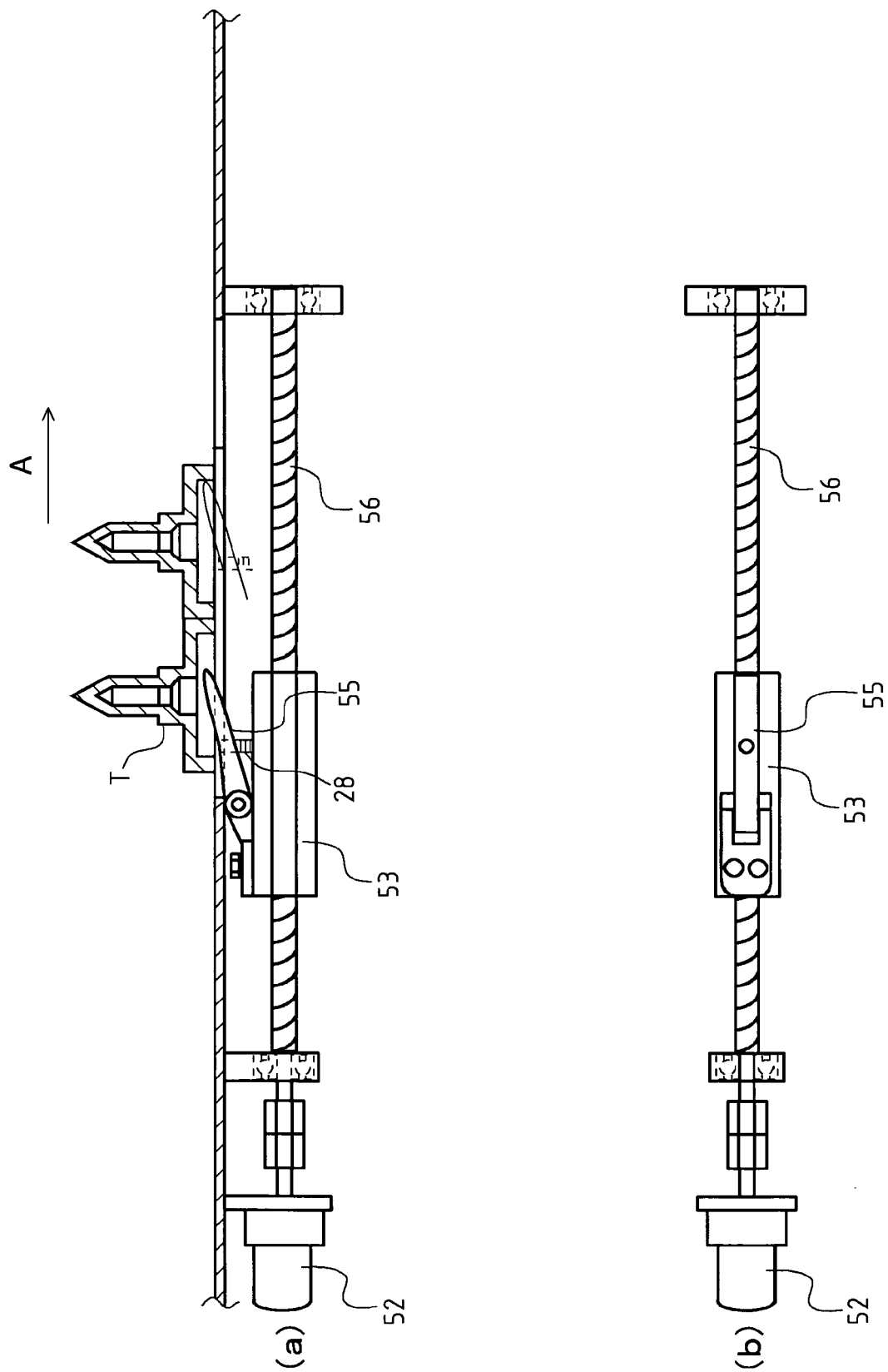


Fig.9

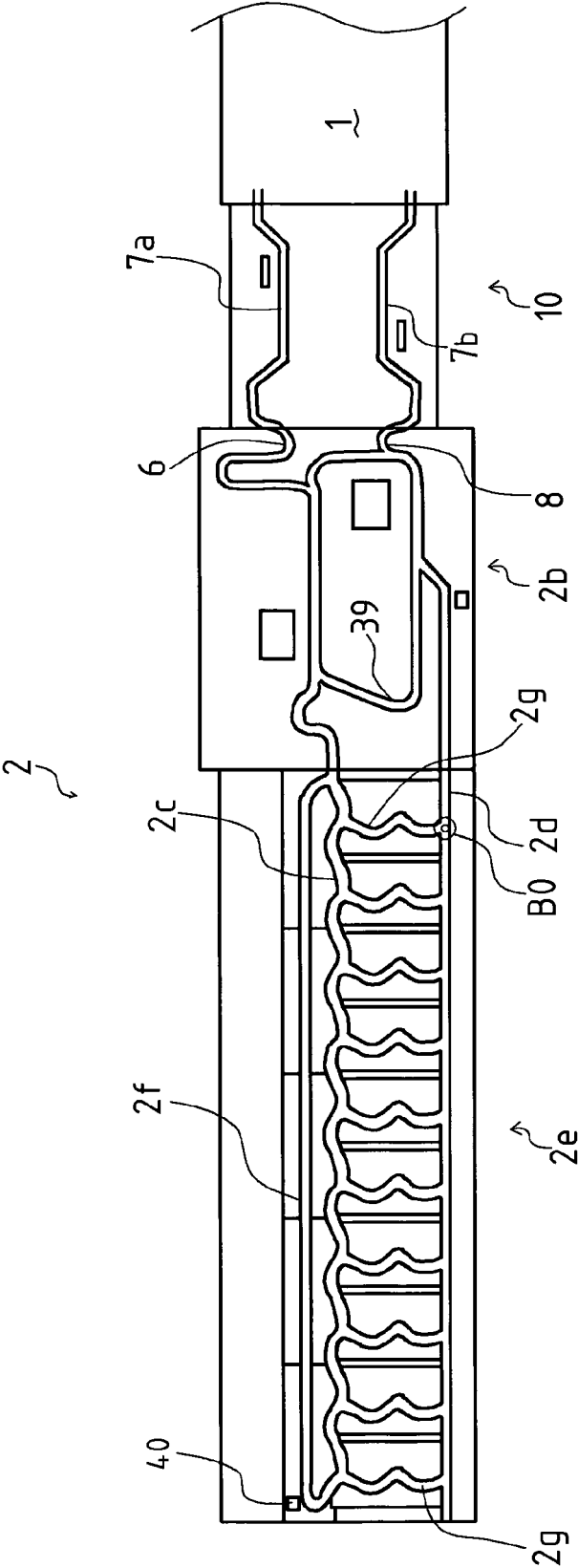


Fig.10

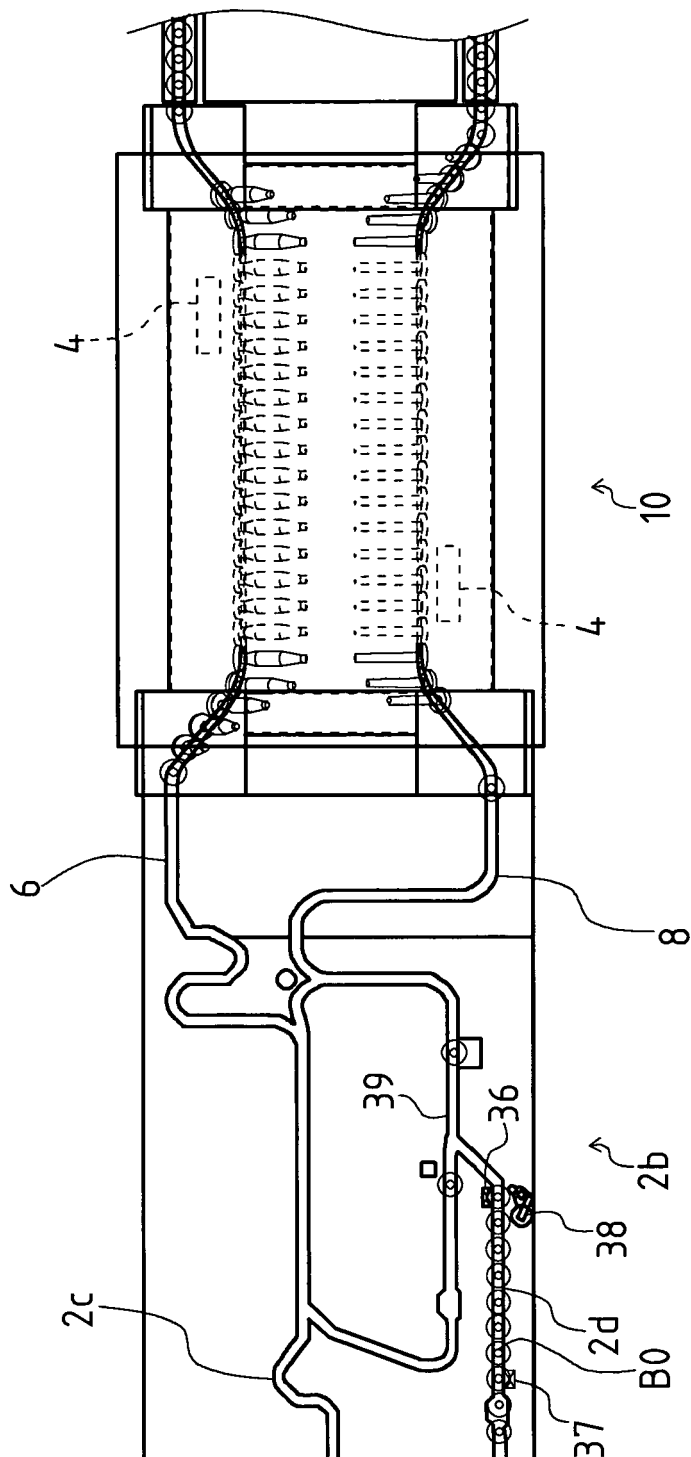
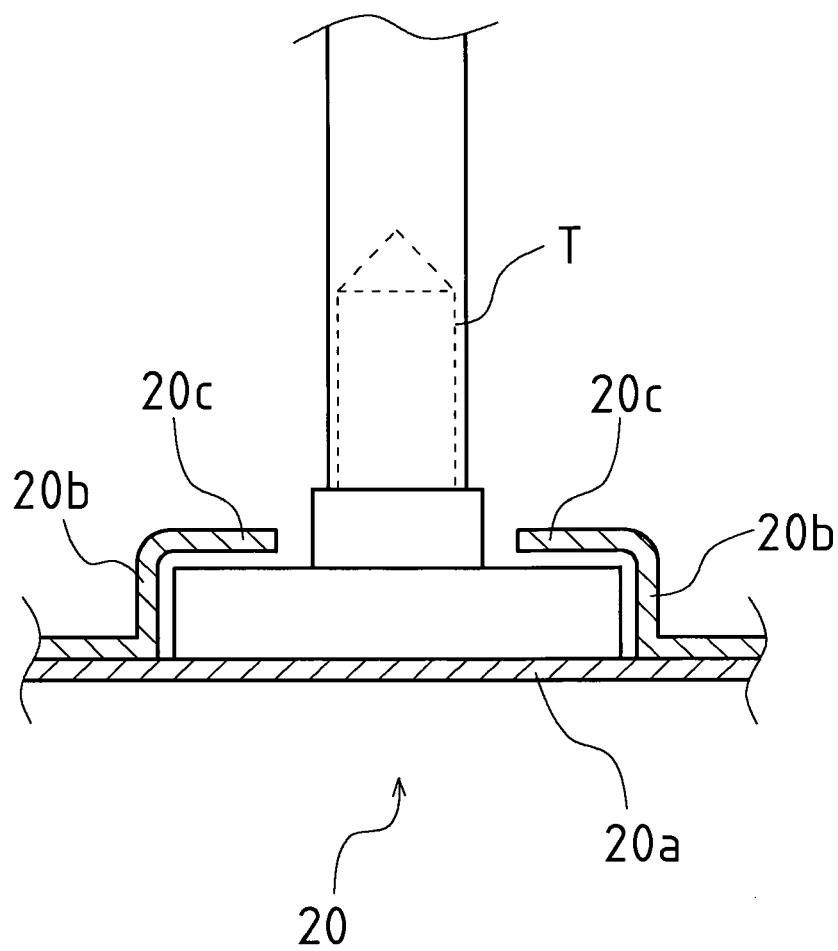


Fig.11



REFERENCES CITED IN THE DESCRIPTION

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