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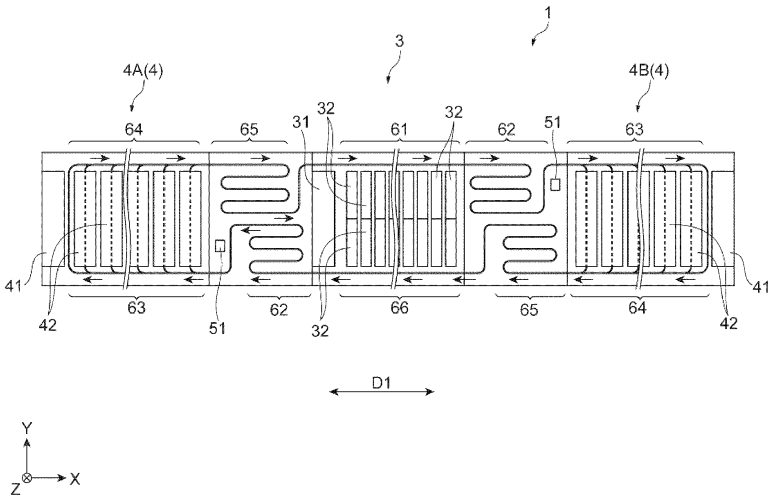
(54) YARN WINDING SYSTEM

(57) A yarn winding system (1) includes: one spinning frame (3) including a plurality of spinning units (42) aligned in one direction; a plurality of automatic winders (4) each including a plurality of winding units (42) and a machine control device (41) configured to control the winding units (42); and a conveying device (5) configured to convey yarn feeding bobbins (11) formed in the one spinning frame (3) to the automatic winders (4) and convey used yarn feeding bobbins (11) used in the automatic winders (4) to the spinning frame (3). The one spinning frame (3) and the automatic winders (4) are aligned along an alignment direction (D1). The conveying device (5) conveys yarn feeding bobbins (11) from the one spinning frame (3) to each one of the automatic winders (4) without conveying the yarn feeding bobbins (11) through others of the automatic winders (4).

Fig.2



EP 3 753 888 A1

Description

TECHNICAL FIELD

[0001] One aspect of the present disclosure relates to a yarn winding system.

BACKGROUND

[0002] A yarn winding system including: a spinning frame including a plurality of spinning units each configured to generate yarn and wind the yarn onto a bobbin to form a yarn feeding bobbin; a yarn winding machine including a plurality of winding units each configured to unwind yarn from the yarn feeding bobbin and wind the yarn onto a package; and a conveying device configured to convey the yarn feeding bobbin from the spinning frame to the yarn winding machine and also convey a used yarn feeding bobbin from the yarn winding machine to the spinning frame has been known. One example of this yarn winding system is disclosed in Japanese Unexamined Patent Publication No. H6-191734. In this patent document, spinning cops (yarn feeding bobbins) formed in a plurality of the spinning frames (spinning machines) are conveyed to one yarn winding machine (yarn winder), and traverse-wound bobbins (packages) are formed in the one yarn winding machine.

SUMMARY

[0003] Recently, there has been a desire to increase package manufacturing capacity of yarn winding machines, in line with the increased yarn feeding bobbin manufacturing capacity of spinning frames. Thus, it is conceivable that the manufacturing capacity can be increased by increasing the number of winding units of the yarn winding machine included in the above-described conventional yarn winding system. However, in consideration of the limited yarn feeding bobbin conveying capacity of the yarn winding machine or limited suction capacity of a blower included in the yarn winding machine, for example, the manufacturing capacity cannot be increased by simply increasing the number of the winding units included in the yarn winding machine. In addition to this desire, there is also a desire to reduce the possibility of the operation of the yarn winding system completely stopping even if trouble occurs in the yarn winding machine for some reason.

[0004] In view of the foregoing, it is an object of one aspect of the present disclosure to provide a yarn winding system that can increase the package manufacturing capacity and can reduce the possibility of the operation of the yarn winding system completely stopping.

[0005] A yarn winding system according to one aspect of the present disclosure includes: one spinning frame including a plurality of spinning units aligned in one direction and each configured to form a yarn feeding bobbin that is a bobbin around which yarn is wound; a plurality of yarn winding machines each including a plurality of winding units each configured to wind yarn from the yarn feeding bobbin to form a package; and a conveying device configured to convey the yarn feeding bobbin formed in the one spinning frame to the yarn winding machines and convey a used yarn feeding bobbin used in the yarn winding machines to the spinning frame. The one spinning frame and the yarn winding machines are aligned along an alignment direction of the spinning units.

[0006] Each yarn winding machine herein can be defined in a plurality of manners. For example, each yarn winding machine can be defined to include one machine control device and the winding units placed under control of the one machine control device. For example, each yarn winding machine can also be defined to include one blower and the winding units connected to the one blower. In the same manner, the one spinning frame can be defined to include one machine control device and the spinning units placed under control of the one machine control device. For example, the one spinning frame can also be defined to include one blower and the spinning units connected to the one blower.

[0007] In the yarn winding system thus configured, the one spinning frame and the yarn winding machines are aligned along the alignment direction of the spinning units, and so the yarn winding machines can be connected to the one spinning frame without complicating the configuration of the conveying device. Furthermore, in the yarn winding system thus configured, the yarn winding machines are provided in the one spinning frame without increasing the number of the winding units included in each yarn winding machine, and so the package manufacturing capacity can be increased without significantly changing the configuration of conventional yarn winding machines such as increasing output of the blower. Thus, the yarn winding system according to this aspect of the present disclosure can increase the package manufacturing capacity and also reduce the possibility of the operation of the yarn winding system completely stopping.

[0008] In the yarn winding system according to one aspect of the present disclosure, the conveying device may convey the yarn feeding bobbin from the one spinning frame to each one of the yarn winding machines without conveying the yarn feeding bobbin through others of the yarn winding machines. This configuration can prevent occurrence of the problem of the yarn feeding bobbin not being supplied to a winding unit included in a yarn winding machine that is disposed in a position far from the one spinning frame.

[0009] In the yarn winding system according to one aspect of the present disclosure, the yarn winding machines may be disposed at both ends of the one spinning frame in the alignment direction. In this configuration, the yarn winding machines can be connected to the one spinning frame with a simpler configuration of the conveying device.

[0010] In the yarn winding system according to one aspect of the present disclosure, the number of the yarn

winding machines provided may be two, these two yarn winding machines may be disposed at both ends of the one spinning frame in the alignment direction on a one-on-one basis, and the conveying device may form one closed-loop conveyance path among the one spinning frame and the two yarn winding machines. This configuration can increase the package manufacturing capacity and also reduce the possibility of the operation of the yarn winding system completely stopping without significantly changing the configuration of conveying sections in a conventional spinning frame.

[0011] In the yarn winding system according to one aspect of the present disclosure, the spinning units may include a spinning unit belonging to a first group and a spinning unit belonging to a second group consisting of a spinning unit that does not belong to the first group. The conveying device may convey the yarn feeding bobbin from the spinning unit belonging to the first group to a yarn winding machine disposed on one end side of the one spinning frame in the alignment direction, and convey the used yarn feeding bobbin from the yarn winding machine disposed on the one end side to the spinning unit belonging to the second group. The conveying device may convey the yarn feeding bobbin from the spinning unit belonging to the second group to a yarn winding machine disposed on another end side of the one spinning frame in the alignment direction, and convey the used yarn feeding bobbin from the yarn winding machine disposed on the other end side to the spinning unit belonging to the first group. This configuration can increase the package manufacturing capacity and also reduce the possibility of the operation of the yarn winding system completely stopping without significantly changing the configuration of conveying sections in a conventional spinning frame.

[0012] In the yarn winding system according to one aspect of the present disclosure, the number of the yarn winding machines provided may be two, these two yarn winding machines may be disposed at both ends of the one spinning frame in the alignment direction on a one-on-one basis, and the spinning units may include a spinning unit belonging to a first group and a spinning unit belonging to a second group consisting of a spinning unit that does not belong to the first group. The conveying device may form one closed-loop conveyance path between one of the yarn winding machines and the spinning unit belonging to the first group, and form another closed-loop conveyance path, which is different from the one closed-loop conveyance path, between the other of the yarn winding machines and the spinning unit belonging to the second group. This configuration can increase the package manufacturing capacity and also reduce the possibility of the operation of the yarn winding system completely stopping without significantly changing the configuration of conveying sections in a conventional spinning frame.

[0013] In the yarn winding system according to one aspect of the present disclosure, the spinning units may include a spinning unit belonging to a first group and a spinning unit belonging to a second group consisting of a spinning unit that does not belong to the first group. The conveying device may convey the yarn feeding bobbin from the spinning unit belonging to the first group to a yarn winding machine disposed on one end side of the one spinning frame in the alignment direction, and convey the used yarn feeding bobbin from the yarn winding machine disposed on the one end side to the spinning unit belonging to the first group. The conveying device may convey the yarn feeding bobbin from the spinning unit belonging to the second group to a yarn winding machine disposed on the other end side of the one spinning frame in the alignment direction, and convey the used yarn feeding bobbin from the yarn winding machine disposed on the other end side to the spinning unit belonging to the second group. This configuration can increase the package manufacturing capacity and also reduce the possibility of the operation of the yarn winding system completely stopping without significantly changing the configuration of conveying sections in a conventional spinning frame.

[0014] In the yarn winding system according to one aspect of the present disclosure, the conveying device may convey the yarn feeding bobbin from the spinning unit belonging to the first group to a yarn winding machine disposed on one end side of the one spinning frame in the alignment direction, and convey the used yarn feeding bobbin from the yarn winding machine disposed on the one end side to the spinning unit belonging to the first group. The conveying device may convey the yarn feeding bobbin from the spinning unit belonging to the second group to a yarn winding machine disposed on the other end side of the one spinning frame in the alignment direction, and convey the used yarn feeding bobbin from the yarn winding machine disposed on the other end side to the spinning unit belonging to the second group. This configuration can increase the package manufacturing capacity and also reduce the possibility of the operation of the yarn winding system completely stopping without significantly changing the configuration of conveying sections in a conventional spinning frame.

[0015] In the yarn winding system according to one aspect of the present disclosure, the yarn winding machines may be aligned on one end side of the one spinning frame in the alignment direction. In this configuration, the yarn winding machines can be connected to the one spinning frame with a simpler configuration of the conveying device.

[0016] In the yarn winding system according to one aspect of the present disclosure, the conveying device may be connected from the one spinning frame to each of the yarn winding machines via a branching section at which a conveyance route is divided into two or more conveyance routes. The conveying device may be connected from each of the yarn winding machines to the one spinning frame via a merging section at which the two or more conveyance routes are merged. In this con-

figuration, the yarn feeding bobbin can be conveyed from the one spinning frame to each one of the yarn winding machines with a simple configuration without being conveyed through others of the yarn winding machines.

[0017] In the yarn winding system according to one aspect of the present disclosure, the number of the yarn winding machines provided may be two. The conveying device may form a first closed-loop conveyance path among the one spinning frame, the branching section, one of the yarn winding machines, and the merging section, and may form a second closed-loop conveyance path, which is different from the closed-loop conveyance path, among the spinning frame, the branching section, the other of the yarn winding machines, and the merging section. In this configuration, the yarn feeding bobbin can be conveyed from the one spinning frame to each one of the yarn winding machines with a simple configuration without being conveyed through others of the yarn winding machines.

[0018] In the yarn winding system according to one aspect of the present disclosure, at least one of the yarn winding machines may be provided with a first storage section configured to temporarily store the yarn feeding bobbin conveyed from the one spinning frame to adjust timing of supplying the yarn feeding bobbin to the yarn winding machines. With this configuration, the yarn feeding bobbin can be stably supplied without stopping the operation of the spinning frame even if the yarn feeding bobbin is excessively supplied from the spinning frame to the yarn winding machines.

[0019] In the yarn winding system according to one aspect of the present disclosure, the first storage section may be provided in each of the yarn winding machines. In the yarn winding system thus configured, the yarn feeding bobbin can be more stably supplied from the spinning frame to the yarn winding machines.

[0020] In the yarn winding system according to one aspect of the present disclosure, at least one of the yarn winding machines may be provided with a second storage section configured to temporarily store the used yarn feeding bobbin conveyed from the yarn winding machines to adjust timing of supplying the used yarn feeding bobbin to the one spinning frame. With this configuration, the used yarn feeding bobbin can be stably supplied without stopping operation of the yarn winding machines even if the used yarn feeding bobbin is excessively supplied from the yarn winding machines to the spinning frame.

[0021] In the yarn winding system according to one aspect of the present disclosure, the second storage section may be provided to each of the yarn winding machines. In the yarn winding system thus configured, the used yarn feeding bobbin can be more stably supplied from the yarn winding machines to the spinning frame.

[0022] In the yarn winding system according to one aspect of the present disclosure, each of the yarn winding machines may be provided with a first storage section configured to temporarily store the yarn feeding bobbin conveyed from the one spinning frame to adjust timing of supplying the yarn feeding bobbin to the yarn winding machines. Each of the yarn winding machines may be provided with a second storage section configured to temporarily store the used yarn feeding bobbin conveyed from the yarn winding machines to adjust timing of supplying the used yarn feeding bobbin to the one spinning frame.

[0023] There is a configuration in which the yarn feeding bobbin formed by the spinning unit belonging to the first group directly returns as the used yarn feeding bobbin to the spinning unit belonging to the first group. Instead of such a configuration, the configuration of the yarn winding system, in which the yarn feeding bobbin formed by the spinning unit belonging to the second group returns as the used yarn feeding bobbin to the spinning unit belonging to the first group, is more likely to cause imbalance between supply of the yarn feeding bobbin and supply of the used yarn feeding bobbin. Thus, the yarn winding system including the first storage section and the second storage section that are capable of adjusting the timing of supplying the yarn feeding bobbin from the spinning frame to the yarn winding machines and the timing of supplying the used yarn feeding bobbin from the yarn winding machines to the spinning frame can appropriately adjust balance between the supply of the yarn feeding bobbin and the supply of the used yarn feeding bobbin.

[0024] One aspect of the present disclosure can increase the package manufacturing capacity, and reduce the possibility of the operation of the yarn winding system completely stopping.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a front view of a yarn winding system according to one embodiment.

FIG. 2 is a plan view of the yarn winding system in FIG. 1.

FIG. 3 is a side view of a spinning unit in FIG. 1.

FIG. 4 is a side view of an automatic winder in FIG. 1.

FIG. 5A is a perspective view of a tray, FIG. 5B is a perspective view of an empty bobbin, FIG. 5C is a perspective view of a yarn feeding bobbin, and FIG. 5D is a perspective view of a prepared yarn feeding bobbin.

FIG. 6 is a plan view of a yarn winding system according to a modification 1.

FIG. 7 is a plan view of a yarn winding system according to a modification 2.

DETAILED DESCRIPTION

[0026] One embodiment will now be described with reference to the drawings. In the description of the drawings, like elements are designated by like numerals, and du-

plicate description is omitted. In FIG. 1, FIG. 2, FIG. 6, and FIG. 7, an X-axis, a Y-axis, and a Z-axis that are orthogonal to each other are defined for convenience of description. In the following description, as illustrated in FIG. 1, the front side, the rear side, the left side, and the right side when a yarn winding system 1 is viewed from the front (Y-axis direction) are also called front, rear, left, and right, respectively. Specifically, the Y-axis direction, the X-axis direction, and the Z-axis direction are also called the front-rear direction, the left-right direction, and the vertical direction, respectively.

[0027] As illustrated in FIG. 1 and FIG. 2, the yarn winding system 1 includes one spinning frame 3, two (a plurality of) automatic winders (yarn winding machines) 4, and a conveying device 5. In the yarn winding system 1 according to the present embodiment, the automatic winders 4 the number of which is larger than that of the spinning frame 3 are connected by the conveying device 5.

[0028] The spinning frame 3 generates yarn Y2 from roved yarn Y1, and winds the yarn Y2 onto a bobbin B to form a yarn feeding bobbin 11 (see FIG. 5C). A roved yarn bobbin 10 to be used in the spinning frame 3 is supplied from, for example, a roving frame (not illustrated) configured to generate roved yarn Y1 from a sliver and wind the roved yarn Y1 onto a bobbin B0 (see FIG. 3) to form a roved yarn bobbin 10.

[0029] The spinning frame 3 includes a machine control device 31 configured to control operation of the spinning frame 3 and a plurality of spinning units 32 each configured to form a yarn feeding bobbin 11. The machine control device 31 includes a display section 31a such as a display and an operation section 31b such as an input key. The display section 31a displays, for example, an operating status of each spinning unit 32. The operation section 31b is a part for an operator to set operating conditions, for example, of each spinning unit 32.

[0030] As illustrated in FIG. 3, each of the spinning units 32 includes a roved yarn feeding section 36, a drafting device 33, and a twisting device 34. The spinning units 32 are aligned along one direction. Hereinafter, the direction in which the spinning units 32 are aligned is called the alignment direction D1. In the spinning frame 3 according to the present embodiment, the spinning units 32 are aligned in the alignment direction D1 on each of the front side and the rear side of the whole frame.

[0031] The roved yarn feeding section 36 supports the roved yarn bobbin 10 formed by winding the roved yarn Y1 onto the bobbin B0. The drafting device 33 includes a back roller pair 331, a middle roller pair 332, and a front roller pair 333. In the drafting device 33, the back roller pair 331, the middle roller pair 332, and the front roller pair 333 are rotated at a predetermined speed ratio, whereby the roved yarn Y1 that has been unwound from the roved yarn bobbin 10 is drafted.

[0032] The back roller pair 331 includes a bottom roller 331a and a top roller 331b, and is disposed such that these rollers are opposed to each other with a traveling route of the roved yarn Y1 interposed therebetween. The bottom roller 331a is connected to a first drive motor 331c via an output shaft disposed over a plurality of spinning units (not illustrated). The middle roller pair 332 includes a bottom roller 332a and a top roller 332b, and is disposed such that these rollers are opposed to each other with the traveling route of the roved yarn Y1 interposed therebetween. Around the bottom roller 332a and the top roller 332b, apron belts are each wound. The bottom roller 332a is connected to a second drive motor 332c via an output shaft disposed over the spinning units (not illustrated). The front roller pair 333 includes a bottom roller 333a and a top roller 333b, and is disposed such that these rollers are opposed to each other with the traveling route of the roved yarn Y1 interposed therebetween. The bottom roller 333a is connected to a third drive motor 333c via an output shaft disposed over the spinning unit (not illustrated).

[0033] Examples of the first drive motor 331c, the second drive motor 332c, and the third drive motor 333c are servomotors. The first drive motor 331c, the second drive motor 332c, and the third drive motor 333c each include a rotary encoder (not illustrated), and are each independently controlled by the machine control device 31 via a servomotor drive circuit and a servo driver.

[0034] The twisting device 34 includes a spindle shaft 341, a ring rail 342, a ring 343, and a traveller 344. The spindle shaft 341 holds a bottom portion Ba of the bobbin B with a top portion Bb of the bobbin B facing upward, and rotates the bobbin B. The ring rail 342 is movable in the axial direction of the bobbin B. The ring 343 is fixed to the ring rail 342. The traveller 344 is supported by the ring 343, and is movable along the ring 343.

[0035] In the twisting device 34, roved yarn Y1 that has been drafted by the drafting device 33 is inserted into a space between the ring 343 and the traveller 344, and an end portion of the roved yarn Y1 is fixed to the bobbin B. In this state, when the spindle shaft 341 rotates the bobbin B, the traveller 344 moves along the ring 343 in a manner being pulled by the roved yarn Y1. At this time, the ring rail 342 gradually moves from the bottom portion Ba side to the top portion Bb side while reciprocating within a predetermined range along the axial direction of the bobbin B. In the twisting device 34, rotation of the traveller 344 lags behind rotation of the bobbin B, whereby the roved yarn Y1 is twisted to form yarn Y2, and the yarn Y2 is wound around the bobbin B to form a yarn feeding bobbin 11.

[0036] The spinning frame 3 including the spinning unit 32 each configured as described above is configured to be of what is called a simultaneous doffing type. Specifically, the spinning frame 3 stocks a plurality of empty bobbins 13 conveyed from the automatic winders 4 by the conveying device 5, simultaneously sets the empty bobbins 13 on the respective spinning units 32, and simultaneously starts yarn winding. When the yarn winding has been completed in the respective spinning units 32 and yarn feeding bobbins 11 have been formed, the spin-

ning frame 3 simultaneously doffs all of the yarn feeding bobbins 11. Subsequently, the spinning frame 3 simultaneously pulls out empty bobbins 13 that have been stocked during the above processes from trays 9 (described later in detail) and sets the empty bobbins 13 on the respective spinning units 32 again and, instead, simultaneously sets the doffed yarn feeding bobbins 11 on the trays 9.

[0037] Each automatic winder 4 winds yarn Y2 from yarn feeding bobbins 11 to form packages 15. As illustrated in FIG. 1 and FIG. 2, each automatic winder 4 includes a machine control device 41 configured to control operation of the automatic winder 4 and a plurality of winding units 42 each configured to form a package 15.

[0038] In the present embodiment, as illustrated in FIG. 2, two automatic winders 4, 4 are disposed on both ends of one spinning frame 3 in the alignment direction D1. The one spinning frame 3 and the two automatic winders 4, 4 are aligned along the alignment direction D1 of the spinning units 32. In other words, the one spinning frame 3 and the two automatic winders 4, 4 are disposed so as to be arranged in a straight line along the alignment direction D1. More specifically, the alignment direction D1 of the spinning units 32 is the same as the alignment direction of the winding units 42 in that both directions extend along the X-axis direction. Hereinafter, the automatic winder 4 disposed on the left end side of the spinning frame 3 in the alignment direction D1 is also called "left automatic winder 4A", and the automatic winder 4 disposed on the right end side of the spinning frame 3 in the alignment direction D1 is also called "right automatic winder 4B".

[0039] The machine control device 41 includes a display section 41a such as a display and an operation section 41b such as an input key. The display section 41a displays, for example, an operation status of each winding unit 42. The operation section 41b is a part for the operator to set operation conditions, for example, of each winding unit 42. The machine control device 41 also controls operation of the conveying device 5, which will be described later in detail.

[0040] As illustrated in FIG. 4, each of the winding units 42 includes a winding device 43, a tension applying device 44, a yarn monitoring device 45, an upper-yarn catching device 46, a lower-yarn catching device 47, a splicing device 48, and a unit controller 49.

[0041] The winding device 43 includes a cradle 43a and a winding drum 43b. The cradle 43a supports a package 15. The winding drum 43b rotates the package 15 while traversing the yarn Y2. Thus, the yarn Y2 is wound from a yarn feeding bobbin 11 set at a predetermined position to form the package 15. The tension applying device 44 applies a predetermined tension to the yarn Y2 that is traveling from the yarn feeding bobbin 11 to the package 15.

[0042] The yarn monitoring device 45 monitors the traveling yarn Y2 to detect a yarn defect (thickness abnormality of yarn Y2, mixing of foreign matter into yarn Y2, etc.). When a yarn defect has been detected, the yarn Y2 is cut by a cutter separately provided. When the yarn Y2 has been cut, the upper-yarn catching device 46 catches a yarn end of the yarn Y2 on the package 15 side and guides the yarn end to the splicing device 48. When the yarn Y2 has been cut, the lower-yarn catching device 47 catches a yarn end of the yarn Y2 on the yarn feeding bobbin 11 side and guides the yarn end to the splicing device 48. The joining device 48 joins the yarn ends that have been guided by the upper-yarn catching device 46 and the lower-yarn catching device 47 to each other.

[0043] The unit controller 49 controls operations of the winding device 43, the tension applying device 44, the yarn monitoring device 45, the upper-yarn catching device 46, the lower-yarn catching device 47, and the splicing device 48, for example, in the winding unit 42. For example, the unit controller 49 controls the splicing device 48 so as to cut a thick yarn portion in the yarn feeding bobbin 11 on the basis of information acquired by the yarn monitoring device 45, and join the yarn end of the cut yarn Y2 on the yarn feeding bobbin 11 side and the yarn end of the cut yarn Y2 on the package 15 side.

[0044] The conveying device 5 conveys a yarn feeding bobbin 11 formed in the one spinning frame 3 to each of the two automatic winders 4, 4, and conveys empty bobbins 13 as used yarn feeding bobbins 11 that have been used in the respective two automatic winders 4, 4 to the spinning frame 3. The empty bobbins 13 herein include a bobbin B on which yarn Y2 is not wound and a bobbin (defective bobbin) that is a bobbin B around which yarn Y2 is wound however the number of windings of which has become smaller than that of the bobbin B (full yarn feeding bobbin 11) around which a predetermined length of yarn Y2 has been wound so as to be supplied from the spinning frame 3.

[0045] The conveying device 5 conveys each of the yarn feeding bobbins 11 and the empty bobbins 13 while placing each bobbin on a tray 9 illustrated in FIG. 5A. The tray 9 has a disk-like base portion 91, a protruding portion 92 protruding upward from the base portion 91, and a pin 93 protruding further upward from the protruding portion 92. The pin 93 is inserted into the bottom portion Ba of the bobbin B, whereby the yarn feeding bobbin 11 (including the prepared yarn feeding bobbin 11 illustrated in FIG. 5D) illustrated in FIG. 5C and the empty bobbin 13 illustrated in FIG. 5B are each mounted on the tray 9 with one end portion of the bobbin B facing upward. In other words, the tray 9 is configured so that the bobbin B can be mounted upright thereon with its axial direction aligned with the vertical direction.

[0046] As illustrated in FIG. 2, the conveying device 5 includes a plurality of conveying sections (a first conveying section 61 to a sixth conveying section 66) as described later. The conveying sections (the first conveying section 61 to the sixth conveying section 66) constitute one closed-loop conveyance path. Specifically, the conveying device 5 forms the one closed-loop conveyance

path among the one spinning frame 3 and the two automatic winders 4, 4. Each of the conveying sections 61 to 66 can be configured appropriately with a known configuration including a guide groove formed by a guide plate, a conveyor belt or a round belt provided along the guide groove and below the guide groove, and a drive unit configured to drive the conveyor belt or the round belt. The conveying sections 61 to 66, in the guide grooves of which trays 9 are put, convey the trays 9 with a yarn feeding bobbin 11 and an empty bobbin 13 placed thereon.

[0047] The following describes conveying sections configured to convey yarn feeding bobbins 11 formed in the one spinning frame 3 to the right automatic winder 4B and convey empty bobbins 13 that are used yarn feeding bobbins 11 used in the right automatic winder 4B to the spinning frame 3. The conveying sections thus configured are disposed as the first conveying section 61, the second conveying section (first storage section) 62, and the third conveying section 63 in this order along the conveyance direction of the yarn feeding bobbins 11 from the spinning frame 3 to the right automatic winder 4B. The conveying sections are also disposed as the fourth conveying section 64, the fifth conveying section 65, and the sixth conveying section 66 in this order along the conveyance direction of the empty bobbins 13 from the right automatic winder 4B to the spinning frame 3.

[0048] The first conveying section 61 is provided below the spinning units 32 aligned on the machine rear side of the spinning frame 3 so as to extend along the alignment direction D1 of the spinning units 32. The first conveying section 61 carries out yarn feeding bobbins 11 that have been supplied to the first conveying section 61 in simultaneous doffing of the spinning units 32 disposed on the machine rear side of the spinning frame 3 toward the right automatic winder 4B, and also carries in empty bobbins 13 supplied from the left automatic winder 4A to below the spinning units 32 aligned on the machine rear side of the spinning frame 3.

[0049] The second conveying section 62 is provided between the machine exit of the spinning frame 3 and the machine entrance of the right automatic winder 4B. The second conveying section 62 conveys yarn feeding bobbins 11 carried out from the spinning frame 3 to the right automatic winder 4B. The second conveying section 62 temporarily stores yarn feeding bobbins 11 conveyed from the spinning frame 3 to adjust timing of supplying the yarn feeding bobbins 11 to the right automatic winder 4B. A stopper (not illustrated), for example, is provided in a most downstream part of the second conveying section 62, and supply of the yarn feeding bobbins 11 to the right automatic winder 4B is controlled by the machine control device 41. The second conveying section 62 is provided with a yarn end finder 51.

[0050] The yarn end finder 51 pulls out a yarn end Y21 of yarn Y2 for each yarn feeding bobbin 11 conveyed to the right automatic winder 4B. Furthermore, the yarn end finder 51 performs a process of inserting the yarn end Y21 pulled out of the yarn feeding bobbin 11 into an inner portion Bc of the bobbin B from a top portion Bb of the bobbin B (yarn end finding process) to form a prepared yarn feeding bobbin 11 as illustrated in FIG. 5D. This process enables the lower-yarn catching device 47 in each of the winding units 42 of the right automatic winder 4B to catch the yarn end Y21 of the yarn feeding bobbin 11.

[0051] The third conveying section 63 is provided on the machine rear side of the right automatic winder 4B along the alignment direction of the winding units 42. The third conveying section 63 conveys yarn feeding bobbins 11 from the machine entrance (second conveying section 62) of the right automatic winder 4B through the machine rear side thereof to below the respective winding units 42.

[0052] The fourth conveying section 64 is provided on the machine front side of the right automatic winder 4B so as to extend along the alignment direction of the winding units 42. The fourth conveying section 64 conveys empty bobbins 13 from the respective winding units 42 of the right automatic winder 4B through the machine front side thereof to the machine exit (fifth conveying section 65) of the right automatic winder 4B.

[0053] The fifth conveying section 65 is provided between the machine exit of the right automatic winder 4B and the machine entrance (sixth conveying section 66) of the spinning frame 3. The fifth conveying section 65 temporarily stores empty bobbins 13 conveyed from the right automatic winder 4B to adjust timing of supplying the empty bobbins 13 to the spinning frame 3. A stopper (not illustrated), for example, is provided in a most downstream part of the fifth conveying section 65, and supply of the empty bobbins 13 to the spinning frame 3 is controlled by the machine control device 41. The fifth conveying section 65 may be provided with a processing device (not illustrated) configured to, when yarn Y2 remains on a used yarn feeding bobbin 11 discharged from the right automatic winder 4B, remove the yarn Y2 to use the bobbin as an empty bobbin 13.

[0054] The sixth conveying section 66 is provided below the spinning units 32 aligned on the machine front side of the spinning frame 3 so as to extend along the alignment direction D1 of the spinning units 32. The sixth conveying section 66 carries out yarn feeding bobbins 11 that have been supplied to the sixth conveying section 66 in simultaneous doffing of the spinning units 32 disposed on the machine front side of the spinning frame 3 toward the left automatic winder 4A, and also carries in empty bobbins 13 supplied from the right automatic winder 4B to below the respective spinning units 32.

[0055] Herein, in the conveying device 5, a circulation route for circulating a yarn feeding bobbin 11 and an empty bobbin 13 may be formed between the second conveying section 62 and the fifth conveying section 65. With this circulation route, a yarn feeding bobbin 11 on which the yarn end finding process has not been able to be performed or the yarn end finding process has failed to be performed in the second conveying section 62 may

be conveyed to the fifth conveying section 65. Furthermore, a bobbin B on which yarn Y2 remains or a tray 9 on which a bobbin B is not placed may be removed from the fifth conveying section 65, and the tray 9 may be conveyed with an empty bobbin 13 being newly placed thereon to the second conveying section 62.

[0056] The following describes conveying sections configured to convey yarn feeding bobbins 11 formed in the one spinning frame 3 to the left automatic winder 4A and convey empty bobbins 13 used in the left automatic winder 4A to the spinning frame 3. The conveying sections thus configured are disposed as the sixth conveying section 66, the second conveying section 62, and the third conveying section 63 in this order along the conveyance direction of the yarn feeding bobbins 11 from the spinning frame 3 to the left automatic winder 4A. The conveying sections are also disposed as the fourth conveying section 64, the fifth conveying section 65, and the first conveying section 61 in this order along the conveyance direction of the empty bobbins 13 from the left automatic winder 4A to the spinning frame 3. Because the first conveying section 61 to the sixth conveying section 66 are the same as those described above (the conveyance direction may be different), detailed description is omitted.

[0057] The spinning units 32 of the spinning frame 3 according to the present embodiment belong to either of two groups that are different from each other. Specifically, the spinning frame 3 includes a group of spinning units 32 aligned on the machine rear side (spinning units belonging to a first group) and a group of spinning units 32 aligned on the machine front side (spinning units belonging to a second group). Each of the two groups of spinning units 32 is a group of spinning units 32 to be simultaneously doffed.

[0058] The conveying device 5 conveys yarn feeding bobbins 11 from the group of spinning unit 32 aligned on the machine rear side of the spinning frame 3 to the right automatic winder 4B, and conveys empty bobbins 13 from the right automatic winder 4B to the group of spinning unit 32 aligned on the machine front side of the spinning frame 3. Furthermore, the conveying device 5 conveys yarn feeding bobbins 11 from the group of spinning unit 32 aligned on the machine front side of the spinning frame 3 to the left automatic winder 4A, and conveys empty bobbins 13 from the left automatic winder 4A to the group of spinning unit 32 aligned on the machine rear side of the spinning frame 3.

[0059] The following describes operation of conveying yarn feeding bobbins 11 formed in the respective spinning units 32 aligned on the machine rear side of the spinning frame 3. The respective spinning units 32 aligned on the machine rear side of the spinning frame 3 simultaneously pull out, from trays 9, a plurality of empty bobbins 13 that have been conveyed from the left automatic winder 4A and stoked in the first conveying section 61 to set the empty bobbins 13 on predetermined positions, and simultaneously start winding of yarn Y2. When the winding of yarn Y2 has been completed in the respective spinning units 32 and yarn feeding bobbins 11 have been formed, the spinning frame 3 simultaneously doffs all of the yarn feeding bobbins 11 aligned on the machine rear side of the spinning frame 3. The spinning frame 3 simultaneously pulls out again, from the trays 9, the empty bobbins 13 that have been conveyed from the automatic winder 4A on the left side of the spinning frame 3 and stocked in the first conveying section 61 during the above processes again to set the empty bobbins 13 on predetermined positions and, instead, simultaneously sets the doffed yarn feeding bobbins 11 on the trays 9.

[0060] The yarn feeding bobbins 11 simultaneously set on the trays 9 are conveyed to the second conveying section 62. The yarn feeding bobbins 11 conveyed to the second conveying section 62 are temporarily stocked (stored) in a partial section of the second conveying section 62, whereby timing of supplying the yarn feeding bobbins 11 to the right automatic winder 4B (third conveying section 63) is adjusted. In the second conveying section 62, the yarn end finding process for the yarn feeding bobbins 11 are performed by the yarn end finder 51. When empty bobbins 13 have been discharged from the winding units 42 in the right automatic winder 4B (when having received a signal for requesting supply to the right automatic winder 4B), the second conveying section 62 carries out the yarn feeding bobbins 11 on which the yarn end finding process has been performed for the winding units 42 to the third conveying section 63.

[0061] The third conveying section 63 to which the yarn feeding bobbins 11 have been carried in from the second conveying section 62 conveys the yarn feeding bobbins 11 to the winding units 42. The winding units 42 to which the yarn feeding bobbins 11 have been supplied wind yarn Y2 wound around the yarn feeding bobbins 11 to form packages 15. When having wound the yarn Y2 from the yarn feeding bobbins 11, the winding units 42 discharge the used yarn feeding bobbins 11 as empty bobbins 13. The empty bobbins 13 discharged from the winding units 42 are discharged from the machine of the right automatic winder 4B and conveyed to the fifth conveying section 65 by the fourth conveying section 64.

[0062] The fifth conveying section 65 carries out the empty bobbins 13 conveyed from the fourth conveying section 64 to the sixth conveying section 66 configured to supply the empty bobbins 13 to the spinning units 32 aligned on the machine front side of the spinning frame 3. The fifth conveying section 65 may temporarily stock (store) the empty bobbins 13 in a partial section of the fifth conveying section 65 to adjust timing of supplying the empty bobbins 13 to the spinning frame 3 (sixth conveying section 66).

[0063] Operation of conveying yarn feeding bobbins 11 formed in the respective spinning units 32 aligned on the machine front side of the spinning frame 3 is the same as the operation described above except the points that the yarn feeding bobbins 11 are conveyed to the left automatic winder 4A and the used yarn feeding bobbins 11

(empty bobbins 13) are conveyed to the respective spinning units 32 aligned on the machine rear side. Thus, detailed description thereof is omitted.

[0064] The following describes functional effects of the yarn winding system 1 according to the above-described embodiment. In the present embodiment, one machine control device 41 and a plurality of winding units 42 placed under control of the one machine control device 41 constitute one automatic winder 4. In the yarn winding system 1 according to the present embodiment, the one spinning frame 3 is provided with two automatic winders 4 each of which is the above-described one automatic winder 4. Furthermore, in the yarn winding system 1 according to the present embodiment, the one spinning frame 3 and the two automatic winders 4, 4 are aligned along the alignment direction D1 of the spinning units 32. Thus, the two automatic winders 4, 4 can be disposed for the one spinning frame 3 without complicating the configuration of the conveying device 5.

[0065] In the yarn winding system 1 according to the embodiment, because the one spinning frame 3 is provided with the two automatic winders 4, 4, the capacity for manufacturing packages 15 can be increased without significantly changing the configuration of conventional automatic winders 4, 4 such as increasing output of a blower. In the yarn winding system 1 according to the embodiment thus configured, because yarn feeding bobbins 11 are conveyed from the one spinning frame 3 to each one of the two automatic winders 4, 4 without being conveyed through the other automatic winder 4, the problem that a yarn feeding bobbin 11 is not supplied to a winding unit 42 disposed in a position far from the machine entrance of each automatic winder 4 will not occur. Even if one of the two automatic winders 4, 4 has to be stopped for maintenance, for example, operation of the yarn winding system 1 can be continued with the other automatic winder 4 and the one spinning frame 3. Thus, the yarn winding system 1 according to the embodiment can increase the capacity for manufacturing packages 15 and also can reduce the possibility that operation of the yarn winding system 1 may completely stop.

[0066] In the yarn winding system 1 according to the embodiment, because the automatic winders 4 are disposed at both ends of the one spinning frame 3 in the alignment direction D1, the two automatic winders 4, 4 can be disposed for the one spinning frame 3 with a simpler configuration of the conveying device 5.

[0067] In the yarn winding system 1 according to the embodiment, yarn feeding bobbins 11 are conveyed from the spinning units 32 aligned on the machine rear side of the spinning frame 3 to the right automatic winder 4B, and empty bobbins 13 are conveyed from the right automatic winder 4B to the spinning units 32 aligned on the machine front side of the spinning frame 3. Yarn feeding bobbins 11 are also conveyed from the spinning units 32 aligned on the machine front side of the spinning frame 3 to the left automatic winder 4A, and empty bobbins 13 are conveyed from the right automatic winder 4B to the spinning units 32 aligned on the machine rear side of the spinning frame 3. This configuration can increase the capacity for manufacturing packages 15 and also can reduce the possibility that operation of the yarn winding system 1 may completely stop without significantly changing the configuration of the conveying device 5 in a conventional spinning frame 3.

[0068] There is a configuration in which yarn feeding bobbins 11 formed by the spinning units 32 aligned on the machine rear side of the spinning frame 3 directly return as empty bobbins 13 to the spinning units 32 aligned on the machine rear side of the spinning frame 3. Instead of such a configuration, in the configuration as in the yarn winding system 1 according to the embodiment in which the yarn feeding bobbins 11 return as the empty bobbins 13 to the spinning units 32 aligned on the machine front side of the spinning frame 3, imbalance between supply of the yarn feeding bobbins 11 and supply of the empty bobbins 13 is more likely to be caused. Thus, in the yarn winding system 1 including the conveying device 5 including the second conveying sections 62 and the fifth conveying sections 65 that are capable of adjusting the timing of supplying the yarn feeding bobbins 11 from the spinning frame 3 to the automatic winders 4 and the timing of supplying the empty bobbins 13 from the automatic winders 4 to the spinning frame 3, balance between the supply of the yarn feeding bobbins 11 and the supply of the empty bobbins 13 can be adjusted as appropriate.

[0069] One embodiment according to one aspect of the present disclosure has been described above. However, the one aspect of the present disclosure is not limited to the embodiment.

<Modification 1>

[0070] A yarn winding system 1A according to a modification 1 is different from the yarn winding system 1 according to the above-described embodiment in the way of grouping a plurality of spinning units 32 included in the spinning frame 3 and in the configuration of a portion of the conveying device 5 disposed below the spinning frame 3. In the yarn winding system 1 according to the embodiment, different groups are configured between the group of spinning units 32 aligned on the machine front side and the group of spinning units 32 aligned on the machine rear side. By contrast, in the yarn winding system 1A according to the modification 1, different groups are configured as illustrated in FIG. 6 between the group of spinning units 32 aligned on the machine right side (including spinning units 32 disposed on the machine front side and the machine rear side) and the group of spinning units 32 aligned on the machine left side (including spinning units 32 disposed on the machine front side and the machine rear side). Hereinafter, these groups are called "right group" and "left group".

[0071] The configuration of the conveying device 5 is changed in accordance with the groups. Specifically, in-

stead of the first conveying section 61 disposed below the spinning units 32 aligned on the machine rear side of the spinning frame 3, a first conveying section 61A extending along below the group of spinning units 32 belonging to the right group is disposed. Instead of the sixth conveying section 66 disposed below the spinning units 32 aligned on the machine front side of the spinning frame 3, a sixth conveying section 66A extending along below the group of spinning units 32 belonging to the left group is disposed.

[0072] The conveying device 5 forms a first closed-loop conveyance path among one automatic winder 4 and the spinning units 32 belonging to the right group (first group), and forms a second closed-loop conveyance path among the other automatic winder 4 and the spinning units 32 belonging to the left group (second group). The first closed-loop conveyance path includes the first conveying section 61A, the second conveying section 62, the third conveying section 63, the fourth conveying section 64, and the fifth conveying section 65. The second closed-loop conveyance path includes the sixth conveying section 66A, the second conveying section 62, the third conveying section 63, the fourth conveying section 64, and the fifth conveying section 65.

[0073] The first conveying section 61A is formed in a U-shape having the machine exit and the machine entrance arranged on the machine right side as both end portions of the conveying section. The first conveying section 61A can be configured appropriately as described above with a known configuration including a guide groove formed by a guide plate, a conveyor belt or a round belt provided along the guide groove and below the guide groove, and a drive unit configured to drive the conveyor belt or the round belt. The first conveying section 61A carries out yarn feeding bobbins 11 that have been supplied to the first conveying section 61A in simultaneous doffing of the spinning units 32 disposed on the right side of the spinning frame 3 toward the right automatic winder 4B. The first conveying section 61A carries in empty bobbins 13 supplied from the right automatic winder 4B to below the respective spinning units 32.

[0074] The sixth conveying section 66A is formed in a U-shape having the machine exit and the machine entrance arranged on the machine left side as both end portions of the conveying section. The sixth conveying section 66A can be configured appropriately as described above with a known configuration including a guide groove formed by a guide plate, a conveyor belt or a round belt provided along the guide groove and below the guide groove, and a drive unit configured to drive the conveyor belt or the round belt. The sixth conveying section 66A carries out yarn feeding bobbins 11 that have been supplied to the sixth conveying section 66A in simultaneous doffing of the spinning units 32 disposed on the left side of the spinning frame 3 toward the left automatic winder 4A. The sixth conveying section 66A carries in empty bobbins 13 supplied from the left automatic winder 4A to below the respective spinning units 32.

[0075] The second conveying section 62 to which yarn feeding bobbins 11 are carried out from the first conveying section 61A and the sixth conveying section 66A and the fifth conveying section 65 from which empty bobbins 13 are carried in to the first conveying section 61A and the sixth conveying section 66A are the same as those described in the embodiment, and thus detailed description thereof including illustration in FIG. 6 is omitted.

[0076] As described above, the spinning frame 3 according to the modification 1 includes a group of spinning units 32 aligned on the machine right side (spinning units belonging to the first group) and a group of spinning units 32 aligned on the machine left side (spinning units belonging to the second group). In the spinning frame 3 according to the modification 1, the spinning units 32 each belong to either of these two different groups. Each of the two groups is a group of spinning units 32 to be simultaneously doffed.

[0077] The conveying device 5 conveys yarn feeding bobbins 11 from the group of spinning units 32 aligned on the machine right side of the spinning frame 3 to the right automatic winder 4B, and conveys empty bobbins 13 from the right automatic winder 4B to the group of spinning units 32 aligned on the machine right side of the spinning frame 3. Furthermore, the conveying device 5 conveys yarn feeding bobbins 11 from the group of spinning units 32 aligned on the machine left side of the spinning frame 3 to the left automatic winder 4A, and conveys empty bobbins 13 from the left automatic winder 4A to the group of spinning units 32 aligned on the machine left side of the spinning frame 3.

[0078] In the yarn winding system 1A according to the modification 1, the one spinning frame 3 is provided with two automatic winders 4 each of which is the above-described one automatic winder 4. In the yarn winding system 1A according to the modification 1, because the one spinning frame 3 and the two automatic winders 4, 4 are aligned along the alignment direction D1 of the spinning units 32, the two automatic winders 4, 4 can be disposed for the one spinning frame 3 without complicating the configuration of the conveying device 5.

[0079] In the yarn winding system 1A according to the modification 1, because the one spinning frame 3 is provided with the two automatic winders 4, 4, the capacity for manufacturing packages 15 can be increased without significantly changing the configuration of the conventional automatic winders 4, 4 such as increasing output of the blower. In the yarn winding system 1A thus configured, because yarn feeding bobbins 11 are conveyed from the one spinning frame 3 to each one of the two automatic winders 4, 4 without being conveyed through the other automatic winder 4, the problem that a yarn feeding bobbin 11 is not supplied to a winding unit 42 disposed in a position far from the machine entrance of each automatic winder 4 will not occur. Even if one of the two automatic winders 4, 4 has to be stopped for maintenance, for example, operation of the yarn winding system 1A can be continued with the other automatic winder

4 and the one spinning frame 3. Thus, the yarn winding system 1A according to the modification 1 can increase the capacity for manufacturing packages 15 and also can reduce the possibility that operation of the yarn winding system 1A may completely stop.

[0080] In the yarn winding system 1A according to the modification 1, because the automatic winders 4 are disposed at both ends of the one spinning frame 3 in the alignment direction D1, the two automatic winders 4, 4 can be disposed for the one spinning frame 3 with a simpler configuration of the conveying device 5.

<Modification 2>

[0081] In the embodiment and the modification 1 above, examples have been described in which the automatic winders 4, 4 are disposed at both ends of the one spinning frame 3 in the alignment direction D1. However, the present disclosure is not limited to this. For example, as illustrated in FIG. 7, two (a plurality of) automatic winders 4, 4 may be disposed on the right end side of the one spinning frame 3 in the alignment direction D1. Hereinafter, an automatic winder disposed on a side closer to the spinning frame 3 in the alignment direction is also called "first automatic winder 4C", and an automatic winder disposed on a side far from the spinning frame 3 is also called "second automatic winder 4D". As for details of a yarn winding system 1B according to a modification 2 thus configured, points different in configuration from the embodiment or the modification 1 will be described.

[0082] In the modification 2, an example will be described in which two (a plurality of) automatic winders 4, 4 are disposed on the right end side of the one spinning frame 3 in the alignment direction D1. However, the two (a plurality of) automatic winders 4, 4 may be disposed on the left end side of the one spinning frame 3 in the alignment direction D1.

[0083] In the yarn winding system 1B according to the modification 2, the configuration of the spinning units 32 that belong to either of two groups different from each other as in the embodiment and the modification 1 is not necessary. Thus, instead of the first conveying section 61 according to the embodiment (the first conveying section 61A according to the modification 1), one first conveying section 61B is disposed so as to extend along below all of the spinning units 32 aligned on the machine rear side and the machine front side of the spinning frame 3 in the yarn winding system 1B.

[0084] The conveying device 5 forms a first closed-loop conveyance path among the one spinning frame 3, a branching section 68, one automatic winder 4C, and a merging section 69, and also forms a second closed-loop conveyance path among the one spinning frame 3, the branching section 68, the other automatic winder 4D, and the merging section 69. The first closed-loop conveyance path and the second closed-loop conveyance path each include the first conveying section 61B, the second conveying section 62, the third conveying section 63, the fourth conveying section 64, and the fifth conveying section 65.

[0085] The first conveying section 61B is formed in a U-shape having the machine exit and the machine entrance arranged on the machine right side as both end portions of the conveying section. The first conveying section 61B can be configured appropriately as described above with a known configuration including a guide groove formed by a guide plate, a conveyor belt or a round belt provided along the guide groove and below the guide groove, and a drive unit configured to drive the conveyor belt or the round belt. The first conveying section 61B carries out yarn feeding bobbins 11 that have been supplied to the first conveying section 61B in simultaneous doffing of all the spinning units 32 in the spinning frame 3 toward the first automatic winder 4C and the second automatic winder 4D. The first conveying section 61B carries in empty bobbins 13 supplied from the first automatic winder 4C and the second automatic winder 4D to below the respective spinning units 32.

[0086] The configuration of the conveying device 5 of the yarn winding system 1B according to the modification 2 is different from the configurations of the conveying devices 5 according to the embodiment and the modification 1 in including the branching section 68 at which a conveyance route is divided into two conveyance routes and the merging section 69 at which the two conveyance routes are merged so as to correspond to the configuration in which the two automatic winders 4 are disposed on one end side of the spinning frame 3 in the alignment direction D1.

[0087] The branching section 68 is provided to the second conveying section 62. The branching section 68 is a section configured to distribute yarn feeding bobbins 11 between the first automatic winder 4C and the second automatic winder 4D, and is controlled by the machine control device 41. The configurations of the third conveying section 63 and the fourth conveying section 64 are the same as those described in the embodiment, and thus description thereof is omitted. The merging section 69 is provided to the fifth conveying section 65. The merging section 69 is a section configured to merge empty bobbins 13 conveyed from the first automatic winder 4C and the second automatic winder 4D. The configurations of the fourth conveying section 64 and the fifth conveying section 65 are the same as those described in the embodiment, and thus description thereof is omitted.

[0088] As described above, the conveying device 5 is connected from the one spinning frame 3 to each of the first automatic winder 4C and the second automatic winder 4D via the branching section 68, and is connected from each of the first automatic winder 4C and the second automatic winder 4D to the one spinning frame 3 via the merging section 69.

[0089] In the yarn winding system 1B according to the modification 2, the one spinning frame 3 is provided with two automatic winders 4 each of which is the above-described one automatic winder 4. In the yarn winding sys-

tem 1B according to the modification 2, because the one spinning frame 3 and the two automatic winders 4, 4 are aligned along the alignment direction D1 of the spinning units 32, the two automatic winders 4, 4 can be disposed for the one spinning frame 3 without complicating the configuration of the conveying device 5.

[0090] In the yarn winding system 1B according to the modification 2, because the one spinning frame 3 is provided with the two automatic winders 4, 4, the capacity for manufacturing packages 15 can be increased without significantly changing the configuration of the conventional automatic winders 4, 4 such as increasing output of the blower. In the yarn winding system 1B thus configured, because yarn feeding bobbins 11 are conveyed from the one spinning frame 3 to each one of the two automatic winders 4, 4 without being conveyed through the other automatic winder 4, the problem that a yarn feeding bobbin 11 is not supplied to a winding unit 42 disposed in a position far from the machine entrance of each automatic winder 4 will not occur. Even if one of the two automatic winders 4, 4 has to be stopped for maintenance, for example, operation of the yarn winding system 1B can be continued with the other automatic winder 4 and the one spinning frame 3. Thus, the yarn winding system 1B according to the modification 2 can increase the capacity for manufacturing packages 15 and also can reduce the possibility that operation of the yarn winding system 1B may completely stop.

[0091] The conveying device 5 of the yarn winding system 1B according to the modification 2 includes the branching section 68 and the merging section 69. Thus, even when the two automatic winders 4 are disposed on one end side of the one spinning frame 3, yarn feeding bobbins 11 can be conveyed from the one spinning frame 3 to each one of the two automatic winders 4, 4 with a simpler configuration without being conveyed through the other automatic winder 4.

<Other Modifications>

[0092] In the embodiment and the modifications described above, examples have been described in which the second conveying section 62 configured to temporarily store yarn feeding bobbins 11 conveyed from the one spinning frame 3 to adjust timing of supplying the yarn feeding bobbins 11 to the automatic winder 4 is provided to each of the two automatic winders 4, 4. However, the present disclosure is not limited to this. For example, the second conveying section 62 as the first storage section may be selectively provided to the two automatic winders 4, 4, or may be omitted.

[0093] In the embodiment and the modifications, examples have been described in which the fifth conveying section 65 configured to temporarily store empty bobbins 13 conveyed from the automatic winder 4 to adjust timing of supplying the empty bobbin 13 to the one spinning frame 3 is provided to each of the two automatic winders 4, 4. However, the present disclosure is not limited to this. For example, the fifth conveying section 65 as the second storage section may be selectively provided to the two automatic winders 4, 4, or may be omitted.

[0094] Examples have been described in which the two automatic winders 4, 4 are provided to each of the yarn winding system 1, 1A, 1B according to the embodiment and the modifications. However, for example, three or more automatic winders 4 may be provided to the yarn winding system. In the yarn winding system, a plurality of automatic winders 4 may be disposed at one or each of both ends of the spinning frame 3 in the alignment direction D1. In this case also, the automatic winders 4 and the one spinning frame 3 are disposed so as to be arranged in a straight line along the alignment direction D1.

[0095] In the embodiment and the modifications, examples have been described in which a plurality of automatic winders 4 are disposed, each including one machine control device 41 and a plurality of winding units 42 placed under control of the one machine control device 41. However, the present disclosure is not limited to this. For example, in the yarn winding system, a plurality of automatic winders 4 may be disposed, each including one machine control device 41 and one blower (not illustrated) connected to a plurality of winding units 42.

[0096] In the embodiment and the modifications, examples have been described in which one spinning frame 3 is disposed, including one machine control device 31 and a plurality of spinning units 32 placed under control of the one machine control device 31. However, the present disclosure is not limited to this. For example, the yarn winding system may include one spinning frame 3 including one machine control device 31 and one blower (not illustrated) connected to a plurality of winding units 42.

[0097] In the embodiment, the spinning frame 3 has been described as a ring spinning frame. However, the spinning frame 3 is not limited to the ring spinning frame. As the spinning frame 3, another spinning device such as an open-end spinning frame and an air spinning frame may be used.

[0098] At least some configurations in the embodiment and the modifications described above may be optionally used in combination.

Claims

1. A yarn winding system (1, 1A, 1B) comprising:

one spinning frame (3) including a plurality of spinning units (32) aligned in one direction and each configured to form a yarn feeding bobbin (11) that is a bobbin (B) around which yarn (Y2) is wound;

a plurality of yarn winding machines (4) each including a plurality of winding units (42) each configured to wind yarn from the yarn feeding

bobbin (11) to form a package (15); and
a conveying device (5) configured to convey the yarn feeding bobbin (11) formed in the one spinning frame (3) to the yarn winding machines (4) and convey a used yarn feeding bobbin (11) used in the yarn winding machines (4) to the spinning frame (3), wherein
the one spinning frame (3) and the yarn winding machines (4) are aligned along an alignment direction of the spinning units (32).

2. The yarn winding system (1, 1A, 1B) according to claim 1, wherein the conveying device (5) conveys the yarn feeding bobbin (11) from the one spinning frame (3) to each one of the yarn winding machines (4) without conveying the yarn feeding bobbin (11) through others of the yarn winding machines (4).

3. The yarn winding system (1, 1A, 1B) according to claim 1 or 2, wherein the yarn winding machines (4) are disposed at both ends of the one spinning frame (3) in the alignment direction.

4. The yarn winding system (1, 1A, 1B) according to any one of claims 1 to 3, wherein
the number of the yarn winding machines (4) provided is two,
these two yarn winding machines (4) are disposed at both ends of the one spinning frame (3) in the alignment direction on a one-on-one basis, and
the conveying device (5) forms one closed-loop conveyance path among the one spinning frame (3) and the two yarn winding machines (4).

5. The yarn winding system (1, 1A, 1B) according to claim 3 or 4, wherein
the spinning units (32) includes a spinning unit belonging to a first group and a spinning unit belonging to a second group consisting of a spinning unit that does not belong to the first group,
the conveying device (5) conveys the yarn feeding bobbin (11) from the spinning unit belonging to the first group to a yarn winding machine (4) disposed on one end side of the one spinning frame (3) in the alignment direction, and conveys the used yarn feeding bobbin (11) from the yarn winding machine (4) disposed on the one end side to the spinning unit belonging to the second group, and the conveying device (5) conveys the yarn feeding bobbin (11) from the spinning unit belonging to the second group to a yarn winding machine (4) disposed on an other end side of the one spinning frame (3) in the alignment direction, and conveys the used yarn feeding bobbin (11) from the yarn winding machine (4) disposed on the other end side to the spinning unit belonging to the first group.

6. The yarn winding system (1, 1A, 1B) according to any one of claims 1 to 3, wherein
the number of the yarn winding machines (4) provided is two,
these two yarn winding machines (4) are disposed at both ends of the one spinning frame (3) in the alignment direction on a one-on-one basis,
the spinning units (32) includes a spinning unit belonging to a first group and a spinning unit belonging to a second group consisting of a spinning unit that does not belong to the first group, and
the conveying device (5) forms one closed-loop conveyance path between one of the yarn winding machines (4) and the spinning unit belonging to the first group, and forms another closed-loop conveyance path, which is different from the one closed-loop conveyance path, between an other of the yarn winding machines (4) and the spinning unit belonging to the second group.

7. The yarn winding system (1, 1A, 1B) according to claim 3, wherein
the spinning units (32) includes a spinning unit belonging to a first group and a spinning unit belonging to a second group consisting of a spinning unit that does not belong to the first group,
the conveying device (5) conveys the yarn feeding bobbin (11) from the spinning unit belonging to the first group to a yarn winding machine (4) disposed on one end side of the one spinning frame (3) in the alignment direction, and conveys the used yarn feeding bobbin (11) from the yarn winding machine (4) disposed on the one end side to the spinning unit belonging to the first group, and
the conveying device (5) conveys the yarn feeding bobbin (11) from the spinning unit belonging to the second group to a yarn winding machine (4) disposed on the other end side of the one spinning frame (3) in the alignment direction, and conveys the used yarn feeding bobbin (11) from the yarn winding machine (4) disposed on the other end side to the spinning unit belonging to the second group.

8. The yarn winding system (1, 1A, 1B) according to claim 6, wherein
the conveying device (5) conveys the yarn feeding bobbin (11) from the spinning unit belonging to the first group to a yarn winding machine (4) disposed on one end side of the one spinning frame (3) in the alignment direction, and conveys the used yarn feeding bobbin (11) from the yarn winding machine (4) disposed on the one end side to the spinning unit belonging to the first group, and
the conveying device (5) conveys the yarn feeding bobbin (11) from the spinning unit belonging to the second group to a yarn winding machine (4) disposed on the other end side of the one spinning frame (3) in the alignment direction, and conveys the used yarn feeding bobbin (11) from the yarn winding

machine (4) disposed on the other end side to the spinning unit belonging to the second group.

9. The yarn winding system (1, 1A, 1B) according to any one of claims 1 to 8, wherein the yarn winding machines (4) are aligned on one end side of the one spinning frame (3) in the alignment direction.

10. The yarn winding system (1, 1A, 1B) according to claim 9, wherein the conveying device (5) is connected from the one spinning frame (3) to each of the yarn winding machines (4) via a branching section (68) at which a conveyance route is divided into two or more conveyance routes, and the conveying device (5) is connected from each of the yarn winding machines (4) to the one spinning frame (3) via a merging section at which the two or more conveyance routes are merged.

11. The yarn winding system (1, 1A, 1B) according to claim 10, wherein
the number of the yarn winding machines (4) provided is two, and
the conveying device (5) forms a first closed-loop conveyance path among the one spinning frame (3), the branching section (68), one of the yarn winding machines (4), and the merging section (69), and forms a second closed-loop conveyance path, which is different from the first closed-loop conveyance path, among the spinning frame (3), the branching section (68), the other of the yarn winding machines (4), and the merging section (69).

12. The yarn winding system (1, 1A, 1B) according to any one of claims 1 to 11, wherein at least one of the yarn winding machines (4) is provided with a first storage section (62) configured to temporarily store the yarn feeding bobbin (11) conveyed from the one spinning frame (3) to adjust timing of supplying the yarn feeding bobbin (11) to the yarn winding machines (4).

13. The yarn winding system (1, 1A, 1B) according to according to claim 12, wherein the first storage section (62) is provided to each of the yarn winding machines (4).

14. The yarn winding system (1, 1A, 1B) according to any one of claims 1 to 13, wherein at least one of the yarn winding machines (4) is provided with a second storage section (65) configured to temporarily store the used yarn feeding bobbin (11) conveyed from the yarn winding machines (4) to adjust timing of supplying the used yarn feeding bobbin (11) to the one spinning frame (3),
wherein the second storage section (65) is preferably provided to each of the yarn winding machines (4).

15. The yarn winding system (1, 1A, 1B) according to claim 5, wherein
each of the yarn winding machines (4) is provided with a first storage section (62) configured to temporarily store the yarn feeding bobbin (11) conveyed from the one spinning frame (3) to adjust timing of supplying the yarn feeding bobbin (11) to the yarn winding machines (4), and
each of the yarn winding machines (4) is provided with a second storage section (65) configured to temporarily store the used yarn feeding bobbin (11) conveyed from the yarn winding machines (4) to adjust timing of supplying the used yarn feeding bobbin (11) to the one spinning frame (3).

Fig.1

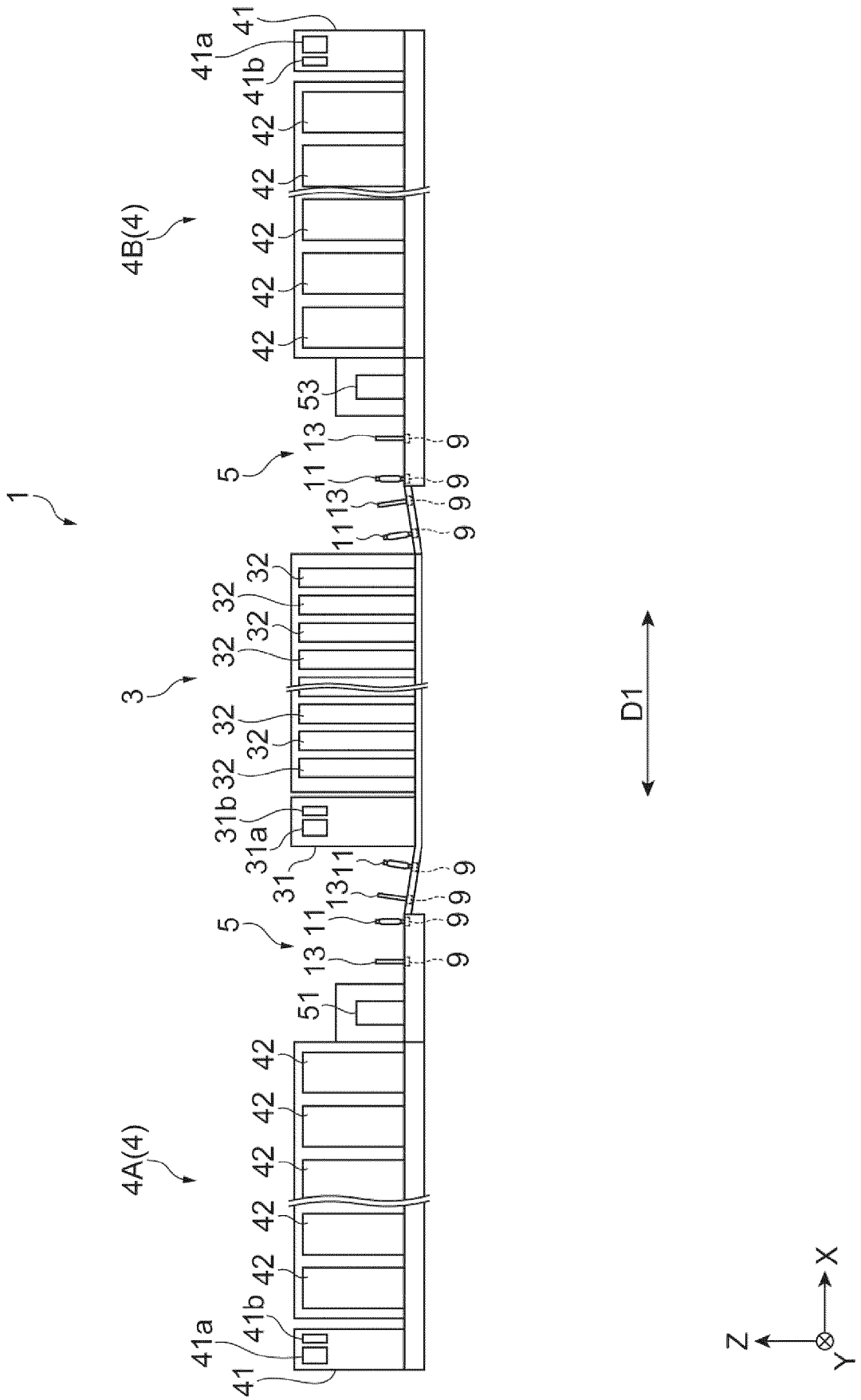


Fig.2

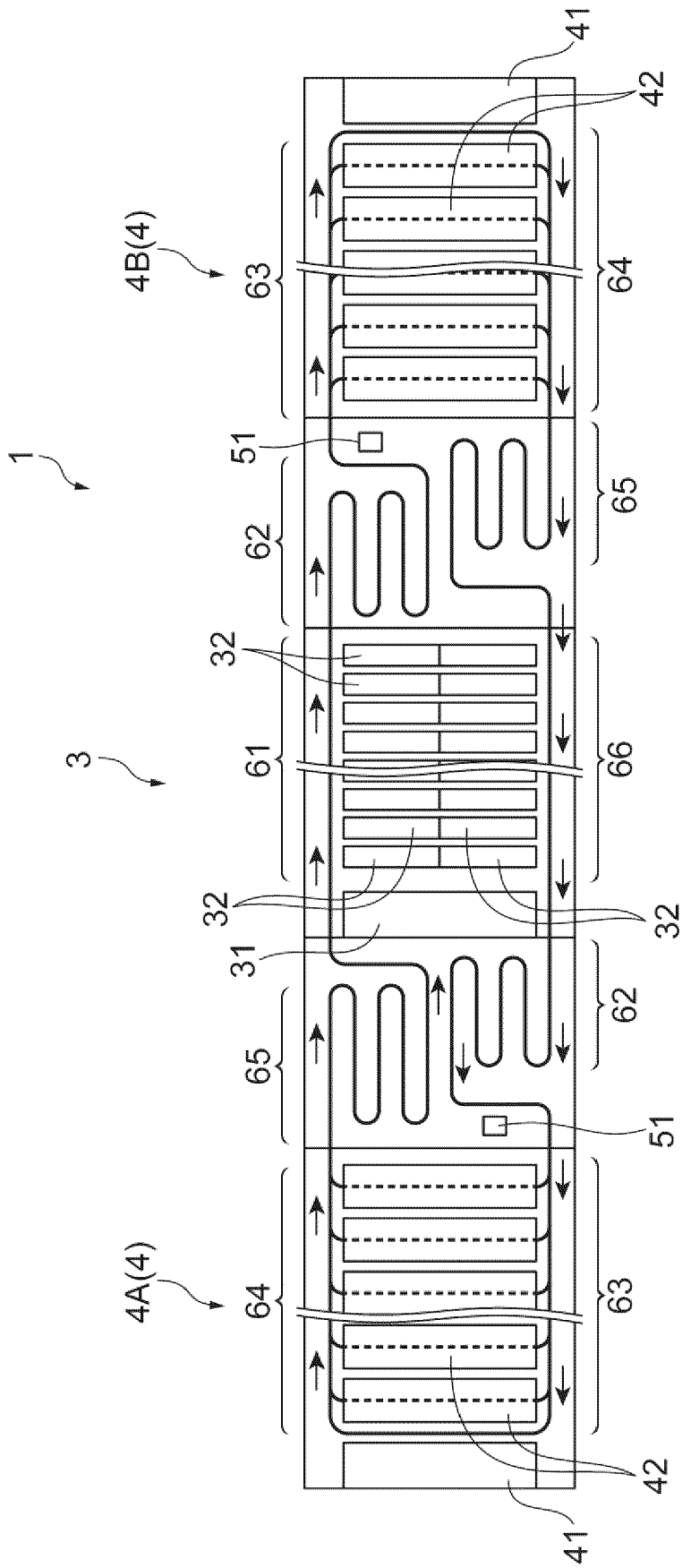


Fig.3

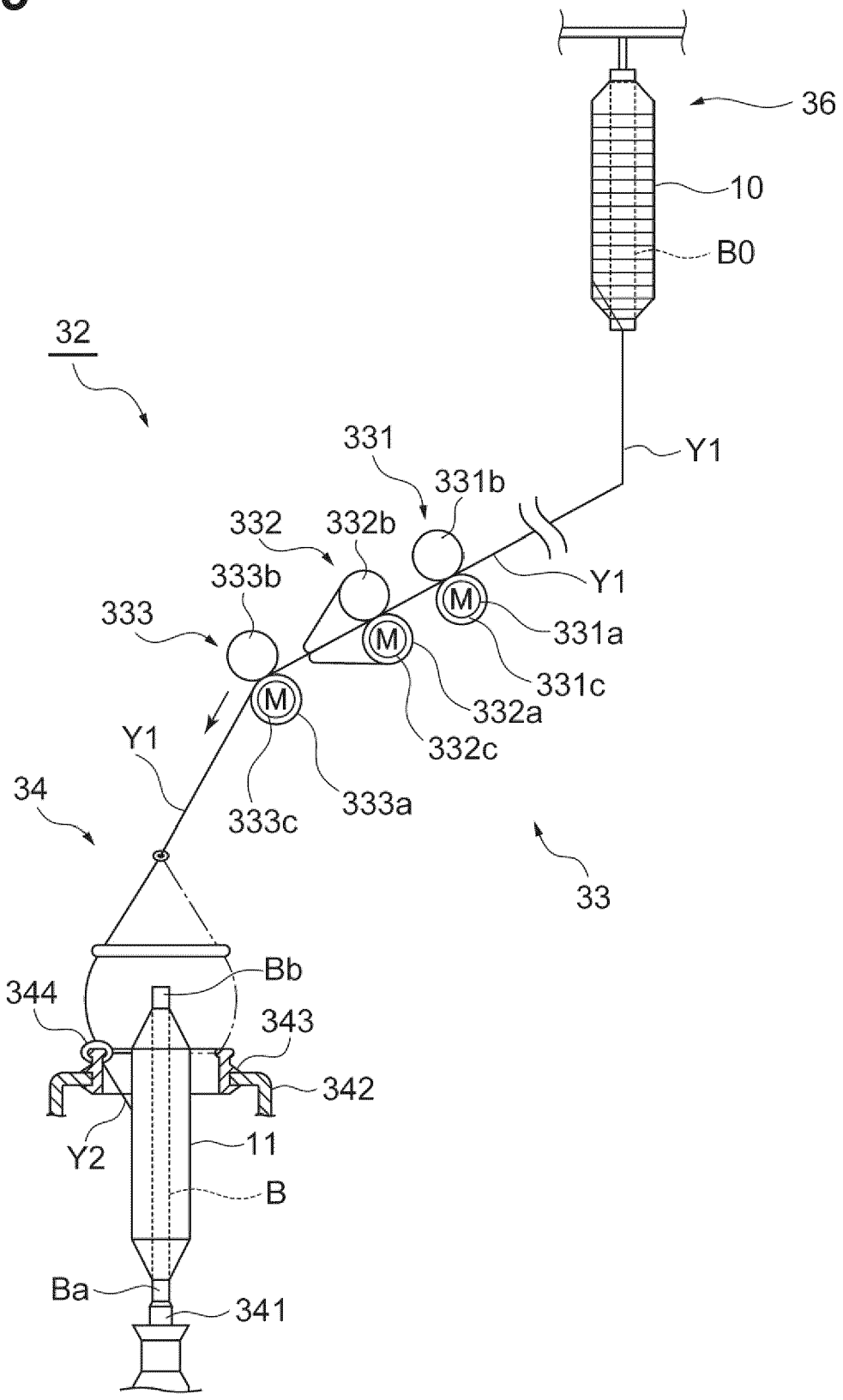
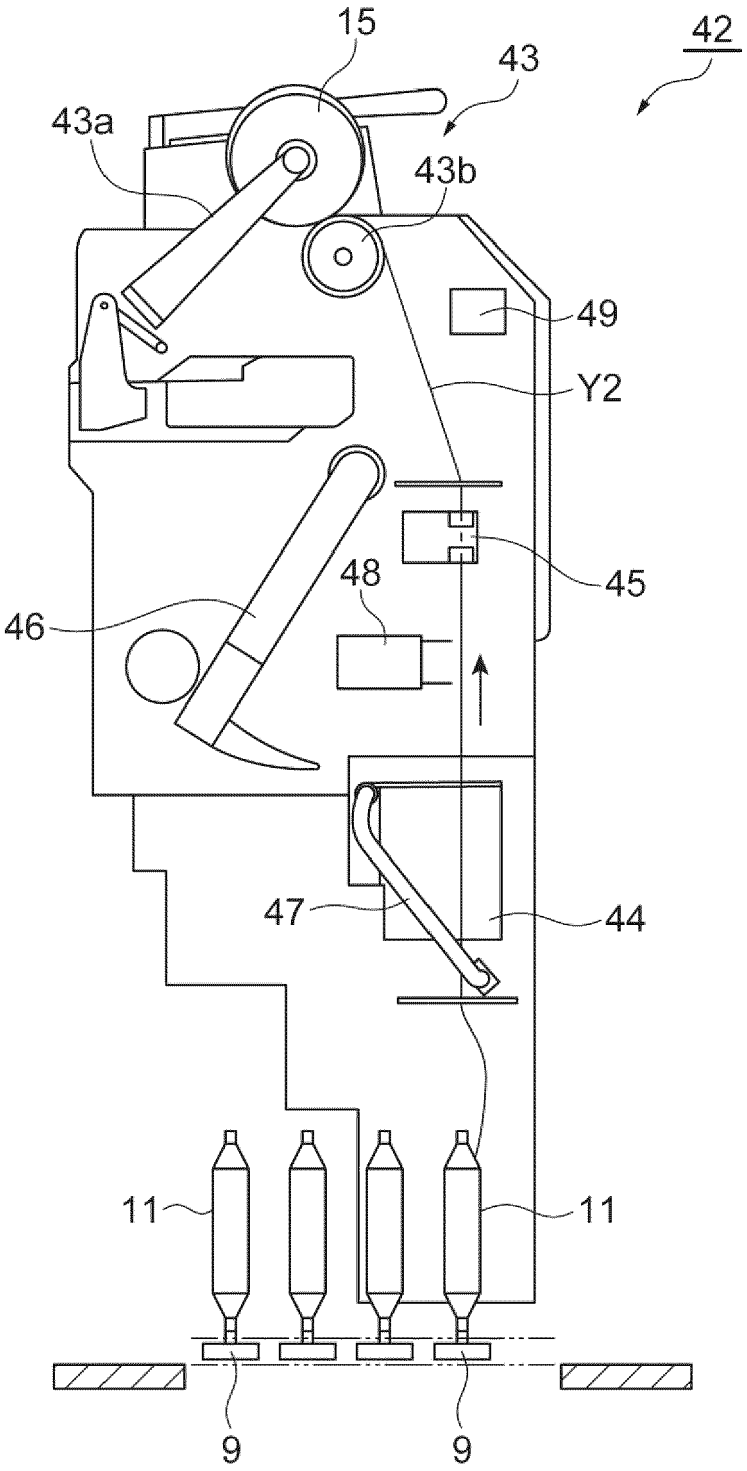

36
10
B0
32
331
331b
Y1
332
332b
333b
333
Y1
331a
331c
332a
332c
Y1
333c
333a
34
33
Bb
344
343
342
Y2
11
B
Ba
341

Fig.4



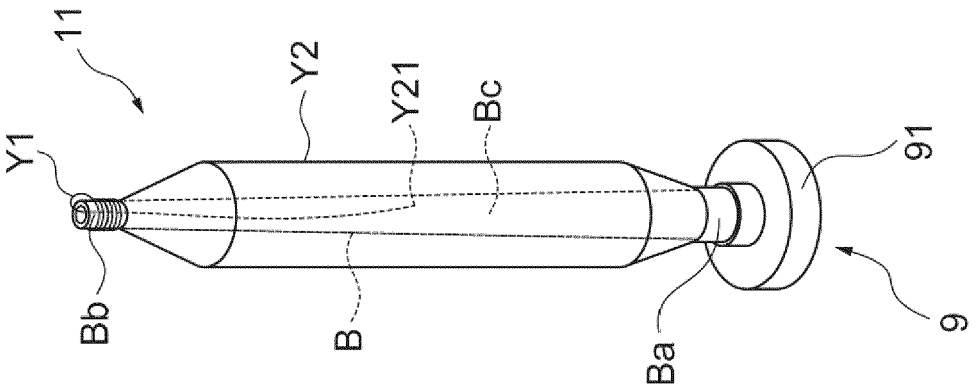


Fig.5D

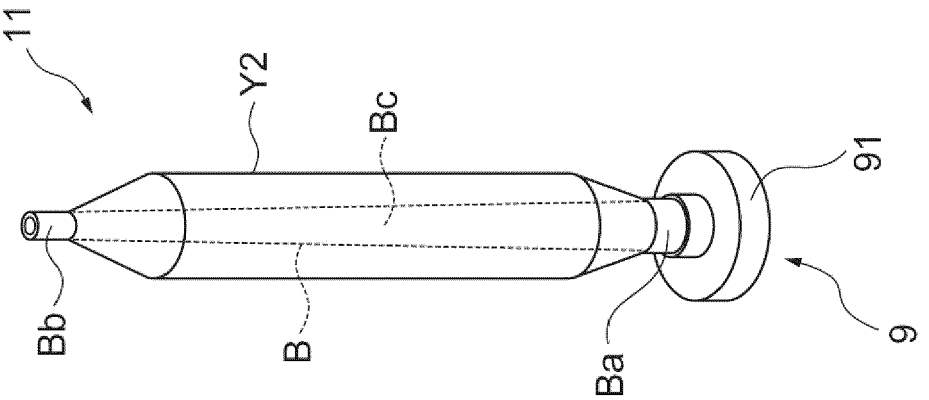


Fig.5C

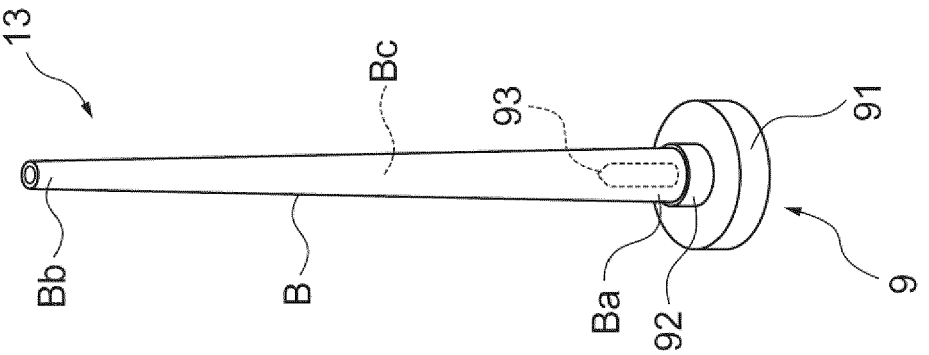


Fig.5B

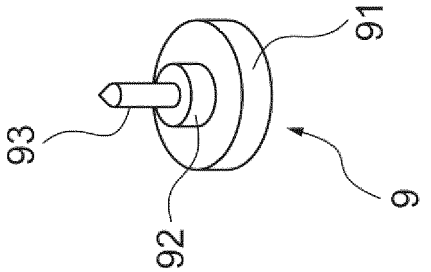


Fig.5A

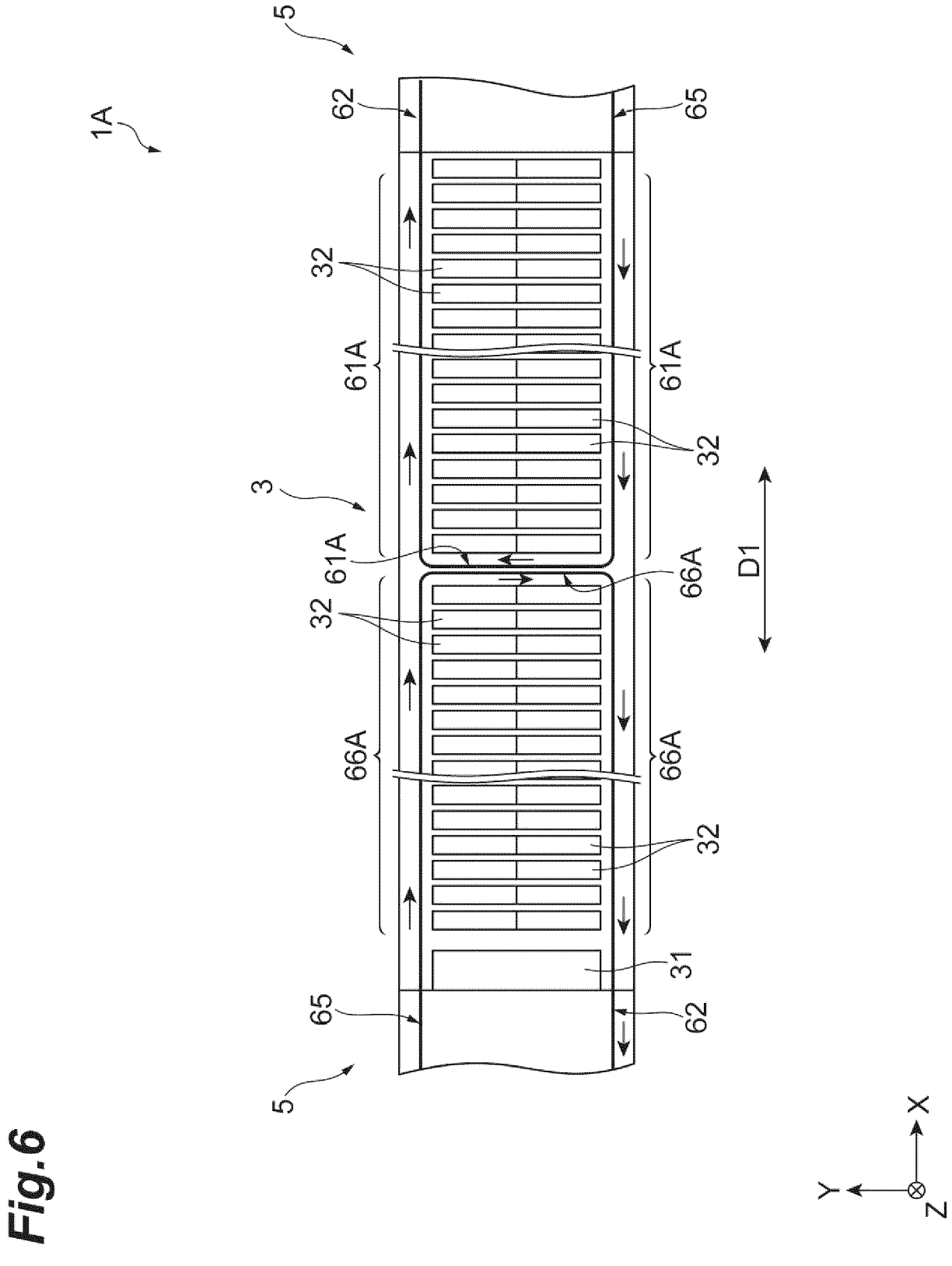
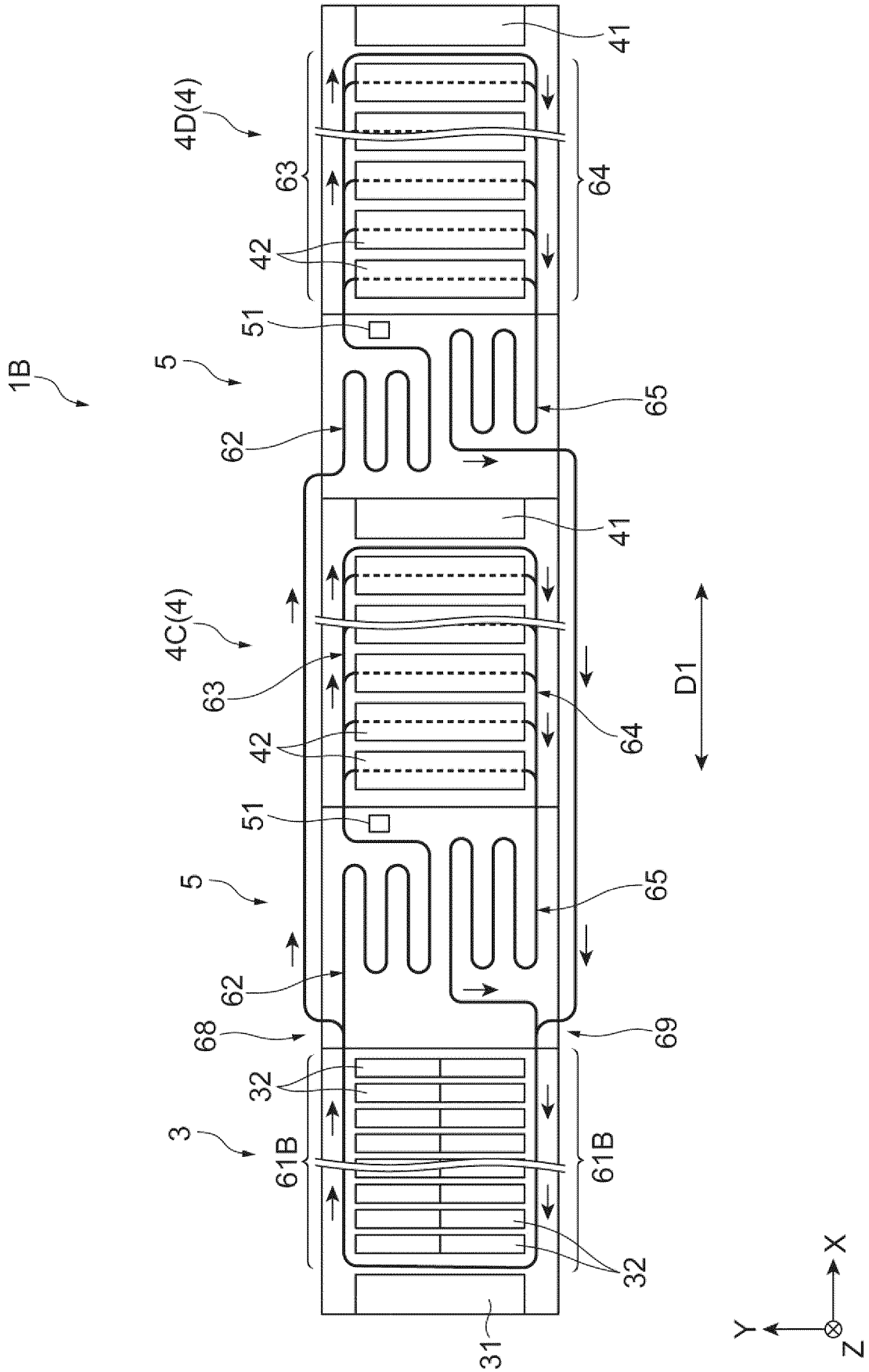


Fig.6

Fig.7



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EUROPEAN SEARCH REPORT

Application Number
EP 20 18 0496

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13 October 2020	Pussemier, Bart

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