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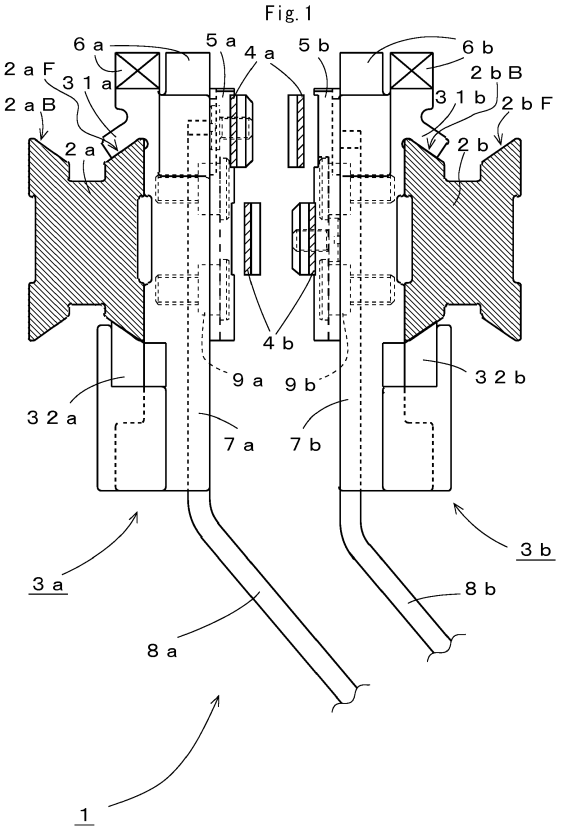
(54) YARN FEEDING DEVICE

(57) Provided is a yarn feeding device capable of easily performing a necessary operation for a process to change or to mix specification among entraining-type and self-running-type running members such as yarn feeders.

Two movement belts 4a, 4b are arranged between adjacent yarn feeder rails 2a, 2b while being divided into upper and lower stages. The upper and lower movement belts 4a, 4b respectively move yarn feeders 3a, 3b that are respectively mounted on trucks 2aF, 2bB of the yarn feeder rails 2a, 2b. Movement driving part driving the movement belts 4a, 4b are mounted on end portions of the yarn feeder rails 2a, 2b, so that no configuration supporting the movement belts 4a, 4b and the movement driving part is required for the yarn feeder rails 2a, 2b. The yarn feeder rails 2a, 2b could be shared by the entraining-type and self-running-type running members. The process for the specification change from the entrainment-running type to the self-running type, the mixing of the entrainment-running type and the self-running type, or the like could therefore be performed without detaching the yarn feeder rails 2a, 2b, thereby reducing the labor.

Fig. 1



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Description

[Technical Field]

[0001] The present invention relates to a yarn feeding device including a running member capable of self-running above needle beds of a flatbed knitting machine in a lengthwise direction of the needle beds and forming a part of a route for feeding a knitting yarn to knitting needles in the needle beds in order to knit a knitted fabric.

[Background Art]

[0002] Conventionally, a flatbed knitting machine includes needle beds in which knitting needles are arranged in parallel along the lengthwise direction and yarn feeder rails installed above the needle beds and extending in the lengthwise direction of the needle beds. A knitted fabric is knitted with knitting yarn fed to the knitting needles through yarn feeders that are mounted on trucks provided on the yarn feeder rails and run in the lengthwise direction. In recent years, such type of flatbed knitting machines that includes a carriage reciprocable along the lengthwise direction of the needle beds and drives knitting needles for knitting a knitted fabric with cams mounted on the carriage are used in many cases. In the flatbed knitting machine including the carriage, entraining-type yarn feeders that are entrained by the carriage are used in many cases whereas self-running-type yarn feeders that are capable of running without being entrained by the carriage are also used.

[0003] In case the entraining-type yarn feeders are used, the carriage is provided with an entrainment member such as entrainment pin capable of switching whether to entrain the yarn feeders by being selectively engaged with the yarn feeders. However, in case the entraining-type yarn feeders are used, there might be some cases in which the carriage has to stop running and to inverse moving direction by switching of the yarn feeder so that the carriage is caused to run on the halfway of a course for knitting the knitted fabric, thereby the knitting efficiency of the knitted fabric might be lowered. In such a case, usage of the self-running-type yarn feeders can avoid lowering of the knitting efficiency. However, when the self-running-type yarn feeders are used, movement members such as belts for causing the yarn feeders to run along the yarn feeder rails and mechanisms driving the movement members are required. The flatbed knitting machine employing only the self-running-type yarn feeders therefore has a complicated configuration in comparison with the flatbed knitting machine employing only the entraining-type yarn feeders, resulting in increase in manufacturing cost.

[0004] The present applicant discloses a yarn feeding device of a flatbed knitting machine, which enables an entraining-type yarn feeder to also self-run (for example, see Patent Literature 1). The yarn feeding device is provided with a movement member in the lengthwise direction of a yarn feeder rail, enables the entraining-type yarn feeder to be engaged with the movement member, and enables the yarn feeder in an engaged state to self-run. A flatbed knitting machine having a configuration in which entraining-type yarn feeders and self-running-type yarn feeders are mounted on yarn feeder rails having different structures for use in combination is also disclosed (for example, see Patent Literature 2). Figs. 3c and 3d in Patent Literature 2 respectively show an example of a yarn feeder rail (60') on which both of entraining-type yarn feeders (40) and self-running-type yarn feeders (50) are provided in a mixed manner on one side surface and an example of a yarn feeder rail (60") on which they are arranged while being divided into upper and lower stages.

[Citation List]

[Patent literatures]

[0005]

Patent Literature 1: Japanese Patent No. 2903152B1
Patent Literature 2: European Patent Application Publication No. 3115491A1

[Summary of Invention]

[Technical Problem]

[0006] The movement members for causing the self-running-type yarn feeders to run are arranged at the inner side of the yarn feeders that are mounted on the trucks, for example, arranged in the yarn feeder rails. The yarn feeder rails for self-running in which the movement members capable of being arranged could also be used to cause the entraining-type yarn feeders to run without arranging the movement members. Only the entraining-type yarn feeders would be used on the yarn feeder rails for self-running and specification might be changed after manufacturing the flatbed knitting

machine, so that the entraining-type yarn feeders could be replaced by the self-running-type yarn feeders or they could be mixed. In such case, the movement members and driving parts need to be added. It is however difficult to perform an operation of adding the movement members and the like on the trucks facing each other between already attached yarn feeder rails because a space between the rails is small. Such operation could be easily performed by once detaching the yarn feeder rails. When only the entraining-type yarn feeders would be used, usage of the yarn feeder rails for self-running would increase cost, so that it could be considered that the yarn feeder rails available for only the entraining-type yarn feeders might be employed and would be detached to replace a unit including the yarn feeder rails for self-running and the driving parts if necessary in the case of specification change or the like. It should be noted that an operation of installing the detached yarn feeder rails or replaced yarn feeder rails would be difficult and needs labor because it requires adjustment in the horizontal direction, the parallel direction, intervals therebetween, and the like.

[0007] An object of the present invention is to provide a yarn feeding device capable of easily performing a necessary operation for a process to change or to mix specification among entraining-type and self-running-type running members such as yarn feeders or the like by utilizing a space between yarn feeder rails.

[Solution to Problem]

[0008] The present invention is a yarn feeding device being provided in a flatbed knitting machine, which includes:

at least two needle beds interleaving a needle bed gap to face each other in a front-back direction and having knitting needles to be lined up in a lengthwise direction;
a carriage being capable of reciprocating along the lengthwise direction of the needle beds and being mounted with a knitting cam to sequentially select the knitting needles and to drive for knitting a knitted fabric; and
yarn feeder rails being installed above the needle bed gap and having trucks to extend in the lengthwise direction of the needle beds, and

the yarn feeding device including a self-running-type running member mounted on the truck and capable of running in the lengthwise direction on a part of a route for feeding knitting yarn to the knitting needles:
characterized in that the yarn feeding device comprises;

a movement member that has a movement part extending in the lengthwise direction, is arranged in parallel on an outer side of the truck in the front-back direction, and is capable of moving in the lengthwise direction;
a coupling member that couples the running member to the movement part; and
a movement driving part that is provided on an end portion in the lengthwise direction and is capable of driving the running member to run through the movement member and the coupling member.;
wherein there being a distance capable of interleaving the movement member mounted on the truck in the front-back direction between the movement part and the truck.

[0009] In the present invention, said movement member has two said movement parts, which are arranged in parallel with different distances to said truck in said front-back direction, and are coupled to each other at both ends in said lengthwise direction so as to move in opposite directions, and
said coupling member couples the movement part, having a smaller distance to the truck, to said self-running-type running member.

[0010] In the present invention, a plurality of said yarn feeder rails each having said trucks at both sides in said front-back direction and being arranged in parallel in the front-back direction,
at least two said self-running-type running members being respectively mounted on one truck and the other truck facing each other on adjacent yarn feeder rails, and
at least two movement members are arranged between the adjacent yarn feeder rails while being divided into upper and lower stages and move the running members which are respectively mounted on the one truck and the other truck.

[0011] In the present invention, said carriage being provided with an entrainment member which is capable of being engaged with an entraining-type running member mounted on said truck of said yarn feeder rail and causes the entraining-type running member to run while being engaged, and
said self-running-type running member:

being capable of being mounted on the same truck on which the entraining-type running member is mounted; and
having an entrainment cancellation part that acts so as to release engagement between the entraining-type running member and the entrainment member and cancel entrainment of the entraining-type running member by the carriage when the entraining-type running member makes close to the self-running-type running member within a predetermined distance on the same truck.

[0012] In the present invention, said coupling member, which is mounted to said movement member, being detachable to said self-running-type running member in an up-down direction.

[Advantageous Effects of Invention]

[0013] According to the present invention, a running member, which forms a part of a route for feeding a knitting yarn to knitting needles and is mounted on a yarn feeder rail, can be made to operate as a self-running-type running member because a movement driving part drives it so as to move through a movement member and a coupling member. The movement member is arranged in parallel to a truck of the yarn feeder on an outer side of the truck a distance between the movement member and the truck, and the movement driving part drives the movement member on an end portion of the yarn feeder rail in the lengthwise direction. The distance between the yarn feeder rails from an end portion to the other end portion thereof in the lengthwise direction is utilized as a space in which the movement member is arranged, so that necessary operations for processes of specification change or mixture among the entraining-type and the self-running-type running members can be easily performed. A labor necessary for the process of the specification change from the entraining-type running member to the self-running-type running member or the specification mixture of the entraining-type running member and the self-running-type running member can be reduced. The yarn feeder rail which is installed for mounting the entraining-type running member can also be used as the yarn feeder rail for mounting the self-running-type running member, thereby eliminating readjustment with replacement of the yarn feeder rail.

[0014] According to the present invention, the two movement parts of the movement member are coupled to each other at both ends in the lengthwise direction and move in the opposite directions. It is sufficient that the movement driving part drives the movement member on one end portion of the yarn feeder rail.

[0015] Further, according to the present invention, the movement members arranged while being divided into upper and lower stages between the adjacent yarn feeder rails cause the self-running-type running members mounted on one and the other trucks facing each other between the adjacent yarn feeder rails to run. The two movement members can be arranged at the upper and lower stages to be housed efficiently even in the narrow space between the yarn feeder rails.

[0016] Moreover, according to the present invention, in the case in which the entraining-type running member and the self-running-type running member are mixed on the same truck on the yarn feeder rail, when the entraining-type running member is entrained by the carriage and makes close to the self-running-type running member within a predetermined distance, the entrainment cancellation part cancels entrainment. Even when the carriage continues running, collision can be avoided or impact can be moderated if collision occurs, because the entrainment of the entraining-type running member is canceled. With this configuration, control of changing a position of the self-running-type running member in accordance with a position of the carriage in order to prevent a collision accident needs not to be performed, thereby simplifying control.

[0017] In addition, according to the present invention, after the self-running-type running member is mounted on the truck of the yarn feeder rail, the movement member is arranged on the outer side of the running member with respect to the truck. This arrangement operation can be performed by inserting, from the upper side, the movement member into a narrow space such as a space between the yarn feeder rails. At this time, an operation of coupling the movement member to the running member by the coupling member can also be easily performed. Cancellation of coupling between the movement member and the self-running-type running member can be made by detaching the movement member and the coupling member to the upper side. The operation for the specification change of replacing the entraining-type running member by the self-running-type running member or adding the self-running-type running member to the entraining-type running member is performed more easily.

[Brief Description of Drawings]

[0018]

[Fig. 1] Fig. 1 is a left side view showing a schematic configuration of a yarn feeding device 1 according to an embodiment of the present invention.

[Fig. 2] Fig. 2 is a partial plan view of a flatbed knitting machine 10 including the yarn feeding device 1 in Fig. 1.

[Fig. 3] Fig. 3 is a plan view and a front view of a yarn feeder 3 included, as a running member, in the yarn feeding device 1 in Fig. 1.

[Fig. 4] Fig. 4 is a plan view and a front view of a coupling member 5a included in the yarn feeding device 1 in Fig. 1.

[Fig. 5] Fig. 5 is a simplified plan view and a simplified front view showing a state in which the coupling member 5a in Fig. 4 is mounted on a yarn feeder.

[Fig. 6] Fig. 6 is a plan view, a front view, and a right side view of a movement driving part 12b included in the yarn feeding device 1 in Fig. 1.

[Fig. 7] Fig. 7 is a plan view, a front view, and a left side view of a movement driving part 12a included in the yarn

feeding device 1 in Fig. 1.

[Fig. 8] Fig. 8 is a simplified plan view and a simplified front view showing operations of entrainment cancellation on an entraining-type yarn feeder 60 by an entrainment cancellation part 6a of the yarn feeder 3a in Fig. 3.

[Description of Embodiments]

[0019] Hereinafter, the schematic configuration of a yarn feeding device 1 as an example of the present invention will be described with reference from Fig. 1 to Fig. 8. For the convenience of description, components that are not shown in the drawing as a description target might be referred by using reference numerals shown in the other drawings in some cases. Components denoted by reference numerals with "a", "b", "c", and "d" are basically equivalent to one another and are collectively referred by reference numerals without "a", "b", "c", and "d" in some cases.

[Example]

[0020] Fig. 1 shows a schematic side configuration of the yarn feeding device 1 according to the example of the present invention. The yarn feeding device 1 in the present example includes yarn feeder rails 2a, 2b, yarn feeders 3a, 3b, movement belts 4a, 4b and coupling members 5a, 5b, and is used for feeding knitting yarn to knitting needles in order to knit a knitted fabric in a flatbed knitting machine. Such flatbed knitting machine includes needle beds, in which the knitting needles are arranged in parallel in the lengthwise direction, and a carriage which is capable of moving reciprocally along the lengthwise direction of the needle beds and on which knitting cams, to sequentially select the knitting needles and to drive them for knitting the knitted fabric, are mounted. The needle beds include at least a front needle bed and a back needle bed, facing each other in the front-back direction perpendicular to the lengthwise direction. The yarn feeder rails 2a, 2b are installed above a needle bed gap, which is a space between the needle beds and extends in the lengthwise direction of the needle beds.

[0021] The yarn feeder rails 2a, 2b have trucks 2aB, 2aF, 2bB, 2bF for mounting the yarn feeders 3a, 3b at both of right and left sides in the drawing. The left and right sides in the drawing are assumed to be directions of back B and front F sides on which the back bed and the front needle beds are respectively provided in the flatbed knitting machine. The yarn feeders 3a, 3b in the example are respectively mounted on the truck 2aF on the right side of the yarn feeder rail 2a and the truck 2bB on the left side of the yarn feeder rail 2b. The yarn feeders 3a, 3b mounted on the trucks 2aF, 2bB are self-running-type running members capable of running in the lengthwise direction and form a part of a route to feed the knitting yarn for knitting the knitted fabric to the knitting needles that are driven by the knitting cams. The movement belts 4a, 4b are movement members extending in the lengthwise direction of the yarn feeder rails 2a, 2b, are arranged in a space on the outer sides of the yarn feeders 3a, 3b that are respectively mounted on the trucks 2aF, 2bB of the yarn feeder rails 2a, 2b, and interpose the yarn feeders 3a, 3b between them and the trucks 2aF, 2bB. This space needs to be originally provided so as not to disturb running of the yarn feeders 3a, 3b. When the coupling members 5a, 5b couple the movement belts 4a, 4b to the yarn feeders 3a, 3b, respectively, the yarn feeders 3a, 3b serve as the self-running-type running members movable in the lengthwise direction of the needle beds by being moved by the movement belts 4a, 4b.

[0022] At least two movement belts 4a, 4b are arranged between the adjacent yarn feeder rails 2a, 2b while being divided into upper and lower stages. The upper and lower movement belts 4a, 4b move the yarn feeders 3a,l 3b mounted on the trucks 2aF, 2bB facing each other between the yarn feeder rails 2a, 2b with closer movement parts of two band-like movement parts arranged in parallel. The coupling members 5a, 5b included in the yarn feeding device 1 respectively couple the yarn feeders 3a, 3b to the movement parts of the closer movement belts 4a, 4b, that is, those with smaller distances to the trucks 2aF, 2bB. The yarn feeders 3a, 3b have entrainment cancellation parts 6a, 6b, base bodies 7a, 7b, feeder rods 8a, 8b, and stepped screws 9a, 9b. Sliding parts 31a, 31b that are engaged with upper portions of the trucks of the yarn feeder rails 2a, 2b are respectively provided in upper portions of the base bodies 7a, 7b. Sliding members 32a, 32b that are engaged with lower portions of the trucks can be attached to lower portions of the base bodies 7a, 7b after being mounted on the trucks.

[0023] Fig. 2 shows a partial planar configuration of a flatbed knitting machine 10 including the yarn feeding device 1 in Fig. 1. A support member 11 that supports one ends of yarn feeder rails 2a, 2b, 2c, 2d is provided on one end of the needle beds in the lengthwise direction. The movement belts 4a, 4b have the two band-like movement parts arranged in parallel, which have different distances to the trucks 2aF, 2bB in the front-back direction, and the two band-like movement parts are coupled to each other at both ends in the lengthwise direction. Although the movement belts 4a, 4b are arranged only between the facing trucks 2aF, 2bB among the yarn feeder rails 2a, 2b, they can also be arranged on the inner side between the yarn feeder rails 2b, 2c, among the yarn feeder rails 2c, 2d, and the like, or on the outer side of the truck 2aB of the yarn feeder rail 2a, and the like. Entraining-type yarn feeders that are entrained by the carriage can be mounted on trucks on which the yarn feeders 3a, 3b as the self-running-type running members are not mounted.

[0024] A movement driving part 12b is mounted using the support member 11. The movement driving part 12b can be supported by the support member 11 directly at one ends of the yarn feeder rails 2a, 2b, 2c, 2d in the lengthwise direction or indirectly with some member interposed on the outer side of the one ends. The movement driving part 12b drives the yarn feeder 3b to run through the movement belt 4b and the coupling member 5b. The movement belt 4a is driven by a movement driving part 12a provided on the other ends of the yarn feeder rails 2a, 2b, 2c, 2d similarly to the movement driving part 12b on the one ends. Provision of the movement driving parts 12a, 12b on the end portions of the one ends and the other ends in the lengthwise direction or on the outer sides thereof as described above, enables the movement belts 4a, 4b to be arranged by utilizing spaces generated between the yarn feeder rails 2a, 2b, 2c, 2d among the end portions thereof in the lengthwise direction. The yarn feeding device 1 includes the movement driving parts 12a, 12b and can cause the yarn feeders 3a, 3b as the self-running-type running members to run for yarn feeding in accordance with running of the carriage and to run for preparation for the yarn feeding independently of the carriage.

[0025] The movement driving part 12b includes a movement motor 13b as a driving source, bevel gears 14b, 15b, a driving pulley 16b, and an idle roller 17b. As the movement motor 13b, for example, a servo motor is used, and the movement motor 13b is attached such that an output shaft thereof levels in a horizontal direction. The bevel gears 14b, 15b convert the rotation direction of the movement motor 13b into the up-down direction to rotationally drive the driving pulley 16b. An end portion of the movement belt 4b is wound around the driving pulley 16b. The idle roller 17b is provided so as to reduce a space of the movement belts 4b between the yarn feeder rails 2a, 2b to be smaller than the diameter of the driving pulley 16b. The movement driving part 12b also includes a driven pulley 18a around which an end portion of the movement belt 4a is wound and an idle roller 19a for reducing a space of the movement belts 4a to be smaller than the diameter of the driven pulley 18a. A cover 20b covers the components of the movement driving part 12b. Transmission of rotational driving force through the bevel gears 14b, 15b could be replaced by direct driving of the driving pulley 16b, transmission driving with combination of spur gears, or transmission driving with the pulley and the belt by making the output shaft of the movement motor 13b be the up-down direction.

[0026] Fig. 3(a) is a plan view of the yarn feeder 3 of the yarn feeding device 1 in Fig. 1 and Fig. 3(b) is a front view thereof. The yarn feeder 3 includes, as parts, a base body 7, a feeder rod 8, stepped screws 9, a sliding member 32, a yarn feeder portion 33, and a yarn feeder port 34. The yarn feeder port 34 is attached to the lower end of the feeder rod 8 with the yarn feeder portion 33 interposed therebetween and feeds the knitting yarn to the knitting needle. The stepped screws 9 are used for fixing when the feeder rod 8 is attached to the base body 7 while being adjusted in height.

[0027] Fig. 4(a) is a plan view of the coupling member 5a of the yarn feeding device 1 in Fig. 1 and Fig. 4(b) is a front view thereof. The coupling member 5a includes a substrate 50 and an attachment plate 51. The movement belt 4a is a toothed belt, and concavity and convexity that are fitted with teeth of the movement belt 4a are formed on the attachment plate 51. The substrate 50 has two belt grooves 52 accommodating therein the movement belt 4 at two stages of upper and lower stages and a U-shaped groove 53 from a lower portion to an upper portion. The coupling member 5a fixes the movement belt 4a and the substrate 50 by screwing the attachment plate 51 in a state in which the upper movement belt 4a is accommodated in the belt groove 52 at the upper stage. In the same manner, the coupling member 5b in Fig. 1 fixes the movement belt 4b and the attachment plate 51 by screwing in a state in which the lower movement belt 4b is accommodated in the belt groove 52 at the lower stage. The movement belts 4a, 4b can also be arranged at equal to or more than three stages in the up-down direction without being arranged at the two stages of the upper and lower stages as shown in Fig. 1, in such a case, it would be sufficient that the number of stages of the belt grooves 52 might be increased in a correspondence manner.

[0028] Fig. 5(a) is a plan view of a state in which the coupling member 5a is mounted on the yarn feeder 3a and Fig. 5(b) is a front view thereof. When the yarn feeder 3a is mounted on the truck 2aF shown in Fig. 1, it is sufficient that the sliding member 32a in the lower portion, which is shown in Fig. 1, is detached and the sliding part 31a is hooked on an upper portion of the truck 2aF from the upper side. The sliding member 32a in the lower portion could be attached from the needle bed gap side. Even when the yarn feeders 3 are mounted on the trucks 2B, 2F of the other yarn feeder rails 2 arranged in parallel, the attachment operation might not be disturbed by shifting the positions of the yarn feeders 3 in the lengthwise direction. Accordingly, the operation could be performed with minimum necessary labor even in a small space, thereby eliminating the necessity of detachment and replacement of the yarn feeder rails 2. The coupling member 5a to which the movement belt 4a would have been attached could be mounted, from the upper side, on the yarn feeder 3a mounted on the truck 2aF. The coupling member 5a would be fixed in such a manner that the stepped screws 9a would be inserted into the U-shaped groove 53. The coupling member 5a might also be easily detached from the yarn feeder 3a by pulling it out to the upper side from the mounted state. Although the movement belt 4 could be directly attached to the yarn feeder 3a mounted on the truck 2aF by screwing, an operation of fixing the movement belt 4 by screwing needs to be performed in a small space such as a space between the yarn feeder rails 2. As in the present example, usage of the coupling member 5a, that could be attachable to and detachable from the yarn feeder 3a in the up-down direction and to which the movement belt 4a might have been attached, could facilitate attachment and detachment operations.

[0029] Fig. 6(a) is a plan view of the configuration of the movement driving part 12b in Fig. 2 in a state in which the

cover 20b is removed, Fig. 6(b) is a front view thereof, and Fig. 6(c) is a right side view thereof. The front view shows a cross section along cut line B-B in Fig. 6(a). The idle roller 19a shown in Fig. 6(a) is present on the front side relative to the cross section and is not therefore shown in Fig. 6(b).

[0030] Fig. 7(a) is a plan view of the movement driving part 12a provided on the other ends of the yarn feeder rails 2a, 2b, 2c, 2d in the lengthwise direction in the flatbed knitting machine 10 in Fig. 2, Fig. 7(b) is a left side view thereof, and Fig. 7(c) is a front view thereof. The front view illustrates a cross section along cut line C-C in Fig. 7(a). The movement driving part 12a includes a movement motor 13a, bevel gears 14a, 15a, a driving pulley 16a, an idle roller 17a, a driven pulley 18b, and an idle roller 19b. The movement motor 13a, the bevel gears 14a and 15a, the driving pulley 16a, and the idle roller 17a are provided for driving the movement belt 4a and are basically equivalent to the configuration for driving the movement belt 4b. The movement belt 4b is wound around the driven pulley 18b and the idle roller 19b.

[0031] The movement belts 4 as the movement members are formed by making the two movement parts arranged in parallel continuous to each other at both ends in the lengthwise direction. When the yarn feeders 3 as the running members are caused to run, the two movement parts move in the opposite directions and circulate. It would be therefore sufficient that the movement driving part 12 for driving movement of the movement members might be provided on the one end of the yarn feeder rail 2 and a driven part for supporting it might be provided on the other end thereof. In the present example, the movement belts 4 for reciprocation are arranged in the lateral direction, arrangement of the driving pulleys, the gears, motors, and the like in the movement driving part 12 can be made compact. The movement belts 4 can be used while the two band-like movement parts are arranged vertically, thereby making the movement belts 4 difficult to drop. The movement driving parts 12a, 12b for the movement belts 4a, 4b, which are arranged on the upper and lower sides, are provided while being divided into the both end portions of the yarn feeder rails 2 in the lengthwise direction. The movement driving parts 12a, 12b can be attached to the support member 11 and the like by utilizing spaces on the outer sides of both end portions of the yarn feeder rails 2 in the lengthwise direction, and labor required for attachment is reduced. An annular circulating member such as a chain and a wire could also be used as the movement member. When the two reciprocating movement parts would be arranged in the lateral direction as in each of the movement belts 4, the movement part closer to the yarn feeder rail 2 might be easily coupled to the running member but the movement part farther from the yarn feeder rail 2 could also be coupled thereto. The two reciprocating movement parts could also be arranged in the vertical direction, and coupling of the two movement parts to the running member could be made similarly. Further, the running member could also be moved while winding up and feeding out not the annular member but a flexible linear wire or the like at one end and feeding out and winding up at the other end. The movement member could be formed by a rigid rack or the like, and it could be driven to advance and retreat on one end side and could be supported on the other end side.

[0032] Fig. 8 shows operations of entrainment cancellation on an entraining-type yarn feeder 60 by the entrainment cancellation part 6a of the yarn feeder 3a. Figs. 8(a), 8(b) are respectively a plan view and a front view showing a state in which the entraining-type yarn feeder 60 is mounted on the same truck on which the self-running-type yarn feeder 3a is mounted and they are close to each other. The yarn feeder 60 has an engagement part 62 being a wall surface of a recess portion, which is engaged with an entrainment pin 61 as an entrainment member provided on the carriage, and runs while being entrained by the carriage in an engaged state. The yarn feeder 60 also has a similar configuration to that of the yarn feeder 3a. A part of the yarn feeder 3a in which the entrainment cancellation part 6a is formed and a part of the yarn feeder 60 in which the engagement part 62 is formed project upward, and the positions thereof deviate from each other in the right-left direction as shown in Fig. 3.

[0033] Fig. 8(c) shows a state in which the yarn feeder 60 makes close to the yarn feeder 3a and the leading end of the entrainment cancellation part 6a enters under the entrainment pin 61. When the carriage cancels the entrainment, the entrainment pin 61 is pulled upward whereas when the carriage entrains the yarn feeder 60, the entrainment pin 61 is biased with a spring so as to be lowered. The lower end of the lowered entrainment pin 61 is spaced from the bottom surface of the recess portion of the yarn feeder 60, and the leading end of the entrainment cancellation portion 6a can be inserted into the space. When the yarn feeder 60 makes much closer to the yarn feeder 3a, the entrainment pin 61 is pushed up by a slope of the entrainment cancellation part 6a, and the lower end of the entrainment pin 61 is moved up relative to the engagement part 62 as shown in Fig. 8(d). Thus, when the yarn feeder 60 makes closer to the yarn feeder 3a within a predetermined distance, the entrainment cancellation part 6a acts so as to release the engagement between the entrainment pin 61 and the yarn feeder 60 and cancel the entrainment. The above-described operation of the entrainment cancellation is similar to a conventional operation that is performed by causing the yarn feeder 60 to hit a stopper for entrainment cancellation, which might be provided on an end portion of a truck.

[0034] When the yarn feeder 60 on the same truck, which would be entrained by the carriage, might make close to the self-running-type yarn feeder 3, collision thereof could be avoided by controlling the yarn feeder 3 to escape from the yarn feeder 60. Even when the entraining-type yarn feeder 60 would collide with the self-running-type yarn feeder 3, the entrainment cancellation part 6 cancels the entrainment of the yarn feeder 60, so that impact could be moderated. Accordingly, provision of the entrainment cancellation part 6 could eliminate the necessity to perform control of changing the position of the self-running-type yarn feeder 3 in accordance with the position of the carriage in order to prevent a

collision accident, thereby simplifying the control. When the self-running-type yarn feeder 3 would stop at the end portion of the truck, the entrainment could also be cancelled by causing the entraining-type yarn feeder 60 to hit the self-running-type yarn feeder 3 as in the case of causing it to hit the stopper for the entrainment cancellation.

[0035] Although the yarn feeder 3 is the running member in the present example, a member provided on the route for feeding the knitting yarn and relaying the knitting yarn, such as a movable yarn guide disclosed in Japanese Patent Publication No.S58-126351A1, could also be used as a running member. It is sufficient that the running member for relaying the knitting yarn might be controlled so as to intermittently run while avoiding collision with the yarn feeders 3, 60 even when it might be mounted on the same truck on which the self-running-type yarn feeder 3 and the entraining-type yarn feeder 60 would be mounted.

[0036] The movement members such as the movement belts 4 are arranged in parallel with the yarn feeder rails 2 with the spaces therebetween, and the movement driving part 12 is mounted on the support member 11 supporting the yarn feeder rail 2 on the end portion thereof in the lengthwise direction, so that the yarn feeder rail 2 might be required no movement member and no configuration to support the movement driving part 12. The yarn feeder rails 2 that might be installed for mounting the running members such as the entraining-type yarn feeder 60 thereon could be used as the yarn feeder rails 2 for mounting the self-running-type running members thereon, so that specification change from the entraining-type to the self-running type, mixing of the entraining-type and the self-running type, and the like could be easily made even without detaching and replacing the yarn feeder rails 2. Since the yarn feeder rails 2a, 2b are installed at the same height in Fig. 1, the feeder rods 8a and 8b are bent in lower portions thereof to enable yarn feeding from the yarn feeder ports 34 at substantially the same positions in the needle bed gap. As shown in Fig. 1 in Japanese Patent Publication No. 2011-106059A1, for example, the yarn feeder rails may be arranged in a fan shape, and at least the feeder rod at the center may be formed linearly. Alternatively, the feeder rods may be configured to be movable in the up-down direction, and the feeder rod that is used for yarn feeding may be lowered whereas the feeder rod that is not used may be made to wait in an upper portion.

[Explanation of Reference]

[0037]

1	Yarn feeding device
2, 2a, 2b, 2c, 2d	Yarn feeder rail
2B, 2F, 2aB, 2aF, 2bB, 2bF	Truck
3, 3a, 3b, 60	Yarn feeder
4, 4a, 4b	Movement belt
5, 5a, 5b	Coupling member
6, 6a, 6b	Entrainment cancellation part
7, 7a, 7b	Base body
8, 8a, 8b	Feeder rod
9, 9a, 9b	Stepped screw
10	Flatbed knitting machine
11	Support member
12, 12a, 12b	Movement driving part
53	U-shaped groove
61	Entrainment pin

Claims

1. A yarn feeding device (1) being provided in a flatbed knitting machine (10), which includes:

at least two needle beds interleaving a needle bed gap to face each other in a front-back direction and having knitting needles to be lined up in a lengthwise direction;
a carriage being capable of reciprocating along the lengthwise direction of the needle beds and being mounted with a knitting cam to sequentially select the knitting needles and to drive for knitting a knitted fabric; and
yarn feeder rails (2, 2a, 2b, 2c, 2d) being installed above the needle bed gap and having trucks (2B, 2F, 2aB, 2aF, 2bB,2bF) to extend in the lengthwise direction of the needle beds, and

the yarn feeding device including a self-running-type running member (3, 3a, 3b) mounted on the truck (2B, 2F, 2aB, 2aF, 2bB,2bF) and capable of running in the lengthwise direction on a part of a route for feeding knitting yarn

to the knitting needles:
characterized in that the yarn feeding device (1) comprises;

a movement member (4, 4a, 4b) that has a movement part extending in the lengthwise direction, is arranged in parallel on an outer side of the truck (2B, 2F, 2aB, 2aF, 2bB,2bF) in the front-back direction, and is capable of moving in the lengthwise direction;
a coupling member (5, 5a, 5b) that couples the running member (3, 3a, 3b) to the movement part; and
a movement driving part (12, 12a, 12b) that is provided on an end portion in the lengthwise direction and is capable of driving the running member (3, 3a, 3b) to run through the movement member (4, 4a, 4b) and the coupling member (5, 5a, 5b).;
wherein there being a distance capable of interleaving the movement member (4, 4a, 4b) mounted on the truck (2B, 2F, 2aB, 2aF, 2bB,2bF) in the front-back direction between the movement part and the truck (2B, 2F, 2aB, 2aF, 2bB,2bF).

2. The yarn feeding device (1) according to claim 1,
wherein said movement member (4, 4a, 4b) has two said movement parts, which are arranged in parallel with different distances to said truck (2B, 2F, 2aB, 2aF, 2bB, 2bF). in said front-back direction, and are coupled to each other at both ends in said lengthwise direction so as to move in opposite directions, and
said coupling member (5, 5a, 5b) couples the movement part, having a smaller distance to the truck (2B, 2F, 2aB, 2aF, 2bB, 2bF), to said self-running-type running member (3, 3a, 3b).

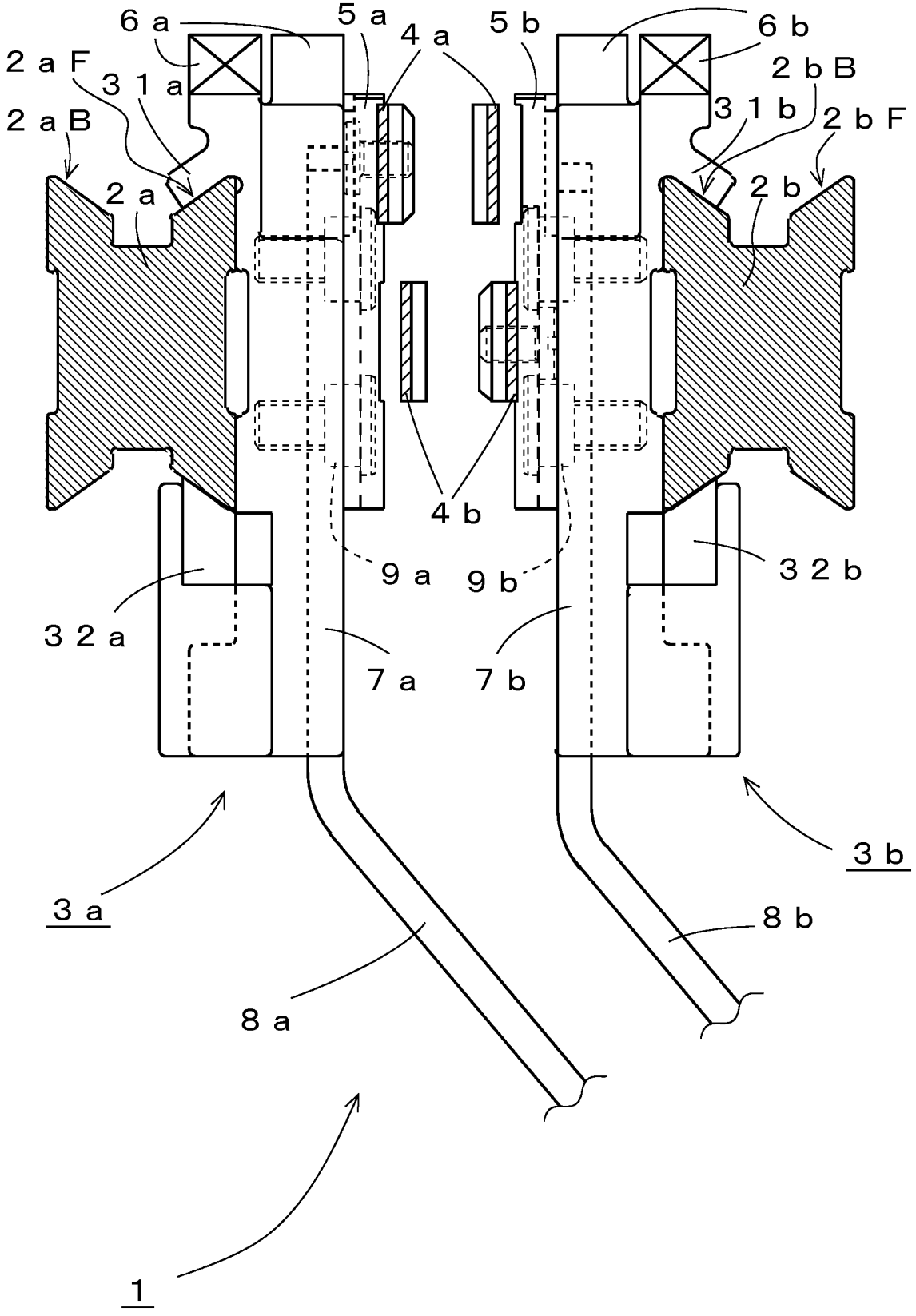
3. The yarn feeding device (1) according to claim 1 or 2,
wherein a plurality of said yarn feeder rails (2, 2a, 2b, 2c, 2d) each having said trucks (2B, 2F, 2aB, 2aF, 2bB, 2bF), at both sides in said front-back direction and being arranged in parallel in the front-back direction,
at least two said self-running-type running members (3a, 3b) being respectively mounted on one truck (2aF) and the other truck (2bB) facing each other on adjacent yarn feeder rails (2a, 2b), and
at least two movement members (4a, 4b) are arranged between the adjacent yarn feeder rails (2a, 2b) while being divided into upper and lower stages and move the running members (3a, 3b) which are respectively mounted on the one truck (2aF) and the other truck (2bB).

4. The yarn feeding device (1) according to any one of claims 1 to 3,
wherein said carriage being provided with an entrainment member (61) which is capable of being engaged with an entraining-type running member (60) mounted on said truck (2B, 2F, 2aB, 2aF, 2bB, 2bF) of said yarn feeder rail (2, 2a, 2b, 2c, 2d) and causes the entraining-type running member (60) to run while being engaged, and
said self-running-type running member (3, 3a, 3b):

being capable of being mounted on the same truck (2B, 2F, 2aB, 2aF, 2bB, 2bF) on which the entraining-type running member (60) is mounted; and
having an entrainment cancellation part (6, 6a, 6b) that acts so as to release engagement between the entraining-type running member (60) and the entrainment member (61) and cancel entrainment of the entraining-type running member (60) by the carriage when the entraining-type running member (60) makes close to the self-running-type running member (3, 3a, 3b) within a predetermined distance on the same truck (2B, 2F, 2aB, 2aF, 2bB, 2bF).

5. The yarn feeding device (1) according to any one of claims 1 to 4,
wherein said coupling member (5, 5a, 5b), which is mounted to said movement member (4, 4a, 4b), being detachable to said self-running-type running member (3, 3a, 3b) in an up-down direction.

Fig. 1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8 a
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Fig. 2

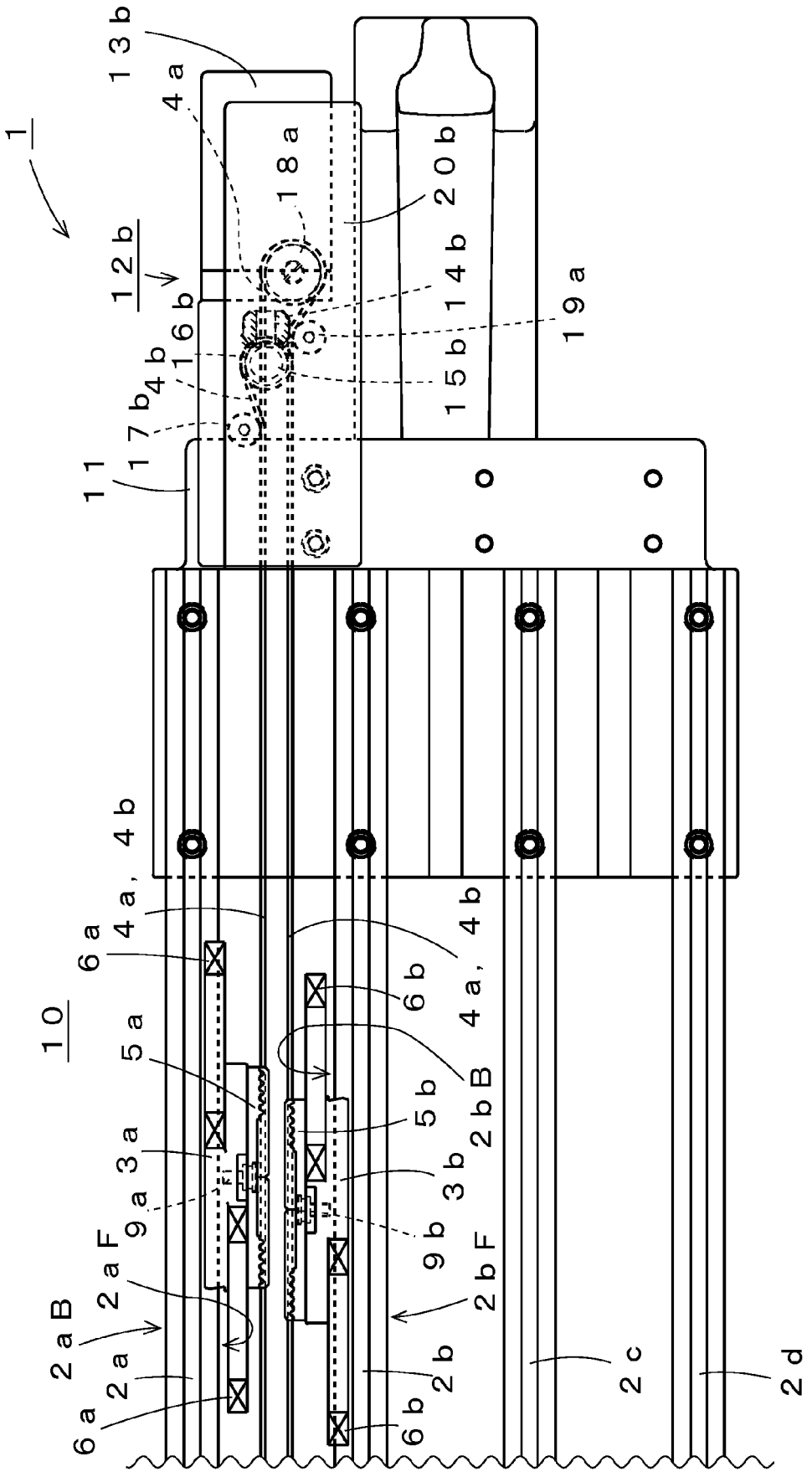
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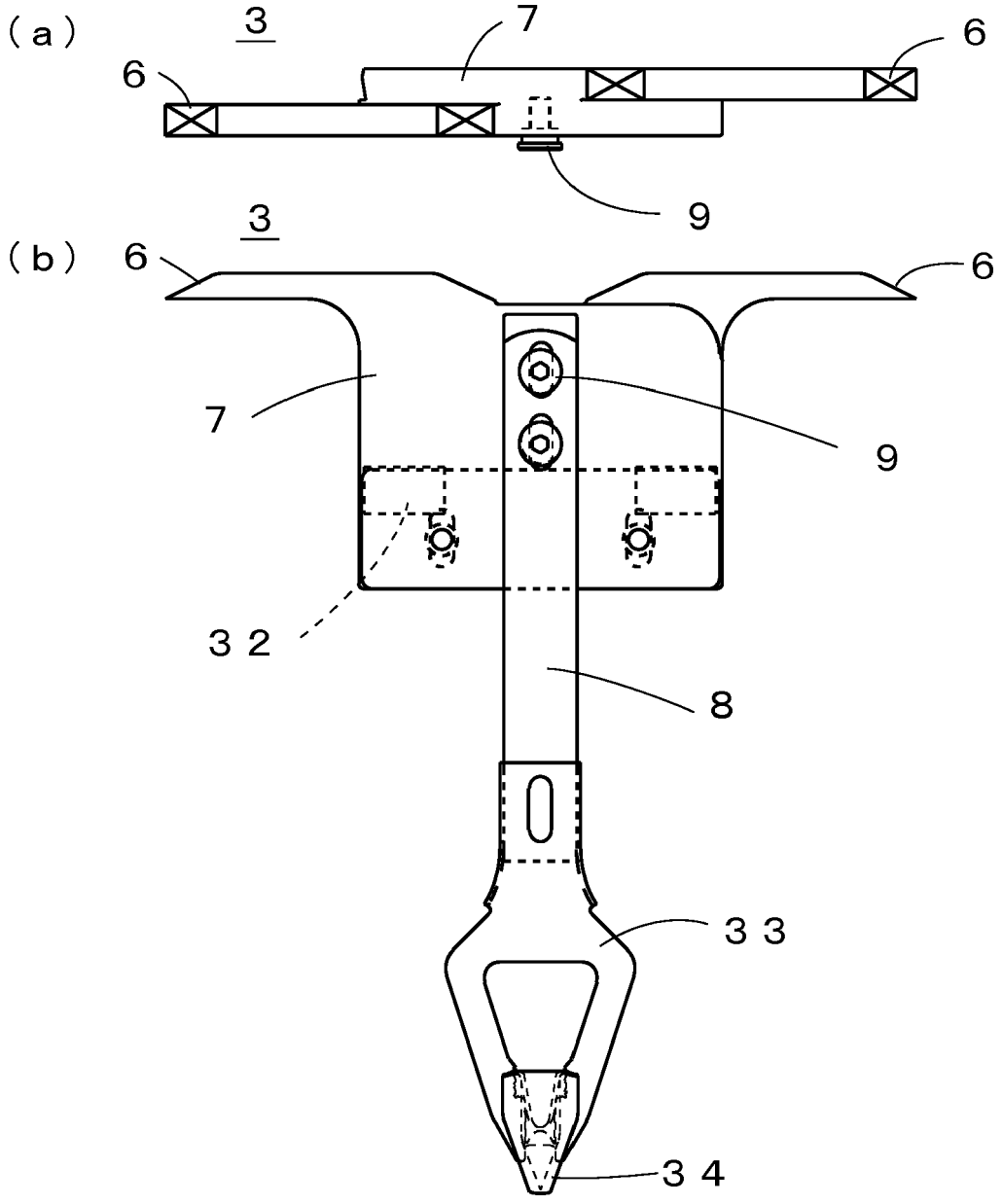
Fig. 3



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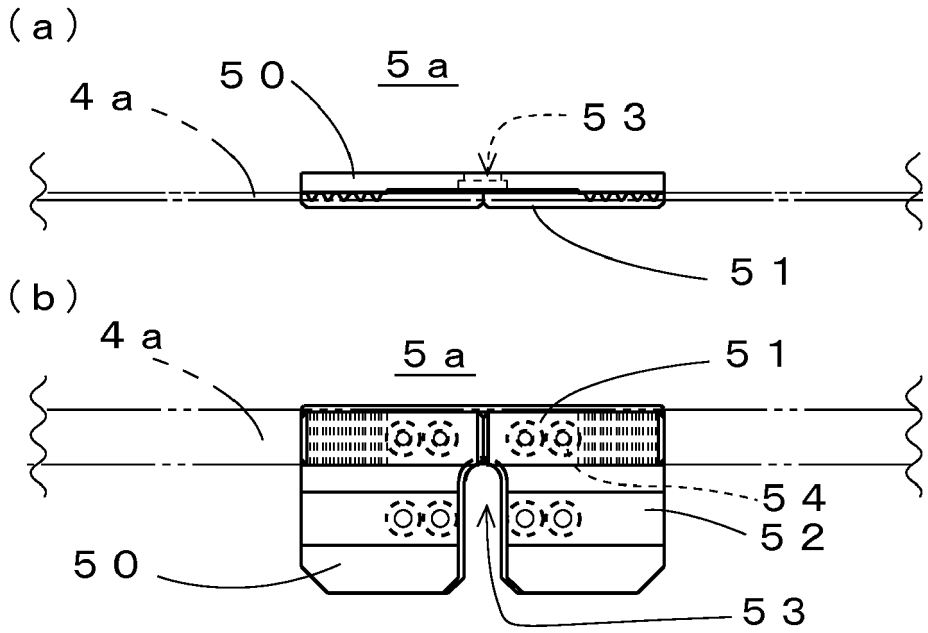
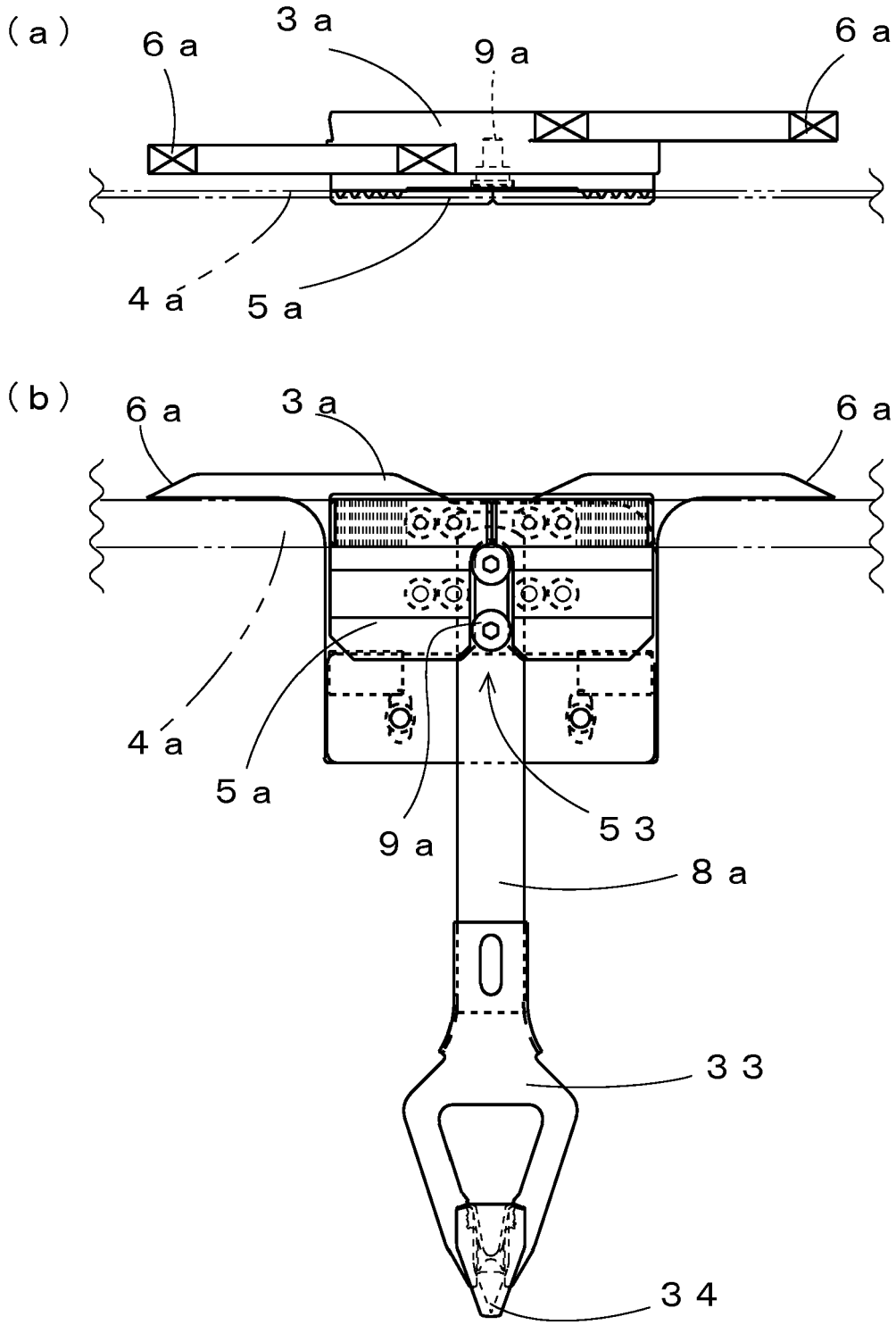


Fig. 5



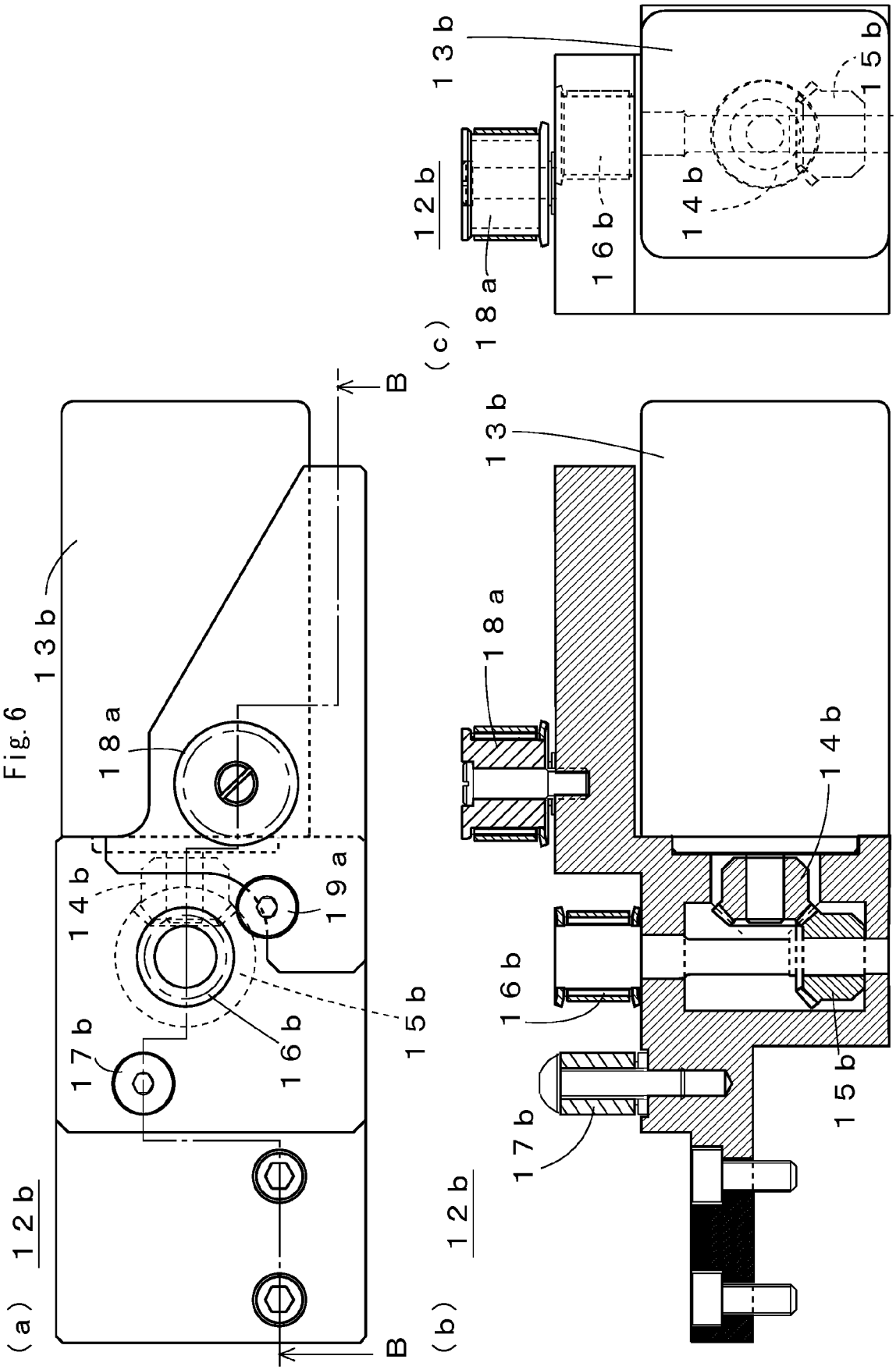

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Fig. 6

Fig. 7

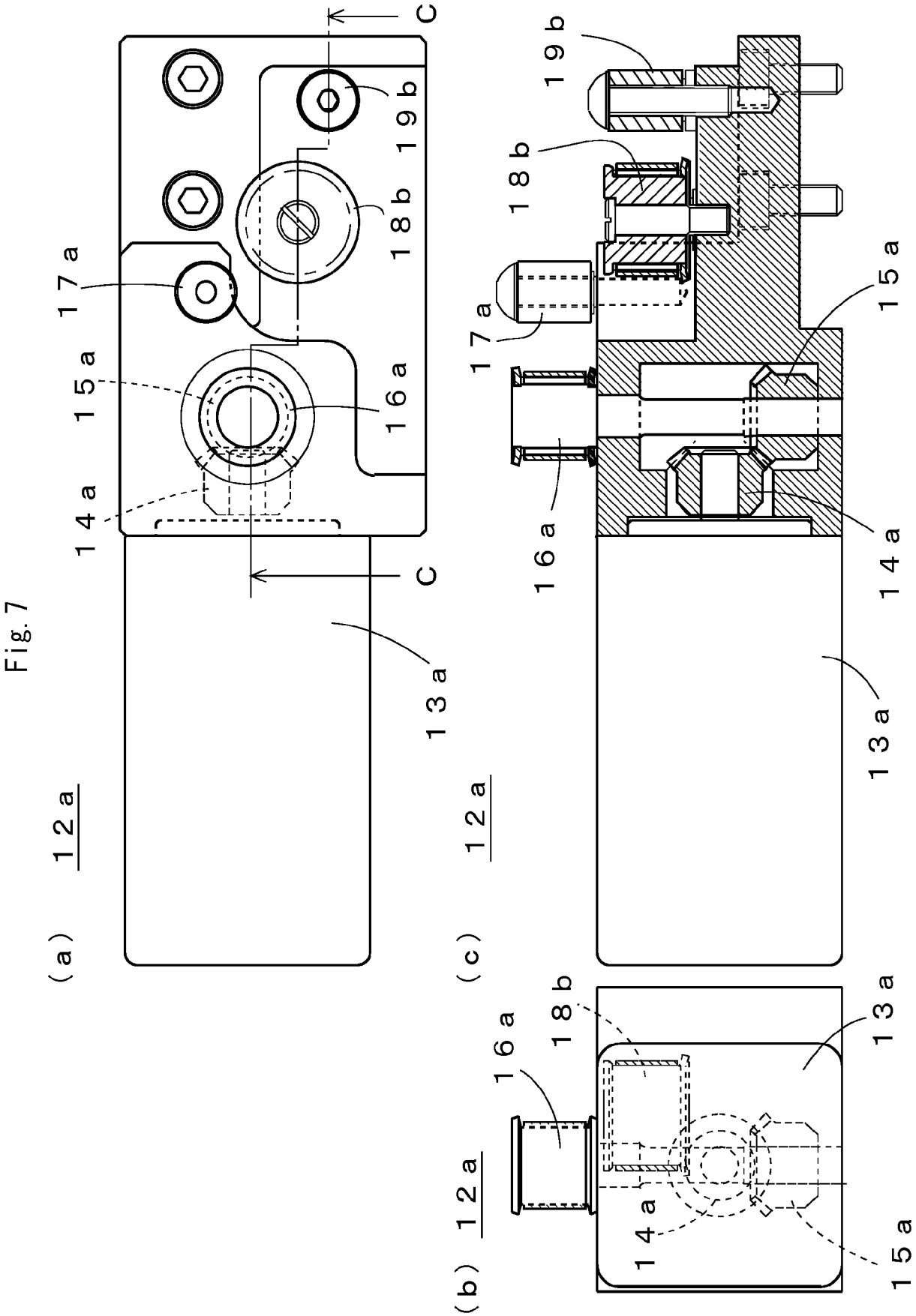
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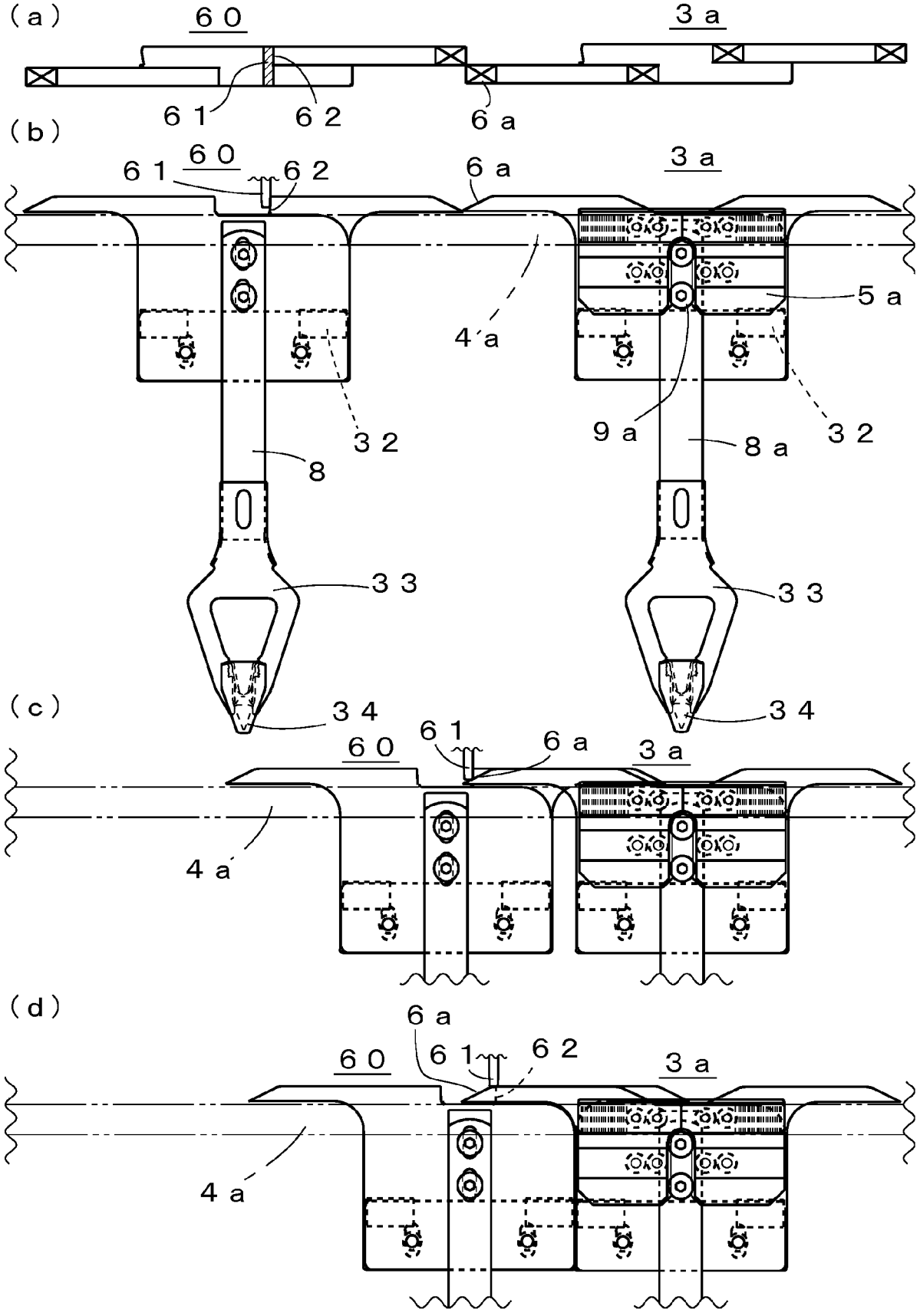
Fig. 8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REFERENCES CITED IN THE DESCRIPTION

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