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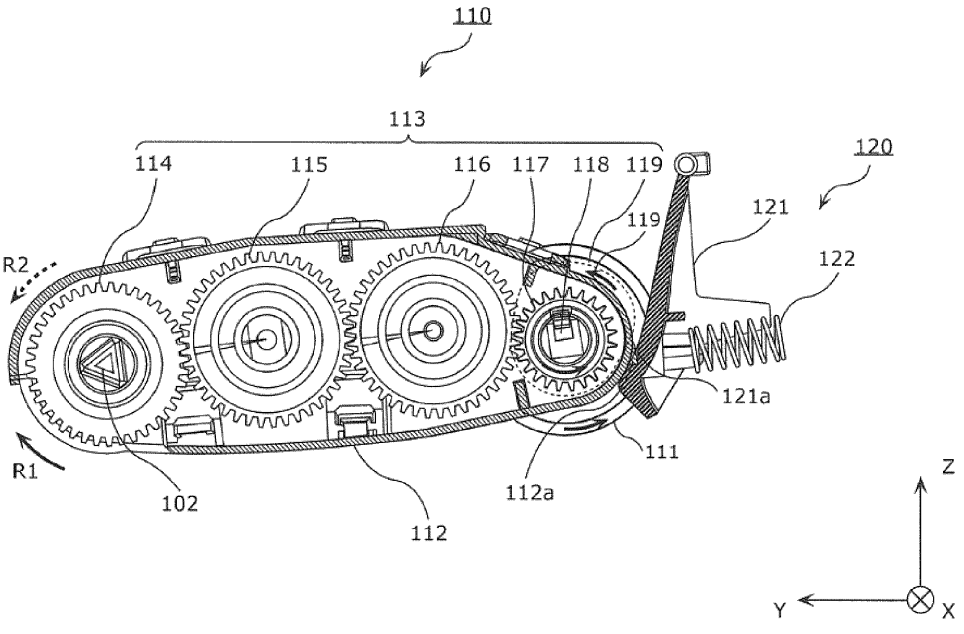
(54) IMAGE FORMING APPARATUS AND METHOD FOR FEEDING A SHEET

(57) An image forming apparatus (10) comprises a feeding mechanism (110) that comprises a driving source (101) configured to rotate a first shaft (102) around the first shaft (102), a transmission mechanism (113) configured to transmit rotation of the first shaft (102) in a first direction (R1) to a second shaft (103) and not to transmit rotation of the first shaft (102) in a direction (R2) opposite the first direction (R1) to the second shaft (103); a roller (111) fixed to the second shaft (103) and configured to feed a sheet from a stack (50) of sheets by rotating around the second shaft (103); and a releasing member (119) fixed to the second shaft (103); and a holding mechanism (120) configured to hold the feeding mechanism (110) with the roller (111) away from the stack (50), wherein the releasing member (119) is configured to release the hold on the feeding mechanism (113) by the holding mechanism (120) when the transmission mechanism (113) transmits the rotation of the first shaft (102) to the second shaft (103).

FIG. 5



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Description

[Technical Field]

[0001] The present invention generally relates to an image forming apparatus and a method for feeding a sheet from a stack of sheets.

[Background Art]

[0002] Conventional printers comprise a sheet feeding device for picking up and feeding to a printing unit one sheet from a stack of a plurality of sheets. The sheet feeding device feeds the top sheet from the stack of the plurality of sheets to the printing unit by, for example, rotating a roller in contact with the sheet (for example, see Patent Literature 1).

[Citation List]

[Patent Literature]

[0003] [Patent Literature 1] Japanese Patent Application Publication No. 2013-234060

[0004] In such a sheet feeding device, when feeding of the sheet ends, the roller is retracted to a retracted position not in contact with the sheet by a driving force that reverses the roller. At this time, the roller is held in the retracted position by a holding portion.

[0005] However, if the roller rotates in reverse while the holding portion is holding the roller, the roller and the holding portion rub together and generate noise.

[Summary of the Invention]

[0006] According to one or more embodiments of the present invention, an image forming apparatus comprises a sheet feeding device that can reduce noise when holding a roller away from a stack of a plurality of sheets.

[0007] According to one or more embodiments of the present invention, an image forming apparatus comprises a driving source configured to rotate a first shaft around the first shaft, for example both in a first and in a second rotation direction opposite the first rotation direction, and a feeding mechanism.

[0008] According to one or more embodiments of the present invention, the feeding mechanism may comprise a transmission mechanism configured to transmit rotation of the first shaft only in a first direction to the second shaft. In other words, the transmission mechanism is configured not to transmit rotation of the first shaft in a direction opposite the first direction to the second shaft.

[0009] According to one or more embodiments of the present invention, the feeding mechanism may also comprise a roller fixed in a rotatable manner to the second shaft and configured to feed a sheet from a stack of sheets by rotating around the second shaft.

[0010] According to one or more embodiments of the present invention, the feeding mechanism may also comprise a releasing member fixed to the second shaft.

[0011] According to one or more embodiments, the image forming apparatus may further comprise a holding mechanism configured to hold the feeding mechanism with the roller away from the stack.

[0012] According to one or more embodiments, the releasing member may be configured to release the feeding mechanism held by the holding mechanism when the transmission mechanism transmits the rotation of the first shaft to the second shaft.

[0013] Further embodiments of the image forming apparatus are defined in the dependent claims.

[0014] According to one or more embodiments of the present invention, for example, a sheet feeding device for feeding a sheet from a stack of a plurality of sheets, may comprise: a driving source configured to rotate a first shaft in both directions; a feeding mechanism that comprises a roller that is fixed in a rotatable manner to a second shaft and is configured to feed the sheet by rotating around the second shaft while contacting the sheet; and a holding mechanism configured to hold the feeding mechanism with the roller away from the stack of the plurality of sheets; wherein the feeding mechanism may further comprise an arm that connects the first shaft and the second shaft, the arm being configured to turn the second shaft around the first shaft by rotation of the first shaft; a transmission mechanism that is provided in the arm and is configured to selectively perform transmission and non-transmission of rotation from the first shaft to the second shaft according to a rotational direction of the first shaft; and a releasing member that is fixed to the second shaft and is configured to release the hold on the feeding mechanism by the holding mechanism by rotating around the second shaft.

[0015] According to this configuration, transmission and non-transmission of rotation from the first shaft to the second shaft can be performed selectively according to a rotational direction of the first shaft. Therefore, reverse rotation of the roller can be prevented, and noise due to the roller and the holding mechanism rubbing together can be reduced. Moreover, by the releasing member rotating around the second shaft, the hold on the feeding mechanism by the holding mechanism can be released. That is, when rotation is transmitted from the first shaft to the second shaft, the hold on the feeding mechanism by the holding mechanism can be released, and the second shaft can be turned around the first shaft in a direction approaching the stack of the sheets. Moreover, when rotation is not transmitted from the first shaft to the second shaft, the hold on the feeding mechanism by the holding mechanism can be maintained. Therefore, it becomes possible to stably hold the feeding mechanism with the roller away from the stack of the plurality of sheets when not feeding the sheet.

[0016] According to one or more embodiments of the present invention, for example, the holding mechanism may comprise a holding portion configured to hold the

arm.

[0017] According to this configuration, the holding portion can hold the arm. The arm has less rattling than the roller and also has high freedom in design for the held portion. Therefore, the feeding mechanism can be held more stably than holding the roller.

[0018] According to one or more embodiments of the present invention, for example, the holding mechanism may further comprise an elastic portion configured to press the holding portion to the arm, and the releasing member may be configured to release the hold on the arm by the holding portion by pressing the holding portion in a direction away from the arm.

[0019] According to this configuration, the releasing member can release the hold on the arm by the holding portion by pressing the holding portion pressed to the arm by the elastic portion in the direction away from the arm. Therefore, the releasing member can be realized by a relatively simple configuration.

[0020] According to one or more embodiments of the present invention, for example, an engaging portion configured to engage with the holding portion may be formed on a tip portion of the arm, and the releasing member may be configured to release the engagement between the engaging portion and the holding portion.

[0021] According to one or more embodiments of the present invention, the holding portion can engage with the engaging portion formed on the tip portion of the arm. Therefore, the holding portion can stably hold the arm.

[0022] According to one or more embodiments of the present invention, for example, the transmission mechanism may be further comprise a plurality of gears, comprising a first gear rotatable around the first shaft and a second gear rotatable around the second shaft; and a clutch that is installed between at least one gear from among the plurality of gears and the rotational shaft of the at least one gear and is configured to transmit transmission and non-transmission of rotation between the at least one gear and the rotational shaft according to a rotational direction of the at least one gear.

[0023] According to this configuration, transmission and non-transmission of rotation between a gear and a rotational shaft can be switched according to a rotational direction of the gear by the clutch installed between the gear and the rotational shaft. That is, transmission and non-transmission of rotation from the first shaft to the second shaft can be switched by the clutch according to a rotational direction of the first shaft.

[0024] According to one or more embodiments of the present invention, for example, the at least one gear may be the second gear, the clutch may be configured to switch transmission and non-transmission of rotation from the second gear to the second shaft according to a rotational direction of the second gear, and the releasing member may be a cam formed integrally with the second gear.

[0025] According to this configuration, the clutch can be installed between the second gear and the second shaft, and the releasing member can be realized as the cam formed integrally with the second gear. Therefore, a component count can be reduced, and an assembly operation of the sheet feeding device can be made more efficient.

[0026] According to one or more embodiments of the present invention, for example, the transmission mechanism may comprise a gear rotatable around the second shaft, and the releasing member may be a cam formed integrally with the gear.

[0027] According to this configuration, the releasing member can be realized as the can formed integrally with the gear. Therefore, the component count can be reduced, and the assembly operation of the sheet feeding device can be made more efficient.

[0028] A printer according to one or more embodiments of the present invention may comprise the above sheet feeding device.

[0029] According to this configuration, effects similar to those of the above sheet feeding device can be obtained in the printer.

[0030] According to one or more embodiments of the present invention, an image forming apparatus, such as for example a printer or any other apparatus having a printing function, may comprise a feeding mechanism that comprises: a transmission mechanism configured to transmit rotation of a first shaft in a first direction to a second shaft and does not transmit rotation of the first shaft in a direction opposite the first direction to the second shaft; a roller that is fixed in a rotatable manner to the second shaft and feeds a sheet from a stack of sheets by rotating around the second shaft; and a releasing member that is fixed to the second shaft; and a holding mechanism configured to hold the feeding mechanism with the roller away from the stack, wherein when the transmission mechanism transmits the rotation of the first shaft to the second shaft, the releasing member is configured to release the hold on the feeding mechanism by the holding mechanism.

[0031] According to one or more embodiments of the present invention, a method for feeding a sheet from a stack of sheets may be as defined in claim 11.

[0032] Embodiments of the method are defined in the dependent claims.

[0033] According to one or more embodiments of the present invention, a method for feeding a sheet from a stack of sheets may comprise rotating a first shaft around the first shaft, transmitting, with a transmission mechanism, rotation of the first shaft in a first direction to a second shaft and does not transmit rotation of the first shaft in a direction opposite the first direction to the second shaft; feeding, with a roller, the sheet from a stack of sheets by rotating around the second shaft; connecting, with an arm, the first shaft and the second shaft; holding, with a holding portion, the arm or the roller with the roller away from the stack; and when the transmitting transmits the rotation of the first shaft to the second shaft, releasing, with the releasing member, the hold on the arm or the

roller by the holding portion.

[0034] According to one or more embodiments, the holding comprises pressing, with an elastic portion, the holding portion to the arm, and the releasing presses the holding portion in a direction away from the arm and releases to hold the arm by the holding portion.

[0035] According to one or more embodiments, an engaging portion that engages with the holding portion is formed on a tip portion of the arm, and the releasing releases the engagement between the engaging portion and the holding portion.

[0036] According to one or more embodiments, the transmission mechanism further comprises a plurality of gears that includes a first gear that rotates around the first shaft and a second gear that rotates around the second shaft, and a clutch that is installed between at least one gear from among the plurality of gears and the rotational shaft of the at least one gear, wherein the transmitting comprises switching, with the clutch, transmission and non-transmission of rotation between the at least one gear and the rotational shaft based on a rotational direction of the at least one gear.

[0037] The image forming apparatus and the method for feeding a stack of sheets according to one or more embodiments of the present invention can reduce noise when holding the roller away from the stack of the plurality of sheets.

[Brief Description of the Drawings]

[0038]

FIG. 1 is a perspective view illustrating a printer according to one or more embodiments of the present invention.

FIG. 2 is a cross-sectional view illustrating the printer according to one or more embodiments of the present invention.

FIG. 3 is a perspective view illustrating a sheet feeding device of the printer according to one or more embodiments of the present invention.

FIG. 4 is a view from above of the sheet feeding device of the printer according to one or more embodiments of the present invention.

FIG. 5 is a cross-sectional view illustrating a feeding mechanism of the printer according to one or more embodiments of the present invention.

FIG. 6 is a view illustrating the feeding mechanism of the sheet feeding device of the printer according to one or more embodiments of the present invention being held by a holding mechanism.

FIG. 7 is a view illustrating an operation by which the hold on the feeding mechanism is released in the sheet feeding device according to one or more embodiments of the present invention.

FIG. 8 is a view illustrating the sheet feeding device of the printer according to one or more embodiments of the present invention feeding a sheet.

FIG. 9 is a cross-sectional view illustrating a feeding mechanism of a sheet feeding device of a printer according to one or more embodiments of a first modified example of the present invention.

FIG. 10 is a view from above of the sheet feeding device of the printer according to one or more embodiments of the first modified example of the present invention.

FIG. 11 is a view from above of a sheet feeding device of a printer according to one or more embodiments of a second modified example of the present invention.

[Detailed Description of Embodiments]

[0039] Embodiments of the present invention will be described below in detail with reference to the drawings.

[0040] Numerous specific details are set forth herein to provide a more thorough understanding of the invention. However, it will be apparent to one of ordinary skill in the art that the invention may be practiced without these specific details. In other instances, well-known features have not been described in detail.

[0041] A sheet feeding device according to embodiments of the present invention will be described below with reference to the drawings. In one or more embodiments of the present invention, the sheet feeding device is included in an image forming apparatus, such as for example a printer or an MFP (Multi-Function Peripheral) including a printing function. In the drawings, an x-axis is an axis direction of a roller 111 of the printer; a y-axis is a direction that crosses the x-axis and a direction to which a recording medium is transported; and a z-axis is a direction that crosses the x-axis and the y-axis.

(Configuration of Printer)

[0042] First, a configuration of a printer 10 in accordance with one or more embodiments comprising a sheet feeding device 100 will be described. FIG. 1 is a perspective view of the printer 10 according to one or more embodiments of the present invention. FIG. 2 is a cross-sectional view illustrating the printer 10 according to one or more embodiments of the present invention.

[0043] In one or more embodiments of the present invention, the printer 10 may be a laser printer. The printer 10 may comprise a chassis 11, a cassette 12, a tray 13, a printing unit 14, and the sheet feeding device 100.

[0044] The cassette 12 is provided in a lower portion of the chassis 11 and is housed in the chassis 11 so as to be able to be pulled out in a y-axis direction. The cassette 12 houses a stack 50 of a plurality of sheets.

[0045] A sheet is a thinly-spread medium. For example, the sheet is made from paper, resin, cloth, or the like.

[0046] The tray 13 is provided on an upper surface of the chassis 11. A printed sheet is discharged onto the tray 13.

[0047] The printing unit 14 prints an image on the

sheet. Specifically, the printing unit 14 comprises, for example, a photoreceptor drum, a transfer roller, a fixing roller, and the like. A toner image formed on the photoreceptor drum is transferred by the transfer roller onto a sheet conveyed along a first route 15. Then, the toner image transferred onto the sheet is fixed on the sheet by the fixing roller.

[0048] The printer 10 according to one or more embodiments of the present invention can print on both sides of the sheet. When performing double-sided printing, a sheet printed on one side, after being conveyed to the tray 13 along the first route 15, has its traveling direction reversed and is conveyed to the cassette 12 along a second route 16. The sheet printed on one side conveyed to the cassette 12 is again fed to the printing unit 14 along the first route 15 to realize double-sided printing.

[0049] The sheet feeding device 100 feeds one sheet from the stack 50 of the plurality of sheets. Specifically, the sheet feeding device 100 feeds to the first route 15 one sheet from the stack 50 of the plurality of sheets housed in the cassette 12.

(Configuration of Sheet Feeding Device)

[0050] Next, a configuration of the sheet feeding device 100 in accordance with one or more embodiments will be described. FIG. 3 is a perspective view illustrating the configuration of the sheet feeding device 100 according to one or more embodiments of the present invention. FIG. 4 is a view from above of the sheet feeding device 100 according to one or more embodiments of the present invention. FIG. 5 is a cross-sectional view of a feeding mechanism 110 according to one or more embodiments of the present invention.

[0051] As illustrated in FIG. 3, the sheet feeding device 100 may comprise a driving source 101, the feeding mechanism 110, and a holding mechanism 120. Moreover, the sheet feeding device 100 may comprise a first shaft 102, a second shaft 103, and a torsion spring 104.

[0052] The driving source 101 is, for example, an electric motor. The driving source 101 rotates the first shaft 102 in both directions. Specifically, in FIG. 3, the driving source 101 rotates the first shaft 102 in a first direction R1 illustrated by the solid arrow and a second direction R2 illustrated by the dashed arrow. The second direction R2 is a direction opposite the first direction R1.

[0053] Furthermore, the driving source 101 rotates in both directions a conveying roller (not illustrated) that conveys the sheet along the first route 15. That is, the driving source 101 is used in both feeding of the sheet by the feeding mechanism 110 and conveying of the sheet along the first route 15.

[0054] The feeding mechanism 110 is a mechanism for feeding one sheet from the stack 50 of the plurality of sheets. The feeding mechanism 110 may comprise a roller 111, an arm 112, a transmission mechanism 113, and a releasing member 119.

[0055] The roller 111 is also referred to as a pickup roller. The roller 111 is fixed in a rotatable manner on both ends of the second shaft 103, which is parallel to the first shaft 102, and rotates around the second shaft 103. The second shaft 103 may be substantially parallel to the first shaft 102.

[0056] The roller 111 feeds the sheet by rotating around the second shaft 103 while contacting the sheet. Specifically, the roller 111, for example, by rotating while contacting the top sheet of the stack 50 of the plurality of sheets, separates the top sheet from the other sheets and feeds this sheet to the first route 15.

[0057] The arm 112 is a member connecting the first shaft 102 and the second shaft 103. The arm 112 turns the second shaft 103 around the first shaft 102 by rotation of the first shaft 102. That is, the arm 112 rotates around the first shaft 102 by rotation of the first shaft 102. As a result, the second shaft 103 and the roller 111 fixed to the second axis 103 turn around the first shaft 102.

[0058] "Turn" means to rotate so as to draw a circle around a rotational axis. That is, "turn" means an object in a position away from a rotational axis rotates around the rotational axis.

[0059] When the first shaft 102 rotates in the first direction R1, the second shaft 103 and the roller 111 turn in a direction approaching the sheet. Conversely, when the first shaft 102 rotates in the second direction R2, the second shaft 103 and the roller 111 turn in a direction away from the stack 50 of the plurality of sheets.

[0060] On a tip portion of the arm 112, a first engaging portion 112a that engages with a holding portion 121 of the holding mechanism 120 is formed. In one or more embodiments of the present invention, the first engaging portion 112a is a convex portion formed on an end portion on a second-shaft 103 side of the arm 112. By this first engaging portion 112a and the holding portion 121 engaging, rotation of the arm 112 around the first shaft 102 is regulated.

[0061] The transmission mechanism 113 is provided in the arm 112. The transmission mechanism 113 selectively performs transmission and non-transmission of rotation from the first shaft 102 to the second shaft 103 according to a rotational direction of the first shaft 102.

[0062] Specifically, the transmission mechanism 113 transmits rotation of the first shaft 102 in the first direction R1 to the second shaft 103 and does not transmit rotation of the first shaft 102 in the second direction R2 to the second shaft 103. In other words, the transmission mechanism 113 transmits to the second shaft 103 only rotation in the first direction R1 from among rotations in the first direction R1 and in the second direction R2 of the first shaft 102.

[0063] The first direction R1 is a rotational direction of the first shaft 102 for turning the second shaft 103 and the roller 111 in a direction approaching the stack 50 of the plurality of sheets. That is, the first direction R1 is a rotational direction for feeding the sheet. Conversely, the second direction R2 is a rotational direction of the first shaft 102 for turning the second shaft 103 and the roller

111 in the direction away from the stack 50 of the plurality of sheets.

[0064] As illustrated in FIG. 5, the transmission mechanism 113 may comprise a first gear 114, a second gear 115, a third gear 116, a fourth gear 117, and a clutch 118.

[0065] The first gear 114 is fixed in a rotatable manner to the first shaft 102 and rotates around the first shaft 102. The first gear 114 engages with the second gear 115. Here, the first gear 114 is a spur gear.

[0066] The second gear 115 engages with the first gear 114 and the third gear 116. That is, the second gear 115 transmits rotation from the first gear 114 to the third gear 116. Here, the second gear 115 is a spur gear.

[0067] Furthermore, on a side surface of the second gear 115, pressure is added by an elastic member (for example, a coil or a spring) that is not illustrated. By this, a load is applied to rotation of the second gear 115, and the arm 112 rotates around the first shaft 102.

[0068] The third gear 116 engages with the second gear 115 and the fourth gear 117. That is, the third gear 116 transmits rotation from the second gear 115 to the fourth gear 117. Here, the third gear 116 is a spur gear.

[0069] The fourth gear 117 engages with the third gear 116 and rotates around the second shaft 103. Here, the fourth gear 117 is a spur gear.

[0070] The clutch 118 is a so-called one-way clutch (also referred to as a one-way freewheel clutch). The clutch 118 is installed between the fourth gear 117 and the second shaft 103.

[0071] The clutch 118 switches transmission and non-transmission of rotation between the fourth gear 117 and the second shaft 103 according to a rotational direction of the fourth gear 117. That is, the clutch 118 switches transmission and non-transmission of rotation from the fourth gear 117 to the second shaft 103 according to the rotational direction of the fourth gear 117.

[0072] Specifically, when the first shaft 102 is rotating in the first direction R1, the clutch 118 transmits rotation from the fourth gear 117 to the second shaft 103. Meanwhile, when the first shaft 102 is rotating in the second direction R2, the clutch 118 does not transmit rotation from the fourth gear 117 to the second shaft 103.

[0073] The releasing member 119 is fixed to the second shaft 103. The releasing member 119 releases a hold on the feeding mechanism 110 by the holding mechanism 120 by rotating around the second shaft 103. Specifically, the releasing member 119 releases the engagement between the first engaging portion 112a of the arm 112 and the holding portion 121.

[0074] In one or more embodiments of the present invention, the releasing member 119 releases the hold on the feeding mechanism 110 by the holding mechanism 120 by contacting the holding mechanism 120. Specifically, the releasing member 119 releases a hold on the arm 112 by the holding portion 121 by pressing the holding portion 121 of the holding mechanism 120 in a direction away from the arm 112. For example, the releasing member 119 converts rotational movement of the second shaft 103 into linear movement for pressing the holding portion 121.

[0075] Specifically, the releasing member 119 may be, for example, a cam formed integrally with the fourth gear 117. More specifically, the releasing member 119 may be, for example, a plate-shaped cam whose distance from a rotational center (that is, a center of the second shaft 103) to a circumference is not constant. The releasing member 119 does not have to be formed integrally with the fourth gear 117.

[0076] The holding mechanism 120 holds the feeding mechanism 110 with the roller 111 away from the stack 50 of the plurality of sheets. That is, the holding mechanism 120 regulates rotation of the arm 112 around the first shaft 102 and turning of the second shaft 103 and the roller 111 around the first shaft 102. In one or more embodiments of the present invention, the holding mechanism 120 may comprise the holding portion 121 and an elastic portion 122.

[0077] The holding portion 121 holds the arm 112. A second engaging portion 121a that engages with the first engaging portion 112a of the arm 112 is formed on the holding portion 121. Here, the second engaging portion 121 a is a concave portion corresponding to the convex portion that is the first engaging portion 112a.

[0078] The elastic portion 122 is, for example, a coil spring. The elastic portion 122 presses the holding portion 121 to the arm 112. That is, the elastic portion 122 presses the holding portion 121 to the arm 112 so the engagement between the first engaging portion 112a of the arm 112 and the second engaging portion 121 a of the holding portion 121 is not released.

[0079] That is, the holding portion 121 is provided in a retractable manner relative to the arm 112 and is biased toward the arm 112 by the elastic portion 122. Moreover, the holding portion 121 moves in the direction away from the arm 112 by being pressed by the releasing member 119. As a result, the hold on the arm 112 by the holding portion 121 is released.

[Operation of Sheet Feeding Device]

[0080] Next, an operation of the sheet feeding device 100 configured as above in accordance with one or more embodiments will be described. FIG. 6 is a view illustrating the feeding mechanism 110 of the sheet feeding device 100 according to one or more embodiments of the present invention being held by the holding mechanism 120. FIG. 7 is a view illustrating an operation by which the hold on the feeding mechanism 110 is released in the sheet feeding device 100 according to one or more embodiments of the present invention. FIG. 8 is a view illustrating the sheet feeding device 100 according to one or more embodiments of the present invention feeding a sheet. In FIG. 7, the arrows illustrate rotational direction of each mechanical component when the first shaft 102 rotates in the first direction R1.

[0081] In FIG. 6, the feeding mechanism 110 is held

by the holding mechanism 120 with the roller 111 away from the stack 50 of the plurality of sheets housed in the cassette 12. This position of the feeding mechanism 110 is referred to as a retracted position.

[0082] With the feeding mechanism 110 held in the retracted position in this manner, when the first shaft 102 rotates in the first direction R1, as illustrated in (a) of FIG. 7, the third gear 116 rotates in the direction of the arrow. As a result, the releasing member 119 and the roller 111 also rotate in the direction of the arrows together with the second shaft 103.

[0083] As a result of the releasing member 119 having rotated, as illustrated in (b) of FIG. 7, the holding portion 121 is pressed by the releasing member 119, and the first engaging portion 112a and the second engaging portion 121 a separate. That is, the engagement between the holding portion 121 and the first engaging portion 112a is released.

[0084] When the engagement between the holding portion 121 and the first engaging portion 112a is released, the arm 112 rotates around the first shaft 102 in the first direction R1. That is, the second shaft 103 and the roller 111 turn around the first shaft 102 in the first direction R1. As a result, the feeding mechanism 110 moves to the position illustrated in FIG. 8. This position of the feeding mechanism 110 is referred to as a feeding position.

[0085] That is, the feeding mechanism 110 moves to the feeding position illustrated in FIG. 8 from the retracted position illustrated in FIG. 6. In the feeding position, the roller 111, by rotating while contacting the sheet, feeds one sheet from the stack 50 of the plurality of sheets to the first route 15.

[0086] The torsion spring 104 applies a force in a direction that rotates the arm 112 in the second direction R2 for adjusting a force with which the roller 111 is pressed to the sheet. However, the torsion spring 104 only applies a force to an extent that cancels a deadweight of the feeding mechanism 110 in the feeding position. That is, with the torsion spring 104 alone, the feeding mechanism 110 cannot be held stably in the retracted position.

[0087] When feeding of the sheet ends, the first shaft 102 rotates in the second direction R2. Then, the arm 112 rotates around the first shaft 102 in the second direction R2. That is, the second shaft 103 and the roller 111 turn around the first shaft 102 in the second direction R2. As a result, the feeding mechanism 110 returns to the retracted position and is held by the holding mechanism 120.

[0088] When the first shaft 102 is rotating in the second direction R2, rotation is not transmitted from the fourth gear 117 to the second shaft 103 by the clutch 118. That is, the releasing member 119 does not rotate. Therefore, the hold on the arm 112 by the holding portion 121 is maintained.

(Effects)

[0089] As above, according to the sheet feeding device 100 according to one or more embodiments of the present invention, transmission and non-transmission of rotation from the first shaft 102 to the second shaft 103 can be performed selectively according to a rotational direction of the first shaft 102. Therefore, reverse rotation of the roller 111 can be prevented, and noise due to the roller 111 and the holding mechanism 120 rubbing together can be reduced. Moreover, by the releasing member 119 rotating around the second shaft 103, the hold on the feeding mechanism 110 by the holding mechanism 120 can be released. That is, when rotation is transmitted from the first shaft 102 to the second shaft 103, the hold on the feeding mechanism 110 by the holding mechanism 120 can be released, and the second shaft 103 can be turned around the first shaft 102 in the direction approaching the stack 50 of the sheets. Moreover, when rotation is not transmitted from the first shaft 102 to the second shaft 103, the hold on the feeding mechanism 110 by the holding mechanism 120 can be maintained. Therefore, it becomes possible to stably hold the feeding mechanism 110 with the roller 111 away from the stack 50 of the plurality of sheets when not feeding the sheet.

[0090] Furthermore, according to the sheet feeding device 100 according to one or more embodiments of the present invention, the holding portion 121 can hold the arm 112. The arm 112 has less rattling than the roller 111 and also has high freedom in design for the held portion. Therefore, the feeding mechanism 110 can be held more stably than holding the roller 111.

[0091] Furthermore, according to the sheet feeding device 100 according to one or more embodiments of the present invention, the releasing member 119 can release the hold on the arm 112 by the holding portion 121 by pressing in the direction away from the arm 112 the holding portion 121 pressed to the arm 112 by the elastic portion. Therefore, the releasing member 119 can be realized by a relatively simple configuration.

[0092] Furthermore, according to the sheet feeding device 100 according to one or more embodiments of the present invention, the holding portion 121 can engage with the engaging portion formed on the tip portion of the arm 112. Therefore, the holding portion 121 can stably hold the arm 112.

[0093] Furthermore, according to the sheet feeding device 100 according to one or more embodiments of the present invention, transmission and non-transmission of rotation between a gear and a rotational shaft can be switched according to a rotational direction of the gear by the clutch installed between the gear and the rotational shaft. That is, transmission and non-transmission of rotation from the first shaft 102 to the second shaft 103 can be switched by the clutch according to a rotational direction of the first shaft 102.

[0094] Furthermore, according to the sheet feeding de-

vice 100 according to one or more embodiments of the present invention, the clutch can be installed between the fourth gear 117 and the second shaft 103, and the releasing member 119 can be realized as the cam formed integrally with the fourth gear 117. Therefore, a component count can be reduced, and an assembly operation of the sheet feeding device 100 can be made more efficient.

(First Modified Example)

[0095] Embodiments of a first modified example of the present invention will be described below. Embodiments of the first modified example differ from the above embodiments of the present invention in that a clutch is installed to a third gear. A sheet feeding device according to the present modified example will be described below around the point by which it differs from the above embodiments.

[0096] FIG. 9 is a cross-sectional view illustrating an interior structure of a feeding mechanism 210 according to one or more embodiments of the first modified example of the present invention. FIG. 10 is a view from above of the sheet feeding device according to one or more embodiments of the first modified example of the present invention. In FIG. 10, so that the gears in the arm 112 can be viewed, the feeding mechanism 210 is displayed with a portion of the arm 112 cut out. Moreover, in FIG. 9 and FIG. 10, components identical or analogous to those in FIG. 5 and FIG. 4 will be labeled with the same reference signs, and description thereof will be omitted as appropriate.

[0097] The feeding mechanism 210 may comprise the roller 111, the arm 112, a transmission mechanism 213, and the releasing member 119. The transmission mechanism 213 may comprise the first gear 114, the second gear 115, a third gear 216a, a fourth gear 216b, a third shaft 216c, a fifth gear 217, and a clutch 218.

[0098] The third gear 216a engages with the second gear 115. The third gear 216a rotates around the third shaft 216c.

[0099] The clutch 218 is a one-way clutch similar to the clutch 118 in the above embodiments. The clutch 218 is installed between the third gear 216a and the third shaft 216c.

[0100] The clutch 218 switches transmission and non-transmission of rotation from the third gear 216a to the third shaft 216c according to a rotational direction of the third gear 216a. Specifically, when the first shaft 102 is rotating in the first direction R1, the clutch 218 transmits rotation from the third gear 216a to the third shaft 216c. Meanwhile, when the first shaft 102 is rotating in the second direction R2, the clutch 218 does not transmit rotation from the third gear 216a to the third shaft 216c.

[0101] The fourth gear 216b is fixed in a rotatable manner to the third shaft 216c and rotates around the third shaft 216c. Moreover, the fourth gear 216b engages with the fifth gear 217.

[0102] The fifth gear 217 is fixed in a rotatable manner to the second shaft 103 and rotates around the second shaft 103. Moreover, the fifth gear 217 engages with the fourth gear 216b.

[0103] By the transmission mechanism 213 being configured as above, rotation is transmitted from the first shaft 102 to the second shaft 103 when the first shaft 102 is rotating in the first direction R1, and rotation is not transmitted from the first shaft 102 to the second shaft 103 when the first shaft 102 is rotating in the second direction R2.

[0104] As above, according to the sheet feeding device according to one or more embodiments of the first modified example of the present invention, effects similar to those of embodiments of the present invention can be obtained even when the clutch 218 is installed between the third gear 216a and the third shaft 216c.

(Second Modified Example)

[0105] Embodiments of a second modified example of the invention will be described below. The present modified example differs from the above embodiments in that a holding mechanism holds the roller. A sheet feeding device according to the present modified example will be described below around the point by which it differs from the above embodiments.

[0106] FIG. 11 is a view from above of the sheet feeding device according to one or more embodiments of a second modified example of the present invention. In FIG. 11, components identical or analogous to those in FIG. 4 will be labeled with the same reference signs, and description thereof will be omitted as appropriate.

[0107] A holding mechanism 320 holds the feeding mechanism 110 with the roller 111 away from the stack 50 of the plurality of sheets. The holding mechanism 320 may comprise a holding portion 321 and an elastic portion 322.

[0108] The holding portion 321 holds the roller 111. A contact portion 321a extending toward the releasing member 119 is formed on the holding portion 321. The releasing member 119 releases the hold on the roller 111 by the holding portion 321 by contacting the contact portion 321 a.

[0109] The elastic portion 322 presses the holding portion 121 to the roller 111. That is, the elastic portion 322 presses the holding portion 121 to the roller 111 so the hold on the roller 111 by the holding portion 321 is not released.

[0110] As above, according to the sheet feeding device according to one or more embodiments of the second modified example, even when the holding portion 321 holds the roller 111, reverse rotation of the roller 111 can be prevented by the clutch 118, and noise due to the roller 111 and the holding mechanism 320 rubbing together can be reduced. Moreover, by the releasing member 119 rotating around the second shaft 103, the hold on the feeding mechanism 110 by the holding mecha-

nism 320 can be released; therefore, it becomes possible to stably hold the feeding mechanism 110 with the roller 111 away from the stack 50 of the plurality of sheets.

(Another Modified Example)

[0111] The sheet feeding devices according to one or more embodiments of the present invention and the modified examples are described above, but the present invention is not limited to these embodiments or these modified examples. Various modifications of these embodiments or modified examples and various combinations of components described in these embodiments or examples are also possible.

[0112] For example, in the above embodiments and modified examples, the sheet feeding device is included in a laser printer, but the present invention is not limited thereto. The sheet feeding device may be included in, for example, an inkjet printer. Moreover, for example, the sheet feeding device may be included in a copying machine, a facsimile machine, or a multifunction machine.

[0113] The present invention is also not limited to the configurations of the transmission mechanism as described in the above embodiments and modified examples. For example, the transmission mechanism may transmit power using pulleys and belts. Moreover, the transmission mechanism may transmit power using gears different from spur gears (for example, bevel gears, helical gears, or the like).

[0114] In the above embodiments and modified examples, the first engaging portion and the second engaging portion are formed, but shapes of the first engaging portion and the second engaging portion are not limited to those in the above embodiments and modified examples. For example, the first engaging portion may be a concave portion, and the second engaging portion may be a convex portion. That is, as long as the first engaging portion and the second engaging portion engage, the shapes of the first engaging portion and the second engaging portion may be any shape.

[0115] Furthermore, the first engaging portion and the second engaging portion do not need to be provided. For example, the feeding mechanism may be held in the retracted position by the holding portion supporting the arm from below.

[0116] While in the above embodiments and modified examples the releasing member is a plate-shaped member having a distance from the rotational center to the circumference which is not constant, the shape of the releasing member is not limited thereto. For example, the releasing member may be a rod member extending from the second shaft in a direction intersecting a shaft direction. In this situation, the hold on the feeding mechanism by the holding portion is released by the rod member contacting the holding portion.

[0117] A placement of the clutch is not limited to those in the above embodiments and Modified Example 1. For example, the clutch may be installed between the first shaft and the first gear.

[0118] Although the disclosure has been described with respect to only a limited number of embodiments, those skilled in the art, having benefit of this disclosure, will appreciate that various other embodiments may be devised within the scope of the present invention.

[Explanation of Reference signs]

[0119]

10 Printer
11 Chassis
12 Cassette
13 Tray
14 Printing unit
15 First route
16 Second route
50 Stack of plurality of sheets
100 Sheet feeding device
101 Driving source
102 First shaft
103 Second shaft
104 Torsion spring
110, 210 Feeding mechanism
111 Roller
112 Arm
112a First engaging portion
113,213 Transmission mechanism
114 First gear
115 Second gear
116, 216a Third gear
117, 216b Fourth gear
118, 218 Clutch
119 Releasing member
120, 320 Holding mechanism
121,321 Holding portion
121a Second engaging portion
122, 322 Elastic portion
216c Third shaft
217 Fifth gear
321 a Contact portion

Claims

1. An image forming apparatus (10) comprising:

a driving source (101) configured to rotate a first shaft (102) around the first shaft (102);
a feeding mechanism (110) comprising:

a transmission mechanism (113) that is configured to transmit rotation of the first shaft (102) in a first direction (R1) to a second shaft (103) and not to transmit rotation of the first shaft (102) in a direction (R2) opposite the first direction (R1) to the second

shaft (103);
a roller (111) fixed in a rotatable manner to the second shaft (103) and configured to feed a sheet from a stack (50) of sheets by rotating around the second shaft (103); and
a releasing member (119) fixed to the second shaft (103); and

a holding mechanism (120) configured to hold the feeding mechanism (110) with the roller (111) away from the stack (50), wherein
the releasing member (119) is configured to release the hold on the feeding mechanism (110) by the holding mechanism (120) when the transmission mechanism (113) transmits the rotation of the first shaft (102) to the second shaft (103).

2. The image forming apparatus (10) according to claim 1, wherein the feeding mechanism (110) comprises an arm (112) connecting the first shaft (102) and the second shaft (103).

3. The image forming apparatus (10) according to claim 2, wherein the arm (112) is configured to turn the second shaft (103) around the first shaft (102) in a direction toward the stack (50) when the first shaft (102) rotates.

4. The image forming apparatus (10) according to claim 2 or claim 3, wherein the holding mechanism (120) is configured to hold the arm (112) or the roller (111).

5. The image forming apparatus (10) according to any of claims 2-4, wherein the holding mechanism (120) comprises a holding portion (121) that holds the arm (112).

6. The image forming apparatus (10) according to claim 5, wherein
the holding mechanism (120) further comprises an elastic portion (122) configured to press the holding portion (121) to the arm (112), and
the releasing member (119) is configured to press the holding portion (121) in a direction away from the arm (112) and to release the arm (112) held by the holding portion (121).

7. The image forming apparatus (10) according to claim 6, wherein
the feeding mechanism (110) further comprises an engaging portion (112a) configured to engage with the holding portion (121) and formed on a tip portion of the arm (112), and
the releasing member (119) is configured to release the engagement between the engaging portion (112a) and the holding portion (121).

8. The image forming apparatus (10) according to any of claims 1-7, wherein
the transmission mechanism (113) comprises
a plurality of gears (114, 115, 116, 117) comprising a first gear (114) rotatable around the first shaft (102) and a second gear (117) rotatable around the second shaft (103), and
a clutch (118) installed between at least one gear from among the plurality of gears (114, 115, 116, 117) and the rotational shaft of the at least one gear, and
the clutch (118) is configured to switch transmission and non-transmission of rotation between the at least one gear and the rotational shaft based on a rotational direction of the at least one gear.

9. The image forming apparatus (10) according to claim 8, wherein
the at least one gear is the second gear (117),
the clutch (118) is configured to switch transmission and non-transmission of rotation from the second gear (117) to the second shaft (103) based on a rotational direction of the second gear (117), and
the releasing member (119) is a cam formed integrally with the second gear (117).

10. The image forming apparatus (10) according to any of claims 1-7, wherein
the transmission mechanism (113) comprises a gear rotatable around the second shaft (103), and
the releasing member (119) is a cam formed integrally with the gear.

11. A method for feeding a sheet from a stack (50) of sheets, comprising:

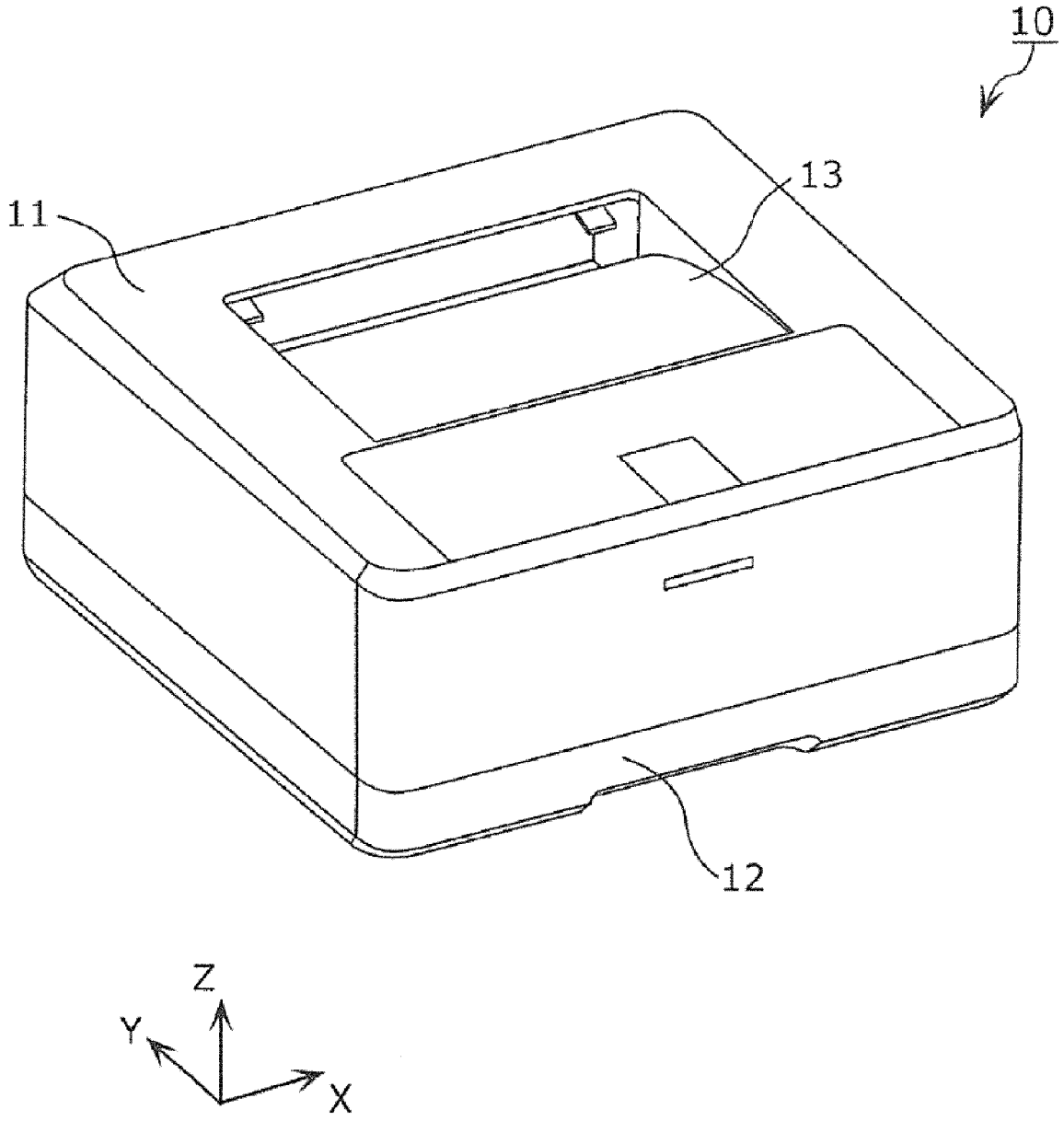
rotating a first shaft (102) around the first shaft (102);
transmitting rotation of the first shaft (102) only in a first direction (R1) to a second shaft (103);
feeding a sheet from a stack (50) of sheets by rotating a roller (111) around the second shaft (103);
connecting, with an arm (112), the first shaft (102) and the second shaft (103);
holding the arm (112) or the roller (111) with the roller (111) away from the stack (50); and
when the rotation of the first shaft (102) is transmitted to the second shaft (103), releasing the arm (112) or the roller (111).

12. The method according to claim 11, wherein
the holding comprises pressing, with an elastic portion (122), a holding portion (121) to the arm (111), and
the releasing presses the holding portion (121) in a direction away from the arm (111) and releases to hold the arm (111) by the holding portion (121).

13. The method according to claim 11 or claim 12, further comprising
engaging an engaging portion (112a) formed on a tip portion of the arm (111) with the holding portion (121), wherein
the releasing releases the engagement between the engaging portion (112a) and the holding portion (121).

14. The method according to any of claims 11-13, further comprising
providing a plurality of gears (114, 115, 116, 117) comprising a first gear (114) rotatable around the first shaft (102) and a second gear (117) rotatable around the second shaft (103), and
providing a clutch (118) installed between at least one gear from among the plurality of gears (114, 115, 116, 117) and the rotational shaft of the at least one gear, wherein
the transmitting comprises switching, with the clutch (118), transmission and non-transmission of rotation between the at least one gear and the rotational shaft based on a rotational direction of the at least one gear.

FIG. 1



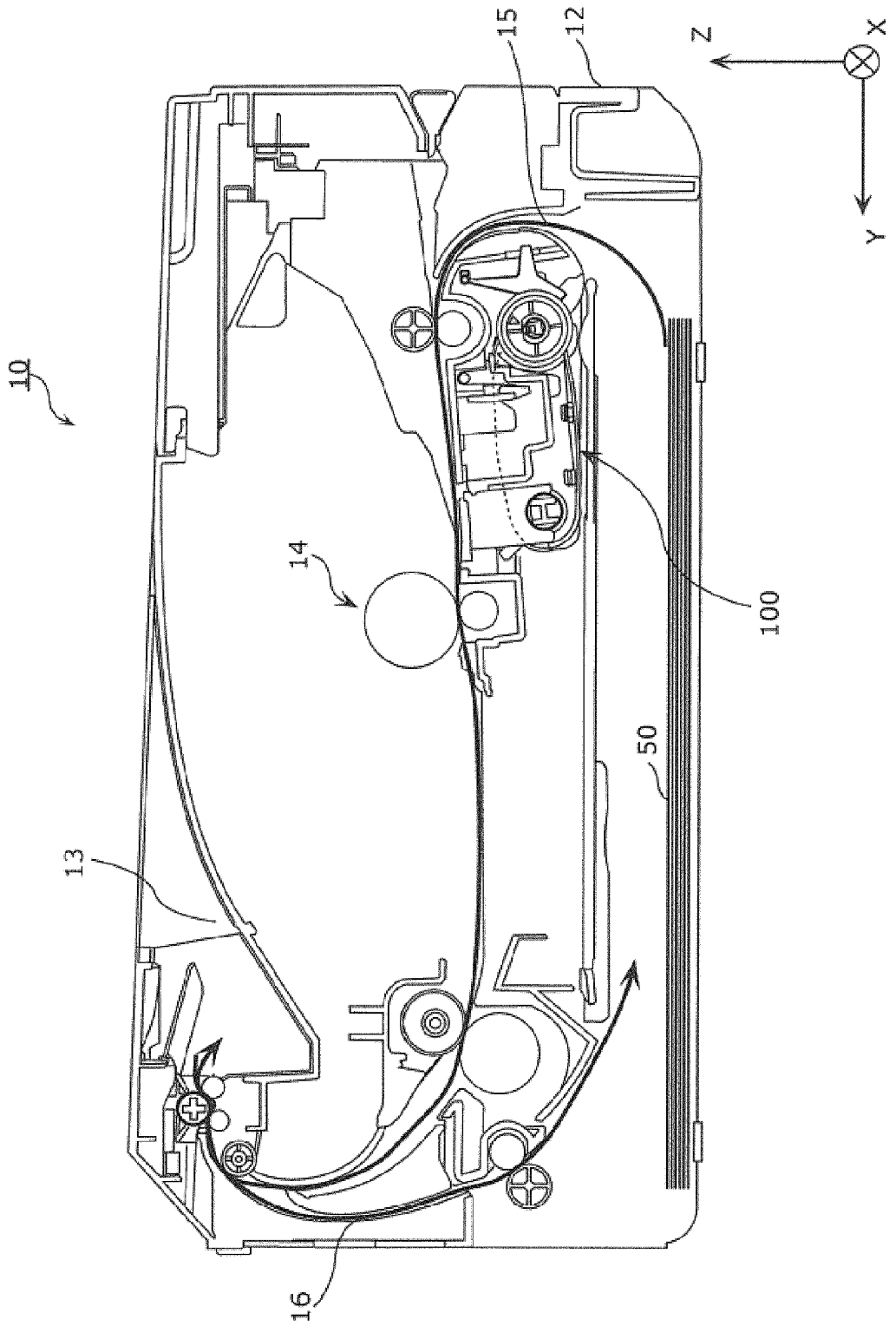


FIG. 2

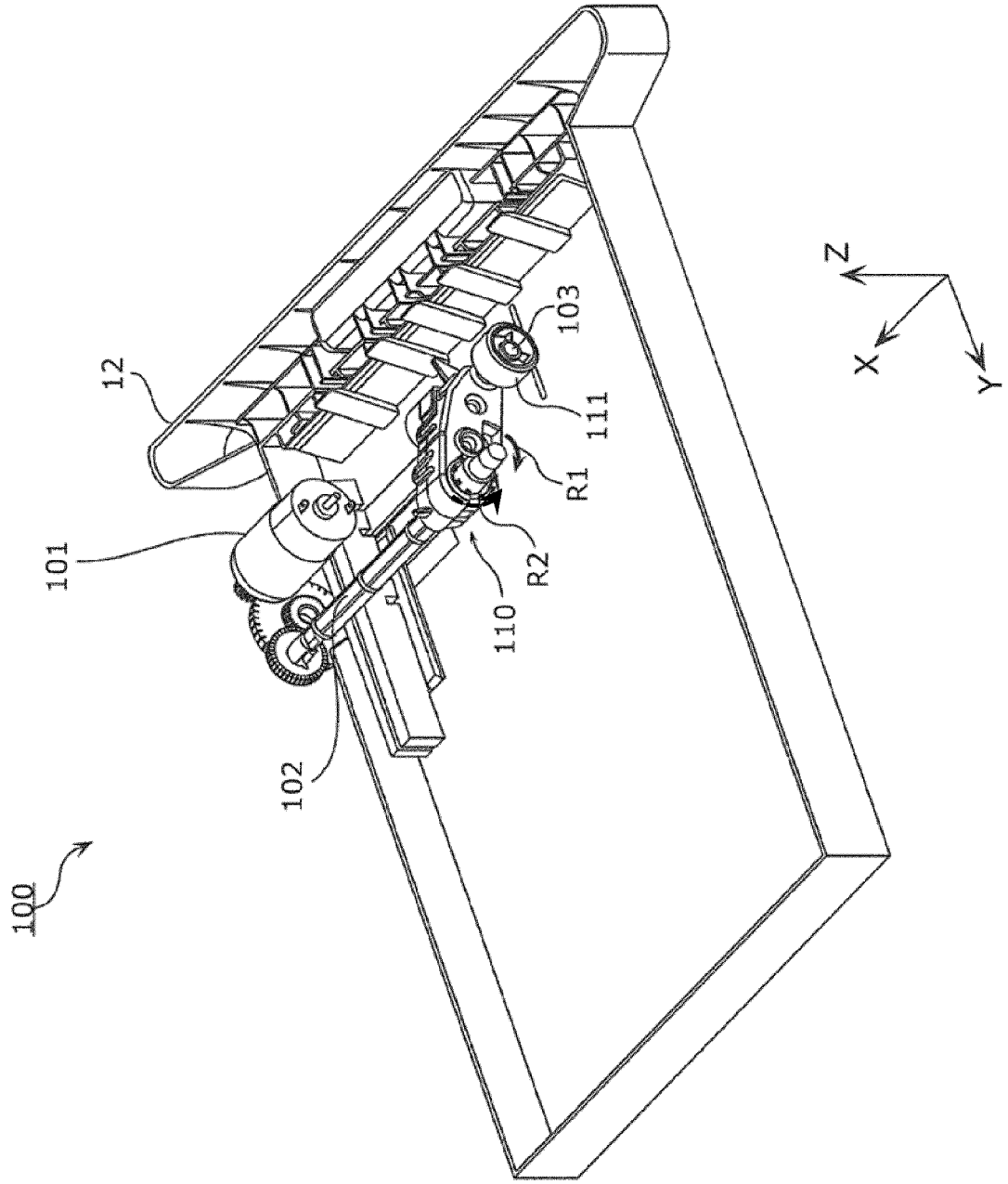


FIG. 3

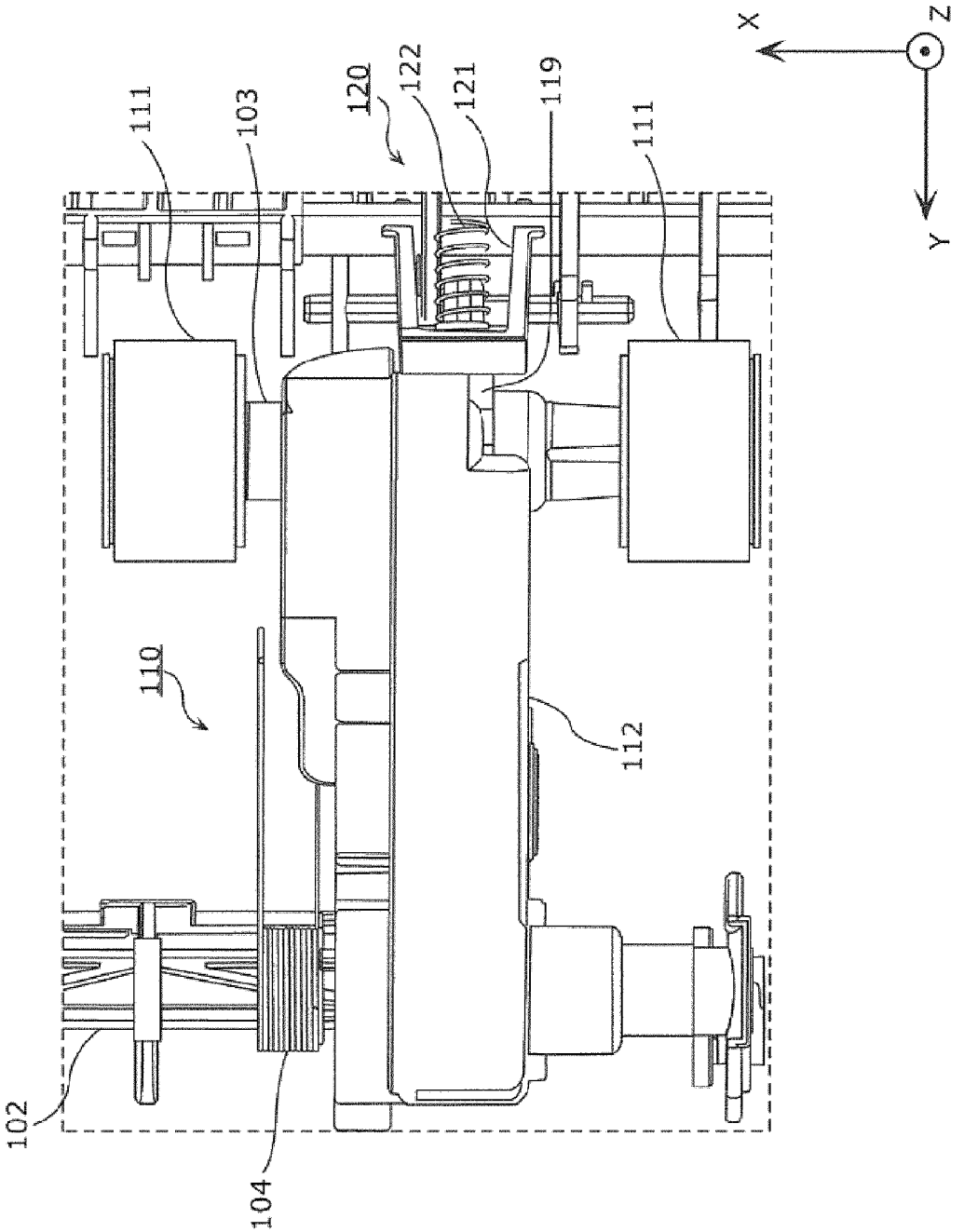


FIG. 4

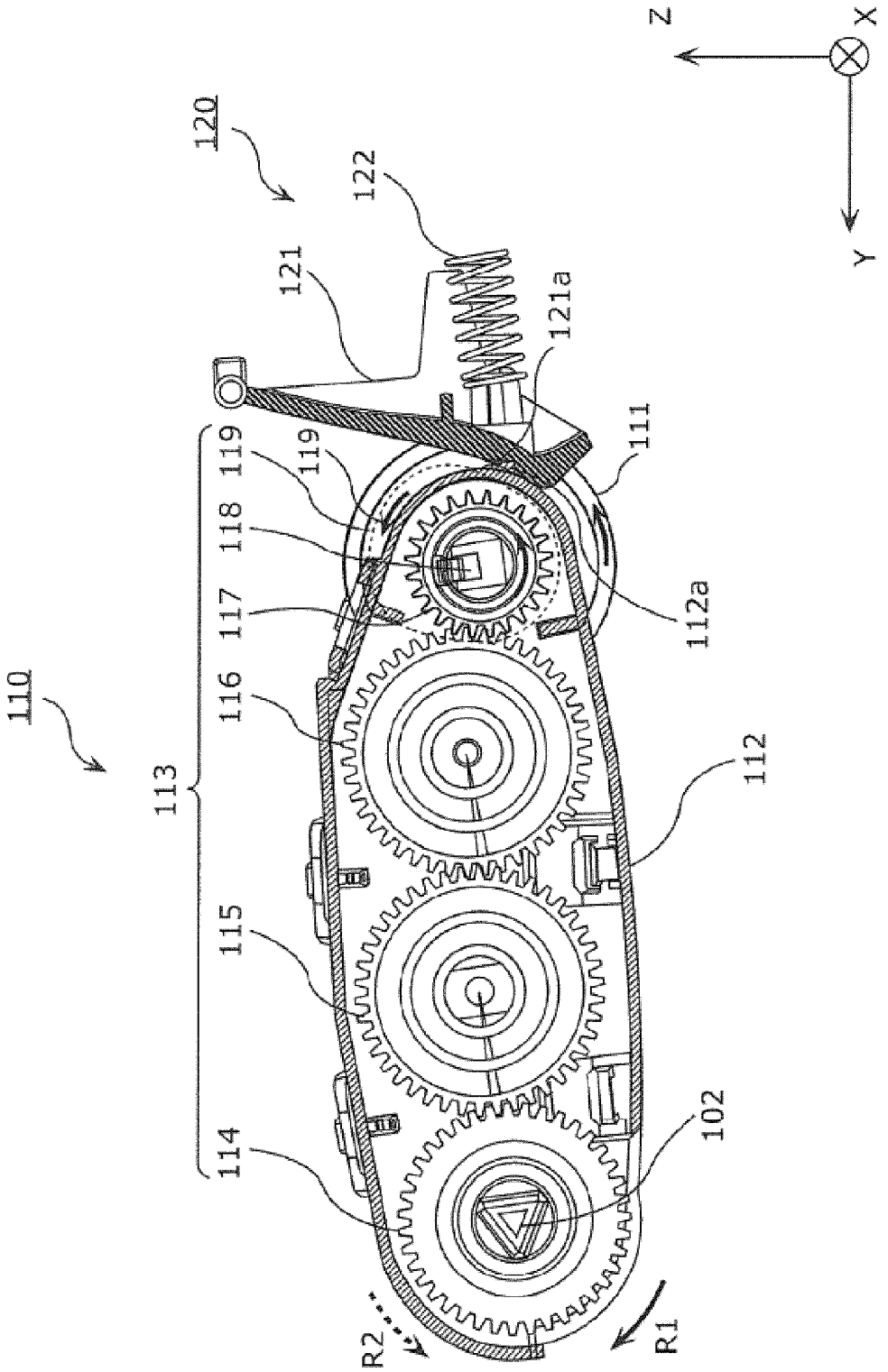

Z
X
Y
120
122
121
121a
111
119
119
118
117
112a
110
116
113
112
115
114
102
R2
R1

FIG. 5

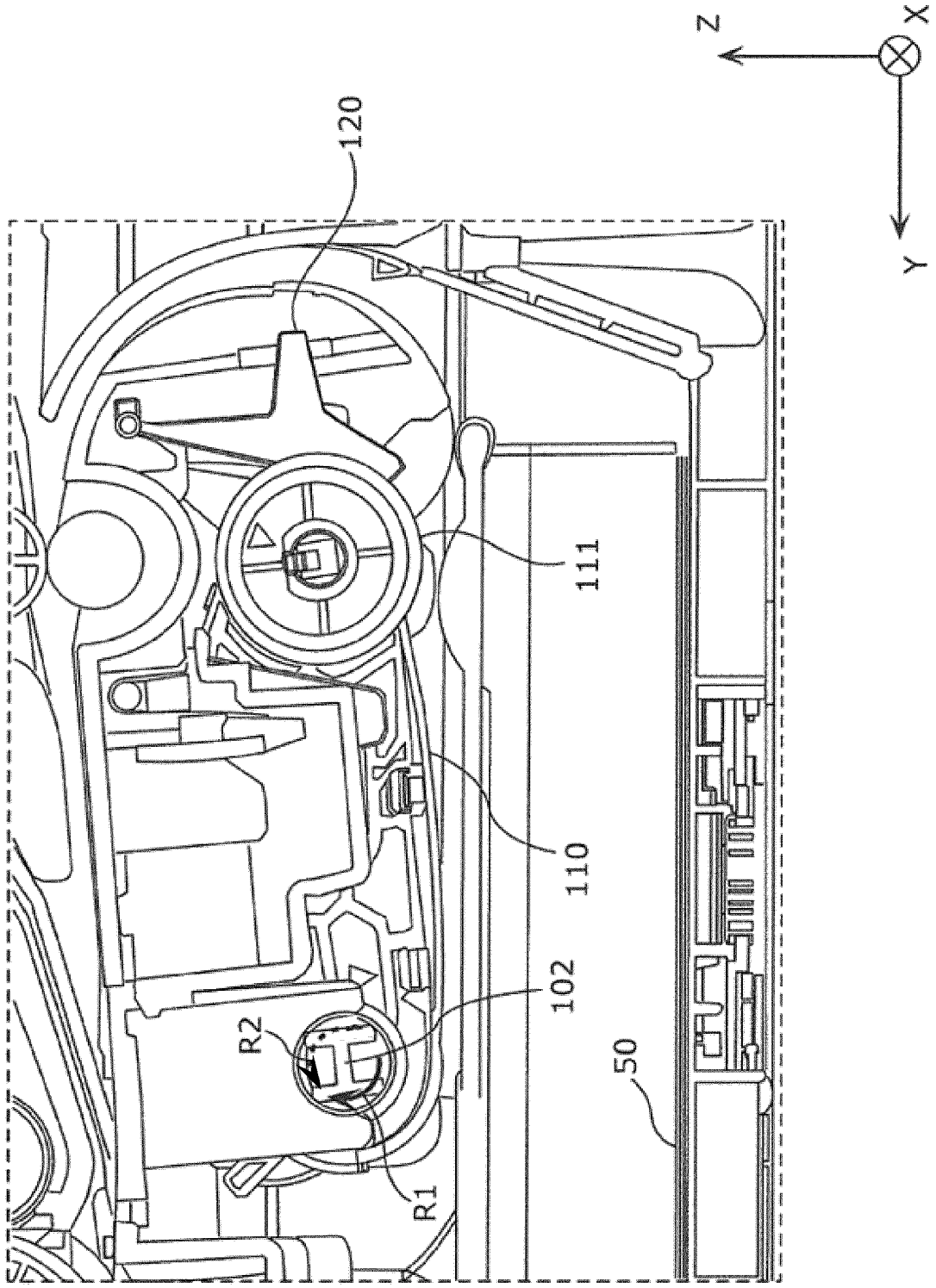


FIG. 6

FIG. 7

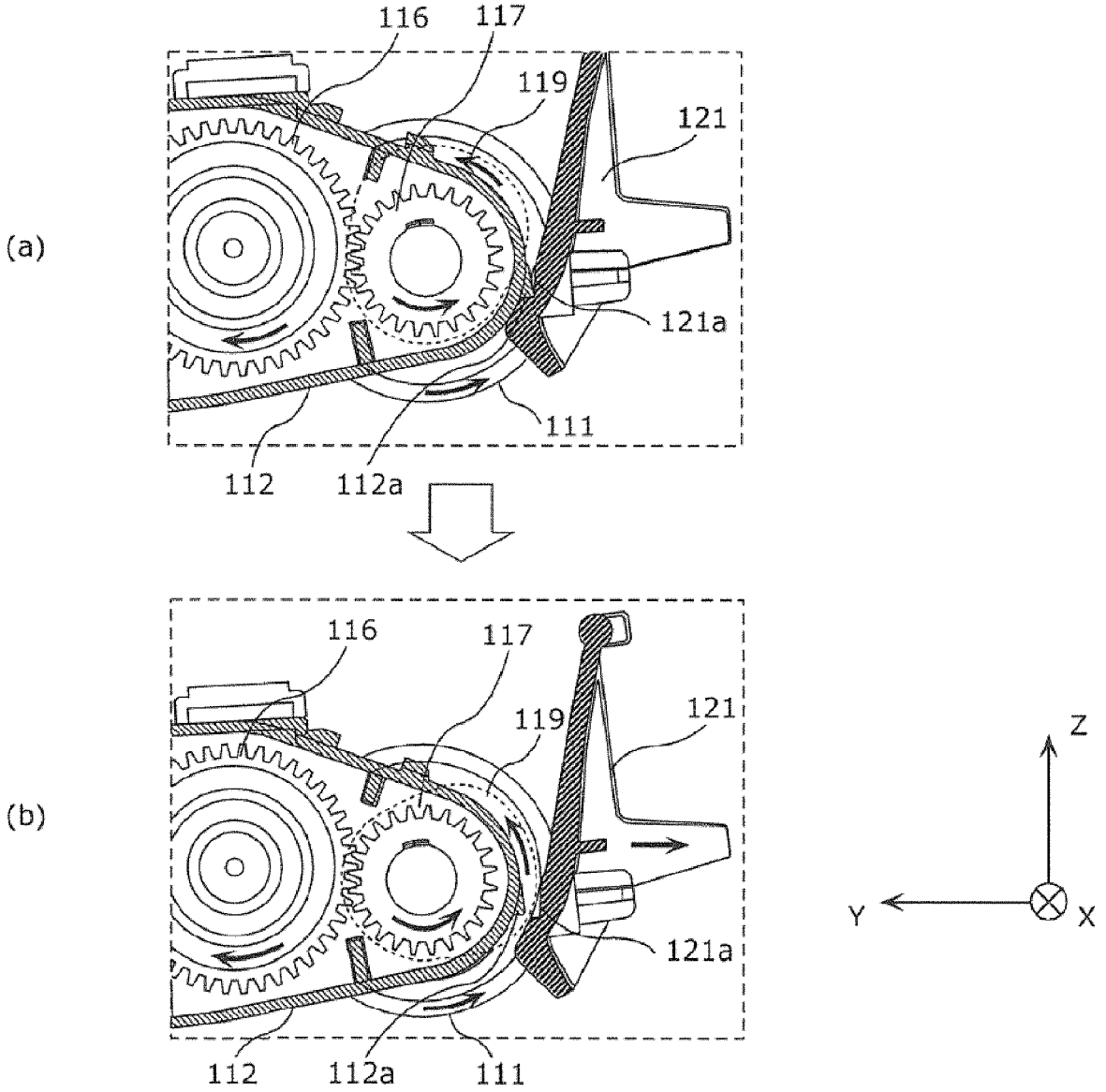
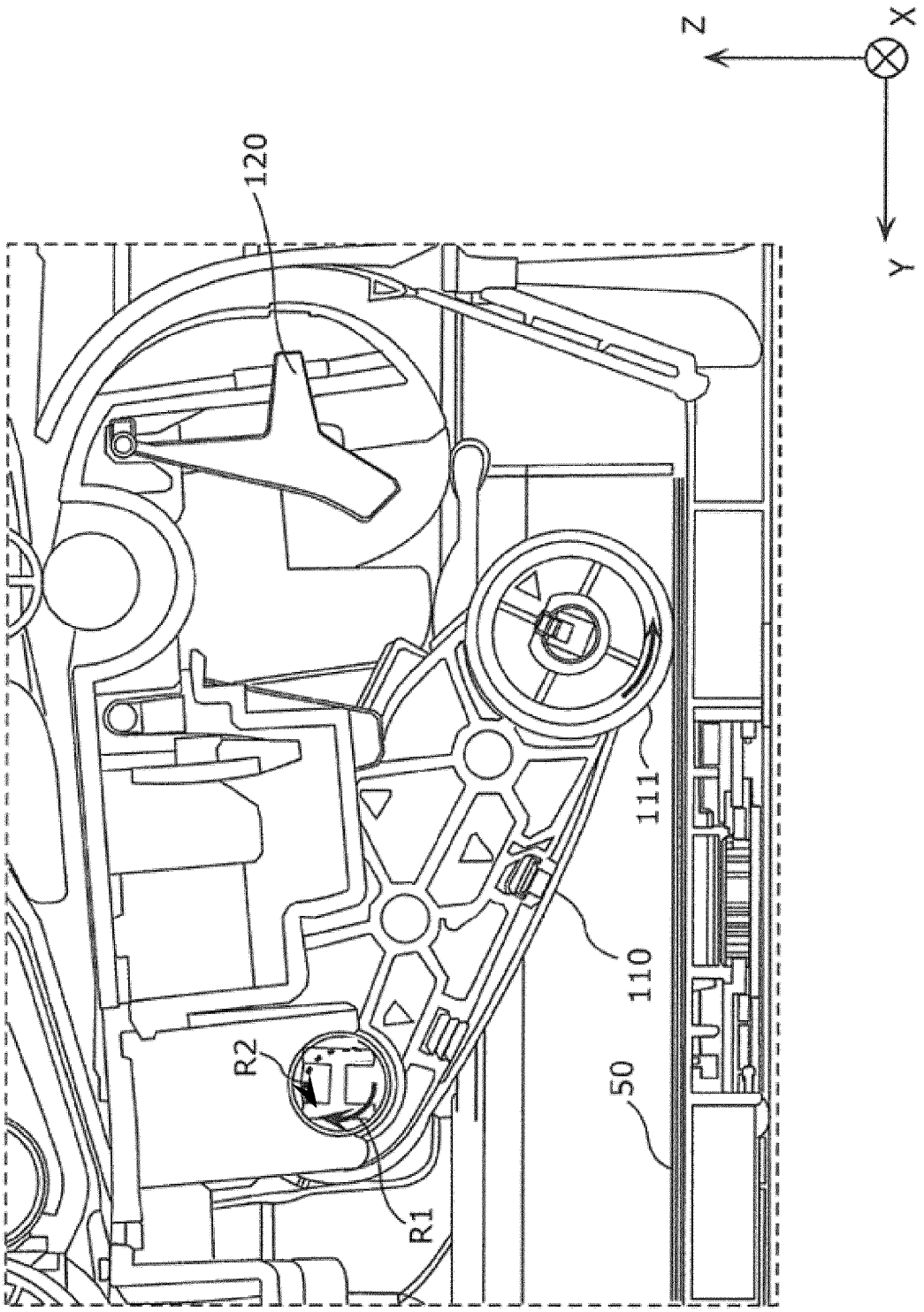

(a)
116
117
119
121
121a
111
112
112a
(b)
116
117
119
121
121a
112
112a
111
Z
Y
X

FIG. 8



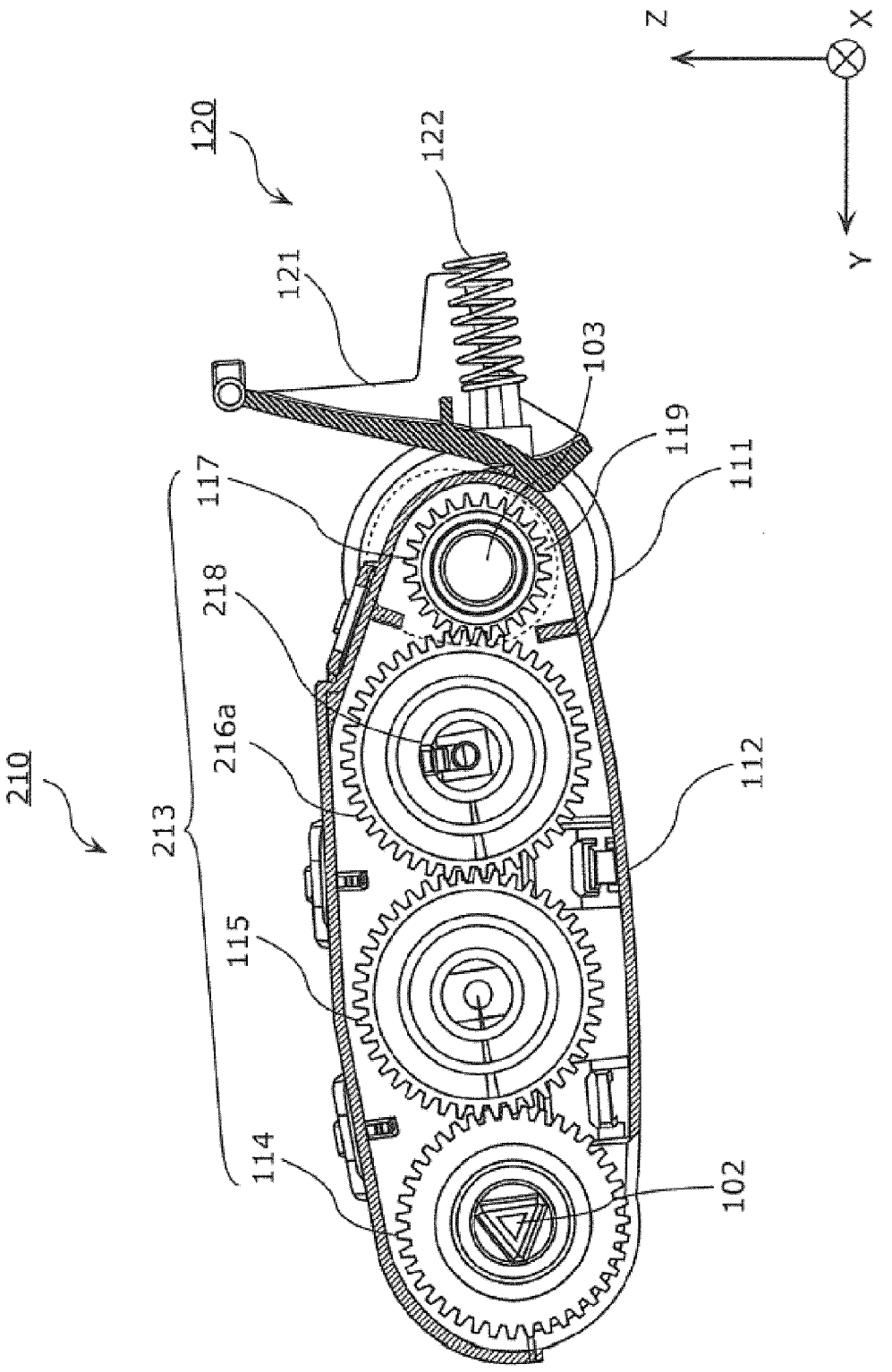


FIG. 9

FIG. 10

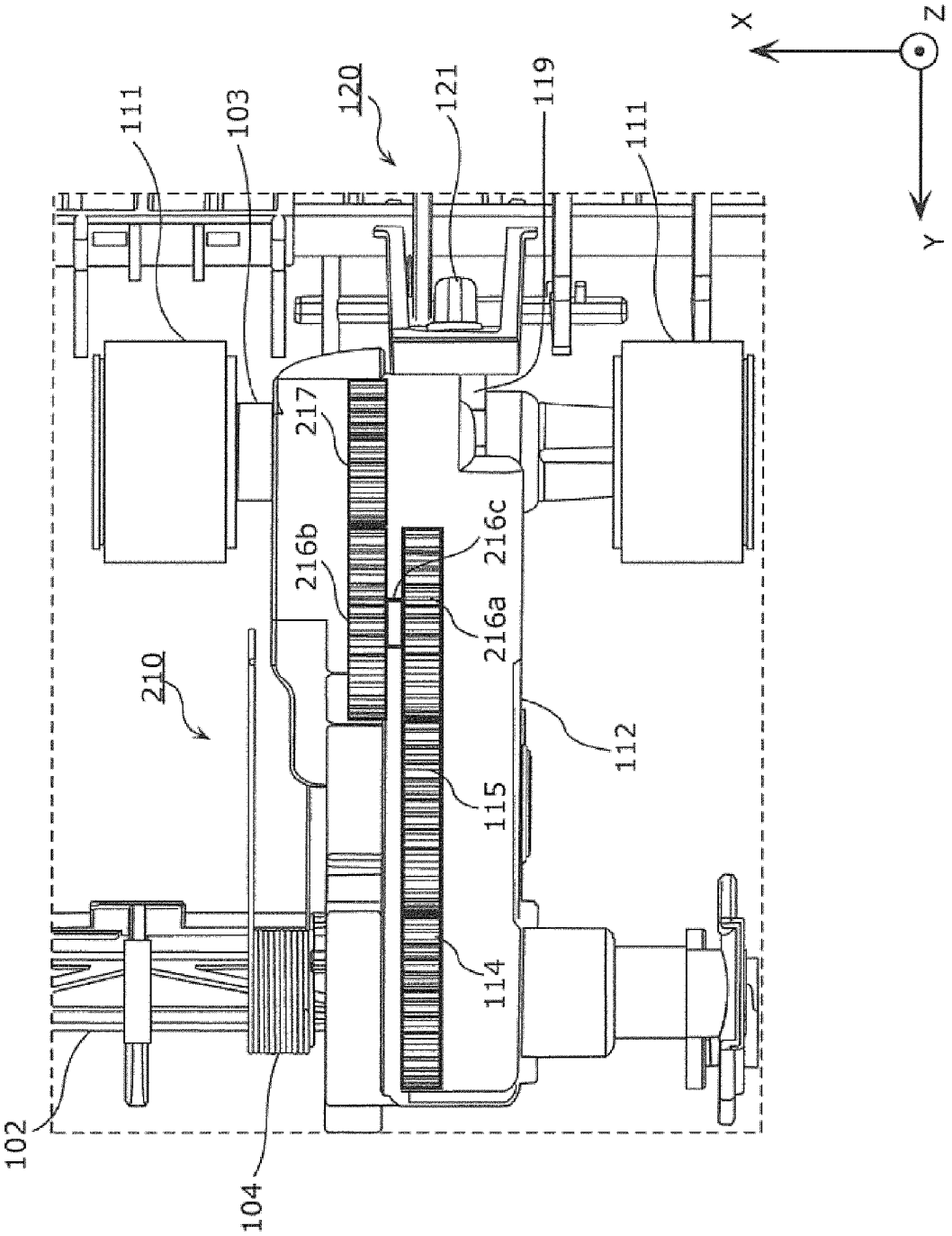
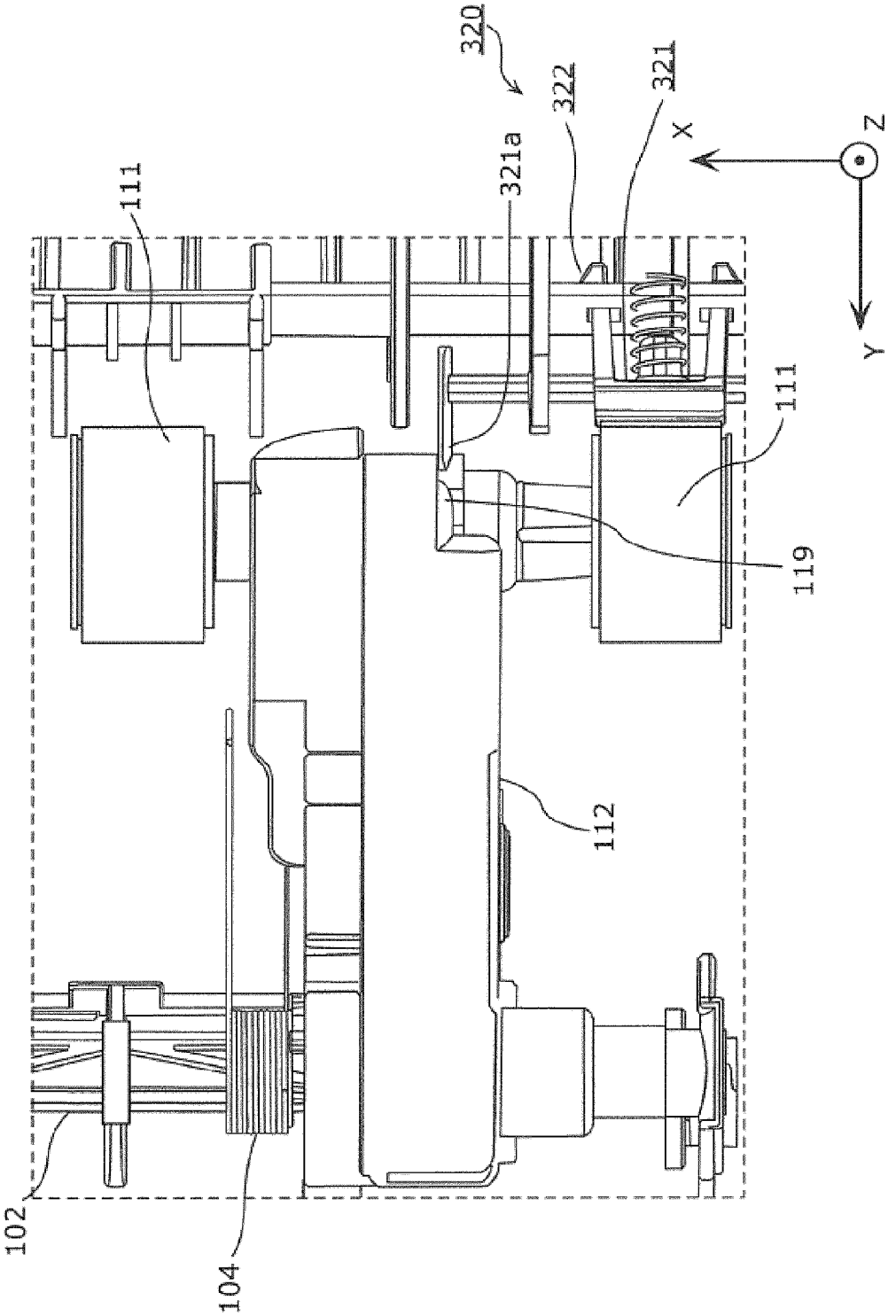

X
Z
Y
111
103
120
121
119
111
217
216b
216c
216a
210
112
115
114
102
104

FIG. 11



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EUROPEAN SEARCH REPORT

Application Number
EP 15 18 3504

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 711 777 A1 (KYOCERA DOCUMENT SOLUTIONS INC [JP]) 26 March 2014 (2014-03-26) * paragraph [0052] - paragraph [0069]; figures 1-16 *	1-14	INV. B65H3/06
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TECHNICAL FIELDS SEARCHED (IPC)

B65H
G03G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 January 2016	Henningsen, Ole

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27-01-2016

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