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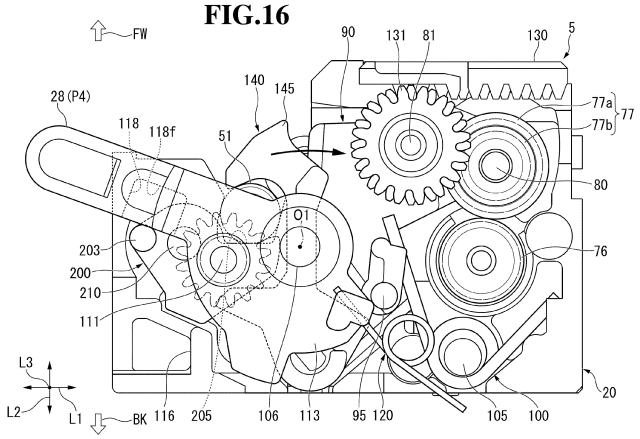
(54) PRINTING UNIT AND THERMAL PRINTER

(57) A printing unit (4) includes: a head unit (5) including a thermal head (25) configured to perform printing on a recording sheet (P); a platen unit (6) including: a platen roller (45) which extends in a first direction, and is configured to feed the recording sheet (P); and a pair of platen bearings (51) configured to support both end portions of the platen roller (45) in the first direction in a rotatable manner, the platen unit (6) being detachably combined with the head unit (5) by allowing the pair of platen bearings (51) to be inserted in and disengaged from a pair of receiving grooves (62) formed in the head unit (5) and recessed toward one side in a second direction orthogonal to the first direction; an operation lever (28) which is swingable about a first swing shaft (106) extending in the first direction between a lock position of locking the platen unit (6) to the head unit (5) and an unlock position of unlocking the platen unit (6) from the head unit (5); a lock arm (140) which is swingable about a second swing shaft (141) extending in the first direction between a lock state of locking the platen roller (45) under a state in which the pair of platen bearings (51) are fitted in the pair of receiving grooves (62) when the operation lever (28) is at the lock position, and an unlock state of allowing the pair of platen bearings (51) to be disengaged from the pair of receiving grooves (62) through openings of the pair of receiving grooves (62) toward another side in the second direction when the operation lever (28) is at the unlock position; and a disengagement arm (200) which is pivoted, along with pivoting of the operation lever (28) from the lock position toward the unlock position, about a third swing shaft (210) extending in the first direction at a position different from the second swing shaft (141), and is configured to press at least one of the pair of platen bearings (51) from an inside of the receiving groove (62) toward the opening side so as to disengage the at least one of the pair of platen bearings (51) from the receiving groove (62).

FIG.16



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a printing unit and a thermal printer.

2. Description of the Related Art

[0002] As a thermal printer, there has been known a printer in which a thermal head and a platen roller are detachably combined with each other. For example, there has been known a thermal printer in which a head unit including a thermal head is provided on a side of a casing configured to receive a roll sheet, and in which a platen unit including a platen roller is provided on a side of a printer cover that is coupled to the casing so as to be operated in an openable and closable manner. According to this thermal printer, the thermal head and the platen roller can be detachably combined with each other along with an opening and closing operation of the printer cover.

[0003] In general, in many cases, the thermal printer of this type includes a lock mechanism configured to hold the platen roller in order to prevent detachment between the thermal head and the platen roller at an unintended timing when the thermal head and the platen roller are combined with each other.

[0004] Hitherto, there has been known a thermal printer having a configuration including a lock arm, a cam, and a pressure spring. In this configuration, the lock arm locks bearings of a platen roller. The cam is provided so as to release locking of the bearings of the platen roller by the lock arm. The pressure spring is provided between the lock arm and a head support member for supporting a thermal head. The pressure spring brings the thermal head into press-contact with the platen roller when the bearings of the platen roller are locked, and pushes the platen roller through intermediation of the thermal head when locking of the bearings of the platen roller is released.

[0005] However, in the configuration of the thermal printer described above, the lock arm has a function of locking the bearings of the platen roller and a function of bringing the thermal head into press-contact with the platen roller with the pressure spring when locking of the bearings of the platen roller is released by the cam. Accordingly, in order to achieve both of the functions, it is difficult to make a design that optimally achieves each of the function of locking the bearings of the platen roller and the function of unlocking the platen roller. As a result, it is inevitable to make a design while examining, for example, a rotation center position and a rotation amount of the lock arm so as to find a point of compromise that enables achievement of both of the functions, and hence it has been difficult to make a design with a high degree of freedom.

[0006] Therefore, in this technical field, there have been demands for a printing unit and a thermal printer that enable a design of each portion with a high degree of freedom while achieving both of a function of locking a platen roller and a function of unlocking the platen roller.

SUMMARY OF THE INVENTION

[0007] According to one embodiment of the present invention, there is provided a printing unit including: a head unit including a thermal head configured to perform printing on a recording sheet; a platen unit including: a platen roller which extends in a first direction, and is configured to feed the recording sheet; and a pair of platen bearings configured to support both end portions of the platen roller in the first direction in a rotatable manner, the platen unit being detachably combined with the head unit by allowing the pair of platen bearings to be inserted in and disengaged from a pair of receiving grooves formed in the head unit and recessed toward one side in a second direction orthogonal to the first direction; an operation lever which is swingable about a first swing shaft extending in the first direction between a lock position of locking the platen unit to the head unit and an unlock position of unlocking the platen unit from the head unit; a lock arm which is swingable about a second swing shaft extending in the first direction between a lock state of locking the platen roller under a state in which the pair of platen bearings are fitted in the pair of receiving grooves when the operation lever is at the lock position, and an unlock state of allowing the pair of platen bearings to be disengaged from the pair of receiving grooves through openings of the pair of receiving grooves toward another side in the second direction when the operation lever is at the unlock position; and a disengagement arm which is pivoted, along with pivoting of the operation lever from the lock position toward the unlock position, about a third swing shaft extending in the first direction at a position different from the second swing shaft, and is configured to press at least one of the pair of platen bearings from an inside of the receiving groove toward the opening side so as to disengage the at least one of the pair of platen bearings from the receiving groove.

[0008] In the above-mentioned printing unit according to the one embodiment of the present invention, preferably at least a part of the third swing shaft overlaps a maximum outer diameter portion of the platen roller in the second direction.

[0009] In the above-mentioned printing unit according to the one embodiment of the present invention, preferably the operation lever and the disengagement arm are arranged adjacent to each other in the first direction, wherein the disengagement arm includes a boss which is formed on the third swing shaft on a radially outer side of the third swing shaft and protrudes in the first direction toward the operation lever side, and the operation lever includes an abutment surface which comes into abut-

ment against an outer peripheral surface of the boss when the operation lever is pivoted from the lock position toward the unlock position.

[0010] In the above-mentioned printing unit according to the one embodiment of the present invention, preferably the abutment surface of the operation lever comes into abutment against the outer peripheral surface of the boss when the operation lever is moved from the lock position toward the unlock position by a predetermined angle.

[0011] In the above-mentioned printing unit according to the one embodiment of the present invention, preferably the boss is arranged on a side opposite to the at least one of the pair of platen bearings across the third swing shaft in a third direction orthogonal to the first direction and the second direction.

[0012] In the above-mentioned printing unit according to the one embodiment of the present invention, preferably the first swing shaft is arranged on a side opposite to the third swing shaft across the at least one of the pair of platen bearings in the third direction.

[0013] In the above-mentioned printing unit according to the one embodiment of the present invention, preferably the third swing shaft is arranged at a position closer to a center of the at least one of the pair of platen bearings than the second swing shaft.

[0014] In the above-mentioned printing unit according to the one embodiment of the present invention, preferably, on an inner surface of the receiving groove, an inclined guide protrusion configured to guide the at least one of the pair of platen bearings toward a groove bottom portion is formed so as to decrease an opening width from the opening side toward the groove bottom portion side of the receiving groove, and the disengagement arm presses the at least one of the pair of platen bearings so as to move a roller center of the platen roller more toward the opening side than an apex portion of the guide protrusion.

[0015] In the above-mentioned printing unit according to the one embodiment of the present invention, preferably the disengagement arm is provided to correspond to at least one of the pair of platen bearings on one side in the first direction.

[0016] According to one embodiment of the present invention, there is provided a thermal printer, including: the printing unit; a printer main body which includes a recording sheet receiving portion configured to receive the recording sheet, and includes one of the head unit and the platen unit mounted thereto; and a printer cover which is coupled to the printer main body so as to be pivotable, and includes another one of the head unit and the platen unit mounted thereto.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Embodiments of the present invention will now be described by way of further example only and with reference to the accompanying drawings, in which:

FIG. 1 is a perspective view for illustrating a thermal printer according to an embodiment of the present invention, for illustrating a state in which a printer cover is closed.

FIG. 2 is a perspective view for illustrating the thermal printer in a state in which the printer cover of FIG. 1 is opened.

FIG. 3 is a perspective view for illustrating a printing unit of FIG. 2.

FIG. 4 is a perspective view for illustrating the printing unit in a state in which gear covers and other components are removed from the state illustrated in FIG. 3.

FIG. 5 is a perspective view for illustrating the printing unit in a state in which a platen frame and other components are removed from the state illustrated in FIG. 4.

FIG. 6 is a perspective view for illustrating a platen unit of FIG. 4.

FIG. 7 is a side view seen from a direction indicated by the arrow "A" of FIG. 5, for illustrating a relationship between a receiving groove and a platen bearing.

FIG. 8 is a perspective view for illustrating a state in which a recording sheet is cut between a fixed blade and a movable blade.

FIG. 9 is a side view seen from the direction indicated by the arrow "A" of FIG. 5.

FIG. 10 is a perspective view for illustrating mechanisms of FIG. 9.

FIG. 11 is a side view for illustrating a state in which a return gear and other components are removed from the state illustrated in FIG. 9.

FIG. 12 is a perspective view for illustrating peripheries of an operation lever and a return mechanism when seen from a side opposite to the viewpoint of FIG. 10.

FIG. 13 is a perspective view for illustrating a state in which the operation lever is removed from the state illustrated in FIG. 11.

FIG. 14 is a perspective view for illustrating the periphery of the operation lever when seen from the side opposite to the viewpoint of FIG. 10.

FIG. 15 is a side view for illustrating a state in which the operation lever is operated to be pushed from a lock position from the state illustrated in FIG. 9.

FIG. 16 is a side view for illustrating a state in which the operation lever is operated to be further pushed from the state illustrated in FIG. 15.

FIG. 17 is a side view for illustrating a state in which the operation lever is operated to be further pushed from the state illustrated in FIG. 16, thereby bringing an abutment surface of the operation lever into abutment against a boss of a disengagement arm.

FIG. 18 is a side view for illustrating a state in which the operation lever is operated to be further pushed from the state illustrated in FIG. 17, and thus is positioned at an unlock position, thereby pushing the

platen bearing to an opening of the receiving groove.

DESCRIPTION OF THE EMBODIMENTS

[0018] Now, with reference to the drawings, a printing unit and a thermal printer according to an embodiment of the present invention are described. However, the present invention is not limited to this embodiment. As illustrated in FIG. 1 and FIG. 2, a thermal printer 1 is a printer capable of performing printing on a recording sheet (heat-sensitive paper) P having a roll sheet shape so that the recording sheet P is used as, for example, a ticket or a receipt.

[0019] The thermal printer 1 is placed on, for example, a store counter, and actions of the thermal printer 1 are controlled by an information processing device (not shown). Accordingly, the thermal printer 1 is controlled so as to perform printing of various kinds of information sent from the information processing device on the recording sheet P, and to deliver the printed recording sheet P.

[0020] The thermal printer 1 is placed on, for example, a placement surface S of the store counter, and is formed into a cubic shape as a whole. In this embodiment, when the thermal printer 1 is in a state illustrated in FIG. 1 and FIG. 2, a direction perpendicular to the placement surface S is referred to as an up-and-down direction L1, and directions orthogonal to each other in a plane parallel to the placement surface S are referred to as a front-and-back direction (second direction) L2 and a right-and-left direction (first direction) L3. In the front-and-back direction L2, a front side is indicated by the arrow "FW", and a back side is indicated by the arrow "BK". Therefore, in FIG. 1 and FIG. 2, a lower left side of the drawing sheet is defined as a front side FW, and an upper right side of the drawing sheet is defined as a back side BK.

[0021] The thermal printer 1 includes a casing (printer main body according to the present invention) 2, a printer cover 3, and a printing unit 4 including a head unit 5 and a platen unit 6. The thermal printer 1 is of a so-called front delivery type in which the recording sheet P is delivered to the front side FW. In the illustrated example, the platen unit 6 is provided on the printer cover 3 side, and the head unit 5 is provided on the casing 2 side. However, the present invention is not limited to this case. For example, the head unit 5 may be provided on the printer cover 3 side, and the platen unit 6 may be provided on the casing 2 side.

[0022] The casing 2 is made of a synthetic resin material, a metal material, or a combination of those materials, and thus is formed into a cubic shape having an opening portion on the front side FW. The casing 2 includes a plurality of outer surfaces 10 that include a bottom surface 11 arranged so as to be opposed to the placement surface S. However, the shape of the casing 2 is not limited to this case, and may be modified as appropriate.

[0023] Of the plurality of outer surfaces 10, the outer surface 10 opposed to the bottom surface 11 in the up-and-down direction L1 is referred to as "top surface 12". In addition, of the plurality of outer surfaces 10, the outer surface 10 positioned on the front side FW is referred to as "front surface 13", and the outer surface 10 positioned on the back side BK is referred to as "back surface 14". The front surface 13 and the back surface 14 are opposed to each other in the front-and-back direction L2. Further, of the plurality of outer surfaces 10, the outer surfaces 10 opposed to each other in the right-and-left direction L3 are referred to as "pair of side surfaces 15".

[0024] Inside the casing 2, a recording sheet receiving portion 16 is formed. In the recording sheet receiving portion 16, the recording sheet P having a roll shape can be received through the opening portion formed in the front surface 13 of the casing 2. With this configuration, when the printer cover 3 is opened, the recording sheet P having a roll shape can be loaded into the recording sheet receiving portion 16 from the front side FW.

[0025] The printer cover 3 is coupled to a lower part of the casing 2 on the front surface 13 side through intermediation of a rotary shaft portion 17, and is configured to openably cover the opening portion. The printer cover 3 is coupled to the lower part of the casing 2 on the front surface 13 side so as to be rotated about the rotary shaft portion 17 within an angle range of about 90°. As illustrated in FIG. 1, when the printer cover 3 is closed, a slight gap is designed to be formed between a distal end of the printer cover 3 and the casing 2. The recording paper P is pulled out to the front side FW to be delivered from an inside of the casing 2 through the gap. Thus, the gap serves as a delivery slot 18 for the recording paper P.

[0026] When the printer cover 3 is closed, the casing 2 and the printer cover 3 configured as described above are locked along with combination between the platen unit 6 and the head unit 5. Thus, the printer cover 3 is locked in a closed state.

[0027] Moreover, as illustrated in FIG. 1, on the casing 2, at a corner portion at which the front surface 13, the top surface 12, and one of the side surfaces 15 meet, a lever 19 is provided. The lever 19 is configured to release the combination (locking) between the platen unit 6 and the head unit 5. With this configuration, as illustrated in FIG. 2, locking of the printer cover 3 can also be released, thereby being capable of performing opening operation of the printer cover 3. The lever 19 can be operated to be pushed, for example, downward.

[0028] The printer cover 3 includes, for example, a power button and operation buttons 3a provided as sheet feeding buttons. The operation buttons 3a are arranged on an outer surface of the printer cover 3 under a state of being exposed in a pressable manner. In the illustrated example, the operation buttons 3a are arranged below the lever 19 so as to be aligned with each other in the up-and-down direction L1.

[0029] As illustrated in FIG. 2 to FIG. 5, the printing unit 4 includes the head unit 5, which is provided on the casing 2 side, and the platen unit 6, which is provided on

the printer cover 3 side so as to be detachably combined with the head unit 5.

[0030] The head unit 5 includes a head frame 20, a head cover plate 21, and gear covers 22 and 23. The head frame 20 is made of, for example, a synthetic resin, and forms a basic framework of the head unit 5. The head cover plate 21 is made of, for example, a metal, and is combined with the head frame 20 so as to cover the head frame 20 from the front side FW and the right-and-left direction L3. The gear covers 22 and 23 are each made of, for example, a metal, and are combined with the head frame 20 so as to cover the head frame 20 from the right-and-left direction L3.

[0031] The head unit 5 further includes at least a thermal head 25, a movable blade 26, a drive mechanism 27, an operation lever 28, a return mechanism 29, and a platen lock mechanism 30. The thermal head 25, the movable blade 26, the drive mechanism 27, the operation lever 28, the return mechanism 29, and the platen lock mechanism 30 are mounted mainly through use of the head frame 20, and are covered with the head cover plate 21 and the gear covers 22 and 23.

[0032] The head unit 5 configured as described above is mounted to an interior of the casing 2. Specifically, the head unit 5 is arranged above the recording sheet receiving portion 16 and at a position close to the front surface 13 of the casing 2, and is mounted to the casing 2 mainly by fastening the head frame 20 with screws. In this embodiment, the head unit 5 is mounted such that a blade edge 26a of the movable blade 26 is directed downward. The head unit 5 is described later in detail.

[0033] The platen unit 6 includes a platen frame 40 and a platen cover plate 41. The platen frame 40 is made of, for example, a synthetic resin, and forms a basic framework of the platen unit 6. The platen cover plate 41 is made of, for example, a metal, and is combined with the platen frame 40 so as to cover the platen frame 40 from the front side FW and the right-and-left direction L3. The platen unit 6 further includes at least a platen roller 45 and a fixed blade 46. The platen roller 45 and the fixed blade 46 are mounted mainly through use of the platen frame 40, and are covered with the platen cover plate 41.

[0034] The platen unit 6 configured as described above is mounted to an inner surface of the printer cover 3 mainly through the platen cover plate 41. At this time, the platen unit 6 is mounted at a position at which the platen unit 6 is detachably combined with the head unit 5 along with an opening and closing operation of the printer cover 3. In this embodiment, the platen unit 6 is mounted such that a blade edge 46a of the fixed blade 46 is directed upward.

[0035] The platen unit 6 is described in detail. As illustrated in FIG. 3 to FIG. 6, when the head unit 5 and the platen unit 6 are combined with each other, the fixed blade 46 is supported by the platen frame 40 such that the blade edge 46a is directed toward the head unit 5 side. As illustrated in FIG. 6, in the platen frame 40, at a position more on the back side BK than the fixed blade 46, a platen receiving space 47 configured to receive the platen roller 45 is formed. Further, the platen frame 40 includes support walls 48, which are configured to support the platen roller 45 and are arranged so as to face each other in the right-and-left direction L3 across the platen receiving space 47.

[0036] The platen roller 45 is a rubber roller configured to convey the recording sheet P to an outside of the printer cover 3, and is provided around a platen shaft 50 extending in the right-and-left direction L3. The platen roller 45 is received in the platen receiving space 47 under a state in which a part of an outer peripheral surface of the platen roller 45 is exposed to the head unit 5 side, and is supported by the support walls 48 so as to be rotatable. Specifically, platen bearings 51 each having a cylindrical shape are respectively fitted on both end portions of the platen shaft 50 extending more toward an outer side in the right-and-left direction L3 than the platen roller 45. With this configuration, even when the pair of platen bearings 51 is pressed down, the platen roller 45 can be rotated. A driven gear 52 is fixed to one end portion of the platen shaft 50 located more on the outer side in the right-and-left direction L3 than the platen bearing 51.

[0037] The support walls 48 fix the platen bearings 51 in a holding manner through use of, for example, slit holes. With this configuration, the platen roller 45 is supported by the pair of support walls 48 through intermediation of the pair of platen bearings 51 so as to be rotatable under a state in which the platen roller 45 is received in the platen receiving space 47. The pair of platen bearings 51 extends more toward the outer side in the right-and-left direction L3 than the support walls 48. When the printer cover 3 is closed, as illustrated in FIG. 5, the pair of platen bearings 51 is respectively received in a pair of receiving grooves 62 formed on the head unit 5 side.

[0038] In FIG. 5, the platen roller 45 and the platen bearings 51 of the platen unit 6 are mainly illustrated.

[0039] Next, the head unit 5 is described in detail. As illustrated in FIG. 3 to FIG. 5, the head unit 5 includes at least the thermal head 25, the movable blade 26, the drive mechanism 27, the operation lever 28, the return mechanism 29, and the platen lock mechanism 30.

[0040] As illustrated in FIG. 5, the thermal head 25 includes a plurality of heating elements (not shown) arrayed in line along the right-and-left direction L3. The thermal head 25 is mounted to the head frame 20 so as to be opposed to the platen roller 45 when the printer cover 3 is at a closed position. The recording sheet P is allowed to pass through between the platen roller 45 and the thermal head 25. A coil spring (not shown) configured to urge the thermal head 25 toward the platen roller 45 side is interposed between the thermal head 25 and the head frame 20. With this configuration, the thermal head 25 can be reliably pressed against the recording sheet P fed by the platen roller 45, and hence the printing unit 4 can perform satisfactory printing.

[0041] The head frame 20 includes a pair of side wall portions 60 and 61 located more on the outer side in the

right-and-left direction L3 than the support walls 48 of the platen frame 40 of the platen unit 6. The pair of receiving grooves 62 in which the pair of platen bearings 51 can be fitted individually is formed in the pair of side wall portions 60 and 61, respectively. As illustrated in FIG. 7, each of the receiving grooves 62 has a U shape in side view, which is recessed toward the back side BK in the front-and-back direction L2 (one side in the second direction), and has an opening 62a opened to the front side FW so as to face the platen unit 6 side. A groove bottom portion 62b of each of the receiving grooves 62 is flat. FIG. 7 is an illustration of the receiving groove 62 formed in one side wall portion 60, and illustrations of other components are omitted as appropriate.

[0042] On an inner surface of the receiving groove 62, an inclined guide protrusion 63 configured to guide the platen bearing 51 toward the groove bottom portion 62b side is formed so as to decrease an opening width from the opening 62a side toward the groove bottom portion 62b side. With this configuration, the receiving groove 62 is formed so that the opening width is largest at the opening 62a and the opening width is smallest in the vicinity of an apex portion 63a of the guide protrusion 63. When the guide protrusion 63 is formed on the receiving groove 62, the platen bearing 51 can be guided along the guide protrusion 63 so as to sink toward the groove bottom portion 62b side.

[0043] As described above, the receiving grooves 62 are formed in the pair of side wall portions 60 and 61, respectively. Accordingly, when the head unit 5 and the platen unit 6 are combined with each other, as illustrated in FIG. 5 and FIG. 7, the pair of platen bearings 51 is fitted and received in the pair of receiving grooves 62, respectively. At this time, the platen bearings 51 are received in the receiving grooves 62 in contact with the groove bottom portions 62b.

[0044] As illustrated in FIG. 4, the movable blade 26 is mounted to the head frame 20 through intermediation of the drive mechanism 27 so that the blade edge 26a is directed toward the platen unit 6 side when the head unit 5 and the platen unit 6 are combined with each other. At this time, the movable blade 26 is arranged so as to face the fixed blade 46 in the up-and-down direction L1, and is arranged so as to overlap the fixed blade 46 in the front-and-back direction L2 when being moved to a cutting position P1. As illustrated in FIG. 8, the movable blade 26 is a platelike blade formed to have a V shape so that a length from a blade base to the blade edge 26a gradually decreases from both ends to a center of the movable blade 26. FIG. 8 is a perspective view for illustrating a state in which the movable blade 26 is moved to the cutting position P1 to cut the recording sheet P between the fixed blade 46 and the movable blade 26.

[0045] As illustrated in FIG. 4, the movable blade 26 is mounted to a drive rack 71 of the drive mechanism 27 through intermediation of a movable blade holder 70. The movable blade 26 is configured so as to be movable relative to the head frame 20 in the up-and-down direction L1 through actions of the drive mechanism 27. Thus, the movable blade 26 is supported so as to be movable relative to the fixed blade 46 in the up-and-down direction L1.

[0046] As illustrated in FIG. 4, FIG. 9, and FIG. 10, the drive mechanism 27 is a mechanism configured to move the movable blade 26 between the cutting position P1 and a standby position P2. The cutting position P1 is a position at which the movable blade 26 cuts the recording sheet P together with the fixed blade 46 by climbing over the fixed blade 46 (see FIG. 8). The standby position P2 is a position at which the movable blade 26 is suitably away from the fixed blade 46 (see FIG. 4). The drive mechanism 27 includes a driving motor 75, a drive intermediate wheel 76, a double intermediate wheel 77, a drive pinion 78, and the drive rack 71.

[0047] As illustrated in FIG. 10, the driving motor 75 is a motor that is rotatable in forward and reverse directions, and is fixed to an inner side of the one side wall portion 60 of the head frame 20. A drive shaft of the driving motor 75 is connected to a speed reduction mechanism 75a. Moreover, an output shaft 75b of the speed reduction mechanism 75a protrudes more toward the outer side in the right-and-left direction L3 than the one side wall portion 60 of the head frame 20. The drive intermediate wheel 76 is arranged on the outer side in the right-and-left direction L3 than the one side wall portion 60, and is coupled to the output shaft 75b of the speed reduction mechanism 75a. Therefore, the drive intermediate wheel 76 is rotated along with rotation of the driving motor 75 transmitted through the speed reduction mechanism 75a.

[0048] As illustrated in FIG. 9 and FIG. 10, the double intermediate wheel 77 is arranged between the drive intermediate wheel 76 and the drive pinion 78, and is supported on an intermediate support shaft 80 so as to be rotatable.

[0049] The double intermediate wheel 77 includes a large-diameter intermediate wheel 77a and a small-diameter intermediate wheel 77b having a diameter smaller than that of the large-diameter intermediate wheel 77a. The large-diameter intermediate wheel 77a meshes with the drive intermediate wheel 76 when the operation lever 28 is at a lock position P3. Thus, the entire double intermediate wheel 77 is rotated along with rotation of the drive intermediate wheel 76. The small-diameter intermediate wheel 77b is arranged more on the outer side in the right-and-left direction L3 than the large-diameter intermediate wheel 77a, and meshes with the drive pinion 78.

[0050] The drive pinion 78 is arranged so as to be located more on the operation lever 28 side than the small-diameter intermediate wheel 77b and located on the drive rack 71 side, and is fixed to a pinion support shaft 81 under a state of being arranged coaxially with the pinion support shaft 81. With this configuration, the drive pinion 78 and the pinion support shaft 81 are rotated integrally. Further, the drive pinion 78 meshes with the small-diam-

eter intermediate wheel 77b, and meshes with drive rack teeth 71a of the drive rack 71.

[0051] As illustrated in FIG. 4, the drive rack 71 is arranged not only on the one side wall portion 60 side of the head frame 20 but also on another side wall portion 61 side thereof. That is, the drive racks 71 are arranged on both sides of the head frame 20 in the right-and-left direction L3, respectively while holding the head frame 20. The pinion support shaft 81 is formed so as to pass through the head frame 20 in the right-and-left direction L3, and couples the pair of drive pinions 78 arranged on the both sides of the head frame 20 in the right-and-left direction L3, respectively. With this configuration, the pair of drive pinions 78 can be rotated together in a synchronized state through the pinion support shaft 81.

[0052] The drive racks 71 are mounted to both end portions of the movable blade holder 70 in the right-and-left direction L3 so as to extend in the up-and-down direction L1. With this configuration, the drive racks 71 are combined with the movable blade 26 through intermediation of the movable blade holder 70. The drive rack teeth 71a are formed in an entire region of each of the drive racks 71. The pair of drive pinions 78 meshes with the drive rack teeth 71a. Therefore, along with rotation of the pair of drive pinions 78, the movable blade 26 can be moved between the standby position P2 and the cutting position P1 through the drive racks 71.

[0053] In the following, for ease of understanding of the configuration, the drive pinion 78 and the drive rack 71, which are located on the one side wall portion 60 side (driving motor 75 side), are described in detail. Description of the drive pinion 78 and the drive rack 71, which are located on the another side wall portion 61 side, is omitted.

[0054] The drive mechanism 27 is configured as described above, and hence as illustrated in FIG. 4 and FIG. 9, the drive pinion 78 can be rotated along with rotation of the driving motor 75 through the drive intermediate wheel 76 and the double intermediate wheel 77 (including the large-diameter intermediate wheel 77a and the small-diameter intermediate wheel 77b). Accordingly, the drive rack 71 can be moved in a direction indicated by the arrow "F1" together with a return rack 130 of the return mechanism 29 to be described later, thereby being capable of moving the movable blade 26 in the same direction as the direction indicated by the arrow "F1". Thus, the movable blade 26 can be moved from the standby position P2 to the cutting position P1.

[0055] Meanwhile, when the driving motor 75 is rotated reversely, the drive pinion 78 can be rotated reversely through the drive intermediate wheel 76 and the double intermediate wheel 77. Accordingly, the drive rack 71 can be moved in a direction indicated by the arrow "F2" together with the return rack 130, thereby being capable of moving the movable blade 26 in the same direction as the direction indicated by the arrow "F2". Thus, the movable blade 26 can be moved and returned from the cutting position P1 to the standby position P2.

[0056] Incidentally, the intermediate support shaft 80 configured to support the double intermediate wheel 77 described above is fixed to a swing plate 90 arranged so as to be swingable about the pinion support shaft 81. As illustrated in FIG. 7, FIG. 9, and FIG. 11, the swing plate 90 has an insertion hole (not shown) formed to pass through the swing plate 90 in the right-and-left direction L3 and configured to allow the pinion support shaft 81 to be inserted therethrough. Under a state in which the swing plate 90 allows the pinion support shaft 81 to be inserted through the insertion hole (not shown), the swing plate 90 is arranged along a wall surface of the one side wall portion 60 so as to be swingable.

[0057] The swing plate 90 includes a first plate portion 92 and a second plate portion 93. The first plate portion 92 extends toward a space between the drive intermediate wheel 76 and the drive rack 71. The second plate portion 93 extends toward a swing axis O2 of a lock arm 140 to be described later.

[0058] The intermediate support shaft 80 is formed so as to extend from the first plate portion 92 toward the outer side in the right-and-left direction L3. With this configuration, the double intermediate wheel 77 supported on the intermediate support shaft 80 is swingable about the pinion support shaft 81 along with swing of the swing plate 90. The second plate portion 93 includes an engagement pin 95 formed so as to protrude toward the outer side in the right-and-left direction L3.

[0059] By an urging force of a first urging member 100, the swing plate 90 thus configured is always urged in such a direction that the large-diameter intermediate wheel 77a of the double intermediate wheel 77 meshes with the drive intermediate wheel 76. The first urging member 100 is, for example, a coil spring, and includes a coil portion 100a, a first coil end portion 100b, and a second coil end portion 100c. The coil portion 100a is supported on a coil support shaft 105 formed on the one side wall portion 60 so as to protrude. The first coil end portion 100b is locked to the head frame 20. The second coil end portion 100c is locked to the locking protrusion 94 of the swing plate 90.

[0060] Thus, the second plate portion 93 of the swing plate 90 is urged toward the operation lever 28 side by the urging force (elastic restoration force) of the first urging member 100, and hence the large-diameter intermediate wheel 77a is positioned under a state of being pressed against the drive intermediate wheel 76. The first urging member 100 is not limited to a coil spring, and may be formed of, for example, a plate spring.

[0061] Further, when the engagement pin 95 is pushed up by a pushing-up cam 113 to be described later along with operation of the operation lever 28, the swing plate 90 is swung about the pinion support shaft 81 against the urging force of the first urging member 100 so that the double intermediate wheel 77 is moved away from the drive intermediate wheel 76. Thus, meshing between the double intermediate wheel 77 and the drive intermediate wheel 76 can be released.

[0062] As illustrated in FIG. 4, FIG. 9, and FIG. 10, the operation lever 28 is arranged on the one side wall portion 60 side of the head frame 20, and is supported on a lever support shaft (first swing shaft) 106, which extends in the right-and-left direction L3 and arranged in parallel to the platen roller 45, so as to be rotatable. The operation lever 28 can be operated to be pushed in and rotated about the lever support shaft 106 from the lock position P3 toward a meshing release position P4 or an unlock position P5 to be described later in a counterclockwise direction in side view in which the one side wall portion 60 is seen from the outer side in the right-and-left direction L3.

[0063] The lever support shaft 106 is provided so as to protrude from an inner surface of the gear cover 22 toward the one side wall portion 60 side. A center axis of the lever support shaft 106 matches with a rotation axis O1 of the operation lever 28.

[0064] The lock position P3 refers to a position at which the platen unit 6 is locked to the head unit 5. The meshing release position P4 refers to a position at which meshing between the large-diameter intermediate wheel 77a of the double intermediate wheel 77 and the drive intermediate wheel 76 is released after the swing plate 90 is swung by the pushing-up cam 113 of the operation lever 28 to be described later. The unlock position P5 refers to a position at which locking of the platen unit 6 to the head unit 5 is released.

[0065] As illustrated in FIG. 5 and FIG. 9 to FIG. 11, a lever plate 110 is formed at a proximal end portion of the operation lever 28 so as to have a fan shape in side view. A planetary shaft 111 is provided on an outer surface of the lever plate 110 so as to protrude toward the outer side in the right-and-left direction L3. The lever plate 110 includes the pushing-up cam 113 and a projecting regulation piece 114 that protrude toward a radially outer side of the lever plate 110.

[0066] The planetary shaft 111 is formed at a position of being offset from the lever support shaft 106. The pushing-up cam 113 is arranged more on a clockwise direction side than the engagement pin 95 formed on the swing plate 90 with the lever support shaft 106 as an axis. When the operation lever 28 is rotated from the lock position P3 toward the unlock position P5 side, the planetary shaft 111 can be brought into contact with the engagement pin 95. Moreover, a locking protrusion 115 is formed on an outer surface of the pushing-up cam 113 so as to protrude toward the outer side in the right-and-left direction L3.

[0067] The projecting regulation piece 114 is arranged more on the clockwise direction side than the pushing-up cam 113, and is brought into contact with a regulation wall portion 116 of the head frame 20 from the clockwise direction side when the operation lever 28 is at the lock position P3. Accordingly, the entire operation lever 28 is restrained from being further rotated in the clockwise direction, and thus the operation lever 28 is positioned at the lock position P3. When the operation lever 28 is moved to the unlock position P5 and is operated to be further pushed backward, the operation lever 28 can be brought into contact with a regulation wall portion 117 of the gear cover 22 illustrated in FIG. 3 from the counterclockwise direction side. Therefore, the operation lever 28 is restrained from being operated to be further pushed beyond the unlock position P5.

[0068] A distal end portion of the operation lever 28 is fitted to an inner side of a coupling member 19a (see FIG. 2) of the lever 19 provided on the casing 2. Accordingly, the operation lever 28 is operated in synchronization with operation of the lever 19. Thus, through the operation of the lever 19, the operation lever 28 can be operated from the lock position P3 toward the unlock position P5 in synchronization with the operation of the lever 19.

[0069] As illustrated in FIG. 9 and FIG. 10, by an urging force of a second urging member 120, the operation lever 28 configured as described above is always urged in a direction (clockwise direction) of being moved toward the lock position P3. The second urging member 120 is, for example, a coil spring, and includes a coil portion 120a, a first coil end portion 120b, and a second coil end portion 120c. The coil portion 120a is supported on a coil support shaft (not shown) provided on the inner surface of the gear cover 22 so as to protrude. The first coil end portion 120b is locked to the inner surface of the gear cover 22. The second coil end portion 120c is locked to the locking protrusion 115 of the operation lever 28.

[0070] Thus, the operation lever 28 is urged in the clockwise direction by the urging force (elastic restoration force) of the second urging member 120, and hence the distal end portion of the operation lever 28 is urged in the direction of being moved toward the lock position P3. As described above, the projecting regulation piece 114 of the operation lever 28 is brought into contact with the regulation wall portion 116 of the head frame 20, and hence the operation lever 28 is restrained from being further rotated, thereby being positioned at the lock position P3. The second urging member 120 is not limited to a coil spring, and may be formed of, for example, a plate spring.

[0071] As illustrated in FIG. 4, the return mechanism 29 is a mechanism configured to move the movable blade 26 from the cutting position P1 to the standby position P2 through use of an operating (rotating) force applied to the operation lever 28 from the lock position P3 toward the unlock position P5 under a state in which the movable blade 26 is stopped at the cutting position P1 due to, for example, occurrence of paper jam before the platen lock mechanism 30 switches the lock arm to the unlock state of unlocking the platen roller 45.

[0072] As illustrated in FIG. 10 and FIG. 12, the return mechanism 29 includes a return rack 130, a return pinion 131, a return gear 132, a sun gear 133, a planetary gear 134, and an internal gear 135. The return rack 130 is formed on the drive rack 71. The return pinion 131 meshes with rack teeth 130a of the return rack 130. The return gear 132 and the sun gear 133 provided integrally with the return gear 132 are supported so as to be rotatable

about the rotation axis O1 under a state of being arranged coaxially with the rotation axis O1 of the operation lever 28. The planetary gear 134 meshes with the sun gear 133, and revolves along with movement of the operation lever 28. Further, the planetary gear 134 meshes with the internal gear 135. The sun gear 133, the planetary gear 134, and the internal gear 135 form a speed-increasing mechanism 136 (see FIG. 12).

[0073] The return pinion 131 is supported on the pinion support shaft 81 so as to be rotatable under a state of being arranged more on the outer side in the right-and-left direction L3 than the drive pinion 78. With this configuration, the return pinion 131 is arranged coaxially with the drive pinion 78. The return pinion 131 is capable of meshing with the return gear 132 rotated in synchronization with the operation of the operation lever 28, and is rotated by a rotation force of the return gear 132. Moreover, the return pinion 131 is capable of meshing with the rack teeth 130a of the return rack 130.

[0074] As illustrated in FIG. 10, the return rack 130 is formed integrally with the drive rack 71 under a state of being arranged more on the outer side in the right-and-left direction L3 than the drive rack 71 of the drive mechanism 27. The return rack 130 includes the plurality of rack teeth 130a. The plurality of rack teeth 130a are formed so as to be located not on the blade edge 26a side of the movable blade 26 but on the blade base side thereof. With this configuration, the return rack 130 meshes with the return pinion 131 when the movable blade 26 is at the cutting position P1, and is released from meshing with the return pinion 131 when the movable blade 26 is at the standby position P2.

[0075] In the illustrated example, the drive rack 71 and the return rack 130 are formed integrally with each other, but the present invention is not limited to this case. The return rack 130 may be formed separately from the drive rack 71. However, when the drive rack 71 and the return rack 130 are formed integrally with each other, the return rack 130 can be provided without increasing the number of parts. Accordingly, simplification of the configuration and cost reduction can be achieved, which is preferred.

[0076] Of the plurality of rack teeth 130a, the rack tooth 130a located on the blade edge 26a side of the movable blade 26 is referred to as a rack tooth 130b that is displaceable. The rack tooth 130b is formed at a distal end portion of a rack arm 139. A proximal end portion of the rack arm 139 is coupled to an end portion of the drive rack 71 located on the blade edge 26a side of the movable blade 26. Accordingly, the rack arm 139 is formed as a cantilever arm that is elastically deformable with the proximal end portion as a fulcrum in a direction of moving away from the return pinion 131. Thus, the rack arm 139 can be elastically deformed in the direction of moving away from the return pinion 131, and hence the rack tooth 130b can be retreated toward the radially outer side of the return pinion 131.

[0077] The reason why the rack tooth 130b of the return rack 130 is formed so as to be capable of retreating toward the radially outer side of the return pinion 131 is briefly described. For example, it is conceivable that, when the return rack 130 is moved in the direction indicated by the arrow "F1" of FIG. 9, the rack tooth 130b of the return rack 130 is brought into abutment against a tooth tip of a tooth portion of the return pinion 131. In this case, there is a fear in that movement of the return rack 130 is hindered by the tooth tip of the return pinion 131. In consideration of this, the rack tooth 130b is formed at the distal end portion of the rack arm 139, thereby providing a configuration in which due to elastic deformation of the rack arm 139, the rack tooth 130b is retreated toward the radially outer side of the return pinion 131 so as to be capable of climbing over the tooth tip of the return pinion 131. Accordingly, after the rack tooth 130b climbs over the tooth tip of the return pinion 131, the rack tooth 130b can be returned to an original position through use of an elastic restoration force of the rack arm 139, and thus the returned rack tooth 130b can be suitably meshed with a next tooth portion of the return pinion 131. In this manner, without causing a problem in which movement of the return rack 130 is hindered, the rack tooth 130b of the return rack 130 and the return pinion 131 can be suitably meshed with each other.

[0078] As illustrated in FIG. 9 and FIG. 10, the return gear 132 is supported on the lever support shaft 106 so as to be rotatable under a state of being arranged more on the outer side in the right-and-left direction L3 than the lever plate 110 of the operation lever 28. With this configuration, the return gear 132 is arranged coaxially with the rotation axis O1 of the operation lever 28.

[0079] The return gear 132 includes a gear plate 132a and a plurality of gear tooth portions 132b formed along an outer peripheral edge of the gear plate 132a. The plurality of gear tooth portions 132b are formed not along an entire periphery of the gear plate 132a but in a range along substantially a half of the periphery of the gear plate 132a. The plurality of gear tooth portions 132b are capable of meshing with the return pinion 131.

[0080] Of the plurality of gear tooth portions 132b, the gear tooth portion 132b that meshes with the return pinion 131 first through the operation of the operation lever 28 from the lock position P3 toward the unlock position P5 is displaceable toward a radially inner side of the return gear 132, and can be retreated from the tooth portion of the return pinion 131.

[0081] The gear tooth portion 132b is formed at a distal end portion of an elastic arm portion 132c. A proximal end portion of the elastic arm portion 132c is formed integrally with a portion of the outer peripheral edge of the gear plate 132a in which the gear tooth portions 132b are not formed, and the elastic arm portion 132c extends along the outer peripheral edge of the gear plate 132a in the clockwise direction in an arc shape. With this configuration, the elastic arm portion 132c is supported at the proximal end portion thereof on the outer peripheral edge of the gear plate 132a in a cantilevered manner, and is elastically deformable in a radial direction with the prox-

imal end portion as a fulcrum. Thus, when the elastic arm portion 132c is elastically deformed toward the gear plate 132a side, the gear tooth portion 132b can be displaced toward the radially inner side of the return gear 132, thereby being capable of retreating from the tooth portion of the return pinion 131.

[0082] As illustrated in FIG. 12, the sun gear 133 is formed integrally with an inner surface of the gear plate 132a, and is arranged coaxially with the rotation axis O1 of the operation lever 28. With this configuration, the sun gear 133 is rotatable about the rotation axis O1 together with the return gear 132.

[0083] The planetary gear 134 is supported by the operation lever 28 through intermediation of the planetary shaft 111 so as to be rotatable under a state of meshing with the sun gear 133. With this configuration, when the operation lever 28 is rotated about the rotation axis O1, the planetary gear 134 follows movement of the operation lever 28, thereby revolving about the rotation axis O1. The internal gear 135 with which the planetary gear 134 meshes is formed on the inner surface of the gear cover 22. Therefore, the planetary gear 134 revolves along with movement of the operation lever 28, thereby being capable of rotating while meshing with the internal gear 135.

[0084] When the planetary gear 134 thus rotates, the sun gear 133 and the return gear 132 can be rotated about the rotation axis O1, and the gear tooth portions 132b of the return gear 132 can be meshed with the return pinion 131.

[0085] As illustrated in FIG. 5, the platen lock mechanism 30 is a mechanism including lock arms 140 and 150 that are swingable about the swing axis O2 parallel to the platen roller 45, and is configured to be switched between a lock state of locking the platen roller 45 and an unlock state of unlocking the platen roller 45.

[0086] As illustrated in FIG. 5, FIG. 9, and FIG. 10, one lock arm 140 is arranged on the one side wall portion 60 side of the head frame 20, and another lock arm 150 is arranged on the another side wall portion 61 side thereof. When the operation lever 28 is at the lock position P3, each of the pair of lock arms 140 and 150 presses the platen bearing 51 received in the receiving groove 62 from the opening 62a side, and is swung about the swing axis O2 from the platen unit 6 side toward the head unit 5 side along with movement of the operation lever 28 from the lock position P3 toward the unlock position P5 side. Thus, each of the pair of lock arms 140 and 150 is moved away from the platen bearing 51, thereby allowing disengagement of the platen bearing 51 from the receiving groove 62.

[0087] Therefore, through use of the pair of lock arms 140 and 150, the platen lock mechanism 30 in this embodiment can lock the pair of platen bearings 51 at the same time, and can unlock the pair of platen bearings 51 at the same time.

[0088] The one lock arm 140 and the another lock arm 150 are coupled to each other through intermediation of a coupling shaft portion (second swing shaft) 141 having a large length, which extends in the right-and-left direction L3 and is arranged in parallel to the platen roller 45. As illustrated in FIG. 10, the coupling shaft portion 141 is a columnar shaft. The coupling shaft portion 141 is formed so as to pass through the head frame 20 in the right-and-left direction L3, and is supported on the one side wall portion 60 and the another side wall portion 61 so as to be rotatable. A center axis of the coupling shaft portion 141 matches with the swing axis O2.

[0089] Further, the one lock arm 140 and the another lock arm 150 are coupled to both end portions of the coupling shaft portion 141, respectively. With this configuration, the one lock arm 140 and the another lock arm 150 are swingable about the swing axis O2 in a synchronized manner with the coupling shaft portion 141 interposed therebetween.

[0090] The coupling shaft portion 141 is located more on the back side BK in the front-and-back direction L2 than the receiving grooves 62.

[0091] In this embodiment, there is exemplified a case in which the pair of lock arms 140 and 150 arranged in the right-and-left direction L3 is coupled to each other through intermediation of the coupling shaft portion 141 so as to be swingable, but the present invention is not limited to this case. For example, the pair of lock arms 140 and 150 and the coupling shaft portion 141 may be formed of one member by being integrally formed through bending of, for example, a single metal plate.

[0092] The one lock arm 140 is described in detail. As illustrated in FIG. 13, the lock arm 140 is arranged more on the upper side than the receiving groove 62, and is formed so as to extend in the front-and-back direction L2. A proximal end portion of the lock arm 140 is coupled to the end portion of the coupling shaft portion 141. A lock claw portion 145 is formed at a distal end portion of the lock arm 140, and is configured to cover the platen bearing 51 received in the receiving groove 62 from the opening 62a side of the receiving groove 62. With this configuration, the lock claw portion 145 and the groove bottom portion 62b of the receiving groove 62 can hold the platen bearing 51 so as to sandwich the platen bearing 51 therebetween.

[0093] An outer surface of the lock claw portion 145 is formed as an inclined guide surface 145b configured to guide the platen bearing 51 into the receiving groove 62 when the platen bearing 51 is set in the receiving groove 62. The guide surface 145b is formed so as to define a V-shaped groove together with the guide protrusion 63 on the receiving groove 62 side in side view.

[0094] Moreover, an engagement wall portion 146 is formed at the proximal end portion of the lock arm 140 so as to protrude toward the outer side in the right-and-left direction L3. The engagement wall portion 146 is a wall portion with which the lever projecting portion 112 (see FIG. 14) formed on the operation lever 28 is brought into contact after the pushing-up cam 113 swings the swing plate 90 through the engagement pin 95 when the operation lever 28 is operated from the lock position P3

toward the unlock position P5.

[0095] Thus, the entire lock arm 140 is pushed by the lever projecting portion 112 through the engagement wall portion 146 along with the operation of the operation lever 28, thereby being swung about the swing axis O2 in the clockwise direction. That is, the lock arm 140 is configured so as to be swung upward about the swing axis O2 from the platen unit 6 side toward the head unit 5 side. Accordingly, the lock claw portion 145 of the lock arm 140 is gradually moved away from the platen bearing 51 along with the operation of the operation lever 28. When the operation lever 28 reaches the unlock position P5, the lock claw portion 145 is retreated from the receiving groove 62 toward the head unit 5 side, thereby opening the opening 62a. In this manner, the lock arm 140 allows disengagement of the platen bearing 51 from the receiving groove 62.

[0096] As illustrated in FIG. 5, FIG. 11, and FIG. 13, the platen lock mechanism 30 includes a disengagement arm 200. In this embodiment, the disengagement arm 200 is provided on the side wall portion 60 on one side in the right-and-left direction L3. The disengagement arm 200 is provided so as to be swingable about an arm support shaft (third swing shaft) 210 protruding from the side wall portion 60 toward the outer side in the right-and-left direction L3. The arm support shaft 210 extends in the right-and-left direction L3, and is arranged in parallel to the platen roller 45.

[0097] The arm support shaft 210 is arranged at a position different from the coupling shaft portion 141, which supports the lock arm 140 in a swingable manner, and from the lever support shaft 106, which supports the operation lever 28 in a swingable manner. As illustrated in FIG. 11, at least a part of the arm support shaft 210 overlaps a maximum outer diameter portion of the platen roller 45 in the front-and-back direction L2. Moreover, at least a part of the arm support shaft 210 overlaps the platen bearing 51 in the front-and-back direction L2. Further, the arm support shaft 210 is arranged on a side opposite to the lever support shaft 106 across the platen bearing 51 in the up-and-down direction L1.

[0098] As illustrated in FIG. 5, the disengagement arm 200 is arranged adjacent to the operation lever 28 in the right-and-left direction L3. The disengagement arm 200 is arranged on the inner side in the right-and-left direction L3 than the operation lever 28. As illustrated in FIG. 13, the disengagement arm 200 includes an arm main body 201, a boss 203, and a disengagement pressing surface 205.

[0099] The arm main body 201 has a plate shape along a plane orthogonal to the right-and-left direction L3. The arm support shaft 210 passes through the arm main body 201 in the right-and-left direction L3, and the arm main body 201 is thus provided so as to be freely swingable about the arm support shaft 210.

[0100] The boss 203 is formed on the arm main body 201 on a radially outer side of the arm support shaft 210. The boss 203 protrudes from the arm main body 201 toward the outer side in the right-and-left direction L3, that is, toward the operation lever 28 side. As illustrated in FIG. 11 and FIG. 14, a boss receiving groove 118 is formed in the operation lever 28, and allows the boss 203 to be inserted therein. The boss receiving groove 118 is recessed so as to extend in a tangential direction of an imaginary circle having a center on the arm support shaft 210 and having a curvature radius between the arm support shaft 210 and the boss 203. The boss receiving groove 118 includes an abutment surface 118f that comes into abutment against an outer peripheral surface of the boss 203 when the operation lever 28 is pivoted from the lock position P3 toward the unlock position P5. The abutment surface 118f of the operation lever 28 is formed so as to come into abutment against the outer peripheral surface of the boss 203 when the operation lever 28 is moved from the lock position P3 toward the unlock position P5 by a predetermined angle. The operation lever 28 reaches a boss abutment position P6 (see FIG. 17) at which the abutment surface 118f comes into abutment against the outer peripheral surface of the boss 203 at a timing at which, for example, the lock arm 140 is retreated from a movement locus given when the platen bearing 51 is disengaged from the receiving groove 62. The timing at which the operation lever 28 reaches the boss abutment position P6 is not limited thereto. It is only required that the operation lever 28 reach the boss abutment position P6 under a state in which the lock arm 140 at least begins to shift from the lock state to the unlock state and the lock arm 140 does not restrain the platen bearing 51 from being disengaged from the receiving groove 62. When the operation lever 28 is further pivoted toward the unlock position P5, the boss 203 on the arm main body 201 is pressed by the abutment surface 118f so that the arm main body 201 is pivoted about the arm support shaft 210.

[0101] Here, as illustrated in FIG. 11, the boss 203 is arranged on a side opposite to the platen bearing 51 across the arm support shaft 210 in the up-and-down direction L1. With this configuration, a large distance can be secured between the lever support shaft 106, about which the operation lever 28 is rotated, and the boss 203. Therefore, when the operation lever 28 is pivoted from the lock position P3 toward the unlock position P5, the operation lever 28 can efficiently press the boss 203.

[0102] As illustrated in FIG. 13, the disengagement pressing surface 205 is formed on the arm main body 201 on a side opposite to the boss 203 across the arm support shaft 210 in the up-and-down direction L1. The disengagement pressing surface 205 is formed to be directed toward the front side FW. When the arm main body 201 is pivoted about the arm support shaft 210, the disengagement pressing surface 205 presses, toward the front side FW, the platen bearing 51 received in the receiving groove 62. In this case, it is preferred that the disengagement pressing surface 205 be formed so as to be as parallel as possible to the groove bottom portion 62b under a state in which the disengagement pressing

surface 205 is held in abutment against the platen bearing 51 that is held in contact with the groove bottom portion 62b of the receiving groove 62. That is, it is preferred that the disengagement pressing surface 205 be formed so as to extend in the up-and-down direction L1 under a state in which the disengagement pressing surface 205 is held in abutment against the platen bearing 51 that is held in contact with the groove bottom portion 62b of the receiving groove 62. With this configuration, a pressing force applied by the disengagement pressing surface 205 can be efficiently transmitted to the platen bearing 51 in the receiving groove 62.

[0103] Along with pivoting of the operation lever 28 from the lock position P3 toward the unlock position P5, the disengagement arm 200 described above is pivoted about the arm support shaft 210, and presses the platen bearing 51 from an inside of the receiving groove 62 toward the opening 62a side, thereby disengaging the platen bearing 51 from the receiving groove 62.

[0104] As illustrated in FIG. 5, when the platen unit 6 in this embodiment is combined with the head unit 5, the driven gear 52 is capable of meshing with a platen gear train mechanism (not shown) arranged on the another side wall portion 61 side of the head frame 20. The platen gear train mechanism is operated by receiving power from a driving motor (not shown) configured to drive the platen roller 45, thereby playing a role of transmitting the power to the driven gear 52. Thus, when the head unit 5 and the platen unit 6 are combined with each other, the platen roller 45 is rotated, thereby being capable of feeding the recording sheet P.

[0105] Next, description is made of actions of the thermal printer 1 configured as described above. First, description is made of a case in which the head unit 5 and the platen unit 6 are combined with each other. In this case, as illustrated in FIG. 2, after the recording sheet P having a roll shape is loaded into and set in the recording sheet receiving portion 16 of the casing 2, through a closing operation of the printer cover 3, the platen unit 6 can be brought close to the head unit 5. Then, as illustrated in FIG. 1, when the printer cover 3 is completely closed, the head unit 5 and the platen unit 6 can be combined with each other under a state in which the recording sheet P is sandwiched between the thermal head 25 and the platen roller 45.

[0106] Along with the closing operation of the printer cover 3, the platen bearings 51 of the platen roller 45 are guided by the guide protrusions 63 of the receiving grooves 62 and the guide surfaces 145b of the lock claw portions 145 so as to be fitted into the receiving grooves 62, and then are received in the receiving grooves 62.

[0107] After being pushed by the platen bearing 51, each of the lock arms 140 and 150 is swung about the swing axis O2 by the urging force of a return spring (not shown) to be returned to the original position, and then presses the platen bearing 51 from the opening 62a side of the receiving groove 62 through use of the lock claw portion 145. Thus, as illustrated in FIG. 5, through use of the pair of lock arms 140 and 150, the pair of platen bearings 51 respectively received in the pair of receiving grooves 62 can be pressed, thereby being capable of preventing the platen bearings 51 from slipping out of the receiving grooves 62. Therefore, through use of the platen lock mechanism 30, the platen roller 45 can be maintained in the lock state. In the closing operation of the printer cover 3, it is preferred that the abutment surface 118f be not brought into abutment against the boss 203 (the operation lever 28 does not reach the boss abutment position P6 described above) under a state in which the lock arms 140 and 150 are pushed by the platen bearings 51. With this configuration, in the closing operation of the printer cover 3, movement of the disengagement arm 200 can be prevented. However, the disengagement arm 200 may be slightly moved when there is adopted a configuration in which the platen bearing 51 is not brought into abutment against the disengagement pressing surface 205 before each of the lock arms 140 and 150 is returned by the return spring.

[0108] In this manner, combination between the head unit 5 and the platen unit 6 can be locked. At the same time, the printer cover 3 can be locked to the casing 2. When the head unit 5 and the platen unit 6 are combined with each other, the thermal head 25 and the platen roller 45 are held in press-contact with each other by predetermined pressure under a state of sandwiching the recording sheet P therebetween. Further, after passing through between the movable blade 26 and the fixed blade 46, the recording sheet P is drawn out of the casing 2 through the delivery port 18. Moreover, the driven gear 52 of the platen roller 45 meshes with the platen gear train mechanism on the head unit 5 side.

[0109] Next, a case of performing printing of various kinds of information on the recording sheet P is briefly described. In this case, through drive of the driving motor, the driven gear 52 is rotated through the platen gear train mechanism. Thus, the platen roller 45 can be rotated, and the recording sheet P sandwiched between the thermal head 25 and the platen roller 45 can be fed toward the delivery port 18. Further, simultaneously with this, a control signal associated with printing data is output, thereby causing the heating elements of the thermal head 25 to generate heat as appropriate. In this manner, for example, various characters and figures can be clearly printed on the recording sheet P to be fed. A printed part of the recording sheet P is caused to pass through between the fixed blade 46 and the movable blade 26.

[0110] Next, a case of cutting the recording sheet P is briefly described. In this case, through drive of the driving motor 75, the drive intermediate wheel 76 illustrated in FIG. 9 is rotated. Thus, the drive pinion 78 can be rotated through the double intermediate wheel 77 (including the large-diameter intermediate wheel 77a and the small-diameter intermediate wheel 77b), and the drive rack 71 can be moved together with the return rack 130 in the direction indicated by the arrow "F1". Accordingly, the movable blade 26 can be moved from the standby posi-

tion P2 to the cutting position P1, thereby being capable of cutting the recording sheet P while sandwiching the recording sheet P together with the fixed blade 46 as illustrated in FIG. 8. As a result, a cut piece of the recording sheet P can be used as, for example, a receipt or a ticket.

[0111] After cutting of the recording sheet P, the driving motor 75 is rotated reversely. Thus, the drive pinion 78 can be rotated reversely through the drive intermediate wheel 76 and the double intermediate wheel 77, and as illustrated in FIG. 9, the drive rack 71 can be moved together with the return rack 130 in the direction indicated by the arrow "F2". Accordingly, the movable blade 26 can be moved and returned from the cutting position P1 to the standby position P2.

[0112] Further, at the time of cutting of the recording sheet P, meshing between the return pinion 131 and the gear tooth portions 132b of the return gear 132 is released, and hence the return pinion 131 is allowed to idly rotate. Accordingly, when the movable blade 26 is moved to the cutting position P1, even when the rack teeth 130a and the rack tooth 130b of the return rack 130 mesh with the return pinion 131, the return pinion 131 can be idly rotated. Therefore, without being influenced by the return pinion 131, the drive rack 71 and the return rack 130 can be moved, and cutting of the recording sheet P can be performed.

[0113] Next, description is made of a series of actions in a case of unlocking the platen unit 6 so as to open the printer cover 3 while removing paper jam through the operation of the operation lever 28 when paper jam occurs between the movable blade 26 and the fixed blade 46. When paper jam occurs during cutting of the recording sheet P, as illustrated in FIG. 15, against the urging force of the second urging member 120, the operation lever 28 is operated from the lock position P3 toward the unlock position P5 side. Thus, the operation lever 28 can be moved so as to rotate about the rotation axis O1 in the counterclockwise direction. Further, along with movement of the operation lever 28, the planetary gear 134 meshing with the internal gear 135 can be revolved about the rotation axis O1 in the counterclockwise direction while being rotated about the planetary shaft 111 in the clockwise direction. Still further, along with rotation of the planetary gear 134, the sun gear 133 and the return gear 132 can be rotated about the rotation axis O1 in the counterclockwise direction.

[0114] As illustrated in FIG. 16, when the operation lever 28 is rotated in the counterclockwise direction, the pushing-up cam 113 is brought into contact with the engagement pin 95, and thus applies an external force to the swing plate 90 through the engagement pin 95. Accordingly, through further operation of the operation lever 28, the swing plate 90 can be pushed up by the pushing-up cam 113, and the swing plate 90 can be swung about the pinion support shaft 81 in the counterclockwise direction against the urging force of the first urging member 100.

[0115] Thus, the double intermediate wheel 77 mounted to the swing plate 90 can be moved away from the drive intermediate wheel 76, and meshing between the double intermediate wheel 77 and the drive intermediate wheel 76 can be released. Therefore, the position of the operation lever 28 at this time corresponds to the meshing release position P4.

[0116] Further, simultaneously with swing of the swing plate 90, the sun gear 133 and the return gear 132 are rotated in the counterclockwise direction along with the operation of the operation lever 28. Accordingly, at a timing at which meshing between the double intermediate wheel 77 and the drive intermediate wheel 76 is released, the first gear tooth portion 132b of the return gear 132 can be meshed with the return pinion 131. Thus, the return pinion 131 can be rotated in the clockwise direction.

[0117] Therefore, when the operation lever 28 is further operated from the meshing release position P4 illustrated in FIG. 16 toward the unlock position P5 side, the other gear tooth portions 132b of the return gear 132 can be successively meshed with the return pinion 131, thereby being capable of continuously rotating the return pinion 131 in the clockwise direction. Accordingly, the return rack 130 meshing with the return pinion 131 can be moved in the direction indicated by the arrow "F2", and the movable blade 26 can be forcibly returned from the cutting position P1 to the standby position P2. Thus, a state of the movable blade 26 overlapping the fixed blade 46 can be cancelled, and paper jam can be removed.

[0118] When the movable blade 26 is returned to the standby position P2 through use of the return pinion 131, the drive rack 71 is also moved together with the return rack 130, and hence the drive pinion 78 is rotated. At this time, as described above, meshing between the double intermediate wheel 77 and the drive intermediate wheel 76 is released, and hence the drive pinion 78 and the double intermediate wheel 77, which meshes with the drive pinion 78, can be caused to idly rotate. Accordingly, without being influenced by the drive pinion 78 and the double intermediate wheel 77, the movable blade 26 can be returned to the standby position P2.

[0119] When the movable blade 26 is returned to the standby position P2, the rack teeth 130a and the rack tooth 130b of the return rack 130 are disengaged from the return pinion 131. Therefore, at a stage at which the movable blade 26 is returned to the standby position P2 and paper jam is removed, meshing between the rack teeth 130a and the rack tooth 130b of the return rack 130, and the return pinion 131 can be released.

[0120] Further, at a timing at which the movable blade 26 is returned to the standby position P2, the lever projecting portion 112 of the operation lever 28 is brought into contact with the engagement wall portion 146 of the one lock arm 140, and thus applies an external force to the lock arm 140 through the engagement wall portion 146. Thus, the lock arm 140 can be swung about the swing axis O2 from the platen unit 6 side toward the head unit 5 side. Accordingly, along with swing of the lock arm

140, the lock claw portion 145 can be gradually moved away from the platen bearing 51.

[0121] Further, as illustrated in FIG. 17, at a point in time when the operation lever 28 is pivoted from the lock position P3 toward the unlock position P5 by a predetermined angle and reaches the boss abutment position P6, the abutment surface 118f comes into abutment against the outer peripheral surface of the boss 203. When the operation lever 28 is further pivoted toward the unlock position P5, the boss 203 formed on the radially outer side of the arm support shaft 210 is pressed, and the disengagement arm 200 is pivoted about the arm support shaft 210, thereby pressing the platen bearing 51 from the inside of the receiving groove 62 toward the opening 62a side.

[0122] As illustrated in FIG. 18, when the operation lever 28 is pivoted to the unlock position P5, the lock arm 140 is pivoted from the lock state and brought to the unlock state, and the disengagement arm 200 disengages the platen bearing 51 from the receiving groove 62. At this time, the disengagement arm 200 presses the platen bearing 51 until a roller center of the platen roller 45 is moved more toward the opening 62a side than the apex portion 63a of the guide protrusion 63.

[0123] As described above, when the operation lever 28 is brought to the unlock position P5, the platen roller 45 can be switched to the unlock state through use of the platen lock mechanism 30, thereby being capable of detaching the head unit 5 and the platen unit 6 from each other. As a result, the printer cover 3 to which the platen unit 6 is mounted can be opened.

[0124] As described above, according to the printing unit 4 and the thermal printer 1 in this embodiment, when the operation lever 28 is pivoted from the lock position P3 toward the unlock position P5, along with this pivoting, the disengagement arm 200 is pivoted, thereby being capable of disengaging the platen bearing 51 from the receiving groove 62. In this configuration, the lock arm 140 and the disengagement arm 200 are provided as separate components. Accordingly, it is only required that the lock arm 140 achieve (only) a function of locking the platen roller 45 under a state in which the platen bearing 51 is fitted in the receiving groove 62 without having a function of disengaging the platen bearing 51 from the receiving groove 62. Further, it is only required that the disengagement arm 200 achieve (only) a function of disengaging the platen bearing 51 from the receiving groove 62 without having a function of locking the platen roller 45 under a state in which the platen bearing 51 is fitted in the receiving groove 62. Therefore, for each of the lock arm 140 and the disengagement arm 200, a degree of freedom in design is increased, and an optimum design is easily made. As a result, while both of the function of locking the platen roller 45 and the function of unlocking the platen roller 45 are achieved, a design of each portion can be made with a high degree of freedom.

[0125] Moreover, when seen from the right-and-left direction L3, at least a part of the arm support shaft 210 overlaps the maximum outer diameter portion of the platen roller 45 in the front-and-back direction L2. With this configuration, when the platen bearing 51 is disengaged from the opening 62a of the receiving groove 62, the disengagement arm 200 can efficiently press the platen bearing 51 toward the opening 62a located above the platen bearing 51.

[0126] Further, when the operation lever 28 is pivoted from the lock position P3 toward the unlock position P5, the abutment surface 118f comes into abutment against the outer peripheral surface of the boss 203. In this manner, the boss 203 formed on the radially outer side of the arm support shaft 210 is pressed, and the disengagement arm 200 is pivoted about the arm support shaft 210, thereby being capable of disengaging the platen bearing 51 from the receiving groove 62.

[0127] Moreover, when the operation lever 28 is moved from the lock position P3 toward the unlock position P5 by a predetermined angle, the abutment surface 118f of the operation lever 28 comes into abutment against the outer peripheral surface of the boss 203. With this configuration, it is not required to adopt a configuration in which the disengagement arm 200 is pivoted concurrently with the start of pivoting of the operation lever 28 from the lock position P3 toward the unlock position P5. Therefore, a pivoting action of the operation lever 28 and a pivoting action of the disengagement arm 200 can be performed at timings that are suitable for the actions, respectively. Also in this point, degrees of freedom in design for the operation lever 28 and the disengagement arm 200 can be increased.

[0128] Further, the boss 203 is arranged on a side opposite to the platen bearing 51 across the arm support shaft 210. With this configuration, when the abutment surface 118f of the operation lever 28 is brought into abutment against the boss 203, a pressing force applied to the boss 203 by the operation lever 28 can be efficiently transmitted to the platen bearing 51.

[0129] Further, the lever support shaft 106 is arranged on a side opposite to the arm support shaft 210 across the platen bearing 51. With this configuration, a large distance can be secured between the lever support shaft 106, about which the operation lever 28 is rotated, and the boss 203. Further, when the operation lever 28 is pivoted from the lock position P3 toward the unlock position P5, the operation lever 28 can efficiently press the boss 203. Therefore, an operating force required when the operation lever 28 is pivoted to disengage the platen bearing 51 from the receiving groove 62 is reduced.

[0130] Further, when the platen bearing 51 is disengaged from the receiving groove 62 through use of the disengagement arm 200, the disengagement arm 200 considerably and forcibly pushes the platen bearing 51 so as to move the roller center of the platen roller 45 more toward the opening 62a side than the apex portion 63a of the guide protrusion 63. Accordingly, the disengagement arm 200 pushes the platen bearing 51 to a position near the opening 62a of the receiving groove 62, thereby

being capable of shifting the platen bearing 51 to an almost disengaged state. Thus, work of detaching the head unit 5 and the platen unit 6 from each other can be performed more easily.

[0131] The embodiment of the present invention has been described above. However, the embodiment is presented as an example and is not intended to limit the scope of the invention. The embodiment may be implemented in other various modes, and various kinds of omissions, replacements, and modifications can be made without departing from the scope of the invention as defined by the appended claims. The embodiments and modification examples thereof include, for example, those which can be easily assumed by a person skilled in the art, those which are substantially the same, and those which fall within a scope of equivalence.

[0132] For example, in the above-mentioned embodiment, the disengagement arm 200 is provided to correspond to the platen bearing 51 on one side in the right-and-left direction L3. However, the disengagement arm 200 may be provided to correspond to the platen bearing 51 on each side in the right-and-left direction L3.

[0133] Moreover, in the above-mentioned embodiment, both of the pair of platen bearings 51 are pressed through use of the pair of lock arms 140 and 150, but the present invention is not limited to this case. There may also be adopted a configuration in which at least one of the platen bearings 51 is pressed through use of one lock arm.

[0134] Further, for example, shapes and pivot center positions of the disengagement arm 200 and the lock arm 140 may be modified as appropriate in accordance with a function of the disengagement arm 200. For example, in the above-mentioned embodiment, at least a part of the arm support shaft 210 overlaps the maximum outer diameter portion of the platen roller 45 in the front-and-back direction L2, but the present invention is not limited thereto. The arm support shaft 210 may be arranged so as to be prevented from overlapping the maximum outer diameter portion of the platen roller 45 in the front-and-back direction L2. Further, for example, the arm support shaft 210 may be arranged on a side opposite to the platen bearing 51 across the coupling shaft portion 141.

[0135] Further, in the above-mentioned embodiment, the disengagement arm 200 is configured to be pivoted through an action of the operation lever 28, but the present invention is not limited thereto. For example, the disengagement arm 200 may be pivoted through an action of the lock arm 140. That is, the disengagement arm 200 may be configured to be connected to the lock arm 140. In this case, as long as the lock arm 140 does not restrain the platen bearing 51 from being disengaged from the receiving groove 62, movement of the disengagement arm 200 may be started at the same timing as that of the start of movement of the lock arm 140, or movement of the disengagement arm 200 may be started with a time difference from the start of movement of the lock arm 140.

[0136] Still further, in the above-mentioned embodiment, description is made of the example in which the operation lever 28 is operated in synchronization with a pivoting action of the lever 19 provided on the casing 2, but the present invention is not limited to this case. For example, there may also be adopted a configuration in which the distal end portion of the operation lever 28 is exposed to the outside of the casing 2 so that the operation lever 28 can be operated directly from the outside of the casing 2.

Claims

1. A printing unit (4), comprising:

a head unit (5) including a thermal head (25) configured to perform printing on a recording sheet (P);
a platen unit (6) including:

a platen roller (45) which extends in a first direction, and is configured to feed the recording sheet (P); and
a pair of platen bearings (51) configured to support both end portions of the platen roller (45) in the first direction in a rotatable manner,
the platen unit (6) being detachably combined with the head unit (5) by allowing the pair of platen bearings (51) to be inserted in and disengaged from a pair of receiving grooves (62) formed in the head unit (5) and recessed toward one side in a second direction orthogonal to the first direction;

an operation lever (28) which is swingable about a first swing shaft (106) extending in the first direction between a lock position of locking the platen unit (6) to the head unit (5) and an unlock position of unlocking the platen unit (6) from the head unit (5);
a lock arm (140) which is swingable about a second swing shaft (141) extending in the first direction between a lock state of locking the platen roller (45) under a state in which the pair of platen bearings (51) are fitted in the pair of receiving grooves (62) when the operation lever (28) is at the lock position, and an unlock state of allowing the pair of platen bearings (51) to be disengaged from the pair of receiving grooves (62) through openings of the pair of receiving grooves (62) toward another side in the second direction when the operation lever (28) is at the unlock position; and
a disengagement arm (200) which is pivoted, along with pivoting of the operation lever (28)

from the lock position toward the unlock position, about a third swing shaft (210) extending in the first direction at a position different from the second swing shaft (141), and is configured to press at least one of the pair of platen bearings (51) from an inside of the receiving groove (62) toward the opening side so as to disengage the at least one of the pair of platen bearings (51) from the receiving groove (62).

2. The printing unit (4) according to claim 1, wherein at least a part of the third swing shaft (210) overlaps a maximum outer diameter portion of the platen roller (45) in the second direction.

3. The printing unit (4) according to claim 1 or 2,

wherein the operation lever (28) and the disengagement arm (200) are arranged adjacent to each other in the first direction,
wherein the disengagement arm (200) includes a boss (203) which is formed on the third swing shaft (210) on a radially outer side of the third swing shaft (210) and protrudes in the first direction toward the operation lever (28) side, and
wherein the operation lever (28) includes an abutment surface (118f) which comes into abutment against an outer peripheral surface of the boss (203) when the operation lever (28) is pivoted from the lock position toward the unlock position.

4. The printing unit (4) according to claim 3, wherein the abutment surface (118f) of the operation lever (28) comes into abutment against the outer peripheral surface of the boss (203) when the operation lever (28) is moved from the lock position toward the unlock position by a predetermined angle.

5. The printing unit (4) according to claim 3 or 4, wherein the boss (203) is arranged on a side opposite to the at least one of the pair of platen bearings (51) across the third swing shaft (210) in a third direction orthogonal to the first direction and the second direction.

6. The printing unit (4) according to claim 5, wherein the first swing shaft (106) is arranged on a side opposite to the third swing shaft (210) across the at least one of the pair of platen bearings (51) in the third direction.

7. The printing unit (4) according to any one of claims 1 to 6, wherein the third swing shaft (210) is arranged at a position closer to a center of the at least one of the pair of platen bearings (51) than the second swing shaft (141).

8. The printing unit (4) according to any one of claims 1 to 7,

wherein, on an inner surface of the receiving groove (62), an inclined guide protrusion (63) configured to guide the at least one of the pair of platen bearings (51) toward a groove bottom portion (62b) is formed so as to decrease an opening width from the opening side toward the groove bottom portion (62b) side of the receiving groove (62), and
wherein the disengagement arm (200) presses the at least one of the pair of platen bearings (51) so as to move a roller center of the platen roller (45) more toward the opening side than an apex portion (63a) of the guide protrusion (63).

9. The printing unit (4) according to any one of claims 1 to 8, wherein the disengagement arm (200) is provided to correspond to at least one of the pair of platen bearings (51) on one side in the first direction.

10. A thermal printer, comprising:

the printing unit (4) of any one of claims 1 to 9;
a printer main body (2) which includes a recording sheet receiving portion (16) configured to receive the recording sheet (P), and includes one of the head unit (5) and the platen unit (6) mounted thereto; and
a printer cover (3) which is coupled to the printer main body (2) so as to be pivotable, and includes another one of the head unit (5) and the platen unit (6) mounted thereto.

FIG.1

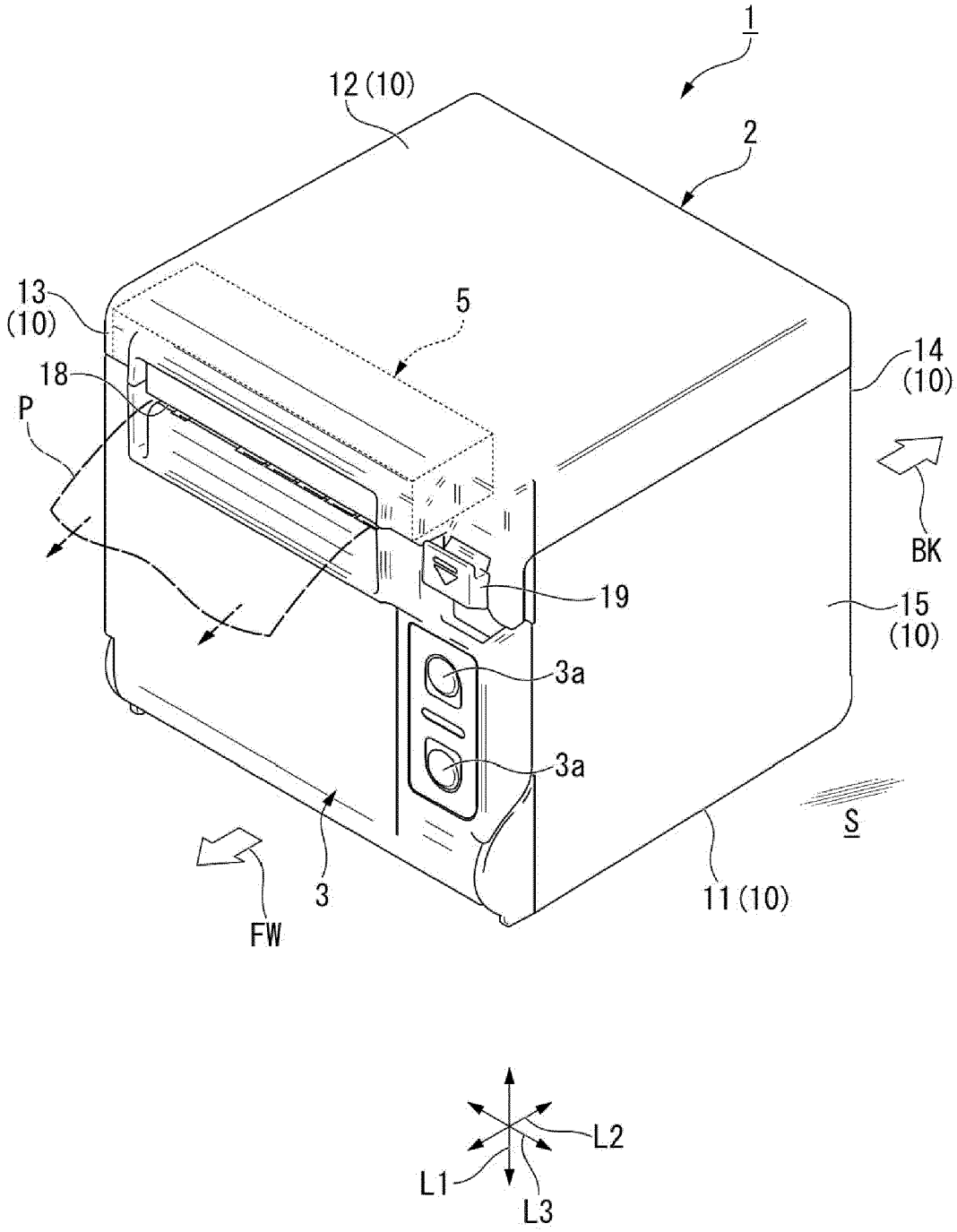


FIG.2

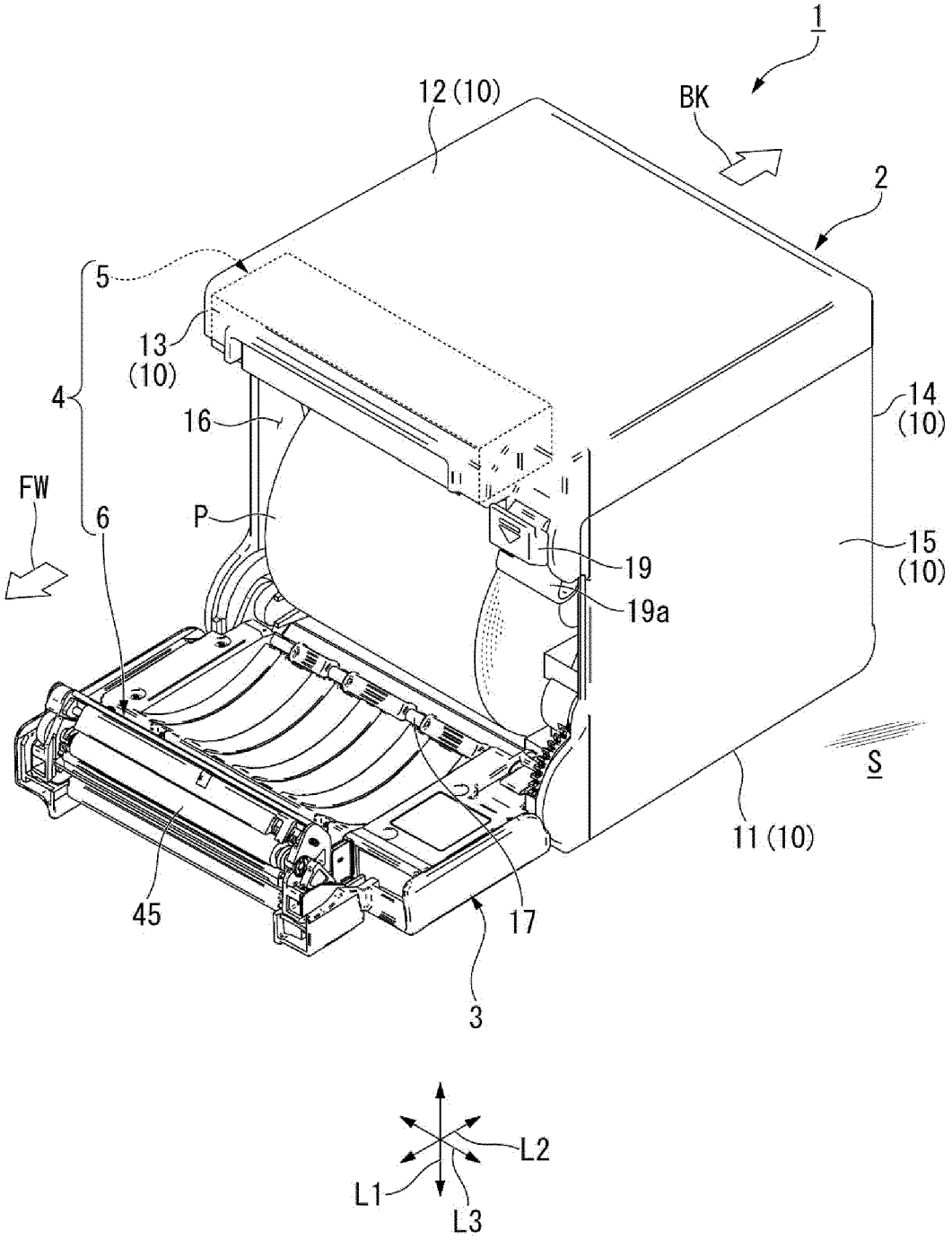


FIG.3

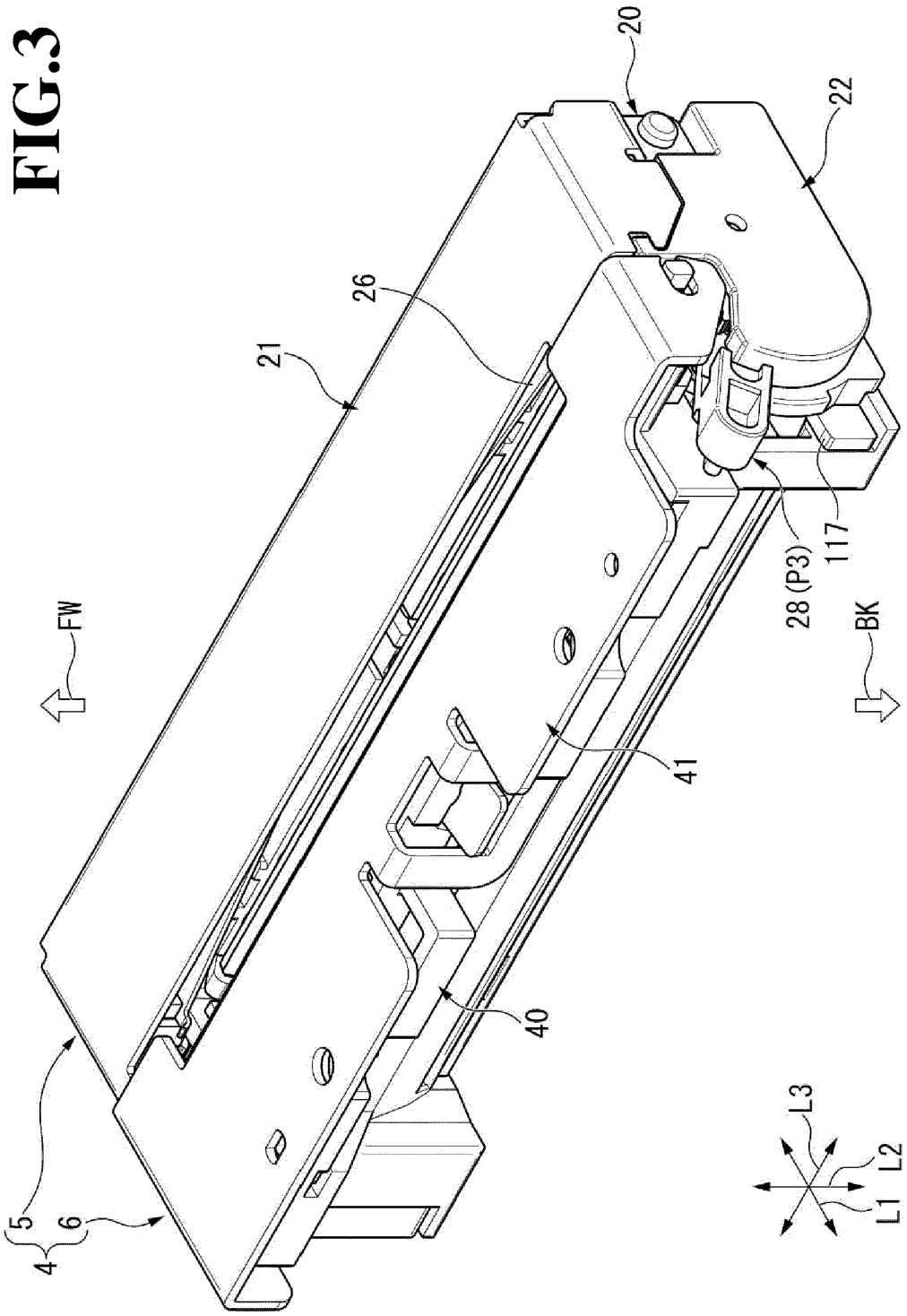


FIG.4

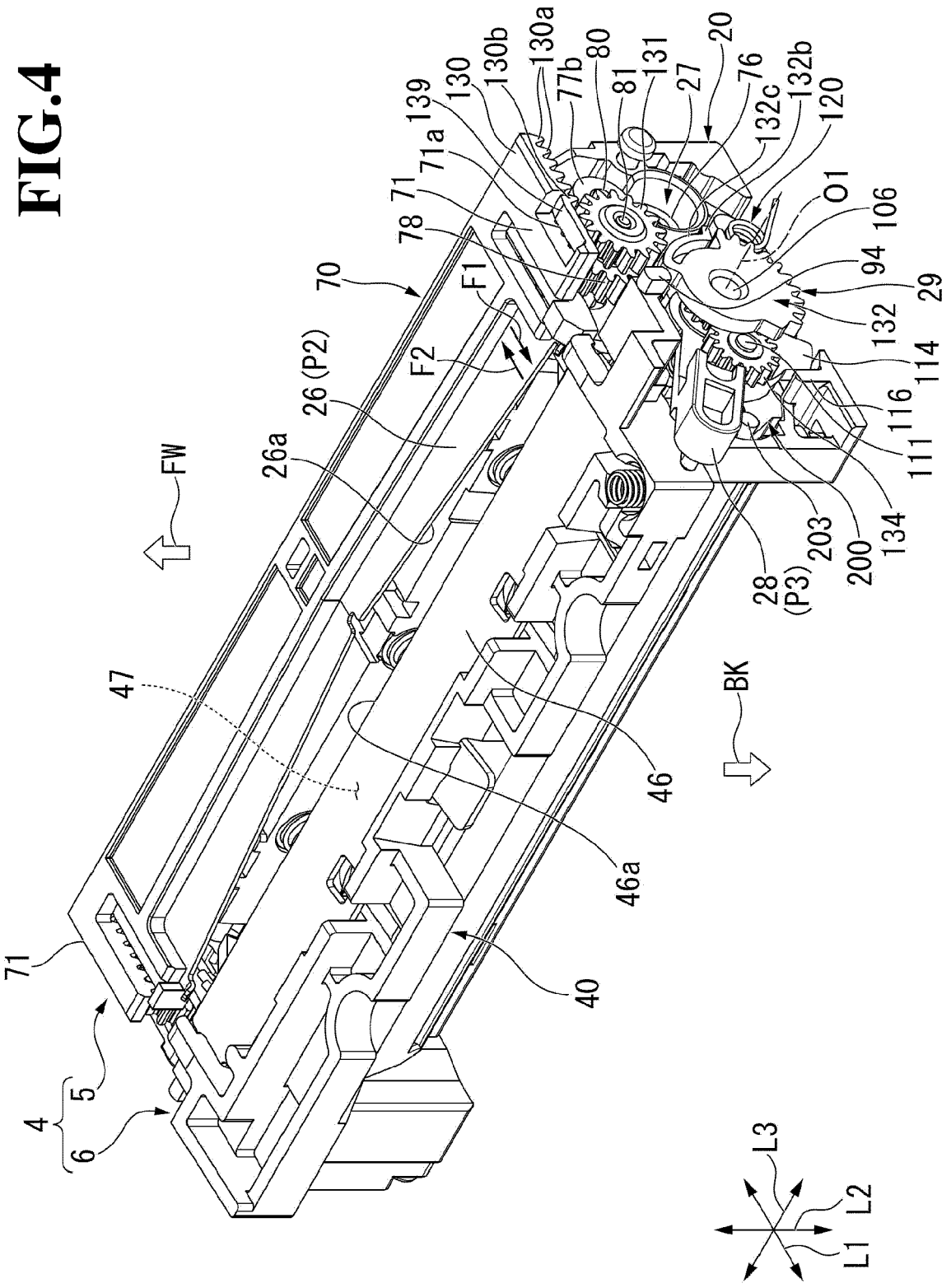

FW
BK
L1
L2
L3
4
5
6
71
40
46a
46
47
26a
26 (P2)
70
F1
F2
78
71
71a
139
130
130b
130a
77b
80
81
131
27
20
76
132c
132b
120
O1
106
94
29
132
114
116
111
134
200
203
28
(P3)

FIG.5

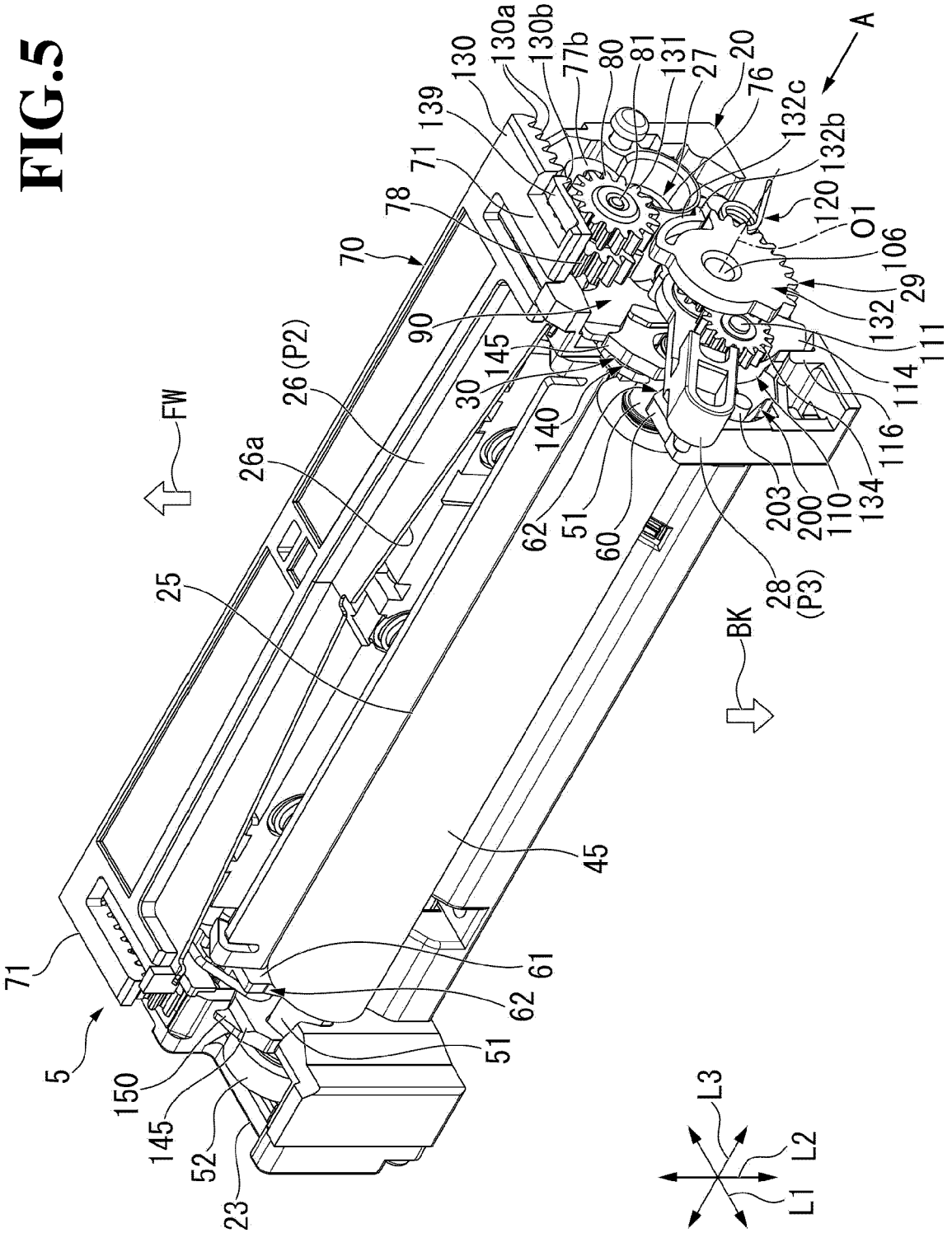

A
FW
BK
L1
L2
L3
5
23
25
26 (P2)
26a
28 (P3)
30
45
51
52
60
61
62
70
71
78
90
106
110
111
114
116
120
130
130a
130b
131
132
132b
132c
134
139
140
145
150
200
203
O1

FIG.6

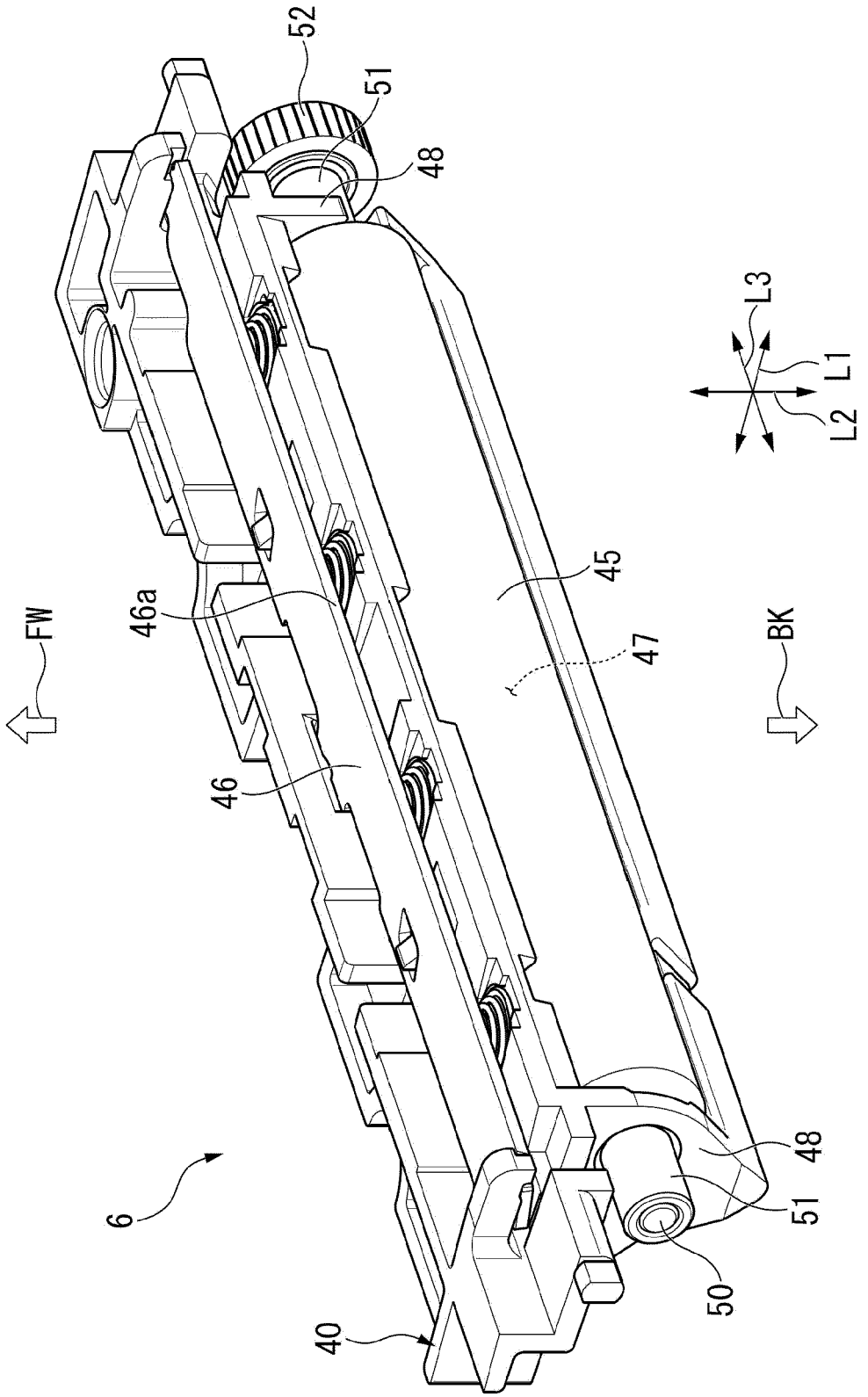


FIG.7

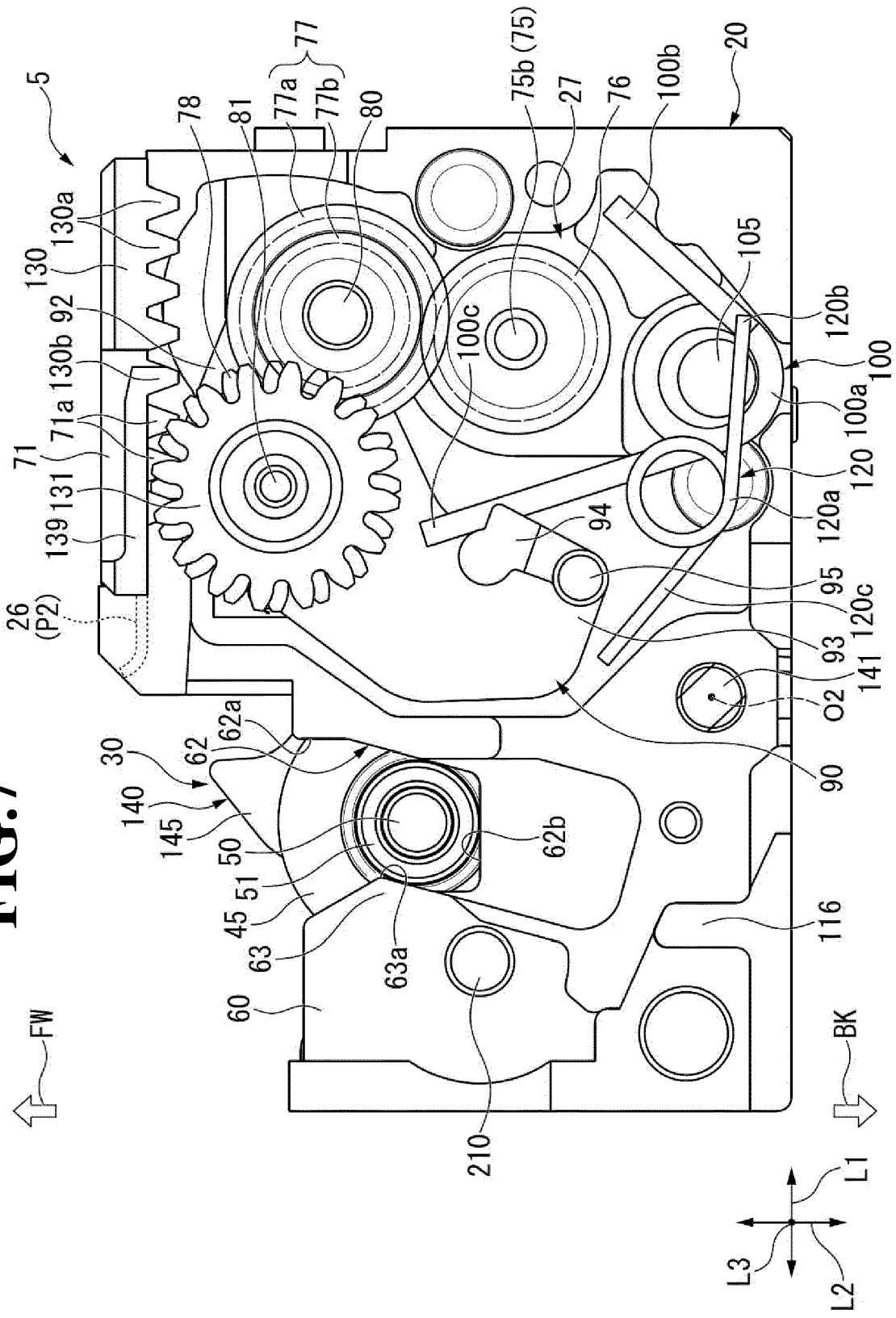

5
78
81
77a
77b
77
80
75b (75)
27
76
100b
20
130a
130
92
130b
71a
71
131
139
26
(P2)
100c
105
120b
100
100a
120
120a
94
95
120c
93
141
O2
90
62a
62
30
140
145
50
51
45
63
63a
62b
60
116
210
FW
BK
L1
L2
L3

FIG.8

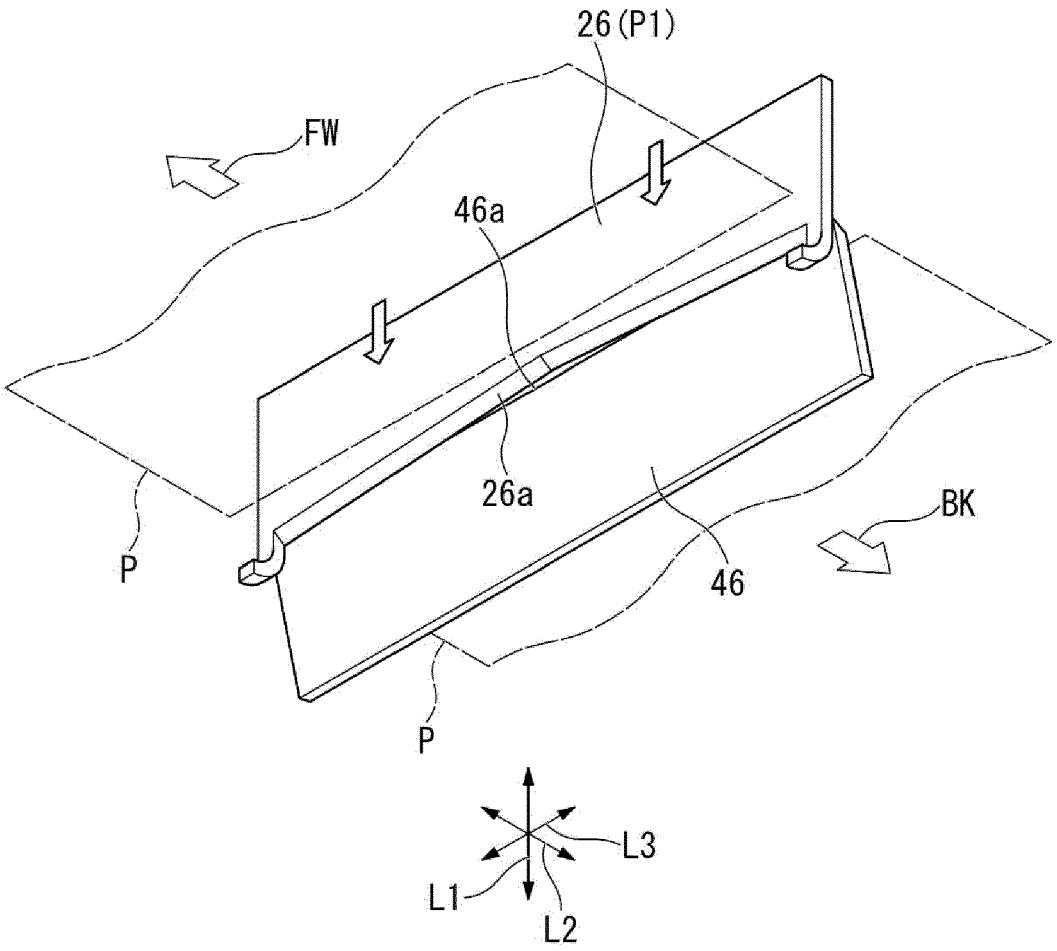


FIG.9

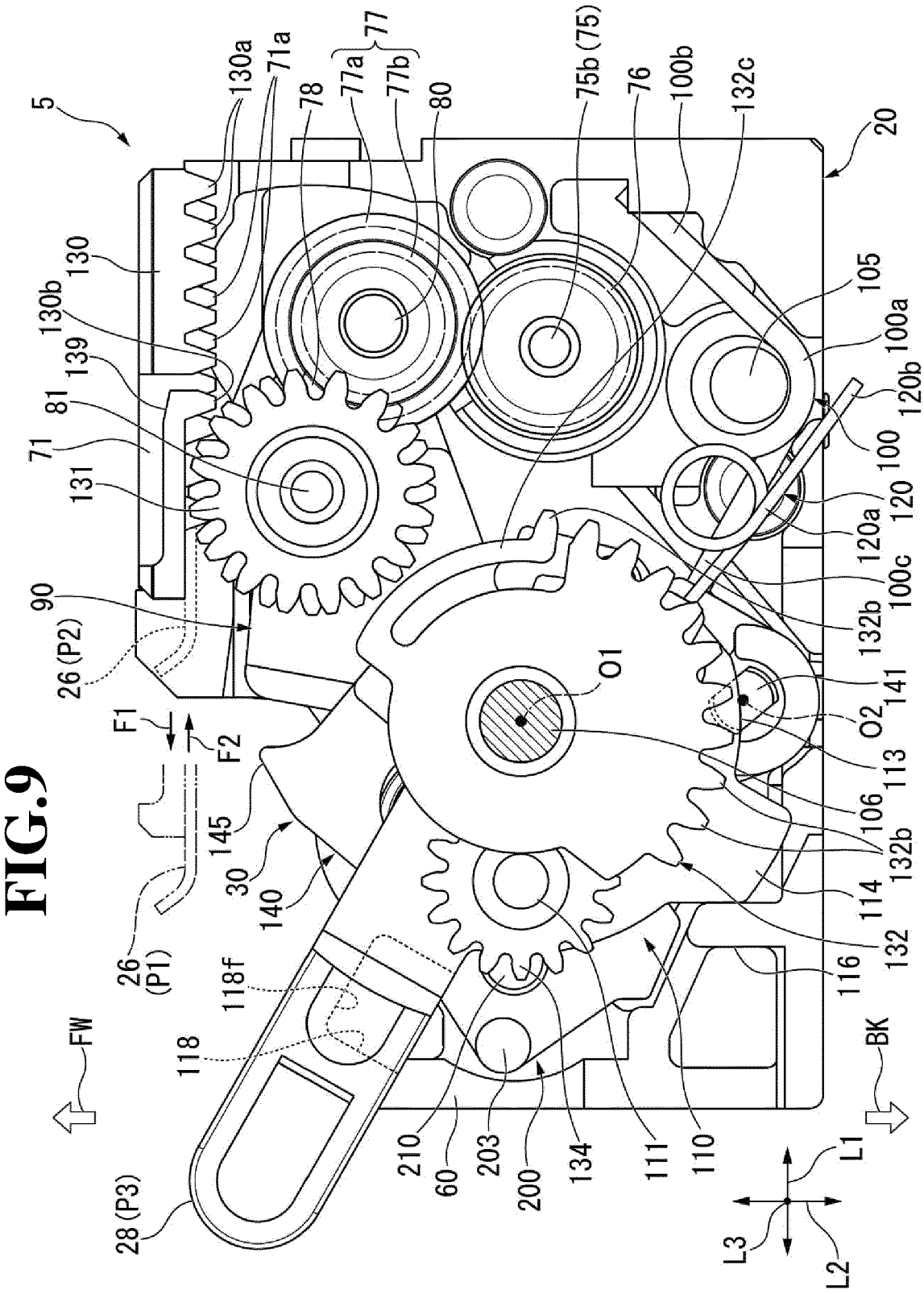

5
20
130a
71a
78
77a
77b
77
80
75b (75)
76
100b
132c
130
130b
139
81
71
131
105
100a
120b
100
120
120a
100c
132b
90
26 (P2)
F1
F2
O1
141
O2
113
106
132b
114
132
116
145
30
140
26 (P1)
118f
118
FW
BK
28 (P3)
210
60
203
200
134
111
110
L1
L3
L2

FIG.10

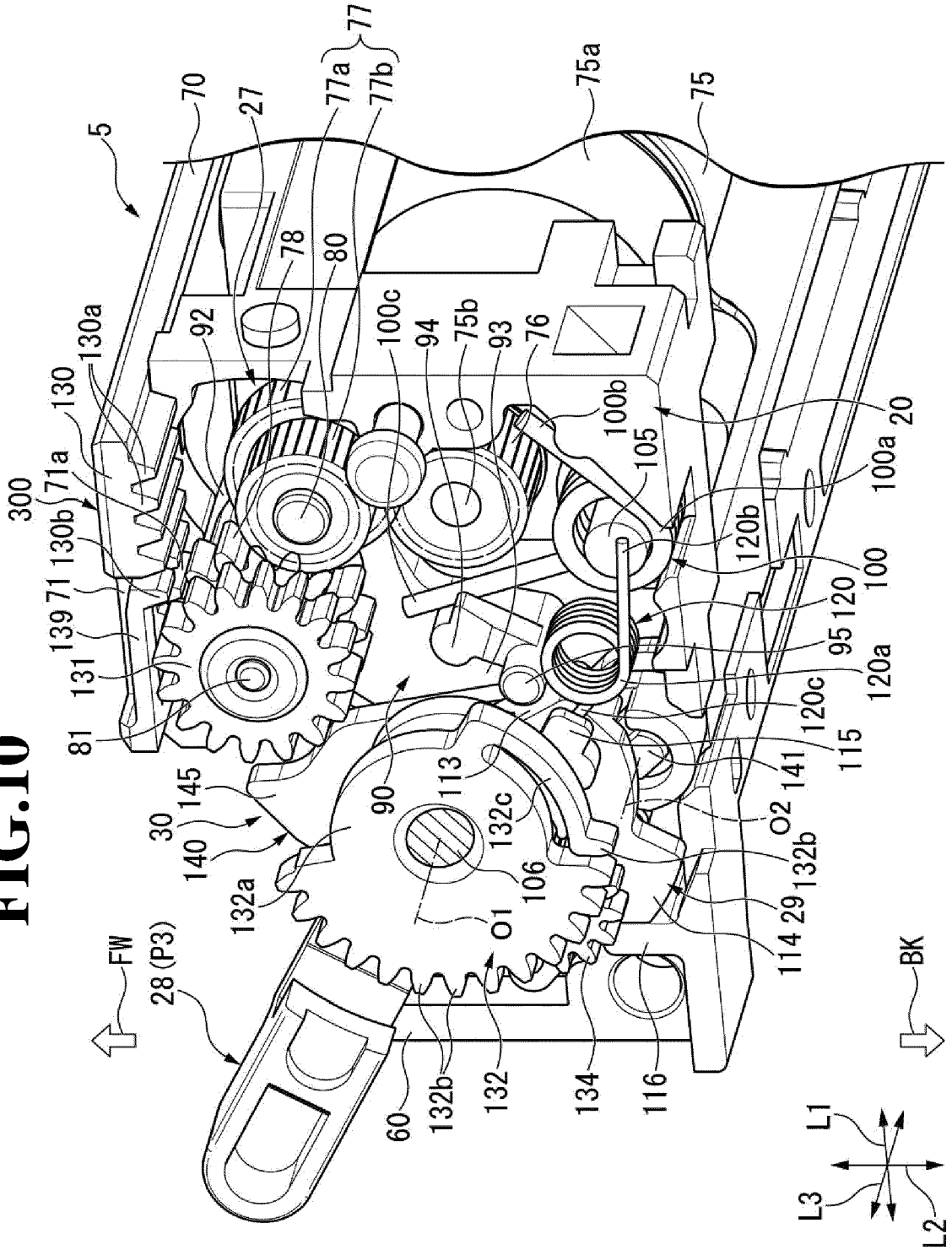

5
70
27
77a
77b
77
75a
75
78
80
92
100c
94
75b
93
76
100b
105
20
100a
120b
100
120
95
120a
120c
115
141
O2
132b
29
114
BK
116
134
132
132b
60
O1
106
132c
113
90
145
30
140
132a
28 (P3)
FW
300
71a
130b
71
139
131
81
130
130a
L1
L3
L2

FIG.11

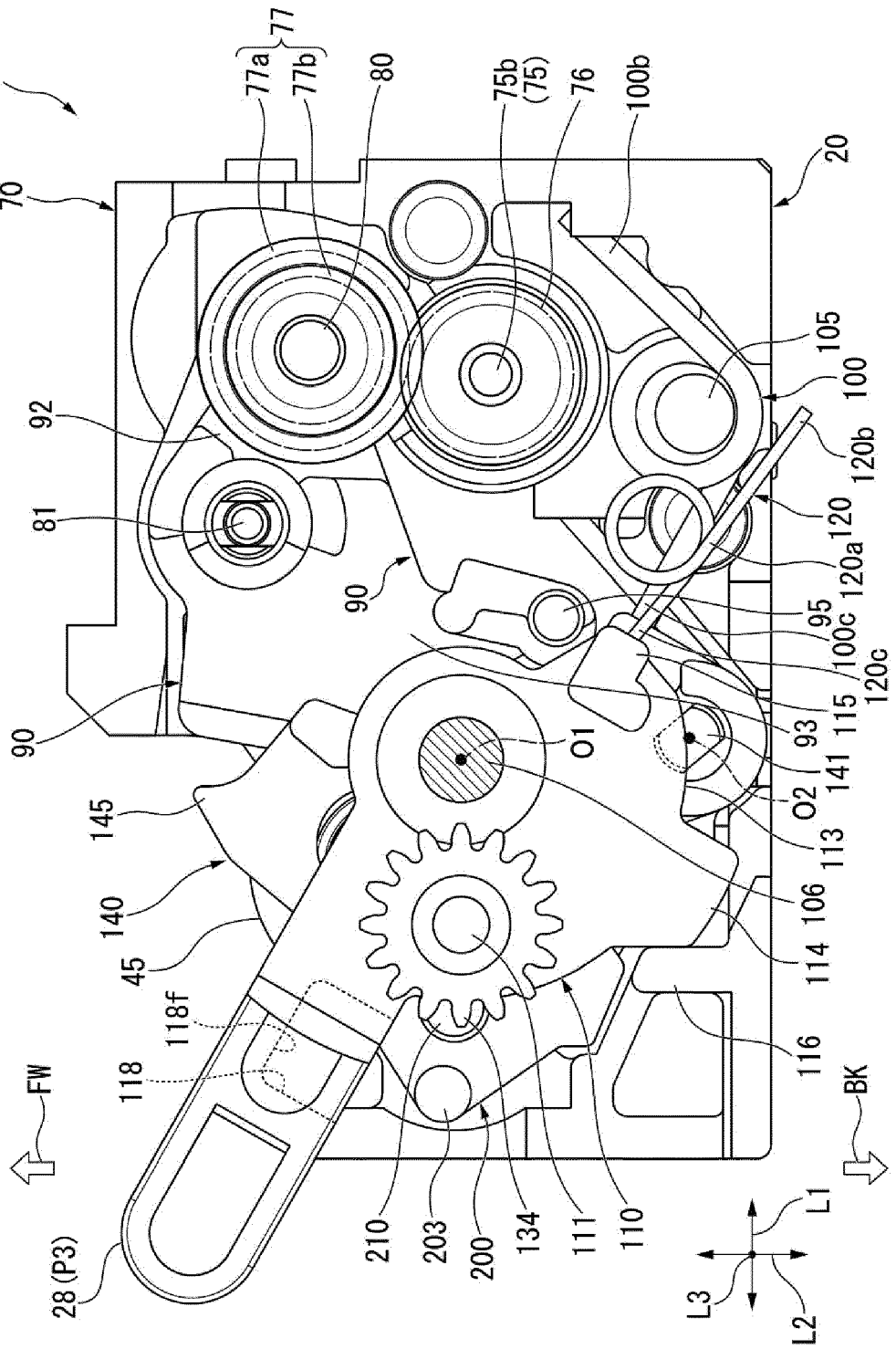

5
70
77a
77b
77
80
75b
(75)
76
100b
20
105
100
120b
120
120a
92
81
90
95
100c
120c
93
115
141
O1
O2
113
106
114
116
145
140
45
118f
118
FW
BK
28 (P3)
210
203
200
134
111
110
L1
L2
L3

FIG.12

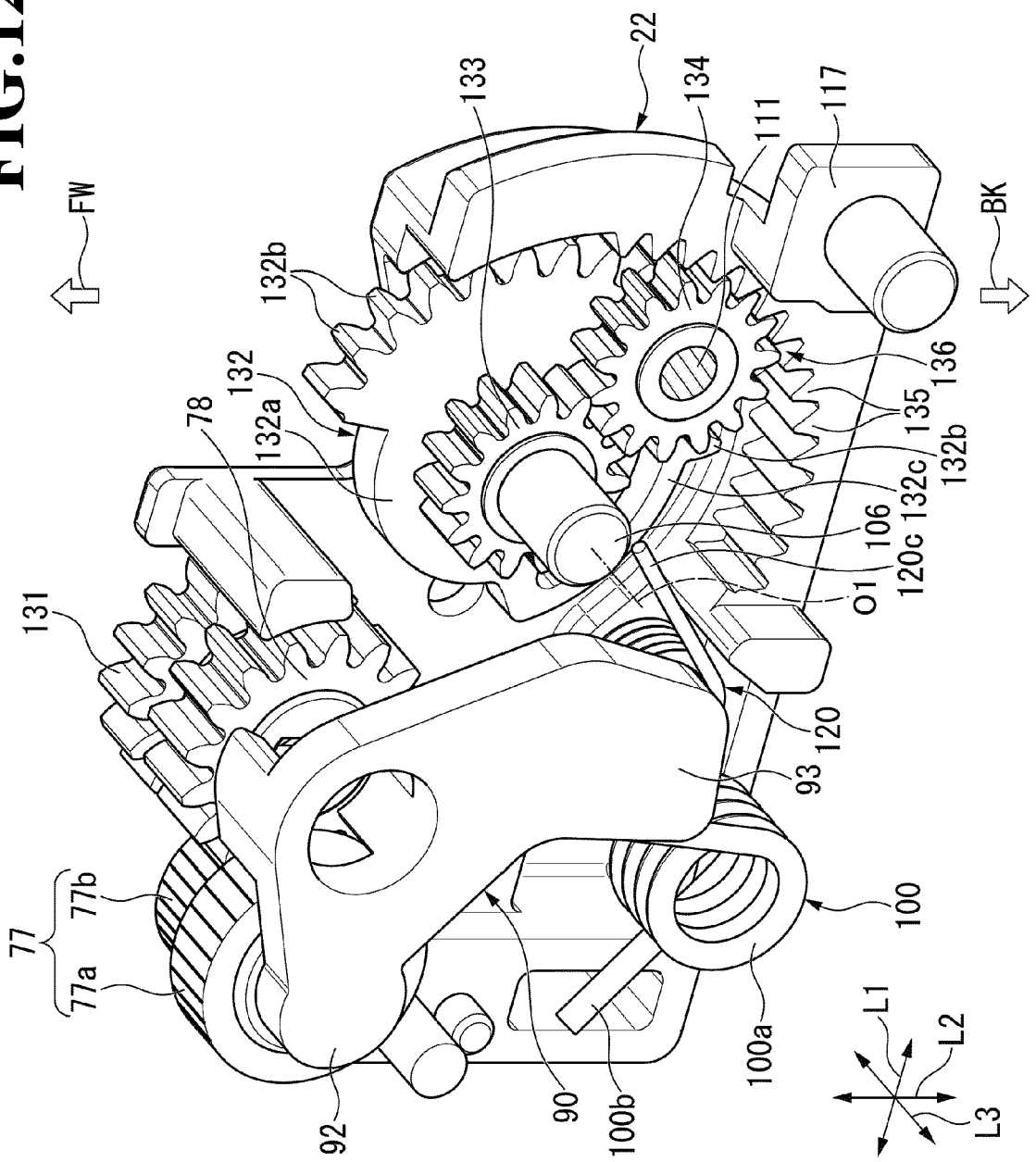

FW
BK
22
133
134
111
117
132b
132
132a
78
136
135
132b
132c
106
120c
O1
131
120
93
77
77b
77a
100
92
90
100b
100a
L1
L2
L3

FIG.13

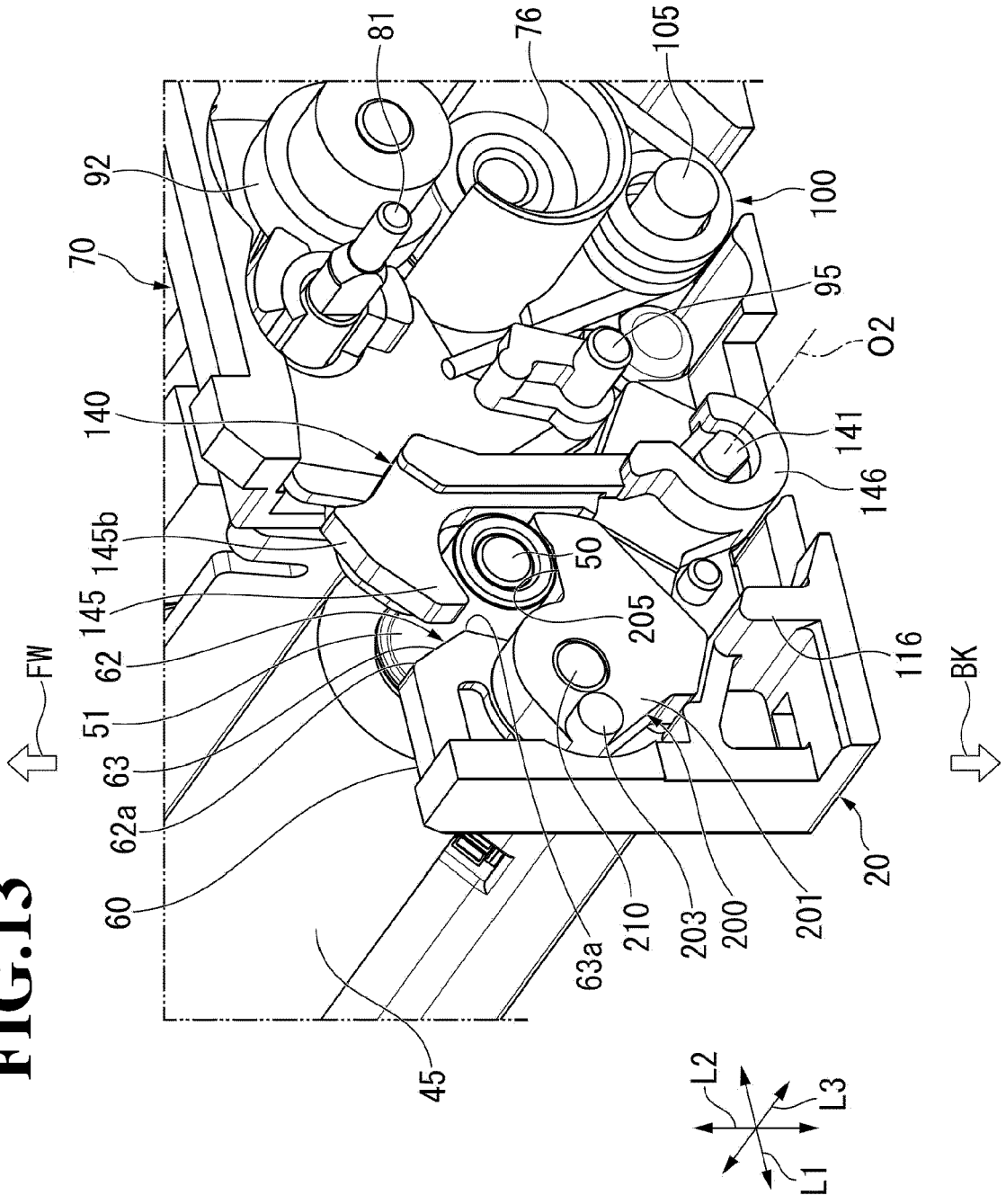

81
76
105
92
100
70
95
O2
140
141
146
145b
50
145
205
116
62
FW
BK
51
63
62a
60
20
210
203
200
201
63a
45
L2
L3
L1

FIG.14

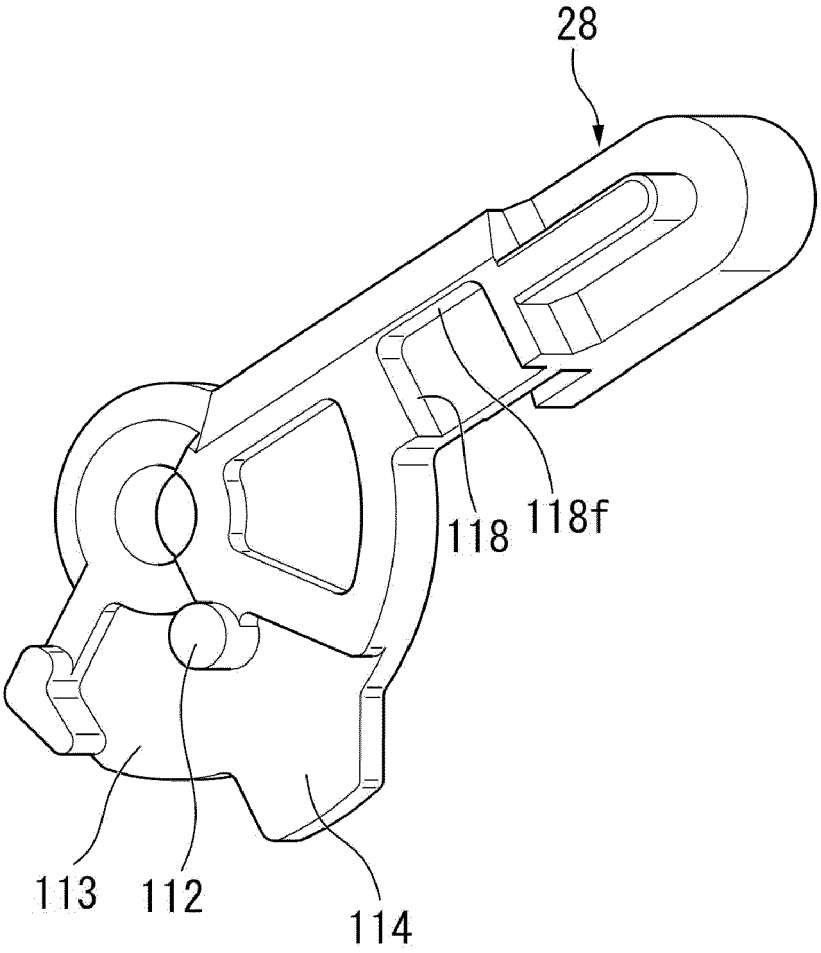


FIG.15

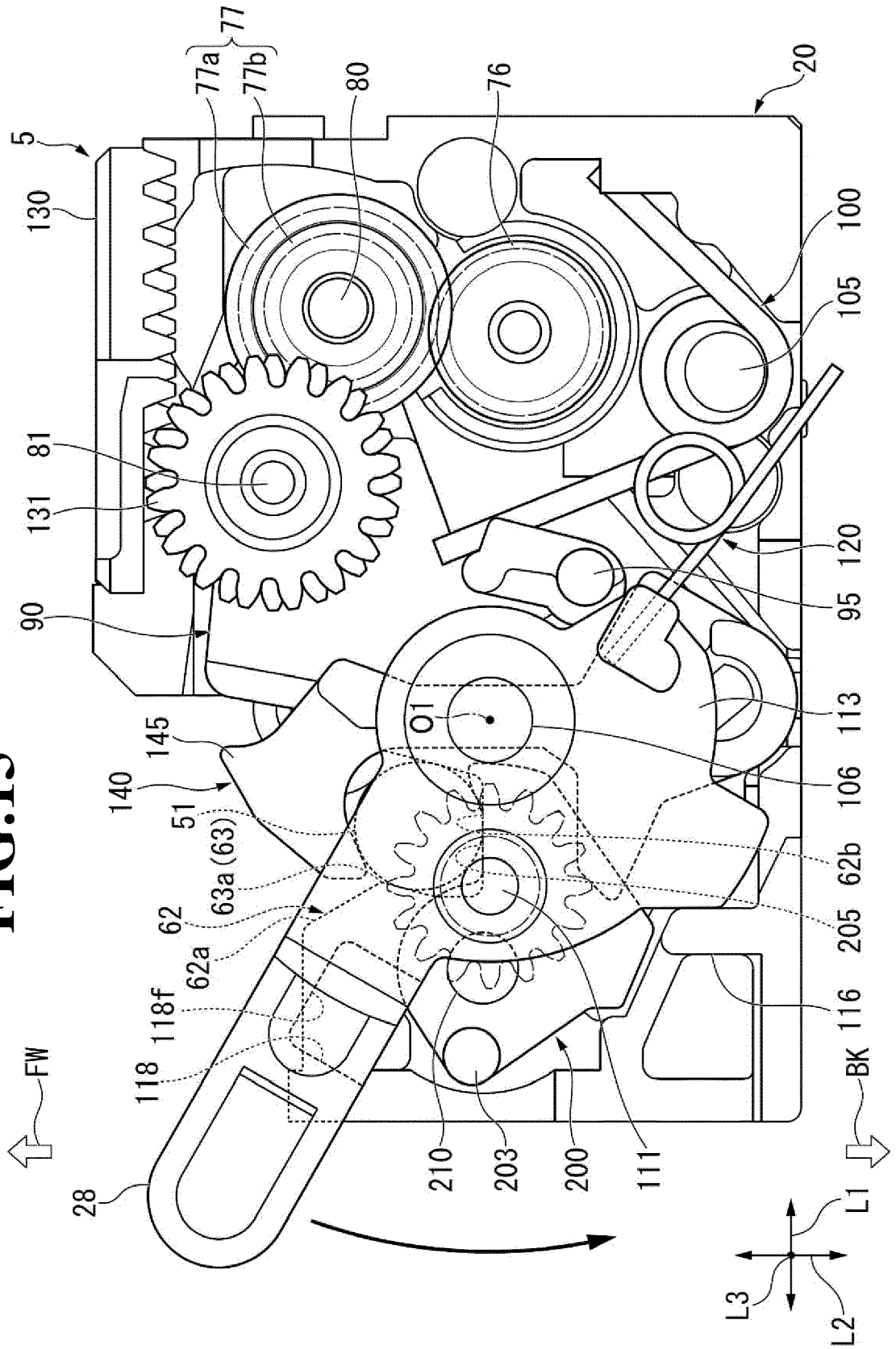

5
130
77
77a
77b
80
76
20
100
105
81
131
90
120
95
113
O1
145
140
106
51
62b
63a (63)
205
62
62a
116
118f
118
FW
BK
28
210
203
200
111
L1
L3
L2

FIG.16

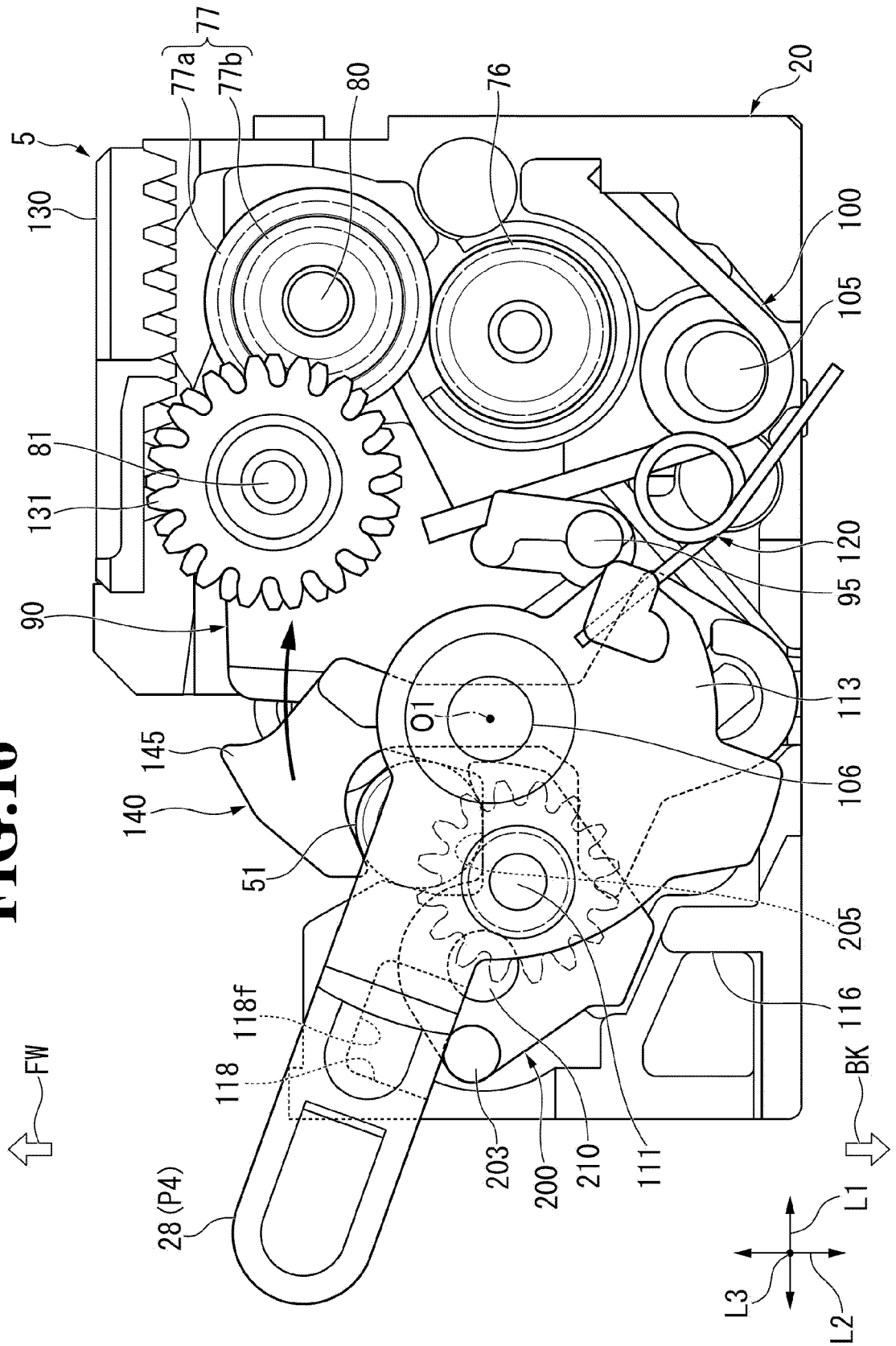

FW
BK
5
130
77
77a
77b
80
76
20
100
105
81
131
90
120
95
113
O1
106
145
140
51
205
116
118f
118
203
200
210
111
28 (P4)
L1
L2
L3

FIG.17

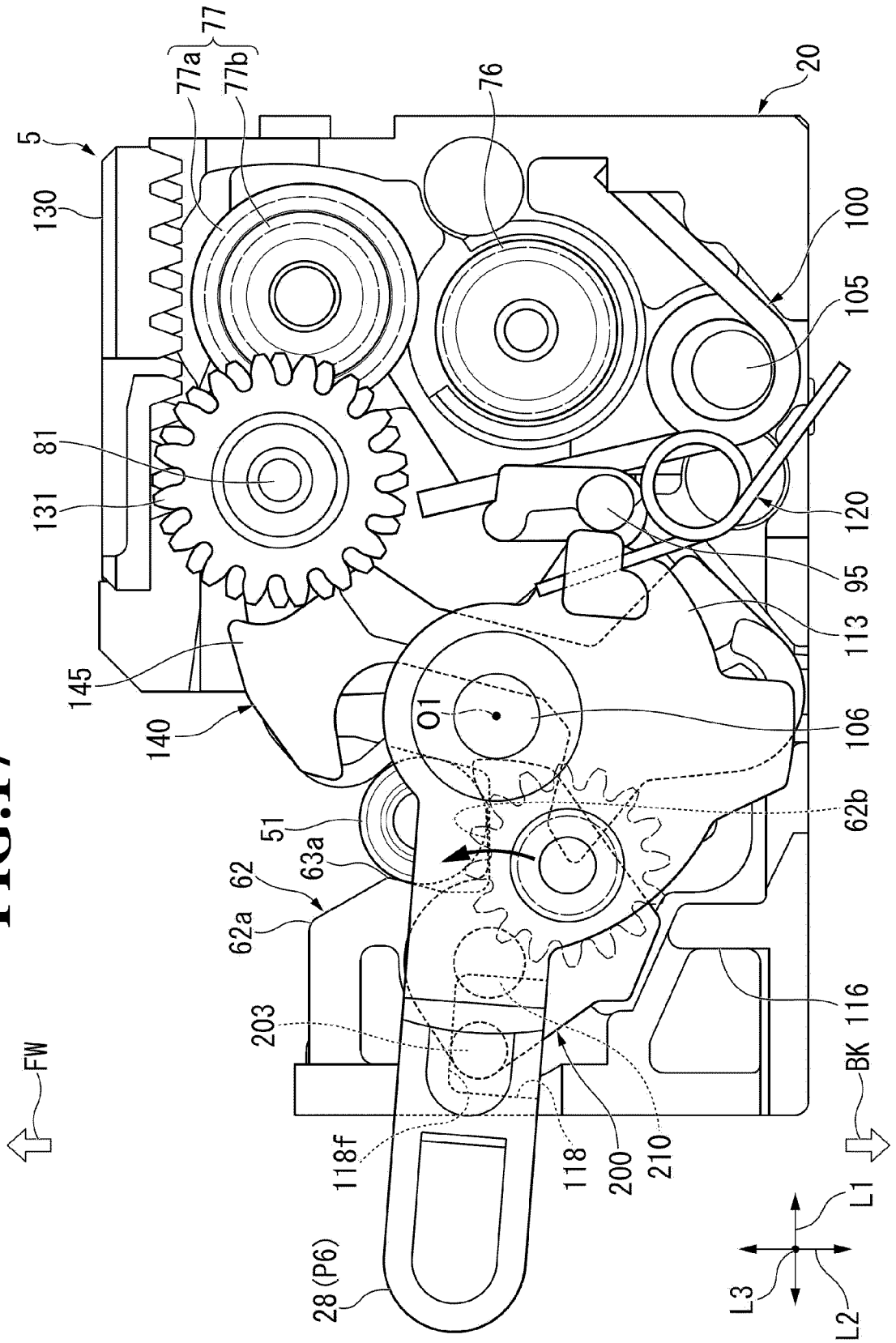
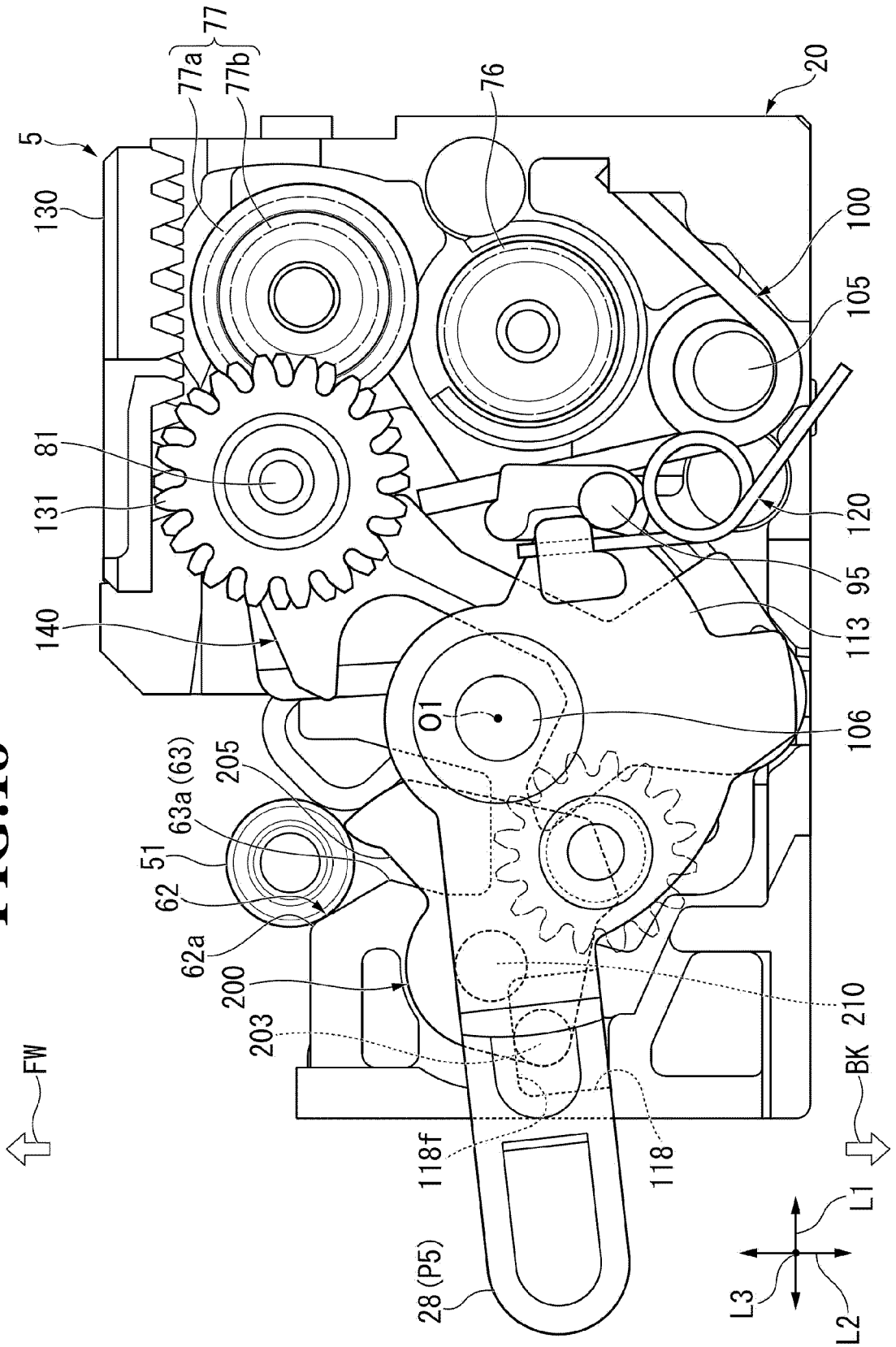

5
130
77a
77b
77
76
20
100
105
81
131
120
95
113
145
140
O1
106
62b
51
63a
62
62a
203
116
BK
FW
118f
118
200
210
28 (P6)
L1
L2
L3

FIG.18


5
130
77
77a
77b
76
20
100
105
81
131
140
120
95
113
O1
106
205
63a (63)
51
62
62a
200
203
210
FW
BK
118f
118
28 (P5)
L1
L2
L3

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EUROPEAN SEARCH REPORT

Application Number
EP 22 16 3750

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B41J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	16 August 2022	Hartmann, Mathias

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