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(72) Inventors:
• **KATO, Sho**
Kyoto, 612-8686 (JP)
• **KITAGAWA, Shigeki**
Kyoto, 612-6868 (JP)
• **CHIKADA, Hidekazu**
Kyoto, 612-8686 (JP)

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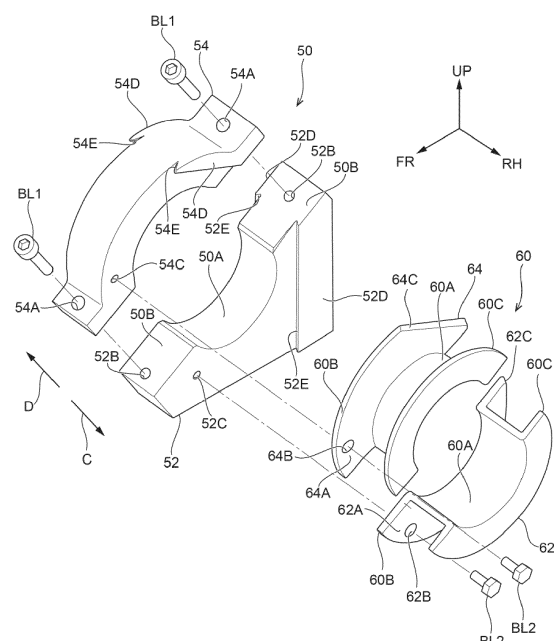
(74) Representative: **Rösler Rasch van der Heide &
Partner**
Bodenseestraße 18
81241 München (DE)

(71) Applicant: **TMT Machinery, Inc.**
Osaka-shi, Osaka 541-0041 (JP)

(54) **YARN FEEDER**

(57) In a yarn feeder (30), a fixing-side cover member (62) and a detachable-side cover member (64) each comprise a fixing portion (62A, 64A) respectively fastened to a fixing-side housing member (52) and a detachable-side housing member 54 by a fastening bolt (BL2) and further comprise an engaging portion (62C, 64C) respectively engaged with the fixing-side housing member and detachable-side housing member in a manner that prevents relative movement. The fixing-side cover member and the detachable-side cover member can be fixed to a housing by using only one fastening point of the fixing-side cover member and the detachable-side cover member to the housing. Man-hours required for mounting and removing the cover can be reduced compared to the case where two fastening points of the fixing-side cover member and the detachable-side cover member to the housing are used.

Fig. 6



Description

[Technical Field]

[0001] The disclosure relates to a yarn feeder.

[Background Art]

[0002] In an apparatus for producing a false twisted composite yarn described in Patent Literature 1 below, a raw yarn supplied to each weight is twisted and heat-set by a false twist twister group and a heater group to form a false twist yarn while being overfed or stretched between a roller group on upstream side and a roller group on downstream side in each weight. The false twisted yarns, which have been false twisted at each weight, are combined to form the false twisted composite yarn.

[0003] The above-mentioned roller group is configured as a yarn feeder for feeding the yarn. Specifically, a roller for each weight is detachably attached to a line shaft, and the roller and a top roller grip the yarn and feed the yarn downstream. The line shaft is usually rotatably supported by a bearing and the bearing is supported by a support member.

[Related Art Documents]

[Patent Literature]

[0004] Patent Literature 1: Japanese Patent Laid-Open No. HI(1989)-132843

[Summary of Invention]

[Technical Problem]

[0005] The yarn feeder used in the apparatus for producing the false twisted composite yarn is equipped with cover to prevent the yarn from wrapping around the line shaft. Specifically, cylindrical cover is mounted to the support member that supports the bearing and is disposed between the support member and the roller, covering the line shaft from outside in radial direction. In the yarn feeder, the line shaft is covered over entire axial direction by a plurality of covers. This prevents the yarn from wrapping around the line shaft.

[0006] However, when cover for preventing yarn wrapping is provided on the yarn feeder, for example, the cover needs to be removed from the support member at every bearing replacement operation. In addition, as mentioned above, the number of covers is relatively large because the line shaft is covered over the entire axial direction by the plurality of covers. Therefore, it is desirable for the yarn feeder to have a structure that can improve workability when mounting and removing the cover.

[0007] Considering the above facts, the present inven-

tion aims to provide the yarn feeder which can improve the workability when mounting and removing the cover.

[Solution to Problem]

[0008] At least one embodiment of the invention is a yarn feeder disposed in a yarn path of a textile machine comprising: a rotary shaft; a bearing for rotatably supporting the rotary shaft; a roller which is integrally rotatable on the rotary shaft and is disposed outward in axial direction of the rotary shaft with respect to the bearing, and which feed a yarn travelling along the yarn path; a support member supporting the bearing and configured by a pair of half support members divided in radial direction of the rotary shaft; and a cover disposed between the support member and the roller, formed in a cylindrical shape covering the rotary shaft from outside in the radial direction and configured by a pair of half cover members divided in the radial direction of the rotary shaft, wherein one half cover member is coupled to one half support member and other half cover member is coupled to other half support member, and wherein at least one of the pair of the half cover members includes a fixing portion fastened to the half support member by a fastening member and an engaging portion engaged with the half support member in axial direction of the rotary shaft and in a direction orthogonal to the axial direction.

[0009] In the yarn feeder of the above configuration, the rotary shaft is rotatably supported on bearing supported by the support member. The roller is integrally rotatable on the rotary shaft, and the roller is disposed outward in the axial direction of the rotary shaft with respect to the bearing. Cylindrical cover is disposed between the support member and the roller and covers the rotary shaft from the outside in the radial direction. The support member is configured by the pair of the half support members divided in the radial direction of the rotary shaft. The cover is also configured by the pair of the half cover members divided in the radial direction of the rotary shaft, said one half cover member being coupled to said one half support member and the other half cover member being coupled to the other half support member.

[0010] At least one of the pair of the half cover members includes the fixing portion fastened to the half support member by the fastening member and engaging portion engaged to the half support member in the axial direction of the rotary shaft and in the direction orthogonal to the axial direction. In other words, at least said one of the pair of the half cover members can fix the half cover member to the support member by making a fastening point of the half cover member to one point. Therefore, compared to, for example, two fastening points of the half cover member to the support member, man-hours required for mounting and removing the cover can be reduced. Therefore, workability when mounting and removing of the cover can be improved.

[0011] At least one embodiment of the invention is the yarn feeder, wherein the half cover member includes half-

cylindrical cover portion covering the rotary shaft from the outside in the radial direction, and a first flange portion provided at end of support member side in the cover portion, wherein the fixing portion is provided at one side end in circumferential direction of the first flange portion and, the engaging portion is provided at other side end in the circumferential direction of the first flange portion, wherein outer circumference of the half support member has an engaging groove open to rotary shaft side and extending in the direction intersecting a divided surface of the support member, viewed from the axial direction, and wherein the engaging portion is inserted into the engaging groove and is engaged with the half support member in a manner that prevents relative movement.

[0012] In the yarn feeder of the above configuration, the fixing portion is provided at one side end in the circumferential direction of the first flange portion of the half cover member and the engaging portion is provided at the other side end in the circumferential direction of the first flange portion. The engaging portion is inserted into the engaging groove formed in the outer circumference of the half support member and is engaged with the half support member in a manner that prevents relative movement. This enables the half cover member to be engaged with the half support member in a simple configuration.

[0013] At least one embodiment of the invention is the yarn feeder, wherein a cover-side side surface in the engaging groove is configured as a groove-side inclined surface, wherein the groove-side inclined surface is, viewed from longitudinal direction of the engaging groove, inclined towards the support member side as it moves towards bottom side of the engaging groove, and wherein the engaging portion has an engaging surface in contact with the groove-side inclined surface.

[0014] In the yarn feeder of the above configuration, when inserting the engaging portion into the engaging groove, the groove-side inclined surface can pull the engaging portion towards the support member side. As a result, the cover can be mounted to the support member by bringing end surface of the cover into close contact with side surface of the support member. Therefore, the cover can be mounted to the support member in a good condition.

[0015] At least one embodiment of the invention is the yarn feeder, wherein the divided surface of a cover is disposed flush with the divided surface of the support member, and viewed from the axial direction, angle between the divided surface of the support member and the engaging groove is set at an acute angle.

[0016] In the yarn feeder of the above configuration, for example, by pressing said one half cover member towards the engaging groove, the engaging portion moves along the engaging groove towards the other half cover member. Therefore, by fastening and fixing said one half cover member in this state, the divided surface of the half cover member can be brought into close contact with each other. Therefore, adhesion between the half cover members can be improved.

[0017] At least one embodiment of the invention is the yarn feeder, wherein the half cover member has second flange portion at roller side end in the cover portion, wherein a recess open to the support member side is formed at the end of the support member side on the roller, and wherein the second flange portion is disposed inside the recess.

[0018] In the yarn feeder of the above configuration, the second flange portion of the half cover member is accommodated in the recess of the roller, so that a so-called labyrinth structure is formed between the cover and the roller. This prevents the yarn from entering the inside of the cover from between the cover and the roller. Thus, a winding of the yarn onto the rotary shaft can be effectively restrained.

[Advantageous Effects of Invention]

[0019] At least one embodiment of the invention, the workability can be improved when mounting and removing the cover.

[Brief Description of Drawings]

[0020]

Fig. 1 is a side view schematically showing a false twisting machine to which a yarn feeder according to the present embodiment is applied.

Fig. 2 is a front view of a part of a first yarn feeder shown in Fig. 1, viewed from front.

Fig. 3 is a cross-sectional view of the first yarn feeder shown in Fig. 2 (cross-sectional view of 3-3 line in Fig. 2) from right side.

Fig. 4 is a cross-sectional view showing an enlarged front portion of a base of the first yarn feeder shown in Fig. 3.

Fig. 5 is a cross-sectional view of the first yarn feeder shown in Fig. 3 (cross-sectional view of 5-5 line in Fig. 3) viewed from upper side.

Fig. 6 is an exploded perspective view of a housing and a cover in the first yarn feeder shown in Fig. 2.

Fig. 7A is a cross-sectional view showing an engaging state between an engaging portion of a detachable-side cover member and an engaging groove of a detachable-side housing member shown in Fig. 4 (cross-sectional view of 7A-7A line in Fig. 4), and 7B is a cross-sectional view showing the engaging state between the engaging portion of the fixing-side cover member and the engaging groove of the fixing-side housing member shown in Fig. 4 (cross-sectional view of line 7B-7B in Fig. 4).

Fig. 8 is an illustration from front side to illustrate a procedure for replacing the bearing of the first yarn feeder.

Fig. 9 is a cross-sectional view corresponding to Fig. 7B to illustrate a variation of the engaging portion of the fixing-side cover member and the engaging

groove of the fixing-side housing member.

[Description of Embodiment]

[0021] A yarn feeder 30 of the present embodiment will be explained below using drawings. The yarn feeder 30 is applied to a false twisting machine 10 as a textile machine, the false twisting machine 10 being an apparatus for producing a false twisted yarn (DTY: Draw Textured Yarn) by false twisting a semi-stretched yarn (POY: Partially Oriented Yarn). Four yarn feeders 30 are used in the false twisting machine 10, and in order to distinguish between the four yarn feeders 30, the following explanation refers to the four yarn feeders 30 as a first yarn feeder 30-1, a second yarn feeder 30-2, a third yarn feeder 30-3, and a fourth yarn feeder 30-4, which will be described separately.

Overall configuration of the false twisting machine 10

[0022] As shown in Fig. 1, the false twisting machine 10 has a main machine stand 12, a winding device 14 and a yarn feed creel 16. The main machine stand 12, the winding device 14 and the yarn feed creel 16 are arranged side by side with a predetermined space in width direction of the false twisting machine 10 (arrow A and arrow B directions in Fig. 1). The first yarn feeder 30-1 is provided on upper side of the winding device 14, the second yarn feeder 30-2 and the third yarn feeder 30-3 are provided on the upper side of the main machine stand 12, and the fourth yarn feeder 30-4 is provided on lower end of the main machine stand 12. By the first yarn feeder 30-1 to the fourth yarn feeder 30-4, a yarn Y supplied from the yarn feeding creel 16 is fed along a yarn path 18 to the winding device 14. In the present embodiment, a plurality of yarns Y are supplied from the yarn feeding creel 16, and the yarns Y supplied from the yarn feeding creel 16 are sent to downstream side by the first yarn feeder 30-1.

[0023] A yarn feed speed of the second yarn feeder 30-2 is set to be faster than the yarn feed speed of the first yarn feeder 30-1. This causes the yarn Y to be stretched between the first yarn feeder 30-1 and the second yarn feeder 30-2. Between the first yarn feeder 30-1 and the second yarn feeder 30-2, a first heater 20, a cooling device 22 and a false twisting device 24 are provided in this order from upstream side. Thereby, as the yarn Y passes through the false twisting device 24, the yarn Y is subjected to a false twisting process.

[0024] A second heater 26 is also provided between the third yarn feeder 30-3 and the fourth yarn feeder 30-4. The yarn Y joined between the second yarn feeder 30-2 and third yarn feeder 30-3, is sent to the second heater 26 by the third yarn feeder 30-3. The yarn Y is then sent by the fourth yarn feeder 30-4 to the winding device 14, where it is wound by the winding device 14 to form a package P.

Yarn feeder 30

[0025] As the first yarn feeder 30-1 to fourth yarn feeder 30-4 are similarly configured, the first yarn feeder 30-1 is used to explain the configuration of the yarn feeder 30.

[0026] The configuration of the first yarn feeder 30-1 is explained below using Fig. 2 to Fig. 7. Arrows UP, FR and RH shown in the drawings as appropriate indicate upper, front and right side of the first yarn feeder 30-1 respectively. In the following explanation, when directions up-down, front-rear, and left-right are used, the directions up-down, front-rear, and left-right of the first yarn feeder 30-1 are indicated, unless otherwise stated. The left-right direction of the first yarn feeder 30-1 corresponds to the left-right direction of the false twisting machine 10 (orthogonal to a sheet in Fig. 1), which is orthogonal to the up-down and width direction of the false twisting machine 10.

[0027] As shown in Fig. 2 to Fig. 5, the first yarn feeder 30-1 includes a base 32, a shaft 34 as a rotary shaft, a bearing 36 as a plurality of bearings supporting the shaft 34, a housing 50 as a support member supporting the bearing 36, a plurality of drive rollers 38 as rollers, a plurality of driven rollers 40, and a plurality of covers 60.

[0028] The base 32 is formed in the form of a substantially rectangular cylinder extending in the left-right direction. The base 32 serves as a member for fixing the first yarn feeder 30-1 to a framework member (frame) of the false twisting machine 10. The shaft 34 is formed in a substantially cylindrical shape with the left-right direction as axial direction and is disposed at front side of the base 32. The shaft 34 is rotatably supported by bearing 36. The bearing 36 is configured as a ball bearing and is supported by the housing 50 described further below and coupled to the base 32 by the housing 50. The plurality of bearings 36 is arranged at predetermined intervals in the left-right direction (in Fig. 3 to Fig. 5, only one bearing 36 is shown). A motor, not shown, is coupled to one end of the shaft 34 in longitudinal direction, and the motor drives the shaft 34 to rotate around its own axis.

[0029] The drive roller 38 is configured as a metal roller and is formed in the substantially cylindrical shape with the left-right direction as the axial direction. At both ends of the drive rollers 38 in the left-right direction, a recess 38A (see Fig. 5) open to the outside in the left-right direction is formed, and the recess 38A is circular in shape, viewed from the left-right direction. The drive roller 38 is disposed outward in the axial direction of the shaft 34 with respect to the bearing 36 and is fixed to the shaft 34 for integral rotation (in the example shown in Fig. 3 to Fig. 5, the drive roller 38 is disposed axially on both sides of the shaft 34 with respect to the bearing 36). The drive roller 38 is fixed to the shaft 34 by a hexagon socket set screw in a position not shown.

[0030] The driven roller 40 is configured as a rubber roller and is paired with the drive roller 38. In other words, the drive roller 38 and the driven roller 40 constitute a feed roller pair 42. The driven roller 40 is disposed above

the drive roller 38 and is rotatably supported by a support mechanism portion 44 with the left-right direction as the axial direction and is coupled to the base 32. The driven roller 40 is configured by the support mechanism portion 44 to be contactable with and detachable from the drive roller 38. In other words, in the position where the driven roller 40 is close to the drive roller 38, the drive roller 38 and the driven roller 40 tuck in the yarn Y and feed the yarn Y downstream side. During bearing 36 replacement work, etc., the driven roller 40 is moved upwards to be separated from the drive roller 38

[0031] As shown in Fig. 2 to Fig. 6, the housing 50 is formed as a whole in the substantially cylindrical shape with the axial direction in the left-right direction. In other words, the housing 50 has a circularly shaped support hole 50A (see Fig. 6) penetrated in the left-right direction. The housing 50 is disposed on the front side of the base 32 and is configured as the support member for supporting the bearing 36 from the outside in the radial direction. In other words, the housing 50 is paired with the bearing 36 and supports the shaft 34 via the bearing 36.

[0032] The housing 50 includes a fixing-side housing member 52 and a detachable-side housing member 54 as half support members divided into two portions in the radial direction of the shaft 34. Specifically, divided surface 50B of the housing 50 extend along the direction inclined to the lower side toward the front side, viewed from the left-right direction. Hereinafter, the direction in which the housing 50 is divided, viewed from the left-right direction, is referred to as division direction (see arrows C and D in Fig. 4 and Fig. 6).

[0033] The fixing-side housing member 52 constitutes one side portion in the division direction (arrow C direction in Fig. 4 and Fig. 6) in the housing 50. The fixing-side housing member 52 is disposed at the front side of the base 32 and is fastened to the base 32 at the position not shown.

[0034] Fixing screw portion 52B (see Fig. 6) for fixing the detachable-side housing member 54 is formed respectively on the divided surface 50B in the fixing-side housing member 52. The fixing screw portion 52B is formed in a concave shape open to the other side in the division direction, and a female screw is formed on inner circumference of the fixing screw portion 52B. On both side surfaces of front end of the fixing-side housing member 52 in the right-left direction, a cover-fixing screw portion 52C (see Fig. 6) is formed to fix the cover 60 (fixing-side cover member 62) which is described further below (in Fig. 6, only the cover-fixing screw portion 52C formed on the right-side surface of the fixing-side housing member 52 is shown). The cover-fixing screw portion 52C is formed in the concave shape open to the outside in the left-right direction, and the female screw is formed on the inner circumference of the cover-fixing screw portion 52C.

[0035] A step portion 52D is formed on both side surfaces of rear end of the fixing-side housing member 52 in the left-right direction, raised one step outwards in the

left-right direction, respectively. The front end of the step portion 52D is extended along the up-down direction (in the direction intersecting with the divided surface 50B), viewed from the left-right direction. An engaging groove 52E is formed at the front end of the step portion 52D and the engaging groove 52E extends along the front end of the step portion 52D and penetrates in the direction of extension. Angle AG1 (see Fig. 4) between the engaging groove 52E and the divided surface 50B, viewed from the left-right direction, is set at an acute angle. The engaging groove 52E is formed in a substantially wedge shape, open to the shaft 34 side, viewed from the longitudinal direction. Specifically, as shown in Fig. 7B, one side-side surface in the width direction (inner side-side surface in the left-right direction) of the engaging groove 52E is configured as a receiving surface 52E1, and the receiving surface 52E1 is disposed along the direction orthogonal to the left-right direction, viewed from the longitudinal direction of the engaging groove 52E. Other side-side surface in the width direction (outer side-side surface in the left-right direction) of the engaging groove 52E is configured as a groove-side inclined surface 52E2, and the groove-side inclined surface 52E2 is inclined to the shaft 34 side towards the left-right direction outwards, viewed from the longitudinal direction of the engaging groove 52E. In other words, the groove-side inclined surface 52E2 constitutes the outer side-side surface of the engaging groove 52E in the left-right direction (on the side of the cover 60 as described further below) and incline inwards (towards the housing 50 side) in the left-right direction towards a bottom of the engaging groove 52E. The receiving surface 52E1 is disposed flush with both left and right-side surfaces of the fixing-side housing member 52.

[0036] As shown in Fig. 2 to Fig. 6, the detachable-side housing member 54 constitutes other side portion in the division direction in the housing 50. A fixing hole 54A (see Fig. 6) is formed and penetrated to the front end and the rear end of the detachable-side housing member 54 in the division direction, and a fixing bolt BL1 inserted in the fixing hole 54A is screwed into the fixing screw portion 52B of the fixing-side housing member 52, and the detachable-side housing member 54 is fixed to the fixing-side housing member 52. In other words, the detachable-side housing member 54 is detachably fixed to the fixing-side housing member 52 and supports the bearing 36 from the other side in the division direction. When replacing the bearing 36, the detachable-side housing member 54 is removed from the fixing-side housing member 52.

[0037] On both side surfaces of the front end of the detachable-side housing member 54 in the left-right direction, a cover-fixing screw portion 54C (see Fig. 6) is formed to fix the cover 60 to be described further below, and the cover-fixing screw portion 54C is disposed symmetrically to the divided surface 50B of the housing 50, viewed from the left-right direction (in Fig. 6, only the cover-fixing screw portion 54C formed on the right side surface of the detachable-side housing member 54 is

shown). The cover-fixing screw portion 54C is formed in the concave shape open to the outside in the left-right direction, and the female screw is formed on the inner circumference of the cover-fixing screw portion 54C.

[0038] The step portion 54D is formed on both side surface of the rear end of the detachable-side housing member 54 in the left-right direction, raised one step outwards in the left-right direction. The front end of the step portion 54D is extended so that it is symmetrical with the step portion 52D of the fixing-side housing member 52 with respect to the divided surface 50B of the housing 50, viewed from the left-right direction. In detail, the front end of the step portion 54D is extended along a direction inclined towards the front side as it moves upwards (in the direction intersecting with the divided surface 50B), viewed from the left-right direction. An engaging groove 54E is formed at the front end of the step portion 54D, the engaging groove 54E extends along the front end of the step portion 54D and penetrates in the direction of extension. Angle AG2 (see Fig. 4) between the engaging groove 54E and the divided surface 50B, viewed from the left-right direction, is set to be the same as the angle AG1. The engaging groove 54E is formed in the substantially wedge shape, open to the shaft 34 side, viewed from the longitudinal direction. Specifically, as shown in Fig. 7A, said one side-side surface in the width direction (inner side-side surface in the left-right direction) of the engaging groove 54E is configured as a receiving surface 54E1, and the receiving surface 54E1 is disposed along the direction orthogonal to the left-right direction, viewed from the longitudinal direction of the engaging groove 54E. The other side-side surface in the width direction (the outer side-side surface in the left-right direction) of the engaging groove 54E is configured as a groove-side inclined surface 54E2, and the groove-side inclined surface 54E2 is inclined to the shaft 34 side towards the left-right direction outwards, viewed from the longitudinal direction of the engaging groove 54E. In other words, the groove-side inclined surface 54E2 constitutes the side surface of the engaging groove 54E in the outside in the left-right direction (towards the cover 60 as described further below) and incline inwards (towards the housing 50 side) in the left-right direction towards the bottom of the engaging groove 54E. The receiving surface 54E1 is disposed flush with both left and right-side surface of the detachable-side housing member 54.

[0039] As shown in Fig. 2 to Fig. 6, the cover 60 is disposed between the housing 50 and the drive roller 38 and is configured as a member covering the shaft 34 from outside in the radial direction. The cover 60 is therefore provided on outside in the radial direction of the shaft 34, in pair with the drive roller 38.

[0040] The cover 60 is formed as a whole in the substantially cylindrical shape with the left-right direction as the axial direction. Specifically, the cover 60 includes a cylindrical cover portion 60A, a substantially circular plate-shaped first flange portion 60B extending outward in the radial direction from an end of the housing 50 side

of the cover portion 60A, and a substantially circular plate-shaped second flange portion 60C extending outward in the radial direction from the end of the drive roller 38 side of the cover portion 60A. The first flange portion 60B of the cover 60 is fixed to the side surface of the housing 50 and the cover 60 extend from the housing 50 to the shaft 34 outward in the axial direction and covers a portion between the bearing 36 and the drive roller 38 on the shaft 34 from outside in the radial direction. When the cover 60 is fixed to the housing 50, the second flange portion 60C is accommodated in the recess 38A of the drive roller 38. This configuration prevents the yarn Y from entering the inside of the cover 60 and prevents the yarn Y from wrapping around the portion between the bearings 36 and the drive roller 38 in the shaft 34 by the cover 60.

[0041] The cover 60 constitutes the fixing-side cover member 62 and the detachable-side cover member 64 as the half cover members divided in two parts in the radial direction of the shaft 34. The fixing-side cover member 62 and the detachable-side cover member 64 are divided in two parts in the division direction, and a divided position of the covers 60 is set so that a divided surface 60D of the cover 60 and the divided surface 50B of the housing 50 in the division direction corresponds. The fixing-side cover member 62 is detachably fixed to the fixing-side housing member 52 in the housing 50, and the detachable-side cover member 64 is detachably fixed to the detachable-side housing member 54.

[0042] One end (front end) in circumferential direction of the first flange portion 60B of the fixing-side cover member 62 is configured as a fixing portion 62A, and a fixing hole 62B (see Fig. 6) is formed through the fixing portion 62A at the position corresponding to the cover-fixing screw portion 52C of the fixing-side housing member 52. A fastening bolt BL2 as a fastening member inserted in the fixing hole 62B is screwed into the cover-fixing screw portion 52C of the fixing-side housing member 52, and the fixing-side cover member 62 is fastened to the fixing-side housing member 52. In other words, the fixing portion 62A is fixed to the fixing-side housing member 52 by the fastening bolt BL2 disposed parallel to the shaft 34.

[0043] At other end (rear end) in the circumferential direction of the first flange portion 60B, an engaging portion 62C is formed at outer circumference of the first flange portion 60B. The engaging portion 62C corresponds to the engaging groove 52E of the fixing-side housing member 52 and extends along the extending direction of the engaging groove 52E as viewed from the left-right direction. The engaging portion 62C is formed in a wedge shape corresponding to the engaging groove 52E, viewed from the longitudinal direction. In other words, as shown in Fig. 7B, the engaging portion 62C includes, viewed from the longitudinal direction, a first engaging surface 62C1 disposed along the direction orthogonal to the left-right direction and a second engaging surface 62C2 as an engaging surface inclined to the shaft

34 side from the rear end of the first engaging surface 62C1 towards the left-right direction outwards. The engaging portion 62C is inserted into the engaging groove 52E and the engaging portion 62C and the engaging groove 52E are engaged. Specifically, the first engaging surface 62C1 contacts the receiving surface 52E1 and the second engaging surface 62C2 contacts the groove-side inclined surface 52E2. As a result, the engaging portion 62C engages the engaging groove 52E in the axial direction of the shaft 34 and in the direction orthogonal to the axial direction, and is coupled to the fixing-side housing member 52 in a manner that prevents relative movement. The first engaging surface 62C1 is disposed flush with end surface of the fixing-side cover member 62.

[0044] As shown in Fig. 2 to Fig. 6, the detachable-side cover member 64 is configured to be symmetrical with the fixing-side cover member 62 with respect to the divided surface 60D of the cover 60. In other words, said one end (front end) in the circumferential direction of the first flange portion 60B of the detachable-side cover members 64 is configured as a fixing portion 64A, and a fixing hole 64B (see Fig. 6) is formed through the fixing portion 64A at the position corresponding to the cover-fixing screw portion 54C of the detachable-side housing member 54. The fastening bolt BL2 inserted in the fixing hole 64B is screwed into the cover-fixing screw portion 54C of the detachable-side housing member 54, and the detachable-side cover member 64 is fastened to the detachable-side housing member 54. In other words, the fixing portion 64A is fixed to the detachable-side housing member 54 by the fastening bolt BL2 disposed parallel to the shaft 34.

[0045] At the other end (rear end) in the circumferential direction of the first flange portion 60B of the detachable-side cover member 64, an engaging portion 64C is formed at the outer circumference of the first flange portion 60B. The engaging portion 64C corresponds to the engaging groove 54E of the detachable-side housing member 54 and extends along the direction of extension of the engaging groove 54E as viewed from the left-right direction. The engaging portion 64C is formed in the wedge shape corresponding to the engaging groove 54E, viewed from the longitudinal direction. In other words, as shown in Fig. 7A, the engaging portion 64C includes, viewed from the longitudinal direction, a first engaging surface 64C1 along the direction orthogonal to the left-right direction and a second engaging surface 64C2 inclined to the shaft 34 side from the rear end of the first engaging surface 64C1 towards the left-right direction outwards. The engaging portion 64C is inserted into the engaging groove 54E and the engaging portion 64C and the engaging groove 54E is engaged. Specifically, the first engaging surface 64C1 contacts the receiving surface 54E1, and the second engaging surface 64C2 contacts the groove-side inclined surface 54E2. As a result, the engaging portion 64C engages the engaging groove 54E in the axial direction of the shaft 34 and in the direction orthogonal to the axial direction, and is coupled to

the detachable-side housing member 54 in a manner that prevents relative movement. The first engaging surface 64C1 is disposed flush with the end surface of the detachable-side cover member 64.

Actions and Effects

[0046] The actions and effects of the present embodiment will now be explained, using Fig. 8 to illustrate a procedure for replacing the bearing 36 in the first yarn feeder 30-1.

[0047] When the yarn Y is fed by the first yarn feeder 30-1, the driven roller 40 is disposed close to the drive roller 38 and on the other side in the division direction with respect to the drive roller 38 (see state (1) in Fig. 8). For this reason, when replacing the bearing 36, the driven roller 40 is separated from the drive roller 38 and the driven roller 40 is positioned so that it is not located on the other side in the division direction with respect to the housing 50 (see state (2) in Fig. 8).

[0048] Next, a fastening state of the fixing bolt BL1 is released in the housing 50 and the detachable-side housing member 54 and detachable-side cover member 64 are moved to the other side in the division direction and removed from the fixing-side housing member 52. This exposes the bearing 36 (see state (3) in Fig. 8). The second flange portion 60C of the cover 60 is accommodated in the recess 38A of the drive roller 38. Therefore, when the detachable-side housing member 54 and the detachable-side cover member 64 are moved to the other side in the division direction, the second flange portion 60C interferes with the drive roller 38. Therefore, one detachable-side cover member 64 on both sides of the detachable-side housing member 54 in the left-right direction is removed from the detachable-side housing member 54. In other words, the fastening state of the fastening bolt BL2 is released. In this state, the second flange portion 60C is dropped from the recess 38A of the drive roller 38 while tilting a posture of the detachable-side cover member 64 towards the drive roller 38. As a result, said one detachable-side cover member 64 is detached from the detachable-side housing member 54. Then, by moving other detachable-side cover member 64 and the detachable-side housing member 54 towards the removed detachable-side housing member 54, the second flange portion 60C of the other detachable-side cover member 64 is dropped from the recess 38A of the drive roller 38. Thus, the other detachable-side housing member 54 and the detachable-side cover member 64 can be removed from the fixing-side housing member 52.

[0049] Next, one fixing-side cover member 62 on both sides of the fixing-side housing member 52 in the right-left direction is removed from the fixing-side housing member 52 (see state (4) in Fig. 8). That is, the fastening state of the fastening bolt BL2 is released and the second flange portion 60C is dropped from the recess 38A of the drive roller 38 while tilting the posture of the fixing-side cover member 62 with respect to the drive roller 38. As

a result, the fixing-side cover member 62 is removed from the fixing-side housing member 52. In the state shown in (4) of Fig. 8, right side of the fixing-side cover member 62 is removed from the fixing-side housing member 52.

[0050] Next, by sliding the shaft 34 to the left, the drive roller 38 slides to the left together with the shaft 34. This releases the housing state of the drive roller 38 in the recess 38A in the second flange portion 60C of the left side detachable-side cover member 64. In this state, the shaft 34 is moved to the other side in the division direction and removed from the fixing-side housing member 52. This allows the bearings 36 to be replaced.

[0051] After replacing the bearing 36, the shaft 34 is mounted on the housing 50 by the reverse procedure to the above.

[0052] Thus, during bearing 36 replacement work, etc., it is necessary to remove the fixing-side cover member 62 (detachable-side cover member 64) from the fixing-side housing member 52 (detachable-side housing member 54) and to mount the fixing-side cover member 62 (detachable-side cover member 64) on the fixing-side housing member 52 (detachable-side housing member 54).

[0053] The fixing-side cover member 62 (detachable-side cover member 64) includes the fixing portion 62A (fixing portion 64A) fastened to the fixing-side housing member 52 (detachable-side housing member 54) by the fastening bolt BL2, and the engaging portion 62C (engaging portion 64C) engaged with the fixing-side housing member 52 (detachable-side housing member 54) in the axial direction of the shaft 34 and orthogonal to the axial direction. In other words, the fixing-side cover member 62 and the detachable-side cover member 64 can be fixed to the housing 50 by using a single fastening point of the fixing-side cover member 62 and the detachable-side cover member 64 to the housing 50. Therefore, compared to, for example, two fastening points of the fixing-side cover member 62 and the detachable-side cover member 64 to the housing 50, man-hours when mounting and removing can be reduced. Therefore, the workability when mounting and removing of the cover 60 can be improved. In addition, by reducing the number of fastening points of the fixing-side cover member 62 and the detachable-side cover member 64 to the housing 50 to one point, the number of parts-pieces can be reduced.

[0054] As described above, the engaging portion 62C of the fixing-side cover member 62 is engaged in the engaging groove 52E of the fixing-side housing member 52 in the axial direction of the shaft 34 and orthogonal to the axial direction, and the engaging portion 64C of the detachable-side cover member 64 is engaged in the engaging groove 54E of the detachable-side housing member 54 in the axial direction of the shaft 34 and orthogonal to the axial direction. This allows the engaging portion 62C (engaging portion 64C) to serve as a detent in fastening the fixing-side cover member 62 (detachable-side cover member 64) to the housing 50, while also serving as fixing portion to the housing 50.

[0055] The fixing-side cover member 62 (detachable-side cover member 64) includes the cover portion 60A covering the shaft 34 from the outside in the radial direction and the first flange portion 60B provided at the housing 50 side end in the cover portion 60A. Furthermore, the fixing portion 62A (fixing portion 64A) of the fixing-side cover member 62 (detachable-side cover member 64) is provided at a front end (one side end in the circumferential direction) of the first flange portion 60B and the engaging portion 62C (engaging portion 64C) is provided at the rear end (other side end in the circumferential direction) of the first flange portion 60B. The engaging portion 62C (engaging portion 64C) is inserted into the engaging groove 52E (engaging groove 54E) formed in the outer circumference of the fixing-side housing member 52 (detachable-side housing member 54) and is engaged in a manner that prevents relative movement. This enables the fixing-side cover member 62 (detachable-side cover member 64) to be engaged with the fixing-side housing member 52 (detachable-side housing member 54) in a simple configuration.

[0056] The side surface of the covers 60 side in the engaging groove 52E (engaging groove 54E) of the housing 50 is configured as the groove-side inclined surface 52E2 (groove-side inclined surface 54E2), and viewed from the longitudinal direction of the engaging groove 52E, the groove-side inclined surface 52E2 (groove-side inclined surface 54E2) incline to the housing 50 side towards the bottom of the engaging groove 52E (engaging groove 54E). Furthermore, the engaging portion 62C (engaging portion 64C) of the cover 60 has the second engaging surface 62C2 (second engaging surface 64C2) that contacts the groove-side inclined surface 52E2 (groove-side inclined surface 54E2). This allows the groove-side inclined surface 52E2 (groove-side inclined surface 54E2) to pull the engaging portion 62C (engaging portion 64C) towards the housing 50 side during insertion of the engaging portion 62C (engaging portion 64C) into the engaging groove 52E (engaging groove 54E). As a result, the end surface of the housing 50 side in the cover 60 can be brought into close contact with the side surface of the housing 50 in the left-right direction, and the cover 60 can be mounted to the housing 50. Therefore, the cover 60 can be mounted on the housing 50 in good condition.

[0057] The divided surface 60D of the cover 60 is disposed flush with the divided surface 50B of the housing 50, and the angle AG1 (angle AG2) between the divided surface 50B of the housing 50 and the engaging groove 52E (engaging groove 54E) is set at the acute angle, viewed from the axial direction of the shaft 34. This enables the detachable-side cover member 64 to be fixed to the detachable-side housing member 54 with the divided surface 60D of the fixing-side cover member 62 and the detachable-side cover member 64 being in close contact with each other. That is, for example, the detachable-side cover member 64 is temporarily fixed to the detachable-side housing member 54 by the fastening bolt

BL2, and in this state, the detachable-side housing member 54 is fixed to the fixing-side housing member 52 by the fixing bolt BL1. Then, the fastening bolt BL2 is tightened. At this time, a rotational moment generated in the detachable-side cover member 64 enables the engaging portion 64C to move along the engaging groove 54E to the fixing-side cover member 62. This allows the divided surface 60D of the fixing-side cover member 62 and the detachable-side cover member 64 to be in close contact with each other and to fix the detachable-side cover member 64 to the detachable-side housing member 54. For example, when tightening the fastening bolt BL2, the detachable-side cover member 64 is pushed towards the rear (towards the engaging groove 54E) by an operator, so that the engaging portion 64C moves along the engaging groove 54E towards the fixing-side cover member 62. Thus, even in this case, the divided surface 60D of the fixing-side cover member 62 and the detachable-side cover member 64 can be brought into close contact with each other and the detachable-side cover member 64 can be fixed to the detachable-side housing member 54. Therefore, adhesion between the fixing-side cover member 62 and the detachable-side cover member 64 can be improved.

[0058] The fixing-side cover member 62 and the detachable-side cover member 64 have the second flange portion 60C provided at the end of the drive roller 38 side in the cover portion 60A, and recess 38A open to the housing 50 side is formed at the end of the drive roller 38 on the housing 50 side. The second flange portion 60C is accommodated inside the recess 38A. This creates a so-called labyrinth structure between the cover 60 and the drive roller 38. Accordingly, the yarn Y can be prevented from entering the inside of the cover 60 from between the cover 60 and the drive roller 38. Thus, a winding of the yarn Y onto the shaft 34 can be effectively restrained.

[0059] In the present embodiment, the engaging portion 62C is provided on the fixing-side cover member 62 and the engaging portion 64C is provided on the detachable-side cover member 64, and the fastening point of the fixing-side cover member 62 and detachable-side cover member 64 is configured in one point, but the fastening point of the fixing-side cover member 62 or the detachable-side cover member 64 may be configured to be two points. In other words, a fastening portion may be provided instead of the engaging portion in said one fixing-side cover member 62 and said one detachable-side cover member 64. In this case, the fastening point is still one point in other fixing-side cover member 62 and the other detachable-side cover member 64, so that the workability when mounting and removing in the other fixing-side cover member 62 and the other detachable-side cover member 64 can be improved.

[0060] In particular, when the engaging portion 64C is provided only on the detachable-side cover member 64, for example, the fixing-side cover member 62 may be configured to be formed as an integral part of the fixing-

side housing member 52. In this case, in a state where the detachable-side housing member 54 and the detachable-side cover member 64 are removed from the fixing-side housing member 52 (state (3) in Fig. 8), by releasing the fastening state of the drive roller 38 to the shaft 34 and by sliding the drive roller 38 with respect to the shaft 34, the shaft 34 can be removed from the housing 50 while suppressing interference with the drive roller 38 and the second flange portion 60C of the fixing-side cover member 62.

[0061] In the present embodiment, the engaging groove 52E of the housing 50 and the engaging portion 62C of the fixing-side cover member 62 are formed in the substantially wedge shape, viewed from the longitudinal direction, so that the engaging groove 52E and the engaging portion 62C engages the shaft 34 in the axial direction and in the direction orthogonal to the axial direction (hereinafter called the orthogonal direction). In other words, the groove-side inclined surface 52E2 of the engaging groove 52E and the second engaging surface 62C2 of the engaging portion 62C serve as the portion that engages the engaging groove 52E and the engaging portion 62C orthogonally to the axially engaging portion of the shaft 34. Similarly, the groove-side inclined surface 54E2 in the engaging groove 54E of the housing 50 and the second engaging surface 64C2 in the engaging portion 64C of the detachable cover member 64 serve as the portion that engages the engaging groove 54E and the engaging portion 64C orthogonally to the axially engaging portion of the shaft 34. Alternatively, shapes of the engaging groove 52E (engaging groove 54E) and the engaging portion 62C (engaging portion 64C) may be modified so that in the engagement of the engaging groove 52E (engaging grooves 54E) and the engaging portion 62C (engaging portion 64C), they are divided into the portion that engages in the axial direction of the shaft 34 and the portion that engages in the orthogonal direction. Shape modifications of the engaging groove 52E (engaging groove 54E) and the engaging portion 62C (engaging portion 64C) are explained below using the engaging groove 52E and the engaging portion 62C.

[0062] As shown in Fig. 9, the engaging groove 52E of a variation is formed in an inner portion in the left-right direction at the front end of the stepped portion 52D and is in the concave shape, open to the shaft 34 side, viewed from the longitudinal direction. Specifically, the engaging groove 52E includes an inner groove surface 52E3, a bottom surface 52E4 extending outwardly in the left-right direction from the rear end of the inner groove surface 52E3, and an outer groove surface 52E5 extending forwardly from an outer end in the left-right direction of the bottom surface 52E4. The inner groove surface 52E3, similar to the receiving surface 52E1 in the present embodiment, is disposed flush with both the left and right sides of the fixing-side housing member 52. The inner groove surface 52E3 and the outer groove surface 52E5 are formed along a surface orthogonal to the left-right direction.

[0063] The engaging portion 62C of the variation is formed in a substantially rectangular shape, corresponding to the engaging groove 52E, viewed from the longitudinal direction. Specifically, the engaging portion 62C includes an inner engaging surface 62C3, tip surface 62C4 extending outward from the rear end of the inner engaging surface 62C3 in the left-right direction, and an outer engaging surface 62C5 extending forward from the tip surface 62C4. The inner engaging surface 62C3 is disposed flush with the end surface of the fixing-side cover member 62, similar to the first engaging surface 62C1 in the present embodiment. The inner engaging surface 62C3 and the outer engaging surface 62C5 are formed along the surface orthogonal to the left-right direction. When the engaging portion 62C is fitted into the engaging groove 52E, the engaging groove 52E and the engaging portion 62C engage in the axial and orthogonal directions of the shaft 34. In other words, the inner groove surface 52E3 and outer groove surface 52E5 of the engaging groove 52E and, the inner engaging surface 62C3 and outer engaging surface 62C5 of the engaging portion 62C correspond to the portion engaging in the axial direction of the shaft 34. The bottom surface 52E4 of the engaging groove 52E and the tip surface 62C4 of the engaging portion 62C correspond to the portion engaging in the orthogonal direction. As a result, the engaging portion 62C (engaging portion 64C) of the fixing-side cover member 62 (detachable-side cover member 64) can be fixed to the housing 50 in the same manner as in the present embodiment.

[0064] Although the yarn feeder 30 is applied to the false twisting machine 10, the yarn feeder 30 may be applied to a textile machine for producing POY, or to a textile machine for producing fully drawn yarn (FDY).

[Explanation of the Reference Numerals]

[0065]

10: False twisting machine (textile machine)
 18: Yarn path
 30: Yarn feeder
 30-1: First yarn feeder
 30-2: Second yarn feeder
 30-3: Third yarn feeder
 30-4: Fourth yarn feeder
 34: Shaft (Rotary shaft)
 36: Bearing
 38: Drive roller
 38A: Recess
 50: Housing (support member)
 52: Fixing-side housing member (half support member)
 52E: Engaging groove
 52E2: Groove-side inclined surface
 54: Detachable-side housing member (half support member)
 54E: Engaging groove

54E2: Groove-side inclined surface
 60: Cover
 60A: Cover portion
 60B: First flange portion
 60C: Second flange portion
 62: Fixing-side cover member (half cover member)
 62A: Fixing portion
 62C: Engaging portion
 62C2: Second engaging surface (engaging surface)
 64: Detachable-side cover member (half cover member)
 64A: Fixing portion
 64C: Engaging portion
 64C2: Second engaging surface (engaging surface)
 AG 1: Angle
 AG2: Angle
 BL2: Fastening bolt (fastening member)

Claims

1. A yarn feeder 30 disposed in a yarn path 18 of a textile machine 10 comprising:

a rotary shaft 34;
 a bearing 36 for rotatably supporting the rotary shaft 34;
 a roller which is integrally rotatable on the rotary shaft 34 and is disposed outward in axial direction of the rotary shaft 34 with respect to the bearing 36, and which feed a yarn travelling along the yarn path 18;
 a support member 50 supporting the bearing 36 and configured by a pair of half support members divided in radial direction of the rotary shaft 34; and
 a cover 60 disposed between the support member 50 and the roller, formed in a cylindrical shape covering the rotary shaft 34 from outside in the radial direction and configured by a pair of half cover members divided in the radial direction of the rotary shaft 34, wherein one half cover member is coupled to one half support member and other half cover member is coupled to other half support member, wherein at least one of the pair of the half cover members includes a fixing portion fastened to the half support member by a fastening member BL2 and an engaging portion engaged with the half support member in axial direction of the rotary shaft 34 and in a direction orthogonal to the axial direction.

2. The yarn feeder 30 according to claim 1,

wherein the half cover member includes half-cylindrical cover portion 60A covering the rotary

shaft 34 from the outside in the radial direction,
 and a first flange portion 60B provided at end of
 support member side in the cover portion 60A,
 wherein the fixing portion is provided at one side
 end in circumferential direction of the first flange
 portion 60B and, the engaging portion is provid- 5
 ed at other side end in the circumferential direc-
 tion of the first flange portion 60B,
 wherein outer circumference of the half support
 member has an engaging groove open to rotary 10
 shaft side and extending in the direction inter-
 secting a divided surface of the support member
 50, viewed from the axial direction,
 wherein the engaging portion is inserted into the
 engaging groove and is engaged with the half 15
 support member in a manner that prevents rel-
 ative movement.

3. The yarn feeder 30 according to claim 2, 20

wherein a cover-side side surface in the engag-
 ing groove is configured as a groove-side in-
 clined surface,
 wherein the groove-side inclined surface is,
 viewed from longitudinal direction of the engag- 25
 ing groove, inclined towards the support mem-
 ber side as it moves towards bottom side of the
 engaging groove,
 wherein the engaging portion has an engaging
 surface in contact with the groove-side inclined 30
 surface.

4. The yarn feeder 30 according to claim 2 or 3,
 wherein the divided surface of a cover 60 is disposed
 flush with the divided surface of the support member 35
 50, and viewed from the axial direction, angle be-
 tween the divided surface of the support member 50
 and the engaging groove is set at an acute angle.

5. The yarn feeder 30 according to any one of claims 40
 2 to 4,

wherein the half cover member has second
 flange portion 60C at roller side end in the cover
 portion 60A, 45
 wherein a recess 38A open to the support mem-
 ber side is formed at the end of the support mem-
 ber side on the roller,
 wherein the second flange portion 60C is dis-
 posed inside the recess 38A. 50

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Fig. 1

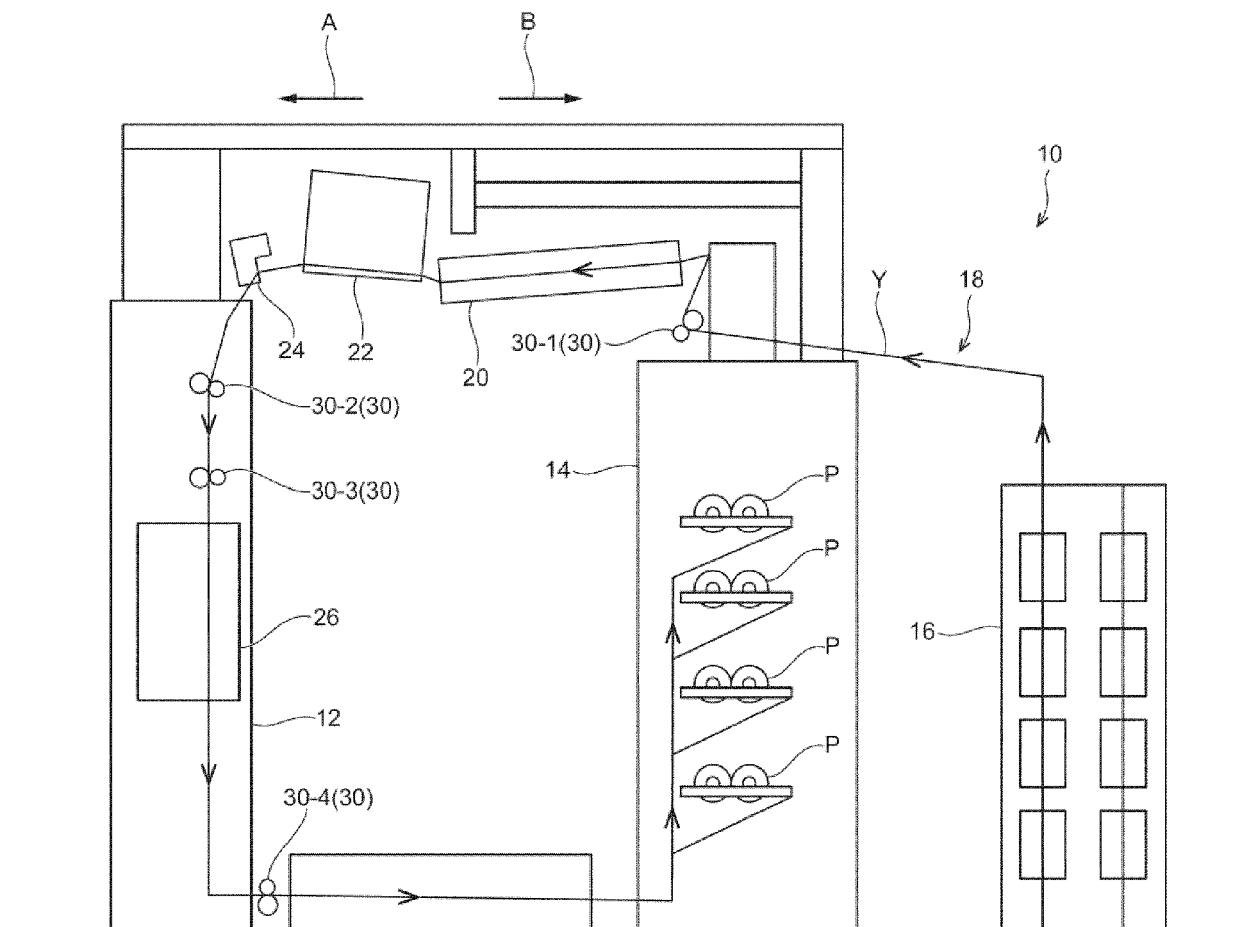


Fig. 2

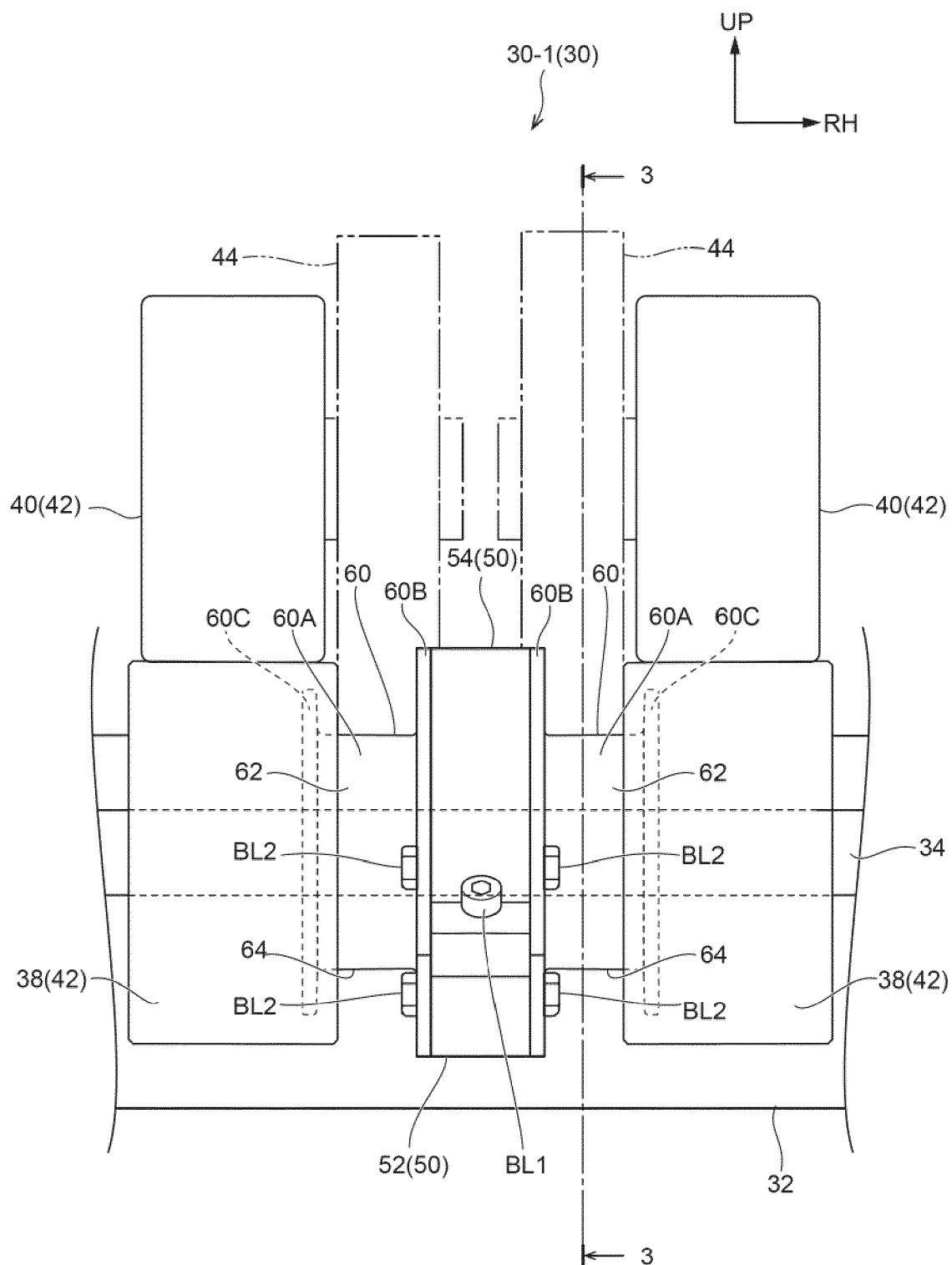


Fig. 3

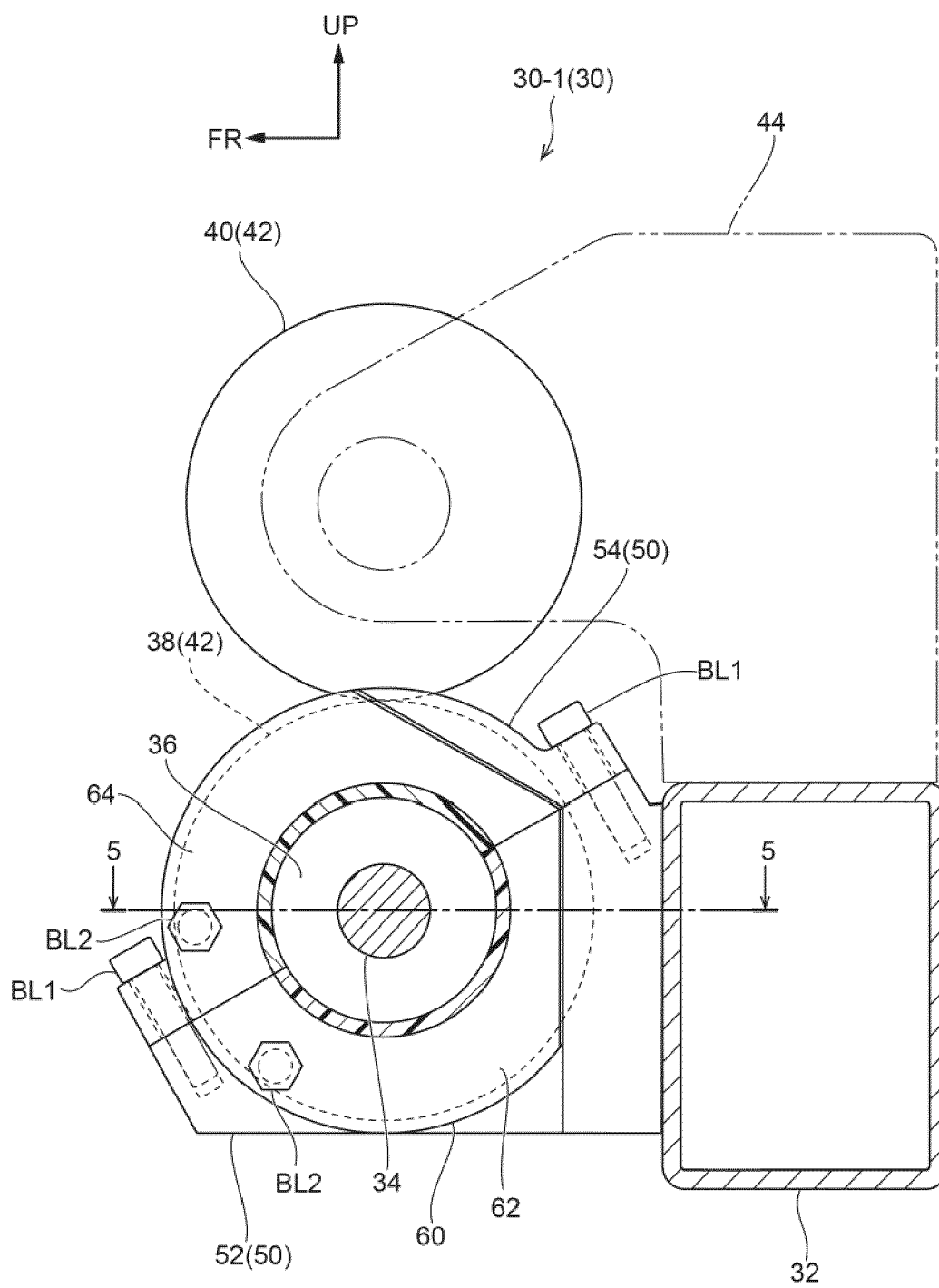


Fig. 4

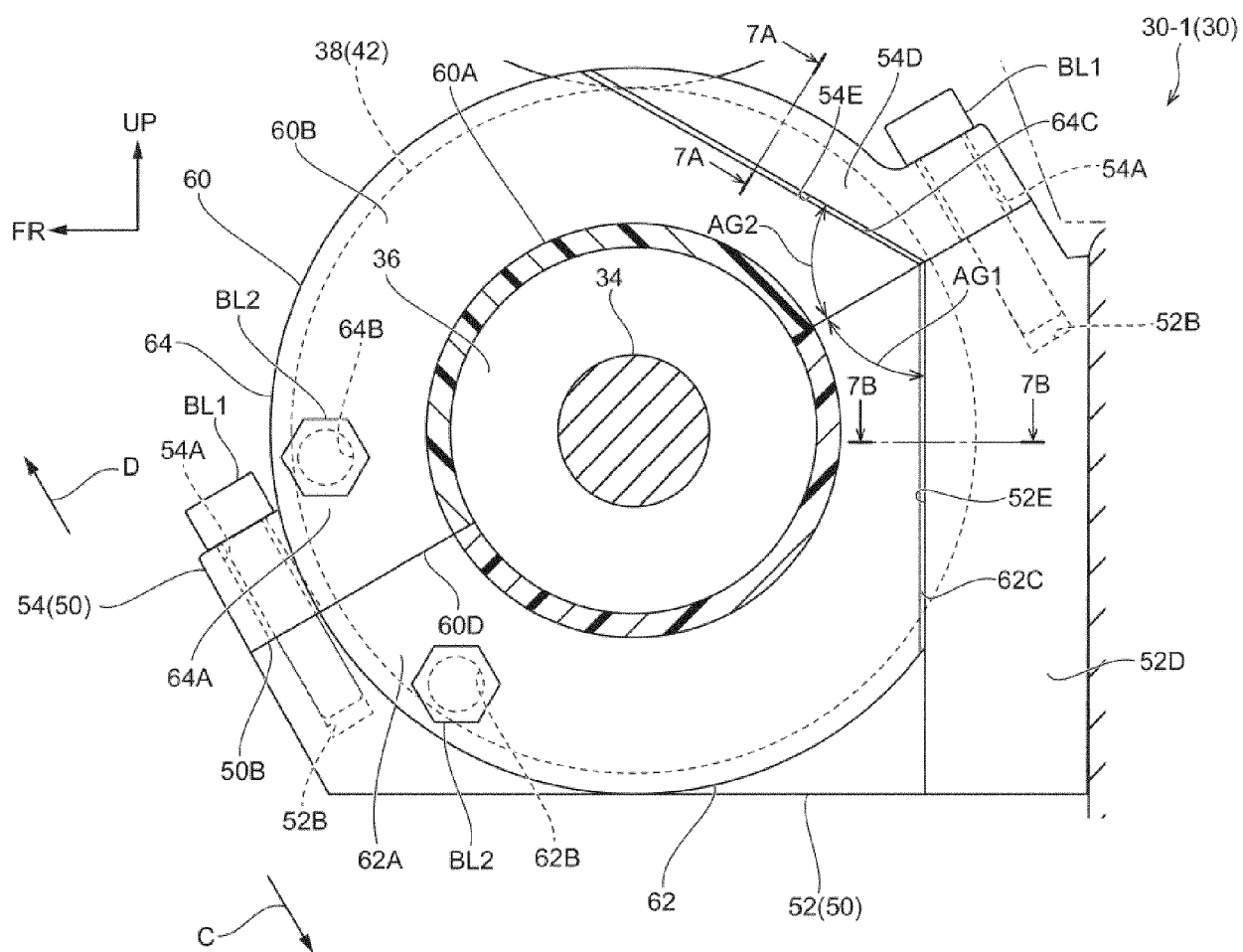


Fig. 5

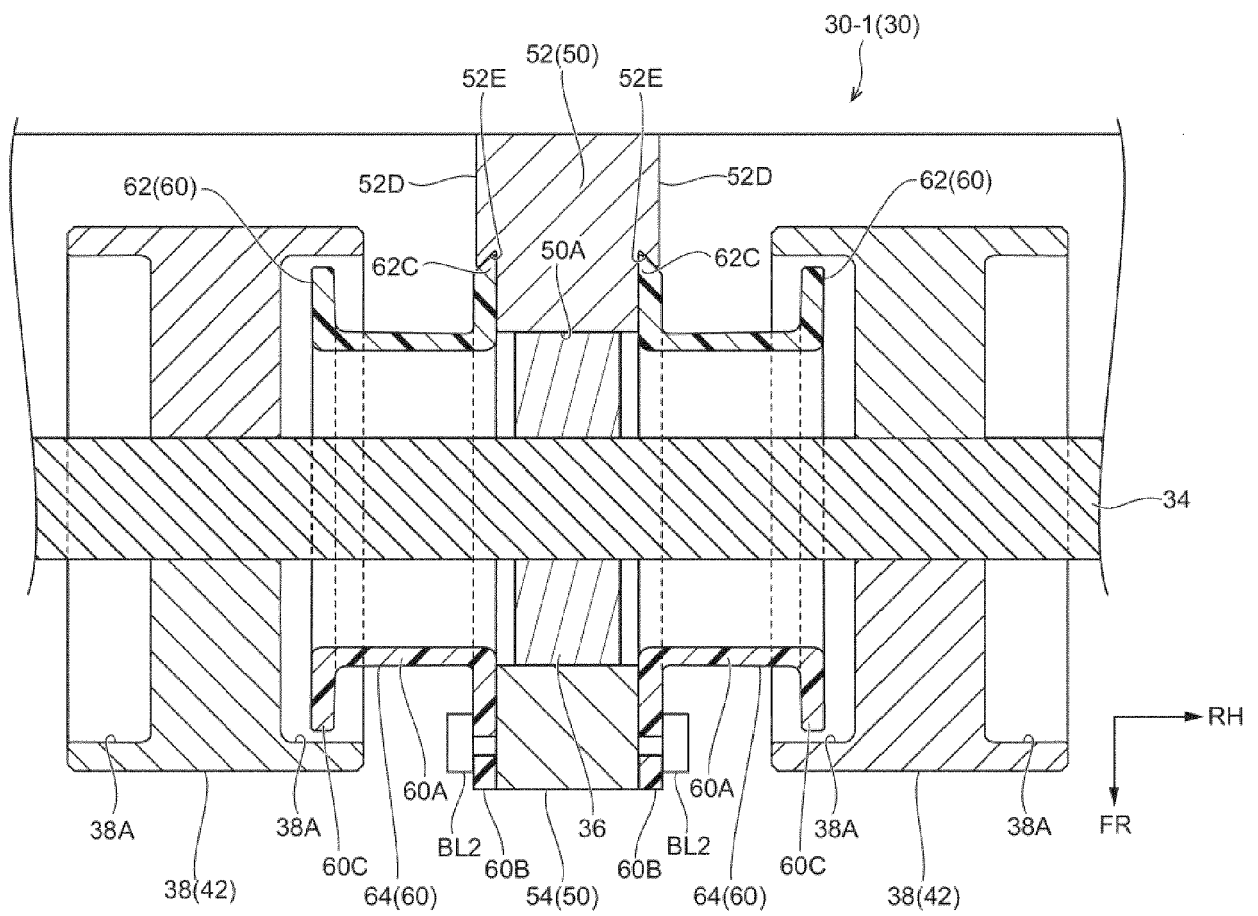


Fig. 6

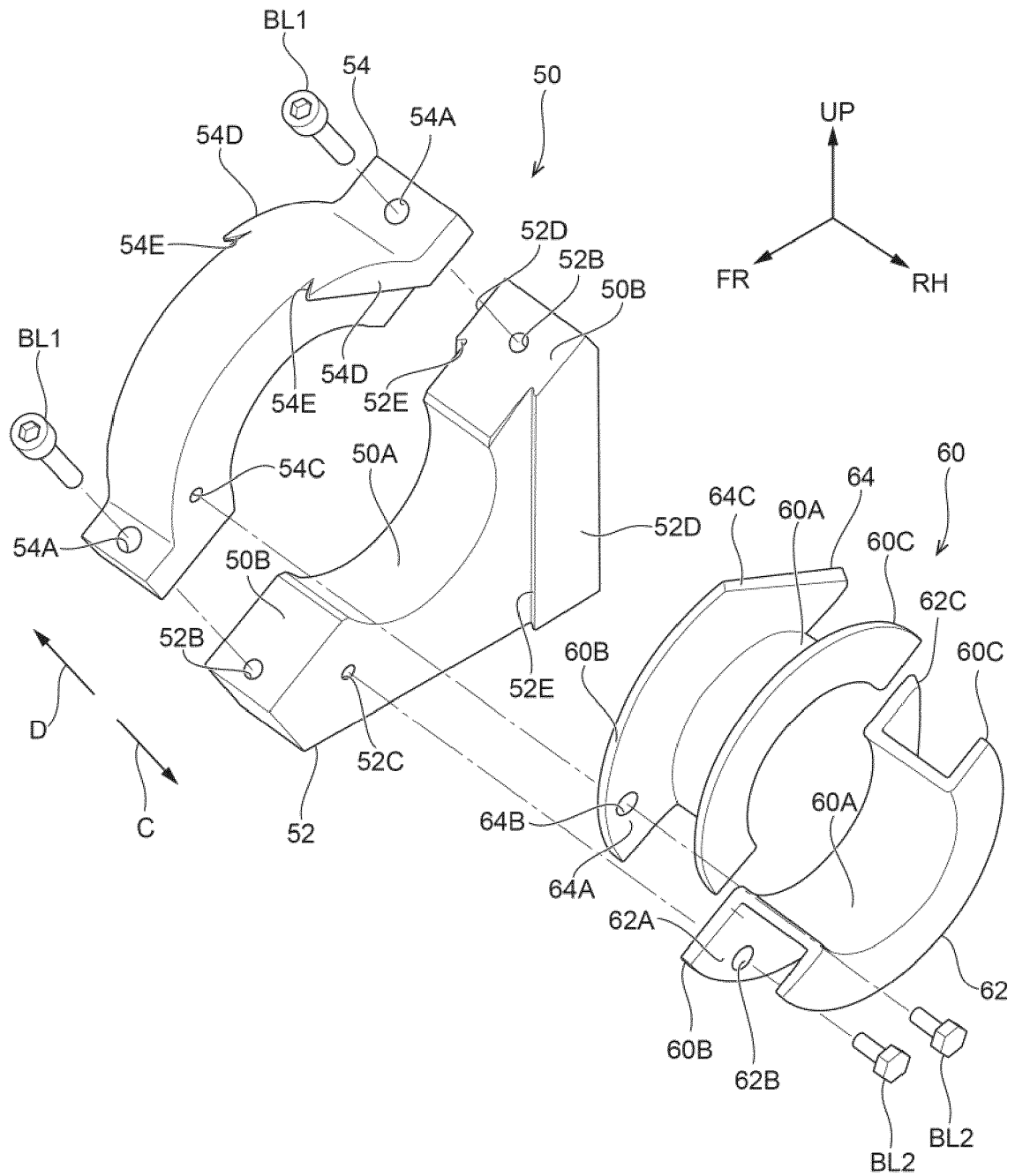


Fig. 7

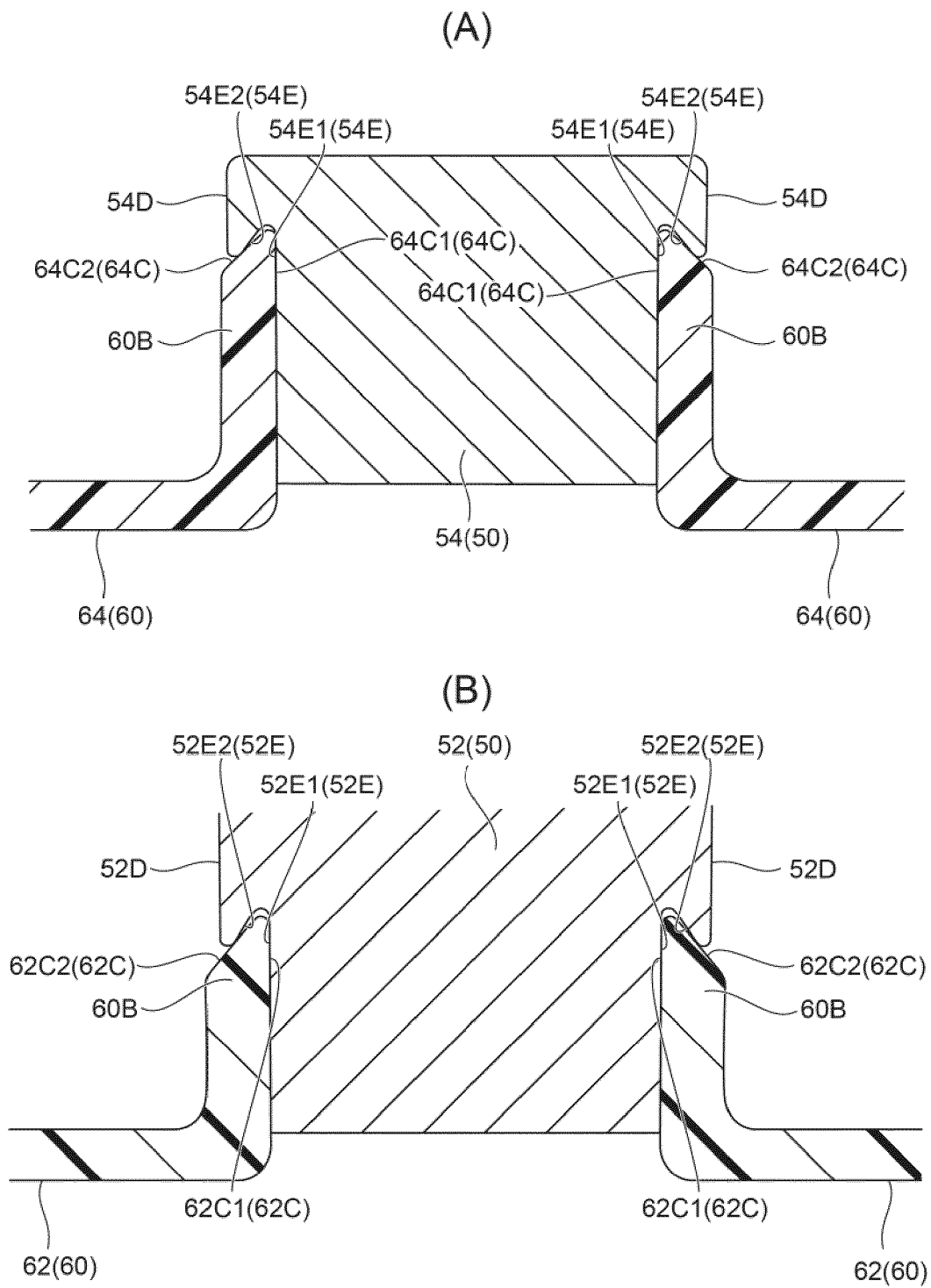


Fig. 8

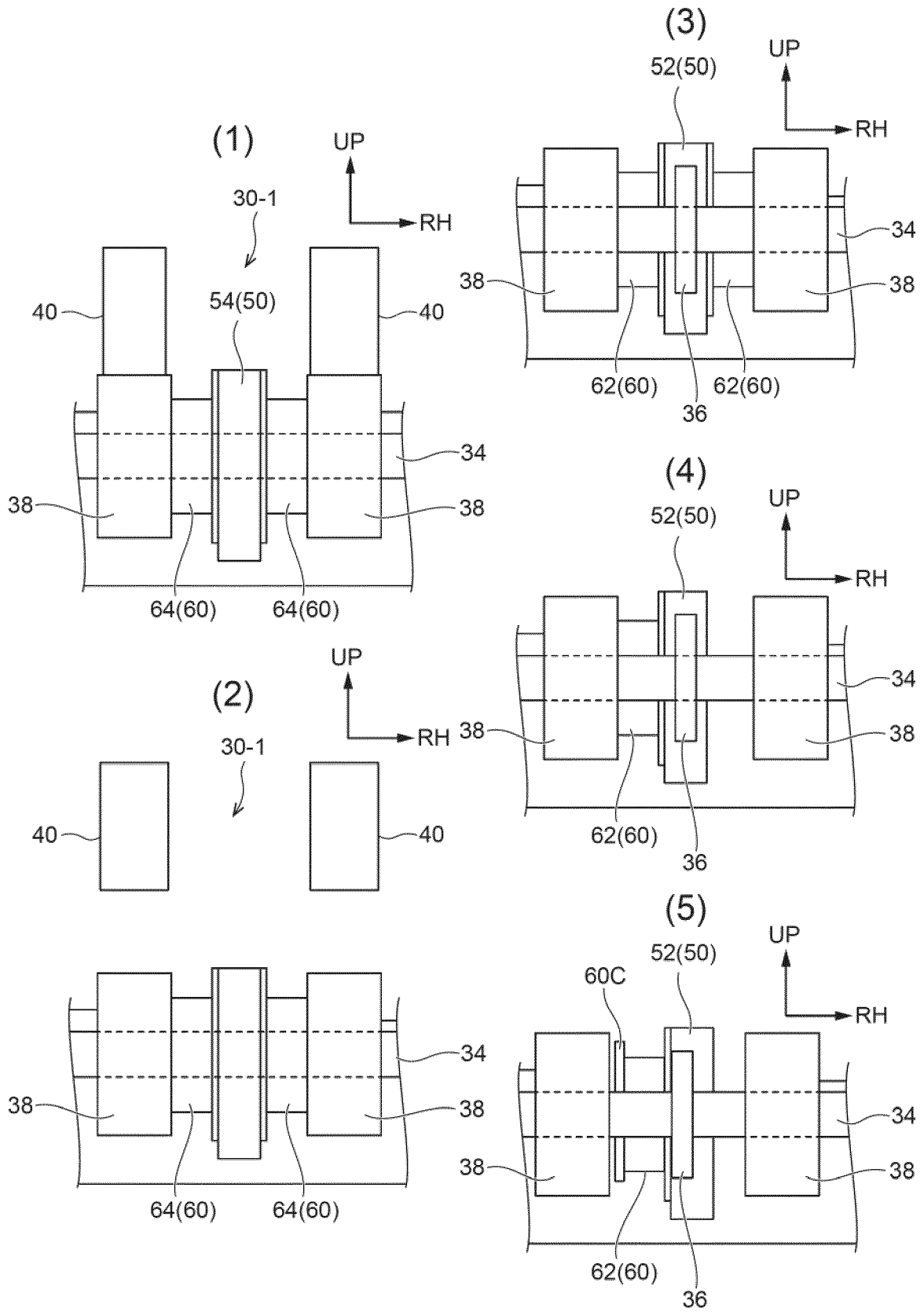
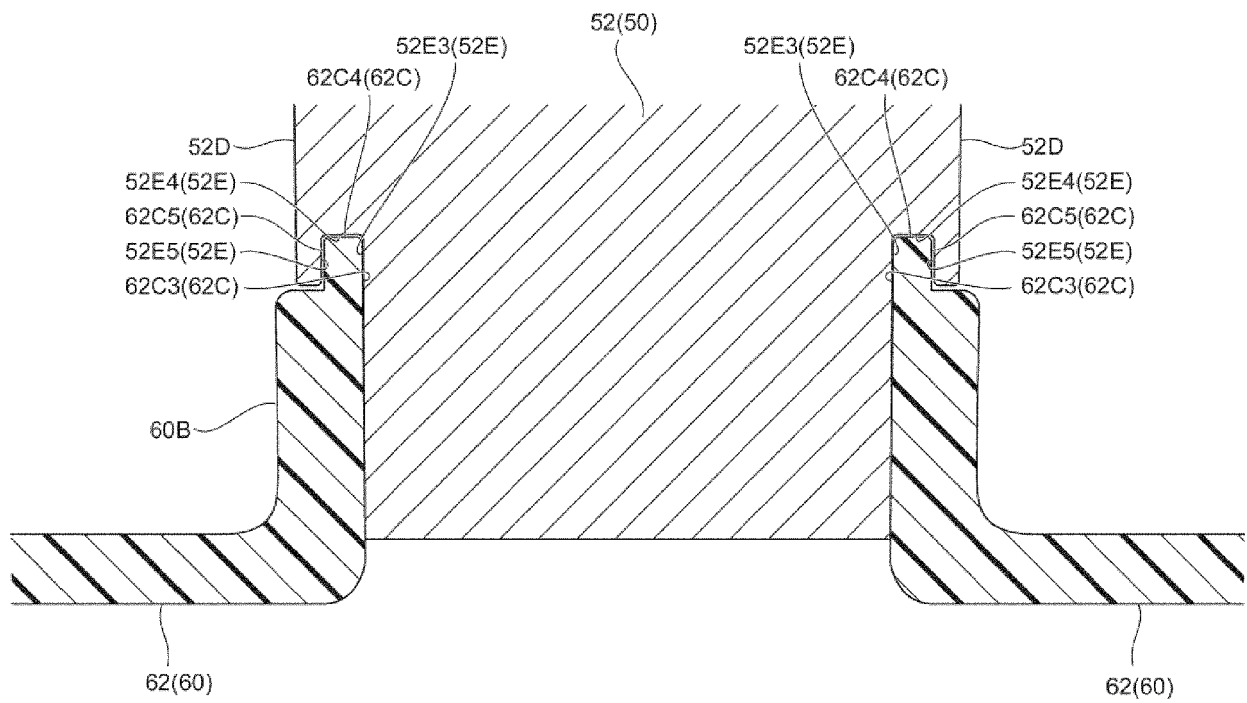


Fig. 9





EUROPEAN SEARCH REPORT

Application Number

EP 24 17 6164

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 3 266 913 A1 (TMT MACHINERY INC [JP]) 10 January 2018 (2018-01-10) * paragraph [0048] * * paragraph [0052] * * paragraph [0056] * * paragraph [0066] * * figures 3,5 * -----	1-5	INV. B65H51/10 B65H51/32
			TECHNICAL FIELDS SEARCHED (IPC)
			B65H D02G
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		25 September 2024	Guisan, Thierry
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 24 17 6164

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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25 - 09 - 2024

10	Patent document cited in search report		Publication date	Patent family member(s)		Publication date
15	EP 3266913	A1	10-01-2018	CN	107541825 A	05-01-2018
				EP	3266913 A1	10-01-2018
				EP	3974568 A1	30-03-2022
				JP	6697963 B2	27-05-2020
				JP	2018003167 A	11-01-2018
				TW	201800632 A	01-01-2018

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP HL 1989132843 A [0004]