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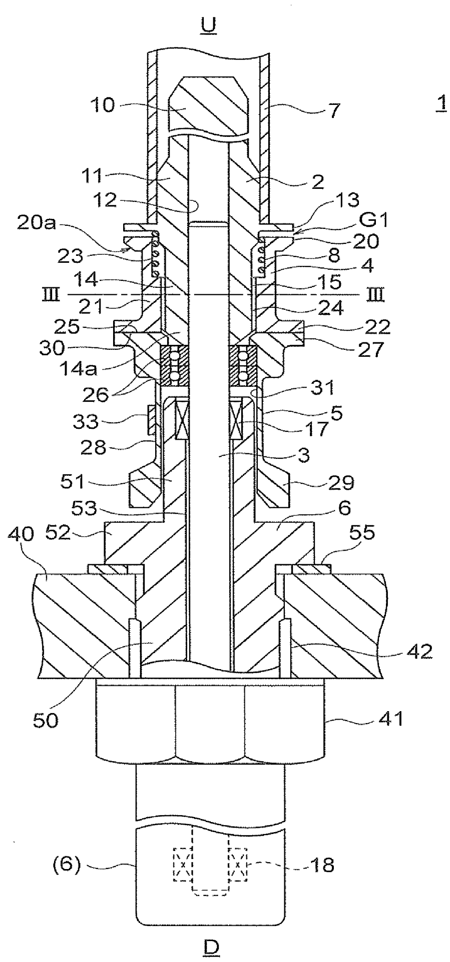
(54) **SPINDLE DEVICE OF SPINNING MACHINE**

(57) A spindle device (1) of a spinning machine includes a spindle shaft (3), a spindle body (2), a bushing (4) having a first clutch surface (25) and mounted on the spindle body (2) movable in an axial direction of the spindle shaft (3), rotates integrally with the spindle shaft (3) and the spindle body (2), and a whorl (5) having a second clutch surface (30) facing the first clutch surface (25), disposed side by side with the bushing (4), and rotatably mounted on the spindle shaft (3) with a bearing (26) interposed between the spindle shaft (3) and the whorl (5). The bushing (4) is disposed closer to the spindle body (2) than the whorl (5) is. The spindle shaft (3), the spindle body (2) and the bushing (4) rotate integrally with the whorl (5) when the first clutch surface (25) and the second clutch surface (30) are connected.

FIG. 1



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Description

[0001] The present disclosure relates to a spindle device of a spinning machine.

BACKGROUND ART

[0002] As an example of the configuration of a spindle device used for a spinning machine such as a spinning flame and a twisting machine, Japanese Utility Model Application Publication No. 02-131563 discloses a spindle device that includes a spindle shaft, a casing, a spring, a piston, a whorl, a clutch drive shaft, and a clutch disk. In this configuration, the clutch drive shaft is mounted to the spindle shaft using a key. In addition, the clutch drive shaft is fixed to an inner ring of a bearing, and the piston is fixed to an outer ring of the bearing.

[0003] According to the configuration of the Publication No. 02-131563, when transmitting a rotational force of the whorl to the spindle shaft, a force of a spring mounted to the casing is applied to the outer ring of the bearing as a thrust load. At this time, the piston fixed to the outer ring of the bearing does not rotate, but the clutch drive shaft fixed to the inner ring of the bearing rotates. While the bearing receives the thrust load by the inner ring, the inner ring and the outer ring of the bearing rotate relative to each other. As a result, heavy load is applied to the bearing when rotating the spindle shaft by the rotation of the whorl.

[0004] Japanese Patent Application Publication No. 48-69934 discloses a spindle device in which a yarn bobbin holder is press-fitted to a spindle shaft and a whorl is rotatably mounted on the yarn bobbin holder with the bearing interposed therebetween. In this spindle device, a cylindrical fastening is mounted on the spindle shaft with the yarn bobbin holder interposed therebetween, and a clutch block is mounted to the cylindrical fastening to be movable up and down. The whorl and the clutch block have a clutch surface, respectively. The clutch surface of the clutch block is pressed against and in contact with the clutch surface of the whorl by the force of the spring. In this state, the rotation of the whorl is transmitted to the spindle shaft via the clutch block, the cylindrical fastening, and the weft bobbin holder. According to this configuration, the yarn bobbin holder and the cylindrical fastening in contact with the inner ring of the bearing and the whorl in contact with the outer ring of the bearing rotate integrally, so that the inner ring and the outer ring of the bearing do not rotate relative to each other. This reduces the load applied to the bearing.

[0005] However, the spindle device of the Publication No. 48-69934 includes a clutch block disposed lower part of the hollow portion of the whorl as a member for the intermittent operation of the clutch, and an operation block disposed lower than the clutch block. The clutch block and the operation block are disposed near the spindle rail, which restricts the space. This leads to a disadvantage that it is difficult to secure an enough space for the intermittent operation of the clutch.

[0006] The present invention, which has been made to solve the above problems, is directed to providing a spindle device of a spinning machine that reduces the load applied to the bearing and secures an enough space for the intermittent operation of the clutch.

SUMMARY

[0007] In accordance with an aspect of the present disclosure, there is provided a spindle device of a spinning machine including a spindle shaft, a spindle body coaxially fixed to the spindle shaft, a bushing that has a first clutch surface, is mounted on the spindle body to be movable in an axial direction of the spindle shaft, and rotates integrally with the spindle shaft and the spindle body, and a whorl that has a second clutch surface facing he first clutch surface, is disposed side by side with the bushing in the axial direction of the spindle shaft, and is rotatably mounted on the spindle shaft with a bearing interposed between the spindle shaft and the whorl. The bushing is disposed closer to the spindle body than the whorl is in the axial direction of the spindle shaft. The spindle shaft, the spindle body and the bushing rotate integrally with the whorl when the first clutch surface and the second clutch surface are connected.

[0008] Other aspects and advantages of the present disclosure will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The present disclosure together with objects and advantages thereof may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

FIG. 1 is a longitudinal sectional view, showing the configuration of a spindle device of a spinning machine according to a present embodiment;
FIG. 2 is a side view, showing a part of the spindle device of FIG. 1;
FIG. 3 is a perspective view of the spindle device, taken along the line III-III of FIG. 1;
FIG. 4 is a side view, showing a state that a bushing is moved upward;
FIG. 5 is a perspective view, showing the configuration of a brake mechanism of the spindle device of FIG. 1;
FIG. 6 is a perspective view, showing a state where the brake mechanism of FIG. 5 is disposed in the operative position; and
FIG. 7 is a side view, showing a state where the brake mechanism of FIG. 5 is disposed in the operative position.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Embodiment

[0010] The following will describe an embodiment of the present disclosure in detail with reference to the accompanying drawings.

[0011] FIG. 1 is a longitudinal sectional view showing the configuration of a spindle device of a spinning machine according to the present embodiment, and FIG. 2 is a side view showing a part of a spindle device of FIG. 1. FIG. 3 is a perspective view of the spindle device, taken along the line III-III of FIG. 1;

[0012] As shown in FIGS. 1 through 3, a spindle device 1 includes a spindle body 2, a spindle shaft 3, a bushing 4, a whorl 5, and a bolster 6. In the following description, the positional relationship among various parts will be specified with one side and the other side of the axis of the spindle shaft 3 defined as the upper side U and the lower side D, respectively.

(Spindle body)

[0013] The spindle body 2 is coaxially fixed to the spindle shaft 3. The spindle body 2 includes a bobbin introduction portion 10, a bobbin mounting portion 11, a shaft hole 12, a first flange portion 13, and a spline shaft portion 14. The bobbin introduction portion 10 is configured to guide the bobbin 7 to the bobbin mounting portion 11. The outer diameter of the bobbin introduction portion 10 is set smaller than the inner diameter of the bobbin 7. The bobbin introduction portion 10 is positioned in the upper end portion of the spindle body 2. The bobbin mounting portion 11 is disposed so as to project in the upper side U from the position of the first flange portion 13. The bobbin mounting portion 11 is a part on which the bobbin 7 is mounted detachably. The outer diameter of the bobbin mounting portion 11 is set slightly smaller than the inner diameter of the bobbin 7. With the bobbin 7 mounted on the bobbin mounting portion 11, the bobbin 7 is disposed coaxially with the spindle body 2.

[0014] The spindle body 2 has therein a shaft hole 12 formed on the axis thereof. The shaft hole 12 is formed extending through the spindle body 2 from the bobbin mounting portion 11 to the spline shaft portion 14. The inner diameter of the shaft hole 12 is set at a dimension that corresponds to the outer diameter of the spindle shaft 3 to be inserted into the shaft hole 12. The first flange portion 13 projects radially outward of the outer peripheral surface of the bobbin mounting portion 11. With the bobbin 7 mounted on the bobbin mounting portion 11, the lower end of the bobbin 7 is placed in contact with the upper surface of the first flange portion 13. Thus, the first flange portion 13 serves as the bobbin receiving member that receives the bobbin 7 mounted on the bobbin mounting portion 11. The spline shaft portion 14 is disposed so as to project toward the lower side D from the position of the first flange portion 13. With respect to the position of the first flange portion 13, the bobbin introduction portion 10 and the bobbin mounting portion 11 are disposed on the upper side U of the first flange portion 13, and the spline shaft portion 14 is disposed on the lower side D of the first flange portion 13. A plurality of grooves 15 is formed in the outer peripheral surface of the spline shaft portion 14 at predetermined angular intervals in the circumferential direction thereof. The grooves 15 are vertical grooves, extending along the axial directions of the spindle body 2 and the spindle shaft 3. The lower end portion 14a of the spline shaft portion 14 has a tapered shape, the diameter of which decreases towards the lower end, so that the lower end portion 14a of the spline shaft portion 14 is only in contact with the inner ring of the ball bearing 26. It is noted that the lower end portion 14a of the spline shaft portion 14 may have a stepped shape, instead of a tapered shape.

(Spindle shaft)

[0015] The spindle shaft 3 is disposed coaxially with the spindle body 2, the bushing 4, the whorl 5, and the bolster 6. The spindle shaft 3 is supported rotatably by first and second roller bearings 17, 18. The spindle shaft 3 is disposed extending through the whorl 5 and the bolster 6. The upper end portion of the spindle shaft 3 is press-fitted into the shaft hole 12 of the spindle body 2. Thus, the spindle body 2 and the spindle shaft 3 are configured to rotate integrally. The lower end of the spindle shaft 3 is disposed near the bottom of the bolster 6 where the second roller bearing 18 rotatably supports the lower end portion of the spindle shaft 3. Although the spindle body 2 and the spindle shaft 3 are formed separately in the present embodiment, the spindle body 2 and the spindle shaft 3 may be formed integrally.

(Bushing)

[0016] The bushing 4 is disposed closer to the spindle body 2 than the whorl 5 is in the axial direction of the spindle shaft 3. Specifically, the bushing 4 is disposed between the bobbin mounting portion 11 of the spindle body 2 and the whorl 5. The bushing 4 and the whorl 5 are disposed in series along the axial direction of the spindle shaft 3, and both the bushing 4 and the whorl 5 are exposed. The bushing 4 is mounted on the spline shaft portion 14 of the spindle body 2. The bushing 4 is movable in the axial direction of the spindle shaft 3 by way of the engagement between the projection 24 and the groove 15, which will be described later. The bushing 4 has a cylindrical shape, and has a second flange portion 20, a body portion 21, and a third flange portion 22 integrally. The second flange portion 20 projects radially outward of the outer peripheral surface of the body portion 21. A slanted surface 20a is formed in the lower surface of the second flange portion 20. The second flange portion 20 is disposed so as to face the first flange portion 13 of the spindle body 2 in the axial direction of the spindle shaft 3. The first flange portion 13 and the second flange portion 20 face each other with a gap G1 formed therebetween. The gap G1 allows the bushing 4 to move in the axial direction of the spindle shaft 3 guided by the spline shaft portion 14 of the spindle body 2

[0017] A spring accommodation portion 23 is formed in the inner peripheral portion of the body portion 21. The spring accommodation portion 23 is formed in the upper side of the inner peripheral surface of the bushing 4. A spring 8 serving as an urging member is disposed in the spring accommodation portion 23. The spring 8 is configured to urge the bushing 4 downward to apply an urging force to the bushing 4 so that the first clutch surface 25 is pressed against and in contact with the second clutch surface 30. In the present embodiment, as an example, the spring 8 is provided by a compression coil spring. The upper end portion of the spring 8 is in contact with the lower surface of the first flange portion 13 of the spindle body 2, and the lower end portion of the spring 8 is in contact with the bottom surface of the spring accommodation portion 23. A plurality of projections 24 is formed at predetermined angular intervals in the circumferential direction in the inner peripheral surface of the body portion 21. The projections 24 are formed so as to correspond to the above-described grooves 15. The bushing 4 is mounted on the spline shaft portion 14 of the spindle body 2 with the projections 24 and the grooves 15 engaged each other. Thus, the bushing 4 is configured to rotate integrally with the spindle body 2 and the spindle shaft 3. The third flange portion 22 projects radially outward of the outer peripheral surface of the body portion 21. The lower surface of the third flange portion 22 corresponds to a first clutch surface 25 (see FIG. 1).

(Whorl)

[0018] The whorl 5 is disposed side by side with the bushing 4 in the axial direction of the spindle shaft 3. In addition, the whorl 5 is rotatably mounted on the spindle shaft 3 with the ball bearings 26 interposed therebetween. Two ball bearings 26 are provided side by side in the vertical direction so as to stabilize the position of the whorl 5. The inner ring of the ball bearing 26 is fixed to the spindle shaft 3 by press-fitting, and the outer ring of the ball bearing 26 is fixed to the inner peripheral surface of the whorl 5 by press-fitting. Further, the lower end portion 14a of the spline shaft portion 14 is in contact with the inner ring of the ball bearing 26.

[0019] The whorl 5 has a cylindrical shape and has a fourth flange portion 27, a belt contact portion 28, and a fifth flange portion 29 formed integrally. The fourth flange portion 27 extends radially outward of the outer peripheral surface of the belt contact portion 28. The fourth flange portion 27 is disposed facing the third flange portion 22 of the bushing 4 in the axial direction of the spindle shaft 3. The upper surface of the fourth flange portion 27 corresponds to a second clutch surface 30 (see FIG. 1). The second clutch surface 30 faces the first clutch surface 25 of the third flange portion 22 in the axial direction of the spindle shaft 3. The first clutch surface 25 and the second clutch surface 30 serve as the clutch surfaces for transmitting the rotational force between the bushing 4 and the whorl 5 and shutting off the transmission of the rotational force between the bushing 4 and the whorl 5. When transmitting the rotational force from the whorl 5 to the bushing 4, the first clutch surface 25 and the second clutch surface 30 are placed in contact (connected). When not transmitting the rotational force from the whorl 5 to the bushing 4, the first clutch surface 25 and the second clutch surface 30 are apart.

[0020] The belt contact portion 28 is positioned between the fourth flange portion 27 and the fifth flange portion 29. A spindle driving belt 33 is wound around the outer peripheral surface of the belt contact portion 28 by a predetermined angle (e.g., 90°). The belt 33 is driven by the operation of a belt driving device (not shown). The whorl 5 is driven to rotate by the operation of the belt 33. The fifth flange portion 29 projects radially outward of the outer peripheral surface of the belt contact portion 28. The whorl 5 has therein a through hole 31. The through hole 31 is formed extending through the fourth flange portion 27, the belt contact portion 28, and the fifth flange portion 29.

(Bolster)

[0021] The bolster 6 is fixed to the spindle rail 40 by a nut 41. The spindle rail 40 has a insertion hole 42 into which the bolster 6 is inserted. The bolster 6 has an external thread (not shown) formed in a part of the outer peripheral surface of the bolster 6 with which the nut 41 engages. The bolster 6 has a bolster body 50, a projection 51, and a flange 52 integrally. The bolster 6 has therein a shaft hole 53. The spindle shaft 3 is inserted into the shaft hole 53. The inner diameter of the shaft hole 53 is set larger than the outer diameter of the spindle shaft 3. The lower end of the bolster body 50 projects toward the lower surface of the spindle rail 40, extending through the insertion hole 42 of the spindle rail 40. The above-described second roller bearing 18 is disposed in the bottom portion of the bolster body 50.

[0022] The projection 51 projects upward from the flange 52. The projection 51 is inserted into the through hole 31 of the whorl 5. The upper end of the projection 51 is disposed near the ball bearing 26. The above-described first roller bearing 17 is mounted on the inner periphery side of the upper end portion of the projection 51. The flange 52 projects radially outward of the outer peripheral surface of the projection 51. A shim 55 is held between the lower surface of the flange 52 and the upper surface of the spindle rail 40. The bolster 6 is fixed to the spindle rail 40 by fastening the nut 41 with the spindle rail 40 held between the flange 52 and the nut 41.

(Brake mechanism)

[0023] The spindle device 1 of the present embodiment includes a brake mechanism 60 as shown in FIG. 5, in addition to the above-described configuration. Although two spindle devices 1 are disposed side by side on the spindle rail 40, and only one of the two spindle devices 1 is provided with the brake mechanism 60 in FIG. 5, in actuality, each of all the spindle devices 1 is provided with the brake mechanism 60. Assuming that two spindle devices 1 form a set of the spindle devices 1, the spindle driving belt 33 is wound around the two whorls 5 belonging to the same set of the spindle devices 1.

[0024] The brake mechanism 60 is configured to shut off the transmission of the rotational force from the whorl 5 to the bushing 4 and thereby to stop the rotation of the spindle body 2, the spindle shaft 3, and the bushing 4. The brake mechanism 60 is movable between the operative position and the inoperative position. The operative position is where the rotation of the spindle shaft 3 is stopped by the brake mechanism 60, i.e., the position to apply braking, and the inoperative position is the position to release the braking. FIG. 5 shows a state where the brake mechanism 60 is positioned at the inoperative position.

[0025] The brake mechanism 60 shuts off the transmission of the rotational force from the whorl 5 to the bushing 4 by moving the bushing 4 upward against the urging force of the spring 8. The brake mechanism 60 stops the rotation of the spindle shaft 3 and the bushing 4 by contacting with the spindle body 2 and the bushing 4. The following will describe the configuration of the brake mechanism 60.

[0026] The brake mechanism 60 includes a pair of arms 61, an operation lever 62, and a pair of clamp members 63. The paired arms 61 are disposed on opposite sides of the flange 52 of the bolster 6 such that the flange 52 of the bolster 6 is disposed between the paired arms 61. A pin (not shown) is formed in the lower end portion 61a of the arm 61, which is fitted into a hole (not shown) formed in the outer peripheral surface of the flange 52, with the result that the arms 61 are supported rotatably about the axis J shown in FIG. 5. The lever 62 is disposed between the pair of arms 61. The lever 62 includes a fixing portion 62a that is fixed to the pair of arms 61 by screwing, bonding, or the like, and an operating portion 62b that extends from the fixing portion 62a.

[0027] The clamp members 63 separate the first clutch surface 25 from the second clutch surface 30, by clamping the first flange portion 13 and the second flange portion 20 in the axial direction of the spindle shaft 3. The clamp members 63 are disposed in the upper end portion 61b of the arm 61. The clamp member 63 includes a first contact portion 65, a second contact portion 66 and a fitting groove 67. The first contact portion 65 is placed in contact with the upper surface of the first flange portion 13 when the brake mechanism 60 is moved to the operative position. The second contact portion 66 is placed in contact with the lower surface of the second flange portion 20, and moves the bushing 4 upward when the brake mechanism 60 is moved to the operative position. The first contact portion 65 and the second contact portion 66 face each other with the fitting groove 67 disposed between the first contact portion 65 and the second contact portion 66. The first contact portion 65 and the second contact portion 66 have a mountain shape, and protrude toward each other.

[0028] The following will describe the operation of the spindle device 1 having the above-described configuration. Firstly, the basic operation of the spindle device 1 and then the operation of the brake mechanism 60 will be described.

[0029] With the belt 33 driven by the belt driving device (not shown), the whorl 5 rotates in accordance with the driving direction and the driving speed of the belt 33. At this time, in the state in which the first clutch surface 25 of the bushing 4 is pressed against and in contact with the second clutch surface 30 of the whorl 5 by the urging force of the spring 8, the rotational force of the whorl 5 is transmitted to the bushing 4 by connecting the first clutch surface 25 and the second clutch surface 30. With the rotation of the whorl 5 driven by the belt 33, the bushing 4, the spindle body 2, and spindle shaft 3 rotate integrally with the whorl 5. As a result, the bobbin 7 mounted on the bobbin mounting portion 11 of the spindle body 2 rotates together with the spindle body 2.

[0030] When the bushing 4 is moved upward against the urging force of the spring 8, the states of the spindle device 1 shown in FIG. 1 and FIG. 2 is changed to the state shown in FIG. 4. As compared with the state of the spindle device 1 before the bushing 4 is moved upward, the gap G1 between the first flange portion 13 of the bobbin mounting portion 11 and the second flange portion 20 of the bushing 4 becomes small. A gap G2 is formed between the third flange portion 22 of the bushing 4 and the fourth flange portion 27 of the whorl 5 by the movement of the bushing 4, which separates the first clutch surface 25 of the third flange portion 22 from the second clutch surface 30 of the fourth flange portion 27 by the dimension of the gap G2. Accordingly, the transmission of the rotational force from the whorl 5 to bushing 4 is shut off. This permits stopping the rotation of the spindle body 2, the spindle shaft 3, and the bushing 4 while the whorl 5 is kept rotating by the operation of the belt 33.

[0031] On the other hand, the brake mechanism 60 operates in the following manner. Before applying the brake, the brake mechanism 60 is positioned at the inoperative position, as shown in FIG. 5. Specifically, the paired clamp members 63 keep the brake mechanism 60 laid so as not to contact the spindle body 2 and the bushing 4. In this state, the first clutch surface 25 is pressed against the second clutch surface 30 by the urging force of the spring 8, so that the rotational force of the whorl 5 transmits to the bushing 4. With the whorl 5 rotated by the operation of the belt 33, the bushing 4, the spindle body 2, and the spindle shaft 3 rotate integrally with the whorl 5.

[0032] The brake mechanism 60 is moved to the operative position as shown in FIGS. 6 and 7 when applying the brake. Specifically, the brake mechanism 60 is placed in a standing state by rotating the paired arms 61 in the B direction about the axis J with the operating portion 62b of the lever 62 held by the operator. The first flange portion 13 and the second flange portion 20 are fitted to the fitting groove 67 of the clamp member 63 while rotating the paired arms 61. The first contact portion 65 of the clamp member 63 is placed in contact with the upper surface of the first flange portion 13, and the second contact portion 66 is placed in contact with the lower surface of the second flange portion 20. As a result, the first flange portion 13 and the second flange portion 20 are clamped by the clamp members 63. At this time, a braking force is applied to the spindle body 2 by the contact of the first contact portion 65 with the first flange portion 13. On the other hand, the bushing 4 is pushed upward by the contact of the second contact portion 66 with the second flange portion 20. Thus, the first clutch surface 25 separates from the second clutch surface 30. As a result, the transmission of the rotational force from the whorl 5 to bushing 4 is shut off. Further, the brake force is applied to the bushing 4 by the contact of the second contact portion 66 with the second flange portion 20. Thus, the spindle body 2, the spindle shaft 3, and the bushing 4 stop rotating even when the whorl 5 is rotated with the operation of the belt 33.

<Effects>

[0033] According to the present embodiment, the thrust load is applied to the outer ring of the ball bearing 26 via the whorl 5 when connecting the first clutch surface 25 and the second clutch surface 30 by applying the urging force of the spring 8 to the bushing 4. With the first clutch surface 25 and the second clutch surface 30 connected, the spindle body 2, the spindle shaft 3, and the bushing 4 rotate integrally with the whorl 5. As a result, the inner ring and the outer ring of the ball bearing 26 do not rotate relative to each other even when transmitting the rotational force of the whorl 5, which is generated by the operation of the belt 33, to the bushing 4. Therefore, the load applied to the ball bearing 26 may be reduced. The bushing 4 is disposed closer to the spindle body 2 than the whorl 5 is with respect to the axial direction of the spindle shaft 3. The bushing 4, which is provided for the intermittent operation of the clutch, may be disposed at a position away from the spindle rail 40. A large space from the spindle rail 40 to the bushing 4 may be used for the intermittent operation of the clutch. This permits securing a space large enough for the intermittent operation of the clutch.

[0034] In the above-cited spindle device of the Publication No. 48-69934, the clutch block and the operation block are disposed in the lower part of the hollowed portion of the whorl, so that parts are likely to interfere with each other when pulling out the spindle shaft from the bolster. According to this configuration, the spindle shaft needs to be carefully pulled out from the bolster while avoiding the interference between the parts for the maintenance of the spindle device, which makes the maintenance work troublesome. In contrast, according to the spindle device 1 of the present embodiment, the bushing 4 is disposed closer to the spindle device 1 than the whorl 5 is, and thus there is no intermediate member disposed between the whorl 5 and the bolster 6. Thus, the parts do not interfere with each other when pulling out the spindle shaft 3 from the bolster 6 for the maintenance of the spindle device 1. Accordingly, the maintenance of the spindle device 1 may be performed easily.

[0035] In addition, the spindle device 1 of the present embodiment shuts off the transmission of the rotational force from the whorl 5 to the bushing 4 by separating the first clutch surface 25 from the second clutch surface 30 with a simple mechanism that clamps the first flange portion 13 of the spindle body 2 and the second flange portion 20 of the bushing 4 with the clamp members 63 of the brake mechanism 60. In addition, the braking force is applied to both the spindle body 2 and the bushing 4 by clamping the first flange portion 13 and the second flange portion 20 with the clamp members 63, whereby the rotation of the spindle body 2 and the rotation of the bushing 4 may be stopped. Furthermore, the bushing 4 is disposed at a position that is easily accessible from the outside, so that the first flange portion 13 and the second flange portion 20 may be easily clamped by the clamp members 63 of the brake mechanism 60. As a result, the brake mechanism 60 need not be provided for the spindle device 1 of each spindle station, but may be provided as a tool. Specifically, the brake mechanism 60 is provided detachably for the spindle device 1 of each spindle station. The brake mechanism 60 may be moved from the inoperative position to the operative position after mounting the brake mechanism 60 to the spindle device 1 in which the rotation of the spindle body 2 and the like needs to be stopped. As a result, the cost may be reduced, as compared with the case where the brake mechanism 60 is provided for each spindle device 1. It is noted that the brake mechanism 60 movable between the inoperative position and the operative position need not be configured to rotate about the axis J, but may move linearly in the front-rear direction.

<Modification>

[0036] The present disclosure is not limited to the above-described embodiment, but intends to include various modifications and improvement within the scope of the present disclosure as long as they offer specific effects provided by the configuration and the combination of the present disclosure.

[0037] For example, although the configuration in which the first clutch surface 25 and the second clutch surface 30 are connected by applying the urging force of the spring 8 to the bushing 4 has been described in the above embodiment, the present disclosure is not limited to this and a magnetic coupling utilizing a magnetic force may be employed for connecting the first clutch surface 25 and the second clutch surface 30. In a case where the magnetic coupling is employed, a space is formed between the first clutch surface 25 and the second clutch surface 30, and the rotational force is transmitted from the whorl 5 to the bushing 4 by magnetic force applied to such space. When shutting off the transmission of the rotational force from the whorl 5 to the bushing 4, the bushing 4 is moved upward, similarly to the above-described embodiment, so as to increase the space between the first clutch surface 25 and the second clutch surface 30 to a degree that is difficult to transmit the driving force by the magnetic force, thereby disconnecting the first clutch surface 25 and the second clutch surface 30. When using the magnetic coupling, the friction between the first clutch surface 25 and the second clutch surface 30 may be prevented.

[0038] The present disclosure is not limited to the configuration in which the first flange portion 13 and the second flange portion 20 are clamped by the clamp members 63 provided for the respective paired arms 61 by rotating the paired arms 61 about the axis J. For example, an air-operated chuck may be used as a clamp member, and the first flange portion 13 and the second flange portion 20 may be clamped by the closing of such chuck.

[0039] If the first clutch surface 25 and the second clutch surface 30 are provided by a clutch pad (not shown) made of high friction materials, sliding is less likely to occur at parts where the first clutch surface 25 and the second clutch surface 30 contact. This permits transmitting the rotational force from the whorl 5 to the bushing 4 reliably without urging the bushing 4 with a large force by the spring 8. If at least one of the first clutch surface 25 and the second clutch surface 30 is provided by a replaceable clutch pad, the serviceable lives of the bushing 4 and the whorl 5, hence the serviceable life of the entire spindle device 1 may be increased.

[0040] A spindle device (1) of a spinning machine includes a spindle shaft (3), a spindle body (2), a bushing (4) having a first clutch surface (25) and mounted on the spindle body (2) movable in an axial direction of the spindle shaft (3), rotates integrally with the spindle shaft (3) and the spindle body (2), and a whorl (5) having a second clutch surface (30) facing the first clutch surface (25), disposed side by side with the bushing (4), and rotatably mounted on the spindle shaft (3) with a bearing (26) interposed between the spindle shaft (3) and the whorl (5). The bushing (4) is disposed closer to the spindle body (2) than the whorl (5) is. The spindle shaft (3), the spindle body (2) and the bushing (4) rotate integrally with the whorl (5) when the first clutch surface (25) and the second clutch surface (30) are connected.

Claims

1. A spindle device (1) of a spinning machine comprising:

    a spindle shaft (3);
    a spindle body (2) coaxially fixed to the spindle shaft (3);
    a bushing (4) that has a first clutch surface (25), is mounted on the spindle body (2) to be movable in an axial direction of the spindle shaft (3), and rotates integrally with the spindle shaft (3) and the spindle body (2); and
    a whorl (5) that has a second clutch surface (30) facing the first clutch surface (25), is disposed side by side with the bushing (4) in the axial direction of the spindle shaft (3), and is rotatably mounted on the spindle shaft (3) with a bearing (26) interposed between the spindle shaft (3) and the whorl (5),
    characterized in that
    the bushing (4) is disposed closer to the spindle body (2) than the whorl (5) is in the axial direction of the spindle shaft (3), and
    the spindle shaft (3), the spindle body (2), and the bushing (4) rotate integrally with the whorl (5) when the first clutch surface (25) and the second clutch surface (30) are connected.

2. The spindle device (1) of the spinning machine according to claim 1, **characterized in that** the spindle body (2) has a first flange portion (13), the bushing (4) has a second flange portion (20) facing the first flange portion (13) in the axial direction of the spindle shaft (3), the spindle device (1) further includes a brake mechanism (60) that is movable between an operative position and an inoperative position, and the brake mechanism (60) includes a clamp member (63) that separates the first clutch surface (25) from the second clutch surface (30) by clamping the first flange portion (13) and the second flange portion (20) in the axial direction of the spindle shaft (3) when the brake mechanism (60) is moved to the operative position.

FIG. 1

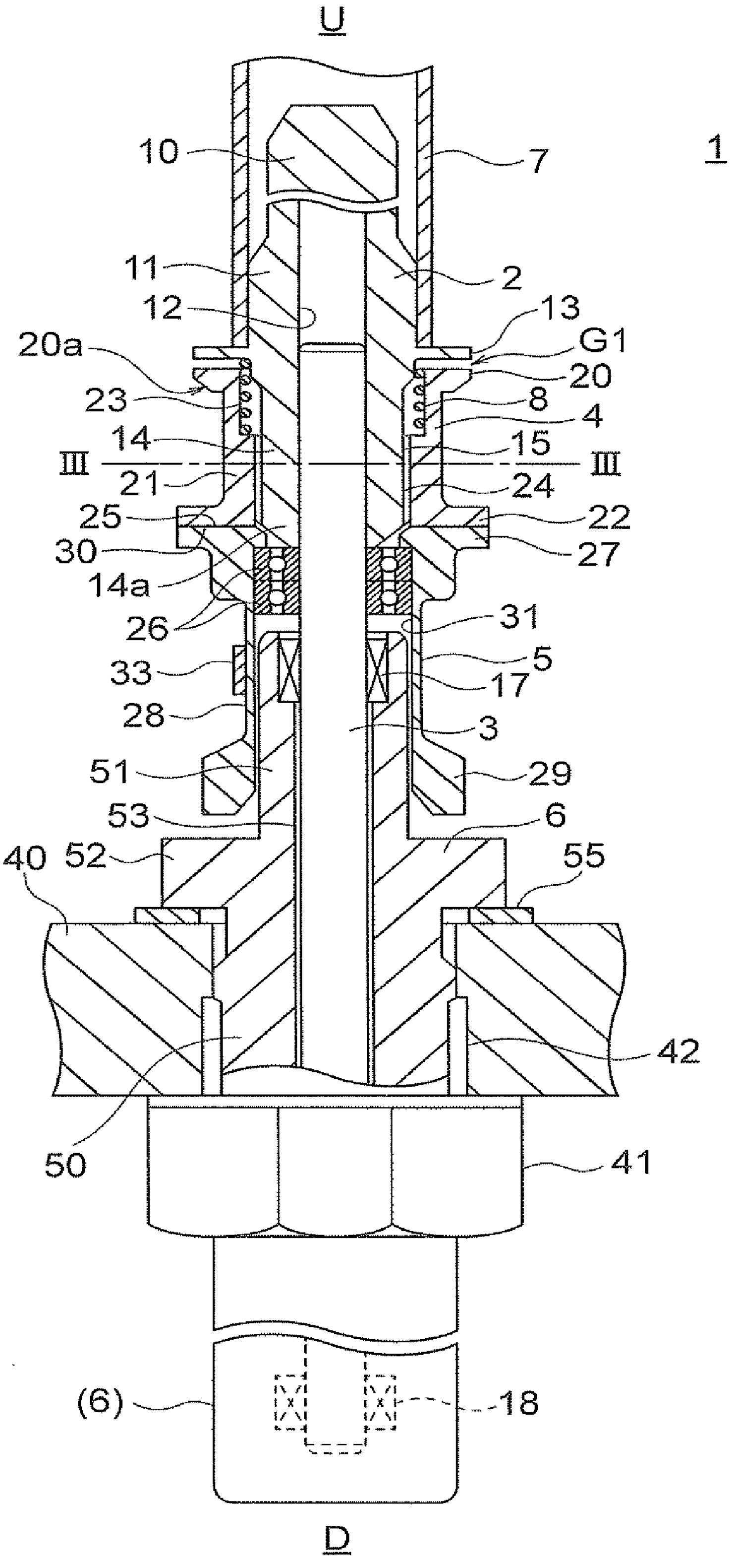

U
1
10
7
11
2
12
13
20a
G1
20
23
8
4
14
15
III
III
21
24
25
22
30
27
14a
26
31
5
33
17
28
3
51
29
53
6
40
52
55
42
50
41
(6)
18
D

FIG. 2

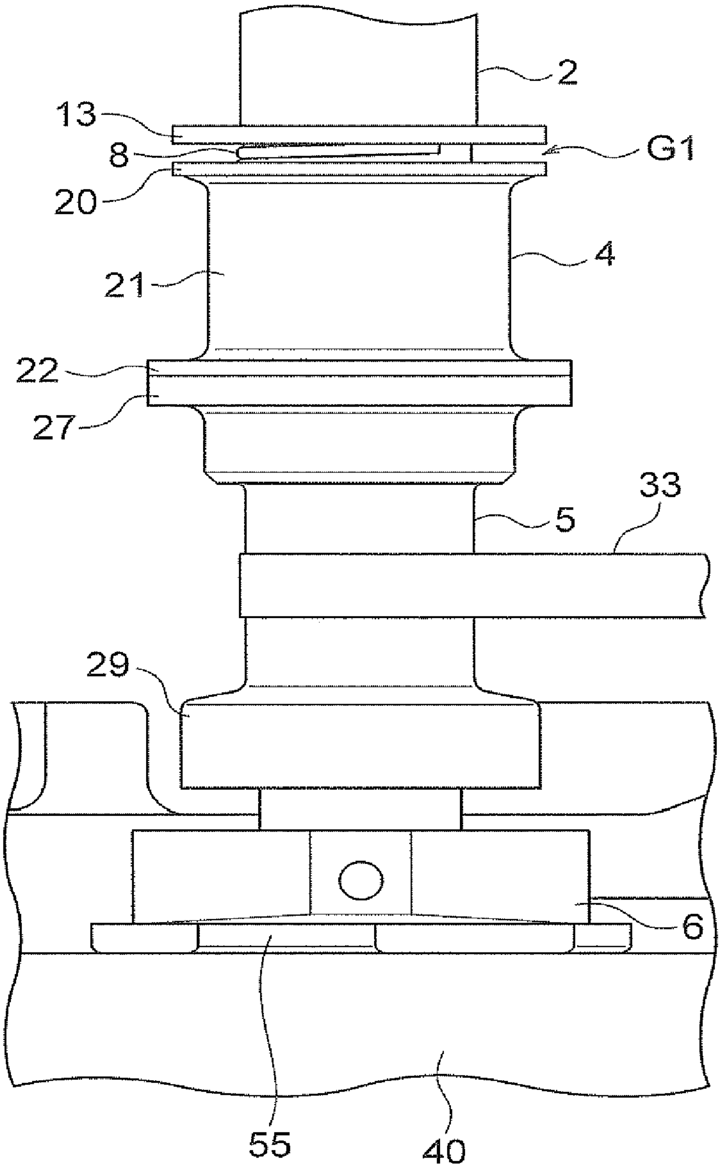


FIG. 3

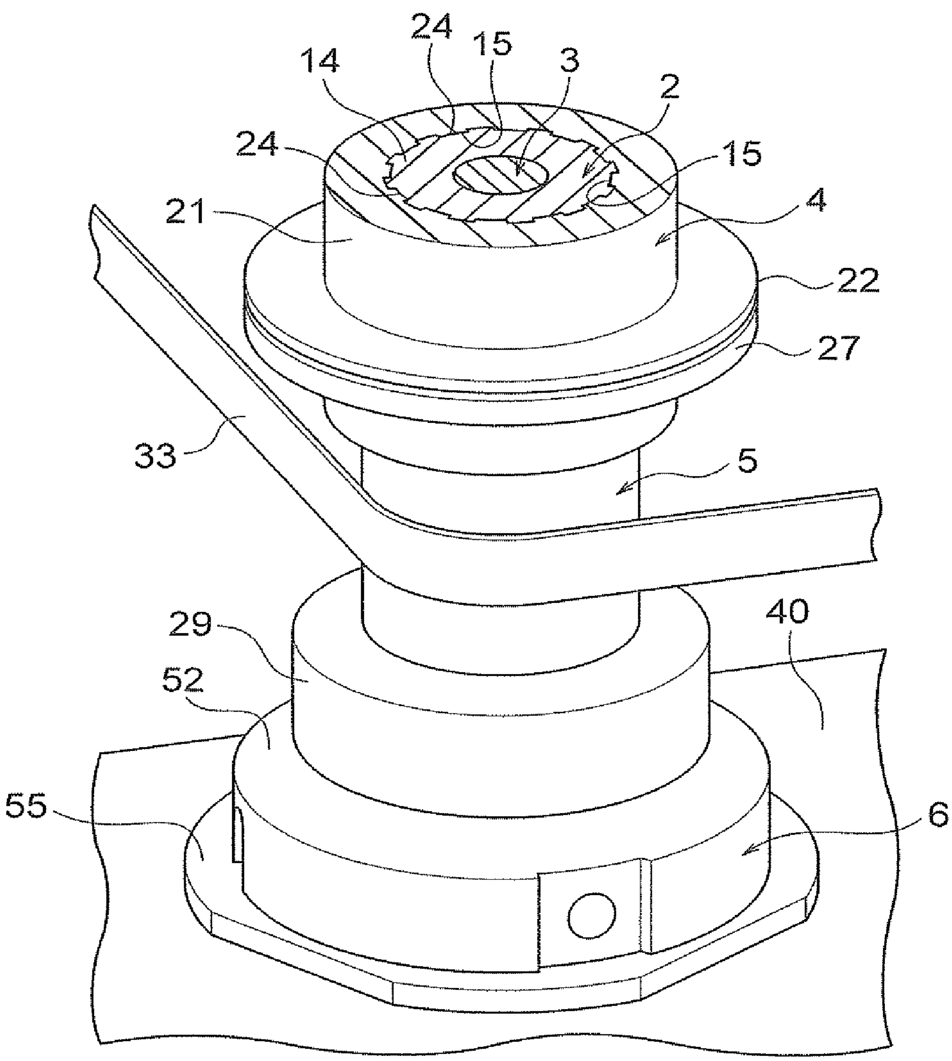


FIG. 4

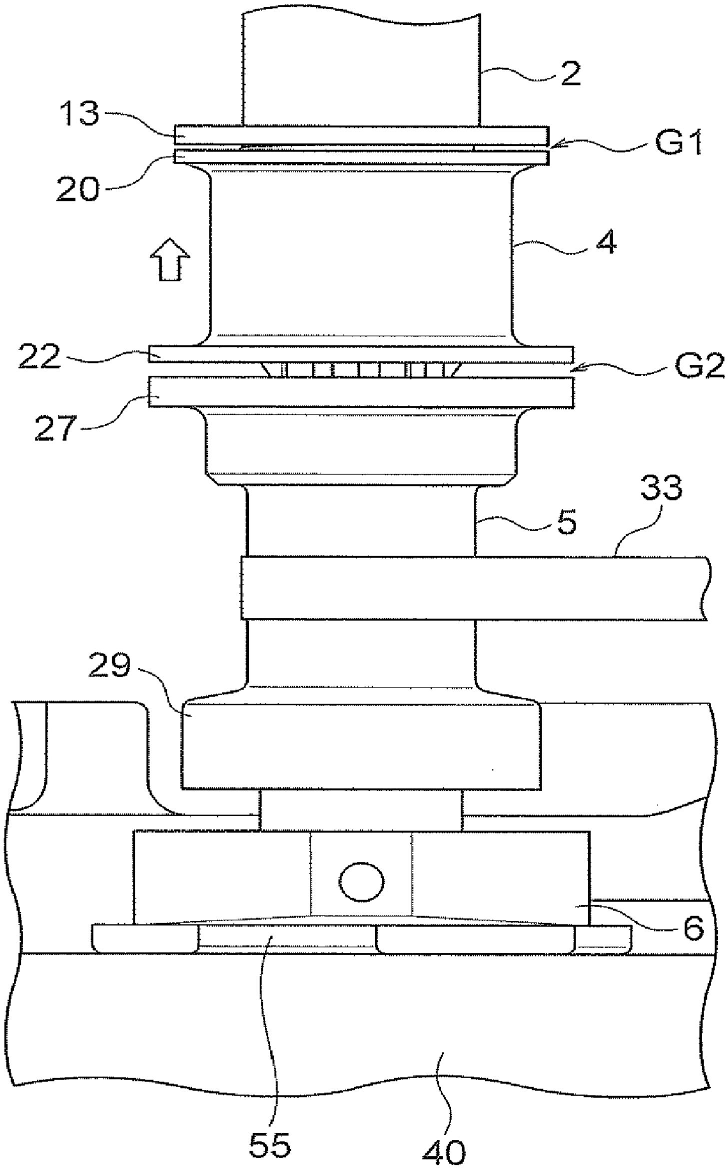


FIG. 5

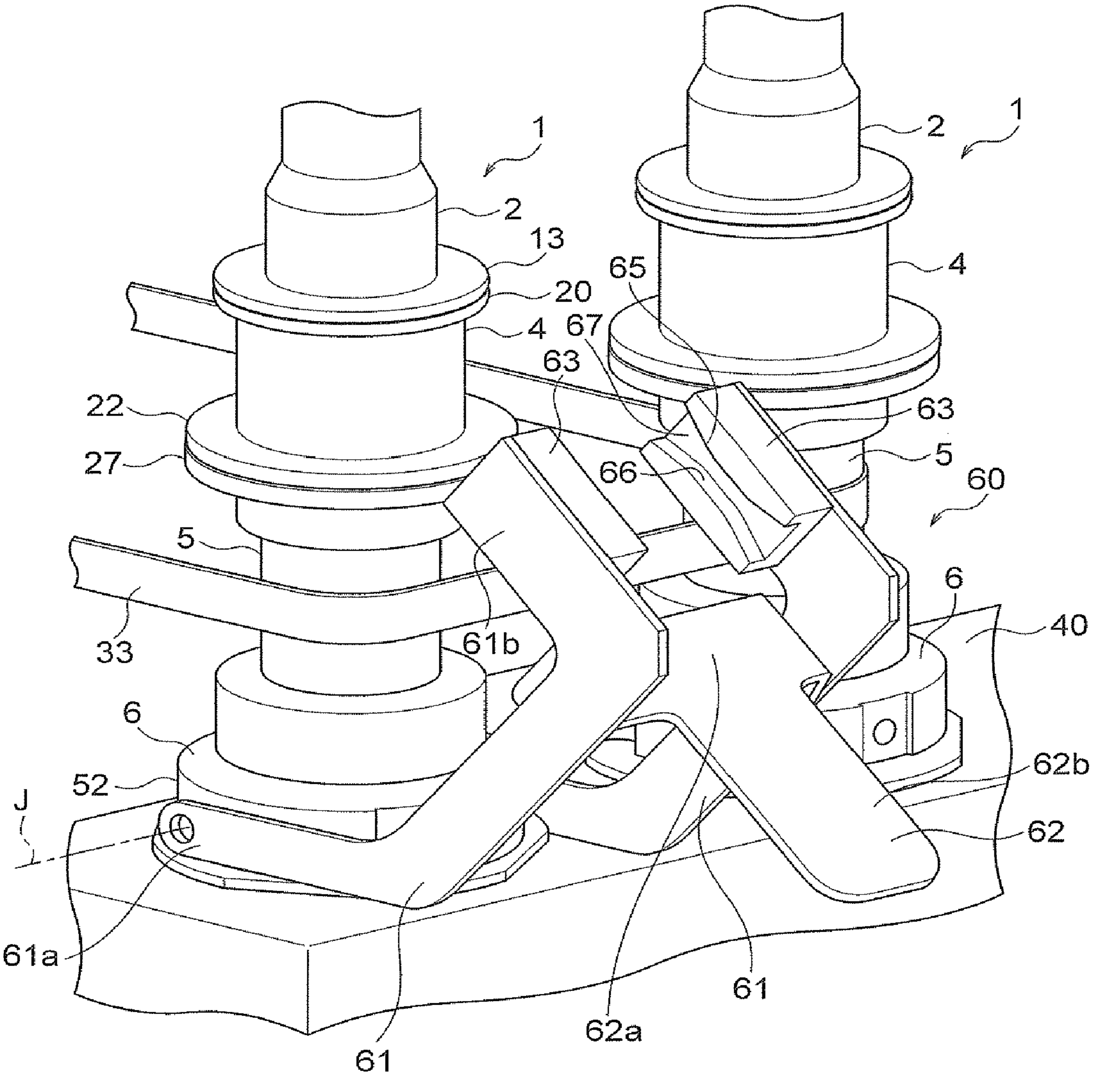

1
2
13
20
4
22
27
5
33
6
52
J
61a
61
61b
63
67
65
66
62a
61
1
2
4
63
5
60
6
40
62b
62

FIG. 6

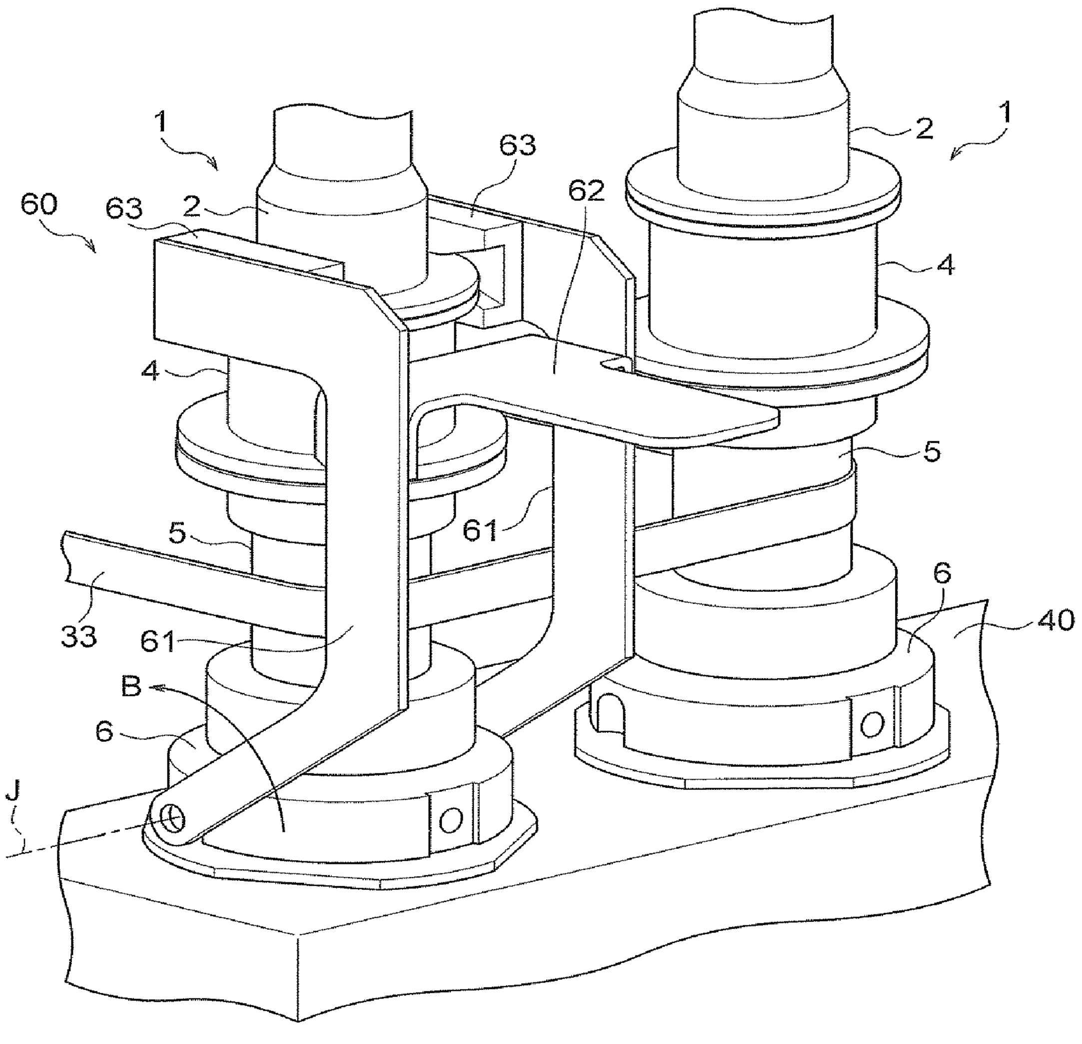
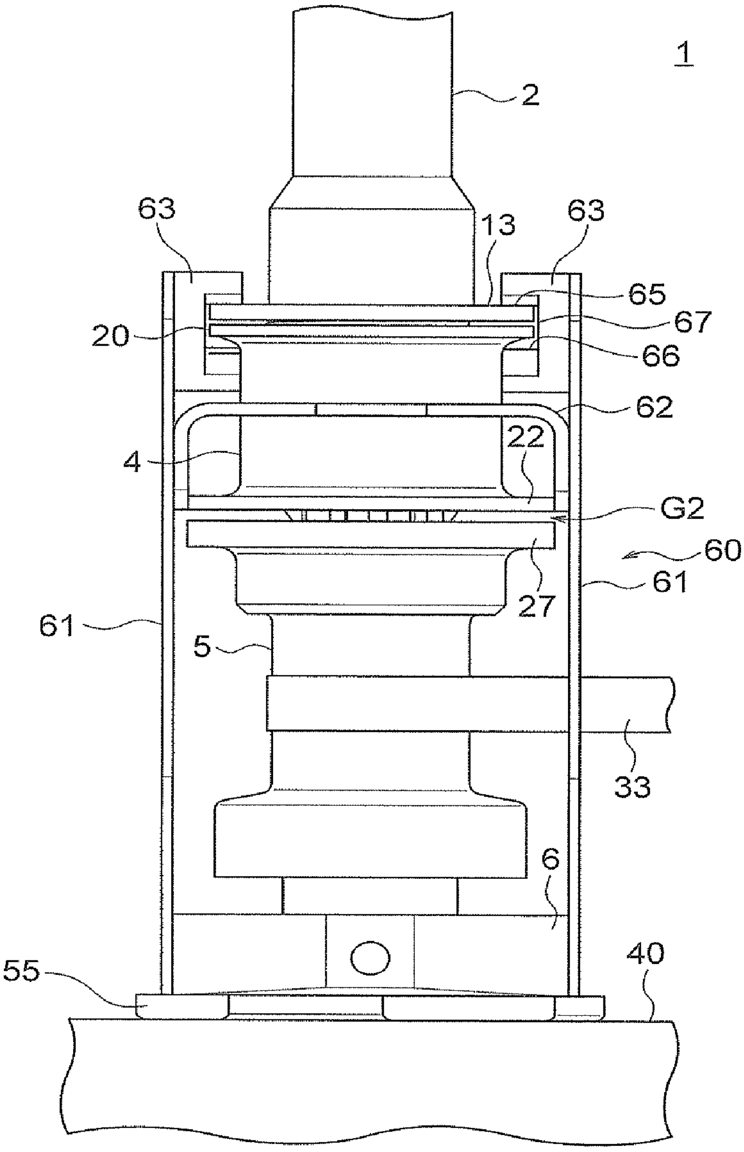


FIG. 7



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EUROPEAN SEARCH REPORT

Application Number
EP 19 20 8788

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	JP S48 69934 A (UNKNOWN) 22 September 1973 (1973-09-22) * the whole document * -----	1	INV. D01H7/04 D01H7/22
X	GB 958 941 A (JOSEPH EARLE MAKANT; HENRY COLLINS) 27 May 1964 (1964-05-27) * page 1, line 59 - line 83 * * page 3, line 31 - line 49 * * figure 4 * -----	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			D01H

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	20 March 2020	Humbert, Thomas

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20-03-2020

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- WO 4869934 A **[0005] [0034]**