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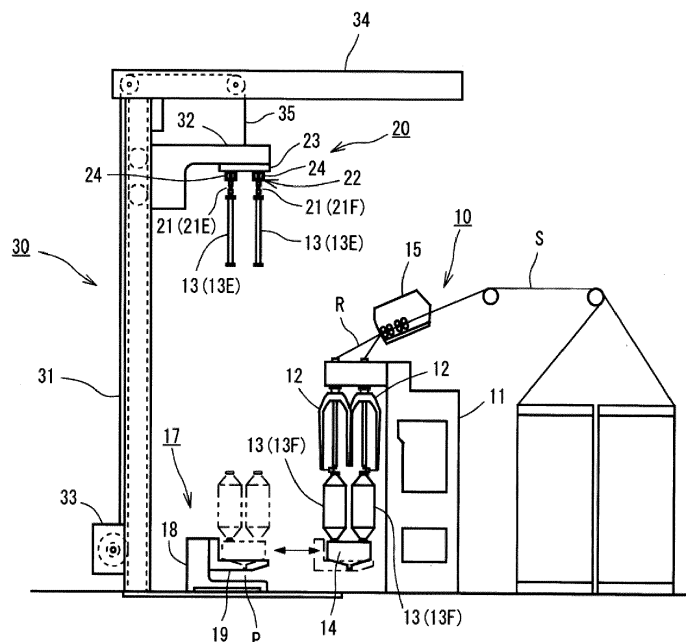
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(54) **BOBBIN DETECTION MECHANISM AND BOBBIN HANGER IN BOBBIN TRANSPORT DEVICE FOR ROVING FRAME**

(57) A bobbin detection mechanism (36) in a bobbin transport device (20) for a roving frame (10) includes a plurality of full bobbin hangers (21F, 61F, 80F), a plurality of empty bobbin hangers (21E, 61E), and a full bobbin hanger photoelectric sensor (37) configured to emit a sensor light (L, L1). Each of the full bobbin hangers (21F, 61F, 80F) includes a full bobbin shaft portion, and a full bobbin vertically movable member (49, 69, 81) movable

up and down relative to the full bobbin shaft portion (45). The bobbin detection mechanism (36) includes a full bobbin hanger sensor light shield (51, 71, 83) formed in the full bobbin hanger vertical movable member (49, 69, 81), and configured to block the sensor light (L, L1) from the full bobbin hanger sensor light emitter (38) when the full bobbin vertically movable member (49, 69, 81) is positioned at the holding position.

FIG. 1



Description

BACKGROUND ART

[0001] The present disclosure relates to a bobbin detection mechanism and a bobbin hanger in a bobbin transport device for a roving frame.

[0002] In recent years, automation in a roving frame has been promoted by mechanizing a doffing operation at which a full bobbin on which winding of roving has been completed is removed from a bobbin rail, and a bobbin supply operation at which an empty bobbin is supplied to a bobbin rail. Japanese Patent Application Publication No. 2000-27041 discloses a bobbin transfer failure detection device that detects a failure of attachment and detachment of full bobbins and empty bobbins by detecting the full bobbins and the empty bobbins with a detection means.

[0003] According to the above-described Publication, a bobbin transport device includes bobbin holding devices which can hold the empty bobbins and the full bobbins alternately in a longitudinal direction, and the bobbin holding devices are disposed alternately at different height. In the bobbin transport device, the bobbin holding devices disposed at upper positions and at lower positions correspond to full bobbin holding devices and empty bobbin holding devices, respectively. A detection region for the detection means is set at a region extending in the longitudinal direction where upper end portions or lower end portions of the empty bobbins held by the empty bobbin holding devices are positioned before bobbin replacement. The detection means determines whether or not there is an upper end portion, or a lower end portion of an empty bobbin held by an empty bobbin holding device in the detection region. It is described that the bobbin transfer failure detection device can detect an empty bobbin even if the empty bobbin is held in a state where the full bobbins are suspended from the bobbin transport device at the bobbin replacement.

[0004] However, in the bobbin transfer failure detection device of the Publication, the full bobbin holding devices and the empty bobbin holding devices are disposed at the different heights, and thus the full bobbins and the empty bobbins need to be transferred at different heights at the doffing operation and the empty bobbin supply operation. In order to transfer the full bobbins and the empty bobbins at different heights, the device needs to include a mechanism specifically provided for the transfer of the full bobbins, and a mechanism specifically provided for the transfer of the empty bobbins. Although a bobbin exchange device is provided for transferring the full bobbins from the bobbin transport device to another transport line and the empty bobbins from such another transport line to the bobbin transport device, the structure for transferring bobbins in the bobbin exchange device becomes complicated.

[0005] The present disclosure, which has been made in light of the above problems, is directed to providing a

bobbin detection mechanism and a bobbin hanger in a bobbin transport device for a roving frame that can detect that there is an empty bobbin suspended from the full bobbin hanger even in the configuration in which the full bobbin hangers and empty bobbin hangers are disposed at the same height.

SUMMARY

[0006] According to one aspect of the present disclosure, there is provided a bobbin detection mechanism in a bobbin transport device for a roving frame, the bobbin detection mechanism including a plurality of full bobbin hangers for hanging a full bobbin, a plurality of empty bobbin hangers for hanging an empty bobbin, the full bobbin hangers and the empty bobbin hangers being arranged alternately, and a rail member guiding the full bobbin hangers and the empty bobbin hangers. Each of the full bobbin hangers includes a full bobbin shaft portion hanging down from the rail member, and a full bobbin vertically movable member contactable with a bobbin mounted on the full bobbin shaft portion and movable to a lowest position relative to the full bobbin shaft portion and to a holding position that is higher than the lowest position, the full bobbin is held by one of the full bobbin hangers with an upward movement of the full bobbin vertically movable member. The bobbin detection mechanism includes a full bobbin hanger photoelectric sensor including a full bobbin hanger sensor light emitter configured to emit a sensor light in a bobbin hanger arrangement direction in which the full bobbin hangers and the empty bobbin hangers are arranged, and a full bobbin hanger sensor light receiver configured to receive the sensor light from the full bobbin hanger sensor light emitter, and a full bobbin hanger sensor light shield formed in the full bobbin hanger vertical movable member, and configured to block the sensor light from the full bobbin hanger sensor light emitter. The sensor light from the full bobbin hanger sensor light emitter is set at a position so that the sensor light is blocked by the full bobbin hanger sensor light shield when the full bobbin vertically movable member is positioned at the holding position.

[0007] According to one aspect of the present disclosure, there is provided a bobbin hanger used for a bobbin detection mechanism in a bobbin transport device for a roving frame including a bobbin shaft portion on which a bobbin is mounted, and a bobbin vertically movable member movable up and down relative to the bobbin shaft portion. The bobbin vertically movable member includes a bobbin hanger sensor light shield, and the bobbin hanger sensor light shield is configured to block a sensor light of a through beam photoelectric sensor provided in the bobbin detection mechanism when the bobbin vertically movable member moves up with the bobbin mounted on the bobbin shaft portion.

[0008] Other aspects and advantages of the disclosure will become apparent from the following description, taken in conjunction with the accompanying drawings, illus-

trating by way of example the principles of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 is a side view of a bobbin detection mechanism of a bobbin transport device for a roving frame according to a first embodiment;

FIG. 2 is a schematic plan view of the bobbin transport device for the roving frame according to the first embodiment;

FIG. 3A is a schematic plan view of the bobbin detection mechanism according to the first embodiment, FIG. 3B is a back view of the bobbin detection mechanism, and FIG. 3C is a front view of the bobbin detection mechanism;

FIG. 4 is a partial cross-sectional view of a bobbin (an empty bobbin);

FIG. 5A is a side view of an empty bobbin hanger when the empty bobbin hanger is holding no bobbin, FIG. 5B is a side view of the empty bobbin hanger when the empty bobbin hanger is holding a bobbin, and FIG. 5C is a side view of the empty bobbin hanger when the holding of the bobbin is released;

FIG. 6A is a side view of a full bobbin hanger when the full bobbin hanger is holding no bobbin, FIG. 6B is a side view of the full bobbin hanger when the full bobbin hanger is holding a bobbin, and FIG. 5C is a side view of the full bobbin hanger when the holding of the bobbin is released;

FIG. 7 is schematic plan view of a bobbin detection mechanism according to a second embodiment;

FIG. 8A is a front view of an empty bobbin hanger, and FIG. 8B is a front view of a full bobbin hanger; and FIG. 9A is a partial front view of a full bobbin hanger according to a modified embodiment, and FIG. 9B is a plan view of a full bobbin hanger sensor light shield.

DETAILED DESCRIPTION OF THE EMBODIMENTS

(First embodiment)

[0010] The following will describe a bobbin detection mechanism and a bobbin hanger in a bobbin transport device for a roving frame according to a first embodiment of the present disclosure with reference to the accompanying drawings.

[0011] As illustrated in FIG. 1, a roving frame 10 includes a machine frame 11, flyers 12 of a top mount type mounted on the machine frame 11, a bobbin rail 14 supporting a plurality of bobbins 13, and a draft mechanism 15 that stretches a sliver S and lets a roving R out. As illustrated in FIG. 2, a plurality of bobbin wheels 16 sup-

porting the bobbins 13, respectively, is mounted on the bobbin rail 14. The bobbin wheels 16 are arranged on the bobbin rail 14 so that the bobbins 13 are disposed in two rows at regular pitches along the longitudinal direction of the roving frame 10. The bobbin wheels 16 in the first row and the bobbin wheels 16 in the second row are displaced at a half pitch to each other in the row direction with respect to the longitudinal direction of the roving frame 10. According to the present embodiment, in distinguishing the bobbins 13 into the bobbins 13 having no roving R and the bobbins 13 on which winding of the roving R is completed fully, the bobbins 13 having no roving R and the bobbins 13 on which the roving R is wound fully are referred to as empty bobbins 13E and full bobbins 13F, respectively.

[0012] As illustrated in FIG. 1, a bobbin rail support device 17, which supports the bobbin rail 14, is disposed on the side of the roving frame 10. The bobbin rail support device 17 includes a main body 18 that is reciprocally movable between the bobbin rail 14 of the roving frame 10 and a bobbin transfer position P set in front of the bobbin rail 14, and a bobbin rail support member 19 that supports the bobbin rail 14 of the roving frame 10. The bobbin transfer position P is a position where the bobbins 13 are transferred between the bobbin rail support device 17 and a bobbin transport device for a roving frame (hereinafter referred to as a bobbin transport device) 20, which will be described later.

[0013] The bobbin transport device 20 movable up and down is disposed above the bobbin transfer position P. The bobbin transport device 20 is configured to transfer the bobbins 13 with the bobbin rail 14 positioned at the bobbin transfer position P. The bobbin transport device 20 includes a plurality of bobbin hangers 21 configured to hang the bobbins 13, a rail member 22 configured to guide the bobbin hangers 21, and a rail support member 23 configured to support the rail member 22.

[0014] The bobbin hangers 21 are hangers for holding the bobbins 13. As illustrated in FIG. 2, the bobbin hangers 21 are disposed at regular pitches on the rail member 22. The bobbin hangers 21 includes a plurality of empty bobbin hangers 21E for hanging the empty bobbins 13E, and a plurality of full bobbin hangers 21F for hanging the full bobbins 13F, and the empty bobbin hangers 21E and the full bobbin hangers 21F are arranged alternately on the rail member 22. The empty bobbin hangers 21E and the full bobbin hangers 21F are disposed at the same height. The structures of the empty bobbin hangers 21E and the full bobbin hangers 21F will be described later.

[0015] The rail member 22 includes a pair of straight rails 24 disposed in parallel to each other, and arc rails 25, each connecting the ends of the straight rails 24. The longitudinal direction of the paired straight rails 24 extends in parallel to the longitudinal direction of the roving frame 10. In a state where the bobbin transport device 20 transfers the bobbins 13, the bobbin hangers 21 are disposed at the regular pitches on the paired straight rails 24 so as to correspond to the bobbin wheels 16 on the

bobbin rail 14 at the bobbin transfer position P. The arc rails 25 are rails each having an arc shape and connecting the ends of the straight rails 24, and the straight rails 24 and the arc rails 25 permit transporting the bobbin hangers 21.

[0016] The rail support member 23 is a bracket for mounting the rail member 22. The paired straight rails 24 and the paired arc rails 25 are mounted to a lower surface of the rail support member 23.

[0017] As illustrated in FIG. 2, a bobbin transport line 26 is disposed close to one of ends of the rail member 22. The bobbin transport line 26 transports the full bobbins 13F on which roving is wound fully by the roving frame 10 towards a spinning frame (not illustrated) and the empty bobbins 13E to be supplied to the bobbin transport device 20. The bobbin transport line 26 is provided with bobbin hangers (not illustrated) for holding the bobbins 13, and the bobbin hangers of the bobbin transport line 26 are transported in one direction.

[0018] A bobbin exchange device 27 is disposed between the bobbin transport device 20 and the bobbin transport line 26. The bobbin exchange device 27 is configured to exchange the empty bobbins 13E with the full bobbins 13F, and vice versa, between the bobbin transport device 20 and the bobbin transport line 26. A bobbin exchange position at which the empty bobbins 13E and the full bobbin 13F are exchanged is positioned at an intermediate portion of one of the arc rails 25 in the bobbin transport device 20. The bobbin exchange device 27 causes the empty bobbin hangers 21E to receive the empty bobbins 13E from the bobbin transport line 26, and causes the full bobbin hangers 21F to transfer the full bobbins 13F to the bobbin transport line 26, thus exchanging the empty bobbins 13E with the full bobbins 13F.

[0019] The bobbin transport device 20 is movable up and down by an elevator device 30. As illustrated in FIG. 1, the elevator device 30 includes a plurality of pillars 31, support arms 32 movable up and down relative to the pillars 31 and supporting the rail support member 23, elevator mechanisms 33 moving the support arms 32 up and down. Although only one pillar 31 is illustrated in FIG. 1, the plurality of pillars 31 are disposed along the longitudinal direction of the roving frame 10. Each of the support arms 32 is provided for each of the pillars 31. A horizontal frame 34 extends horizontally towards the roving frame 10 from upper end portions of the pillars 31. The support arms 32 and the elevator mechanisms 33 are connected by belts 35. Each of the elevator mechanisms 33 includes a motor (not illustrated), and a winding member (not illustrated) for winding each of the belts 35. With the operation of the motor, the support arm 32 moves upward by winding up the belt 35, and the support arm 32 moves downward by rewinding the belt 35.

[0020] In the present embodiment, as illustrated in FIG. 3A, the bobbin transport device 20 includes a bobbin detection mechanism 36 to detect whether or not an empty bobbin 13E is hung by the full bobbin hanger 21F. The

bobbin detection mechanism 36 includes a pair of full bobbin hanger photoelectric sensor 37 so as to correspond to the empty bobbin hangers 21E, the full bobbin hangers 21F, and the pair of straight rails 24.

[0021] As illustrated in FIG. 3A, each of the full bobbin hanger photoelectric sensors 37 are a through-beam type photoelectric sensor and has a full bobbin hanger sensor light emitter 38 and a full bobbin hanger sensor light receiver 39 receiving a sensor light L from the light emitter 38. The full bobbin hanger sensor light emitter 38 is disposed on one end of the rail support member 23 and the full bobbin hanger sensor light receiver 39 is disposed on the other end of the rail support member 23. The full bobbin hanger sensor light emitter 38 emits light from a side of the full bobbin hangers 21F and the empty bobbin hangers 21E in a hanger arrangement direction in which the full bobbin hangers 21F and the empty bobbin hangers 21E are arranged and that extends in parallel to the straight rails 24. As illustrated in FIG. 3A, the full bobbin hanger photoelectric sensor 37 is connected to a control device 28. The control device 28 controls the bobbin transport device 20 and the elevator device 30.

[0022] As illustrated in FIGS. 3B and 3C, the position of the sensor light L of the full bobbin hanger photoelectric sensor 37 is a position close to the bobbin hangers 21. Even when there is one empty bobbin 13E hung by a large number of the full bobbin hangers 21F, the sensor light L is blocked. When the control device 28 detects blockage of the sensor light L, the control device 28 detects that there is an empty bobbin 13E hung by any of the full bobbin hangers 21F. The sensor light L from the full bobbin hanger sensor light emitter 38 is set at a height to which a vertically movable member 49 described later moves up when the empty bobbin 13E is hung by the full bobbin hanger 21F.

[0023] Next, the bobbins 13 will be described. As illustrated in FIG. 4, each of the bobbins 13 includes a bobbin body 40 having a tubular shape. An inclined surface 41 that is inclined relative to the axial direction of the bobbin 13 is formed in an opening of the bobbin body 40. The bobbin body 40 includes a first inner peripheral surface 42 continuous with the inclined surface 41, a second inner peripheral surface 43 having an inner diameter greater than that of the first inner peripheral surface 42, and a stepped surface 44 between the first inner peripheral surface 42 and the second inner peripheral surface 43. The empty bobbins 13E become the full bobbins 13F with the roving R wound on the outer peripheral surface of the bobbin body 40.

[0024] The structures of the empty bobbin hangers 21E and the full bobbin hangers 21F will be described. As illustrated in FIGS. 5A to 5C, each of the empty bobbin hangers 21E includes a shaft portion 45 to be inserted into the empty bobbin 13E, an engaging section 46 in a distal end portion of the shaft portion 45 to project out from the shaft portion 45 and be retracted therein in a radial direction of the shaft portion 45, and a vertically movable member 47 to move up and down relative to the

shaft portion 45. The shaft portion 45 corresponds to the bobbin shaft portion and the empty bobbin shaft portion, and is hung down from the rail member 22. An engaging section control mechanism (not illustrated) causing the engaging section 46 to project out from the shaft portion 45 is accommodated in the shaft portion 45. The vertically movable member 47 has a circular truncated cone shape having the area of an upper surface greater than that of a lower surface, and has, in the center thereof, a through hole 48 through which the shaft portion 45 is inserted.

[0025] The upward and downward movements of the vertically movable member 47 cause the engaging section 46 to project out and retract. Specifically, as illustrated in FIG. 5A, when the vertically movable member 47 is positioned at its lowest position, the engaging section 46 does not project out from the shaft portion 45. The lowest position of the vertically movable member 47 is a position where the vertically movable member 47 lowers the most relative to the shaft portion 45, as illustrated in FIG. 5A. As illustrated in FIG. 5B, when the vertically movable member 47 is placed in contact with the bobbin 13 and pushed up by the bobbin 13, the vertically movable member 47 moves upward, which causes the engaging section 46 to project out from the shaft portion 45 by the engaging section control mechanism. The projection of the engaging section 46 causes the empty bobbin 13E to be held by the empty bobbin hanger 21E. The position of the vertically movable member 47 illustrated in FIG. 5B is above the lowest position and corresponds to a holding position where the empty bobbin 13E is held by the empty bobbin hanger 21 E. As illustrated in FIG. 5C, when the vertically movable member 47 moves upward by being pushed up by the empty bobbin 13E in a state where the empty bobbin 13E is hung by the empty bobbin hanger 21E, the engaging section 46 retracts inside the shaft portion 45, so that empty bobbin 13E may be detached from the empty bobbin hanger 21E. The vertically movable member 47 corresponds to the bobbin movable member and the empty bobbin movable member.

[0026] Next, the full bobbin hanger 21 F will be described. As illustrated in FIGS. 6A to 6C, the configuration of the full bobbin hanger 21 F is substantially the same as that of the empty bobbin hanger 21E except for the vertically movable member 49, and the same components will be designated by the same reference numerals. The vertically movable member 49 of the full bobbin hanger 21F includes a main body 50 and a full bobbin hanger sensor light shield 51 formed integrally with the main body 50. The main body 50 corresponds to the vertically movable member 47 of the empty bobbin 21E. The shaft portion 45 of the full bobbin hanger 21F corresponds to the bobbin shaft portion and the full bobbin shaft portion, and the vertically movable member 49 corresponds to the bobbin vertically movable member and the full bobbin vertically movable member. The bobbin vertically movable member 47 includes the bobbin hanger sensor light shield 51, and the bobbin hanger sensor light shield

51 is configured to block a sensor light L of a through beam photoelectric sensor 37 provided in the bobbin detection mechanism 36 when the bobbin vertically movable member 47 moves up with the bobbin 13 mounted on the bobbin shaft portion 45.

[0027] As illustrated in FIG. 6B, the full bobbin hanger sensor light shield 51 is a part that blocks the sensor light L when there is an empty bobbin 13E hung by any of the full bobbin hangers 21F. The vertically movable member 49 has a generally a circular truncated cone shape, and the dimension of the vertically movable member 49 in the axial direction is two times as large as that of the vertically movable member 47. The full bobbin hanger sensor light shield 51 has a cylindrical shape so that the main body 50 is movable up to the upper end of the shaft portion 45.

[0028] The upward and downward movements of the vertically movable member 49 cause the engaging section 46 to project out and retract. The vertically movable member 49 functions as a detectable member for detecting whether or not there is an empty bobbin 13E hung. Specifically, as illustrated in FIG. 6A, when the vertically movable member 49 is at the lowest position, the engaging section 46 does not project out from the shaft portion 45. The lowest position of the vertically movable member 49 is a position where the vertically movable member 49 lowers the most relative to the shaft portion 45 as illustrated in FIG. 6A. As illustrated in FIG. 6B, when the vertically movable member 49 is placed in contact with the bobbin 13 and pushed up by the bobbin 13, the vertically movable member 49 moves upward, which causes the engaging section 46 to project out from the shaft portion 45 by the engaging section control mechanism. The projection of the engaging section 46 causes the bobbin 13 to engage with the fully bobbin hanger 21F. The position of the vertically movable member 49 illustrated in FIG. 6B is above the lowest position, and corresponds to the holding position where the empty bobbin 13E is held by the empty bobbin hanger 21E. As illustrated in FIG. 6C, when the vertically movable member 49 moves upward by being pushed up by the empty bobbin 13E in a state where the bobbin 13 is hung by the full bobbin hanger 21F, the engaging section 46 retracts inside the shaft portion 45, so that bobbin 13 may be detached from the full bobbin hanger 21F.

[0029] Next, bobbin replacement according to the present embodiment will be described. In the roving frame 10, the roving R is wound on each of the bobbins 13. In the bobbin transport device 20, the empty bobbin hangers 21E holding the empty bobbins 13E, and the empty bobbins 13E are on standby above the bobbin transfer position P for next winding of the roving R. Since the full bobbin hangers 21F of the bobbin transport device 20 are to hold the full bobbins 13F from the roving frame 10, the full bobbin hangers 21F have no bobbin 13 hung thereby.

[0030] Winding of the roving R by the roving frame 10 stops when the bobbin 13 becomes a full bobbin by wind-

ing of the roving R by the roving frame 10. Once the winding by the roving frame 10 stops, the bobbin rail support device 17 moves towards the roving frame 10. With the bobbin rail support member 19 supporting the bobbin rail 14, the bobbin rail support device 17 moves to the bobbin transfer position P. The axes of the full bobbins 13F on the bobbin rail 14 coincide with the axes of the full bobbin hangers 21F at the bobbin transfer position P.

[0031] The elevator mechanism 33 operates so as to move the support arm 32 of the elevator device 30 downward. The bobbin transport device 20 moves downward along with the downward movement of the support arm 32. The shaft portions 45 of the full bobbin hangers 21F are inserted through the full bobbins 13F, respectively, on the bobbin rail 14 with the downward movement of the bobbin transport device 20, which causes the vertically movable members 49 of the full bobbin hangers 21F to be in contact with the full bobbins 13F and pushed up thereby. As a result, the engaging sections 46 project out from the respective shaft portions 45. The full bobbins 13F may be held by the full bobbin hangers 21F with the engaging section 46 projecting out from the shaft portion 45. Then, the elevator mechanism 33 operates so as to move the support arms 32 upward, thereby moving the bobbin transport device 20 upward. Thus, the full bobbins 13F are hung by the full bobbin hangers 21 F and moved from the bobbin rail 14 to the bobbin transport device 20.

[0032] The bobbin transport device 20 operates so as to move the empty bobbin hangers 21E and the full bobbin hangers 21F by one pitch relative to the rail member 22. By moving the empty bobbin hangers 21E and the full bobbin hangers 21F by one pitch relative to the rail member 22, the axes of the empty bobbins 13E coincide with the axes of the bobbin wheels 16 of the bobbin rail 14.

[0033] Then, the elevator mechanisms 33 operate so as to move the support arms 32 of the elevator devices 30 downward, thereby moving the bobbin transport device 20 downward with the full bobbins 13F and the empty bobbins 13E hung thereby. The empty bobbins 13E are mounted on the bobbin wheels 16 with the downward movement of the bobbin transport device 20. When the bobbin transport device 20 moves further downward after the empty bobbins 13E are mounted on the bobbin wheels 16, the vertically movable members 47 of the empty bobbin hangers 21E are in contact with and pushed up by the empty bobbins 13E, which moves the vertically movable members 47 upward. As a result, the engaging sections 46 projecting out from the shaft portions 45 are retracted inside the shaft portions 45. The holding of the empty bobbins 13E by the empty bobbin hangers 21E is released, and the empty bobbins 13E are transferred to the bobbin rail 14. Then, the bobbin transport device 20 moves upward, and the bobbin rail 14 holding the empty bobbins 13E is moved to the roving frame 10 for next winding of the roving R.

[0034] After the doffing and the transferring of the empty bobbins 13E are completed, the roving frame 10 starts winding of the roving R on the empty bobbins 13E. On

the other hand, the bobbin exchange device 27 exchanges the full bobbins 13F with the empty bobbins 13E between the bobbin transport device 20 and the bobbin transport line 26. Specifically, the full bobbins 13F in the bobbin transport device 20 and the empty bobbins 13E transported from the bobbin transport line 26 are exchanged. That is, the full bobbins 13F in the bobbin transport device 20 are sent to the bobbin transport line 26, and the empty bobbins 13E transported from the bobbin transport line 26 are sent to the empty bobbin hangers 21E of the bobbin transport device 20. The bobbin transport line 26 transports the full bobbins 13F towards the spinning frame. The bobbin transport device 20 has the empty bobbins 13E hung only by the empty bobbin hangers 21E, and is on standby for next bobbin replacement.

[0035] The following will describe the detection of an empty bobbin 13E in the full bobbin hangers 21F by the bobbin detection mechanism 36 according to the present embodiment. Even if there is one empty bobbin 13E held by a full bobbin hanger 21F of the bobbin transport device 20 for some reason, when the full bobbins 13F on the bobbin rail 14 are transferred to the full bobbin hangers 21F, the empty bobbin 13E held by the full bobbin hanger 21F hits one of the full bobbins 13F. Therefore, in the present embodiment, the bobbin detection mechanism 36 detects the empty bobbin 13E held by the full bobbin hanger 21F before the full bobbins 13F are transferred to the full bobbin hangers 21F, so that the empty bobbin 13E held by the full bobbin hanger 21F does not hit the full bobbin 13F.

[0036] As illustrated in FIG. 6A, in a state where the empty bobbin 13E is not held by the full bobbin hanger 21F, the vertically movable member 49 is positioned at the lowest position relative to the shaft portion 45, and the full bobbin hanger sensor light shield 51 is positioned lower than the sensor light L, so that the sensor light L is not blocked. Thus, the sensor light L emitted from the full bobbin hanger sensor light emitter 38 is received by the full bobbin hanger sensor light receiver 39. The control device 28 does not detect blockage of the sensor light L, and detects that there is no empty bobbin 13E held by the plurality of full bobbin hangers 21.

[0037] As illustrated in FIG. 6B, in a case where the empty bobbin 13E is held by the full bobbin hanger 21F, the vertically movable member 49 is placed in contact with the empty bobbin 13E and pushed up by the empty bobbin 13E, which causes the full bobbin hanger sensor light shield 51 to block the sensor light L. Since the sensor light L is blocked, the full bobbin sensor light receiver 39 does not receive the sensor light L, and the control device 28 detects the blockage of the sensor light L, and detects that there is an empty bobbin 13E held by at least one of the plurality of the full bobbin hangers 21F. The control device 28 stops the operation of the bobbin transport device 20 in response to the detection of the empty bobbin 13E, and notifies abnormality.

[0038] The bobbin detection mechanism 36 of the present embodiment offers the following operational ef-

fects.

(1) The full bobbins 13F each on which the roving R is wound fully are to be held by the full bobbin hangers 21F, which are empty, in the bobbin transport device 20. However, when an empty bobbin 13F is held by one of the full bobbin hangers 21F for some reason, the vertically movable member 49 moves upward and hence the full bobbin hanger sensor light shield 51 blocks the sensor light L. Thus, it is detected that there is an empty bobbin 13E hung by one of the full bobbin hangers 21 G by detecting the blockage of the sensor light L. This permits detecting that there is an empty bobbin 13E held by one of the full bobbin hangers 21F even in the configuration in which the full bobbin hangers 21F and the empty bobbin hangers 21E are disposed at the same height.

(2) Even in the configuration in which the full bobbin hangers 21F and the empty bobbin hangers 21E are disposed at the same height, whether there is an empty bobbin 13E held by one of the full bobbin hangers 21F may be detected. As compared with a configuration in which the full bobbin hangers and the empty bobbin hangers are disposed at different heights, the full bobbins 13F and the empty bobbins 13E need not be transferred at different heights in the doffing operation and the empty bobbin supply operation. As a result, the mechanisms for transferring the full bobbins 13F and the empty bobbins 13E need not be separately provided, so that the configuration and the control of the bobbin transport device 20 may be simplified.

(3) A bobbin hanger 21 provided with the vertically movable member 49 including the full bobbin hanger sensor light shield 51 is set as the full bobbin hanger 21 F, and a bobbin hanger 21 provided with the vertically movable member 47 without the full bobbin hanger sensor light shield 51 is set as the empty bobbin hanger 21E. According to this configuration, whether there is an empty bobbin 13E held by one of the full bobbin hangers 21F may be detected even in the configuration in which the full bobbin hangers 21F and the empty bobbin hangers 21E are disposed at the same height.

(4) Each of the pair of full bobbin hanger photoelectric sensors 37 is a through beam type photoelectric sensor, and detects whether there is an empty bobbin 13E may be detected simultaneously for a large number of the full bobbin hangers 21F arranged in two rows.

(Second embodiment)

[0039] The following will describe the bobbin detection

mechanism according to a second embodiment. In the present embodiment, not only whether there is an empty bobbin held by one of the full bobbin hangers, but also whether or not there is a bobbin held by one of the empty bobbin hangers, are detected. In the following, for the same configurations as those in the first embodiment, the description thereof will not be reiterated, and the same reference numerals will be used.

[0040] As illustrated in FIG. 7, empty bobbin hangers 61E and full bobbin hangers 61F are disposed alternately in line in a bobbin transport device 60. A full bobbin hanger photoelectric sensor 37 and an empty bobbin hanger photoelectric sensor 62 are disposed with the empty bobbin hangers 61E and the full bobbin hangers 61 F arranged therebetween in line so that a pair of sensor lights L1, L2 are emitted. In the present embodiment, the full bobbin hanger photoelectric sensor 37 includes a full bobbin hanger sensor light emitter 38 that emits a sensor light L1 and a full bobbin hanger sensor light receiver 39 that receives the sensor light L1.

[0041] The empty bobbin hanger photoelectric sensor 62 has the configuration the same as the full bobbin hanger photoelectric sensor 37, and includes an empty bobbin hanger sensor light emitter 63 that emits a sensor light L2 and an empty bobbin hanger sensor light receiver 64 that receives the sensor light L2. The empty bobbin hanger photoelectric sensor 62 is connected to the control device 28. The empty bobbin hanger photoelectric sensor 62 and the full bobbin hanger photoelectric sensor 37 corresponds to the bobbin detection mechanism 65. The height of the sensor light L2 emitted from the empty bobbin hanger sensor light emitter 63 is set at the same height to which a vertically movable member 66, which will be described later, moves up when the empty bobbins 13E are hung by the empty bobbin hangers 61E.

[0042] As illustrated in FIG. 8A, each of the empty bobbin hangers 61E includes a shaft portion 45, an engaging section 46, and the vertically movable member 66. The vertically movable member 66 includes a main body 67 and an empty bobbin hanger sensor light shield 68. The empty bobbin hanger sensor light shield 68 is formed in the upper portion of the main body 67, and has a shape that blocks the sensor light L2 of the empty bobbin hanger photoelectric sensor 62 when the empty bobbins 13E are hung by the empty bobbin hangers 61E. The vertically movable member 66 has a shape that does not block the sensor light L1 of the full bobbin hanger photoelectric sensor 37 when the empty bobbins 13E are hung by the empty bobbin hangers 61E. The empty bobbin hanger sensor light shield 68 of the present embodiment is formed in a shape in which the full bobbin hanger sensor light shield 51 of the first embodiment is cut in half and one of the halves is removed. The shaft portion 45 of the empty bobbin hanger 61E corresponds to the bobbin shaft portion and the empty bobbin shaft portion, and the vertically movable member 66 corresponds to the bobbin vertically movable member and the empty bobbin vertically movable member.

[0043] As illustrated in FIG. 8B, each of the full bobbin hangers 61 F includes the shaft portion 45, the engaging section 46, and the vertically movable member 69. The vertically movable member 69 includes a main body 70 and a full bobbin hanger sensor light shield 71. The full bobbin hanger sensor light shield 71 is formed in the upper portion of the main body 70, and has a shape that blocks the sensor light L1 of the full bobbin hanger photoelectric sensor 37 when an empty bobbin 13E is hung by one of the full bobbin hanger 61F. The vertically movable member 69 has a shape that does not block the sensor light L2 of the empty bobbin hanger photoelectric sensor 62 when an empty bobbin 13E is hung by one of the full bobbin hangers 61F. The full bobbin hanger sensor light shield 71 of the present embodiment is formed in a shape in which the full bobbin hanger sensor light shield 51 of the first embodiment is cut in half and one of the halves is removed. The shaft portion 45 of the full bobbin hanger 61F corresponds to the bobbin shaft portion and the full bobbin shaft portion, and the vertically movable member 69 corresponds to the bobbin vertically movable member and the full bobbin vertically movable member.

[0044] According to the present embodiment, even if there is an empty bobbin 13E hung by any one of a large number of the full bobbin hangers 61F before the transfer of the full bobbins 13F, the full bobbin hanger sensor light shield 71 of the vertically movable member 69 of the full bobbin hanger 61 F blocks the sensor light L1 of the full bobbin hanger photoelectric sensor 37. As a result, the control device 28 detects the blockage of the sensor light L1, and detects that there is an empty bobbin 13E hung by one of the full bobbin hangers 61F.

[0045] Furthermore, even if any one of a large number of the empty bobbin hangers 61E holds an empty bobbin 13E after the empty bobbins 13E are transferred to the slide rail, the sensor light L2 of the empty bobbin hanger photoelectric sensor 62 is blocked by the empty bobbin hanger sensor light shield 68 of the vertically movable member 66 provided in the empty bobbin hanger 61 E by which the empty bobbin 13E is held. As a result, the control device 28 detects the blockage of the sensor light L2, and detects that the empty bobbin 13E is hung by the empty bobbin hangers 61E. In this case, it is possible to detect that the transfer of the empty bobbins 13E to the bobbin rail 14 is incomplete. When the blockage of light is not detected, the control device 28 detects that the transfer of the empty bobbins 13E to the bobbin rail 14 is successful. The vertically movable member 66 and the vertically movable member 69 have the same shape, but are mounted at the different positions relative to the shaft portions 45. Since there is no need to prepare vertically movable members having a different shape, the production cost for the bobbin hangers 61, i.e., bobbin hangers 61E, 61F, may be reduced.

(Modified embodiment)

[0046] The following will describe a full bobbin hanger 80F of a bobbin hanger 80 as illustrated in FIGS 9A and 9B according to a modified embodiment. The full bobbin hanger 80F of the present modified embodiment is a modification of the full bobbin hanger 21F of the first embodiment. As illustrated in FIG. 9A, the full bobbin hanger 80F includes a vertically movable member 81 movable up and down relative to the shaft portion 45. The vertically movable member 81 includes a main body 82 and a full bobbin hanger sensor light shield 83. The main body 82 corresponds to the main body 50 of the first embodiment. The full bobbin hanger sensor light shield 83 is provided as a separate part from the main body 82, has a hollowed circular truncated cone shape made of a resin, and is detachable from the main body 82. A plurality of engaging pins 84 are formed in an end of an inner peripheral surface of the full bobbin hanger sensor light shield 83 on a smaller diameter side thereof. Four engaging pins 84 are disposed at regular intervals in the circumferential direction of the inner peripheral surface. Placing the full bobbin hanger sensor light shield 83 to the main body 82 from below so that the main body 82 is inserted through the full bobbin hanger sensor light shield 83 allows the full bobbin hanger sensor light shield 83 to be mounted on the main body 82 by engaging the engaging pins 84 with the upper end portion of the main body 82 by way of the elastic formation of the resin.

[0047] According to the present modified embodiment, similarly to the first embodiment, it is possible to detect that there is an empty bobbin 13E hung by one of the full bobbin hangers 21F when the full bobbin hanger sensor light shield 83 blocks the sensor light L. Further, since the full bobbin hanger sensor light shield 83 and the main body 82 are separately provided, the main body 82 may be made of a material different from that of the full bobbin hanger sensor light shield 83, so that the weight of the vertically movable member 81 may be reduced. Further, the sensor light L may be blocked by mounting the full bobbin hanger sensor light shield 83 even if the main body 82 is identical to the vertically movable member 47 of the empty bobbin hanger 21. Thus, the existing full bobbin hanger may be used as the full bobbin hanger 80F that blocks the sensor light L.

[0048] The present disclosure is not limited to the above-described embodiments, and may be modified in various manners within the technical scope of the present disclosure, as exemplified below.

[0049] In the above-described embodiments (including the modified embodiment), a light shield of the vertically movable member in the bobbin hanger has a tubular circular truncated cone shape or a shape in which the tubular circular truncated cone is cut in half and one of the halves is removed, but it is not limited thereto. The shape of the light shield of the vertically movable member may be designed freely as long as the light shield can block the sensor light. For example, the light shield may

have a plate shape.

[0050] In the above-described modified embodiment, the full bobbin hanger sensor light shield is mounted on the main body with the engaging pins, but it is not limited thereto. For example, the full bobbin hanger sensor light shield may be mounted on the main body by using a fastener such as a bolt. Mounting of the full bobbin hanger sensor light shield to the main body may be designed freely.

[0051] A bobbin detection mechanism (36) in a bobbin transport device (20) for a roving frame (10) includes a plurality of full bobbin hangers (21F, 61F, 80F), a plurality of empty bobbin hangers (21E, 61E), and a full bobbin hanger photoelectric sensor (37) configured to emit a sensor light (L, L1). Each of the full bobbin hangers (21F, 61F, 80F) includes a full bobbin shaft portion, and a full bobbin vertically movable member (49, 69, 81) movable up and down relative to the full bobbin shaft portion (45). The bobbin detection mechanism (36) includes a full bobbin hanger sensor light shield (51, 71, 83) formed in the full bobbin hanger vertical movable member (49, 69, 81), and configured to block the sensor light (L, L1) from the full bobbin hanger sensor light emitter (38) when the full bobbin vertically movable member (49, 69, 81) is positioned at the holding position.

Claims

1. A bobbin detection mechanism (36) in a bobbin transport device (20) for a roving frame (10), the bobbin detection mechanism (36) comprising:

a plurality of full bobbin hangers (21F, 61F, 80F) for hanging a full bobbin (13F);

a plurality of empty bobbin hangers (21E, 61E) for hanging an empty bobbin (13E), the full bobbin hangers (21F, 61F, 80F) and the empty bobbin hangers (21E, 61E) being arranged alternately; and

a rail member (22) guiding the full bobbin hangers (21F, 61F, 80F) and the empty bobbin hangers (21E, 61E),

each of the full bobbin hangers (21F, 61F, 80F) including:

a full bobbin shaft portion hanging down from the rail member (22); and

a full bobbin vertically movable member (49, 69, 81) contactable with a bobbin (13) mounted on the full bobbin shaft portion and movable to a lowest position relative to the full bobbin shaft portion and to a holding position that is higher than the lowest position,

the full bobbin (13F) being held by one of the full bobbin hangers (21F, 61F, 80F) with an upward movement of the full bobbin vertically movable

member (49, 69, 81), **characterized in that** the bobbin detection mechanism (36) includes:

a full bobbin hanger photoelectric sensor (37) including a full bobbin hanger sensor light emitter (38) configured to emit a sensor light (L, L1) in a bobbin hanger arrangement direction in which the full bobbin hangers (21F, 61F, 80F) and the empty bobbin hangers (21E, 61E) are arranged, and a full bobbin hanger sensor light receiver (38) configured to receive the sensor light from the full bobbin hanger sensor light emitter; and a full bobbin hanger sensor light shield (51, 71, 83) formed in the full bobbin hanger vertical movable member (49, 69, 81), and configured to block the sensor light (L, L1) from the full bobbin hanger sensor light emitter (38), and

the sensor light (L, L1) from the full bobbin hanger sensor light emitter (38) is set at such a height where the sensor light (L, L1) is blocked by the full bobbin hanger sensor light shield (51, 71, 83) when the full bobbin vertically movable member (49, 69, 81) is positioned at the holding position.

2. The bobbin detection mechanism (36) in the bobbin transport device (20) for the roving frame (10) according to claim 1, **characterized in that** each of the empty bobbin hangers (21E, 61E) includes:

an empty bobbin shaft portion hanging down from the rail member (22); and

an empty bobbin vertically movable member (66) contactable with the bobbin (13) mounted on the empty bobbin shaft portion and movable to a lowest position relative to the empty bobbin shaft portion and to a holding position that is higher than the lowest position,

the bobbin detection mechanism (36) includes:

an empty bobbin hanger photoelectric sensor (62) including an empty bobbin hanger sensor light emitter (63) configured to emit a sensor light (L2) in the bobbin hanger arrangement direction, and an empty bobbin hanger sensor light receiver (64) configured to receive the sensor light (L2) from the empty bobbin hanger sensor light emitter (63); and

an empty bobbin hanger sensor light shield (68) formed in the empty bobbin hanger vertical movable member (66), and configured to the sensor light (L2) from the empty bobbin hanger sensor light emitter (63),

the sensor light from the empty bobbin hanger sensor light emitter (63) is set at such a height where the sensor light (L2) is blocked by the empty bobbin hanger sensor light shield (68) when the empty bobbin vertically movable member (66) is positioned at the holding position. 5

3. The bobbin detection mechanism (36) in the bobbin transport device (20) for the roving frame (10) according to claim 1 or 2, **characterized in that** 10
 the full bobbin hanger sensor light shield (83) and the full bobbin vertically movable member (81) are provided as separate parts.

4. A bobbin hanger used for a bobbin detection mechanism (36) in a bobbin transport device (20) for a roving frame (10), the bobbin hanger comprising: 15

a bobbin shaft portion (45) on which a bobbin (13) is mounted; and 20
 a bobbin vertically movable member (47, 49, 66,69, 81) movable up and down relative to the bobbin shaft portion (45),

characterized in that 25
 the bobbin vertically movable member (47, 49, 66,69, 81) includes a bobbin hanger sensor light shield (51, 68, 71, 83), and

the bobbin hanger sensor light shield (51, 68, 71, 83) is configured to block a sensor light (L, L1, L2) of a through beam photoelectric sensor (37, 62) provided in the bobbin detection mechanism (36) when the bobbin vertically movable member (47, 49, 66,69, 81) moves up with the bobbin (13) mounted on the bobbin shaft portion (45). 30
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FIG. 1

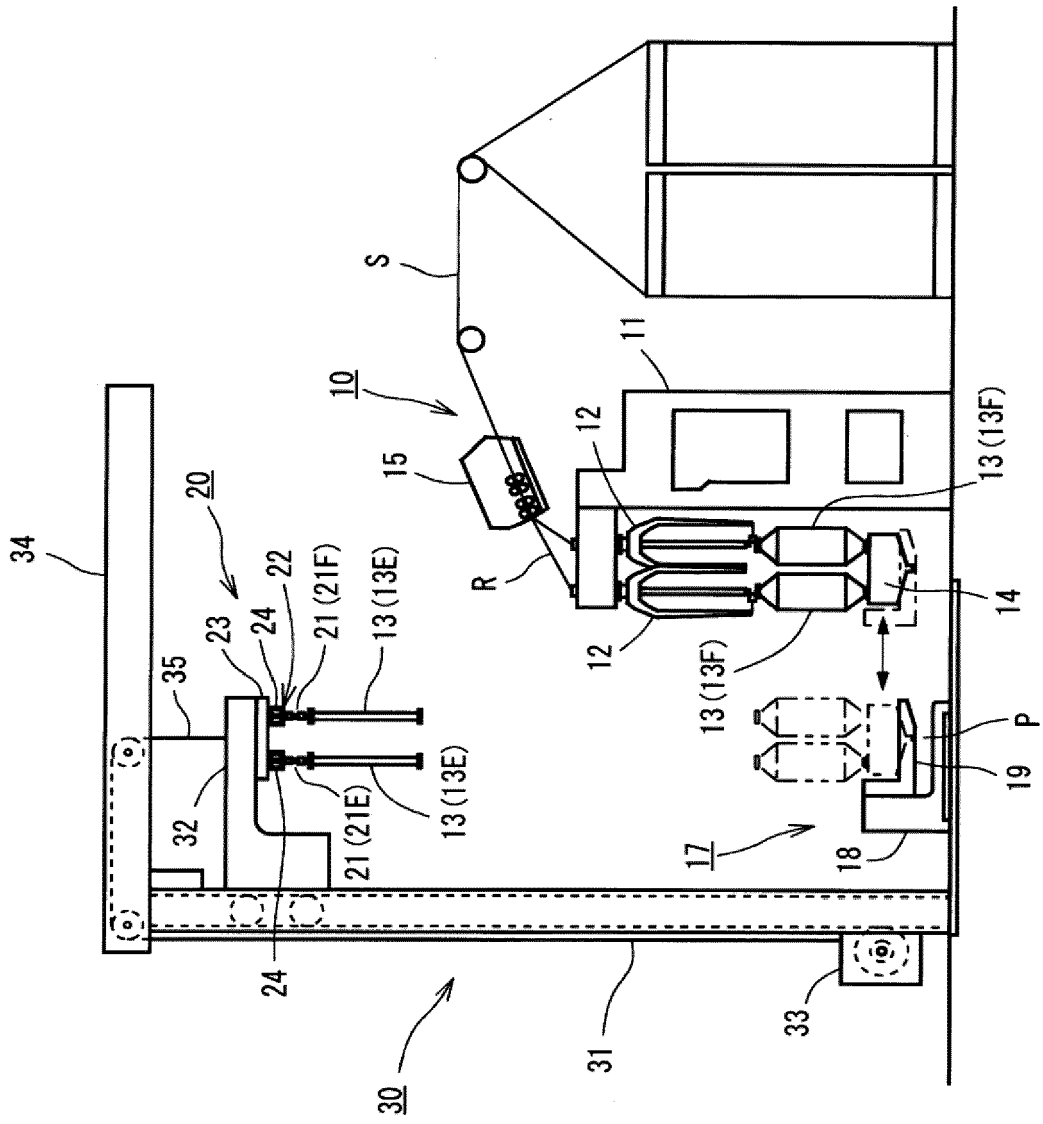


FIG. 2

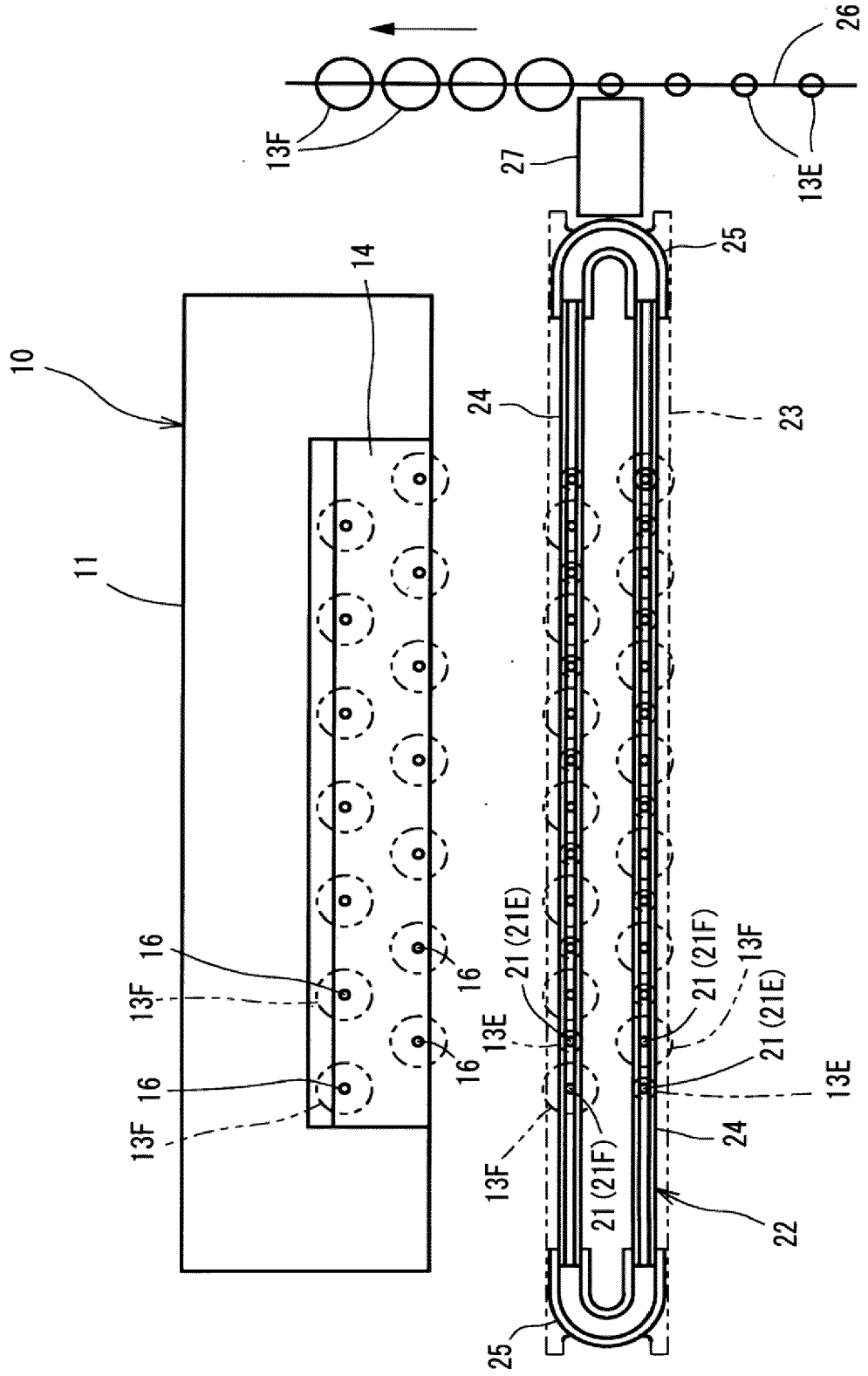


FIG. 3A

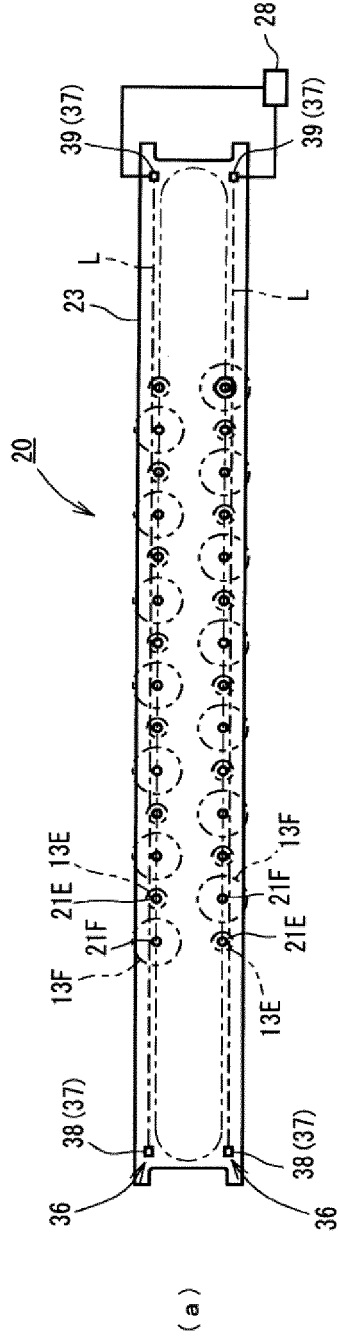


FIG. 3B

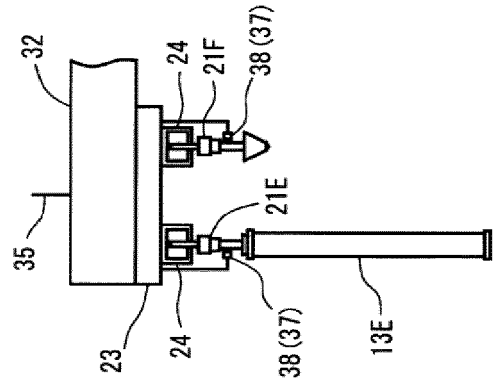


FIG. 3C

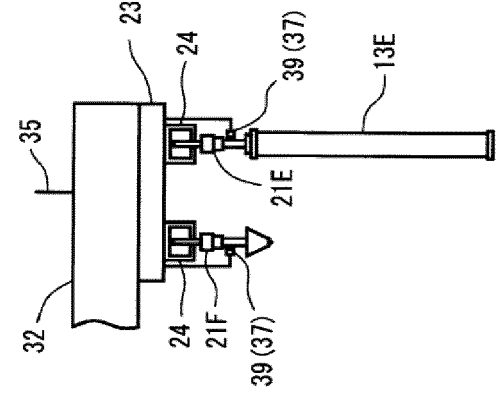


FIG. 4

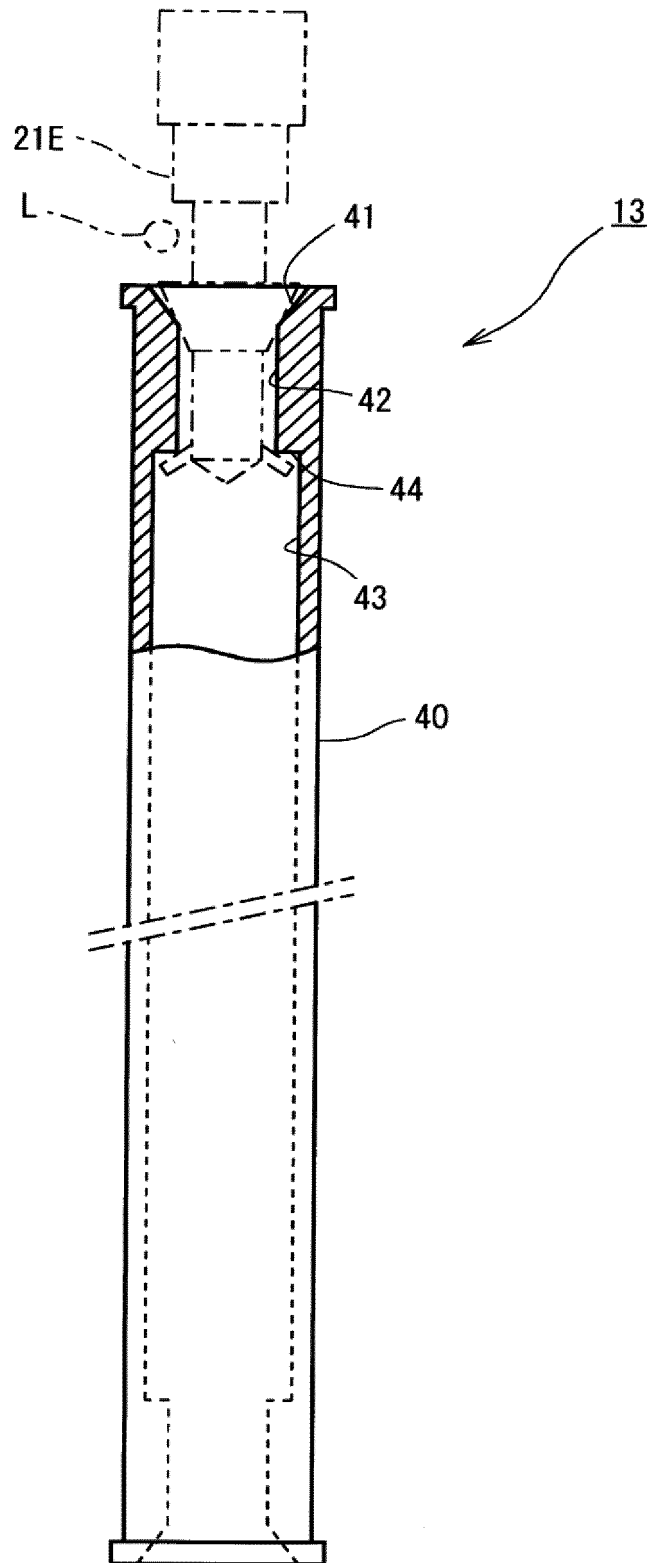


FIG. 5C

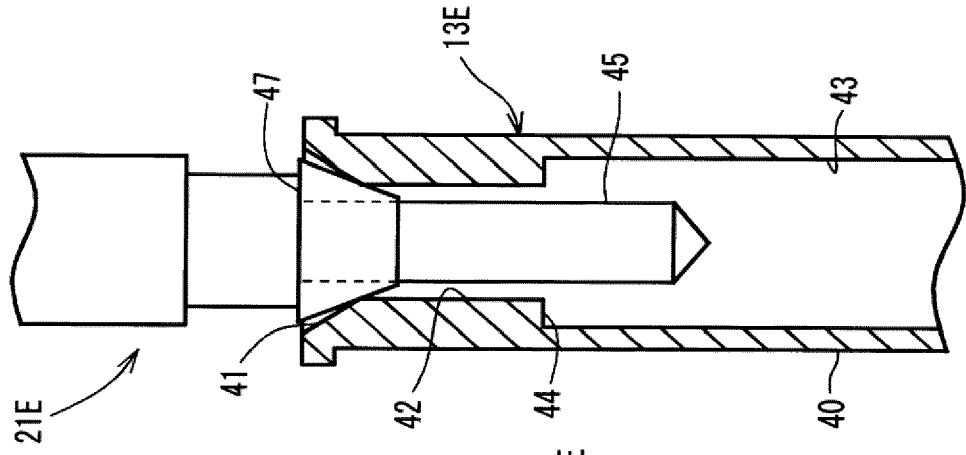


FIG. 5B

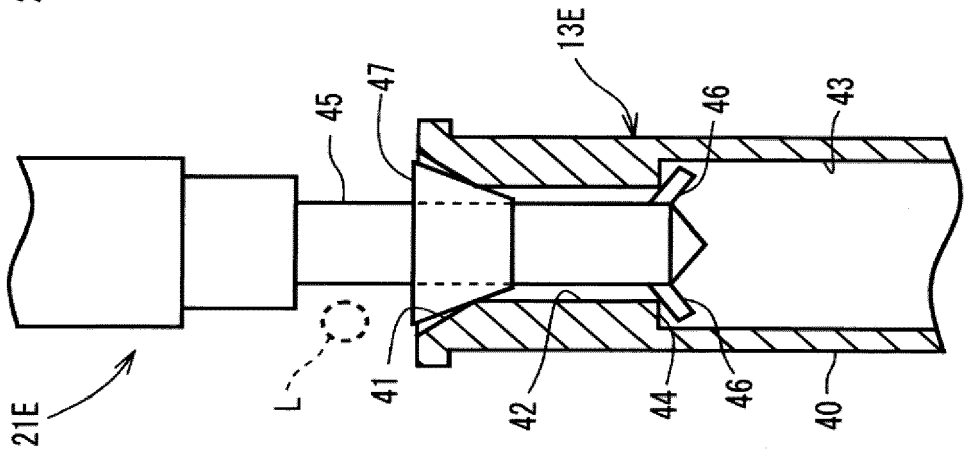


FIG. 5A

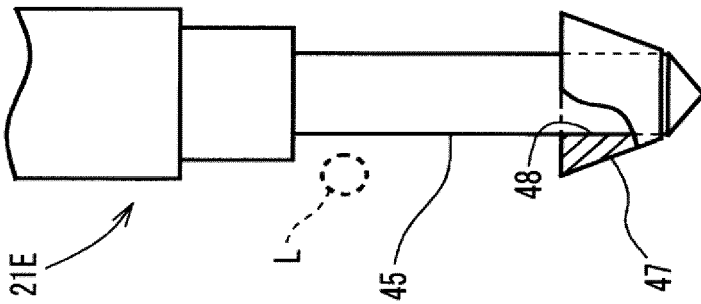


FIG. 6C

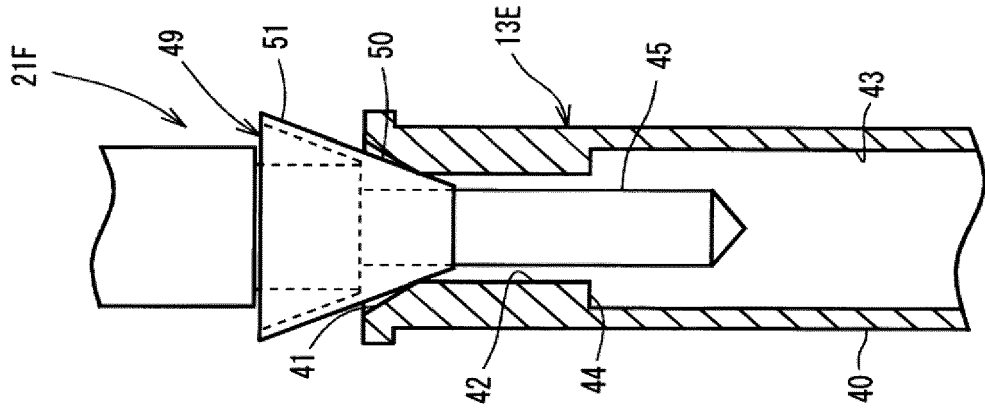


FIG. 6B

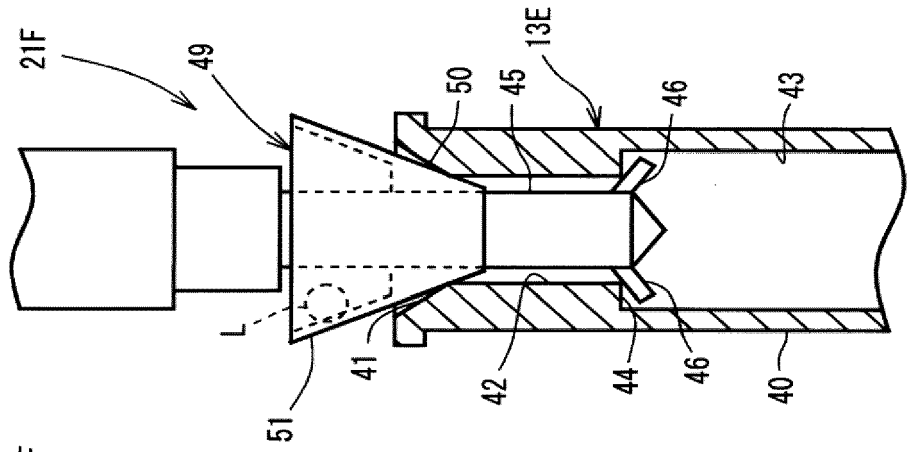


FIG. 6A

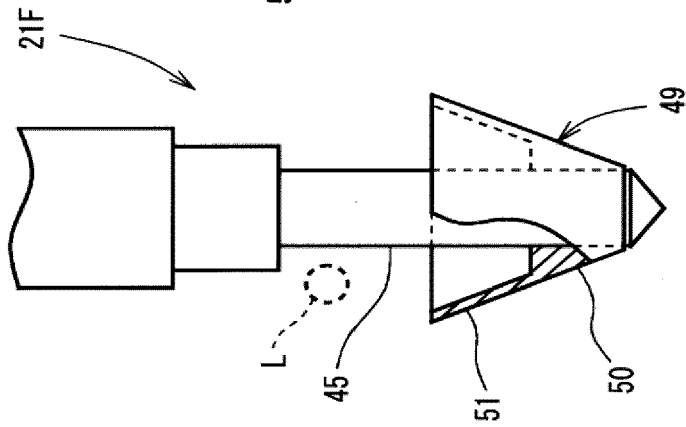


FIG. 7

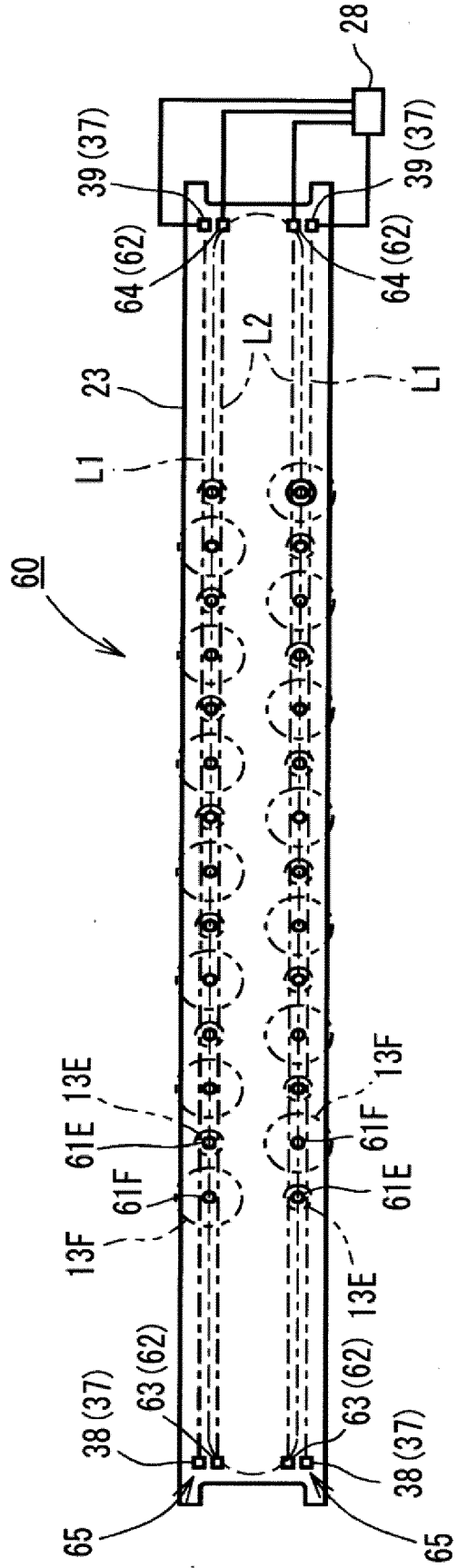


FIG. 8A

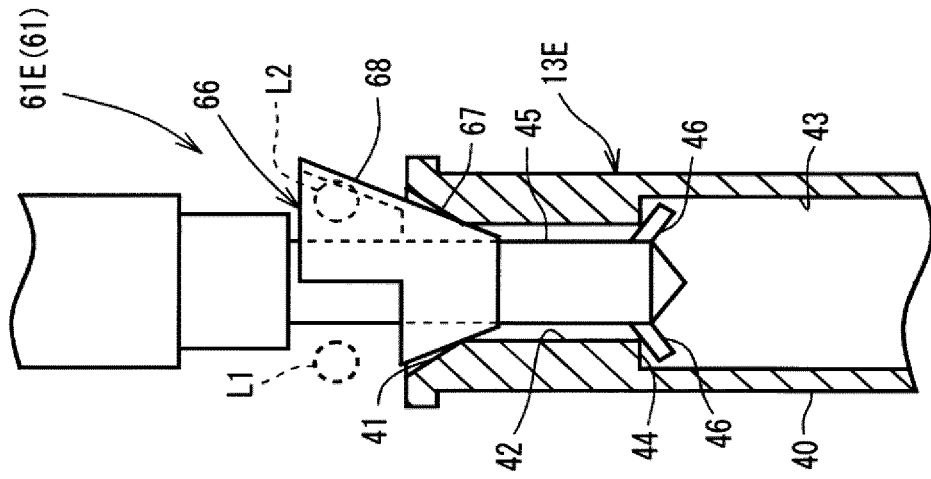


FIG. 8B

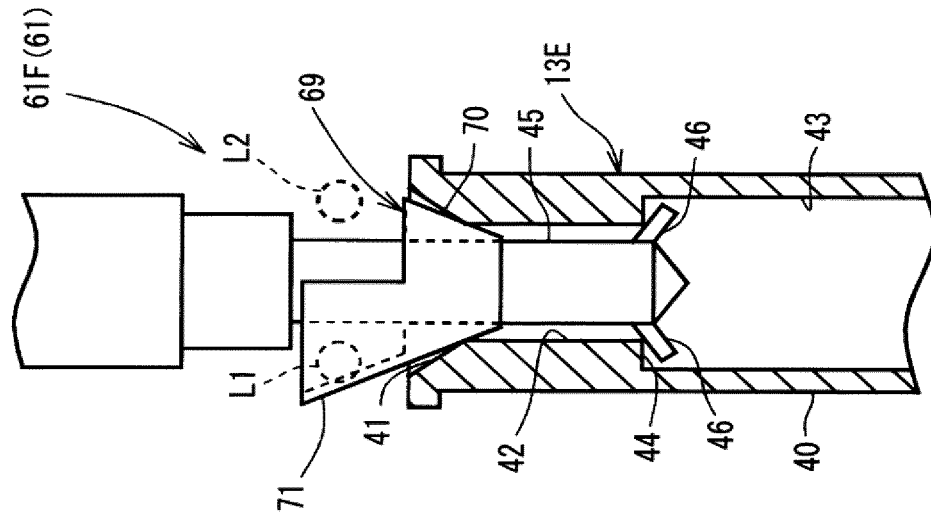


FIG. 9B

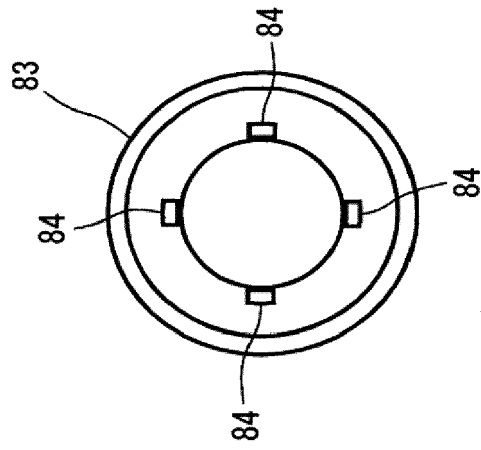
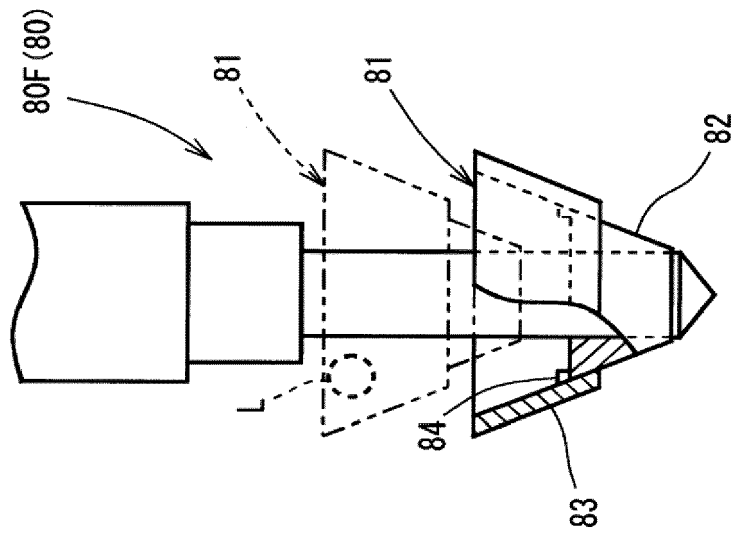


FIG. 9A





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Application Number
EP 21 16 4190

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			B65H D01H
Place of search		Date of completion of the search	Examiner
The Hague		23 August 2021	Pussemier, Bart
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