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(54) Bobbin changing method in roving frame and apparatus for carrying out said method.

(57) A method and apparatus for carrying out a bobbin changing operation whereby full bobbins or empty bobbins are displaced by a bobbin carrying unit in a suspended condition between the respective bobbin wheels and a peg bar for full bobbins or a peg bar for empty bobbins positioned at the lower common transfer position, where the full bobbins can be transferred from the bobbin carrying unit to the peg bar for full bobbins, or the empty bobbins can be transferred from the peg bar for empty bobbins to the bobbin carrying unit, respectively, while full bobbins are displaced while mounted on the peg bar for full bobbins between the above mentioned lower common transfer position and the upper common transfer position where the full bobbins can be the upper common transfer position where the full bobbins can be transferred to the corresponding respective bobbin supporting members positioned above the roving frame before starting the bobbin changing operation, or empty bobbins are displaced while mounted on the peg bar for empty bobbins from the upper common transfer position where the empty bobbins can be transferred from the bobbin supporting members to the peg bar for empty bobbins, before that the peg bar for full bobbin is displaced to the upper common transfer position, to the lower common transfer position, after the peg bar for mounting full bobbins is displaced to the upper common transfer position, the peg bar for full bobbins and the peg bar for empty bobbins are held at temporarily reserving positions to prevent possible interference between them while either one of these peg bars is displaced.

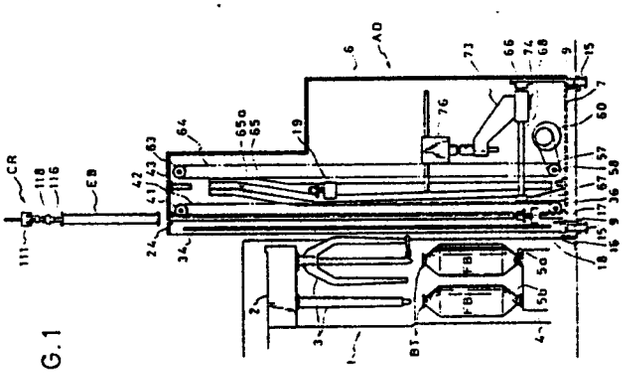

FIG. 1

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Description

BOBBIN CHANGING METHOD IN ROVING FRAME AND APPARATUS FOR CARRYING OUT SAID METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a bobbin changing method in a roving frame and an apparatus for carrying out this bobbin changing method. More particularly, the present invention relates to a bobbin changing method in a roving frame in which full bobbins held on a bobbin wheel of a roving frame, having a top-support-type flyer, are exchanged with empty bobbins suspended by the respective bobbin supporting members which are arranged in advance in upper corresponding positions above the roving frame, and an apparatus for carrying out this bobbin changing method.

2. Description of the Related Art

A bobbin changing apparatus, in which an operation of exchanging bobbins is carried out by a bobbin changer capable of running along a machine frame of a roving frame, is disclosed in Japanese Unexamined Patent Publication No. 50-89642. In this apparatus, the exchange of bobbins is carried out for each bobbin held by the respective bobbin wheels of the roving frame by one bobbin changing arm moving forward and backward and in the vertical direction. More specifically, the top portion of each of two empty bobbins suspended by the respective bobbin supporting members of a transporting apparatus is held and taken out by the bobbin changing arm and placed on the corresponding peg of a bobbin reserving mechanism, and the bobbin reserving mechanism is swung to retreat the empty bobbins to the position where the taking-out of each full bobbins is not disturbed. The full bobbins are then taken out from bobbin wheels by the bobbin changing arm and mounted on the corresponding bobbin supporting members supported by the transporting apparatus, and the bobbin reserving mechanism is returned to the original position and the full bobbins are held by the corresponding bobbin changing arms and fed onto the corresponding bobbin wheels of the roving frame.

According to this conventional technique, since empty bobbins suspended by the bobbin supporting members are once taken out and placed on the corresponding pegs of the bobbin reserving mechanism, and the bobbin changing arms must travel two times between the respective bobbin wheels and the corresponding bobbin supporting members, and since only two empty bobbins can be simultaneously exchanged with full bobbins, the time required for the bobbin changing operation becomes long. Furthermore, since full and empty bobbins are moved forward and backward and in the vertical direction between the respective bobbin wheels and the corresponding bobbin supporting members in the state where the top portions of the bobbins are suspended by the respective bobbin changing arms, the overhang quantity of the bobbin changing arm holding heavy full bobbins becomes large and the height of the rising end of the bobbin changing arm also becomes large, and therefore, the bobbin changer becomes tall and unstable. Further, it is impossible to move the bobbin changing arm forward and backward and in the vertical direction at a high speed. Moreover, since the bobbin changing arm transfers full bobbins on the respective bobbin wheels of front and rear rows to the bobbin supporting members while maintaining the distance between the front and rear full bobbins as it is, the same distance as that between the full bobbins on the respective bobbin wheels of front and rear rows must be maintained between the bobbin supporting members of the transporting apparatus. If full bobbins suspended by the bobbin supporting members of the transporting apparatus are arranged in a zigzag manner, the automation of a roving bobbin exchange in a spinning frame becomes very difficult.

To solve the above-mentioned problems, we developed a bobbin changing method and apparatus in which the bobbin reserving mechanism in the above-mentioned bobbin changing apparatus is omitted and each of the respective bobbin changing arms per se is moved along a course formed between the respective bobbin exchange positions of bobbin wheels of the roving frame and bobbin supporting members located above the roving frame (Japanese Unexamined Patent Publication No. 60-139835 and No. 60-167940). According to this system, to exchange bobbins held on front and rear rows of bobbin wheels of the roving frame with bobbins on bobbin supporting members located above the roving frame, two bobbin changing arms, working separately for the front and rear rows of bobbin wheels, are used for full bobbins and empty bobbins, respectively, and independent moving mechanisms are used to cause the respective bobbin changing arms to make forward-backward movements and vertical movements between the respective bobbin wheels of the roving frame and the corresponding bobbin supporting members of a bobbin delivery means. Accordingly, the construction becomes complicated and it is impossible to design the bobbin changing apparatus in a compact form. Furthermore, according to this system, since bobbins are held by suspending upper flange portions of the bobbins with the bobbin changing arm, it is necessary to elevate the bobbin changing arm to such a position level at which it is adjacent to the bobbin supporting members of the bobbin transporting apparatus, and the height of the bobbin changing apparatus per se becomes large. Accordingly, the bobbin changing apparatus becomes unstable, and the bobbins suspended by the bobbin supporting members interfere with the bobbin changing apparatus, and the bobbin changing apparatus cannot pass below the bobbins. Therefore, it is impossible to adopt a layout in which the transporting rails for the trans porting apparatus and the guide rail of the bobbin changing apparatus sterically cross each other, and it is difficult to

automatically control the bobbin changing apparatus as a machine for carrying out the bobbin exchange operation for a group of many roving frames.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a practical bobbin changing method applied for the roving process, by which the above-mentioned problems are solved, and an apparatus for use in carrying out this bobbin changing method.

The basic technical idea for attaining this object is that the unitary cycle of bobbin changing work, consisting of the bobbin changing operation of displacing and exchanging full bobbins and empty bobbins between the respective bobbin wheels of a roving frame and the corresponding bobbin supporting members which are arranged in advance in upper corresponding positions above the roving frame concerned is divided into the step of vertically moving each one of the full bobbins and the corresponding one of the empty bobbins between a bobbin transfer position, which is common for each one of the full bobbins and the corresponding one of the empty bobbins, at the level of the bobbin wheels of the roving frame and a bobbin holding and releasing position of the bobbin supporting member, which is common for the each one of the full bobbins and the respective one of the corresponding empty bobbins, along the same course, except for a part thereof, and the step of transferring the bobbins between the respective bobbin wheels of the roving frame and the above-mentioned corresponding common bobbin transfer positions, whereby it is made possible to simultaneously perform the operation of receiving full bobbins from the bobbin wheels of the flyer frame and the operation of receiving empty bobbins from the bobbin supporting members, and it is also made possible to simultaneously perform at least parts of the operation of displacing the full bobbins received from the roving frame toward the respective bobbin supporting members, from which the empty bobbins have been taken out, and suspending the full bobbins on the corresponding bobbin supporting members, and the operation of displacing the empty bobbins taken out from the bobbin supporting members to the above-mentioned corresponding common bobbin transfer positions. Accordingly, the construction of the bobbin changing apparatus for carrying out this bobbin changing method is greatly simplified and the apparatus can be made compact, and the bobbin changing operation can be performed assuredly and promptly. Furthermore, since in the displacing courses for full bobbins and empty bobbins, the bobbin transferring position and the bobbin holding releasing position of each one of the bobbin supporting members are common to the corresponding full bobbin and empty bobbin, in order to avoid interference in the vertical movements of the full bobbins and empty bobbins, a stand-by position for each empty bobbin is formed in the displacing course for each one of the empty bobbins at a position deviated from a linear course connecting the above-mentioned holding and releasing position and the bobbin transferring position.

In view of the desired compactness of the bobbin changing apparatus, where full bobbins are taken out from the respective bobbin wheels of the roving frame and displaced to the above-mentioned respective corresponding common bobbin transfer positions, and where empty bobbins are placed on the respective corresponding bobbin wheels of the roving frame from the respective common transfer positions, the bobbins are moved in the state where the upper flange portion of each bobbin is suspended; and where the full bobbins are elevated from their transfer positions to the respective corresponding bobbin holding and releasing positions of the bobbin supporting members and are held by the respective corresponding bobbin supporting members, and where the empty bobbins are received from the bobbin supporting members and are brought down to the above-mentioned respective transfer positions, the bobbins are displaced in the state where each bobbin is held at the bottom thereof. If this method is adopted, the manner of holding bobbins to be displaced is changed at the above-mentioned respective common bobbin transfer position. Accordingly, in the bobbin changing apparatus of a roving frame according to the present invention, the apparatus height can be effectively reduced, and thus the method according to the present invention contributes greatly to the compactness of the bobbin changing apparatus.

The bobbin changing method in a roving frame based on the above-mentioned basic technical concept, according to the present invention, is a bobbin changing method in which the bobbin changing operation of a group of bobbins is carried out by using a bobbin changing apparatus for empty bobbins prepared and arranged in advance at an upper position of the roving frame and full bobbins held on bobbin wheels of the flyer frame. After completion of the above-mentioned unit operation for a group of bobbins, the bobbin changing apparatus is displaced along bobbin rails and is located at a position corresponding to bobbin wheels for the subsequent unit operation, and this unit operation is repeated, until the above-mentioned bobbin changing operation is completed for all bobbin wheels of a roving frame. This method is characterized by the following constitutional elements of the invention, that is, the bobbin changing operation is carried out by displacing full bobbins and empty bobbins along the respective bobbin moving courses formed between the positions of bobbin wheels of the roving frame and the corresponding positions for holding bobbins by the respective bobbin supporting members and releasing these bobbins therefrom above the roving frame; a common lower bobbin transfer position is formed in each of the above-mentioned bobbin displacing courses, to which position a full bobbin taken out from a bobbin wheel of the roving frame is carried before this bobbin is displaced to the above-mentioned position for holding by the corresponding bobbin supporting member and empty bobbin previously received from the corresponding supporting member is displaced before this empty bobbin is carried to a such position for mounting the

corresponding bobbin wheel of the roving frame, at substantially the same height level as the height of the bobbin wheels within the bobbin changing apparatus; the bobbins are displaced along the respective displacing courses between the above-mentioned respective common lower transfer positions and the positions of the respective corresponding bobbin wheels, while holding the upper position of each bobbin, and the bobbins are displaced along the respective displacing courses between the respective common lower transfer positions and the holding and releasing positions of the respective corresponding bobbin supporting members while holding the lower portion of each bobbin; the state of holding each bobbin is changed to the other bobbin holding state at each common lower transfer position; and empty bobbins received from the respective bobbin supporting members are reserved for a while at a position deviated from the respective linear courses connecting the respective bobbin supporting members to the respective corresponding common lower transfer positions when the full bobbins are displaced to the corresponding bobbin supporting members from the above-mentioned respective common lower transfer positions during the unit operation of the bobbin changing operation. The above-mentioned position for holding a full bobbin by the corresponding bobbin supporting member and also for releasing an empty bobbin from this bobbin supporting member is hereinafter referred to as a common upper transfer position.

As the method in which empty bobbins to be subjected to the bobbin changing operation are prepared and arranged in advance in the upper portion of the roving frame, there can be mentioned a method in which a bobbin transporting apparatus comprising a plurality of transporting members, each having a plurality of bobbin supporting members for suspending a bobbin is travelled along transporting rail means laid out in the longitudinal direction of the roving frame in the upper portion of the roving frame and is stopped at predetermined positions for carrying out the bobbin changing operation. Instead of this automatic method, there may be adopted a method in which a creel or creels for holding bobbin supporting members is arranged above the roving frame, empty bobbins are manually suspended by the bobbin supporting members in advance, these empty bobbins are exchanged with full bobbins by the bobbin changing operation of the present invention, and then are manually delivered out from the bobbin supporting members. Moreover, such a manual operation may be performed by a method similar to the known bobbin exchange method in a spinning frame, as disclosed in Japanese Unexamined Patent Publication No. 58-120826. In view of the above-mentioned, the bobbin changing method and apparatus of the present invention can be utilized in various modes according to actual conditions at the spinning mills.

In the present invention, since application of an automatic system for supplying roving bobbins from the roving process to the spinning process is intended, the pitches of bobbin supporting members are made to correspond with the pitches of bobbin hangers of the creel of a spinning frame. Accordingly, when the operation is carried out in a roving frame in which front and rear rows (two rows) of bobbin wheels are arranged, this two-row arrangement is not in agreement with the one-row arrangement of the bobbin supporting members and the operation is disturbed by this disagreement. However, this problem can be practically solved by changing the pitches of bobbins held by the respective bobbin changing arms, and by changing the arrangement conditions between the zigzag arrangement and a linear arrangement, while the bobbins are displaced between the position of the bobbin wheels and the respective corresponding lower transfer positions.

As is apparent from the above-mentioned description, in the apparatus for use in carrying out the bobbin changing method in a roving frame according to the present invention, a peg bar for full bobbins and a peg bar for empty bobbins, each having a plurality of bobbin holding pegs, are used for moving full bobbins and empty bobbins between the above-mentioned common lower transfer positions and the common upper transfer positions for the respective bobbin supporting members, these two peg bars are moved between the position coinciding to the common lower and upper bobbin transfer positions along the above-mentioned respective displacing courses except an intermediate stand-by position for each peg bar for empty bobbins, a carrying mechanism is used to carry full bobbins and empty bobbins between the respective bobbin wheels of the roving frame and the respective corresponding common lower bobbin transfer positions, the full bobbins received from the respective bobbin wheels of the roving frame are transferred to the respective corresponding peg bar for full bobbins at the respective corresponding common lower transfer positions, and the empty bobbins taken out from the respective bobbin supporting members to the peg bar for empty bobbins at the respective common upper transfer positions are displaced to the respective common lower transfer positions by displacing the peg bar for the empty bobbins downward, and these empty bobbins are transfered to the carrying mechanism from the peg bar for empty bobbin at the corresponding respective common lower transfer positions.

Elements having different functions are combined in the above-mentioned manner to construct the apparatus of the present invention. Since these elements are arranged so that mutual interference is avoided among these elements, the apparatus is made compact by a combination of simple mechanisms, and therefore, the operation can be carried out in simple way and the operational steps can be promptly carried out. Accordingly, the practical value of the present invention is very high.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a side view of a bobbin changing apparatus for a roving frame, wherein a part of a bobbin transporting apparatus is shown;

Figure 2A is a front view of an upper portion

of the bobbin changing apparatus, together with the part of the bobbin transporting apparatus shown in Fig. 1;

Fig. 2B is a front view of the bobbin changing apparatus shown in Fig. 1 wherein the upper portion thereof is omitted;

Fig. 3 is a plan view of the bobbin changing apparatus shown in Fig. 1;

Fig. 4 is a side view of a part of a lifting mechanism for a peg bar for full bobbins;

Fig. 5 is a schematic front view of the bobbin changing apparatus, omitting machine elements except for the lifting mechanism for the peg bar for full bobbins, for illustrating the displacing operation of the peg bar for full bobbins;

Fig. 6 is a side view of a main part of the lift mechanism for a peg bar for empty bobbins;

Fig. 7 is a view taken along the line VII-VII in Fig. 6;

Fig. 8 is a diagram illustrating the moving locus of the peg bar for empty bobbins;

Fig. 9 is a sectional view of a bobbin changing bar of a bobbin carrying device mounted on the bobbin changing apparatus shown in Fig. 1;

Fig. 10 is a view showing the section taken along the line X-X in Fig. 9;

Fig. 11A and Fig. 11B are diagrams illustrating the operation of a bobbin changing arms for front and rear rows which are mounted at the bobbin changing bar shown in Fig. 9;

Fig. 12 is a plan view showing a bobbin transporting apparatus, a travelling rail and a roving frame, which are designed so that they are adapted to the bobbin changing apparatus in a roving frame according to the present invention;

Fig. 13 is a plan view showing a connection unit of the bobbin transporting apparatus;

Fig. 14 is a side view showing the unit transporting device and a positioning device thereof;

Fig. 15 is a sectional view of a positioning device taken along the line XV-XV in Fig. 14.

Fig. 16 is a plan view of a switching mechanism applied for the transporting apparatus shown in Fig. 12;

Fig. 17 is an electric circuit diagram illustrating a control circuit for the transporting apparatus and positioning device;

Figs. 18A, 18B, 18C, 18D, 18E, 18F, 18G, and 18H are drawings illustrating the operational steps of the bobbin changing process according to the present invention; and

Figs. 19A and 19B are diagrams illustrating the positional relationship among the roving frame, the bobbin changing apparatus, and the transporting apparatus when the transporting apparatus shown in Fig. 12 is utilized.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Some modifications may be made to the bobbin changing method in a roving frame according to the present invention when this method is practically carried out, but the above-mentioned basic technical idea should be always embodied. Accordingly, the bobbin changing apparatus in which this technical idea is embodied will now be described in detail with reference to a preferred embodiment illustrated in the accompanying drawings.

Referring to Figs. 1 through 3, a bobbin changing machine AD is positioned at a predetermined position in front of a roving frame 1. In this roving frame 1, top support type front and rear flyers 3 are disposed in a zigzag manner on a top rail 2 of the roving frame 1 and one group of four top support type flyers 3 are arranged in one staff so that a pitch P1 (Fig. 3) is maintained between adjacent flyers 3 and a pitch P2 is maintained between adjacent flyers 3 of adjacent groups, in the longitudinal direction of the top rail 2. Furthermore, a distance L is set between the front and rear rows of the flyers 3. The flyers 3 are rotated at a high speed through driving shafts and gears (not shown) arranged within the top rail 2. Below the flyers 3, a bobbin rail 4 is vertically movably arranged, and bobbin wheels 5a and 5b concentric with the flyers 3 are arranged on the bobbin rail 4 and are rotated at a high speed through driving shafts and gears (not shown).

For a better understanding of the practical value of the bobbin changing method and apparatus of the present invention, an automatic bobbin changing system in which the above-mentioned bobbin transporting apparatus is used will now be described in detail. This automatic bobbin changing system comprises the bobbin changing apparatus AD of the present invention and a roving bobbin transporting apparatus CR located above a roving frame 1. The bobbin changing apparatus AD is first described.

In the bobbin changing apparatus AD, running wheels 9 secured to wheel shafts 8 are rotatably supported on a bottom plate 7 of a body 6 of the bobbin changing apparatus AD through a pair of bearings 10 at front and rear parts thereof, in the running direction. A driven pulley 11 is secured to one wheel 8 (the left wheel in Fig. 3) and a timing belt 14 is mounted between this pulley 11 and a driving pulley 13 of a driving motor 12 located on the bottom plate 7. The running wheels 9 are mounted on running rails 15 laid out on the front floor surface of the roving frame 1 along the entire length of the roving frame 1, so as to be able to run in the longitudinal direction thereof. Approach members 16 are arranged at respective staff centers (bobbin changing centers CL1, CL2, ..., of the roving frame 1) between bobbin wheels 5a and 5b on the floor surface along the longitudinal direction of the machine frame. A proximity switch 17 capable of detecting the approach member 16 is secured to the bottom plate 7 of the machine body 6 of the bobbin changing apparatus AD at a position conforming to the center of the pitch of bobbin changing arms for the respective second and third front and rear rows of a bobbin changing bar (described below as bobbin changing center CL of the bobbin changing apparatus AD). The construction of the bobbin changing bar and bobbin changing arms will be explained in detail later. When the driving motor 12 is driven, the bobbin changing apparatus AD is

displaced on the running rails 15 along the front face of the roving frame 1, and when the approach member 16 confronts the proximity switch 17, the bobbin changing apparatus AD is atopped at a predetermined bobbin changing position.

Full bobbin and empty bobbin peg bars 18 and 19 of the machine body 6 and lifting mechanisms for these pegs will now be described in detail. Pegs 20 for one staff (four pegs) are arranged on the top face of the full bobbin peg bar 18 so that the distance between two adjacent pegs 20 is equal to the bobbin pitch P of a spinning creel. Each peg 20 is vertically slidable on the upper face of the full bobbin peg bar 18 and is urged upward by a spring 21, and the top end of the peg 20 is positioned by a fall-preventing screw 22. Pegs 20 of the empty bobbin peg bar 19, described below, also have the same structure (see Fig. 6). Guide blocks 23 are secured to both the left and right ends of the full bobbin peg bar 18, and these guide blocks 23 are slidably mounted on the corresponding respective guide bars 27 mounted perpendicularly to the corresponding respective slide blocks 26, which are slidably mounted on the corresponding respective guide bars 25 extended from the left and right end portions of the bottom plate 7 of the machine body 6 to the top plate 24 thereof. One end of each of first and second links 28 and 29 is connected by a pin to the front faces of the left and right guide blocks 23 and the front faces of the left and right slide blocks 26, respectively. Instead of using the above-mentioned combination of the guide block 23 with the corresponding end of the full bobbin peg bar 18, both ends of the full bobbin peg bar 18 can be extended to create a pair of end portions having the same function as the above-mentioned guide block 23. A pin 31 on the side of each slide block 26 is located vertically below a pin 30 on the side of the corresponding guide block 23. The other ends of the first and second links 28 and 29 are turnably connected by a pin to supporting shafts of a corresponding cam follower 32. Cam plates 34 confronting the corresponding cam followers 32 and having a inwardly inclined face 34a are attached to left and right outer side plates 33 of the full bobbin guide bars 25 of the body 8, in the vertical direction of the machine body 6 substantially along the entire length thereof (the cam plates 34 are omitted in Figs. 1 and 2). The intervening space between the two inclined faces 34a is narrowed upward as shown in Fig. 5. A driving shaft 35 is rotatably supported on the bottom plate 7 over the distance between the side plates 33 along the running direction of the bobbin changing apparatus AD. Driving sprockets 36 are secured to the both end portions of the driving shaft 35 between the full bobbin guide bars 25 and the side plates 33 in both sides, and a sprocket 37 is secured to one end of the driving shaft 35 which projects toward the running wheel beyond the side plate 33 as shown in Fig. 2B. A chain 40 is mounted between this sprocket 37 and a sprocket 39 of the rotation shaft of a driving motor 38. Driven sprockets 41 are rotatably supported on a respective bracket attached to the top plate 24 vertically above the corresponding driving sprockets 36, and lifting chains 42 are mounted between left and right corresponding driving and driven sprockets 36 and 41, respectively (Fig. 1). Intermediate parts of the lifting chains 42 are secured to the corresponding slide blocks 26 on the side faces in the direction of the running wheels. The lifting mechanism for the full bobbin peg bar 18 is thus constructed, and as shown in Fig. 5, by the motion of the lifting chains 42, the slide blocks 26 are vertically displaced. When the slide blocks 26 move upward, the full bobbin peg bar 18 is pushed up by the slide blocks 26 because the distance between the left and right cam followers 32 is contracted by engagement with the corresponding respective cam plates 34, and the full bobbin peg bar 18 is vertically moved among the common upper transfer position (rise end) S4 where full bobbins FB can be caught by the corresponding bobbin supporting members of a bobbin transporting apparatus 114 described later, a receiving position S2 of the common lower transfer motion where full bobbins FB taken out from the respective bobbin wheels 5a and 5b by a bobbin changing bar described hereinafter and mounted on the corresponding pegs 20 on the full bobbin peg bar 18, and led to a preparation position S1 (lowermost displaced position) of the common lower transfer motion below the receiving position S2.

As shown in Figs. 1 through 3 and 6 through 8, in the empty bobbin peg bar 19, as in the above-mentioned full bobbin peg bar 18, pegs 20 (four pegs) of one staff are arranged in a line, in a condition such that the distance between adjacent two pegs 20 is set at the pitch P in the spinning creel. The lifting mechanism for the empty bobbin peg bar 19 is now described. Empty bobbin guide bars 43 are arranged in parallel to the full bobbin guide bars 25 slightly obliquely behind the full bobbin guide bars 25, and a lift block 44 is slidably fitted to each of the empty bobbin guide bars 43. In each lift block 44, a cam lever 46 having a cam follower 45 is connected by a key to one end of a shaft 47 rotatably mounted on the lift block 44 on the side of the corresponding side plate 33 and is swung in the front-rear direction (left-right direction in Fig. 6), and a fan-shaped sector gear 48 is connected by a key to the other end of the shaft 47. This sector gear 48 is engaged with a gear 51 of a swinging arm 50 supported by a supporting shaft 49 and swingably movable in the vertical direction. The shaft 49 is secured to each lift block 44. Each swinging arm 50 clips a stationary shaft 52 with the top end thereof and a pair of timing belt pulleys 53 integrally secured to both the left and right sides of the empty bobbin peg bar 19 are rotatably fitted to the corresponding swinging arm 50. A timing pulley 54 is connected by a key to the top end of each supporting shaft 49 so that the pulley 54 does not turn relative to the corresponding lift block 44. Timing belts 56 is mounted between the above-mentioned each pair of timing pulleys 54 and 53 through a respective tension pulley 55, so that even if the swinging arms 50 swing, the empty bobbin peg bar 19 is always kept at the horizontal posture. Driving sprockets 57 secured to a driving shaft 58 are rotatably supported at the bottom plate 7 of the machine body 6 of the bobbin changing apparatus in the rear of the empty bobbin guide bars

43, and a driven sprocket 59 is secured to one end of the driving shaft 58 and a driving chain 62 is mounted between this sprocket 59 and a sprocket 61 of a driving motor 60 (see Figs. 1 and 3). Driven sprockets 63 corresponding to the driving sprockets 57 are pivoted in the vicinity of the top plate 24 vertically above the driving sprockets 57. A pair of lift chains 64 are mounted between each pair of these driving and driven sprockets 57 and 63, and an intermediate part of each chain 64 is connected to the rear face of the corresponding lift block 44 (see Fig. 6). Grooved cam plates 64 having a cam groove 65a, in which the cam followers 45 are fitted and guided, are secured to the inner sides of the left and right side plates 33. Each cam groove 65a is formed to have a cam groove shape such that with the vertical movement of each lift blocks 44, the empty bobbin peg bar 19 can be displaced along a locus T shown in Fig. 8, and at the stand-by position S7 intermediate in the vertical direction, the axial center of each peg 20 is located in the rear of the empty bobbin guide bar 43 so that the pegs 20 do not interfere with the vertical movement of the full bobbin peg bar 19 carrying full bobbins FB thereon. The upper receiving position S8 of the empty bobbin peg bar 19 and the common upper transfer position S6 and completion position (fall end) S5 of the common lower transfer position of the empty bobbin peg bar 19 are in agreement with the respective positions S4, S2, and S1 of the full bobbin peg bar 19. The lift device for the empty bobbin peg bar 19 is thus constructed with a mechanism for forward-backward movement.

The full bobbin and empty bobbin carrying device will now be described with reference to Figs. 1 through 3 and 9 through 11. On the bottom plate 7 of the machine body 6 of the bobbin changing apparatus AD, brackets 67 are arranged on the left and right sides at positions equidistant with respect to the bobbin changing center CL. Horizontal guide bars 68 are laterally arranged between the brackets 67 and rear plates 66. A supporting block 69c is secured on the axial line of the bobbin changing center CL and a feed bar 69a parallel to the horizontal bars 68 is rotatably supported between the supporting block 69c and the rear plate 66. A sprocket 69b is secured to the end of the feed bar 69a on the side of the rear plate 66, and a chain 71b is mounted between this sprocket 69b and a sprocket 85 of a motor 70. A feed screw 72 is formed on the feed bar 69a substantially along the entire length thereof. Legs of a gate-like slide base 73 are fitted in the horizontal guide bars 68 movably in the front-rear direction, and a plate 74 is secured to the lower faces of the legs. A feed bracket 75 having a female screw engaged with the feed screw 72 of the feed bar 69 is secured to this plate 74. Lift bars 77 arranged vertically on the left and right lower parts of a bobbin changing bar 76 are vertically movably fitted on the upper portions of the legs of the slide base 73 respectively. A lift screw lever 78 is vertically mounted at an intermediate part between the lift bars 77 of the bobbin changing bar 76, and a female screw 80 of a driving sprocket 79 rotatably supported on the slide base 73 is screwed to the screw lever 78. A chain 83 is mounted between the driving sprocket 79 and a sprocket 82 of a driving motor 81 secured to the slide base 73. Accordingly, the bobbin changing bar 76 can make a forward-backward movement on the front side of the roving frame and a vertical movement. As shown in Fig. 10, the upper face of the bobbin changing bar 76 is opened to form sliding faces 84, and sliders 85 and 86 for the front and rear rows, which have bobbin changing arms (bobbin changing arms for the front and rear rows) described below, are alternately arranged on the sliding faces 84 in the order of the slider for the front row and the slider for the rear row from the left side, when seen from the back face of the machine body 6 of the bobbin changing apparatus AD, as shown in Fig. 9. The sliders 85 and 86 are movable only in the left-right direction (Fig. 10) by front and rear slider holders 87 and 88 of the bobbin changing bar 76. Two spline shafts 89 and 90 are supported on the bobbin changing bar 76 rotatably along the longitudinal direction of the machine frame, and one end of each of the two spline shafts 89 and 90 is connected to a driving motor 92 through a gear row 91. A groove cam 93 having cylindrical cam grooves 93A and 93B formed on both sides with a distance corresponding to the distance between the sliders 85 and 86 for the front and rear rows, is slidably spline-fitted to the spline shaft 89. A member 94 for regulating the left-right movement of the groove cam 93, which is in sliding contact with both the left and right ends of the groove cam 93, is secured to the bobbin changing bar 76. Cam followers 95 are arranged on the lower faces of the sliders 85 and 86 for the respective front and rear rows at positions corresponding to the cam grooves 93A and 93B. These cam followers 95 are engaged with the corresponding cam grooves. The sliders 85 and 86 for the respective front and rear rows slide in two adjacent groove cams, except those located on both the ends, and when these groove cams 93A and 93B are turned by a predetermined angle θ (between points A and B shown in Fig. 10), the slider pitch is changed from P1 to P (or vice versa) (Fig. 3). The device for changing the left-right distance between the bobbin changing arms for the front and rear rows is thus constructed. Each slider 85 for the front row has, integrated therewith, each bobbin changing arm 96 for the front row, which can confront the row of bobbin wheels 5a of the roving frame 1, and the bifurcate top end of the slider 85 supports a flange B1 of the upper portion of the bobbin from below. Each one of sliders 86 for two bobbins of the rear row is provided with a bobbin changing arm 97 for the corresponding one of two bobbins of rear row, which can confront the row of bobbin wheels 5b, and each bobbin changing arm 97 for the bobbins of rear row has bifrucated fork portion connecting the tip ends of left and right guide levers 98. The guide levers 98 are inserted in slide apertures 99 of the respective sliders 86 for the two bobbins of the rear row so that the bobbin changing arms 97 for the two bobbins of the rear row can slide in the front-rear direction. Racks 100 are formed on the lower sides of each guide lever 98. A pinion 101 rotatably supported on each slider 86 for the rear row is

engaged with the rack 100. The pinion 101 is spline-fitted to the spline shaft 90 and each slider 85 for the bobbin of front row is freely fitted to the corresponding spline shaft 90. The device for changing the front-rear distance between the bobbin changing arms 96 and 96 for the respective front and rear rows is thus constructed. The tooth numbers of respective gears of the gear row 91 are set so that when the spline shaft 89 is turned by 9, each bobbin changing arm 97 for the rear row is displaced by L, and the operation of changing the zigzag arrangement of bobbins of one staff in the roving frame 1 to the arrangement in agreement with the bobbin arrangement of the spinning creel (or reverse change), as shown in Fig. 11, can be synchronously performed by one driving motor 92.

On the inner sides of the left and right side plates 33 of the machine body 6 of the bobbin changing apparatus, proximity switches SW1 through SW8 are arranged at predetermined positions in the vertical direction. The proximity switches SW1 through SW4 are for detecting approach members 102 (Fig. 2) mounted on the slide blocks 26 of the full bobbin peg bar 18, and these proximity switches SW1 through SW4 confirm, in the order form below, the preparation position (lower end) S1 of the position for lower transfer operation of the full bobbin peg bar 18, the slightly elevated receiving position S2 of the above-mentioned position for the lower transfer operation, and the intermediate stop position S3 and the position for upper transfer operation S4, respectively. to stop the driving motor 38 (Fig. 3) and stop the full bobbin peg bar 18 at the respective positions. The proximity switches SW5 through SW8 are for detecting approach members 103 (Fig. 3) projected from the rear faces of the slide blocks 44 of the empty bobbin peg bar 19, and these proximity switches SW5 through SW8 confirm, in the order from below, the completion position (lower end) S5 of the position for lower transfer operation of the empty bobbin peg bar 19, the slightly elevated receiving position S6 of the position for the lower transfer operation, the stand-by position S7 shown in Fig. 8, and the position for upper transfer operation S8, respectively, to stop the driving motor 60 (Fig. 3) and stop the empty bobbin peg bar 19 at the respective positions. Limit switches LS1 through LS3 are for confirming the retreat end of the slide base 73, the transfer position (the position where the forks of the bobbin changing arms 96 and 97 for the bobbins of front and rear rows are arranged in one line vertically above the line of the pegs of the full bobbin peg bar 18), and the front ends of the forks of zigzag bobbin changing arms for the respective bobbins of front and rear rows on zigzag bobbin wheels, and the limit switches LS1 through LS3 are energized by a dog 104 attached to the leg of the slide base 73 to stop the slide base 73 at the respective positions. Furthermore, as shown in Fig. 2, a dog 105 is attached to one slide bar 77 on the lower face of the slide base 77 and upper and lower limit switches LS4 and LS5 are arranged on the slide based through brackets to confirm the rise end and drop end of the bobbin changing bar 76 and stop the bobbin changing bar 76 at the respective positions.

A roving bobbin transporting unit CR used in combination with the bobbin changing apparatus AD of the present invention will now be described with reference to Fig. 2 and Figs. 12 through 17.

A main transporting rail connecting the roving frame 1 to the creel of the spinning frame (not shown) is laid out above the end side of the machine frame. A branched transporting rail 111 on the side of the roving frame is connected to the main transporting rail 110 through a changeover switch device 112. The branched transporting rail 111 is disposed vertically above the full bobbin peg bar 18 of the bobbin changing apparatus AD at the time of bobbin changing along the bobbin wheels 5a and 5b of the roving frame 1 and is laid out at the rear of the machine frame while bypassing the outer end side of the machine frame. Each of the transporting rails 110 and 111 has a rectangular cross-section having the lower side opened, and wheels 113 roll within the transporting rails 110 and 111 to displace bobbin transporting members 114 for the transportation of roving bobbins along the transporting rails 110 and 111. A plurality (6 in the present embodiment) of bobbin supporting members 116 are suspended from the lower side of a base plate 116 of the bobbin transporting member 114 while keeping the bobbin pitch P of the spinning creel in the longitudinal direction between two adjacent bobbin supporting members 116. The bobbin transporting members 114 are connected to each other through a connecting lever 117. These bobbin transporting member 114 are connected so that roving bobbins of one roving frame can be held, whereby a large bobbin transporting unit 118 is constructed. The bobbin changing centers are set at points L1, L2, ..., that is, these centers are set at the center between the second and third bobbin supporting member 116 members counted from the bobbin supporting member 116 located on the right end in Fig. 2A and the positions apart from this center by 4•P and multiples thereof. A driving device 119, which is provided with a mechanism for displacing the transporting unit 118, is mounted on the transporting rail 110 in a condition wherein it is capable of running on the branched transporting rail. A plurality of driving devices 119 are arranged at intervals shorter than the entire length of the transporting unit 118. In this driving device 119 (Figs. 13 and 14), swinging arms 122 are supported swingably in the horizontal direction with a vertical shaft 121 on both sides of a base 120 secured across the transporting rails 110 and 111, a rotary disk 123 is rotatably supported on one swinging arm 122, and a rotary disk 125 attached to a driving motor 124 is rotatably supported on the other swinging arm 122, so that the rotary disk 125 confronts the rotary disk 123.

The base plate 115 of the bobbin transporting member 114 is clipped from both sides by the force of a spring 126 and the rotary disk 125 is positively driven to move the bobbin transporting unit 118. On the base plates 115 of these bobbin transporting members 114 located in the rear (the right side in Figs. 14, 19A, 19B) of the bobbin transporting unit 118, positioning split cotter pins 127 in a number

corresponding to the frequency of stoppage for bobbin changing in one roving frame are secured while maintaining the mutual pitch P4 which coincides with the difference between one movement pitch (3•P1 + P2) of the bobbin changing apparatus AD and the bobbin changing center pitch (4•P) of the bobbin transporting member 114 (see Fig. 3). A proximity switch PX for detecting the positioning split cotter pin 127 is attached to the transporting rail 111 through a bracket 128 (see Fig. 15). On the side opposite to the proximity switch PX, a catcher 129 is swung by the operation of a cylinder 130 mounted on the rail 111. (see Fig. 14). When the transporting unit 118 is at the first bobbin changing position L1, the first positioning split cotter pin 127 confronts the proximity switch PX and the catcher 129 is capable of engaging to the split cotter pin 127, and after the completion of the bobbin change operation for the first bobbin transporting member 114, the catcher 129 is capable of disengaging from this positioning split cotter pin 127. At the time of carrying out the bobbin changing operation, the driving motor 124 and cylinder 130 make a one-pitch (P4) feeding of the bobbin transporting unit 118, and after completion of the bobbin changing operation, displace the bobbin transporting unit 118 to the spinning process to feed full roving bobbins to the spinning frames, and displace the bobbin transporting unit having empty bobbins EB to the roving frames which must carry out the bobbin changing operation by a control circuit 210 shown in Fig. 17. In this control circuit, a controller SPC is disposed to control the driving motor 124, and turning-ON and turning-OFF of the motor and changing of the rotation speed or rotation direction are controlled by opening and closing contacts RMH-1 and the like. The changeover switch device 112 (see Fig. 16) comprises a supporting bracket 131 secured to the transporting rail 110 and a solenoid 133 turnably mounted to the bracket 131, a swing • arm 134 turnably pivoted on a free end portion of a piston of the solenoid 133, a delivery course changeover plate 32, one end portion of which is connected by a pin to the other end of the swing arm 134 in a condition such that the plate 132 is capable of taking two guide positions for guiding the transporting unit 118 along the transporting rail 110 or to the branched transporting rail 111.

The bobbin changing operation by the above-mentioned preferable embodiment will be hereinafter described in detail. When an advance instruction to start the bobbin changing operation is electrically sent to a particular roving frame 1, the transporting unit 118 having empty bobbins EB is displaced to the branched transporting rail 111 along the front face of the roving frame 1 from the main transporting rail 110. At this point, the driving device 119 closes a contact Hi of a high speed switch of the circuit 205 shown in Fig. 17 and a contact R of an inversion switch of the circuit 207, to excite relays RTH and RTHR, and a normally closed contact RTH-1 of the circuit 208 is opened and a solenoid SOL of a solenoid valve (not shown) connected to the cylinder 130 for the catcher 129 is changed over, whereby the cylinder 130 (Fig. 14) is advanced and the catcher 129 is moved upward. Simultaneously, a contact RTHR-1 connected to the controller SPC of the circuit 209 is closed and the forward end of the cylinder 130 turns ON the forward end limit switch LSA (circuit 200) to turn ON a relay RLSA, whereby a contact RLSA-2 of the contact 206 is closed to turn ON a relay RMH and close contacts RMH-1 and RMH-2 of the circuit 209, and the driving motor 124 (Fig. 14) of the driving device 119 is reversed at a high speed to displace the transporting unit 118 at a high speed by the rotary disk 125. When the top end of the transporting unit 118 is detected by the proximity switch 135 as shown in Fig. 19-(A), the contact Hi of the circuit 205 is opened and the solenoid SOL is changed over to retreat the cylinder 130 and engage the catcher 129 with the first positioning split cotter pin 127, whereby the bobbin changing center L1 of the transporting unit 118 is made to correspond with the bobbin changing center CL1 of the roving frame 1 and the transporting unit 118 is stopped at the bobbin changing position. In this condition, when an electrical signal is issued to indicate that the size of the thread package of bobbins of the roving frame becomes full, so that the bobbin changing operation must be applied to this roving frame, the bobbin changing apparatus AD is brought close to the front face of this roving frame 1, and the first approach member 16 confronts the proximity switch 7 and the bobbin changing apparatus AD is stopped at the first bobbin changing position, whereby the bobbin changing centers CL, L1 and CL1 of the bobbin changing apparatus AD, the transporting unit 18 and the roving frame 1 are made to correspond with one another (see Figs. 2 and 3). At this point, the bobbin changing bar 76 is located at the position of the lower end or retreat end (stand-by position), the full bobbin peg bar 18 is located at the preparation position (lower end position) S1 of the common lower transfer position and the empty bobbin peg bar 19 is located at the stand-by position S7 (Fig. 18A).

When the bobbin changing bar 76 is at the stand-by position, the one-line arrangement of the bobbin changing arms 96 and 97 for the respective front and rear rows of the bobbin wheels (hereinafter refers only to the respective front and rear rows) is changed to the zigzag arrangement, and simultaneously, by rotating the feed bar 69a, bobbin changing bar 76 is advanced toward the full bobbins FB on the respective bobbin wheels 5a, 5b and is stopped at the forward end. The forks of the bobbin changing arms 96 and 97 for the respective front and rear rows are inserted below the upper flanges BT of the corresponding full bobbins FB and the lift screw lever 78 is turned to raise the bobbin changing bar 76 to the rise end and suspend the full bobbins FB on the respective bobbin changing arms 96 and 7 for the respective front and rear rows. At this time, the empty bobbin peg bar 9 is moved forward from the standby position S7 by driving the lift chains 64, and raised to the upper transfer position S8, and four empty bobbins EB of the transporting unit 118 at the bobbin changing position are loaded on the pegs 20 of the empty bobbin peg bar 9 (Fig. 18B). Then, the empty bobbin peg bar 19 having the empty bobbins

EB loaded thereon is displaced downward, and retreated and stopped at the stand-by position S7. Simultaneously, while the bobbin changing bar 76 is being retreated, the bobbin changing arms 96 and 97 for the respective front and rear rows, which have the full bobbins FB suspended therefrom, are re-arranged from the zigzag arrangement into a one-line arrangement, and the bobbin changing arms 96 and 97 for the respective front and rear rows are stopped at the transfer position where the respective full bobbins FB taken out are located vertically above the respective pegs 20 of the full bobbin peg bar 18. At this point, the full bobbin peg bar 18 is slightly elevated, and the full bobbins FB are placed on the respective pegs 20 at the receiving position S2 (see Fig. 18C). Then, the bobbin changing bar 76 is retreated to the retreat end and the lift chain 42 are driven to elevate the full bobbin peg bar 18 upward in the vertical direction and attach the full bobbins FB to the bobbin supporting member 116. Simultaneously, the empty bobbin peg bar 19 located at the stand-by position S7 is displaced downward to the lower transfering position S6 where the bobbin changing arms 96 and 97 of the bobbin changing bar 76 for the respective front and rear rows, located at the elevated end and retreat end in the one-line arrangement, are at a height allowing insertion of their furcate free end portions into the upper flanges BT of the corresponding empty bobbins EB (Fig. 18D). Then, the full bobbin peg bar 18 is displaced downward and stopped at the intermediate stop position S3, and the bobbin changing arms 96 and 97 for the respective front and rear rows, which are located at the rise end and retreat end in the one-line arrangement, are advanced and stopped at the above-mentioned transfer position and the furcate free end portions of the bobbin changing arms 96 and 97 are inserted below the respective upper flanges BT of the corresponding empty bobbins EB. The empty bobbin peg bar 19 is then slightly displaced downward and located at the completion position (lower end position) S5 of the common lower transfer position which coincides with the above mentioned position S6, and the empty bobbins EB are suspended in a one-line arrangement of the bobbin changing arms 96 and 97 for the respective front and rear rows (Fig. 18E). Then, while the one-line arrangement of the bobbin changing arms 96 and 97 for the respective front and rear rows is changed to the zigzag arrangement, the bobbin changing bar 76 is located on the advance end and the bobbin changing bar 76 is displaced downward, and the empty bobbins EB are attached to the corresponding empty bobbin wheels 5a and 5b of the roving frame 1 (Fig. 18F). Then, the bobbin changing bar 76 is retreated to the retreat end, and the zigzag arrangement of the bobbin changing arms 96 and 97 for the front and rear rows is changed to the one-line arrangement (Fig. 18G). Then, the empty bobbin peg bar 19 located at the completion position S5 of the common lower transfer position is displaced upward to the stand-by position S7 and the full bobbin peg bar 8 located at the intermediate stop position S3 is displaced downward to the preparation position S1 of the common lower tranfer position, see Fig. 18.H.

When one cycle of the bobbin changing operation is thus completed, the bobbin changing apparatus AD is displaced to the position for the next bobbin changing operation. At this point, a contact Pi (for issuing a one-pitch feed signal) of the circuit 201 shown in Fig. 17 is closed to turn ON a relay RTP. Thereupon, a contact TRP-1 of the circuit 208 is turned OFF to effect changeover of the solenoid SOL of the solenoid valve of the cylinder 130, and the cylinder 130 is advanced to swing the catcher 129 upward and release the engagement with the first positioning split cotter pin 127. Then, at the advance end, the cylinder 130 turns ON the limit switch LSA to turn ON a relay RLSA, and a contact RLSA-1 of the circuit 202 is turned ON and a relay RMP is turned ON. Accordingly, contacts RMP-1 and RMP-2 of the controller SPC of the circuit 209 are turned ON to rotate the driving motor 124 at a low speed in the normal direction and move the transportation unit 118 in the direction of arrow B in Fig. 19. Then, when the second positioning split cotter pin 127 is detected by the proximity swich PX, the proximity switch contact PX of the circuit 203 and relay RPX are turned ON (at this point, the contact PI is turned OFF), and the contact RPX-1 of the circuit 201 is turned OFF, the relay RTP is turned OFF, RPX-2 of the circuit 204 is turned ON and a timer TR is turned ON. Thereupon, the contact TRP-1 of the circuit 208 is turned ON to effect changeover of the solenoid SOL, and the timer TR turns the driving motor 124 in the normal direction excessively for a predetermined time so that the cylinder 130 is retreated, the catcher 129 is brought down, the transportation unit 118 is displaced at a low speed, the second positioning split cotter pin 127 which has been moved is caught by the catcher 129, and the second positioning split cotter pin 127 is firmly pressed to the front end portion of the catcher 129. When the timer TR runs out, the timer contacts TR-1 and TR-2 are turned OFF, the relays RMP and RPX are turned OFF, the timer TR is reset, and the driving motor 124 is stopped. Accordingly, the transporting unit 18 is displaced by one pitch P4, and as shown in Fig. 19B, the bobbin changing center C1 of the bobbin changing apparatus AD is made to correspond with the second bobbin changing centers CL1 and L2 of the roving frame 1 and the transporting unit 118, and the second bobbin changing operation is started. When the above mentioned operation is repeated and the bobbin changing for one roving frame 1 is completed, in order to transport the transporting unit 118 at a high speed toward the spinning frame, the contact Hi is closed at the circuit 205 to turn ON the relay RTH and turn OFF the contact RTH-1 and to effect changeover of the solenoid SOL, whereby the cylinder 130 for the catcher 129 is advanced to elevate the catcher 129 and the limit switch LSH at the advance end is turned ON to turn ON the relay RLSA and turn ON the relay RMH. Thereupon, the contacts RMH-1 and RMH-2 connected to the controller of the circuit 209 are closed, and at this point, since the contact RTHR-2 is closed, the driving motor 124 is rotated at a high speed in the

normal direction and the transporting unit 118 suspending full bobbins for one spinning frame is transported to the position adjacent to the creel of the spinning frame.

As shown in Fig. 18A or 18H, a sufficient vertical space is formed between the lower ends of the bobbins suspended from the transporting unit 118 and the top end of the bobbin changing apparatus AD. Accordingly, as shown in Fig. 12, in the portion CP where the transporting rails 110 and 111 cross the running rail of the bobbin changing apparatus AD in one plane, even if the transporting unit 118 having bobbins suspended therefrom is superposed on the bobbin changing apparatus AD in a plane, since the transporting unit 118 is not superposed on the bobbin changing apparatus AD in the vertical direction, layout of the transporting rail and the running rail of the bobbin changing apparatus AD or a running rail 136 (Fig. 12) for a truck for loading and moving the bobbin changing apparatus along the side face of the roving frame can be facilitated.

Incidentally, in the present embodiment, since the zigzag bobbin arrangement in the roving frame is changed to the bobbin arangement (one-line arrangement) of the creel in the spinning frame only by the doffing operation of the bobbin changing apparatus, the post treatment at the time of transporting doffed full bobbins to the spinning frame can be simplified. Furthermore, in the present embodiment, when the full bobbin peg bar and empty bobbin peg bar are displaced upwards toward the upper transfer position, the rising slide block or lift block is further moved upward by utilizing this movement of raising the peg bars, and therefore, the actual rise end of the slide block or lift block is at a position lower than the upper transfer position of each peg bar and the height of the machine body of the bobbin changing apparatus can be effectively reduced. Moreover, in the present embodiment, since the common lower transporting position of the full bobbin peg bar and the empty bobbin peg bar are set at the same position, the position for controlling the bobbin changing bar can be set at three points (front end, rear end, and intermediate position), and the control of the bobbin changing bar is facilitated and the space necessary for the movement of the bobbin changing bar in the forward-backward direction is reduced.

In the present embodiment, at the common lower transfer position, the full bobbin peg bar is raised to the receiving position from the preparation position and full bobbins are loaded on the full bobbin peg bar, but there may be adopted a modification in which the full bobbin peg bar is stopped at the receiving positon of the common lower transfer position and the bobbin changing bar is vertically moved to transfer full bobbins onto the full bobbin peg bar. A known battery car or the like may be used as the driving device of the transporting unit. Furthermore, bobbin changing bars for the respective front and rear rows of the bobbin wheels of a roving frame are not limited to those used in the present embodiment, but means using a screw feed mechanism or a cylinder, as disclosed in Japanese Patent Application No. 58-250963 (Japanese Unexamined Patent Publication No. 60-167940), may be used. In the present embodiment, the lift devices for full and empty bobbins utilize chains and chain sprockets, but lift devices utilizing a belt driving mechanism or other type of known lifting devices may be used. In the present embodiment, four bobbins are subjected to the bobbin changing operation at a time, but an appropriate number of bobbins may be treated at a time according to the arrangement of bobbin wheels in the roving frame. The same upper transfer position is used for the full bobbin peg bar and empty bobbin peg bar in the above-mentioned embodiment as the common upper transfer position, but there may be adopted a modification in which the forward-backward movement mechanism of the lift device for the empty bobbin peg bar is omitted, a vertical lift device similar to that for the full bobbin peg bar is used, and two rails for the full bobbin peg bar and the empty bobbin peg bar are arranged above the full bobbin peg bar and the empty bobbin peg bar, respectively. In this modification, full bobbins are taken out on the full bobbin peg bar and attached to the bobbin supporting members of the full bobbin transporting rail located vertically above, and then the empty bobbin peg bar is raised to receive empty bobbins from the empty bobbin transporting rail, and after the empty bobbin peg bar is brought down, the bobbin changing arm is advanced and empty bobbins are fed to the roving frame.

Claims

1. A method for carrying out a bobbing changing operation applied for a roving frame, wherein empty bobbins, suspended by respective bobbin supporting members which are prepared and arranged in advance at positions above said roving frame, are changed by full packaged bobbins held by respective bobbin wheels of said roving frame by utilizing a bobbin changing apparatus which is capable of being displaced along a machine frame of said roving frame, said bobbing changing operation is carried out continuously by repeated cycle oeprations, each operation cycle being applied for group of plural bobbins, and therefore, upon completion of one unit cycle of operation, said bobbin changing apparatus is displaced to the succeeding downstream position where said bobbin changing apparatus confronts the next group of bobbin wheels of said roving frame which must be applied to said bobbin changing operation,

said bobbin changing operation consisted of an identical operation for each bobbin of said group,

said identical bobbin changing operation comprises, exchanging said full packaged bobbin held by a bobbin wheel of said roving frame by an empty bobbin suspended by a corresponding one of said bobbin supporting members by separately displacing said full packaged bobbin

and said empty bobbin along the respective displacing passages formed between a position of said bobbin wheel and an upper transfer position for these bobbins against said bobbin supporting member,
said bobbin transfer passages are provided with a lower common bobbin transfer position respectively, to where said full package bobbin taken from said bobbin wheel is displaced before displaced to said upper tansfer position, and said empty bobbin taken from said bobbin supporting members is displaced before carrying said full packaged bobbin taken from said bobbin wheel is displaced to said upper transfer position, said common lower bobbin transfer position is formed in said bobbin changing apparatus at approximately the same level as said bobbin wheel,
holding upper portions of these bobbins while displacing between said upper transfer position and said lower common transfer position, holding lower portions of said bobbins while displacing between said lower common transfer position and said bobbin wheel,
changing holding conditions of said bobbins at said lower common transfer position,
when said bobbin changing operation is carried out, said empty bobbin taken from said bobbin supporting member is temporarily reserved at a position biased from a linear passage connecting said upper transfer position and said lower common transfer position.

2. The bobbin changing method of the roving frame according to claim 1, wherein said upper transfer position of said displacing passage for said full packaged bobbin is identical to said upper transfer position of said displacing passage for said empty bobbin.

3. The bobbin changing method of the roving from according to claim 1, when said bobbins are displaced from the respective bobbin wheels to said lower common transfer positions tehreof, arrangement of plural bobbins is changed from a zig-zag arrangement to a one line arrangement, when said bobbins are displaced from said lower common transfer positions therof to corresponding bobbin wheels respectively, arrangement of prural bobbins is changed from the one-line arrangement to a zig-zag arrangement.

4. Bobbin changing apparatus for carrying out bobbin changing operation for a roving frame, wherein full packaged bobbins held by respective bobbin wheels of said roving frame are changed for empty bobbins suspended by the respective bobbin supporting members which are prepared and arranged in advance at their positions above said roving frame, said bobbin changing operation is carried out for a plurality of bobbins as a group and upon completion of said bobbin changing operation for one grup of bobbins, this unit cycle of bobbin changing operation is successively repeated by displacing said bobbin changing apparatus along a bobbin rail of said roving frame and successively stoped at predetermined positions confronting said bobbin wheels which are necessary to apply said one cycle of bobbin changing operation, said unit opreations are continuously repated until a full operation for all bobbin wheels of said roving frame is completed,
Comprising
a first peg bar provided with a plurality of pegs for supporting full packaged bobbins by insertion thereinto, a second peg bar provided with an identical number of pegs to said first peg bar for supporting empty bobbins by inserting therein,
a first means provided with a pair of lifting mechanisms for separately displacing said first peg bar and said second peg bar along their own lifting passage between an upper common transfer position where empty bobbins are received from the respective bobbin supporting members by corresponding pegs of said second peg bar and full packaged bobbins are taken from pegs of said first peg bar and suspended by corresponding bobbin supporting members and a lower common transfer position where full packaged bobbins taken from the respective bobbin wheels are mounted on corresponding pegs of said first peg bar, or empty bobbins displaced downward by the respective pegs of said second peg bar are changed their holding condition so as to be carried to corresponding bobbin wheels of said roving frame.
carrying means for taking off said full packaged bobbins from said bobbin wheels of said roving frme by catching on upper end portion of each bobbin and there after carring said bobbins to said lower transfer positions respectively, and then moanting said full packaged bobbins on corresponding pegs of said first peg bar, while taking off said empty bobbins from said pegs of said second peg bar by catching send upper end portion of each bobbin and thereafter mounting said empty bobbins on corresponding bobbin wheels from which said full packaged bobbins have been taken off,
said guide passage for said second bar being provided with a position for reserving said second peg bar which is biased from a linear passage connecting said common lower transfer position and said upper transfer position.

5. The bobbin changing apparatus according to claim 4, wherein said first means comprises, a first lifting mechanism for lifting said first peg bar for displacing between a preparation position slightly below said lower common transfer position and said upper common transfer position, and for temporarily reserving said first peg bar before starting said unit cycle of said bobbin changing operation, and a second lifting mechanism for lifting said second peg bar for displacing between said common upper transfer position and a completion position slightly below said lower common transfer position,
said first lifting mechanism being provided with

a first guide means for leading said first peg bar along a passage connecting said upper common transfer position and said preparation position, and a first lift for displacing said first peg bar along said first guide means.
said second lifting mechanism being provided with a second guide means for leading said second peg bar along a passage connecting said upper common transfer position and said completion position and a second lift for displacing said second peg bar along said passage of said second guide means, said passage of said second guide means being provided with a position for reserving said second peg bar biased from a linear line connecting said upper and lower common transfer positions,
an electric control means for control timing for displacing said first and second peg bars while temporarily reserving either one of said two peg bars when the other one of said peg bars is displaced so that possible interference between motions of said peg bars can be completely prevented.

6. The bobbin changing apparatus according to claim 5, wherein, said apparatus is provided with a machine frame formed by bottom plate and a pair of side plates extended upwards from both side ends thereof and a top plate connecting said side plates at their top ends respectively;
said first lift for the first peg bar is a sprocket-chain lfit-ing system;
said first guide means comprises,
a pair of first pillars secured to said bottom plate of said machine frame of said bobbin changing apparatus at both side-end portions thereof adjacent to the respective side paltes, each of said first pillars extending to said top plate of bobbin changing apparatus,
a pair of slide blocks slidably mounted on the respective first pillars, each of said blocks connected to a chain-element of siad sprocket chain lifting system,
a pair of second pillars vertical secured to corresponding one of said slide blocks respectively in an upwardly extending condition, each of said second pillars slidably supporting a corresponding side end portion of said first peg bar,
a pair of link motion mechanisms, each one connecting one of said slide blcoks to a corresonding one of side-end portions of said first peg bar,
a cam follower rotatably mounted to each of said link motion mechanisms,
a pair of guide surfaces formed on said side plates of said machine frame of said bobbin changing apparatus at respective positions facing and corresponding to said first pillars, wherein a distance between said guide surfaces becomes gradually narrower from the level of each bottom end of said guide surfaces to the level of each top end of said guide surfaces,
each of said link motion mechanisms comprising a pair of link members, a cam pin turnably connected to one free end of each of said link members, the other free end of said link members being pivoted to a corresponding side end of said first peg bar respectively, said cam follower being rotatably mounted on said cam pin,
whereby, when said slide blocks are displaced upwards, said first peg bar is capable of taking a position more elevated than the elevation of said slide blocks.

7. The bobbin changing apparatus according to claim 5, wherein said electric control means comprises a first position detecting means for detecting said first peg bar and a second position detecting means for detecting said second peg bar, said first position detecting means comprises a first approach member secured to said first peg bar and a plurality of proximity switches disposed on one of said side plates facing said approach member at respective predetermined positions, whereby when said first peg bar is being lifted and approaches either one of said predetermined positions, said first peg bar can be detected by a corresponding one of said proximity switches mounted at said predetermiend position; said second position detecting means comprising a second approach member secured to said second peg bar at a position facing the other one of said side plates and a plurality of proximity switches disposed on said side plate facing said approach member of said second peg bar at respective predetermined positions, whereby when said second peg bar is being lifted and approaches either one of said predetermined positions, said second peg bar can be detected by a corresponding one of said proximity switches mounted at said predetermined position; and
driving devices to drive said lifting means by an actuating signal issued from a corresponding one of said proximity switches, respectively.

8. The bobbin changing apparatus according to claim 5, wherein said apparatus is provided with a machine frame formed by a bottom plate and a pair of side plates extended upwards from both side ends thereof and a top plate connecting said side plates at their top ends respectively;
said second lift for the second peg bar is a sprocker-chain lifting system,
said second guide means comprises,
a pair of guide grooves formed on said pair of side plates of sid machine frame of said bobbin changing apparatus,
a pair of pillars secured to said bottom plate of machine frame of said bobbin changing apparatus at both side-end portions thereof adjacent to respective side plates, each of said pillars extending to said top plate of said machine frame of said bobbin changing apparatus,
a pair of lifting blocks secured to respective side-ends of said second peg bar and slidably supported by a corresponding one of said

pillars and also connected to a corresponding chain-element of the respective one of said sprocket chain lifting systems,
a rotatable shaft rotatably supported by each of said lifting blocks,
a cam lever mounted on one end of each one of said rotatable shafts and secured thereon by a key,
a cam follower rotatably supported by each one of said cam levers and engaged with a corresponding one of said cam grooves,
a connecting member for connecting a first horizontal supporting shaft to a corresponding one of said rotatable shafts, said connecting member being provided with a function such that when both of said cam followers approach respective elevated positions in said respective cam grooves by displacing said lifting blocks upwards, said second peg bar is projected upwards from said lifting blocks, while maintaining the horizontal attitude of said second pag bar and is further provided with a function of displacing said second peg bar to a predetermined position biased from a lifting passage of said first peg bar.

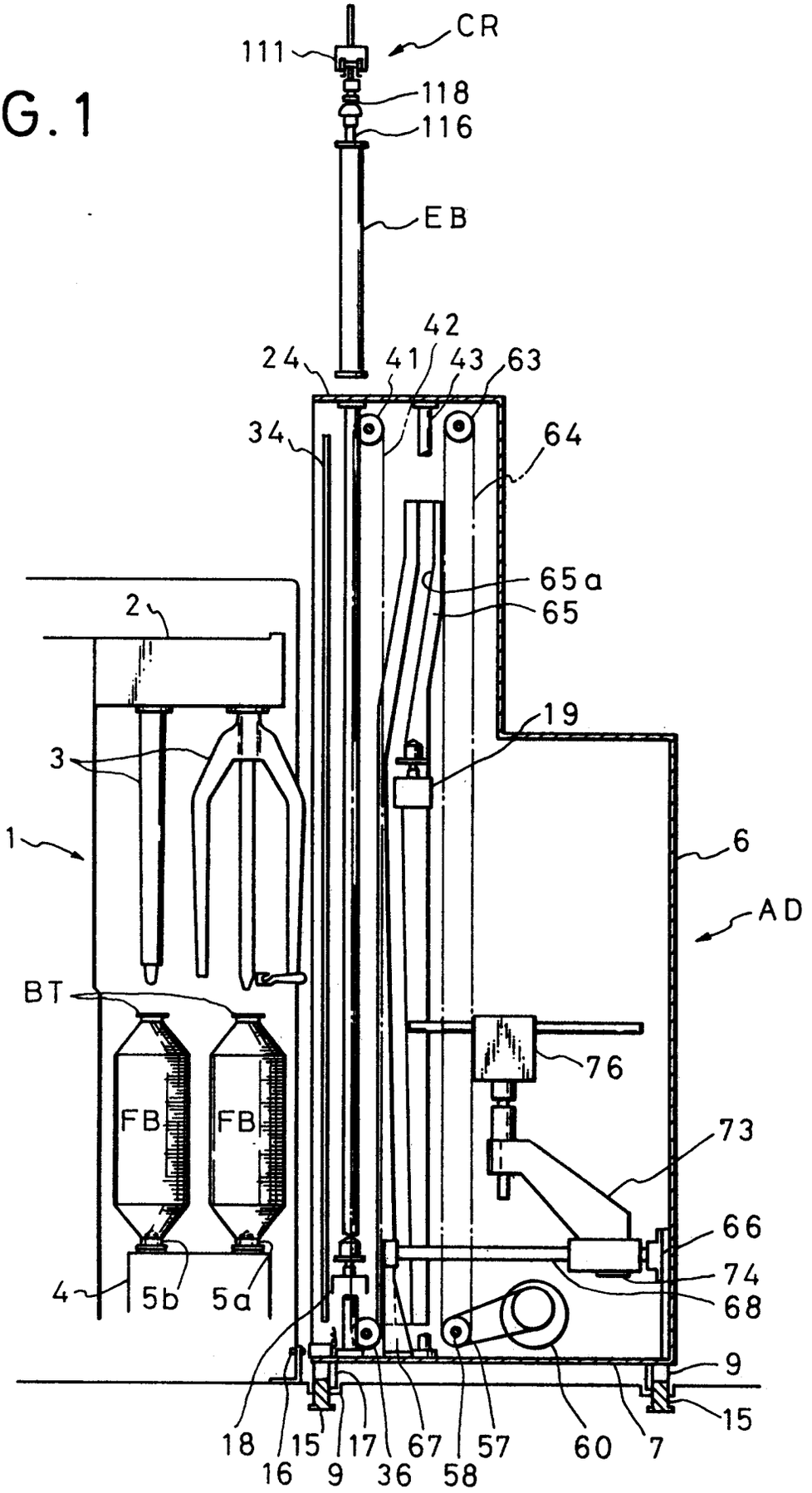
9. The bobbin changing apparatus according to claim 8, wherein, each of said connecting members comprises a sector gear secured to said rotable shaft at the other end thereof,
a second horizontal shaft rigidly supported by each one of said lifting blocks in parallel to said rotatable shaft,
a swing arm rotatably mounted on each of said second horizontal shafts,
a toothed portion formed on a part of said swing arms respectively for engaging with a corresponding one of said sector gears,
a pair of first timing belt pulleys secured to a corresponding one of outside extended portions of said first horizontal supporting shaft of said second peg bar,
a second timing belt pulley rigidly mounted on each one of said second horizontal shafts,
a timing belt mounted on each bombination of said first and said second timing belt pulleys,
a free end portion of each second horizontal shaft being secured to the other end portion of a corresponding one of said swing arms.

10. The bobbin changing apparatus according to claim 4, wherein, said first peg bar and second peg bar are provided with a plurality of pegs aligned on an upper surface thereof respectively for supporting bobbins, with an intervened pitch P between two adjacent pegs, which is identical to a creel pitch of a spinning frame.

11. The bobbin changing apparatus according to claim 6, wherein, a plurality of pegs of said first peg bar are positioned at the respective positions right below corresponding bobbin supporting members prepared in advance at the respective positions above said roving frame, said first peg bar being capable of lifting in a vertical direction.

12. The bobbin changing apparatus according to claim 4, wherein, said apparatus is utilized to carry out said bobbin changing operation for such roving frame provided with plural bobbin wheels arranged in a zig-zag arrangement,
said bobbin carrying means being provided with a bobbin carrying bar which is capable of being displacing forward and backward to said roving frame and also capable of lifting upwards and downwards,
said carrying bar being provided with a plurality of bobbin changing amrs for said bobbin wheels of front and rear rows,
said carrying arms being capable being positioned to face corresponding flyers arranged in a zig-zag arrangement in said roving frame when said bobbin changing apparatus is positioned at a predetermined working position for carrying out said bobbin changing operation,
said bobbin carrying bar being provided with a mechanism for changing an arrangement of said carrying arms from a two rows arrangement to a one-line arrangement, and also for changing a distance between two adjacent carrying arms.

FIG. 1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65a
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19
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AD
BT
76
FB
FB
73
66
74
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5b
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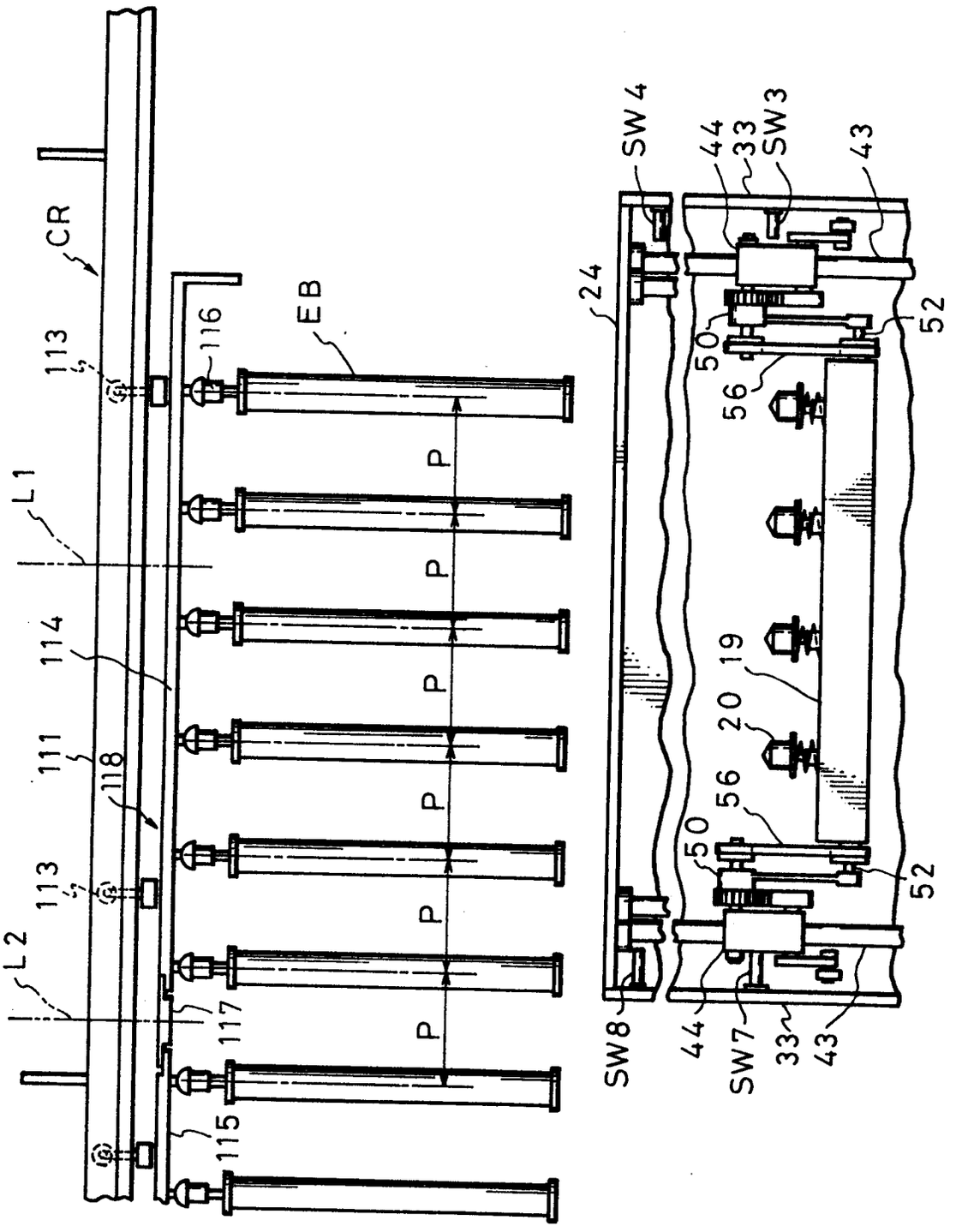
FIG. 2A


CR
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L1
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L2
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P
P
P
P
P
P
SW4
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SW3
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SW8
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SW7
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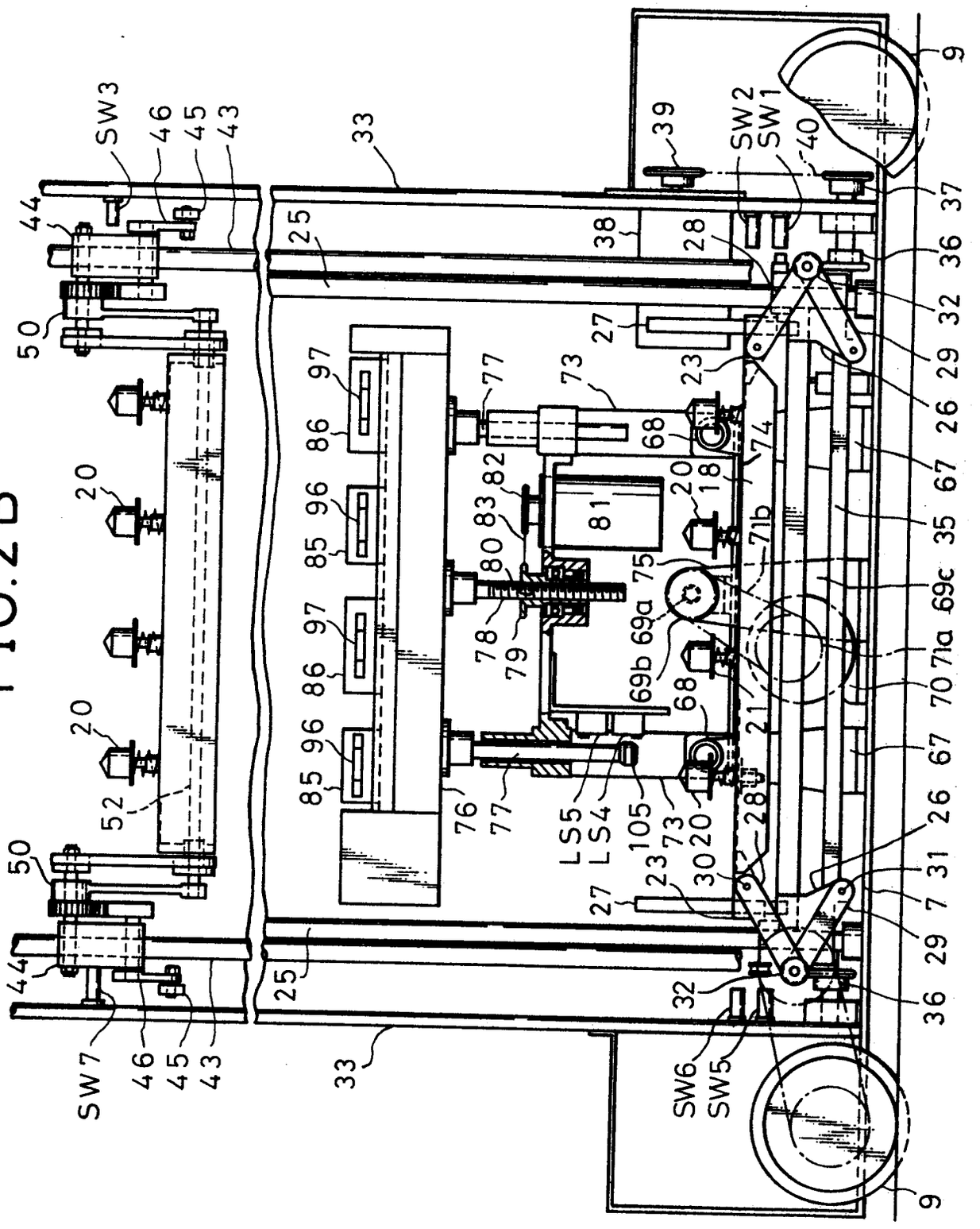
FIG.2B


SW3
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45
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44
50
20
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SW7
33
25
38
28
39
SW2
SW1
40
9
37
36
32
29
26
27
23
97
86
85
96
77
73
68
74
82
83
80
81
75
69a
69b
78
79
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LS5
LS4
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71a
69c
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18
21
SW6
SW5

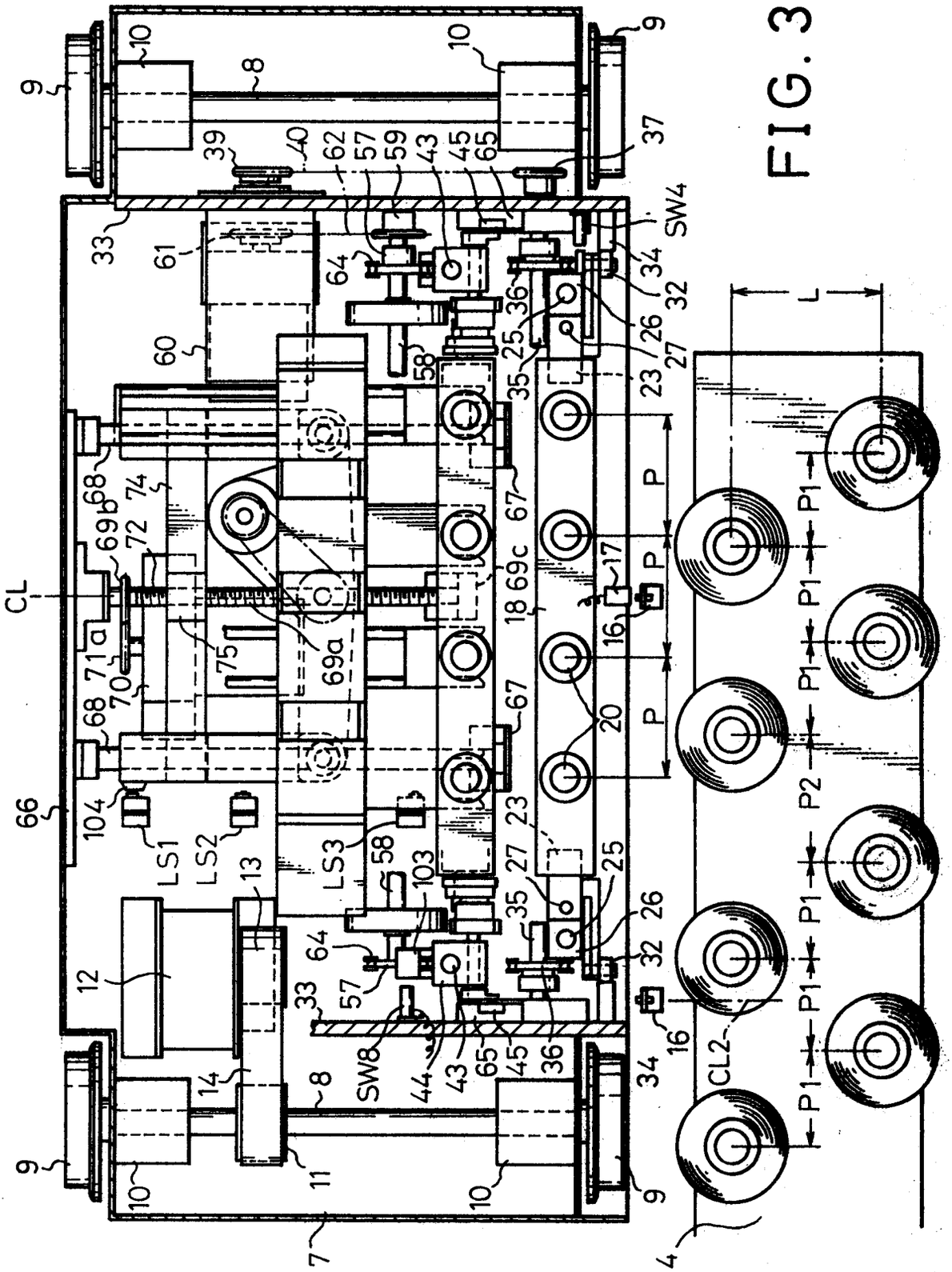

FIG. 3

FIG.4

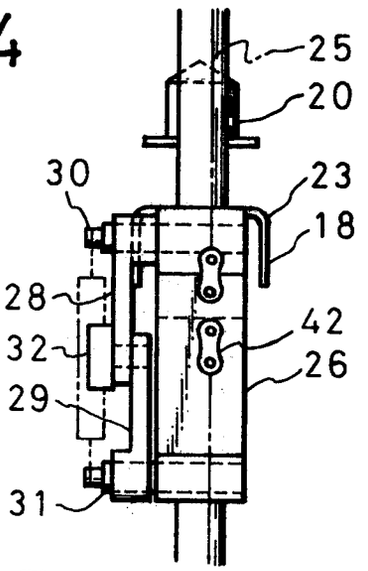
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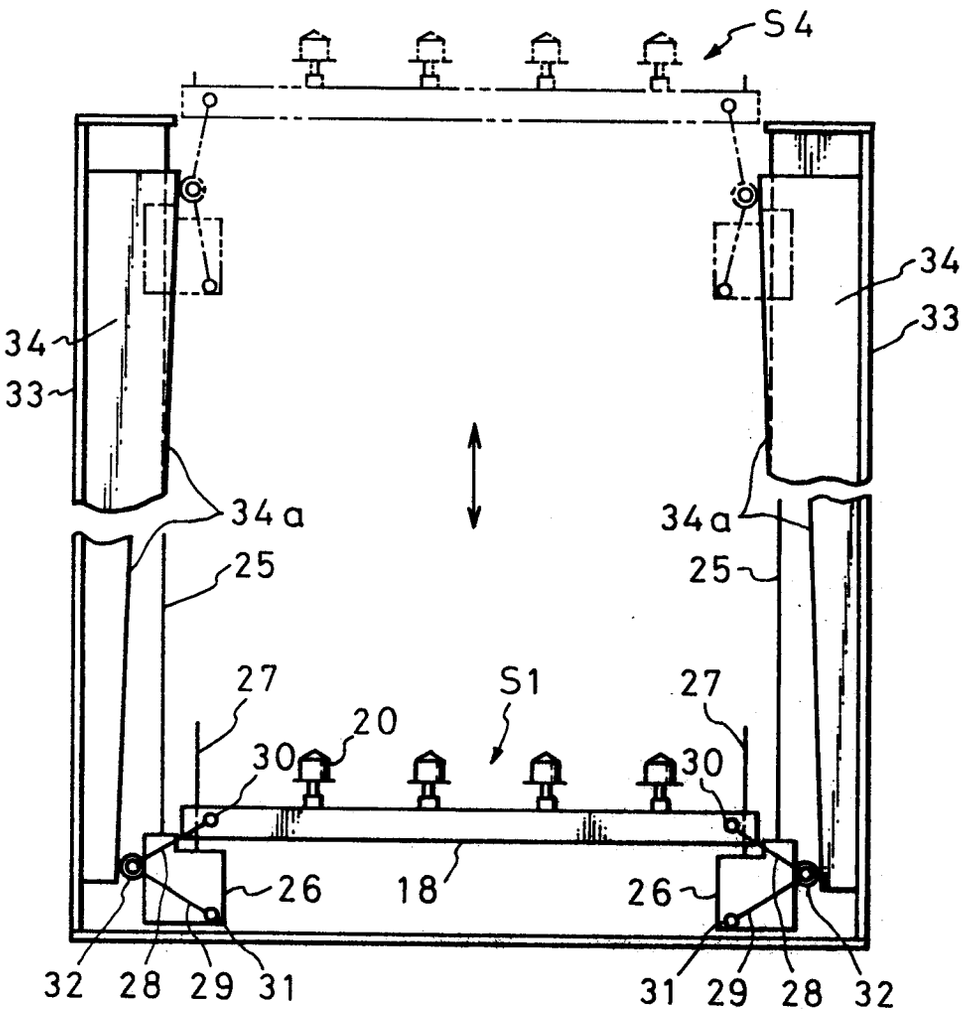
FIG.5


S4
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34a
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S1
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FIG.7

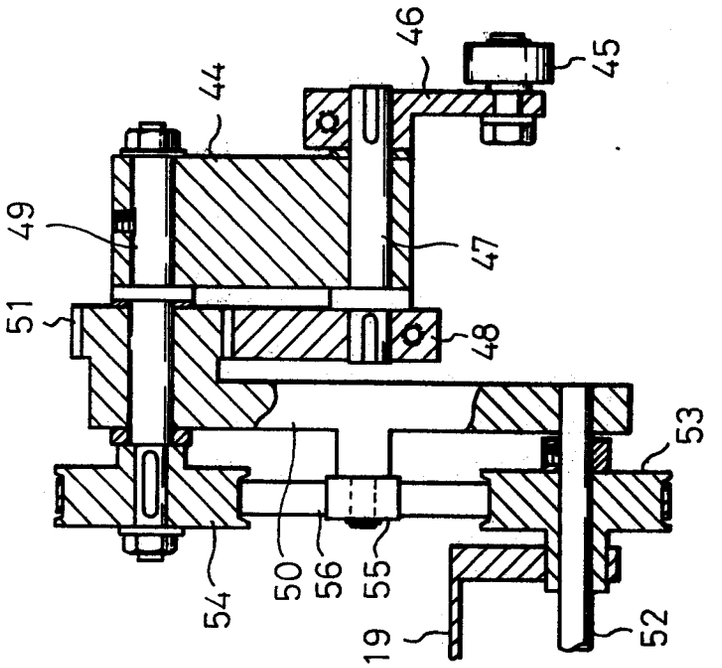
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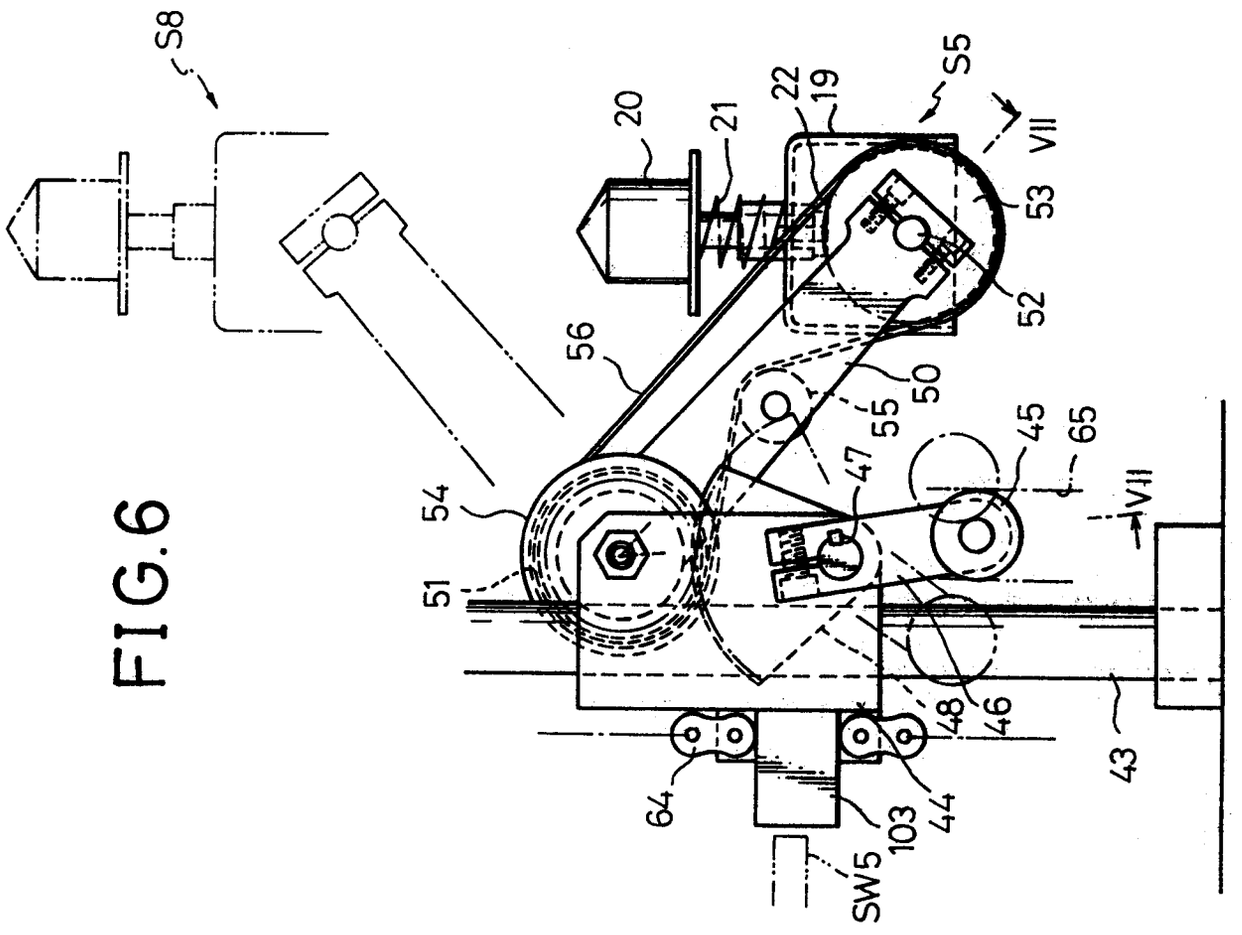
FIG.6


S8
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S5
VII
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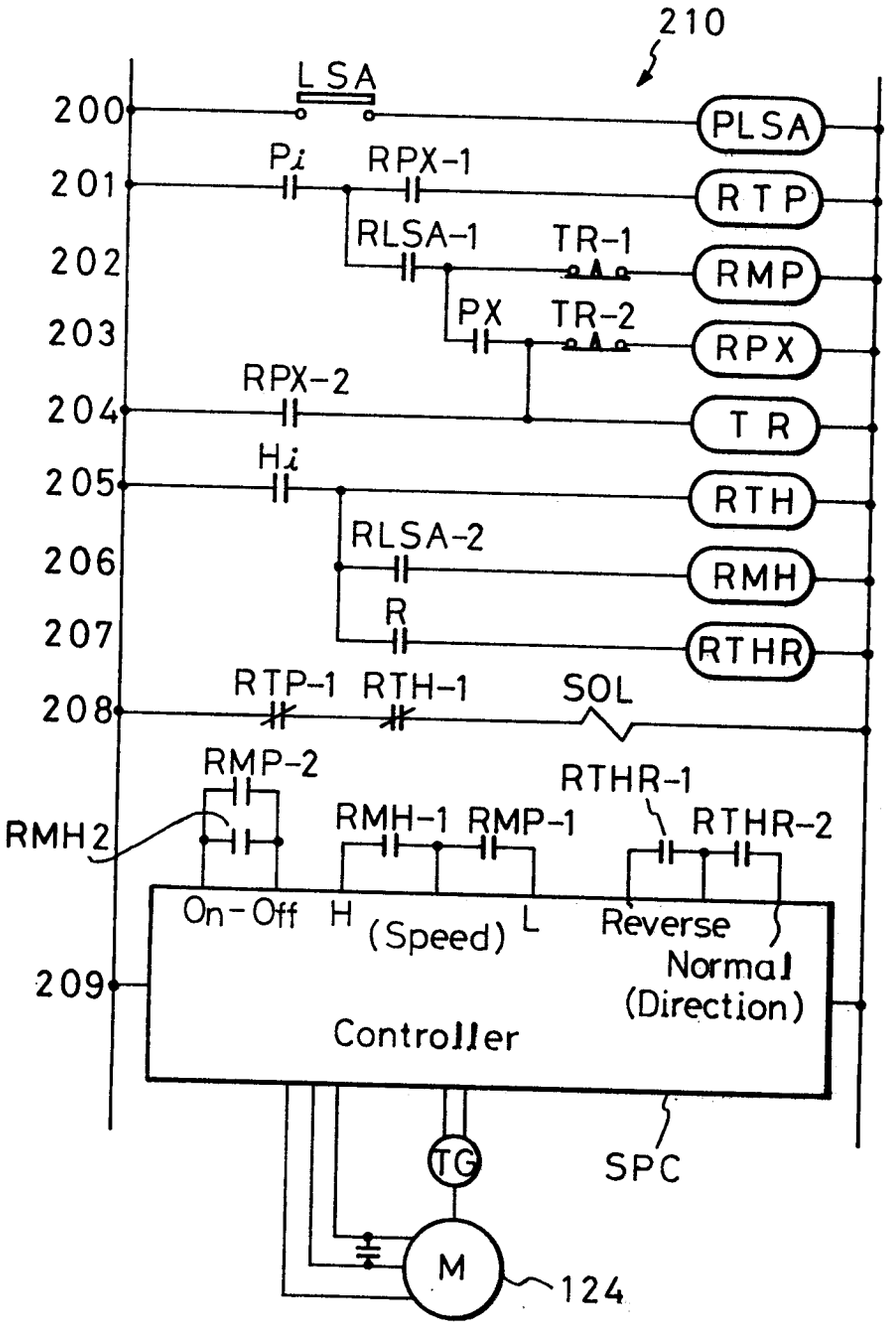
44
SW5

FIG.17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RLSA-1
TR-1
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TR-2
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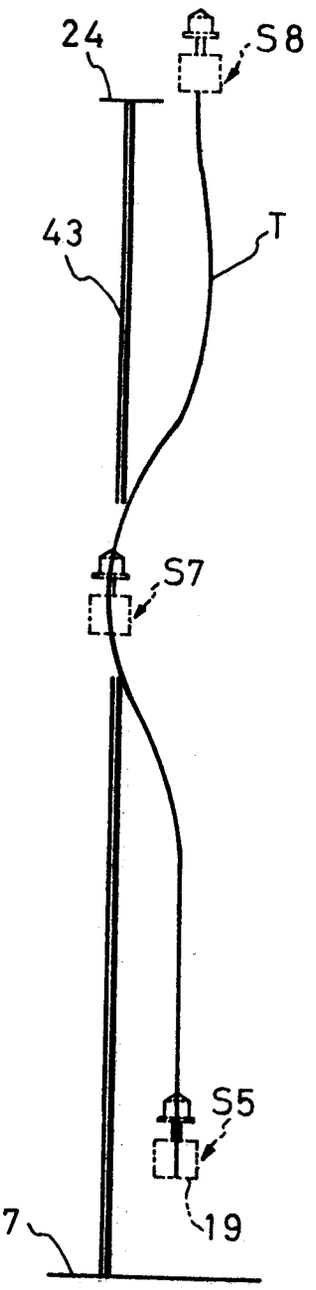
RPX-2
204
TR
Hi
205
RTH
RLSA-2
206
RMH
R
207
RTHR
RTP-1
RTH-1
SOL
208
RMP-2
RMH2
RMH-1
RMP-1
RTHR-1
RTHR-2
On-Off
H
(Speed)
L
Reverse
Normal
(Direction)
209
Controller
TG
SPC
M
124

FIG.8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S8
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S7
S5
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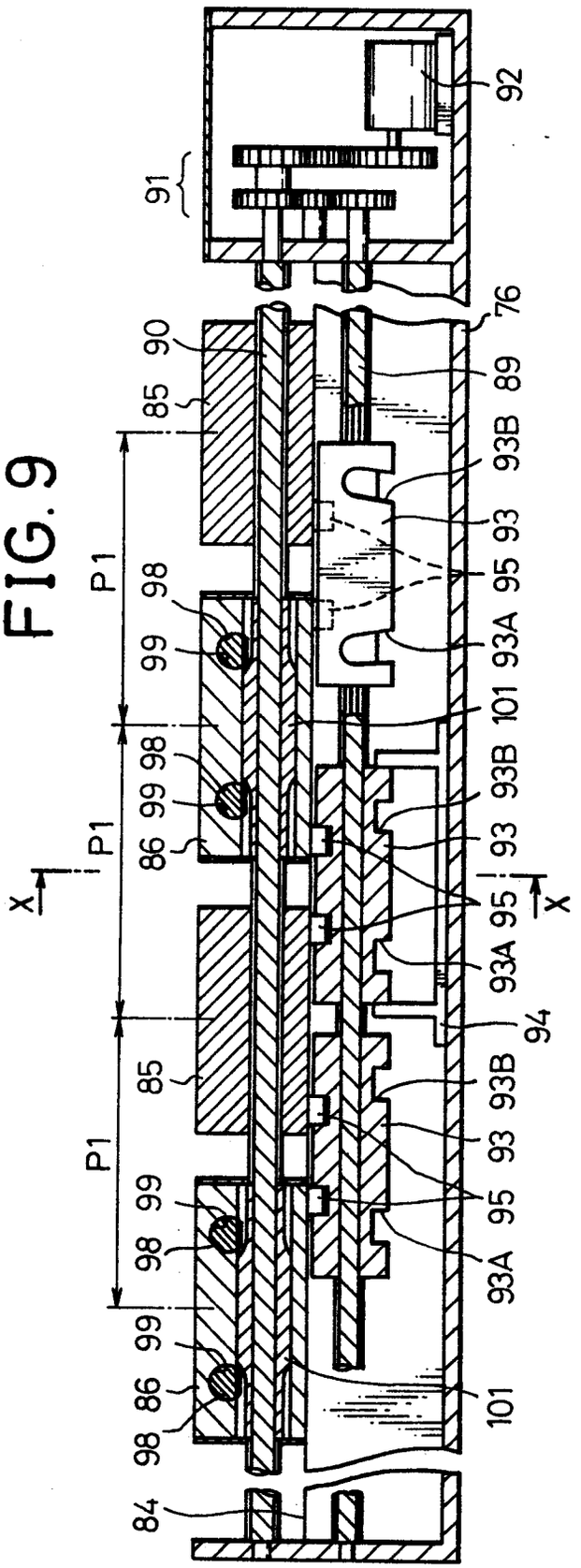
7

FIG. 9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84

FIG. 10

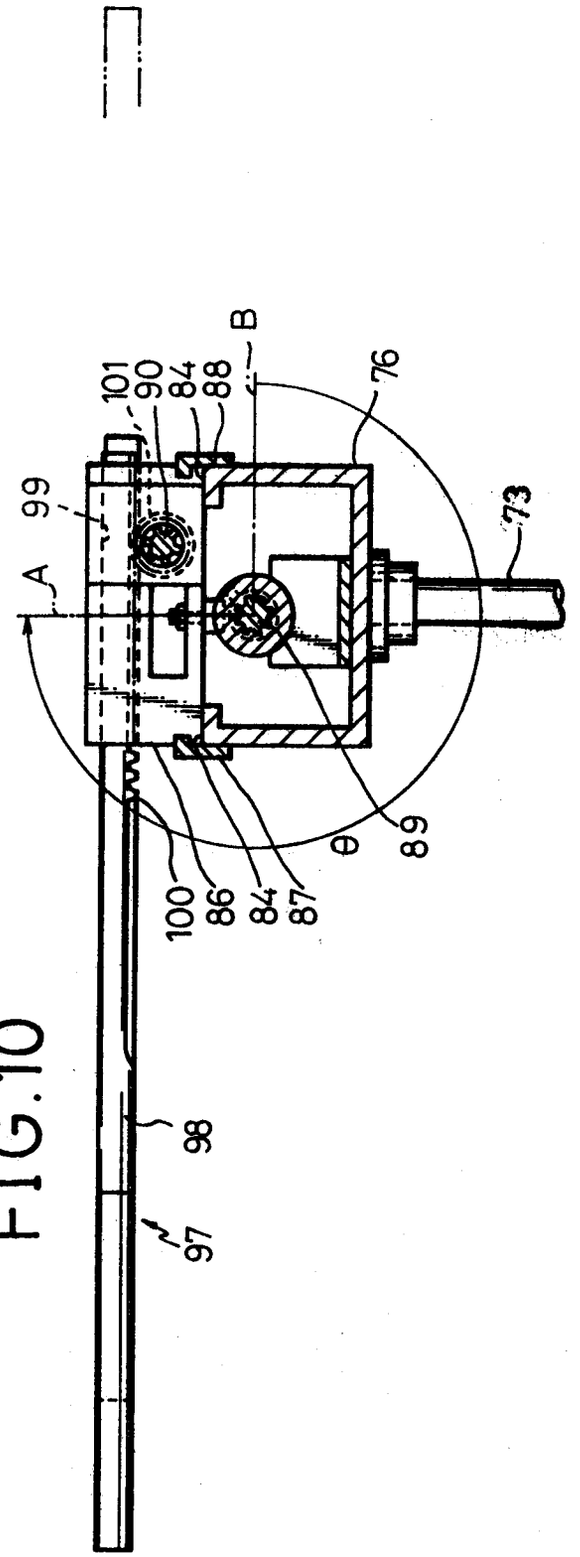
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FIG.11A

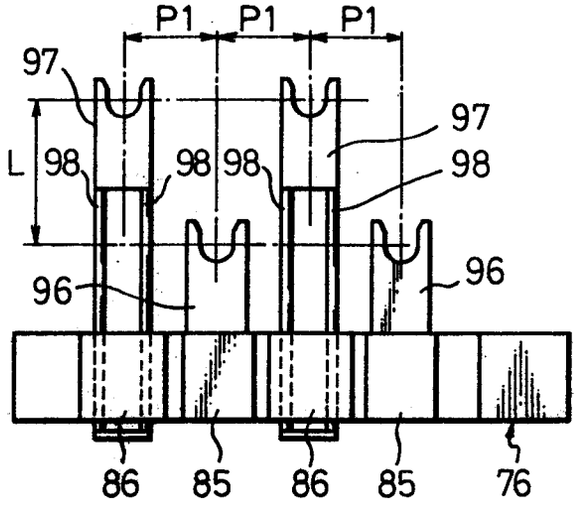


FIG.11B

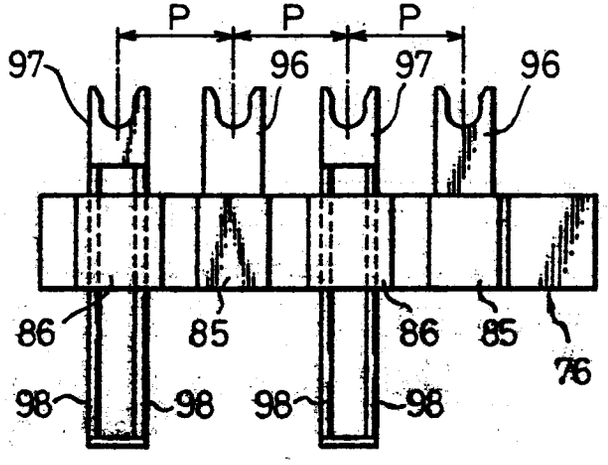


FIG.13

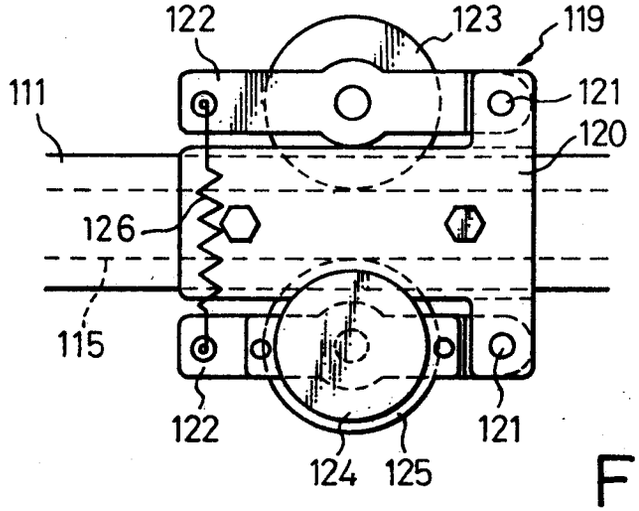


FIG.15

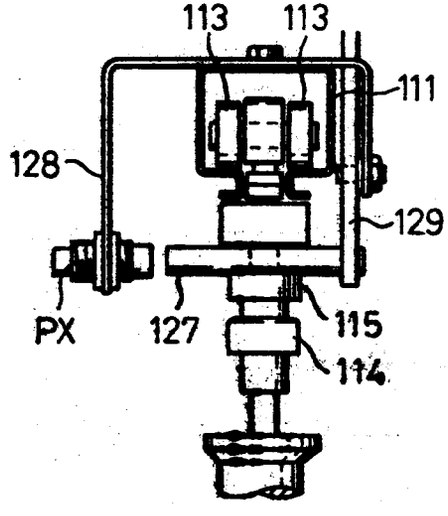


FIG.16

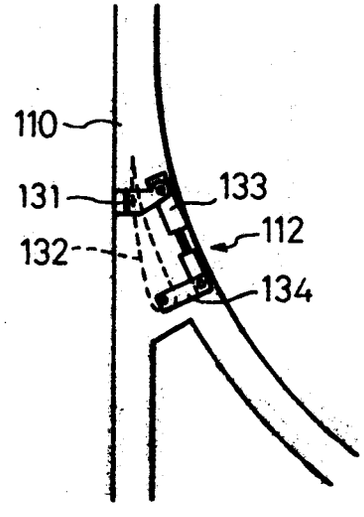


FIG. 12

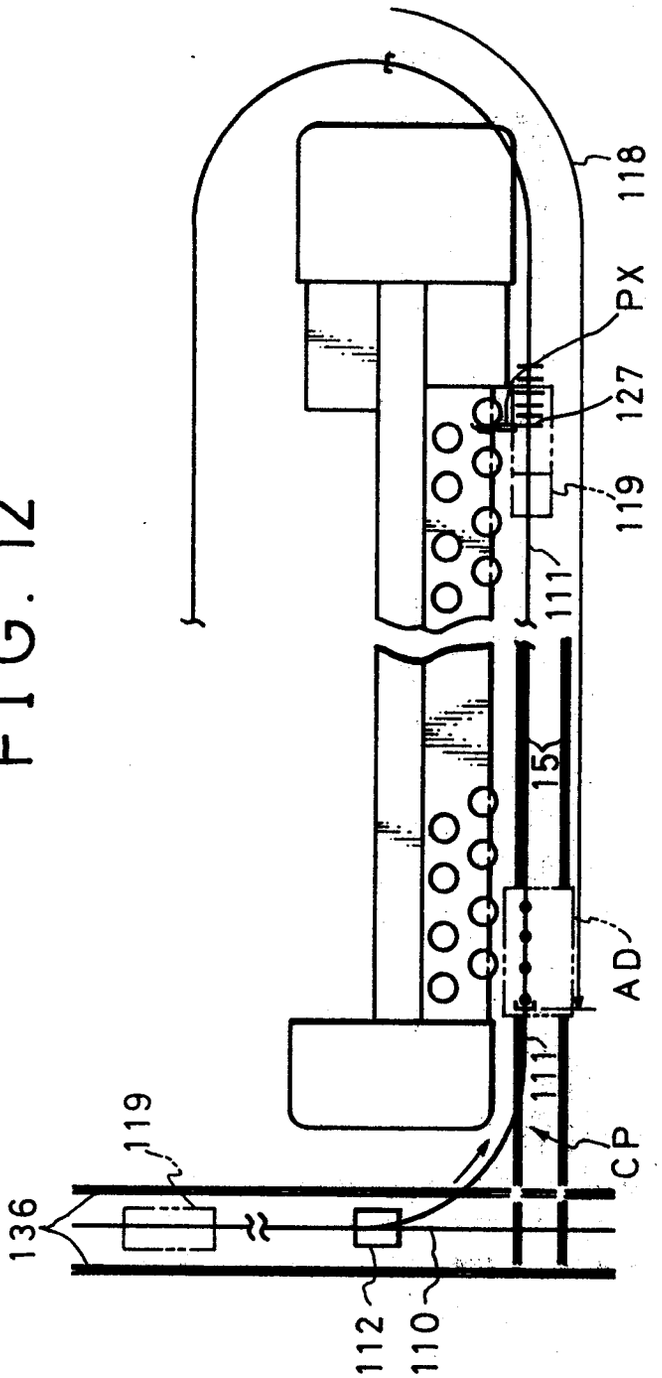
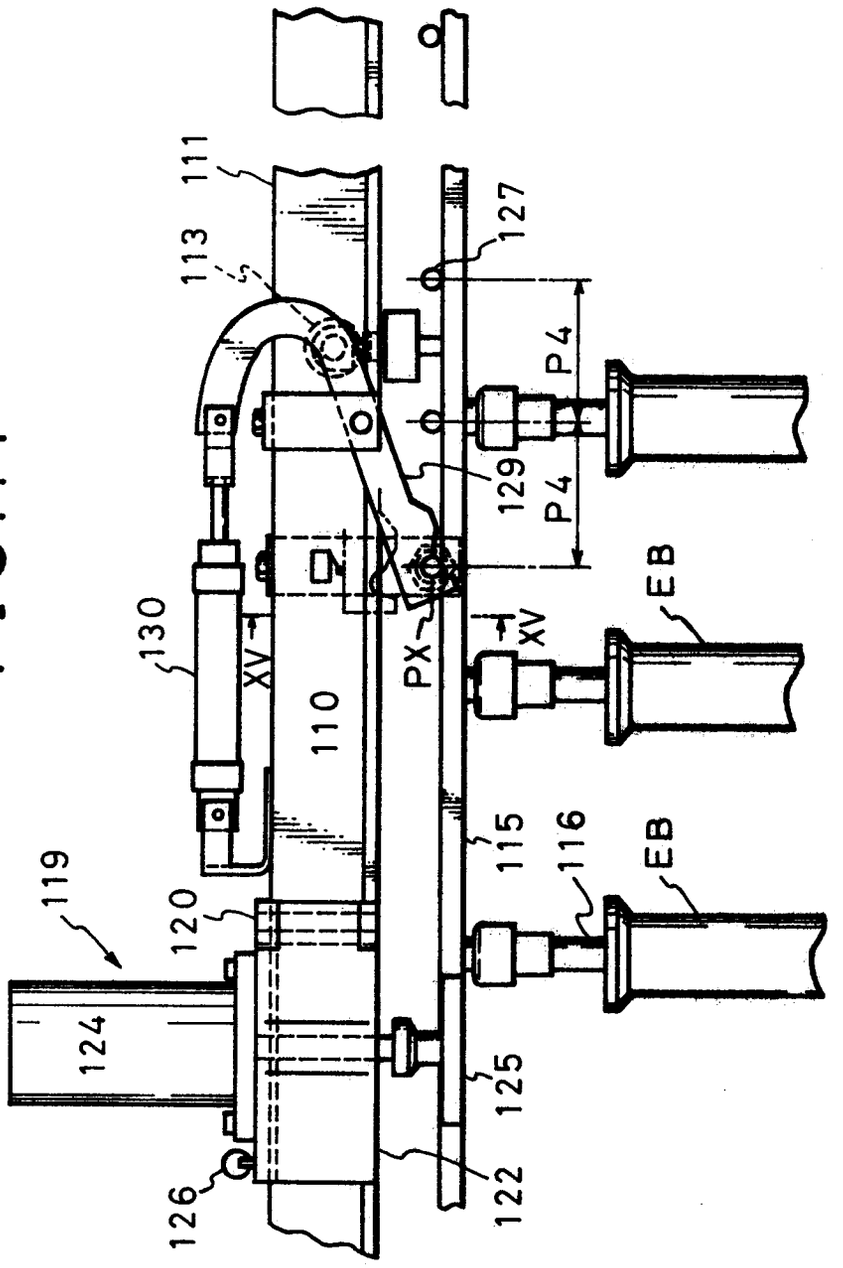


FIG.14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113
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126

FIG.18A

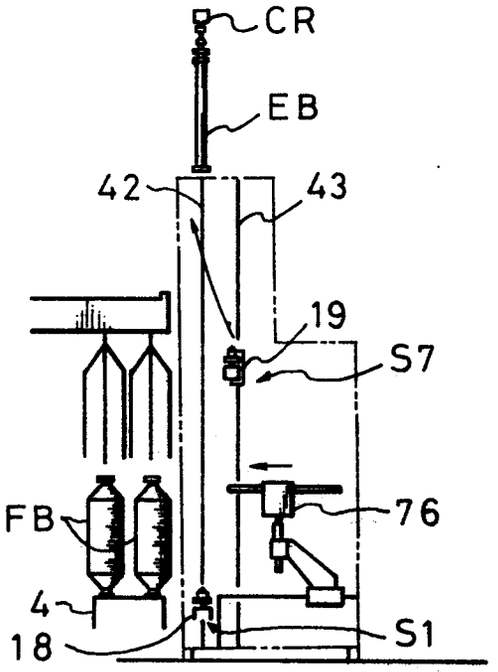


FIG.18B

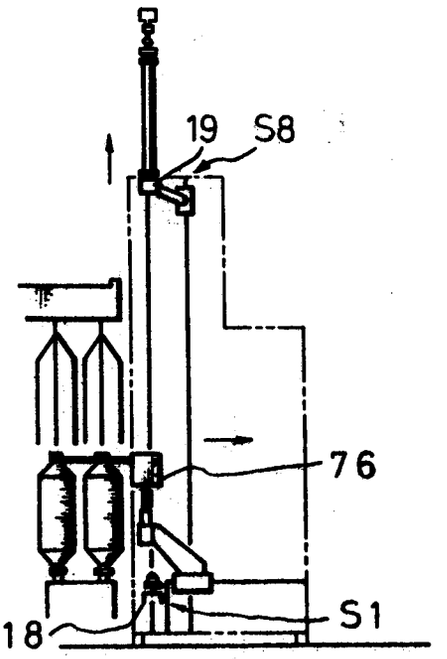


FIG.18C

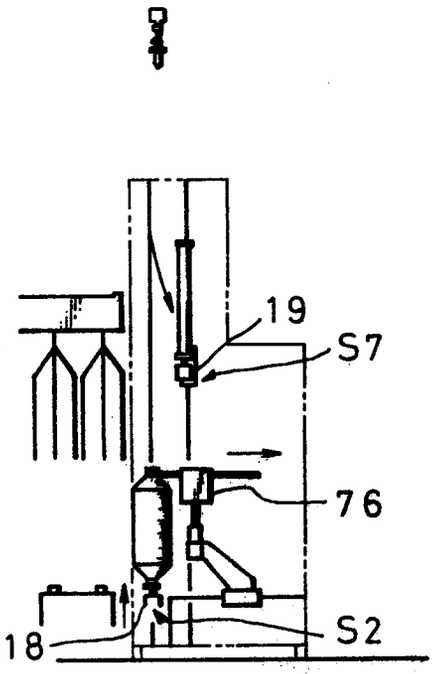


FIG.18D

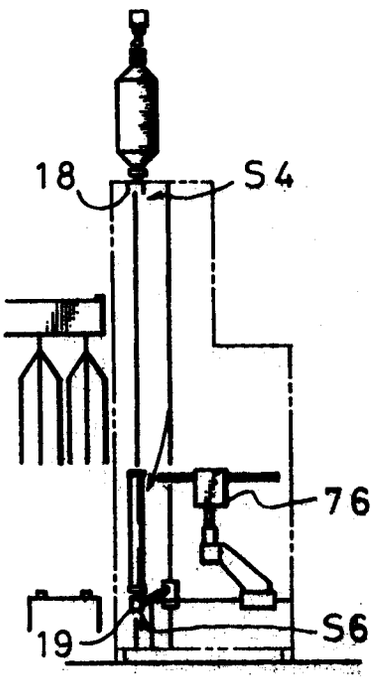


FIG.18E

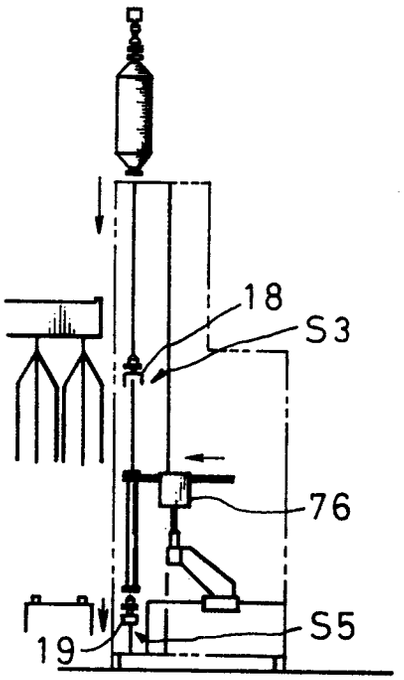


FIG.18F

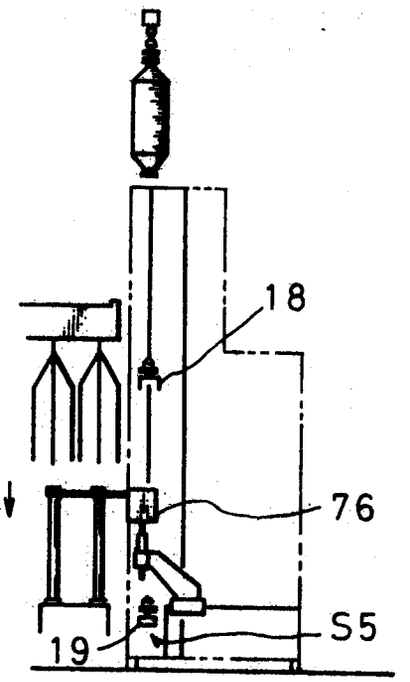


FIG.18G

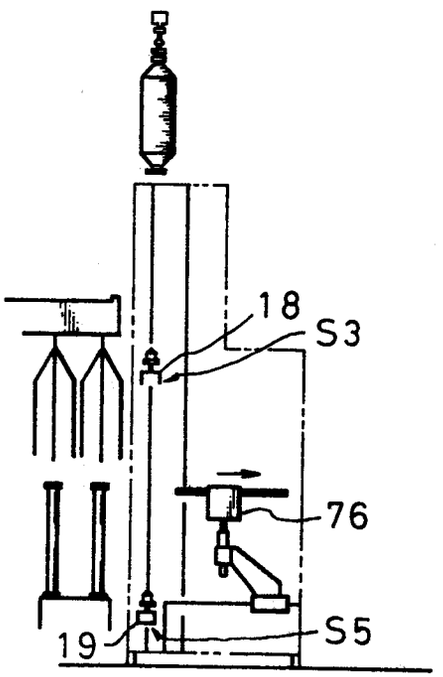


FIG.18H

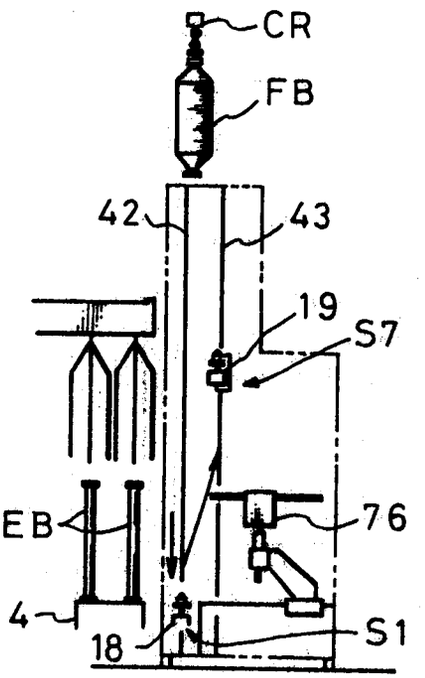


FIG.19A

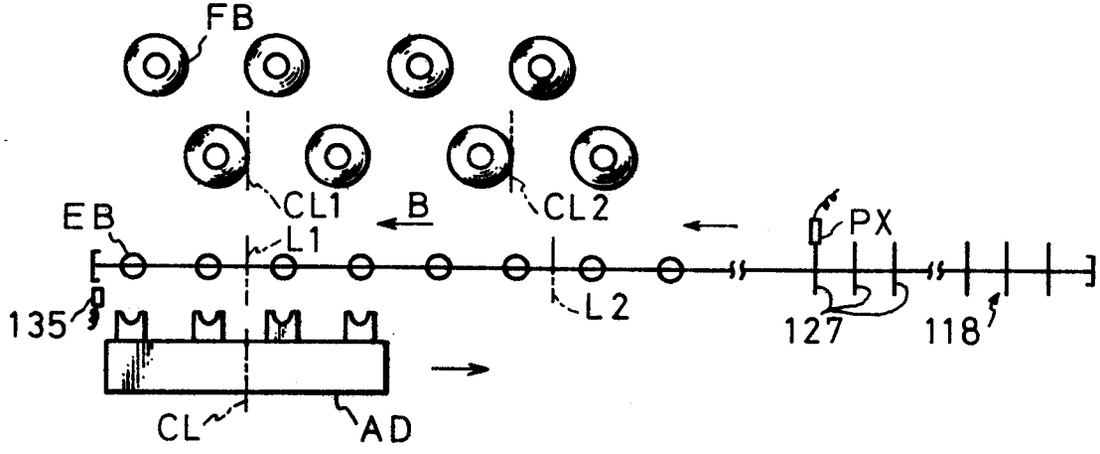
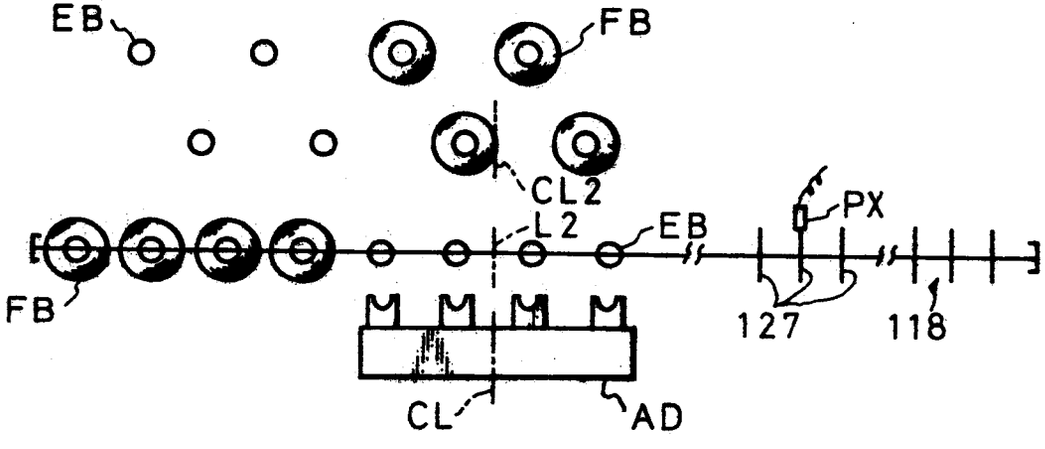


FIG.19B



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