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(54) Method and apparatus for synchronously piecing roving for a continuous feeding thereof to a ring spinning frame.

(57) A method and apparatus for synchronously piecing rovings applied to a ring spinning frame in combination with a known system of transporting rovings bobbins by bobbin carriages between a roving room and a spinning room, wherein rovings supplied from corresponding roving bobbins of a bobbin carriage in a creel portion of the ring spinning frame are synchronously pieced with corresponding supplemental rovings taken from respective full packaged roving bobbins held by another bobbin carriage in the creel portion of the ring spinning frame.

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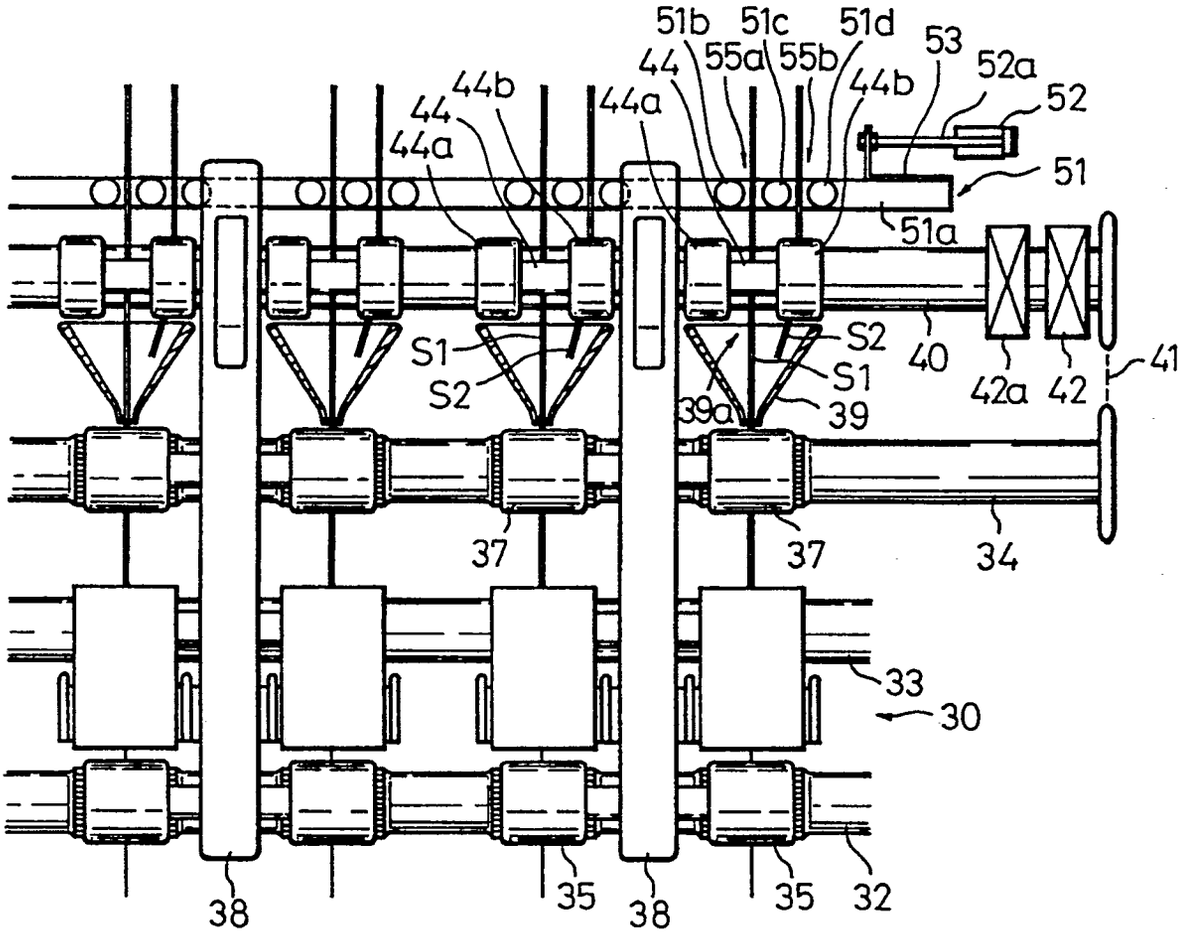
Fig. 1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METHOD AND APPARATUS FOR SYNCHRONOUSLY PIECING ROVING FOR A CONTINUOUS FEEDING THEREOF TO A RING SPINNING FRAME

BACKGROUND OF THE INVENTION

Description of the Related Art

As disclosed in the Japanese Unexamined Patent Publication Sho 62 (1987)-57957, it is well known that, in the conventional system, when the roving bobbins from which rovings are fed to draft parts of a ring spinning frame become almost exhausted and small in size and the yarn packages of the spinning frame reach a predetermined size after the completion of forming a starting portion thereof, i.e., one-third of a full package size thereof, supplemental rovings are taken from the full packaged roving bobbins prepared in advance in a creel part of a ring spinning frame, during a predetermined period between a time at which the size of the yarn packages reaches one-third of the full yarn package size and a time at which the size of the yarn package becomes 90% of the full yarn package size, and these rovings are carried to positions right above trumpets of the corresponding draft parts of the ring spinning frame, respectively. Thereafter, the above-mentioned supplemental rovings are combined with corresponding rovings fed from the almost exhausted roving bobbins, respectively, and the rovings, which are connected to the respective roving bobbins, are separated from the combined portion of the rovings immediately after the above-mentioned combination. The above-mentioned unit operation is carried out from one end of the spindle alignment of the ring spinning frame to the other end, by utilizing a roving piecing apparatus having a function of synchronously carrying out the unit operation for a group of a plurality of successive spindles, for example, two to six spindles. It is also possible to carrying out the above-mentioned unit operation manually.

In the above mentioned roving piecing operation utilizing the apparatus disclosed in the above-mentioned prior art, the unit operation by the apparatus is carried out by successive operations such as a first operation for reserving supplemental rovings at the respective positions close to the trumpets of the corresponding draft parts, and a second operation, i.e., the joint piecing operation of supplemental rovings with the corresponding rovings, which are fed from the respective roving bobbins, at the above-mentioned positions, and a third operation of cutting the rovings which are supplied from the respective roving bobbins arranged at the creel portion of the ring spinning frame, at the respective positions upstream of the corresponding trumpets of the draft parts, and the above-mentioned unit operation by the apparatus is successively carried out by displacing the apparatus along the spindle alignment. Therefore, the time required to carry out the roving piecing operation at the time of exchanging almost exhausted roving bobbins for the full packages roving bobbins, utilizing the above-mentioned known apparatus is fairly long. This problem becomes more serious when producing a coarse count yarn, which is preferably produced by utilizing a ring spinning frame having a larger number of spindles than the standard size spinning frame, because the time required to produce the full size yarn package is shorter than the time required to complete the successive roving piecing operation for all spindles of the ring spinning frame. Accordingly, the above-mentioned roving piecing method and apparatus are not suitable for producing a coarse count yarn.

SUMMARY OF THE INVENTION

The present invention is based on the following technical concept. Namely, it is well known that the yarn piecing operation of a ring spinning frame is carried out in a period between a time at which the size of the yarn package reaches one-third of the full size thereof and a time at which the size of the yarn package becomes 90% of the full size thereof, because the spinning condition, such as a variation of yarn tension, are very stable, and thus the average yarn tension is such that possible yarn breakages will not occur. Nevertheless, even during the above-mentioned period since the ring rail is stepwisely raised upward while repeating the traverse lifting motions thereof to create chases, and as it is well known that, in each chase formation, the size of the ballooning created in a condition such that the ring rail of the ring spinning frame takes a higher position is normally smaller than the size of the ballooning created in a condition such that the ring rail takes a lower position. Therefore, if the roving piecing operation is carried out in a restricted period during which the ring rail takes a position as close as possible to the uppermost position of the ring rail in a chase formation, the roving piecing operation can be carried out in a condition such that possible yarn breakage will not occur. Therefore, since the chase forming is carried out synchronously for all spindles of the ring spinning frame, if the roving piecing operation is synchronously carried out for all of the draft parts for which the roving piecing operation is required, the above-mentioned desirable condition for carrying out the roving piecing operation can be created.

Based upon the above-described technical concept, in the roving piecing method according to the present invention, supplemental rovings are taken

from the corresponding supplemental full size roving bobbins, which are located at the creel position of a ring spinning frame, and these rovings are carried to respective standby reserve positions close to the corresponding rovings being fed to the corresponding draft parts respectively, during the above-mentioned desirable period, and when the roving bobbins mounted at the creel position of a ring spinning frame reach an almost exhausted condition, the supplemental rovings from the supplemental roving bobbins are introduced synchronously into the respective draft parts together with the corresponding rovings from the almost exhausted roving bobbins, while the rovings from the almost exhausted roving bobbins are separated from the above-mentioned rovings which are being fed to the respective draft parts, immediately after the above-mentioned operation, hereinafter referred to as "joint piecing operation". The above-mentioned roving piecing operation is carried out synchronously at all draft parts to which the rovings are being fed from the respective almost exhausted roving bobbins held by a bobbin carriage supported at the creel position of the ring spinning frame. The above-mentioned all draft parts are hereinafter referred to as "all draft parts concerned". Therefore, the time required to complete the roving piecing operation can be remarkably reduced when compared with the known method. Moreover, if the above-mentioned synchronous operation is carried out at the time that the ring rail takes a position for forming the upper end portion of each chase formation, since the roving piecing operation is carried out in the most desirable condition for preventing possible yarn breakage(s) in the roving piecing operation, a most effective continuous spinning operation can be carried out.

To carry out the synchronous roving piecing method of the present invention, in the apparatus for carrying out the above-mentioned method according to the present invention, it is essential to provide a means for synchronously reserving free end portions of supplemental rovings taken from the respective supplemental roving bobbins at the respective positions in the trumpets of the corresponding draft parts, wherein each position is close to the passage of the roving fed from the roving bobbin which is supplying the roving to the identical draft part, a means for synchronously introducing the above-mentioned free end portions of the supplemental rovings into the corresponding draft parts in a doubled condition with the corresponding rovings which are being fed from the respective roving bobbins which have reached an almost exhausted condition, so that a joint piecing operation of the respective supplemental rovings to the corresponding rovings which are being fed to the corresponding draft parts is completed, and a means for cutting the rovings at the respective positions upstream of the corresponding draft parts immediately after the completion of the above-mentioned joint piecing operation.

Nevertheless, in the practical apparatus for carrying out the synchronous roving piecing method according to the present invention, the above-mentioned essential means for carrying out the synchronous roving piecing operation are designed in another combination, i.e., machine elements of the practical apparatus perform parts of the functions of the above-mentioned means respectively, so that the essential function of completing the synchronous roving piecing operation according to the present invention can be created by the combination of the functions of the machine elements of the practical apparatus as hereinafter explained in detail.

BRIEF EXPLANATION OF THE DRAWINGS

Fig. 1 is a plan view of a plurality of draft parts of a ring spinning frame to which the present invention is applied;

Fig. 2 is a plan view of the draft parts shown in Fig. 1, wherein a condition in which the synchronous roving piecing operation is completed is shown;

Fig. 3 is a cross sectional view of the draft parts shown in Fig. 1.

Fig. 4 is a cross sectional view of the draft parts shown in Fig. 1, showing the condition wherein a nip roller of a mechanism for feeding a roving is released from a supplemental roving bobbin;

Fig. 5 is a side view of the creel portion of the ring spinning frame shown in Fig. 1;

Fig. 6 is a side view of a rail for transporting a bobbin carriage concerned with the present invention;

Fig. 7 is an explanatory view of the positional relationship between the roving bobbins and roving guides concerned with the present invention;

Fig. 8 is a side view of a bobbin carriage utilized to carry out the present invention;

Fig. 9 is a side view of the ring spinning frame to which the second embodiment of the present invention is applied;

Fig. 10 is a plan view of a plurality of draft parts of a ring spinning frame to which the second embodiment of the present invention is applied;

Fig. 11 is a plan view of a plurality of draft parts of the ring spinning frame shown in Fig. 10, and shows the condition wherein the synchronous roving piecing operation is completed according to the present invention;

Fig. 12 is a side sectional view of the draft parts of the ring spinning frame shown in Fig. 10;

Fig. 13 is a view of a plurality of draft parts of a ring spinning frame to which the third embodiment of the present invention is applied;

Fig. 14 is a side sectional view of the draft parts of the ring spinning frame shown in Fig. 13;

Fig. 15 is an enlarged sectional view of a line shaft

utilized in the apparatus according to the present invention;

Fig. 16 is a plan view of a plurality of draft parts, partly omitted, of a ring spinning frame to which the fourth embodiment of the present invention is applied;

Fig. 17 is a sectional view of the draft parts of the ring spinning frame shown in Fig. 16;

Fig. 18 is an explanatory view of the separating action applied to a sliver according to the present invention; and

Fig. 19 is a plan view of a plurality of draft parts of a ring spinning frame to which a further modified means for carrying out the separation of a sliver according to the present invention is applied.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is carried out in cooperation with a conventional roving bobbin transporting system utilizing main transporting rails arranged between a room wherein a plurality of roving frames are installed and a room wherein a plurality of ring spinning frames are installed. In this roving bobbin transporting system, each bobbin carriage is provided with a plurality of bobbin hangers and is capable of carrying roving bobbins along the transporting rail between a particular position in the roving room and a particular position in the ring spinning frame. This transporting system is well known in the art, however, and therefore, a detailed explanation thereof is omitted, except for the points which are necessary to the explanation of the present invention.

As shown in Fig. 5, horizontal supporting arms 4 are rigidly mounted on upper end portions of creel pillars 3, which are vertically and rigidly mounted on a machine frame 2 of a ring spinning frame, with a predetermined pitch along the lengthwise direction thereof. At each side of the spinning frame, a pair of transporting rails 5, 6 are secured to these supporting arms 4 in parallel along the lengthwise direction of the spinning frame, whereby a creel portion 1 is formed at each side of the spinning frame. The transporting rails 5 and 6 are connected with a main transporting rail (not shown) at each terminal portion thereof, respectively. The main transporting rail and the transporting rails 5 and 6 have an identical cross-sectional construction. As shown in Fig. 6, these transporting rails are provided with a hollow frame having a rectangular cross section and a guide opening portion 7 formed at a bottom portion of the hollow frame such that the guide opening 7 extends along the lengthwise direction of the hollow frame, so that a pair of inside guide surfaces 8 are formed inside the hollow frame at both sides of the guide opening portion 7, respectively. As shown in Fig. 9, a bobbin carriage 9 is displaceably supported by the main transporting rail (not shown) and the transporting rails 5, 6. The bobbin carriage 9 is formed by a plurality of carriage elements 9a connected in an alignment, and each carriage element 9a comprises a carriage bar 10 provided with a pair of vertical supporting rods 11, which are disposed on the carriage bar 10 at both end portions thereof, and each supporting rod 11 is provided with a guide roller 14 rotatable about the central axis thereof so that, when the carriage element 9a is assembled with the main transporting rail and the transporting rails 5 and 6, the guide roller 14 is rotatably guided by the opening 7 of the main transporting rail and transporting rails 5 and 6, respectively. A pair of rotation rollers 13 are secured on a horizontal shaft (not shown) which passes rotatably through the vertical supporting rod 11 at the top end portion thereof in a condition such that, when the bobbin carriage 9 is assembled with the main transporting rail and transporting rails 5 and 6, the rotation rollers 13 are able to rotate on the corresponding inside surfaces 8,8 of the hollow frame of the main transporting rail and the transporting rails 5 and 6, respectively. The carriage bar 10 is provided with a plurality of horizontal frames 15 rigidly mounted thereon in a condition such that a pair of horizontal wing portions 15a of an identical length are extended to the outer sides from a central point thereof, and the angle between each wing portion 15a and the lengthwise direction of the carriage bar 10 is 90 degrees. Each horizontal frame 15 is provided with a vertical rod 17 which is projected downwards from the central point thereof. These horizontal frames 15 are arranged at an identical predetermined pitch which is double that of the spindle pitch, and bobbin hangers 16 are rigidly supported by each horizontal frame 15 at both end portions of the wing portions 15a thereof. As shown in Fig. 7, a roving guide 18 is mounted on the bottom end portion of each vertical rod 17, and each roving guide 18 is provided with a pair of guide pins 18a formed at both sides of the vertical rod 17 in a condition such that each guide pin 18a is directed upward. A plurality of the carriage bars 9a are connected in alignment by utilizing universal joints 19 to form the bobbin carriage 9, so that the number of bobbin hangers 16 of each bobbin carriage 9 is identical to 1/2 the number of spindles at each side of the spinning frame.

The above-mentioned bobbin carriage 9 is transported along the main transporting rail and the transporting rails 5 and 6 by a suitable means for displacing the bobbin carriage between the roving room and the ring spinning room, such as a carrying apparatus (e.g., a battery car as disclosed by Japanese Unexamined Patent Publication Sho 62 [1987]-263332, etc.). A supporting bar 21 is rigidly mounted on each creel pillar 3 and a pair of guide bars 22, 23 are horizontally supported by the supporting bars 21 in a condition such that these guide bars 22, 23

extend the entire length of the spindle alignment of each side of the spinning frame, so that rovings S1 supplied from the respective bobbins supported by the corresponding bobbin hangers 16 of the bobbin carriage 9 positioned at the creel position of the ring spinning frame are fed to the corresponding draft parts by way of the roving guides 18 and roving guide bars 22, 23. The rovings S2 from the supplemental roving bobbins supported by the corresponding bobbin hangers 16 of the bobbin carriage 9 positioned at the other creel position of the ring spinning frame are also introduced to the corresponding draft parts in the same condition as mentioned above, when the synchronous roving piecing operation according to the present invention is carried out.

As shown in Fig. 5, the draft parts 30 are disposed on the corresponding roller stands 31 at a position below the arrangement of the supporting arms 21. The main portion of the synchronous roving piecing apparatus of the present invention is shown in Figs. 1 and 3. That is, in each draft part 30, top rollers 35, 36, and 37 are disposed on a front roller 32, a second roller 33 and back roller 34, respectively, in a rotatable condition at both sides of a top arm 38, and trumpet 39 is disposed at an entrance of each back roller 34. The opening portion of the trumpet 39 is expanded to be larger than that of the conventional trumpet to attain the purpose of the present invention. Namely, since the opening of the trumpet 39 is expanded, the rovings S1 and S2 can be introduced therein synchronously when the roving piecing operation of the present invention is carried out.

A supplemental common feed roller 40 is rotatably mounted in the draft parts of the spinning frame at a position closely upstream of the trumpets 39 in a condition such that the roller 40 extends along the entire length of the spinning frame. The supplemental feed roller 40 is driven by a suitable drive system 41 such as a gear train, at a surface rotation speed equal to that of the back roller 34 and the starting and stopping of the rotation of the roller 40 is controlled by a clutch and brake mechanism comprising a clutch and a brake 42a, which is arranged between the drive system and the supplemental feed roller 40, as shown in Figs. 1 and 2.

A bifurcate lever 43 is provided and comprises two elementary lever portions connected to each other, and is mounted in swingable condition about a horizontal shaft mounted on each top arm 38, and a horizontal supporting shaft 44 is mounted so that a pair of nip rollers 44a and 44b are rotatably mounted on the shaft 44 in a condition such that these nip rollers 44a and 44b are projected toward an outer side from the top arm 38 respectively, to take respective positions at both sides of the roving S1 supplied to the corresponding draft part as shown in Figs. 1 and 2. Each bifurcate lever 43 is provided with a coil expansion spring 45 between the top arm 38 and the upper elementary lever portion so that, when the top arm 38 is set at the working position thereof, the nip rollers 44a and 44b are pressed against the supplemental feed roller 40 in a rotatable condition as shown in Fig. 3. Therefore, the above-mentioned contact between the supplemental feed shaft 40 and the nip rollers 44a, 44b can be released by turning the lever 43 upwards about the horizontal axis of the top arm 38.

A solid support member 50 is rigidly mounted on each roll, stand 31 as shown in Fig. 1. Each solid support member 51 is provided with a guide groove 50a having a rectangular cross section. A roving guide member 51 extending the entire length of the spindle alignment is slidably inserted in the guide groove 50a of each solid supporting member 50, for controlling the supply direction of the rovings S1 and S2, respectively, to the trumpet 39 of each draft unit 30. The roving guide member 51 comprises a solid rod 51a having a rectangular cross section and provided with a plurality of sets of three guide pins 51b, 51c and 51d planted vertically on the upper surface thereof in the respective positions for controlling the introducing positions of the sliver S1 and the sliver S2 into each draft part 30. At one side end of the rod 51a, a bracket 53 is connected to a piston rod 52a of a reciprocal pneumatic cylinder 52, so that the transversal reciprocal motion of the roving guide member 51 along the lengthwise direction of the spinning frame can be obtained. The relative position between the arrangement of the guide pins 51b, 51c and 51d and the arrangement of the nip rollers 44a and 44b is designed to satisfy the following condition. That is, when one of roving guide spaces 55a and 55b formed between the guide pins 51b and 51c faces one of the nip rollers 44a and 44b, in a condition such that the roving guide member 51 is stopped at either one of the terminal points of the reciprocal stroke motion of the piston rod 52a of the cylinder 52, the other one of the roving guide spaces 55a and 55b is at an intervening position between the nip rollers 44a and 44b. The function of the roving guide member 51 is to act as a means for synchronously cutting the slivers S1 fed to the corresponding draft parts 30.

Next, the function of the above-mentioned apparatus for synchronously piecing rovings is hereinafter explained in detail. Since the function of the apparatus of the present invention is identical with respect to both sides of the ring spinning frame, the following explanation is directed only to one side of the spinning frame.

During a period in which the spinning operation is normally carried out, the rovings S1 are continuously supplied from the roving bobbins S of two parallel alignments of the bobbin carriage 9 temporarily located at a creel position of a ring spinning frame represented by the transporting rail 5, at corresponding draft parts of each side of the ring spinning frame, respectively in each draft part 30, the roving S1 is intro-

duced to the trumpet 39 of the corresponding draft part 30 by way of the roving guide 18, the roving guide bars 22 and 23, and the intervening space 55a, and therefore, a bundle of fibers delivered from the draft part 30 is twisted and wound on a bobbin mounted on the corresponding spindle. During a fairly long interval until the roving bobbins S reach an almost exhausted condition, another bobbin carriage holding a plurality of full packaged roving bobbins F in two alignments, which number of each alignment is identical to 1/2 of the total number of spindles at each side of the spinning frame, is displaced to the other creel position of the ring spinning frame, i.e., the above-mentioned bobbin carriage 9 having the full packaged roving bobbins F of two alignments is introduced to the transportating rail 6, as shown in Fig. 5.

Next, the clutch 42 of the supplemental feed roller 40 is released, and synchronously the brake 42a is actuated, and the following operation is carried out successively at all draft parts 30 of the spinning frame, that is, a supplemental roving S2 is taken from the corresponding full packaged roving bobbin F, and then a free end portion of the roving S2 is introduced to the roving guide bar 23 so that the free end portion of the roving S2 is temporarily hung on the roving guide bar 23.

The above-mentioned free end portion of the roving S2 is inserted to an intervening space 33a between the nip roller 44b and the supplemental feed roller 40 via a roving guide intervening space 55b, immediately after the lever 43 of the top arm 38 is turned upward about the axial center thereof to thereby separate the nip rollers 44a and 44b from the supplemental feed roller 40, so that the free end of the supplemental roving S2 is introduced to a position inside the trumpet 39 in a condition such that the free end of the roving S2 is close to the running roving S1, and thereafter, the lever 43 is turned back to the normal position at which the nip rollers 44a and 44b are in rotatable contact with the supplemental feed roller 40. According to the above-mentioned operation, the supplemental roving S2 is gripped by the nip roller 44b and the supplemental feed roller 40 which is held stationary (Fig. 3). The above-mentioned operation is carried out to all draft parts 30 concerned at each side of the spinning frame.

Under the above-mentioned condition, the normal spinning operation is continuously carried out, and when all of the roving bobbins S of the bobbin carriage 9 supported by the transporting rail 5 reach an almost exhausted condition, the clutch 42 is reconnected synchronously release the action of the brake 42a during a period in which the size of all of the yarn packages of the ring spinning frame becomes between 30% to 90% of the full size yarn package. According to the above-mentioned operation of the clutch 42, and the brake 42a, the rotation of the supplemental feed roller 40 is started at the same surface rotation speed as that of the back roller 34, so that the supplemental roving S2 maintained at the standby position in the trumpet 39 of each draft part 30, is carried to the running position of the roving S1, and accordingly, the roving S2 is fed to the back roller 34 of each draft part synchronously, so that the supplemental roving S2 is introduced to the back roller 34 of each draft part 30. Therefore, a joint piecing of the rovings is carried out synchronously at the all draft parts 30 concerned at each side of the ring spinning frame.

Immediately after or synchronously with the above-mentioned synchronous joint piecing operation, the piston rod 52a of the reciprocal cylinder 52 is actuated to project outwards as shown in Fig. 2, so that the roving guide member 51 is displaced in a direction identical to the projected direction of the piston rod 52a (right-hand direction in Fig. 2). Due to the motion of the piston rod 52a, in each draft part, the roving S1 and the supplemental roving S2 are displaced toward the above-mentioned direction, by the guide pins 51b, 51c and 51d respectively, so that the roving S1 is displaced to a position at which the roving S1 is passed through the nip point between the nip roller 44a and the supplemental roving feed roller 40. On the other hand, the free end portion of the supplemental roving S2, which was doubled with the running roving S1 by the above-mentioned joint piecing operation, is displaced to the intervening space between the supporting shaft 44 and an intervening portion of the supplemental roving feed roller 40 between the nip rollers 44a and 44b, from the condition of gripping the free end portion of supplemental roving S2 between the nip roller 44b and the supplemental roving feed roller 40. Immediately after the above-mentioned operation, the clutch 42 is actuated to stop the transmission of power and the brake 42a is actuated to instantly stop the rotation of the supplemental roving feed roller 40. Therefore the rovings S1 from the almost exhausted roving bobbins S are synchronously cut in a condition such that the rovings S1 are still gripped by the corresponding nip roller 44a and the supplemental roving feed roller 40. In other words, all of the rovings S1 from the almost exhausted roving bobbins S of the bobbin carriage 9 supported by the transporting rail 5, are synchronously cut at the respective positions close upstream of the supplemental feed roller 40, respectively.

After the above-mentioned cutting operation of the rovings S1, the lever 43 is turned upward about the axial center of the supporting shaft 43a mounted on each top arm 38, so that the grip to the roving S1 by the respective nip roller 44a and the supplemental roving feed roller 40 are released, and thereafter, the rovings S1 connected to the almost exhausted roving bobbins S are successively rewound by the corresponding roving bobbin S of the bobbin carriage 9 supported by the transporting rail 5, with respect to all

draft parts 30 concerned.

After completion of the above-mentioned rewinding of the roving S1 by the almost exhausted roving bobbin S1 with respect to all draft parts 30 concerned, the bobbin carriage 9 supporting the almost exhausted roving bobbins S is displaced from the transporting rail 5 to the roving room, and a bobbin carriage supporting full packaged roving bobbins F is introduced to the transporting rail 5 from which the bobbin carriage having the almost exhausted roving bobbins S has been discharged.

In the next synchronous roving piecing operation applied to all draft parts of each side of the ring spinning frame, since the full packaged roving bobbins F are going to almost exhausted condition, the operation identical to the operation mentioned above is applied to all draft parts aligned at each side of the spinning frame, with respect to the roving bobbins which are changed from the above-mentioned full packaged roving bobbins F supported by the transporting rail 6 and the full packaged roving bobbins of a bobbin carriages 9 which are introduced to the transporting rail 5 of the ring spinning frame. This operation is started from a condition such that the rovings F2 are nipped between the respective nip rollers 44a and the supplemental roving feed roller 40. As mentioned above, the above-mentioned two successive synchronous roving piecing operations are combined and such combined operations are successively repeated during the spinning operation.

Since the roving piecing operation is carried out synchronously as mentioned above, the operation can be carried out regardless of the time required for completing the formation of full yarn packages, and of the number of spindles, and since the roving piecing operation according to the present invention is carried out under a preferable condition such that the ring rail is located at the uppermost position in the chase formation, wherein the ballooning is very small, possible yarn breakages can be easily prevented.

The second embodiment of the present invention is hereinafter explained with reference to Figs. 9, 10, 11 and 12. As shown in these drawings, three transporting rails 5a, 5b and 5c are provided at each side of the ring spinning frame, and these transporting rails 5a, 5b and 5c are provided with functions such that a bobbin carriage 9 having a plurality of bobbin hangers, a number of which is 1/2 of the total number of spindles arranged on each side of the spinning frame, is displacably supported. During the spinning operation, two of these transporting rails 5a, 5b, and 5c continuously support the bobbin carriage 9 supplying rovings to the respective spindles, and the remaining one of these transporting rails 5a, 5b, and 5c supports the bobbin carriage on which the full packaged roving bobbins or almost exhausted roving bobbins are carried after completion of the synchronous roving piecing operation. Therefore, the functions of these three transporting rails 5a, 5b, and 5c are stepwisely changed so as to carry out the supply of rovings to the respective draft parts concerned of each side of the spinning frame, which consist of the draft parts alternately positioned along the lengthwise direction of the spinning frame, respectively. Therefore, when the roving bobbins (S) of one of two bobbin carriages 9 supported by two of three transporting rails 5a, 5b, and 5c, which are supplying rovings to the respective draft parts 30, reach an almost exhausted condition, the rovings from full packaged roving bobbins (F) of a bobbin carriage 9 supported by one of three transporting rails 5a, 5b, and 5c, are successively pieced with the corresponding roving S1 from the almost exhausted roving bobbins S of one of the remaining two transporting rails, other than the above-mentioned transporting rail supporting the bobbin carriage 9 holding the full packaged roving bobbins.

Since in this embodiment, draft parts of each side of the ring spinning frame consist of the above-mentioned two groups of draft units, the synchronous roving piecing operation according to the present invention is alternately and separately applied to each one group of draft parts concerned arranged at each side of the ring spinning frame.

As shown in Fig. 10, a pair of roving guide members 61 and 62 are disposed at respective positions behind the supplemental roving feed roller 40 in a condition such that they can be displaced along the lengthwise direction of the spinning frame. In this embodiment, instead of utilizing a spindle guide element such as the element 51 in the first embodiment, a pair of roving guide members 61 and 62 are utilized, and a plurality of groups of three guide pins 61b, 61c and 61d are planted vertically to the respective positions of the roving guide members 61, and a plurality of three guide pins 62b, 62c, and 62d are planted vertically to the roving guide member 62. Accordingly, the plurality of groups of guide members 61b, 61c, and 61d introduce roving to corresponding draft parts 30 which form a group of alternate draft parts of the alignment of all of the draft parts 30 arranged at one side of the ring spinning frame, and a plurality of groups of the guide members 62b, 62c, and 62d introduce roving to corresponding draft parts 30 which form other alternate draft parts in an identical alignment of the draft parts 30 at each side of the spinning frame.

The roving guide members 61, 62 are displaced along the lengthwise direction of the spinning frame by the action of the reciprocal pneumatic cylinders 63 and 64 respectively, as in the first embodiment. To simplify the explanation of the second embodiment, machine elements having the same function as the machine elements of the first embodiment are identified by the same reference numerals as used in Fig. 10.

Referring to Figs. 9 and 10, the transporting rails 5a and 5b support the respective bobbin carriage 9

holding the roving bobbins S for feeding rovings to the corresponding draft parts 30 of the spinning frame. The successive roving piecing operation applied to the roving bobbins S of the bobbin carriage 9 supported by the transporting rail 5a and the full packaged roving bobbins F of the bobbin carriage 9 supported by the transporting rail 5c is hereinafter explained in detail. As is clear from the previous explanation, the number of full packaged roving bobbins F is a 1/2 of the number of spindles at each side of the spinning frame, and the supplemental rovings S2 taken from the respective full packaged roving bobbins F are introduced to the respective positions in the trumpets of the corresponding draft parts respectively in almost the manner as in the first embodiment, and then free end portions of the supplemental rovings S2 are nipped by the nip roller 44b and the supplemental roving feed roller 40 at the respective positions upstream of the corresponding draft parts 30. In this condition, the free end portion of the above-mentioned supplemental roving S2 takes a position close to the roving S1, which is supplied to the corresponding draft part 30 in the trumpet 39 thereof, and the rovings 61 and 62 take a position controlled by the roving guide member 62 as shown in Fig. 10.

When the roving bobbins S of the bobbin carriage 9 supported by the transporting rail 5a reach an almost exhausted condition, the following synchronous roving piecing operation is started in a preferable condition such that the ring rail of the spinning frame takes a position close to the uppermost position in the chase formation. As in the first embodiment, the synchronous roving piecing operation is carried out during a period in which the size of the yarn package becomes 30% of the full size yarn package and the size of the yarn package becomes 90% of the full yarn package.

The synchronous roving piecing operation is carried out as follows: First, the clutch 42 is connected and synchronously, the action of the brake 42a is released so that the rotation of the supplemental roving feed roller 40 is started at a surface rotation speed identical to that of the back roller 34. According to this operation, the free end of the supplemental roving S2 is doubled with the roving S1 supplied and introduced into the corresponding draft part 30, whereby the joint piecing of two rovings S1 and S2 is performed. The roving guide member 62 is displaced only for a predetermined distance along the lengthwise direction of the spinning frame (in Fig. 11, left-hand side) so that the roving S1 is nipped by the roller 44a and the roller 40 while the supplemental roving S2 is released from the nip roller 44b and the roller 40. Thereafter, the clutch 42 is disconnected and the brake 42a is actuated, and the rovings S1 which are supplied from the almost exhausted roving bobbins S of the bobbin carriage 5a are synchronously cut as shown in Fig. 11. The above-mentioned operation is applied to the draft parts 30 which are alternately arranged along the alignment of all of the draft parts 30 at each side of the spinning frame. As in the first embodiment, the cut rovings S1 connected to the respective roving bobbins S, which are created by the above-mentioned synchronous operation, are rewound on the corresponding almost exhausted roving bobbins S and then the bobbin carriage 9 holding these almost exhausted roving bobbins S is discharged from the transporting rail 5a of the spinning frame and a fresh bobbin carriage 9 holding full packaged roving bobbins F is introduced the transporting rail 5a to replace the above-mentioned bobbin carriage 9 discharged therefrom.

During the above-mentioned desirable period for carrying out the synchronous roving piecing operation according to the present invention, the rovings S2 from the above-mentioned fresh full packaged roving bobbins F are introduced to the respective trumpets 39 of the corresponding draft parts 30 which form the other alternate draft parts of the identical alignment of all draft parts 30 at each side of the spinning frame. (draft parts 30 positioned at the left-hand side with respect to each top arm 38), by passing through the respective roving guide intervening spaces 65b formed between each pair of guide pins 61c and 61d of the roving guide member 61, while the free end of each roving S2 is nipped by the corresponding nip roller 44b and the supplemental roving guide roller 40.

The synchronous roving piecing operation is carried out by a method almost identical to the above-mentioned synchronous roving piecing operation, except that the roving guide member 61 is displaced only towards the direction opposite to the first embodiment (left-hand side in Fig. 11).

The third embodiment of the present invention, which is a modification of the second embodiment, is explained with reference to Figs. 13, 14 and 15.

As is clear from the drawing of Fig. 13, the construction of the apparatus of the third embodiment differs from the second embodiment only in the construction of the roving guide member. That is, in the third embodiment, a single roving guide member formed by a line shaft 71 is extended for the entire length of the spindle alignment of the ring spinning frame, instead of utilizing a pair of roving guide members 61 and 62 as in the second embodiment. The line shaft 71 is mounted on the spinning frame in a condition such that the line shaft 71 is able to rotate about the axis thereof, and able to slide along the axis thereof. One end of the line shaft 71 is rotatably supported by a shift-plate 72 as shown in Fig. 13. The shift-plate 72 is connected to a piston rod 52a of a pneumatic cylinder 52, a motor 73 is rigidly mounted on the shift-plate 72, and the line shaft 71 is rotated by 180 degrees once, by a suitable power transmission system such as an endless chain driving system, when the motor 73 is actuated.

The line shaft 71 is provided with two groups of guide means, one group consisting of a pair of guide grooves 75a and 75b, and the other group consisting of a pair of guide groups 76a and 76b. The pairs of guide grooves belonging to one group and the pairs of guide grooves belonging to the other group are alternately formed in the line shaft, and these first pairs of grooves 75a, 75b, and the second pairs of grooves 76a, 76b, are formed in the line shaft 71 in a condition such that the angular phase difference between the first pairs of grooves 75a, 75b and the second pairs of grooves 76a, 76b is 180 degrees, as shown in Fig. 15. Further, the above-mentioned arrangement of the first pairs of grooves 75a, 75b and the second pairs of grooves 76a, 76b is such that, when the first pair of guide grooves 75a, 75b face one of the corresponding nip rollers 44a, 44b, the second pair of guide grooves 76a, 76b face the respective intervening positions between the corresponding pairs of the nip rollers 44a and 44b.

In this embodiment, each roving S1 from the corresponding roving bobbin S is introduced to the trumpet 39 of the corresponding draft part 30 after passing a position below the line shaft 71. Under the above-mentioned condition, the rovings S1 passes through the roving guide groove 75a, which is facing downwards, to the corresponding draft part 30 as shown in Fig. 13.

Before carrying out the synchronous roving piecing operation, the supplemental rovings S2 are taken from the full packaged roving bobbins F and then introduced to the respective nip rollers 44b of the corresponding draft parts 30, and the free end portions of the supplemental rovings F are nipped between the nip roller 44b of the corresponding draft part 30 and the supplemental roving feed roller 40.

When the synchronous roving piecing operation is started at a preferable time mentioned in the explanation of the previous embodiment, the supplemental rovings S2 are supplied to the corresponding draft parts 30 by rotating the supplemental roving feed roller 40 by the operation of the clutch 42 and the brake 42a. The line shaft 71 is synchronously displaced toward the direction of the nip rollers 44a (left-hand side in Fig. 13) so that the supplied roving S1 is nipped by the nip roller 44a of the corresponding draft part 30 and the supplemental roving feed roller 40, while the supplemental roving S2 is released from the nipping action by the nip roller 44b of the corresponding draft part 30 and the supplemental roving feed roller 40. Accordingly in the above-mentioned operation, the joint piecing of the roving S2 with the roving S1 is carried out synchronously in the draft parts 30 which are alternate draft parts of the alignment of the draft parts 30 at each side of the ring spinning frame. Thereafter, the rovings S1 connected to the respective almost exhausted roving S are synchronously cut by the action of the clutch 42 and the brake 42a, as described in the second embodiment and thereafter, these rovings S1 are rewound on the corresponding almost exhausted roving bobbins S of the bobbin carriage 9 supported by the transporting rail 5a, and this bobbin carriage 9 is discharged from the transporting rail 5a. Then, a fresh bobbin carriage 9 holding the full packaged roving bobbins F is carried to the transporting rail 5a. During the above-mentioned synchronous roving piecing operation, with respect to the draft parts 30 to which the synchronous roving piecing operation is not applied, since the roving guide grooves 76a and 76b are in the respective positions facing upward, the rovings S1 which are supplied to the corresponding draft parts are not displaced towards the nip roller 44a of each draft part 30, but are introduced into the corresponding guide groove 76a of each draft part 30, where the roving guide groove 76a faces the nip roller 44a of each corresponding draft part 30.

When the above-mentioned other rovings S1, which are not subjected to the above-mentioned synchronous roving piecing operations, are subjected to the synchronous roving piecing operation, the motor 73 is actuated so that the line shaft 71 is turned by 180 degrees, and accordingly, the positions of the pairs of the roving guide grooves 76a and 76b, which are facing the other rovings S1, are changed to the respective positions facing downward, and accordingly,the another rovings S1 are introduced into the corresponding roving guide grooves 76b. Under the above-mentioned condition, the supplemental rovings S2 taken from the full packaged roving bobbins F of the bobbin carriage 9 supported by the transporting rail 5a are introduced to the respective positions close to the mity to the corresponding nip rollers 44a respectively, by way of the corresponding roving guide grooves 76a facing the respective nip rollers 44a, and then nipped by the corresponding nip rollers 44a and the supplemental roving feed roller 40, and the synchronous roving piecing operation is carried out after displacing the line shaft 71 towards the direction opposite to the direction of the previous synchronous roving piecing operation (right-hand side in Fig. 13).

The fourth embodiment of the present invention is hereinafter explained in detail with reference to Figs. 16, 17, and 18. In this embodiment, the roving S1, which are supplied from the respective almost exhausted roving bobbins S1, are synchronously cut by a cutting means at the respective positions upstream of the respective draft parts, and the supplemental roving S2 are synchronously supplied to the corresponding draft parts together with the roving S1 which are separated from the respective roving S1 connected to the corresponding roving bobbins S after the above-mentioned cutting operation or synchronously therewith, to carry out the above-mentioned cutting operation. In the apparatus of the fourth

embodiment of the present invention, one of the nip rollers 44a and 44b is omitted in each combination of these nip rollers 44a and 44b, for example, the nip rollers 44a and 44b taking respective positions close to the top arm 38 are omitted as shown in Fig. 16, and the means for synchronously cutting the rovings S1, which are supplied from the respective roving bobbins S, are additionally utilized. That is, the roving cutting means 80 comprises a line shaft 71 supported by a supporting member 50 at a position upstream of the supplemental feed roller 40, and a cutting shaft 81 which is rotatably supported by the supporting member 50 in parallel to the line shaft 71, at a position below the shaft 71. The shaft 71 is able to rotate about the axial center thereof and is able to be synchronously displaced along the axial direction thereof. The line shaft 71 is provided with roving guide grooves 75a for guiding rovings S, which are supplied from the respective roving bobbins S, to the group of draft parts 30 which are alternate draft parts 30 of the alignment of the draft parts 30 at each side of the spinning frame, and with roving guide grooves 76a for guiding the rovings S1 to the group of the draft parts 30 which are other alternate draft parts 30 of the alignment of the draft parts 30, and these roving guide grooves 75a and the roving guide grooves 76a are formed in a condition such that the angular phase difference between each roving guide groove 75a and each roving guide groove 76a is 180 degrees about the axial center of the line shaft 71. The cutting shaft 81 is provided with a group of cutting members 82, which are planted on the cutting shaft 81 vertical to the axis thereof, and another group of cutting members 83 which are planted on the cutting shaft 81 vertical to the axis thereof. The cutting members 82 can be inserted to the corresponding roving guide grooves 75a respectively, and the cutting members 83 can be inserted into the corresponding roving guide grooves 76a respectively. One end portion of the cutting shaft 81 is connected to a shaft of a drive pulley 84a driven by a drive motor 84 rigidly mounted on a machine frame 2 of the spinning frame, by way of a drive system 85 such as an endless chain drive system, and the cutting shaft 81 is able to be turned 180 degrees about the axis thereof once when required. When the cutting members 82 or 83 are inserted to the corresponding roving guide groove 75a or 76b, respectively, the rovings, which are supplied from the respective almost exhausted roving bobbins S, are forcibly cut at the respective positions between the corresponding cutting members 82 or 83 and the line shaft 71.

In the above-mentioned embodiment, the rovings S1 are introduced to the respective trumpets 39 of the corresponding draft parts 30 after passing through the respective passages above the cutting shaft 81 and below the line shaft 71. In this condition, the rovings S1 are introduced into the respective roving grooves 75a of the line shaft 71, because these guide grooves 75a face downward. Since the cutting shaft 81 is able to be rotated in a direction which is opposite to the rotating direction of the back roller 34 of the draft parts 30, when the cutting members 82 (83) are inserted to the corresponding roving guide grooves 75a (76a) while turning, the rovings S1 can be easily cut by the cutting members 82 (83) and the corresponding roving guide grooves 75a (76a).

As in the above-mentioned three embodiments, the supplemental rovings S2 are taken from the respective full packaged roving bobbins F and introduced to the respective nip rollers 44b of the corresponding draft parts 30, and held there in a condition such that these supplemental roving S2 are nipped between the corresponding nip rollers 44b and the supplemental roving feeding shaft 40.

When the synchronous roving piecing operation is required, the motor 84 is actuated automatically or by a manual operation of a switch, so that the cutting shaft 81 is turned by 180 degrees about the axis thereof toward the direction indicated by an arrow in Fig. 18. According to the above-mentioned operation, when the cutting members 82 are inserted to the corresponding roving guide grooves 75a, the rovings S1, which are supplied from the almost exhausted rovings of the bobbin carriage 9, are cut by gripping between the respective cutting members and the corresponding roving guide grooves 75a. Each roving S1, which is cut and continuously fed to the corresponding draft part 30 remains a certain length in the region upstream of the trumpet 39 of the corresponding draft part 30, and the above-mentioned remaining portion of the roving S1 is eliminated when this portion is introduced to the corresponding draft part 30. At a predetermined time, as described in the other embodiments, the clutch 42 is temporarily actuated to connect the component shafts thereof so that the supplemental rovings S2 are synchronously fed to the respective trumpets 39 of the corresponding draft parts 30. Due to this operation, since the supplemental rovings S2 are introduced into the respective back rollers 30 while doubled with the corresponding rovings S1, the line shaft 71 is synchronously displaced towards a direction along the axis thereof so that the supplemental rovings S2 are released from the nipping action by the corresponding nip roller 44 and the supplemental roving feed roller 40. The above-mentioned displacement of the line shaft 71 is carried out towards the left-hand side in Fig. 16. Due to the above-mentioned motion of the line shaft 71, the supplemental rovings S2 are continuously fed to the respective trumpets 39 of the corresponding draft parts 30 through the intervening space between the corresponding nip roller 44b and the top arm 38 thereof, so that the synchronous roving piecing operation applied to half the number of draft parts at each side of the spinning frame is completed. To carry out the synchronous roving piecing operation applied at

the other half of the number of draft parts at each side of the spinning frame, the line shaft 71 is turned 180 degrees about the axis thereof so that the supplemental rovings S2 are nipped by the nip rollers 44a of each pair of nip rollers 44a and 44b and the supplemental roving feed roller 40. Before the operation of the synchronous roving piecing operation applied to the other draft parts 30, to which the previous synchronous roving piecing operation was not applied, is started, the supplemental rovings S2 are introduced to the respective nip rollers 44a of the corresponding draft parts 30 so that the supplemental rovings S2 are nipped by the respective nip rollers 44a of the corresponding draft parts 30 and the supplemental roving feed roller 40, respectively. When the synchronous roving piecing operation is carried out, the cutting roller 81 is turned by 180 degrees about the axis thereof, and the cutting members 83 are inserted to the respective roving guide grooves 76b facing the corresponding draft units 30 respectively, so that the rovings S1 from the respective roving bobbins S of the bobbin carriage 9 are respectively cut. Thereafter, the supplemental roving feed roller 40 is temporarily rotated by actuating the clutch 42 and the brake 42a, whereby the supplemental rovings S2 are synchronously introduced to the trumpets 39 of the corresponding draft parts 30, and the supplemental rovings S2 are released from the nipping action by the respective nip rollers 44a and the supplemental roving feed roller 40 by displacing the line shaft 71 in the direction towards the right-hand side in Fig. 16. The synchronous roving piecing operation applied to the other all draft parts concerned at each side of the roving frame is completed according to the above-mentioned stepped operation.

In the above described embodiment, the cutting means 80 comprising the cutting shaft 81 and the cutting members 82, 83 is utilized, but instead of the cutting means 80, a mechanism for separating rovings into two portions by applying a tensile force thereto can be applied.

The other the of the roving cutting means is disclosed in Fig. 19. As shown in Fig. 19, a pair of roving guide rods 51A and 51B are mounted on the respective guide grooves (not shown) of supporting members (not shown) rigidly mounted on the roller stands 31, in a condition such that these rods 51A and 51B are reciprocally slidable along the lengthwise direction of the spinning frame. These roving guide rods 51A and 51B have a rectangular cross section.

The roving guide rod 51A extends along the entire length of the spindle alignment of each side of the spinning frame, and is provided with a plurality of pairs of guide pins 51Ab and 51Ac planted at positions facing each draft part 30, with a predetermined intervening space therebetween. The roving guide rod 51B also extends along the entire length of the spindle alignment at each side of the spinning frame, and a plurality of roving guide pins 51Bd are planted on the rod 51B facing each draft part 30.

The above-mentioned roving cutting means is provided with a function such that, when the roving guide rods 51Ab, 51Ac are relatively displaced along the lengthwise direction thereof and cause the guide pins 51Ab, 51Ac of the guide rod 51A to approach the corresponding guide pins 51Bd of the guide rod 51B, the rovings S1 which are supplied from the respective roving bobbins S of the bobbin carriage 9 supported by the transporting rail 5 (Fig. 9) are gripped by the corresponding guide pins 51Ab, 51Ac and the guide pins 51Bd of the corresponding draft parts 30, respectively. Accordingly, when the rod 51B is displaced in the left-hand direction in Fig. 19 for a distance corresponding to the intervening space between the pins 55a and 55b, each roving S1 is gripped by the respective pins 51Ab and the pins 51Bd, and thus the rovings S1, which are continuously introduced to the corresponding draft parts 30 by the continuous rotation of the draft rollers of each draft part, are separated from the gripped portion of the corresponding rovings S1.

In the first, second and third embodiments mentioned above, the following modification can be made. Namely, as a modification of the above embodiments, after the supplemental rovings S2 are introduced into the corresponding draft parts 30 respectively, together with the corresponding rovings S1, the spinning operation of the spinning frame is temporarily stopped and the rovings S1 are synchronously cut at the respective positions close upstream of the respective trumpets 39 of the corresponding draft parts 30, by a manual operation, and the spinning operation of the spinning frame is restarted after the completion of the manual operation. In the above modification, the spinning operation of the spinning frame can be automatically stopped by a signal indicating the most preferable time for stopping the drive of the spinning frame, or the drive of the spinning frame is topped by a manual switching. Therefore, in the above modification, the brake 42a, or the combination of the brake 42a and the roving cutting means 80 can be omitted.

The modification applied to the first, second and third embodiments mentioned above can be also applied to the fourth embodiment. That is, in this modification for cutting the rovings S1 which are supplied to the corresponding draft parts 30, the spinning operation of the spinning frame is temporarily stopped and the rovings S1 are successively cut at the respective positions upstream of the corresponding draft parts 30 by a manual operation, while the drive of the spinning frame is stopped, and after the completion of the above operation, the drive of the spinning frame is restarted so that the cut portions thereof, which remained at the side of the corresponding draft parts, are introduced to the corresponding draft parts. When the free ends of the above-mentioned portions of the

rovings S1 approach the respective positions upstream of the trumpets 39 of the corresponding draft parts 30, the clutch 42 is actuated to introduce the respective supplemental rovings S2 into the corresponding draft parts 30 together with the corresponding free ends of the above-mentioned cut portions of the corresponding rovings S1, and after the free ends of the rovings S1 are completely introduced into the corresponding draft parts 30, the reciprocal pneumatic cylinder 52 is actuated so that the line shaft 71 is displaced towards the left hand side in Fig. 1, and consequently, the guide pins 51b displace the corresponding supplemental rovings S2 towards the left hand direction in Fig. 1 so that the supplemental rovings S2 are released from the nipping action by the corresponding nip rollers 44a and the supplemental feed roller 40. Thereafter, the clutch 42 is disconnected so that the rotation of the supplemental feed roller 40 is stopped. Accordingly, the modified synchronous roving piecing operation applied to all of the draft parts 30 concerned is completed.

As is clear from the above explanation, according to the present invention, the roving piecing operation at the time of changing almost exhausted roving bobbins for the full packaged roving bobbins can be carried out within a very short time due to the application of the synchronous roving piecing method according to the present invention. Therefore, the roving piecing operation can be completed during the formation of a chase in a condition such that the ring rail takes a position close to the uppermost position of each chase formation where the spinning condition is stable, whereby possible yarn breakages are effectively prevented.

Moreover, since the time required to complete the roving piecing operation when changing the almost exhausted roving bobbins for the full packaged roving bobbins can be remarkably reduced, i.e., the above roving bobbin exchange operation can be carried out within a remarkably shorter time than in the conventional method, the working efficiency of the spinning frame can be remarkably improved. This is very advantageous when producing a coarse yarn.

Further, in the synchronous roving piecing operation according to the present invention, the supplemental rovings S2 are taken from the respective full packaged roving bobbins F of a bobbin carriage supported by a transporting rail of the spinning frame and held at the respective positions close to the corresponding rovings S1, which are supplied to the corresponding draft parts 30, before the roving bobbins S reach an almost exhausted condition, and accordingly, the time necessary to complete the operation of taking the supplemental rovings S2 from the respective full packaged roving bobbins F and carrying out the roving piecing operation is variable, and thus the roving bobbin exchange operation can be carried out under very free conditions in comparison with the conventional method.

Claims

1. A method of synchronously piecing rovings in a ring spinning frame provided with a plurality of spindles arranged in an alignment at each side thereof, a creel portion, two groups of draft parts consisting of an identical number of draft parts alternately arranged along the entire length thereof, in combination with a utilizing of a roving bobbin transporting system comprising a plurality of roving bobbin transporting rails disposed in parallel at said creel portion along an entire length of said spinning frame, each one of said transporting rails being capable of temporarily supporting a bobbin carriage holding a plurality of roving bobbins from which rovings are supplied to corresponding draft parts of said spinning frame, while others of said transporting rails being capable of temporarily supporting another bobbin carriage holding a plurality of full packaged roving bobbins, a number of said bobbin carriages being identical, wherein, when said roving bobbins held by said bobbin carriage supported by one of said transporting rails reach an almost exhausted condition, said rovings being fed from said almost exhausted roving bobbins are pieced with corresponding rovings taken from said full packaged roving bobbins respectively, comprising;

   a step of synchronously reserving free ends of said rovings taken from said full packaged rovings at respective positions facing corresponding rovings being fed from said roving bobbins at corresponding positions upstream of said draft parts of a corresponding group, after taking said rovings from said full packaged roving bobbins,

   a step of synchronously doubling said reserved free ends of said roving taken from said full packaged roving bobbins with respective rovings being fed to corresponding draft parts.

2. A method of synchronously piecing rovings in a ring spinning frame according to claim 1, further comprising;

   a step of synchronously cutting said rovings from said roving bobbins at corresponding positions upstream of said draft parts of said corresponding group, when said roving bobbins reach an almost exhausted condition, so that free ends of said rovings are created at said corresponding positions thereof, whereby said synchronously doubling of said reserved free ends of said roving taken from said full packaged roving bobbins is carried out with corresponding free ends of said rovings created by said cutting

operation,

3. A method of synchronously piecing rovings in a ring spinning frame according to claim 2, wherein said synchronous piecing operation is carried out while a spinning operation of said spinning frame is contained.

4. A method of synchronously piecing rovings in a ring spinning frame according to claim 1, further comprising;

a step of cutting said rovings from said roving bobbins at corresponding positions upstream of said draft parts of said corresponding group, after temporarily stopping a spinning operation of said spinning frame, whereby said synchronous doubling of said reserved free ends of said rovings created by said cutting operation is carried out, and thereafter, said ring spinning operation is restarted,

5. A method of synchronous piecing rovings in a ring spinning frame according to claim 1,

wherein a number of said transporting rails is two, and each one of said bobbin carriages is provided with a plurality of bobbin hangers arranged in two alignments along the lengthwise direction thereof, a number of said bobbin hangers of each alignment being identical to the number of draft parts of each one of said groups of draft parts, namely, half the number of spindles at each side of said spinning frame, whereby one of said bobbin carriages holds roving bobbins from which rovings are supplied to all draft parts at each side of said spinning frame, while the other one of said bobbin carriages holds full packaged roving bobbins.

6. A method of synchronously piecing rovings in a ring spinning frame according to claim 1,

wherein said number of said transporting rails is three, each of said bobbin carriages is provided with a plurality of bobbin hangers arranged in single alignment along the lengthwise direction thereof, said number of said bobbin hangers of each bobbin hanger being identical to the number of draft parts of each one of said group of draft parts, namely, half the number of spindles at each side of said spinning frame, whereby two steps of a taper arrangement of roving bobbins is applied to said spinning frame, whereln one of said bobbin carriages is utilized to support said bobbin carriage holding said full packaged roving bobbins, and said synchronous roving piecing operation is applied only to said roving bobbins of one of two other bobbin carriages which holds roving bobbins having a smaller size than the others.

7. An apparatus for a synchronous roving piecing operation applied to a ring spinning frame provided with a plurality of spindles arranged in an alignment at each side thereof, a creel portion, two groups of draft parts consisting of an identical number of draft parts alternately arranged along the entire length thereof, in combination with a roving bobbin transporting system comprising a plurality of roving bobbin transporting rails disposed in parallel at said creel portion along an entire length of said spinning frame, each one of said transporting rails being capable of temporarily supporting a bobbin carriage holding a plurality of roving bobbins from which rovings are supplied to corresponding draft parts of said spinning frame, while others of said transporting rails are capable of temporarily supporting other bobbin carriages holding a plurality of full packaged roving bobbins, a number of roving bobbins of said bobbin carriages being identical, a plurality of top arms arranged along said arrangement of said two groups of draft parts, each one of said top arms corresponding to two adjacent draft parts of said alignment of said draft parts, wherein when said roving bobbins held by said bobbin carriage supported by one of said transporting rails reach an almost exhausted condition, said rovings being fed from said almost exhausted roving bobbins are pieced with corresponding rovings taken from said full packaged roving bobbins, respectively, comprising;

a supplemental roving feed roller disposed at a position upstream of the alignment of said draft parts, each having a trumpet, a long said spindle alignment,

means for temporarily rotating and stopping said supplemental roving feed roller,

a plurality of pairs of nip rollers rotatably and displaceably arranged at respective positions facing corresponding draft parts in a condition such that each roving being supplied to a corresponding draft part passes through an intervening space between said two nip rollers of a corresponding pair,

means for supporting each pair of nip rollers,

each of said supporting means being disposed at said corresponding draft part while selectively pressing said nip rollers against said supplemental roving feed roller, and alternatively, releasing said contact of said nip rollers with said supplemental roving feed roller,

means for guiding respective running positions of said rovings being fed to corresponding draft parts and said rovings taken from corresponding full packaged roving bobbins at each one of said draft parts, said guide means being arranged at a position upstream of said supple-

mental roving feed roller and in parallel thereto,

means for reciprocally displacing said guide means along said spindle alignment.

8. An apparatus for synchronously piecing rovings applied to a ring spinning frame according to claim 7,

wherein said draft parts are provided with a common back roller and said supplemental roving feed roller is connected to said back roller by way of said temporarily rotating and stopping means comprising a clutch and a brake.

9. An apparatus for synchronously piecing rovings applied to a ring spinning frame according to claim 7,

wherein a lever is mounted on each one of said top arms and is swingable upward and downward, a supporting shaft is disposed at a free end portion of said lever while projecting from both outer sides of said lever, and said nip rollers are rotatably mounted on said supporting shaft at both sides thereof.

10. An apparatus for synchronously piecing rovings applied to a ring spinning frame according to claim 7,

wherein said guide means comprises a rod extended along the entire length of said spinning frame, and means for reciprocally displacing said rod by a predetermined distance along a lengthwise direction thereof, said rod being provided with a plurality of sets of three guide pins planted thereon at respective positions facing corresponding draft parts, said positions of said three pins of each set thereof being located such that two intervening spaces for guiding a single roving separately therethrough are formed between each two adjacent pins of said set of pins, and when one of said intervening spaces faces one of two nip rollers with respect to a corresponding draft yart, the other one of said intervening spaces faces an intervening position between said two nip rollers,

11. An apparatus for synchronously piecing rovings applied to a ring spinning frame according to claim 7,

wherein said guide means comprises a pair of rods extended along a lengthwise direction thereof, means for separately, reciprocally displacing said rods by a predetermined distance along the lengthwise direction thereof one of said rods being provided with a plurality of sets of three guide pins planted thereon at respective positions facing corresponding draft parts of one group of draft parts of said two groups of draft parts, while the other one of said rods is provided with a plurality sets of three guide pins planted thereon at respective positions facing corresponding draft parts of the other group of draft parts of two groups of draft parts, the positions of said three pins of each set thereof planted on each one of said rod being located such that two intervening spaces for guiding single rovings separately therethrough are formed between each two adjacent pins of said set of pins, and when one of said intervening spaces faces one of two nip rollers with respect to corresponding draft part, the other one of said intervening spaces faces an intervening position between said two nip rollers.

12. An apparatus for synchronously piecing rovings applied to a ring spinning frame according to claim 7,

wherein said guide means comprises a line shaft, disposed at a position upstream of said alignment of said draft parts in parallel thereto, means for turning said line shaft about the axis thereof while being reciprocally displaced by a predetermined distance along a lengthwise direction thereof, said line shaft being provided with two groups of roving guide grooves formed thereon in a condition such that an angular phase difference between said roving guide groove of one of said groups and said roving guide groove of the other one of said groups is 180 degrees, said roving guide grooves of one of said two groups face corresponding draft parts of one of said groups of draft parts, said roving guide grooves of the other one of said two groups face corresponding draft parts of the other one of said draft part, whereby when said guide grooves of one of said two groups of roving guide grooves face the corresponding draft parts of one of said two groups of said draft parts, said guide grooves of the other one of said two groups face an intervening space formed between said pair of said nip rollers facing corresponding draft parts of the other one of said two groups of said draft parts.

13. An apparatus for synchronously piecing roving applied to a ring spinning frame provided with a plurality of spindles arranged in an alignment at each side thereof, a creel portion, two groups of draft parts consisting of an identical number of draft parts alternately arranged along the entire length thereof, in combination with a roving bobbin transporting system comprising a plurality of roving bobbin transporting rails disposed in parallel at said creel portion along an entire length of said spinning frame, each one of said transporting rails being capable of temporarily supporting a bobbin carriage holding a plurality of roving bobbins from which rovings are supplied to corresponding draft parts of said spinning frame, while

others of said transporting rails are capable of temporarily supporting other bobbin carriages holding a plurality of full packaged roving bobbins, a number of both of said bobbin carriages being identical, a plurality of top arms arranged along said arrangement of said two groups of draft parts, each one of said top arms corresponding to two adjacent draft parts of said alignment of said draft parts, wherein when said roving bobbins held by said bobbin carriage supported by one of said transporting rails reach an almost exhausted condition, said rovings being fed from said almost exhausted roving bobbins are pieced with corresponding rovings taken from said full packaged roving bobbins respectively, comprising;

a supplemental roving feed roller disposed at a position upstream of said alignment of said draft parts,

means for temporarily rotating and stopping said supplemental roving feed roller,

a horizontal shaft mounted on each of said top arms,

a plurality of pairs of nip rollers rotatably mounted on a corresponding one of said horizontal shafts of said top arms in a condition such that one of each pair of nip rollers faces one of a corresponding pair of said draft parts while the other one of each pair of nip rollers faces the other one of a corresponding pair of said draft parts, in a condition such that said nip rollers are selectively pressed against said supplemental roving feed roller and alternately released from the contact with said nip rollers with said supplemental roving feed a roller,

a line shaft disposed at a position upstream of said alignment of said draft parts in parallel thereto,

means for turning said line shaft about the axis thereof while being reciprocally displaced by a predetermined distance along a lengthwise direction thereof,

said line shaft being provided with two pairs of roving grooves formed thereof in a condition such that an angular phase difference between said roving groove of one of said groups and said roving guide groove of the other one of said groups is 180 degrees, said roving guide grooves of one of said two groups facing corresponding draft parts of one of said groups of draft parts and said roving guide groove of the other one of said two groups facing corresponding draft parts of the other one of said draft parts,

means for synchronously cutting rovings which are fed to corresponding draft parts of said groups of draft parts, said cutting means functioning in cooperation with said corresponding roving guide grooves of said line shaft.

Fig. 1

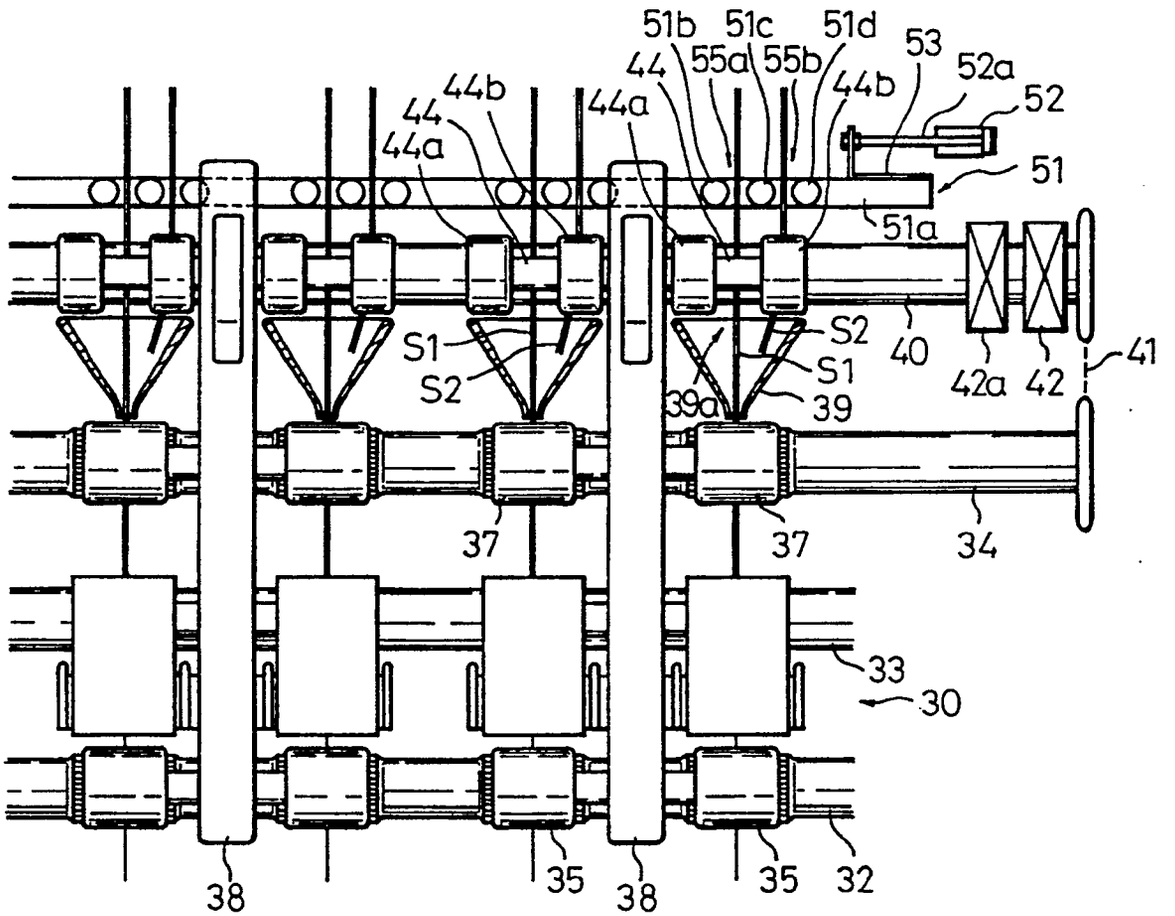

51b
51c
51d
53
52a
52
44
55a
55b
44b
44b
44
44a
44a
51
51a
S1
S2
S2
S1
40
41
42a
42
39a
39
37
37
34
33
30
38
35
38
35
32

Fig. 2

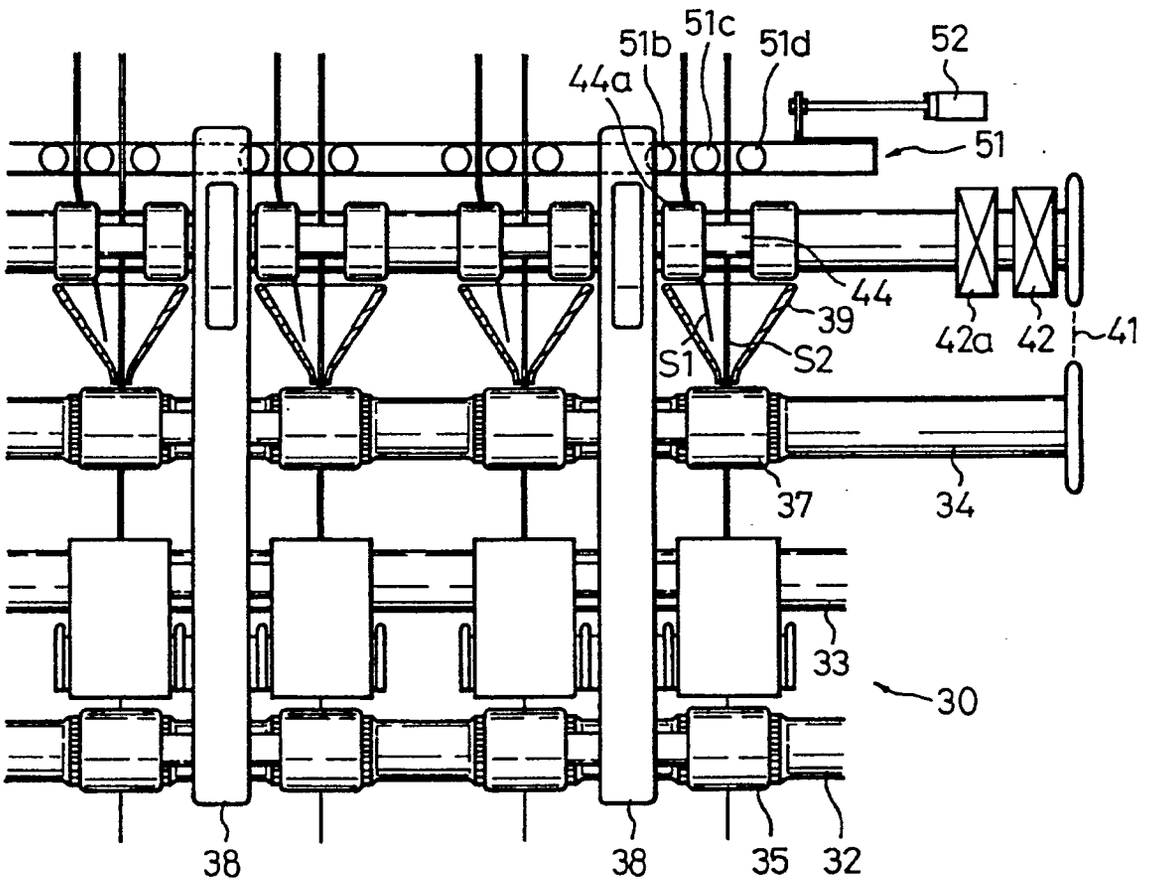


Fig. 4

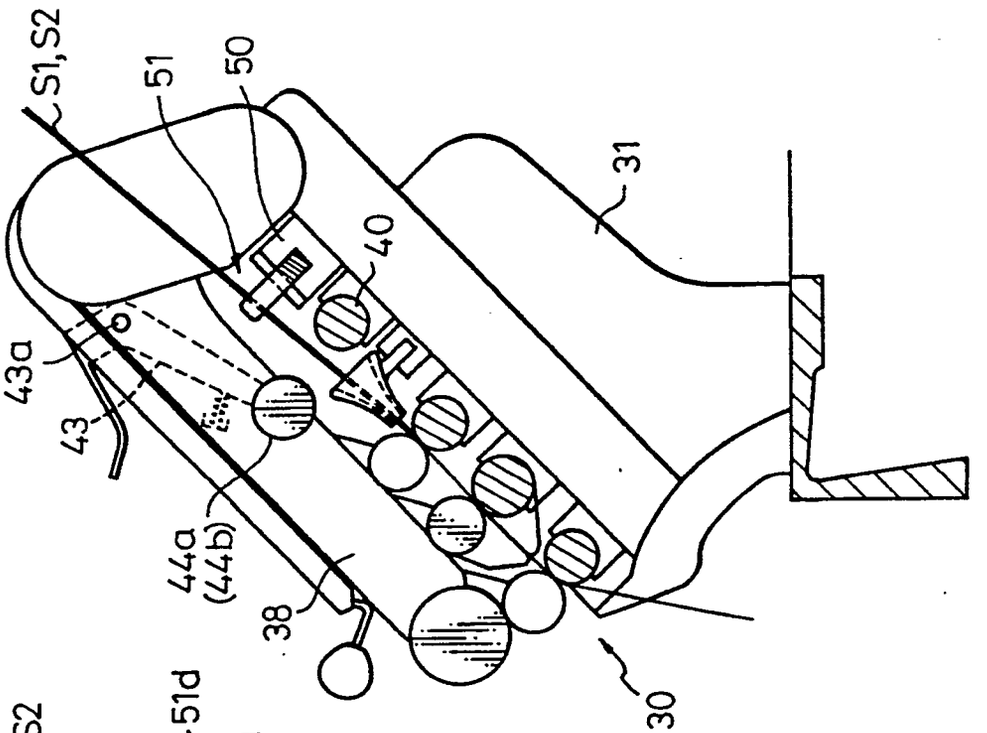

S1,S2
51
50
31
40
43a
43
44a
(44b)
38
30

Fig. 3

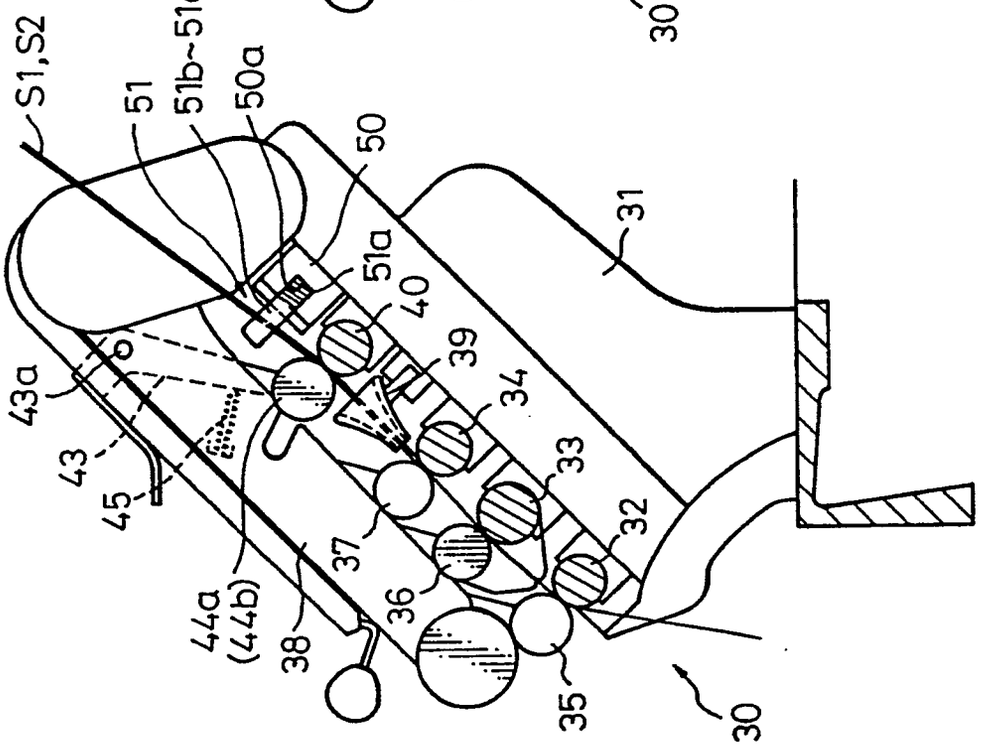

S1,S2
51
51b~51d
50a
50
31
51a
40
39
34
33
43a
43
45
32
37
36
44a
(44b)
38
35
30

Fig. 5

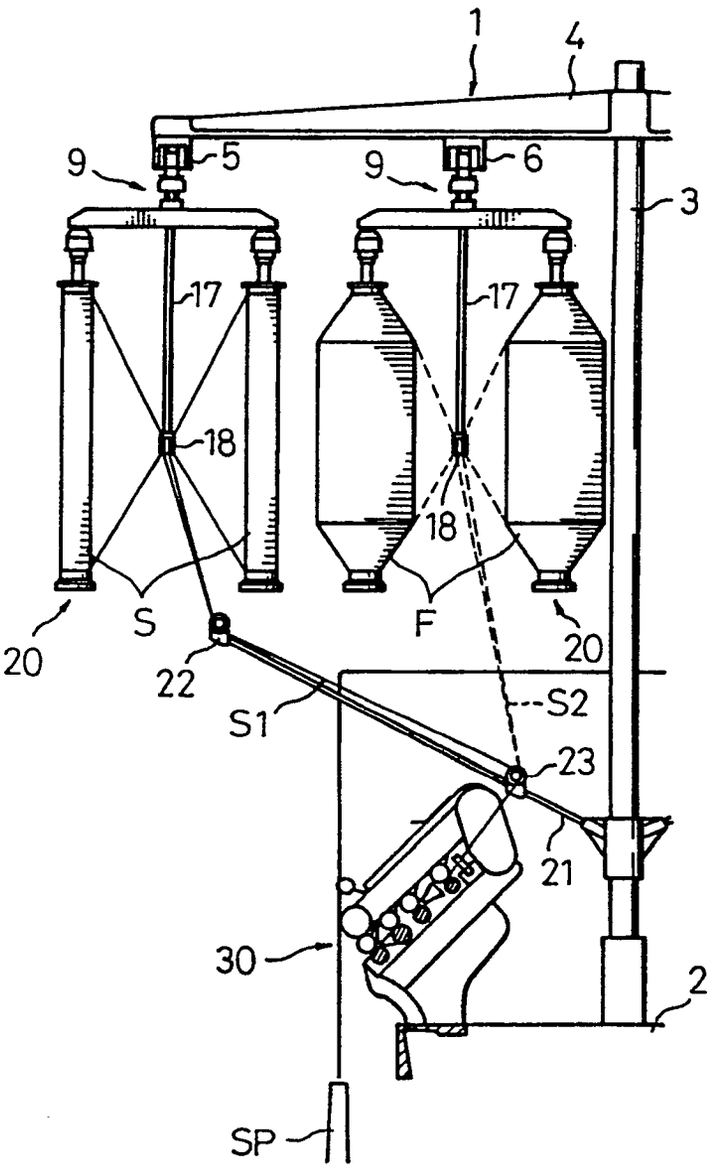


Fig. 6

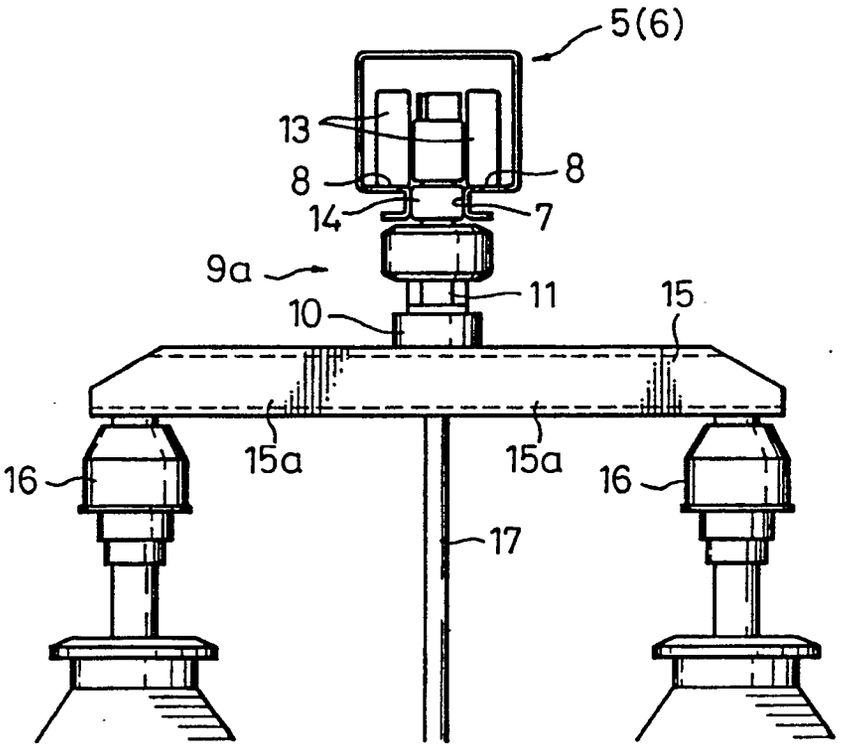


Fig. 7

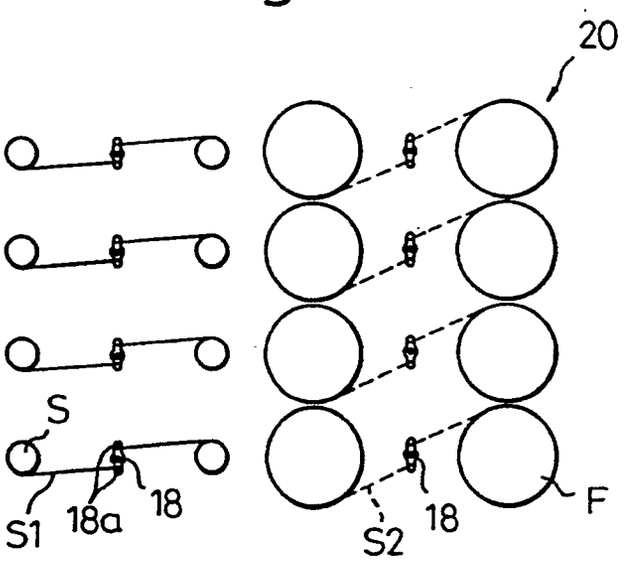


Fig. 9

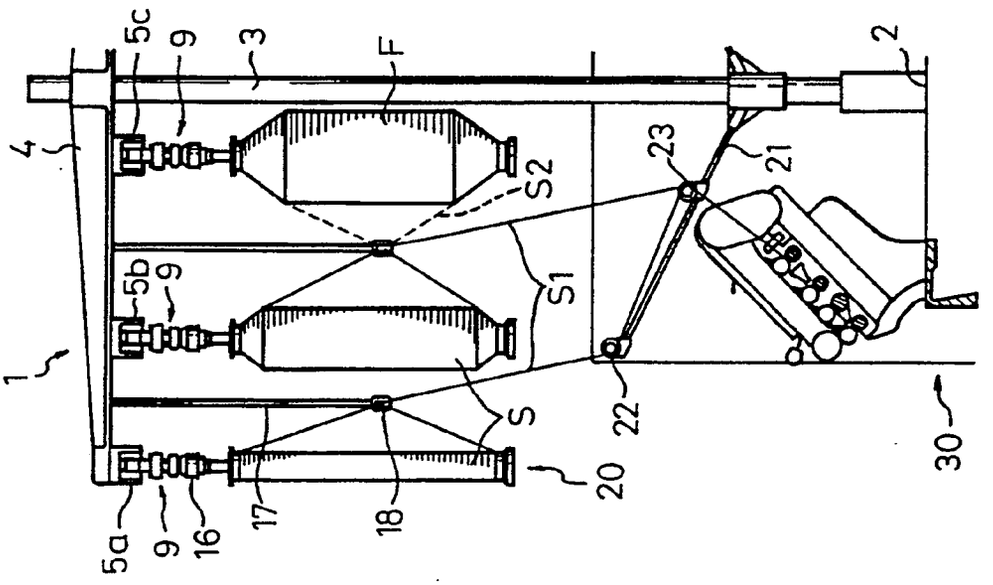

5c
9
3
F
2
4
S2
23
21
5b
9
S1
1
S
22
30
20
5a
9
16
17
18

Fig. 8

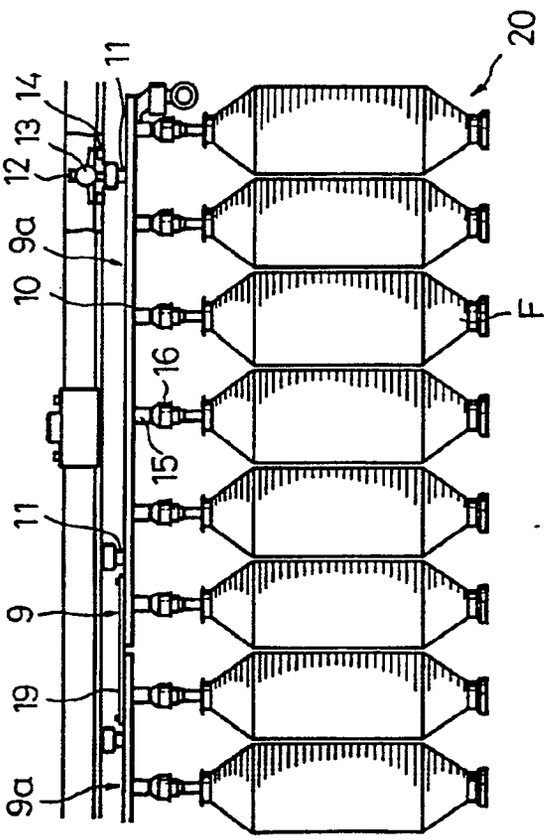

20
11
14
13
12
9a
10
F
16
15
11
9
19
9a

Fig. 10

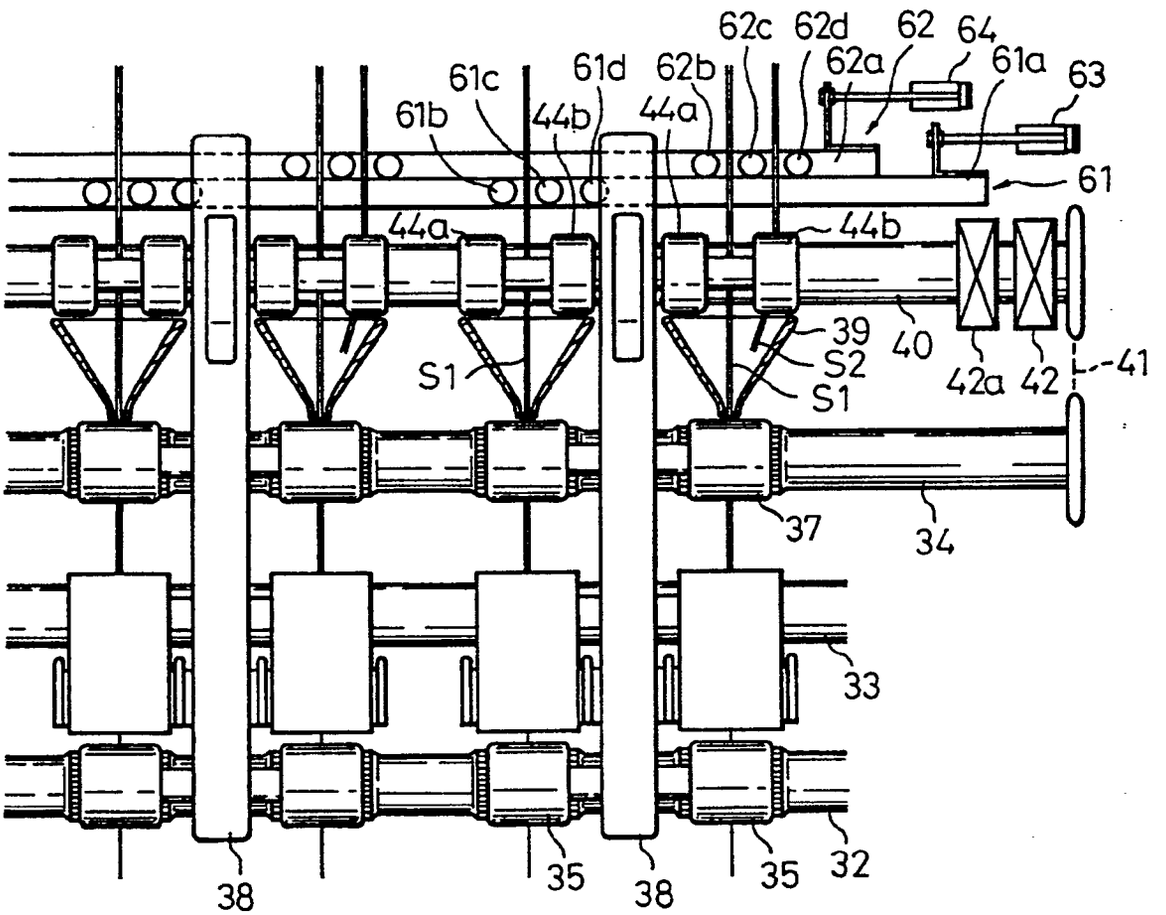

62c
62d
62
64
62a
61a
63
61c
61d
62b
61b
44b
44a
61
44a
44b
39
40
S1
S2
S1
42a
42
41
37
34
33
38
35
38
35
32

Fig.11

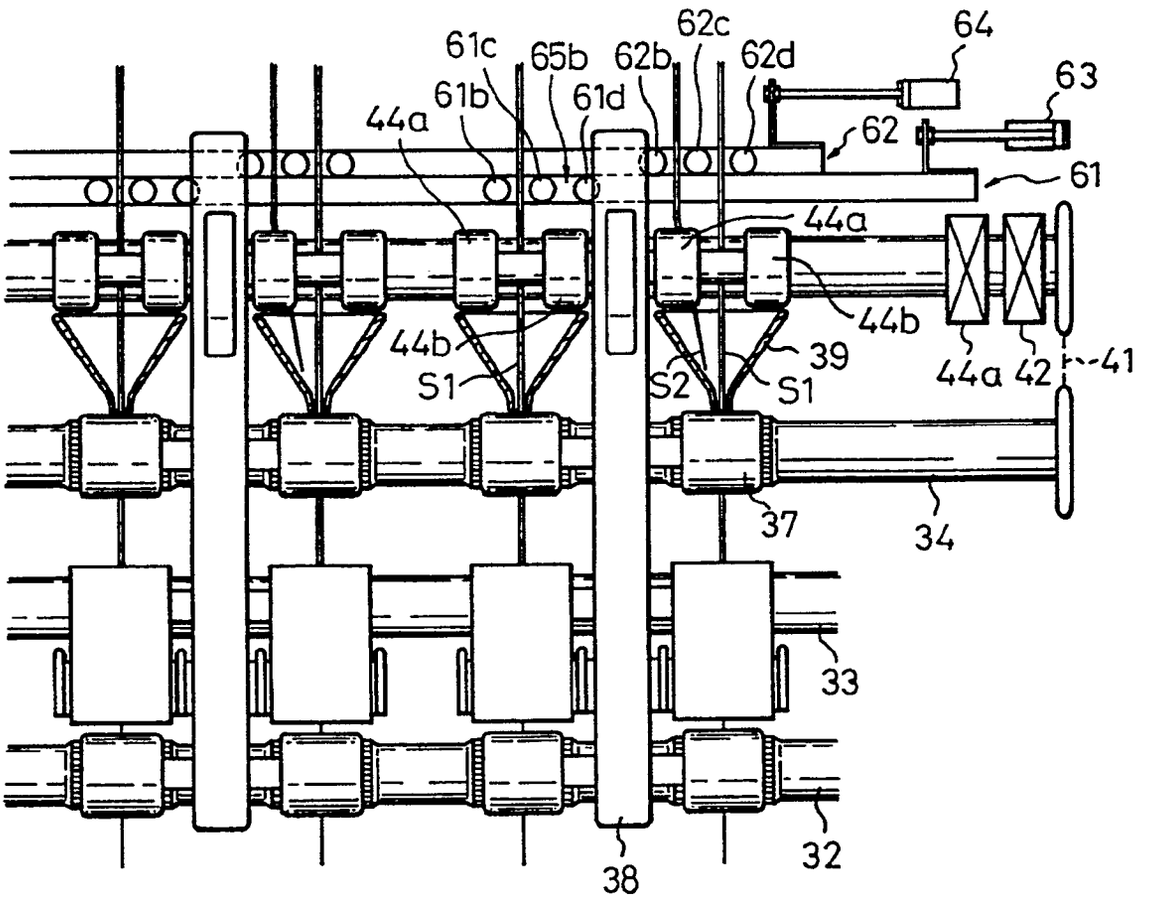

61c
65b
62b
62c
62d
64
63
61b
61d
44a
62
61
44a
44b
44b
39
S1
S2
S1
44a
42
41
37
34
33
32
38

Fig. 12

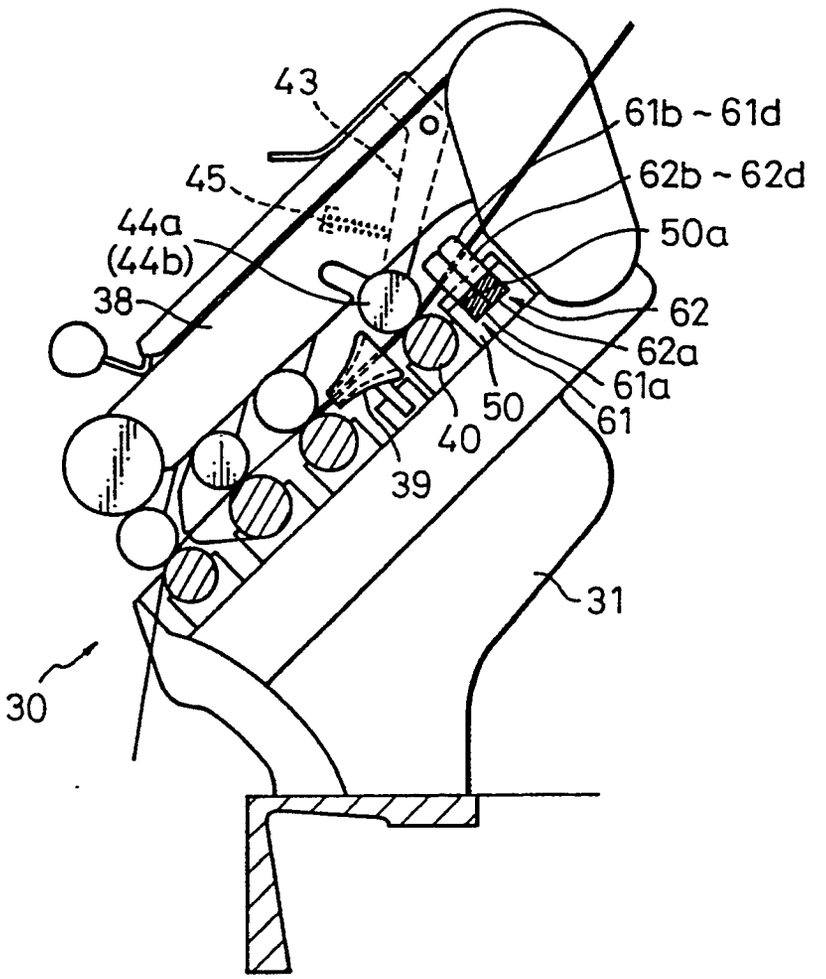


Fig.13

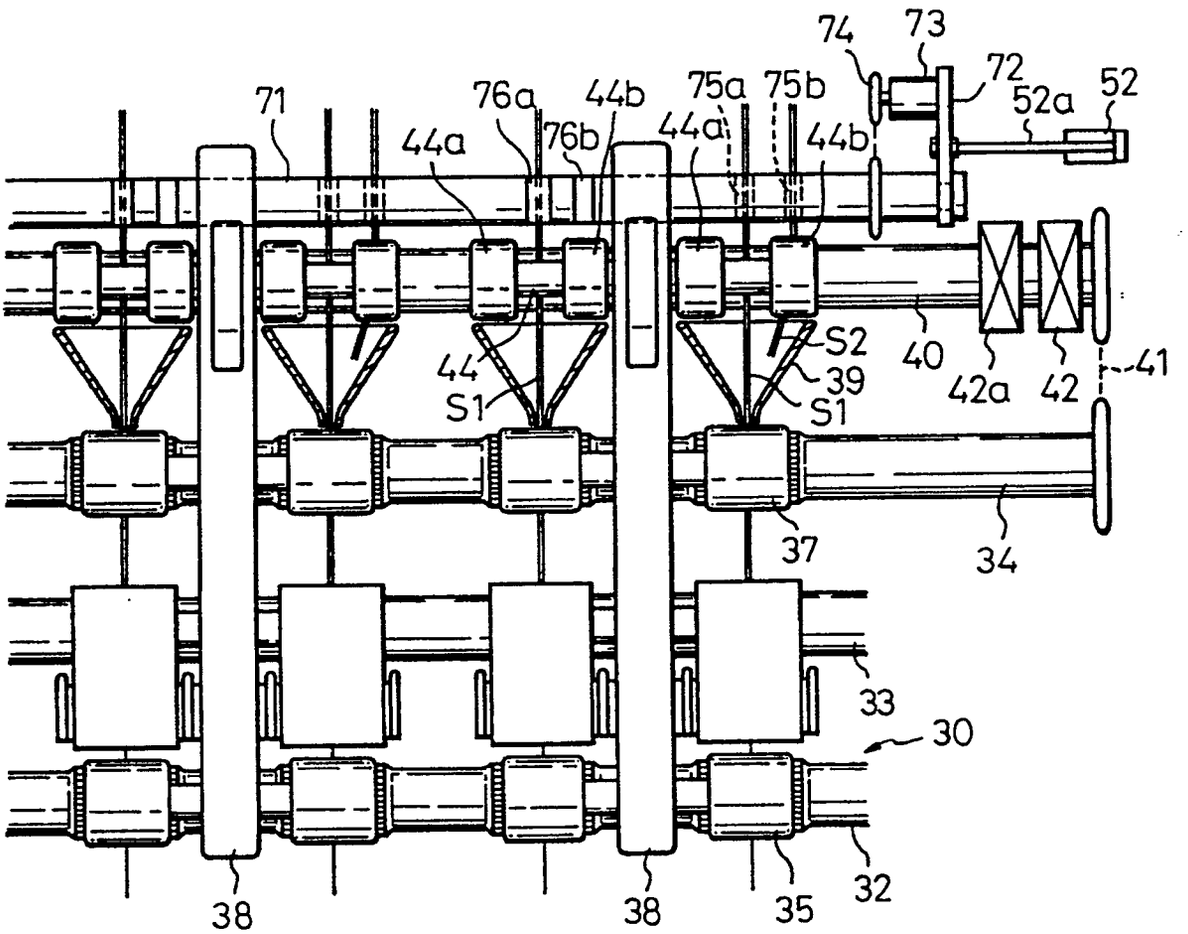

74
73
72
52a
52
71
76a
44b
75a
75b
44a
76b
44a
44b
S2
40
44
S1
39
S1
42a
42
41
37
34
33
30
38
38
35
32

Fig. 14

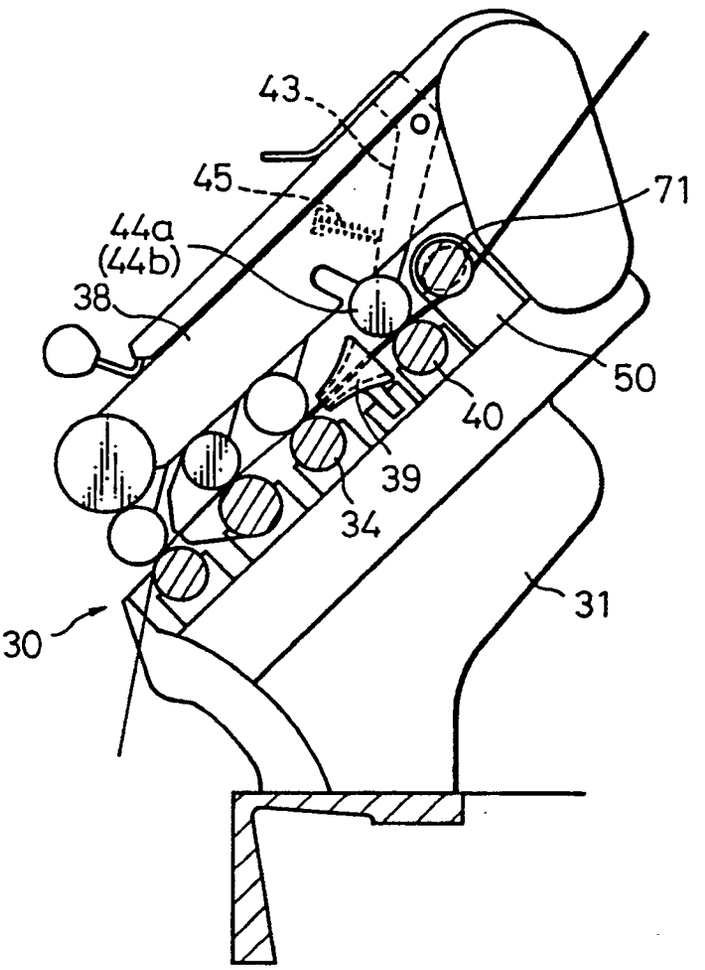


Fig. 15

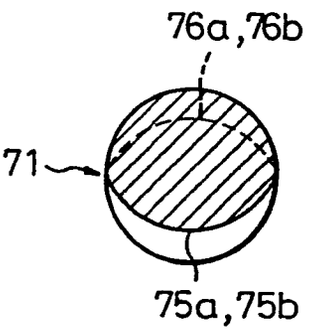


Fig. 16

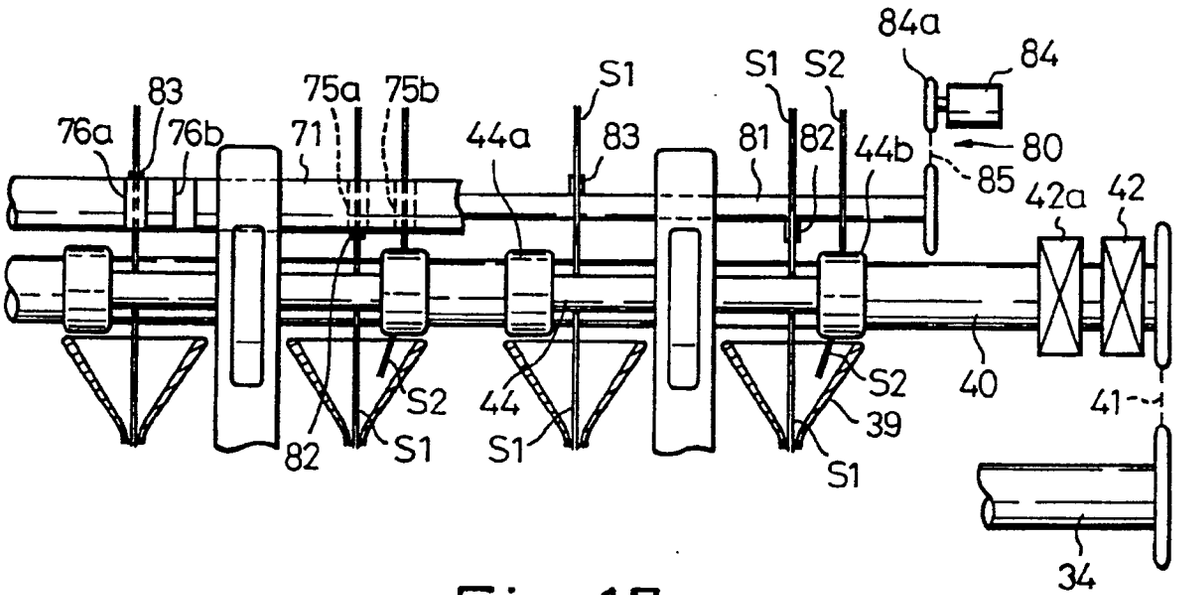

84a
84
S1
S1 S2
83
75a 75b
76a
76b
71
44a
83
81
82
44b
80
85
42a
42
S2
44
40
41
S2
39
82
S1
S1
S1
34

Fig. 17

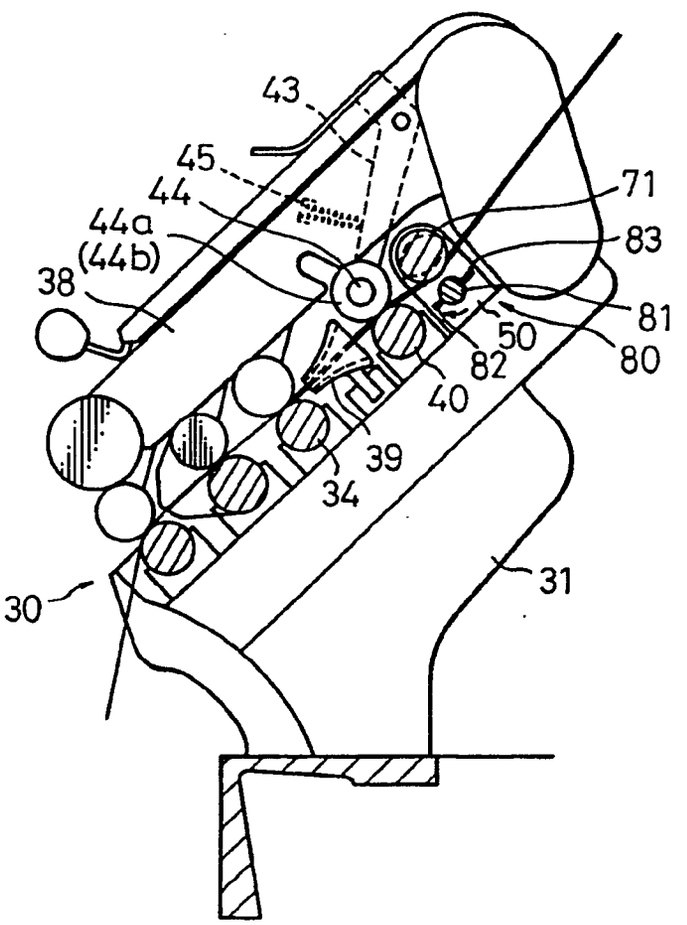

43
45
44
44a
(44b)
38
71
83
81
50
82
80
40
39
34
30
31

Fig. 18

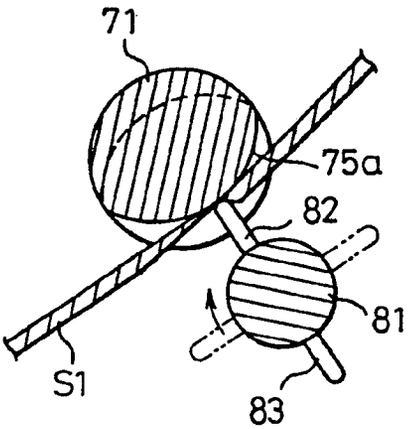
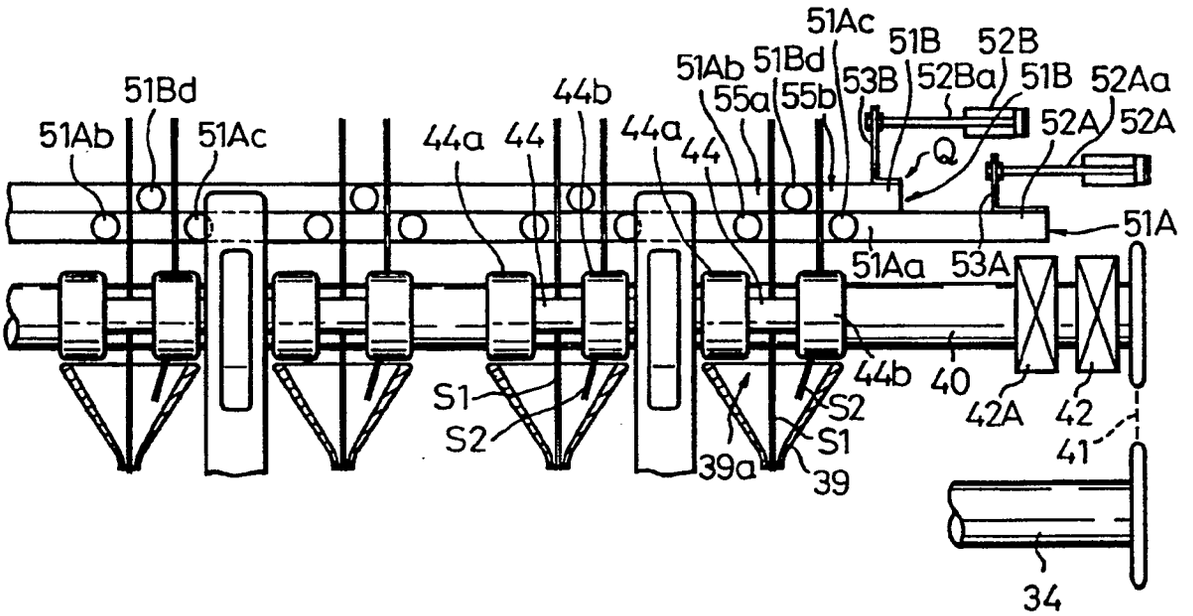

71
75a
82
81
S1
83

Fig. 19


51Ac
51B
52B
51Bd
51Ab
55a
55b
53B
52Ba
51B
52Aa
51Bd
44b
52A
52A
51Ab
51Ac
44a
44
44a
44
Q
51A
51Aa
53A
44b
40
S1
S2
S2
S1
39a
39
42A
42
41
34