



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
23.10.2002 Bulletin 2002/43

(51) Int Cl.7: **D01H 5/34, D01H 5/44**

(21) Application number: **01109364.8**

(22) Date of filing: **17.04.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR
 Designated Extension States:
AL LT LV MK RO SI

- **Kodama, Kazuyasu**
Ogaki-shi, Gifu-ken 503-0014 (JP)
- **Hayano, Thuyoshi**
Ogaki-shi, Gifu-ken 503-0033 (JP)

(71) Applicant: **Hara Corporation**
Gifu-ken 503-2426 (JP)

(74) Representative: **Maiwald Patentanwalts GmbH**
Elisenhof
Elisenstrasse 3
80335 München (DE)

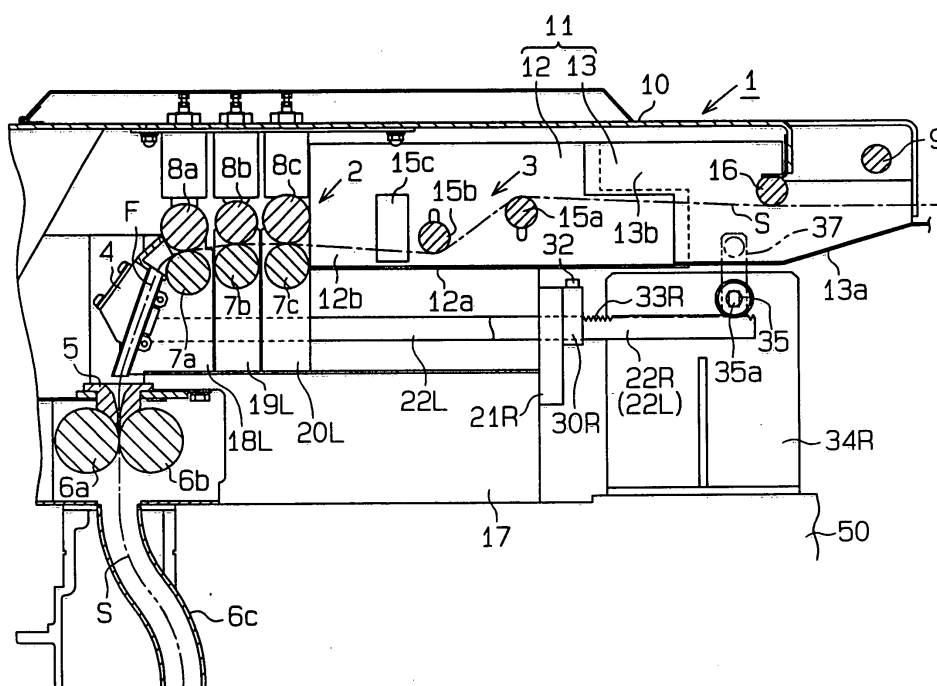
(72) Inventors:
 • **Kobori, Seiji**
Ogaki-shi, Gifu-ken 503-0995 (JP)

(54) **Drafting apparatus**

(57) A drafting apparatus includes a pair of first slides, a pair of second slides, and a pair of third slides. The draft apparatus includes a pair of roller stands. A pair of outer rods are fixed to the second slides. A pair of inner rods are fixed to the third slides. An adjusting shaft has pinions. Racks are formed on the outer rods.

The racks mesh with the pinions. The outer and inner rods are fixed to the roller stands at locations that are rearward of the third slides. When the adjusting shaft is rotated, the outer rods move simultaneously. This is capable of facilitating the gauge adjustment and of making adjustment device relatively small.

Fig.1



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a drafting apparatus for a spinning machine, and more particularly, to a drafting apparatus that includes a gauge adjuster for sliding a supporting member that supports a bottom roller on a roller stand to change the position.

[0002] In a drafting apparatus for a spinning machine, it is necessary to adjust the distance (gauge) between draft rollers, gripping force (load) of the draft rollers, distribution of draft depending on the type of fiber to be spun, the length of the fiber, the amount of fiber to be supplied, and the degree of parallelism of the fiber to a tensioning direction, to impart an optimal draft.

[0003] A drafting force has a certain limit when a bundle of fibers having a constant strength is drafted with a certain roller gripping force. With a roller gauge, which tends to provide an extremely strong drafting force, the drafting effect is reduced, which increases the likelihood that draft spots will occur. Conversely, with an extremely weak drafting force, the cohesion of fibers is reduced, which causes draft spots. Therefore, for drafting, the roller gauge, load and draft are set to provide a proper drafting force based on experience, experimental spinning and so on.

[0004] A drafting unit of a drafting apparatus includes a plurality of positively rotated bottom rollers. Top rollers are arranged in respective correspondence with the bottom rollers. The top rollers and bottom rollers are arranged in pairs to constitute draft rollers. Each of the top rollers is held in contact with the associated bottom roller. Each of the bottom rollers is supported by a pair of roller slides and driven. Each of the roller slides is fixed on a roller stand such that its position (gauge) can be adjusted.

[0005] For adjusting and changing the gauge in the drafting apparatus, bolts securing respective roller slides to their roller stands are loosened to permit the respective roller slides to move, so that the distances between a front and a second bottom roller and between a second and a third bottom roller are adjusted based on the front bottom roller. The gauges between the respective bottom rollers are determined by measuring gaps between the respective roller slides and the distances between the respective bottom rollers with an instrument such as a slide caliper or a plate gauge.

[0006] In multiple-type small-lot productions, the type of spinning sliver is often changed. It takes much time to change the roller gauge, since a number of steps are required as described above. For this reason, apparatuses for facilitating the gauge adjustment have been proposed.

[0007] For example, Japanese Unexamined Patent Publication No. Hei 1-156522 discloses a back roller gauge adjusting mechanism 71 for a spinning machine as illustrated in Fig. 7. In the adjusting mechanism 71,

each back slide 72 is provided with a swing lever 74 and a swing bar 73. The swing levers 74 are fixed to a swing shaft 75, which extends in the longitudinal direction of the spinning machine. The swing shaft 75 is coupled to a braked motor 77 through ball screws 76, so that the back slides 72 can be moved in a lateral direction of the spinning machine. Cylinders 79 are also provided for fastening or loosening fixing screws (not shown) for fixing the back slides 72 to the associated roller stand 78. As the braked motor 77 is driven, each back slide 72 is moved to a predetermined position on the roller stand 78 by the associated swing lever 74. Also, fastening and loosening the fixing screws for fixing the back slides 72 to the roller stands 78 are performed by levers (not shown) that are driven by the cylinders 79.

[0008] Japanese Unexamined Patent Publication No. Hei 9-157965 discloses a drafting apparatus 81, which is illustrated in Fig. 8. This drafting apparatus 81 includes front, middle and back bearings 82, 83, 84, respectively, which have holes 82a, 83a, 84a for supporting bottom rollers (not shown), and grooves 82b, 83b, 84b for supporting top rollers (not shown), respectively. The middle bearing 83 and the back bearings 84 are fixed to connecting rods 86a, 86b with screws 87. The connecting rods 86a, 86b extend in the longitudinal direction of a base 85. The middle bearing 83 and the back bearings 84 can slide along a sliding surface 85a formed on the base 85.

[0009] The front bearing 82 is fixed to the base 85. The base 85 is provided with a clamp 88 behind the rear-most back bearing 84. The connecting rods 86a, 86b are arranged to move in a longitudinal direction of the base 85 along guide portions (not shown) formed on the front bearing 82 and the clamp 88, and are fixed to the clamp 88 with a clamping screw 89 of the clamp 88. Each connecting rods 86a, 86b is connected to corresponding bearings 83, 84, respectively. The connecting rods 86a, 86b include a coupler 90 on the rear side of the base 85. The coupler 90 includes a threaded hole (not shown). Each of two screw rods 91 is threaded into the corresponding threaded hole. Each screw rod 91 is driven by a corresponding driving rod 92 through a toothed pulley (not shown) and a toothed belt (not shown). When the screw rods 91 rotate, the corresponding connection rod 86a, 86b is moved in the longitudinal direction of the base 85. The positions of the respective bearings 83, 84 are thus changed by the connecting rods 86a, 86b.

[0010] The gauge adjusting mechanism 71 of Fig. 7 can move the back slide 72 to adjust the gauge without human intervention. For this reason, the time consuming gauge adjustment is facilitated. However, a plurality of the swing levers 74 are required for moving the back slides 72, and a plurality of levers are also required for fastening and loosening the fixing screws. In addition, the swing levers 74 and the levers must be arranged at predetermined intervals in the longitudinal direction of the base such that they do not interfere with each other.

This requires much space. Furthermore, for moving the roller stand 78 in a similar manner to the back slides 72, swing levers 74 and other levers and driving mechanisms for driving them must be additionally provided. Thus the structure is complicated, and a large space is required.

[0011] With a structure which has a long back roller and a plurality of back slides arranged at predetermined intervals, as provided in a fine spinning machine, a back slide to which a swing bar is coupled and a back slide provided with fixing screws for fixing a roller stand can be arranged separately. However, with a short back roller, as provided in drawing machines, employment of the structure described above would result in an excessively high proportion of space occupied by the roller stand and the back slide to the space occupied by the back roller.

[0012] In the apparatus 81 of Fig. 8, the connecting rods 86a, 86b are fixed to the base 85 by the clamp 88. With this apparatus 81, therefore, it is not necessary to manipulate, during adjustment of the gauge, the screw 87, which is difficult to loosen and fasten. However, a plurality of screw rods 91, equal to the number of connecting rods 86a, 86b, are required. This increases costs. In addition, a large space is required for installing the driving mechanism for independently driving each pair of connecting rods 86a, 86b. This increases the size of the apparatus.

BRIEF SUMMARY OF THE INVENTION

[0013] It is an object of the present invention to provide a drafting apparatus for a spinning machine that is capable of facilitating the gauge adjustment and is relatively small.

[0014] To achieve the above objective, the present invention provides a drafting apparatus. The drafting apparatus includes a drafting portion having a first, a second and a third bottom rollers, which are positively rotated and arranged from rearward to frontward in the running direction of slivers. A pair of roller stands support the first, the second and the third bottom rollers. A plurality top rollers are arranged to cooperate with the bottom rollers. The top rollers are pressed against the bottom rollers, respectively. A fiber supplying portion is located rearward of the draft portion for supplying the slivers to the drafting portion. A pair first supporting members support the first bottom roller. A pair of second supporting members support the second bottom roller. A pair of third supporting members support the third bottom roller. The first, the second and the third supporting members are arranged in opposite order in the running direction of the slivers. The second and the third supporting members contact each other and are located on the roller stands to move in a direction perpendicular to the axes of the bottom rollers. A plurality of movable guide members are perpendicular to the axes of the bottom rollers and are supported by the first supporting

member. A plurality of fixed guide members have a plurality of first guide portions. The first guide portions guide the movable guide members in a direction perpendicular to the axes of the bottom rollers. A plurality of fixing means fix the movable guide members to the roller stands at locations that are rearward of the third supporting members. driving means move the second supporting members or the third supporting members with the movable guide members.

[0015] Other aspects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

[0016] The present invention, together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

Fig. 1 is a partial side view of a drafting apparatus according to a first embodiment of the present invention;

Fig. 2 is a partial plan view of a drafting unit;

Fig. 3(a) is a cross-sectional view illustrating a state in which only a first pinion meshes with a corresponding rack;

Fig. 3(b) is a cross-sectional view illustrating a state in which first and second pinions mesh with corresponding racks;

Fig. 4 is a partial side view illustrating a driver for bottom rollers;

Fig. 5 is a plan view for explaining the action of the drafting unit in Fig. 2;

Fig. 6 is a cross-sectional view illustrating guide portions in a second embodiment;

Fig. 7 is a perspective view of a gauge adjusting mechanism in the prior art; and

Fig. 8 is a cross-sectional view of a drafting apparatus in the prior art.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0017] In the following, a first embodiment of a drafting apparatus for a drawing machine will be described with reference to Figs. 1 through 5. As illustrated in Fig. 1, a drafting apparatus 1 includes a drafting unit 2, a fiber feeder 3, a gatherer 4, a trumpet 5, and a pair of calendar rollers 6a, 6b. The fiber feeder 3 is located upstream of the drafting unit 2 (on the right side in Fig. 1). The gatherer 4 and the trumpet 5 are located downstream of the drafting unit 2. Both calendar rollers 6a, 6b are located downstream of the trumpet 5. Below the calendar rollers

6a, 6b, a known coiler wheel (coiler tube) 6c is located for guiding a sliver S compressed by the calendar rollers 6a, 6b to a coiler can (not shown). Assume that in Fig. 1, the right side is the rear and the left side is the front.

[0018] The draft unit 2 includes a plurality (three in this embodiment) of positively rotated first, second, third bottom rollers 7a - 7c, and first, second, third top rollers 8a - 8c, which correspond to the respective bottom rollers 7a - 7c. The first, second, third top rollers 8a - 8c are pressed against the first, second, third bottom rollers 7a - 7c, respectively, by an urging mechanism (not shown). A cover 10 is supported for pivotal movement about a pivot shaft 9, which is located behind the fiber feeder 3. The first, second, third top rollers 8a - 8c are mounted in the cover 10.

[0019] The fiber feeder 3 is provided with a sliver guide 11 for imparting a tension of a predetermined value to a sliver S being fed into the drafting unit 2. The sliver guide 11 includes a front section 12 located, which is near the drafting unit 2, and a rear section 13, which is located behind the front section 12. The rear section 13 is fixed at a predetermined position on a base. The front section 12 is supported by a supporting bracket, not shown, for movement along a running direction of the sliver S, so that its position is adjustable with respect to the running direction of the sliver S. As illustrated in Fig. 4, the front section 12 is coupled to rear slides 20R, 20L through a coupling member 14.

[0020] Each of the sections 12, 13 has a substantially U-shaped cross section, and has a bottom plate 12a, 13a and a pair of side plates 12b, 13b, respectively. The side plate 12b of the front section 12 is positioned outside the side plate 13b of the rear section 13, and the bottom plate 12a of the front section 12 is positioned below the bottom plate 13a of the rear section 13. The front section 12 is movable in this state. Thus, the sliver guide 11 is telescopic.

[0021] The front section 12 of the sliver guide 11 is provided with a plurality (two in this embodiment) of guide bars 15a, 15b that extend in the lateral direction and are vertically adjustable. A pair of width restriction guides 15c is positioned in front of the guide bar 15b. One guide bar 16 is fixed at a predetermined position in the rear section 13.

[0022] As illustrated in Figs. 1 and 2, on a pair of roller stands 17 fixed on a base frame 50, a first pair of movable slides 18L, 18R are fixed at predetermined positions with bolts (not shown). Behind the first slides 18L, 18R, a second pair of movable slides 19L, 19R, and a third pair of movable slides 20L, 20R are arranged.

[0023] Behind the third pair of slides 20L, 20R, fixed guide members 21L, 21R are located at the rear end of the roller stands 17. The bottom rollers 7a - 7c are rotatably supported by the respective pairs of slides 18L, 18R; 19L, 19R; 20L, 20R. A groove (not shown) is formed in the bottom of each of the slides 18L - 20R. The groove engages an upper portion of the roller stand 17 for positioning in the lateral direction.

[0024] Fixed to each of the slides 19L, 19R, 20L, 20R are a pair of outer rods 22L, 22R and a pair of inner rods 23L, 23R, respectively, which are perpendicular to the respective bottom rollers 7a - 7c.

[0025] Each of the outer rods 22L, 22R extends through fitting holes 24 formed through each of the slides 19L, 19R of the second pair, and each is fixed to one of the slides 19L or 19R of the second pair with a bolt (not shown). Each of the inner rods 23L, 23R extends through fitting holes 25 formed through each of the third slides 20L, 20R, and each is fixed to one of the slides 20L or 20R of the third pair with a bolt (not shown).

[0026] The first pair of slides 18L, 18R has front guide portions 26, which engage with the outer rods 22L, 22R and the inner rods 23L, 23R to guide them in a direction perpendicular to the first, second, third bottom rollers 7a - 7c. The pair of fixed guide members 21L, 21R is provided with rear guide portions 27, which engage with the respective outer rods 22L, 22R and the respective inner rods 23L, 23R to guide them in the direction perpendicular to the first, second, third bottom rollers 7a - 7c. The rear guide portions 27 are opposite to the respective front guide portions 26. Both guide portions 26, 27 have through holes in which a liner (metal bushing) is fitted. Each of the outer rods 22L, 22R and each of the inner rods 23L, 23R is in engagement with both guide portions 26, 27 at all times.

[0027] Each of the slides 19L, 19R of the second pair is provided with a first intermediate guide portion 28 for allowing the inner rods 23L, 23R to slide horizontally. The slides 20L, 20R of the third pair are provided with second intermediate guide portions 29 for allowing the outer rods 22L, 22R to slide horizontally state. Each of the guide portions 28, 29 is provided with a through hole in which a liner is fitted.

[0028] Behind the fixed guide members 21L, 21R, stop brackets 30L, 30R, 31L, 31R are arranged in correspondence with the outer rods 22L, 22R and the inner rods 23L, 23R. Each stop brackets 30L, 30R, 31L, 31R has a through hole corresponding to the guide portions 27. The outer rods 22L, 22R and the inner rods 23L, 23R pass through the respective through holes, and are fastened with bolts 32, thereby fixing the outer rods 22L, 22R and the inner rods 23L, 23R to prevent their movement relative to the roller stand 17. In this embodiment, the respective stop brackets 30L, 30R, 31L, 31R and the bolts 32 constitute fixing means.

[0029] On the top surface of each of the outer rods 22L, 22R, each of the racks 33L, 33R is positioned in front of the stop bracket 30L or 30R with each of the second slides 19L, 19R placed at the rearmost position. Behind the fixed guide members 21L, 21R, a pair of supporting brackets 34L, 34R are located. Between the supporting brackets 34L, 34R, an adjusting shaft 35 is supported. The adjusting shaft 35 is perpendicular to the rods 22L, 22R and extends laterally for a greater distance than the top rollers 8a - 8c by a predetermined value.

[0030] The adjusting shaft 35 has two pinions 36L, 36R, which mesh with the racks 33L, 33R, respectively. The first pinion 36R is longer axially than the second pinion 36L. The adjusting shaft 35 is located such that it can be adjusted to a first position, at which both pinions 36L, 36R mesh with the corresponding racks 33L, 33R, and a second position, at which only the first pinion 36R meshes with the first rack 33R. In this embodiment, the axial length of the second pinion 36L is substantially one half that of the first pinion 36R.

[0031] As illustrated in Fig. 1, the adjusting shaft 35 has a fitting portion 35a at an end. A handle 37 is fitted to the fitting portion 35a for rotating the adjusting shaft 35. In this embodiment, both racks 33L, 33R, both pinions 36L, 36R, the adjusting shaft 35 and handle 37 constitute a driving mechanism for integrally moving the pair of outer rods 22L, 22R longitudinally.

[0032] As illustrated in Fig. 4, a pulley 38 is fixed to the third bottom roller 7c outside of the right third slide 20R. The third bottom roller 7c is driven through a belt 41 wrapped around a pulley 38, a guide pulley 39, a tension pulley 40 and a driving pulley (not shown). The rotation of the third bottom roller 7c is transmitted to the second bottom roller 7b through a gear (not shown). Outside the right first slide 18R, a pulley 42 is fixed to the first bottom roller 7a. The first bottom roller 7a is driven through a belt 45 wrapped around a pulley 42, a guide pulley 43, a tension pulley 44, and a driving pulley (not shown).

[0033] Next, operation of the action of the apparatus constructed as described above will be described. As illustrated in Fig. 1, a plurality of slivers S drawn from a plurality of feed coiler cans (not shown) located behind the drafting apparatus 1 are combined into a bundle of fibers having a predetermined width by the guide bars 16, 15a, 15b and the width restriction guide 15c and are fed into the drafting unit 2. The bundle of fibers fed into the drafting unit 2 sequentially passes between the first, second, third bottom rollers 7a - 7c and the first, second, third top rollers 8a - 8c and is thereby extended at a predetermined drafting ratio. The bundle is spun from the drafting unit 2 and transformed into a fleece F. The fleece F spun from the drafting unit 2 is converged into a sliver S by the gatherer 4 and the trumpet 5. The sliver S is compressed by the calendar rollers 6a, 6b, and accommodated in the coiler can through the coiler tube 6c.

[0034] Next, a method of adjusting the gauge of each of the bottom rollers 7a - 7c will be described. As illustrated in Fig. 4, first, the tension pulley 40 for imparting tension to the belt 41 for driving the second and third bottom rollers 7b, 7c is moved to loosen the tension in the belt 41. Next, the respective bolts that fix the outer rods 22L, 22R and the inner rods 23L, 23R to the respective stop brackets 30L, 30R, 31L, 31R are loosened.

[0035] Next, the handle 37 is fitted into the fitting portion 35a of the adjusting shaft 35, and the handle 37 is pushed toward the supporting bracket 34R. This causes

the adjusting shaft 35 to move until the first pinion 36R abuts against the supporting bracket 34R, as illustrated in Figs. 2 and 3(b). In this state, the pinions 36L, 36R mesh with the outer rods 22L, 22R, respectively. As the handle 37 is rotated in the counter-clockwise direction in Fig. 1, both racks 33L, 33R, with which the pinions 36L, 36R mesh, are moved rearward. This causes the second pair of slides 19L, 19R to move rearward together.

[0036] As the second pair of slides 19L, 19R moves rearward, the second pair of slides 19L, 19R and the third pair of slides 20L, 20R are moved rearward together after the second slides 19L, 19R abut against the third slides 20L, 20R. When the slides 20L, 20R of the third pair are moved to holding positions on the roller stand 17 of the third slides 20L, 20R, which have been previously determined based on the length of fibers to be spun, the bolts 32 of the pair of stop brackets 31L, 31R are fastened to fix the third slides 20L, 20R at the predetermined positions. As the front section 12 is moved together with the slides 20L, 20R of the third pair, and as the third slides 20L, 20R are placed at predetermined positions, the front section 12 is also fixed at a predetermined position, which has been determined after the gauge adjustment.

[0037] As illustrated in Fig. 5, after the slides 20L, 20R of the third pair have been fixed at the predetermined positions on the roller stand 17, the handle 37 is rotated in the clockwise direction in Fig. 1 to reverse the adjusting shaft 35, which causes the pair of second slides 19L, 19R to move frontward. When the slides 19L, 19R of the second pair are moved to fixed positions previously determined based on the length of fibers, the rotation of the handle 37 is stopped and the bolts 32 of the stop brackets 30L, 30R are fastened. As a result, the second slides 19L, 19R are fixed at the predetermined positions.

[0038] In moving the respective slides 19L, 19R, 20L, 20R through the pinions 36L, 36R and the racks 33L, 33R with the rotation of the adjusting shaft 35, the amounts of movement may differ between the respective slides 19L, 19R, 20L, 20R due to such causes as friction resistance, backlash and so on. In such an event, the left-hand third slide 20L is first moved to a predetermined position with the adjusting shaft 35 placed at the first position, at which both pinions 36L, 36R mesh with the racks 33L, 33R, and then the inner rod 23L is fixed with the bolt 32.

[0039] Next, as illustrated in Fig. 3(a), the adjusting shaft 35 is placed at the second position, at which only the first pinion 36R meshes with the first rack 33R. The adjusting shaft 35 is rotated to finely adjust the position of the right-hand third slide 20R. If the right-hand third slide 20R is located behind the left-hand third slide 20L when the left-hand third slide 20L is fixed at the predetermined position, the handle 37 is rotated in the counter-clockwise direction to move the right-hand third slide 20R rearward together with the right-hand second slide 19R.

[0040] When the right-hand third slide 20R is placed behind the left-hand third slide 20L, the handle 37 is rotated in the clockwise direction to move the right-hand second slide 19R forward, and the inner rod 23R is pushed by hand to move the right-hand third slide 20R forward of the position of the left-hand third slide 20L. Next, the handle 37 is rotated in the counter-clockwise direction to move the right-hand third slide 20R rearward, together with the right-hand second slide 19R, to a predetermined position, at which they are stopped, and the bolt 32 of the inner rod 23R is fastened to fix the right-hand third slide 20R. Thus, alignment of the left and right third slides 20L, 20R is completed.

[0041] Next, the adjusting shaft 35 is pressed again to the first position, at which the pinions 36L, 36R mesh with the racks 33L, 33R, respectively. In this state, the handle 37 is rotated in the clockwise direction to move both of the second slides 19L, 19R forward, and the rotation of the handle 37 is stopped when the left-hand second slide 19L is moved to a predetermined position. Then, the bolt 32 for the outer rod 22L is fastened to fix the left-hand second slide 19L. Next, the adjusting shaft 35 is placed at the second position, and the handle 37 is rotated either to the left or to the right to move the second slide 19R to a predetermined position. Next, the bolt 32 for the right-hand second rod 22R is fastened to fix the right-hand second slide 19R. Thus, the gauge adjustment between the draft rollers is completed. Subsequently, the handle 37 is removed, and the tension pulley 40 is placed at a predetermined position.

[0042] This embodiment provides the following advantages.

[0043] The outer rods 22L, 22R and the inner rods 23L, 23R are fixed to the roller stand 17 at locations that are rearward of the third slides 20L, 20R through the bolts 32 and the stop brackets 30L, 30R, 31L, 31R, such that outer rods 22L, 22R and the inner rods 23L, 23R cannot be moved relative to each other. Thus, at a position apart from the second slides 19L, 19R and the third slides 20L, 20R and therefore at a position where the operation is facilitated, the bolts 32 are fastened to fix the outer rods 22L, 22R and the inner rods 23L, 23R to the roller stand 17.

[0044] The outer rods 22L, 22R that are fixed to the second slides 19L, 19R are integrally moved rearward through both pinions 36L, 36R and both racks 33L, 33R with the rotation of the adjusting shaft 35. In the rearward movement, the slides 20L, 20R of the third pair are moved simultaneously with the second slides 19L, 19R. Therefore, the driving mechanism dedicated to the third slides 20L, 20R can be eliminated, thereby making it possible to reduce the size of the apparatus.

[0045] The outer rods 22L, 22R and the inner rods 23L, 23R are fixed to second slides 19L, 19R and the third slides 20L, 20R and extend through the second slides 19L, 19R and the third slides 20L, 20R, respectively. Further, the respective rods 22L, 22R, 23L, 23R are always in engagement with the guide portions 26

formed on the first slides 18L, 18R, and the outer rods 22L, 22R are guided by the second intermediate guide portions 29 of the third slides 20L, 20R, while the inner rods 23L, 23R are guided by the first intermediate guide portions 28 of the second slides 19L, 19R. Therefore, the second slides 19L, 19R and the third slides 20L, 20R are each moved in a stable state.

[0046] The pinions 36L, 36R, which mesh with the racks 33L, 33R, respectively, are integrally fixed to the adjusting shaft 35, which is perpendicular to the outer rods 22L, 22R. It is therefore possible to integrally move both outer rods 22L, 22R with a simple construction.

[0047] The adjusting shaft 35 is movable to the first position, at which the pinions 36L, 36R can mesh with the racks 33L, 33R, respectively, and to the second position, at which only the first pinion 36R can mesh with the first rack 33R. Therefore, the right-hand second slide 19R and the right-hand third slide 20R can be moved with the rotation of the adjusting shaft 35 without moving the left-hand second slide 19L and the left-hand third slide 20L. As a result, the alignment operation can be carried out for the pair of second slides 19L, 19R and the pair of third slides 20L, 20R.

[0048] The sliver guide 11 located in the fiber feeder 3 is divided into the front section 12 and the rear section 13, and the front section 12 is adjustable in relative to the running direction of the sliver S. Therefore, the sliver guide 11 can be placed at a position suitable for spinning conditions even if the positions of the third slides 20L, 20R are changed due to a gauge adjustment.

[0049] The front section 12 of the sliver guide 11 is coupled to the third slides 20L, 20R through the coupling member 14. Therefore, the front section 12 is automatically brought to a proper position with the movement of the third slides 20L, 20R.

[0050] The adjusting shaft 35 is rotated by the handle 37. This eliminates the need for providing a driving source such as a motor, an engine or the like, thereby achieving a simple and compact construction.

[0051] The foregoing embodiment may be modified, for example, in the following manner.

[0052] A plurality of pinions having a narrow tooth width may be provided to constitute the first pinion 36R to increase a region, as a whole, for meshing with the first rack 33R.

[0053] Thus, any of the pinions having a small axial dimension, may mesh with the first rack 33R whether the adjusting shaft 35 is at the first position or at the second position.

[0054] It may be determined from the lengths of the outer rods 22L, 22R and the inner rods 23L, 23R protruding from the fixed guide members 21L, 21R how far the second slides 19L, 19R and the third slides 20L, 20R are from the positions of the first slides 18L, 18R, which serve as references. Therefore, the positioning is facilitated as compared with the case where the positions of the second slides 19L, 19R and the third slides 20L, 20R are registered to marks impressed on the roller stand

17 in line with the respective slides.

[0055] The handle 37 may be fixed to the adjusting shaft 35 so that it cannot be removed.

[0056] The guide portions 26, 27 are not limited to holes but may be grooves, as illustrated in Fig. 6. Also, the first and second intermediate guide portions 28, 29 may also be formed in similar grooves.

[0057] The pinions 36L, 36R may be formed to have the same axial dimension such that the outer rods 22L, 22R cannot be individually moved. In this event, if the racks 33L, 33R and the pinions 36L, 36R of the outer rods 22L, 22R are accurately formed to reduce backlash and accuracy, the alignment need not be performed for the left-hand and right-hand second slides 19L, 19R and third slides 20L, 20R each time the gauge is adjusted.

[0058] The adjusting shaft 35 for integrally driving the outer rods 22L, 22R may be driven by a driving source such as a motor. For example, a motor is used as a driving source, and a rotary encoder is provided for detecting the amount of rotation of the motor. In this variation, the amounts of movement of the second slides 19L, 19R and the third slides 20L, 20R can be found from the amount of rotation of the motor. By stopping the motor when it has been moved over a predetermined amount, the second slides 19L, 19R and the third slides 20L, 20R can be moved to desired positions.

[0059] As the driving mechanism for moving the pair of outer rods 22L, 22R integrally in the longitudinal direction, a screw shaft may be used in place of the rack and pinion, as in the apparatus illustrated in Fig. 8. For example, blocks are fixed to the outer rods 22L, 22R, respectively, and the each of the blocks is formed with a threaded hole, and a screw shaft is provided for screw engagement with the threaded hole. Both screw shafts are simultaneously driven through a belt driving mechanism. The belt driving mechanism may be driven manually or using a driving source such as a motor.

[0060] As a structure for simultaneously moving the second slides 19L, 19R and the third slides 20L, 20R, the inner rods 23L, 23R may be provided with racks. Then, the adjusting shaft 35 is rotated while the racks mesh with pinions located on the adjusting shaft 35 to move the inner rods 23L, 23R. During a gauge adjustment, the adjusting shaft 35 is rotated from a state in which the second slides 19L, 19R and the third slides 20L, 20R are placed behind the desired positions, to move the second slides 19L, 19R forward together with the third slides 20L, 20R. Then, after the second slides 19L, 19R are moved to the desired positions and fixed there by fastening the bolts 32, the adjusting shaft 35 is rotated in the reverse direction to move the third slides 20L, 20R to the desired positions, at which they are fixed.

[0061] The present invention may be applied to a drafting apparatus that has four or more bottom rollers. For example, with four bottom rollers, back roller slides may be provided behind the third slides 20L, 20R. Likewise, the back roller slides can be moved perpendicular

to the bottom rollers and fixed to the roller stand 17. During a gauge adjustment, the third slides 20L, 20R and the back slides are moved rearward together with the second slides 19L, 19R to fix the back slides at predetermined positions. Next, the second slides 19L, 19R and the third slides 20L, 20R are moved forward, and the third slides 20L, 20R and the second slides 19L, 19R are fixed at predetermined positions from that state in a similar manner. In this event, the back slides may be provided with movement guide members as is the case of the foregoing embodiment.

[0062] The rods 22L, 22R, 23L, 23R may be directly fixed to the fixed guide members 21L, 21R, respectively, with the bolts 32. In this case, the structure becomes simpler.

[0063] As the movement guide member, a plate-like member may be used in place of the rods.

[0064] The drafting apparatus 1 is not limited to a drafting apparatus for a drawing machine but may be applied to other spinning machines which comprise a fiber feeder for supplying the sliver S to the drafting unit, for example, a sliver lap machine and a comb. Also, the drafting apparatus 1 may be applied to a drafting apparatus for a fine spinning machine and a roving frame.

[0065] It should be apparent to those skilled in the art that the present invention may be embodied in many other specific forms without departing from the spirit or scope of the invention. Particularly, it should be understood that the invention may be embodied in the following forms.

[0066] Therefore, the present examples and embodiments are to be considered as illustrative and not restrictive and the invention is not to be limited to the details given herein, but may be modified within the scope and equivalence of the appended claims. A drafting apparatus includes a pair of first slides, a pair of second slides, and a pair of third slides. The draft apparatus includes a pair of roller stands. A pair of outer rods are fixed to the second slides. A pair of inner rods are fixed to the third slides. An adjusting shaft has pinions. Racks are formed on the outer rods. The racks mesh with the pinions. The outer and inner rods are fixed to the roller stands at locations that are rearward of the third slides. When the adjusting shaft is rotated, the outer rods move simultaneously. This is capable of facilitating the gauge adjustment and of making adjustment device relatively small.

Claims

1. A drafting apparatus including a drafting portion (2) having a first, a second and a third bottom rollers (7a-7c), which are positively rotated and arranged from rearward to frontward in the running direction of slivers (S), a pair of roller stands (17) for supporting the first, the second and the third bottom rollers

(7a-7c), a plurality top rollers arranged to cooperate with the bottom rollers (7a-7c), the top rollers being pressed against the bottom rollers (7a-7c), respectively, a fiber supplying portion (3) located rearward of the draft portion (2) for supplying the slivers (S) to the drafting portion (2), the drafting apparatus being **characterized by:**

a pair first supporting members (18L, 18R), which support the first bottom roller (7a), a pair of second supporting members (19L, 19R), which support the second bottom roller (7b), and a pair of third supporting members (20L, 20R), which support the third bottom roller (7c), wherein the first, the second and the third supporting members (18L, 18R, 19L, 19R, 20L, 20R) are arranged in opposite order in the running direction of the slivers (S), wherein the second and the third supporting members (19L, 19R, 20L, 20R) contact each other and are located on the roller stands (17) to move in a direction perpendicular to the axes of the bottom rollers (7a-7c);

a plurality of movable guide members (22L, 22R, 23L, 23R), which are perpendicular to the axes of the bottom rollers (7a-7c) and are supported by the first supporting member (18L, 18R);

a plurality of fixed guide members (21L, 21R) having a plurality of first guide portions (27), wherein the first guide portions (27) guide the movable guide members (22L, 22R, 23L, 23R) in a direction perpendicular to the axes of the bottom rollers (7a-7c);

a plurality of fixing means (30L, 30R, 31L, 31R, 32) for fixing the movable guide members (22L, 22R, 23L, 23R) to the roller stands (17) at locations that are rearward of the third supporting members (20L, 20R); and

driving means (33L, 33R, 35, 36L, 36R, 37) for moving the second supporting members (19L, 19R) or the third supporting members (20L, 20R) with the movable guide members (22L, 22R, 23L, 23R).

2. The drafting apparatus according to claim 1, **characterized in that** second guide portions (26) are formed in the first supporting members (18L, 18R), wherein the guide portions (26) engage the movable guide members (22L, 22R, 23L, 23R), and wherein the movable guide members (22L, 22R, 23L, 23R) are always engaged with the guide portions (26), respectively.

3. The drafting apparatus according to claim 2, **characterized in that** intermediate guide portions (28, 29) are formed in the second and the third supporting members (19L, 19R, 20L, 20R), wherein the me-

dium guide portions (28, 29) guide the movable guide members (22L, 22R, 23L, 23R) in directions perpendicular to the axes of the bottom rollers (7a-7c), wherein the movable guide members (22L, 22R, 23L, 23R) are fixed to the second and the third supporting members (19L, 19R, 20L, 20R).

4. The drafting apparatus according to any one of claims 1 to 3, **characterized in that** each movable guide member (22L, 22R) has a front end portion and a rear end portion, wherein each movable guide member (22L, 22R) is fixed to one of the second supporting members, wherein, when the second supporting members (19L, 19R) are located at the foremost position, the rear end portions of the movable guide members (22L, 22R) protrude rearward than the rearmost position of the rear end portions of the third supporting members (20L, 20R).

5. The drafting apparatus according to claim 4, **characterized in that** a first and a second racks (33L, 33R) are formed in the rear end portions of the movable guide members (22L, 22R), wherein the driving means includes an adjusting shaft (35), which is perpendicular to the axes of the movable guide members (22L, 22R, 23L, 23R), and a plurality of pinions (36L, 36R), which are integrally rotated to the adjusting shaft (35) to mesh with the first and the second racks (33L, 33R), wherein the movable guide members (22L, 22R, 23L, 23R) move simultaneously with the rotation of the adjusting shaft (35).

6. The drafting apparatus according to claim 5, **characterized in that** the pinions (36L, 36R) include a first pinion (36R) and a second pinion (36L), wherein an axial dimension along which the first pinion (36R) meshes with the first rack (33R) is greater than that along which the second pinion (36L) meshes with the second rack (33L).

7. The drafting apparatus according to claim 6, **characterized in that** the adjusting shaft (35) may be located at a first position and a second position, wherein in the first position, the first and the second pinions (36L, 36R) mesh with the first and the second racks (33L, 33R), and in the second position, the first pinion (36R) meshes with the first rack (33R) and the second pinion (36L) fails to mesh with the second rack (33L).

8. The drafting apparatus according to any one of claims 1 to 7, **characterized in that** the fiber supplying portion (3) has a sliver guide (11), wherein the sliver guide (11) leads the slivers (S) to the drafting portion (2) and applies tension to the slivers (S), wherein the sliver guide (11) has a front section (12) and a rear section (13), wherein the front section

(12) moves in the running direction of the slivers (S).

5

10

15

20

25

30

35

40

45

50

55

Fig.1

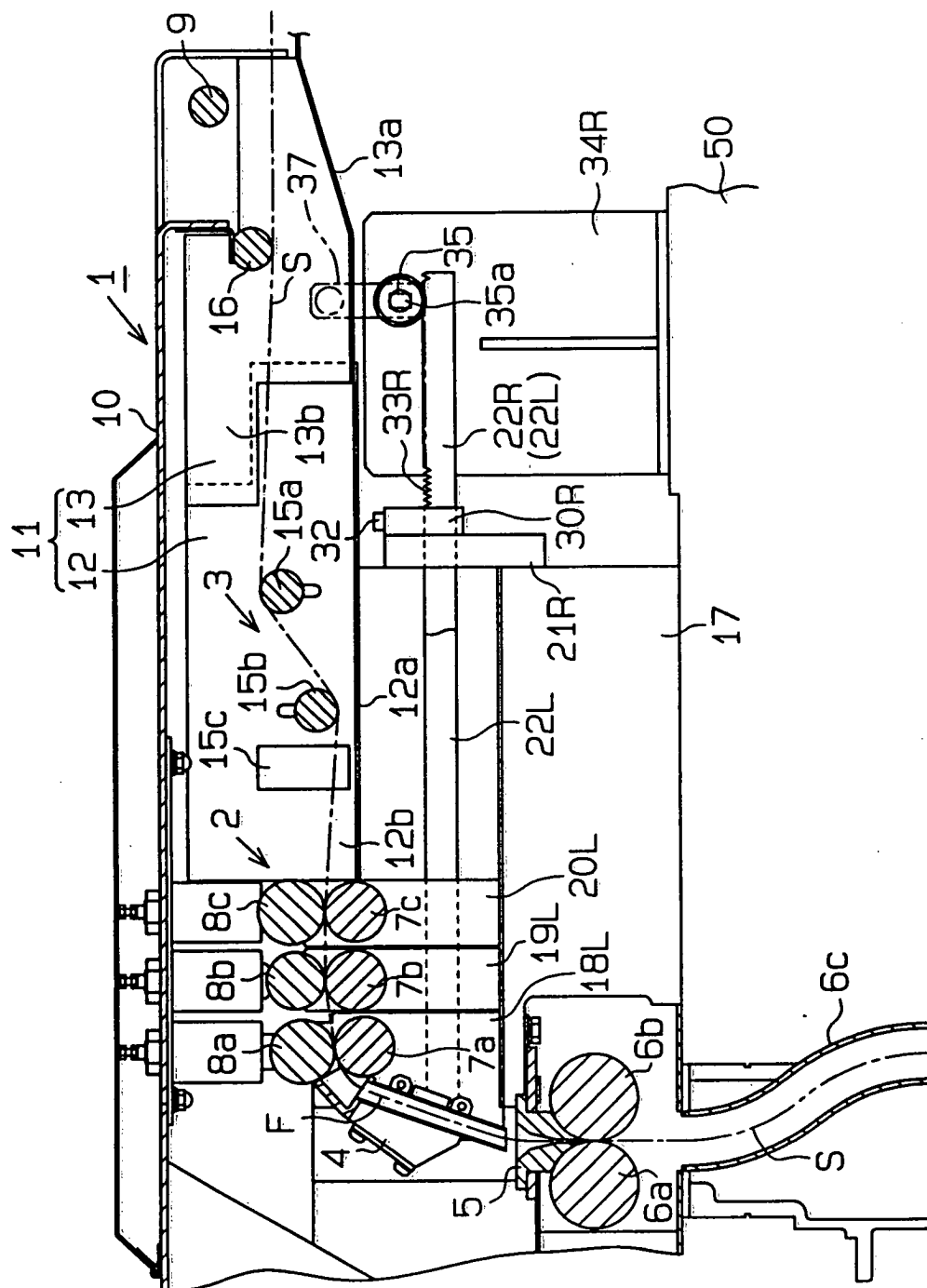
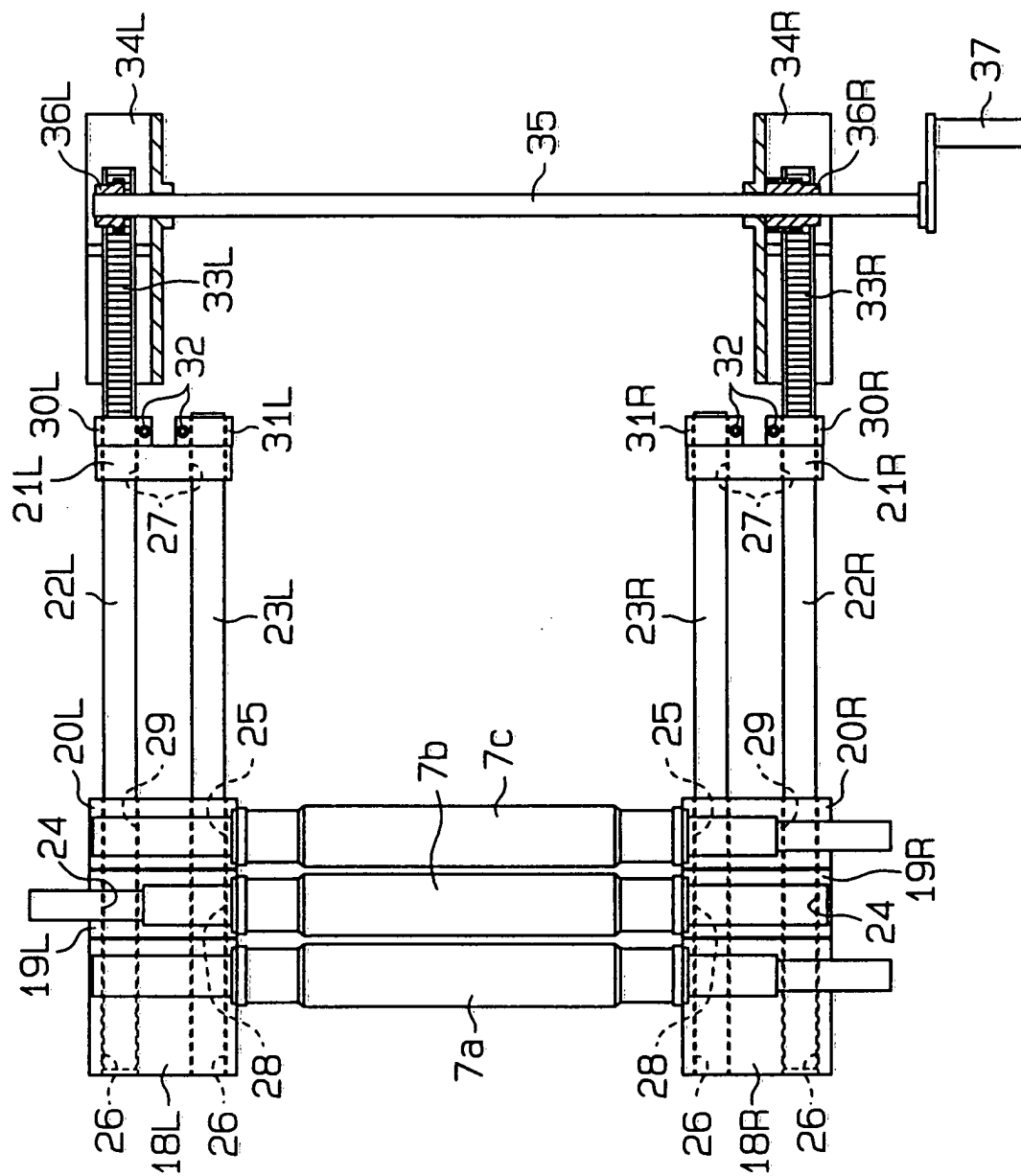


Fig. 2



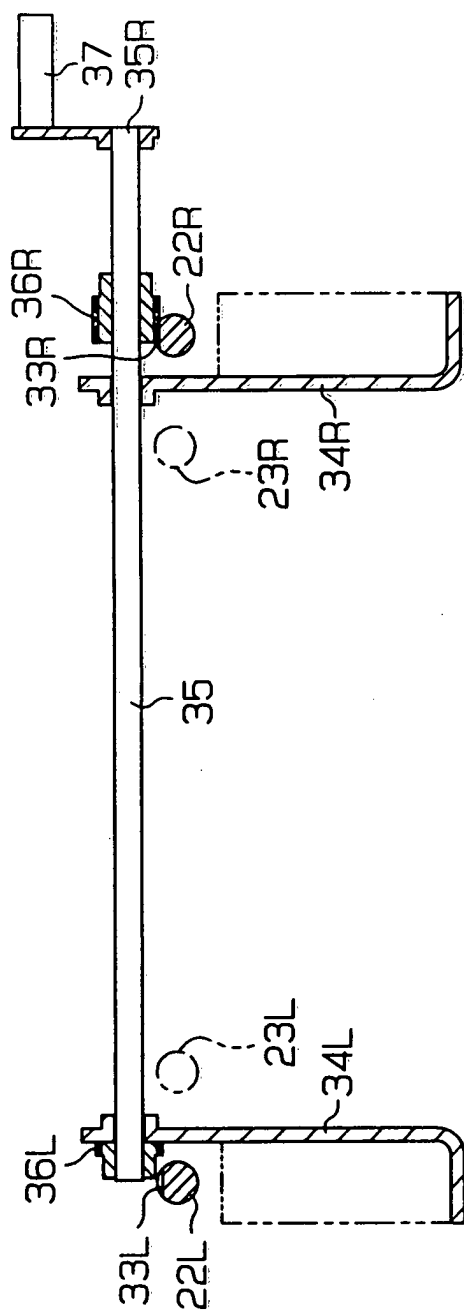


Fig. 3(a)

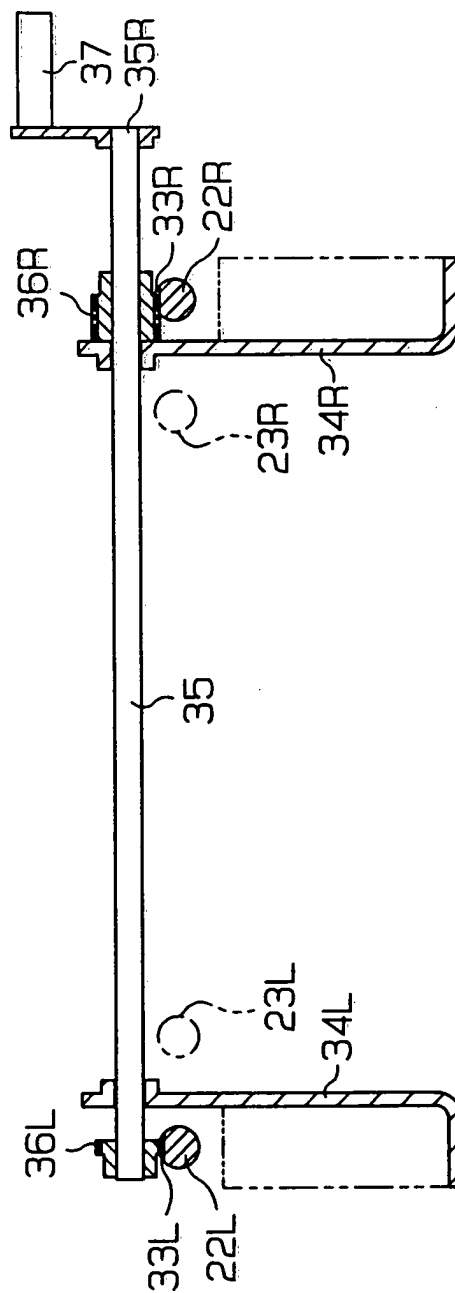


Fig. 3(b)

Fig. 4

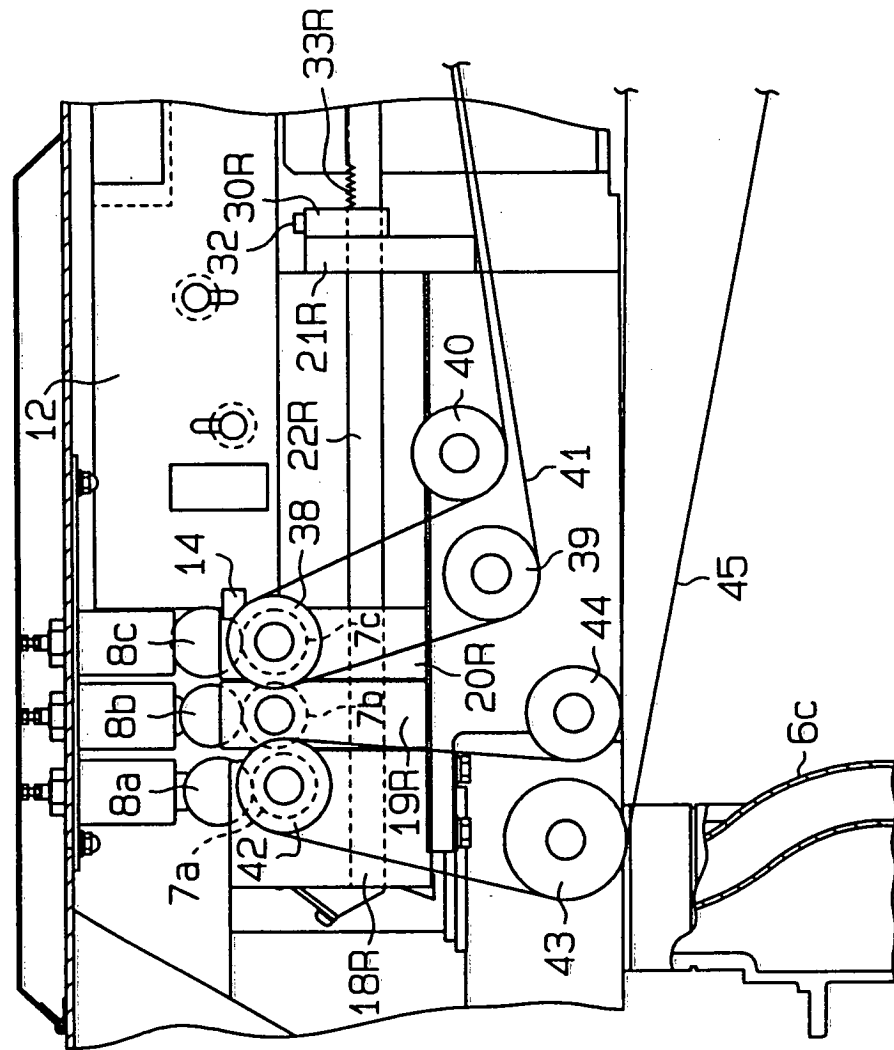


Fig. 5

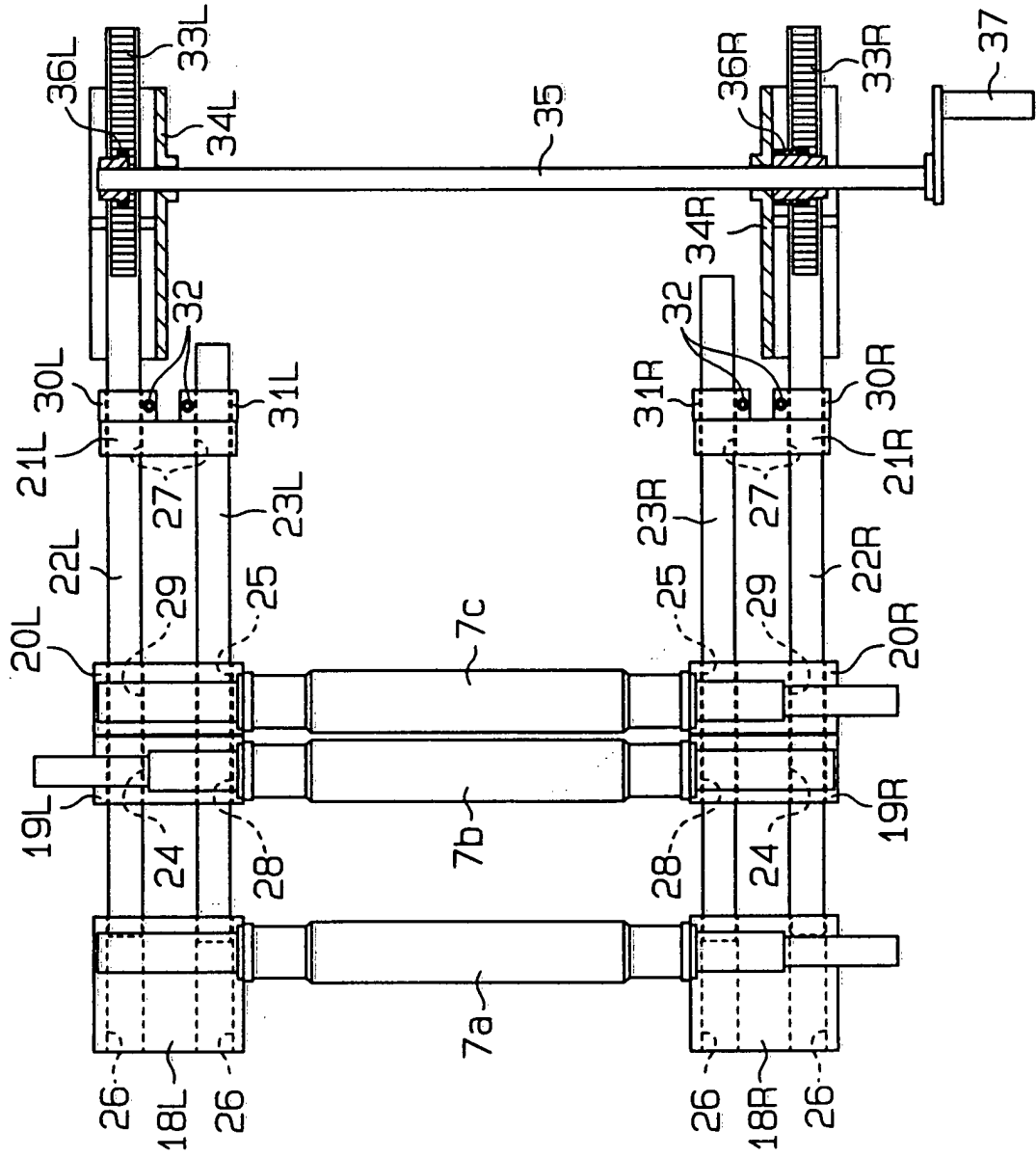


Fig.6

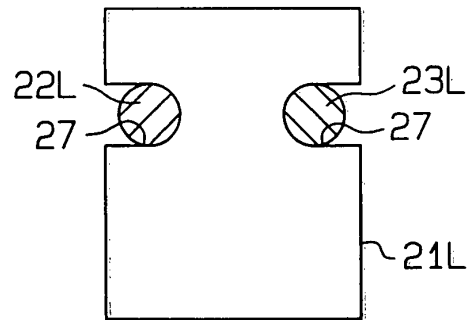


Fig.7

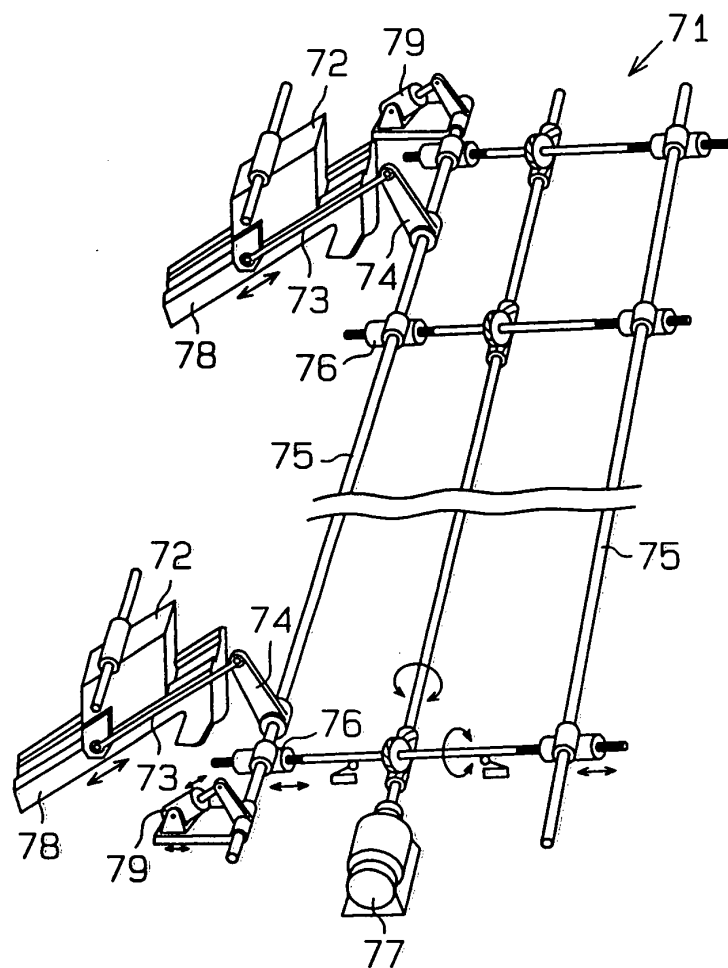
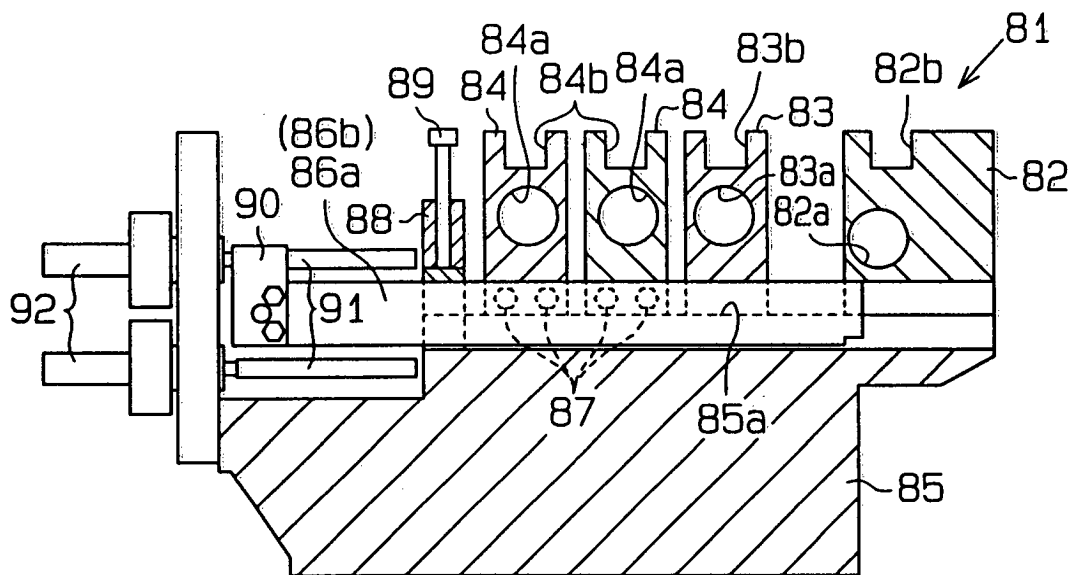


Fig. 8





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 10 9364

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.CI.7)
X	US 2 707 309 A (WILSON THOMAS W) 3 May 1955 (1955-05-03) * claims 1-4; figures 1,3 *	1	D01H5/34 D01H5/44
A	----- US 2 728 111 A (MCFARLAND WILLIAM E ET AL) 27 December 1955 (1955-12-27) * claim 1; figure 1 *	2-5	
A	----- US 5 809 762 A (GOEHLER WOLFGANG) 22 September 1998 (1998-09-22) * claim 1; figure 3 *	1	
D,A	----- DE 35 32 555 A (ZINSER TEXTILMASCHINEN GMBH) 12 March 1987 (1987-03-12) * claim 1; figure 1 *	1	
A	-----		
			TECHNICAL FIELDS SEARCHED (Int.CI.7)
			D01H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 12 October 2001	Examiner D'Souza, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03 02 (P04C01)

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

EP 01 10 9364

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

12-10-2001

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 2707309	A	03-05-1955	NONE		

US 2728111	A	27-12-1955	BE	534595 A	
			CH	329009 A	15-04-1958
			FR	1116619 A	09-05-1956
			GB	755403 A	22-08-1956

US 5809762	A	22-09-1998	DE	19529831 A1	13-02-1997
			EP	0761852 A1	12-03-1997
			JP	9157965 A	17-06-1997

DE 3532555	A	12-03-1987	DE	3532555 A1	12-03-1987

EPO FORM P0459

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