(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 397 585 A2

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.12.2011 Bulletin 2011/51

(51) Int Cl.:
D01G 19/26 *(2006.01)*

(21) Application number: **11169413.9**

(22) Date of filing: **10.06.2011**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **16.06.2010 JP 2010137218**

(71) Applicant: **Kabushiki Kaisha Toyota Jidoshokki**
Kariya-shi,
Aichi 448-8671 (JP)

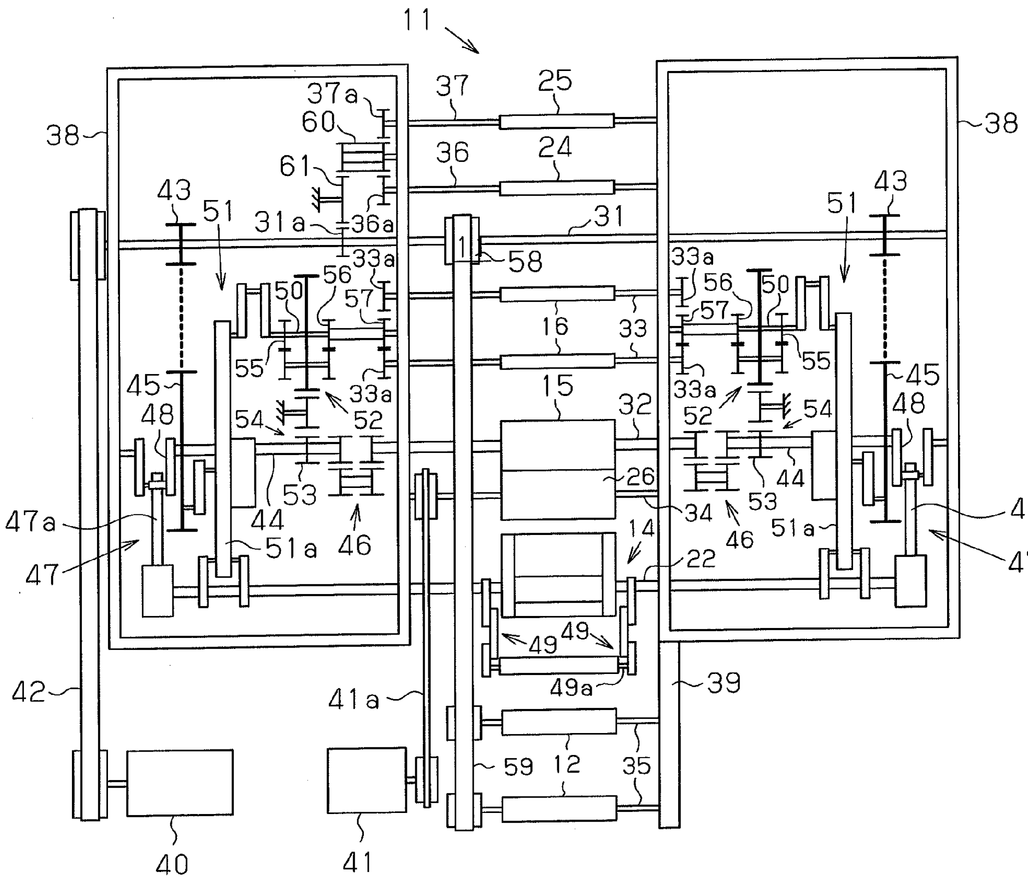
(72) Inventor: **Shinbara, Masami**
Kariya-shi, Aichi 448-8671 (JP)

(74) Representative: **TBK**
Bavariaring 4-6
80336 München (DE)

(54) **Comber**

(57) A comber includes combing heads arranged along a longitudinal direction of a comber, and drive shafts common to the combing heads. The drive shafts include a main drive shaft driven by a main motor. At least a nipper shaft among the drive shafts is driven at both axial end portions by a pair of drive portions to which drive force is transmitted from the main drive shaft.

Fig.1



EP 2 397 585 A2

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a comber.

[0002] The comber typically includes an operational portion 71 provided with eight combing heads 70, which are arranged parallel to each other as shown in Fig. 5. Each of the combing heads 70 includes a pair of lap rollers 72, on which a lap L is placed. A non-illustrated combing part, a table 73, and a calender roller 74 are provided downstream of the lap rollers 72. The table 73 concentrates a fleece F that is fed by combing operation of the combing part. The calender roller 74 compresses the fleece F that has been concentrated on the table 73 into a sliver S.

[0003] A drive portion 75 is provided on one end of the operational portion 71 and transmits drive force from a main motor to the combing heads 70. A draft part 76 is provided on the end of the operational portion 71 opposite to the drive portion 75. The draft part 76 drafts bundles of slivers S formed by the combing heads 70. The finished sliver drafted by the draft part 76 is accommodated in a can by a non-illustrated coiler.

[0004] Each combing head 70 is a section that performs a series of operations for forming the sliver S from the lap L. The lap L is fed by a predetermined amount through the operation of the pair of lap rollers 72 and a feed roller (not shown), and the distal end of the lap L is nipped by a nipper including a bottom nipper and a top nipper. A combing cylinder combs the distal end of the lap L, and the combed fleece F is transferred toward a detaching roller by advance of the nipper. In response to the advance of the fleece, the detaching roller is rotated in the reverse direction, and retracts the previously taken fleece F. The above-mentioned newly combed fleece F is overlapped on the retracted fleece F. Subsequently, the detaching roller is rotated forward to take the fleece F from the nipper, and the trailing end of the fleece F is combed by a top comb, which is stuck into the fleece F. Then, the fleece F made by repeating this process is compressed by the calender roller 74 into the sliver S.

[0005] Conventionally, combers have been used for spinning fine yarns the count of which is greater than or equal to 60, or yarns that particularly require uniform size or strength. In recent years, combers are used for spinning 40-count yarns or thicker yarns for high-end consumers. Since the productivity of combers is lower than a roving frame and a spinning frame, which are posterior processes, there is a demand for speeding up combers.

[0006] However, unlike roving frames and spinning frames, a comber include not only a shaft that is rotated in one direction at a constant speed, but also a shaft that performs swinging motion (back-and-forth pivoting) and the shaft that varies the speed in one rotation. The torsion angle of each shaft varies due to the difference in the rotational angular speed, the inertia, and the torsional rigidity of each shaft. Therefore, in a high-speed comber, variation in the quality of sliver is caused due to the difference in the relative torsion of the shafts per each combing head, which degrades the quality of the finished sliver. Also, in a case with the comber in which one end of the shaft is driven, the resonance frequency of the shaft is low, and results in deterioration of the quality of the finished sliver.

[0007] Japanese Laid-Open Patent Publication No. 60-215818 discloses a comber that improves the quality of sliver and eliminates variation in the quality of the sliver. In this comber, the length of the shaft that drives each combing head is reduced to half. Thus, the size of the lot is reduced by adjusting half the comber at a time independently with gauge. Therefore, the comber can be used for manufacturing various types of and small lots in a suitable manner. More specifically, in Japanese Laid-Open Patent Publication No. 60-215818, the operational portion of the comber on which the combing heads are arranged is divided into two in the longitudinal direction of the comber. Both of the divided operational portions are arranged symmetrically on both sides of the drive portion in which the main motor for driving the combing heads is provided. The drive portion includes a driving pulley, which is driven by the main motor. Rotation of the driving pulley is transmitted to a main drive shaft via a clutch. Then, rotation of the main drive shaft is transmitted to the sets of four combing heads via a common nipper shaft, cylinder shaft, brush shaft, detaching roller shaft, and table calender roller shaft via a drive gearing.

[0008] Also, a comber in which the drive portion 75 is located between the fourth and fifth combing heads 70 among the eight combing heads 70 has been proposed (see German Patent Application DE102006026850A1) as shown in Fig. 6. In this comber, like the comber of Japanese Laid-Open Patent Publication No. 60-215818, the shaft that drives the combing heads 70 has the length equal to the length of the four combing heads 70. Eight slivers S spun by eight combing heads 70 are concentrated and drafted by a draft part 76, and are accommodated in a can 77. German Patent Application DE102006026850A1 also discloses a comber including two drive portions 75 as shown in Fig. 7. Eight combing heads 70 are divided into two and each drive portion 75 drives four of the combing heads 70.

[0009] In the comber disclosed in Japanese Laid-Open Patent Publication No. 60-215818, the drive portion is located at the center of the comber, and the shafts forming the combing heads are arranged to be symmetric with respect to the drive portion. Therefore, the length of the shafts is half the length of the shafts in the structure in which the drive portion is located on one end of the comber. Therefore, even if the speed is increased in the comber in which one end of each shaft is driven, the difference in the relative torsion between the shafts is reduced. Thus, variation in the quality of the sliver is not at a level that causes deterioration in the quality of the finished sliver. Also, the resonance frequency of the shafts does not become a low frequency that causes deterioration in the quality of the finished sliver. However, since the four slivers S spun by the four combing heads 70 are concentrated and drafted to form a finished sliver in the comber disclosed in Japanese Laid-Open Patent Publication No. 60-215818, it is difficult to obtain a high-quality finished sliver as compared to a comber in which eight slivers S are concentrated and drafted to form a finished sliver.

[0010] In the comber disclosed in German Patent Application DE102006026850A1, the drive portion 75 is also located at the center of the comber. Therefore, even if the speed is increased in the comber in which one end of each shaft is driven, the difference in the relative torsion of the shafts is reduced. Also, the comber disclosed in German Patent Application DE102006026850A1 differs from the comber disclosed in Japanese Laid-Open Patent Publication No. 60-215818 in that the finished sliver is formed by concentrating and drafting eight slivers S spun by eight combing heads 70. However, unlike the comber in which the drive portion 75 is located on one end of the comber, in the comber disclosed in German Patent Application DE102006026850A1, the distance required for the slivers S spun by the combing heads 70 located on the right side of the drive portion 75 to be transferred to the draft part 76 is increased at least by the width of the drive portion 75 as shown in Fig. 6. As a result, faulty draft easily occurs while the slivers S spun by the combing heads 70 are transferred to the draft part 76, and the yarn quality of the finished sliver is deteriorated as compared to the comber in which the drive portion 75 is located on one end of the comber.

[0011] Also, in the comber provided with two drive portions 75 shown in Fig. 7, both drive portions 75 need to be precisely synchronized when being driven, otherwise the quality of the slivers spun by the left and right combing heads 70 varies, and the yarn quality of the finished sliver is deteriorated.

SUMMARY OF THE INVENTION

[0012] Accordingly, it is an objective of the present invention to provide a high-speed comber that reduces variation in the quality of slivers spun by combing heads, and inhibits deterioration of the quality of a finished sliver.

[0013] To achieve the above objective, one aspect of the present invention provides a comber, which includes combing heads and drive shafts common to the combing heads. The combing heads are arranged along a longitudinal direction of a comber. The drive shafts include a main drive shaft driven by a main motor. At least a nipper shaft among the drive shafts is driven at both axial end portions by a pair of drive portions to which drive force is transmitted from the main drive shaft.

[0014] 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 DRAWINGS

[0015] The 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 diagram illustrating a drive system according to a first embodiment of the present invention;
Fig. 2 is a schematic side view illustrating the combing heads of Fig. 1;
Fig. 3 is a diagram illustrating a drive system according to a second embodiment of the present invention;
Fig. 4 is a schematic diagram illustrating a drive mechanism of a detaching roller according to a modified embodiment;
Fig. 5 is a schematic plan view illustrating a typical comber;
Fig. 6 is a schematic plan view illustrating a conventional comber; and
Fig. 7 is a schematic plan view illustrating another conventional comber.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

(First Embodiment)

[0016] A first embodiment of the present invention will now be described with reference to Figs. 1 and 2.

[0017] As shown in Fig. 2, a combing head 11 includes a pair of lap rollers 12, a nipper device 14 provided with a feed roller 13, a combing cylinder 15, and two pairs of detaching rollers 16. Each pair of detaching rollers 16 is displaced from another pair of detaching rollers 16 in the front-back direction. The nipper device 14 includes a nipper frame 17, which is located above the combing cylinder 15 to be able to swing along advancing and retreating directions. A cushion plate 18 is provided at the bottom of the nipper frame 17. A nipper arm 19 is pivotably provided on the nipper frame 17 via a support shaft 17a, and a nipper knife 19a is secured to the distal end of the nipper arm 19. The nipper knife 19a is selectively opened and closed at a predetermined timing in synchronization with the swinging motion of the nipper frame 17 along the advancing and retreating directions, and cooperates with the cushion plate 18 to nip the lap L. A top comb 20 is mounted on the nipper frame 17 to perform a predetermined motion in synchronization with the nipper frame 17 in front of the cushion plate 18. Also, an auxiliary nipper (nipper press) 21 is pivotably supported on the support shaft 17a. When combing, with the top comb 20, the trailing end of the lap that has been combed by the combing cylinder 15, the auxiliary nipper 21 presses the lap against the cushion plate 18 to nip the lap. The auxiliary nipper 21 is selectively opened and closed at a predetermined timing in accordance with back and forth swinging motion of the nipper frame 17 by a known drive mechanism.

[0018] A nipper shaft 22 is arranged at the rear of the combing cylinder 15 and below the nipper frame 17 to be able to pivot back and forth. A first end of a nipper frame drive arm 23 is secured to the nipper shaft 22 to pivot integrally with the nipper shaft 22, and the rear end of the nipper frame 17 is pivotably supported on a second end of the nipper frame drive arm 23 via a support shaft 23a. The nipper frame 17 swings back and forth in accordance with the back-and-forth pivoting of the nipper shaft 22 (swinging motion) so that the distal end of the cushion plate 18 approaches and separates from the detaching roller 16.

[0019] A pair of delivery rollers (drawer rollers) 24 and a pair of calender rollers 25 are provided forward of the detaching rollers 16 (on the left in Fig. 2). A brush 26 is provided below the combing cylinder 15, and a suction duct 27 is provided below the brush 26. Short fibers and neps removed from the lap by the combing cylinder 15 and the top comb 20 are sucked into the suction duct 27.

[0020] A drive mechanism of the combing heads 11 will now be described with reference to Fig. 1. The combing heads 11 are arranged along the longitudinal direction of a comber (the left and right direction of Fig. 1). The combing heads 11 are provided with common drive shafts. Only one of the combing heads 11 is shown and other combing heads 11 are omitted in Fig. 1. The drive shafts include, besides the nipper shaft 22, a main drive shaft 31, a cylinder shaft 32, detaching roller shafts 33, a brush shaft 34, lap roller shafts 35, a delivery roller shaft 36, and a calender roller shaft 37. Gear boxes 38 are provided on both sides of the combing head 11 in the longitudinal direction of the comber. Each of the drive shafts (rotary shafts) is rotatably supported by the gear boxes 38 or a machine frame 39 (only partially shown) via bearings (not shown).

[0021] As shown in Fig. 1, the drive mechanism includes a main motor 40 and a brush motor 41. The main motor 40 drives the drive shafts other than the brush shaft 34. The main drive shaft 31 is driven by the main motor 40 via a belt transmission device 42. The brush shaft 34 is driven by the brush motor 41 via a belt transmission device 41 a.

[0022] A gear 43 is secured to each of the opposite ends of the main drive shaft 31 with the combing head 11 located in between. The gears 43 rotate integrally with the main drive shaft 31. An intermediate shaft 44 is provided in each of the gear boxes 38 to be coaxial with the cylinder shaft 32. A gear 45 is secured to each intermediate shaft 44 to rotate integrally with the intermediate shaft 44. Rotation of each gear 43 is transmitted to the associated gear 45. Since the gear 43 has fewer teeth than the gear 45, the intermediate shaft 44 is rotated at a lower speed than the main drive shaft 31.

[0023] Rotation of each intermediate shaft 44 is transmitted to one of the ends of the cylinder shaft 32 via a transmission device 46, which includes a pair of non-circular gears (for example, a pair of elliptic gears). The transmission devices 46 form a drive portion, which varies the speed of the cylinder shaft 32.

[0024] Rotation-swing conversion mechanisms 47 are located between the intermediate shafts 44 and the nipper shaft 22. The rotation-swing conversion mechanisms 47 convert rotation of the intermediate shafts 44 in one direction into a swinging motion (back-and-forth pivoting) of the nipper shaft 22. Each rotation-swing conversion mechanism 47 includes a crank 48, which has a proximal end that rotates integrally with the intermediate shaft 44, and a swing bar 47a, which swings integrally with the nipper shaft 22 in accordance with rotation of the crank 48. The rotation-swing conversion mechanisms 47 form a drive portion, which swings the nipper shaft 22. Also, the swinging motion of the nipper shaft 22 is transmitted to a swing shaft 49a, which selectively opens and closes the auxiliary nipper 21 at a predetermined timing via link mechanisms 49. The nipper shaft 22 and the link mechanisms 49 form a drive portion, which swings the swing shaft 49a.

[0025] A rotation-swing conversion mechanism 51, a planetary gear mechanism 52, and a gear train 54 are located between each intermediate shaft 44 and the detaching roller shafts 33. Each rotation-swing conversion mechanism 51 converts rotation of the associated intermediate shaft 44 into a swinging motion (back-and-forth pivoting) of a shaft 50. Each gear train 54 includes a gear 53, which is provided on the intermediate shaft 44 to rotate integrally with the intermediate shaft 44. The gear 53 transmits rotation of the intermediate shaft 44 to the associated planetary gear mechanism 52. Each rotation-swing conversion mechanism 51 includes a swing arm 51 a. Each planetary gear mechanism 52 includes sun gears 55, 56. The sun gear 55 is secured to the shaft 50 to rotate integrally with the shaft 50, and the sun gear 56 is rotatably supported on the shaft 50. Gears 33a are secured to both ends of each detaching roller shaft 33 to rotate integrally with the detaching roller shaft 33. A gear 57 is formed integrally with each sun gear 56 to mesh with the gear 33a on one end of the detaching roller shafts 33. In accordance with rotation of the intermediate shafts 44 in one direction, the detaching roller shafts 33 perform the swinging motion (back-and-forth pivoting) by the operation of the rotation-swing conversion mechanisms 51 and the planetary gear mechanisms 52. The rotation-swing conversion mechanisms 51, the planetary gear mechanisms 52, and the gears 33a, 57 form a drive portion, which swings the detaching roller shafts 33.

[0026] A drive pulley 58 is secured to the main drive shaft 31. Rotation of the main drive shaft 31 is transmitted to the lap roller shafts 35 via the drive pulley 58 and a belt transmission device 59. A gear 36a is secured to one end of the delivery roller shaft 36 to rotate integrally with the delivery roller shaft 36. A gear 37a is secured to the calender roller shaft 37 to rotate integrally with the calender roller shaft 37. The gears 36a, 37a mesh with a long gear 60. A gear 31 a is secured to the main drive shaft 31 at a position corresponding to the long gear 60 to rotate integrally with the main drive shaft 31. Rotation of the gear 31 a is transmitted to the long gear 60 via a gear 61. Therefore, the lap roller shafts 35, the delivery roller shaft 36, and the calender roller shaft 37 are rotated in the same direction as the main drive shaft 31.

[0027] Lubricant is stored in each gear box 38 by such a depth that part of the gears is immersed in the lubricant. The lubricant is splattered by rotation of the gears, and after adhering to the non-illustrated cover of the gear box 38, the lubricant drops. In this manner, components are lubricated. The configuration of the drive portion basically employs the configuration used in a conventional comber.

[0028] Operation of the drive mechanism configured as described above will now be described.

[0029] The drive mechanism is driven by two motors including the main motor 40 and the brush motor 41. The nipper shaft 22 and the detaching roller shafts 33, which perform the swinging motion (back-and-forth pivoting), and the cylinder shaft 32, which varies the speed, are driven at both axial end portions by the corresponding drive portions located in the pair of gear boxes 38. That is, the shafts are driven at both ends. The axial end portions include ends and portions closer to the ends of each shaft. Rotation of the main drive shaft 31 driven by the main motor 40 is transmitted to the drive portions.

[0030] Rotation of the main drive shaft 31 is transmitted to the nipper shaft 22 via the gears 43, 45, the intermediate shafts 44, and the rotation-swing conversion mechanisms 47. Rotation of the nipper shaft 22 is transmitted to the swing shaft 49a via the link mechanisms 49.

[0031] Rotation of the main drive shaft 31 is transmitted to the cylinder shaft 32 via the gears 43, 45, the intermediate shafts 44, and the transmission devices 46. Rotation of the main drive shaft 31 is transmitted to the detaching roller shafts 33 via the gears 43, 45, the intermediate shafts 44, the rotation-swing conversion mechanisms 51, the planetary gear mechanisms 52, the gear trains 54, and the gears 57, 33a.

[0032] The nipper shaft 22, the swing shaft 49a, and the detaching roller shafts 33, which perform the swinging motion, and the cylinder shaft 32, which varies the speed, are subjected to greater torsion as compared to the brush shaft 34, the lap roller shafts 35, the delivery roller shaft 36, and the calender roller shaft 37, which are rotated in a certain direction at a constant speed. However, when driving the drive shaft at both ends, torsion is reduced to a quarter of that in a case in which one end of the drive shaft is driven (that is, when driving the drive shaft on one end). Thus, variation in the quality of the slivers among the combing heads 11 is reduced without reducing the length of the drive shafts as in the conventional comber. Also, in a case in which the lengths of the drive shafts are the same, the resonance frequency is increased when driving the drive shafts at both ends as compared to a case in which one end of the drive shafts is driven. Since the rotation speed deviates from the resonance frequency when the speed of the comber is increased, the quality of the sliver is prevented from being deteriorated.

[0033] The first embodiment has the following advantages.

(1) The combing heads 11 are arranged along the longitudinal direction of the comber, and use the common drive shafts. Among the drive shafts, the nipper shaft 22 performs the swinging motion (back-and-forth pivoting), and receives a greater load as compared to other drive shafts since the nipper shaft 22 drives the drive system of the nipper unit, which includes the nipper frame 17 (nipper plate) and the top nipper. The nipper shaft 22 is arranged to extend parallel to the longitudinal direction of the comber. At least the nipper shaft 22 is driven at both axial end portions via the drive portions to which drive force is transmitted from the main drive shaft 31, which is driven by the main motor 40. Therefore, in a case in which the speed of the comber is increased, the torsion angle of the nipper shaft 22 is reduced as compared to the configuration in which only one end of the nipper shaft is driven, and the resonance frequency of the nipper shaft 22 is also not reduced. Therefore, when the speed of the comber is increased, the variation in the quality of the slivers S spun from the combing heads 11 is reduced, and deterioration of the quality of the finished sliver is inhibited without increasing the distance by which the slivers S spun from the combing heads 11 are transferred to the draft part.

(2) The cylinder shaft 32, which is rotated in one direction but the speed of which is varied in one rotation, and the detaching roller shafts 33 and the swing shaft 49a, which are subjected to a smaller load than the nipper shaft but perform the swinging motion (back-and-forth pivoting), are also driven at both ends by the drive portions to which drive force is transmitted from the main drive shaft 31. Therefore, as compared to the comber configured such that the cylinder shaft 32, the swing shaft 49a, and the detaching roller shafts 33 are driven at one end, the difference in the torsion angle of the drive shafts is reduced when the speed of the comber is increased. This reduces variation in the quality of the sliver due to the difference in the relative torsion of the shafts per each combing head 11.

(3) The main drive shaft 31 is rotated at a higher speed than the cylinder shaft 32. Therefore, as compared to a configuration in which the main drive shaft 31 is rotated at a slower speed than the cylinder shaft 32, the torsion of the main drive shaft 31 is reduced. Accordingly, the torsion of the nipper shaft 22, the swing shaft 49a, and the detaching roller shafts 33, which are pivoted back and forth (swinging motion),

or the cylinder shaft 32, which varies the rotation speed, is also reduced.

(4) The nipper shaft 22, the cylinder shaft 32, the detaching roller shafts 33, and the swing shaft 49a are driven at both ends. The drive portions used in the conventional comber can basically be employed as the drive portions.

(Second Embodiment)

[0034] A second embodiment will now be described with reference to Fig. 3. The second embodiment mainly differs from the first embodiment in that the detaching roller shafts 33 are driven by servomotors 62 separate from the main motor 40. Like or the same reference numerals are given to those components that are like or the same as the corresponding components of the first embodiment and detailed explanations are omitted.

[0035] As shown in Fig. 3, two servomotors 62 are provided on the outside of each gear box 38 corresponding to two detaching roller shafts 33. Each servomotor 62 has an output shaft 62a, which projects into the gear box 38. A drive gear 63 is secured to each output shaft 62a to rotate integrally with the output shaft 62a. Each drive gear 63 meshes with the corresponding one of the gears 33a secured to the detaching roller shafts 33. That is, the ends of each detaching roller shaft 33 are driven by the two servomotors 62. That is, the combing head 11 according to the second embodiment is not provided with the rotation-swing conversion mechanisms 51, the planetary gear mechanisms 52, or the gear trains 54, which form the drive portion for the detaching roller shafts 33 provided in the first embodiment.

[0036] Rotation of the main drive shaft 31 is transmitted to a rotary shaft 64 via a belt transmission device 65. The rotary shaft 64 transmits rotation to the delivery roller shaft 36 and the calender roller shaft 37. A gear 64a, which meshes with the gears 36a, 37a, is secured to the rotary shaft 64 to rotate integrally with the rotary shaft 64. Rotation of the rotary shaft 64 is transmitted to the delivery roller shaft 36 via the gear 64a and the gear 36a, and to the calender roller shaft 37 via the gear 64a and the gear 37a.

[0037] Also, instead of driving the lap roller shafts 35 by the main motor 40, a lap roller motor 66 is provided. The lap roller shafts 35 are driven by the lap roller motor 66 via a belt transmission device 67. The lap roller motor 66 is rotated in the same direction as the main motor 40.

[0038] The second embodiment has the following advantages in addition to the advantage (1) of the first embodiment.

(5) Each detaching roller shaft 33 is driven by the servomotors 62 at both ends. Thus, the detaching roller shafts 33 are driven independently from the main motor 40, which facilitates adjusting the rotation speed. Also, the drive mechanism for transmitting the drive force from the main drive shaft 31 is unnecessary, which simplifies the drive mechanism of the detaching roller shafts 33, and reduces the size of the gear boxes 38.

(6) The ends of each detaching roller shaft 33 are driven by the two servomotors 62. Therefore, unlike the case in which the length of the detaching roller shafts 33 is reduced to half and each detaching roller shaft 33 having half the length is driven by the single servomotor 62, synchronization of the left and right servomotors 62 does not need to be set strictly.

[0039] The present invention is not restricted to the illustrated embodiments but may be embodied in the following modifications.

[0040] In the comber in which the combing heads 11 use the common drive shafts, at least the nipper shaft 22 may be arranged to extend along the longitudinal direction of the comber, and driven at both ends via the drive portion. Drive force is transmitted to the drive portion from the main drive shaft 31, which is driven by the main motor 40. That is, the drive shafts other than the nipper shaft 22 may be driven at one end. In the first and second embodiments, the cylinder shaft 32 may be driven at one end. In the first embodiment, the detaching roller shafts 33 may be driven at one end.

[0041] When driving the detaching roller shafts 33 at both ends as in the second embodiment, both ends of each detaching roller shaft 33 may be driven by the servomotor 62 located on one end of each detaching roller shaft 33 as shown in Fig. 4. In this case, a drive shaft 68 is provided corresponding to each detaching roller shaft 33. A gear 68a may be provided on each of the ends of the drive shaft 68 to rotate integrally with the drive shaft 68. Each gear 68a meshes with the associated gear 33a secured to the detaching roller shaft 33. The drive force of each drive shaft 68 is transmitted to the associated detaching roller shaft 33 via the gears 68a and gears 33a. In this case, the number of the servomotors 62 is reduced.

[0042] In the first embodiment, the lap rollers 12 may be driven by a motor separate from the main motor 40 as in the second embodiment. Alternatively, in the second embodiment, the lap rollers 12 may be driven by the main motor 40 as in the first embodiment.

[0043] Instead of driving the brush shaft 34 by the brush motor 41, the brush shaft 34 may be driven by the main motor 40.

[0044] The swing shaft 49a, which swings the auxiliary nipper 21, may be swung by a gear train instead of the link mechanisms 49 located between the nipper shaft 22 and the swing shaft 49a.

[0045] With the structure in which the detaching roller shafts 33 are driven by the servomotors 62 separate from the main motor 40 as in the second embodiment, the number of the drive mechanisms such as the gears accommodated in the gear boxes 38 is reduced. Therefore, the lubricant may be pumped up and supplied to necessary points. In this case, the amount of the lubricant is reduced.

[0046] A comber includes combing heads arranged along a longitudinal direction of a comber, and drive shafts common to the combing heads. The drive shafts include a main drive shaft driven by a main motor. At least a nipper shaft among the drive shafts is driven at both axial end portions by a pair of drive portions to which drive force is transmitted from the main drive shaft.

Claims

1. A comber comprising a plurality of combing heads arranged along a longitudinal direction of a comber and a plurality of common drive shafts common to the combing heads,
   the comber being **characterized in that** the drive shafts include a main drive shaft driven by a main motor, and at least a nipper shaft among the drive shafts is driven at both axial end portions by a pair of drive portions to which drive force is transmitted from the main drive shaft.

2. The comber according to claim 1, **characterized in that** the drive shafts include a cylinder shaft, a detaching roller shaft, and a swing shaft, and each of the cylinder shaft, the detaching roller shaft, and the swing shaft is driven at both axial end portions by the corresponding pair of drive portions.

3. The comber according to claim 2, **characterized in that** the main drive shaft is rotated at a higher speed than the cylinder shaft.

4. The comber according to claim 1, **characterized in that** the drive shafts include a cylinder shaft, and the main drive shaft is rotated at a higher speed than the cylinder shaft.

5. The comber according to claim 1, **characterized in that** the drive shafts include a detaching roller shaft, and the detaching roller shaft is driven at both axial end portions by at least a single servomotor.

6. The comber according to claim 5, wherein the detaching roller shaft is driven at both axial end portions by two servomotors.

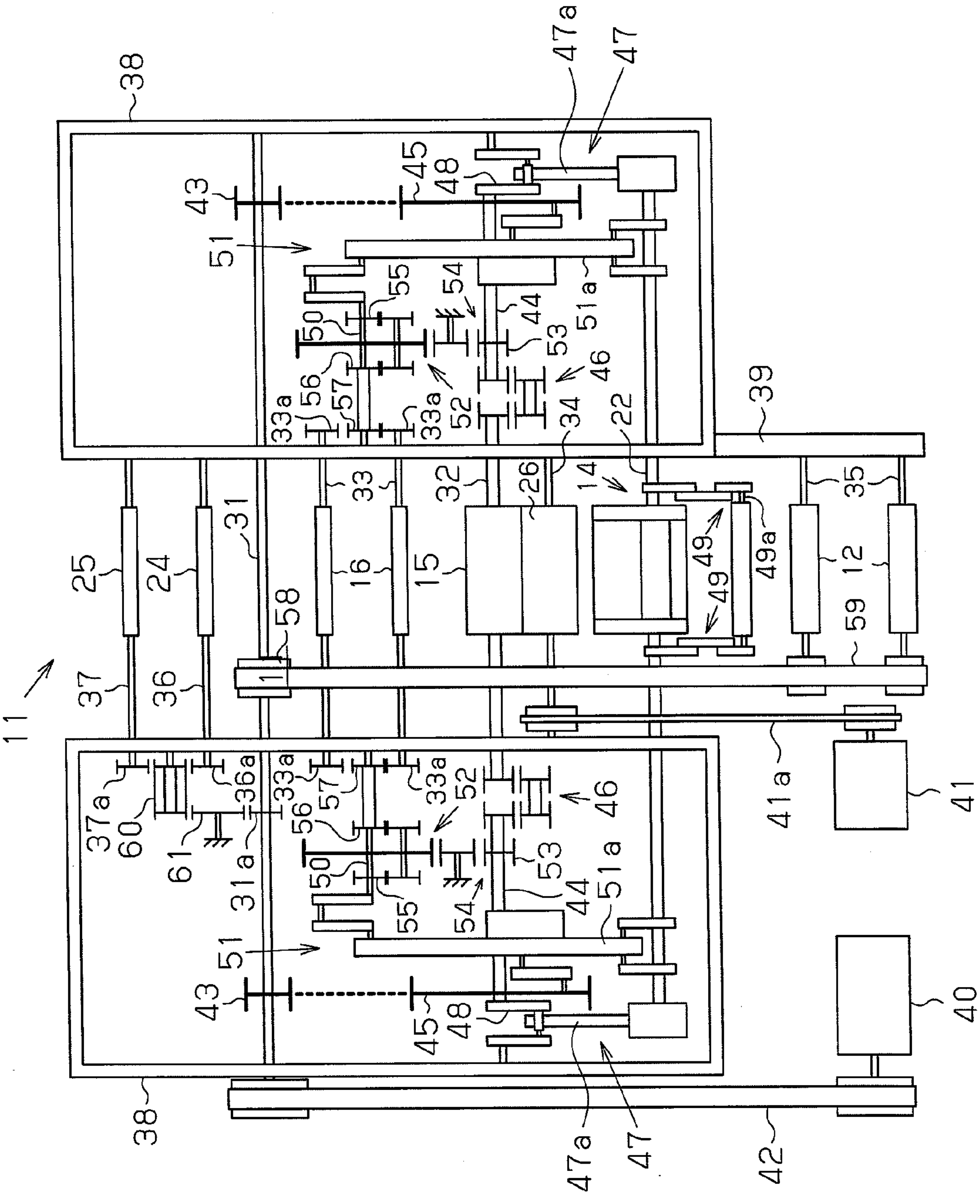


Fig.1

Fig.2

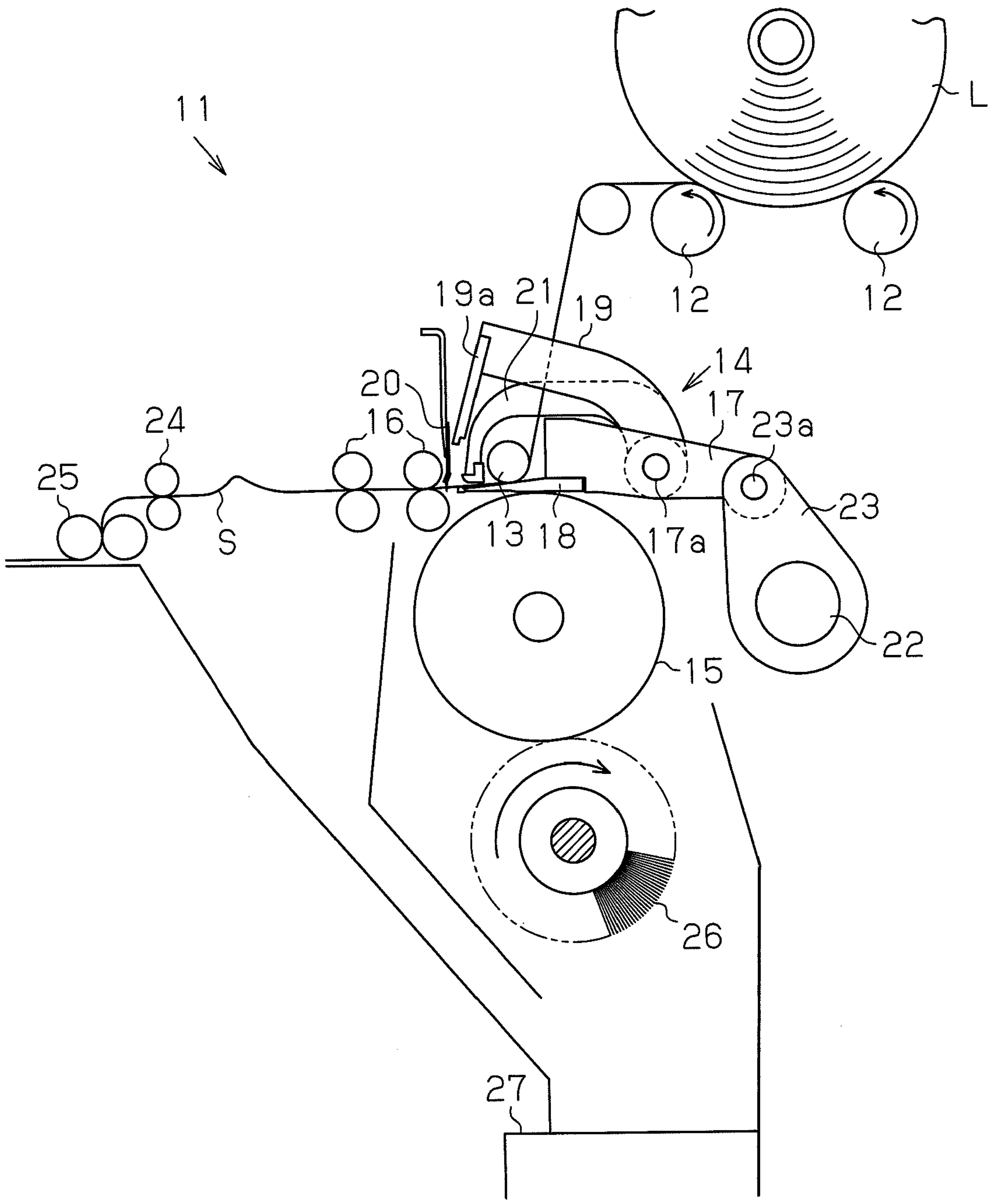


Fig.3

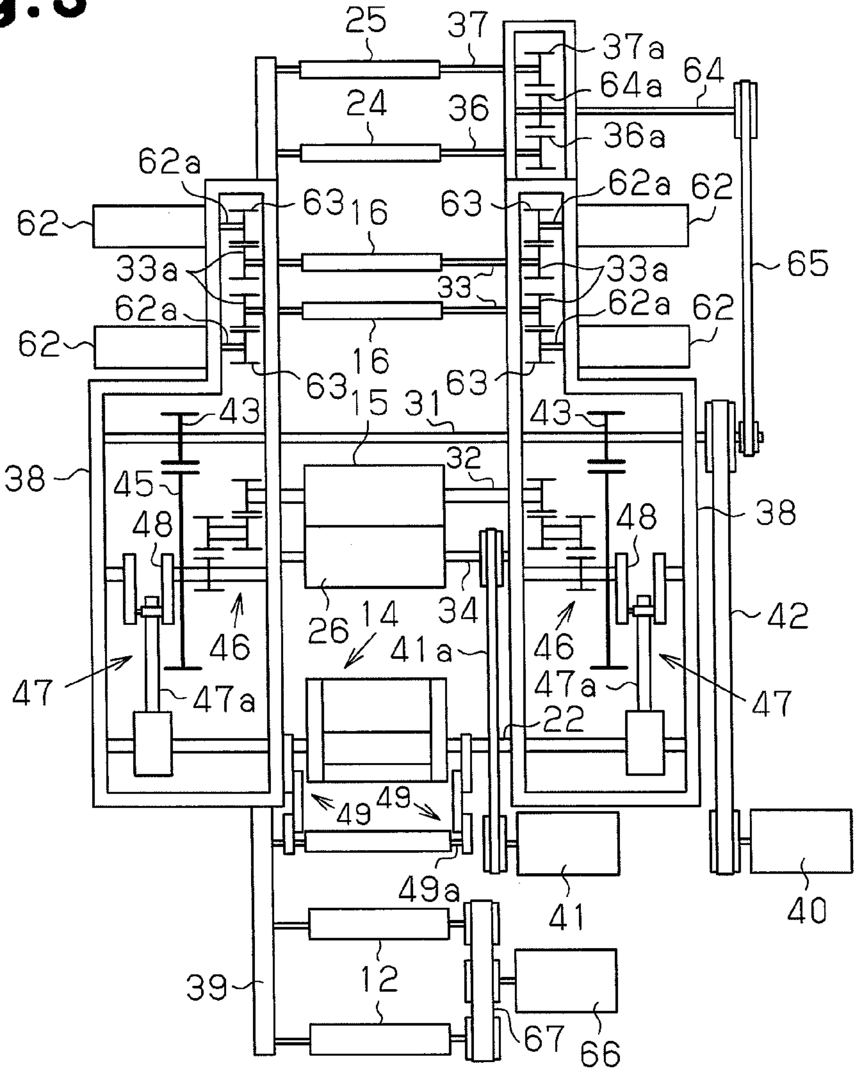

25
37
37a
64a
64
24
36
36a
62a
62
63
16
33a
33
65
15
31
43
38
45
32
48
26
14
34
46
41a
47
47a
22
42
49
49a
41
40
39
12
67
66

Fig.4

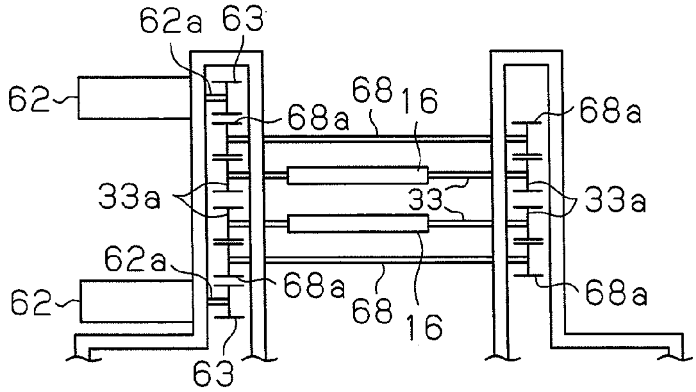

62a
63
62
68a
68
16
33a
33

Fig.5

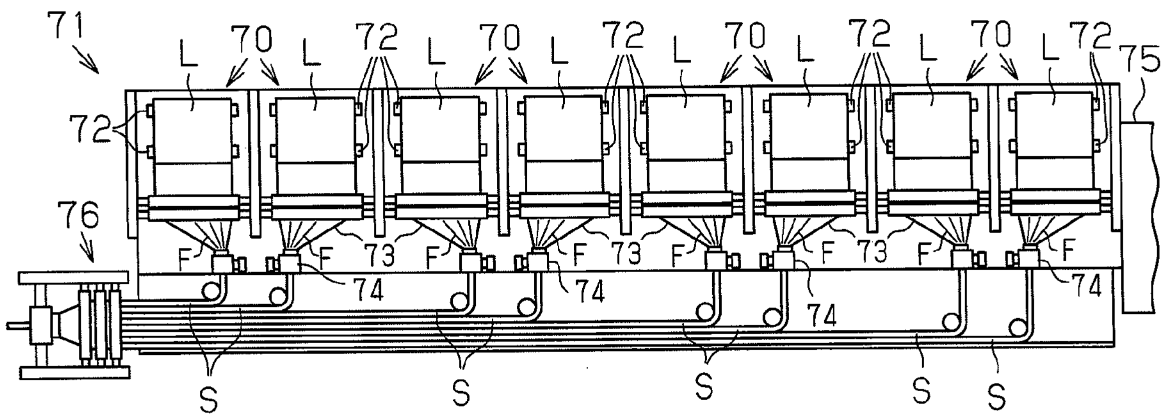


Fig.6

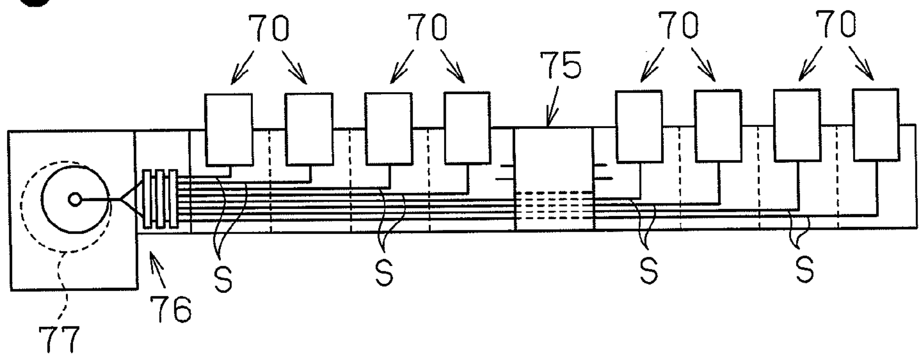
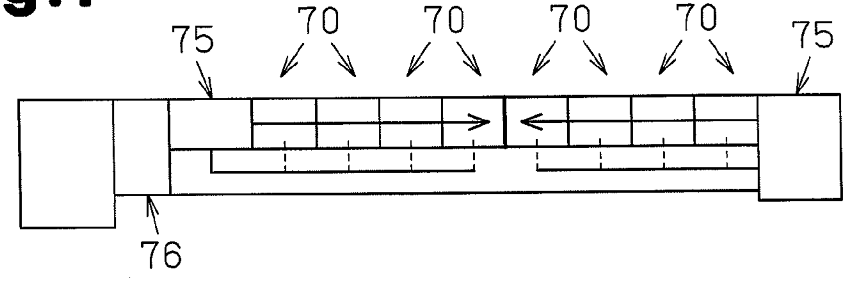


Fig.7



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 60215818 A **[0007] [0008] [0009] [0010]**
- DE 102006026850 A1 **[0008] [0010]**