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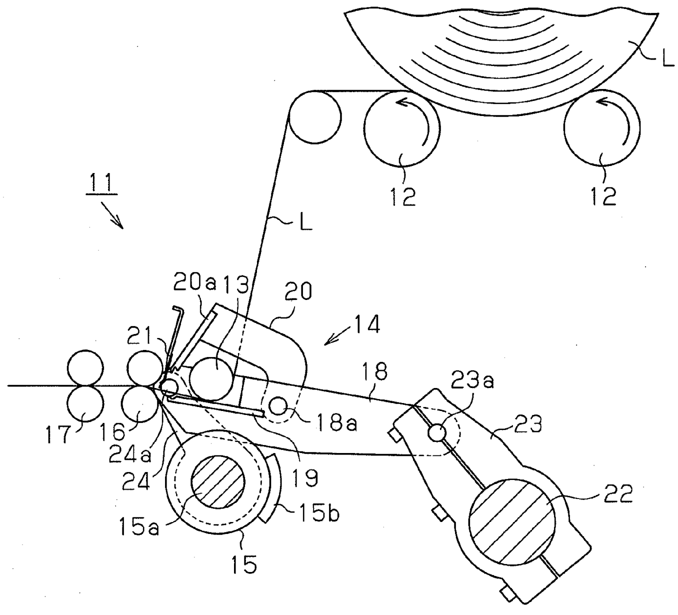
(54) Comber

(57) A nipper shaft driving portion (25) has an output shaft (28), which is pivoted in a reciprocating manner coaxially with a nipper shaft (22) in synchronization with a combing cylinder (15). The output shaft (28) has a first end, which is relatively close to the nipper shaft (22), and a second end, which is opposite to the first end. At least the first end of the output shaft (28) is arranged to protrude outside of a gear box (26). A nipper gauge adjusting mechanism (34) is provided between the first end of the output shaft (28) and one end of the nipper shaft (22). The nipper gauge adjusting mechanism (34) is configured to permit the nipper shaft (22) and the output shaft (28) are to be switched between a state where the shafts are integrally rotatable and a state where the nipper shaft (22) can rotate relative to the output shaft (28).

Fig.1



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Description

BACKGROUND

[0001] The present invention relates to a comber, and more specifically to a comber having a nipper gauge adjusting mechanism.

[0002] A comber has an operational portion, in which a plurality of (typically, eight) combing heads are arranged. A nipper device holds a lap fed by a predetermined amount at a time. Each combing head combs the distal end of a lap held by the nipper device using a combing cylinder. Fleece that is generated by combing of the lap is moved to detaching rollers as the nipper device advances. In response to the advance of the fleece, the detaching rollers are rotated in the reverse direction and retract fleece that has been taken before, or preceding fleece. Then, the trailing end of the preceding fleece and the advancing end of the newly combed fleece, or succeeding fleece, are overlapped. Subsequently, the detaching rollers are rotated forward to take the fleece from the nipper device, and the trailing end of the fleece is combed with a top comb stuck into the fleece. The comber bundles the fleece made by repeating this process in the combing heads and drafts the fleeces, and thereafter compresses the fleeces using calender rollers to obtain sliver.

[0003] A nipper device basically includes a nipper frame, a bottom nipper fixed to the distal end of the nipper frame, and a top nipper that cooperates with the bottom nipper to hold a lap. The top nipper and the distal end of the bottom nipper hold the lap. The nipper device is structured to be swung between a position where the distal end of the bottom nipper is in the vicinity of the pivoting path of a cylinder needle of a combing cylinder and a position where the distal end of the bottom nipper is in the vicinity of detaching rollers.

[0004] When adjusting the amount of cotton waste from a lap in a comber, the distance between the detaching rollers and the nipper, or the nipper gauge, with the nipper frame moved to the most advanced position, needs to be adjusted. Conventionally, a nipper gauge adjusting mechanism has been proposed that adjusts the nipper gauges of a plurality of combing heads (refer to German Patent Application DE10206605A1). As shown in Fig. 7, a conventional nipper gauge adjusting mechanism 61 is attached to and rotates integrally with one end of a nipper shaft 63, which extends through a gear box 62, (the right end as viewed in Fig. 7). A part of the nipper gauge adjusting mechanism 61 (left portion as viewed in Fig. 7) protrudes into the gear box 62. The nipper gauge adjusting mechanism 61 is formed to be substantially cylindrical. The part of the nipper gauge adjusting mechanism 61 protruding from the gear box 62 is split into two semi-cylindrical shapes. The two semi-cylindrical shapes are fastened to each other by a plurality of screws 64 to be fixed to the nipper shaft 63. When the screws 64 are loosened, the nipper gauge adjusting mechanism 61 is allowed to pivot relative to the nipper shaft 63.

[0005] One end 65a of an arm 65 is fixed to a part of the nipper gauge adjusting mechanism 61 that protrudes into the gear box 62 with a screw (not shown), so that the arm 65 and the nipper gauge adjusting mechanism 61 rotate integrally. A drive gear 66, which is driven in synchronization with the combing cylinder, is provided in the gear box 62. A rotating member 67 is provided on the opposite side of the arm 65 with respect to the drive gear 66. The rotating member 67 is coaxial with the drive gear 66. The arm 65 is coupled to the drive gear 66 via a slider portion 69. The slider portion 69 is supported by a supporting portion 68 provided between the drive gear 66 and the rotating member 67.

[0006] In a state where the screws 64 are fastened so that the nipper gauge adjusting mechanism 61 is integrally rotatable with the nipper shaft 63, the nipper shaft 63 is swung in a predetermine range (pivoted in a reciprocating manner) via the nipper gauge adjusting mechanism 61, in synchronization with rotation of the drive gear 66. In contrast, when the screws 64 are loosened, the nipper shaft 63 is pivoted relative to the nipper gauge adjusting mechanism 61. Thereafter, the screws 64 are fastened again to change the nipper gauge amount. The nipper gauge amount is adjusted in this manner.

[0007] However, the conventional nipper gauge adjusting mechanism 61 is attached to an end of the nipper shaft 63 that protrudes from the gear box 62 in a state where the mechanism 61 extends through the wall of the gear box 62. Therefore, the nipper gauge adjusting mechanism 61 needs to be assembled to the nipper shaft 63 after the nipper shaft 63 is installed in a predetermined position of the gear box 62. That is, the nipper gauge adjusting mechanism 61 needs to be fixed to the nipper shaft 63 to be integrally rotatable with the nipper shaft 63, while maintaining a seal with the gear box 62. Further, the nipper gauge adjusting mechanism 61 needs to be pivotal relative to the nipper shaft 63 when the screws 64 are loosened. Therefore, the nipper gauge adjusting mechanism 61 is difficult to install, which reduces the manufacturability of the combing part.

[0008] It is an objective of the present invention to provide a comber that allows a nipper gauge adjusting mechanism to be easily installed and improves the manufacturability of a nipper device including a nipper driving portion.

SUMMARY OF THE INVENTION

[0009] To achieve the foregoing objective, the present invention provides a comber having a plurality of combing heads, each of which has a nipper frame. When a common nipper shaft is rotated in a reciprocating manner with respect to the nipper frames, the nipper frames of all the combing heads are swung back and forth in synchronization, and the nipper shaft is rotated in a reciprocating manner in synchronization with a combing cylinder by a nipper shaft driving portion located in a gear box. The nipper shaft driving portion has an output shaft arranged coaxially with the nipper shaft. The output shaft is rotated in a reciprocating manner in synchronization with the combing cylinder. The output shaft has a first end, which is relatively close to the nipper shaft, and a second end, which is opposite to the first end. At least the first end of the output shaft protrudes to the outside of the gear box. A nipper gauge adjusting mechanism is provided between the first end of the output shaft and one end of the nipper shaft. The nipper gauge adjusting mechanism is configured to permit the nipper shaft and the output shaft to be switched between a state where the nipper shaft and the output shaft rotate integrally and a state where the nipper shaft is allowed to rotate relative to the output shaft.

[0010] According to this configuration, the nipper shaft is coupled to the output shaft of the nipper shaft driving portion in the gear box via the nipper gauge adjusting mechanism to be integrally rotatable with the output shaft. In a state of being coupled to the output shaft, the nipper shaft is pivoted in a reciprocating manner, or swung, in synchronization with the combing cylinder. To adjust the nipper gauge, the nipper shaft is pivoted relative to the output shaft by a required adjustment amount in a state where the nipper shaft is pivotable relative to the output shaft. After the relative pivoting motion, the nipper shaft is again coupled to the output shaft via the nipper gauge adjusting mechanism to be integrally rotatable with the output shaft. The required adjustment amount is an amount of pivoting motion of the nipper shaft that corresponds to a nipper gauge in a case where the amount of cotton waste is equal to a target amount. The nipper shaft driving portion swings the output shaft always in the same state regardless of adjustment of the nipper gauge. On the other hand, the start position of swinging motion of the nipper shaft is changed when the nipper gauge adjustment is executed. Accordingly, the range of swinging motion of the nipper shaft is varied. This changes the range of swinging motion of the nipper frame in the forward-rearward direction. As a result, the nipper gauge is changed. Unlike the conventional art, the nipper gauge adjusting mechanism of the present invention is located between the end of the output shaft protruding to the outside of the gear box and one end of the nipper shaft. The nipper shaft driving portion, which has the output shaft, is located inside the gear box. Accordingly, the nipper gauge adjusting mechanism is easy to install, and the manufacturability of the nipper device, which includes the nipper driving portion, is improved.

[0011] The nipper gauge adjusting mechanism preferably has a joint portion. The joint portion is formed by a first member fixed to and integrally rotatable with the output shaft and a second member fixed to and integrally rotatable with the nipper shaft. The second member has an elongated hole, which extends in the circumferential direction of the nipper shaft. A fastener is passed through the elongated hole. When the fastener is fastened, the first member and the second member are fixed relative to each other. When the fastener is loosened, the first member and the second member are allowed to pivot relative to each other.

[0012] According to this configuration, the nipper gauge adjusting mechanism can be manufactured independently from the nipper shaft driving portion and the nipper shaft. The nipper gauge adjusting mechanism can be retrofitted to the nipper shaft driving portion and the nipper shaft.

[0013] Preferably, an axis aligning portion is provided between the first member and the second member. According this configuration, even if the nipper shaft and the second member are pivoted relative to the first member to adjust the nipper gauge, the coaxial arrangement of the output shaft and the nipper shaft is maintained.

[0014] The nipper gauge adjusting mechanism preferably has a joint portion. The joint portion includes a fixed portion fixed to and integrally rotatable with the output shaft and a joint portion that can be switched between a state where the joint portion is rotatable relative to the nipper shaft and a state where the joint portion is fixed relative to the nipper shaft. An internal thread portion is formed in the circumferential surface of the nipper shaft. The joint portion has an elongated hole, which extends in the circumferential direction of the nipper shaft. The elongated hole is formed at a position that faces the internal thread portion. A bolt, which is passed through the elongated hole, is threaded to the internal thread portion. When the bolt is fastened, the joint portion is fixed relative to the nipper shaft. The bolt is loosened, the joint portion is allowed to rotate relative to the nipper shaft. This configuration has fewer components compared to a nipper gauge adjusting mechanism that has a joint portion formed by a first member and a second member.

[0015] The joint portion preferably includes an insertion hole into which the output shaft and the nipper shaft are inserted, a groove that connects the insertion hole with the outer circumferential surface of the joint portion, and a bolt hole perpendicular to the groove. A fastening bolt is threaded to the bolt hole. When the fastening bolt is fastened, the joint portion is fixed to the output shaft and the nipper shaft. This configuration has fewer components compared to a configuration in which a joint portion is formed by separable parts that sandwich an output shaft or a nipper shaft. Accordingly, the nipper gauge adjusting mechanism is easy to install.

[0016] 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

[0017] The features of the present invention that are believed to be novel are set forth with particularity in the appended claims. 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 schematic side view illustrating a combing head shown in Fig. 3;
Fig. 2(a) is a cross-sectional plan view of the nipper gauge adjusting mechanism shown in Fig. 1;
Fig. 2(b) is a cross-sectional view taken along line A-A in Fig. 2(a);
Fig. 3 is a plan view, with a part cut away, illustrating the nipper frame driving mechanism and the nipper gauge adjusting mechanism according to a first embodiment of the present invention;
Figs. 4(a) and 4(b) are explanatory side views showing operation of the combing head of Fig. 1;
Fig. 5(a) is a cross-sectional view illustrating a nipper gauge adjusting mechanism according to a second embodiment;
Fig. 5(b) is a cross-sectional view taken along line B-B of Fig. 5(a);
Fig. 6 is a cross-sectional view illustrating a nipper gauge adjusting mechanism according to another embodiment;
Fig. 7 is a diagrammatic plan view showing the prior art.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Figs. 1 to 4(b) show a first embodiment of the present invention.

[0019] Atypical comber has an operational portion, in which eight combing heads are arranged. As shown in Fig. 1, 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, 17. Each pair of detaching rollers 16, 17 is displaced from another pair of detaching rollers 16, 17 in the front-back direction. The left side of Fig. 1 is defined as the front side, and the right side is defined as the rear side. The nipper device 14 has a nipper frame 18, which is located above the combing cylinder 15 to be swingable forward and backward. A bottom nipper 19 is located at the bottom of a front portion of the nipper frame 18. A nipper arm 20 is pivotably connected to a center in the front-back direction of the nipper frame 18 with a support shaft 18a. A top nipper 20a is fixed to the distal end of the nipper arm 20. In synchronization with swinging motion of the nipper frame 18 in the advancing and retreating directions, the top nipper 20a opens and closes at predetermined timing to pinch a lap L in cooperation with the bottom nipper 19. A top comb 21 is attached to the nipper frame 18. The top comb 21 is located forward of the bottom nipper 19 and performs a predetermine action in synchronization with the nipper frame 18.

[0020] A nipper shaft 22 is arranged at the rear of the combing cylinder 15 and below the nipper frame 18 to be able to pivot back and forth. A first end (the lower end as viewed in Fig. 1) of a nipper frame drive arm 23 is secured to the nipper shaft 22 to pivot integrally with the nipper shaft 22. The rear end of the nipper frame 18 is pivotably supported on a second end (the upper end as viewed in Fig. 1) of the nipper frame drive arm 23 via a support shaft 23a. A support arm 24 is rotatably supported to the cylinder shaft 15a. The front end of the nipper frame 18 is pivotably supported on the distal end of the support arm 24 via a support shaft 24a. The nipper frame 18 is configured to be swung back and forth such that the distal end of the bottom nipper 19 approaches and separates from the detaching rollers 16, 17 by back-and-forth pivoting (swinging motion) of the nipper shaft 22. A main motor (not shown) drives a drive shaft, and rotation of the main motor is transmitted to the cylinder shaft 15a and the nipper shaft 22 via mechanical components such as gears and cranks. The nipper device 14 is therefore driven in synchronization with the combing cylinder 15.

[0021] Next, a nipper shaft driving portion 25 and a nipper gauge adjusting mechanism 34 will now be described. As shown in Fig. 3, the nipper shaft driving portion 25 is provided in a gear box 26 located at one end of a machine (not shown). The nipper shaft driving portion 25 has a drive gear 27 driven by a drive shaft. The drive gear 27 is arranged to rotate in a plane perpendicular to the nipper shaft 22. An output shaft 28 is housed in the gear box 26. The output shaft 28 is supported via a pair of bearings 29 to be coaxial with the nipper shaft 22. One end of the output shaft 28, which is a first end 28a, protrudes to the outside of the gear box 26. That is, the output shaft 28 has the first end 28a closer to the nipper shaft 22 (the left end as viewed in Fig. 3), and a second end 28b on the side opposite to the nipper shaft 22 (the right end as viewed in Fig. 3). In the gear box 26, one end of an arm 30 is fixed to the output shaft 28 so that the arm 30 rotates integrally with the output shaft 28. In the gear box 26, a rotating member 31 is provided on the opposite side of the arm 30 with respect to the drive gear 27. The rotating member 31 is coaxial with the drive gear 27. The arm 30 is operably coupled to the drive gear 27 via a slider portion 33. The slider portion 33 is supported by a supporting portion 32 provided between the drive gear 27 and the rotating member 31. That is, the drive gear 27, the output shaft 28, the arm 30, the rotating member 31, the supporting portion 32, and the slider portion 33 form a slider crank mechanism. In synchronization with rotation of the drive gear 27, the output shaft 28 is swung, or pivoted in a reciprocation manner, in a predetermined range.

[0022] As shown in Fig. 3, the nipper gauge adjusting mechanism 34 is located between the first end 28a of the output shaft 28 and the nipper shaft 22. The first end 28a of the output shaft 28 protrudes to the outside of the gear box 26 and is located relatively closer to the nipper shaft 22 than the second end 28b. The nipper gauge adjusting mechanism 34 is configured to permit the nipper shaft 22 and the output shaft 28 to be switched between a state where the nipper shaft 22 and the output shaft 28 rotate integrally and a state where the nipper shaft 22 is allowed to rotate relative to the output shaft 28. When the output shaft 28 is fixed and the nipper shaft 22 is allowed to rotate relative to the output shaft 28, the nipper shaft 22 is rotated relative to the output shaft 28 by a required amount to perform an adjustment. The nipper gauge adjusting mechanism 34 is configured such that, after such relative rotation, the nipper shaft 22 and the output shaft 28 are integrally coupled to each other. In other words, the nipper shaft 22 and the output shaft are again fixed to one another after the adjustment.

[0023] Specifically, the nipper gauge adjusting mechanism 34 includes a joint portion 37. As shown in Figs. 2 and 3, the joint portion 37 is formed a first joint member 35 and a second joint member 36. The first joint member 35 is a first member that is fixed to and rotates integrally with the output shaft 28. The second joint member 36 is a second member that is fixed to and rotates integrally with the nipper shaft 22. As shown in Figs. 2(a) and 2(b), the second joint member 36 has an elongated hole 38, which extends in the circumferential direction of the nipper shaft 22. The first joint member 35 has a threaded hole 39 at a position that corresponds to the elongated hole 38. An adjuster bolt 40, which functions as a fastener, is inserted into the elongated hole 38 and threaded to the threaded hole 39. When the adjuster bolt 40 is fastened, the first joint member 35 and the second joint member 36 are fixed with respect to each other. In contrast, when the adjuster bolt 40 is loosened, the first joint member 35 and the second joint member 36 are allowed to pivot with respect to each other.

[0024] The first joint member 35 is formed to be substantially cylindrical. The first joint member 35 includes an insertion hole 35a into which the output shaft 28 is inserted, a communication groove 35b that connects the insertion hole 35a with the outer circumferential surface of the first joint member 35, and a plurality of first fastening bolt holes 35c perpendicular to the communication groove 35b. First fastening bolts 41 are threaded into the first fastening bolt holes 35c to secure the first joint member 35 to the output shaft 28. Hex socket bolts are used as the first fastening bolts 41. A first projection 35d is formed on the outer circumferential surface of the cylindrical portion of the first joint member 35 at one axial end of the cylindrical portion. The threaded hole 39 is formed in the first projection 35d.

[0025] Like the first joint member 35, the second joint member 36 is also formed to be substantially cylindrical. The second joint member 36 includes an insertion hole 36a into which the nipper shaft 22 is inserted, a communication groove 36b that connects the insertion hole 36a with the outer circumferential surface of the second joint member 36, and second fastening bolt holes 36c perpendicular to the communication groove 36b. Second fastening bolts 42 are threaded into the second fastening bolt holes 36c to secure the second joint member 36 to the nipper shaft 22. Hex socket bolts are used as the second fastening bolts 42. A second projection 36d is formed on the outer circumferential surface of the cylindrical portion of the second joint member 36 at one axial end of the cylindrical portion. The elongated hole 38 is formed in the second projection 36d.

[0026] As described above, the joint portion 37 includes the insertion holes 35a, 36a into which the output shaft 28 and the nipper shaft 22 are inserted, the communication grooves 35b, 36b that connect the insertion holes 35a, 36a with the outer circumferential surface of the joint portion 37, the first fastening bolts 35c and the second fastening bolts 36c perpendicular to the communication grooves 35b 36b. The joint portion 37 is fixed to the output shaft 28 and the nipper shaft 22 by fastening the first fastening bolts 41 and the second fastening bolts 42 threaded to the first fastening bolt holes 35c and the second fastening bolt holes 36c.

[0027] As shown in Figs. 2(a) and 2(b), an axis aligning portion 43 is located between the first joint member 35 and the second joint member 36. In the present embodiment, the axis aligning portion 43 is formed by a substantially annular protrusion 44 formed on the first joint member 35 and a substantially annular recess 45 formed in the second joint member 36 to be engaged with the annular protrusion 44. That is, the annular protrusion 44 is formed in an inner circumferential portion on the end face of the first joint member 35 that faces the second joint member 36. The annular recess 45 is formed in an inner circumferential portion on the end face of the second joint member 36 that faces the first joint member 35. The annular protrusion 44 and the annular recess 45 each have a shape in which a part corresponding to the communication grooves 35b, 36b is cut.

[0028] When installing the nipper gauge adjusting mechanism 34 between the nipper shaft 22 and the output shaft 28, the first joint member 35 and the second joint member 36 are split from each other, and the first fastening bolts 41 and the second fastening bolts 42 are loosened. In this state, the first joint member 35 is fitted to the first end 28a of the output shaft 28, and the second joint member 36 is fitted to the end of the nipper shaft 22. Thereafter, the first fastening bolts 41 are fastened to secure the first joint member 35 to the first end 28a of the output shaft 28, and the second fastening bolts 42 are fastened to secure the second joint member 36 to the nipper shaft 22. Next, with the nipper shaft 22 and the output shaft 28 arranged coaxially, the nipper shaft 22 is moved such that the annular protrusion 44 of the axis aligning portion 43 fitted to the annular recess 45. Thereafter, with the adjuster bolt 40 extending through the elongated hole 38 of the second joint member 36, the adjuster bolt 40 is threaded to the threaded hole 39 of the first joint member 35, thereby assembling the second joint member 36 to the first joint member 35. The assembly of the nipper gauge adjusting mechanism 34 is completed.

[0029] Operation of the device configured as described above will now be described.

[0030] When the comber is operating, the drive gear

27 is rotated in synchronization with the combing cylinder 15 via the drive shaft driven by the main motor (not shown). The output shaft 28 of the nipper shaft driving portion 25 is rotated in a reciprocating manner (alternating clockwise and counterclockwise motion) in a predetermined range by rotation of the drive gear 27. Accordingly, the nipper shaft 22 moves integrally with the output shaft 28 via the nipper gauge adjusting mechanism 34. As the nipper shaft 22 is rotationally reciprocated, the bottom nipper 19 is swung back and forth together with the nipper frame 18. Since the top nipper 20a is swung upward and downward, the top nipper 20a and the distal end of the bottom nipper 19 selectively hold and release the lap L. The distal end of the lap L held by the nipper device 14 is combed with a combing segment 15b of the combing cylinder 15. When the lap L is combed with the combing segment 15b, the amount of cotton waste removed from the lap L is changed in accordance with the timing at which the combing segment 15b combs the lap L held by the nipper device 14.

[0031] The combing cylinder 15 is rotated at a predetermined speed in accordance with spinning conditions. Accordingly, the combing segment 15b passes below the bottom nipper 19 at predetermined intervals. On the other hand, the nipper frame 18 is swung back and forth in a predetermined range by the reciprocating motion of the nipper shaft 22, which is moved in synchronization with the combing cylinder 15. Therefore, when the front-most position of the nipper frame 18 is changed, the timing at which the combing segment 15b combs the distal end of the lap L held by the nipper device 14 changes. Accordingly, the amount of waste cotton is changed.

[0032] To make the amount of waste cotton an adequate value in accordance with the quality of the spun product, a nipper gauge G needs to be adjusted. The nipper gauge G refers to the distance between the front edge of the bottom nipper 19 and the detaching roller 16 when the nipper frame 18 is moved to the front-most position. Adjustment of the nipper gauge G is executed by adjusting the nipper gauge adjusting mechanism 34 prior to operation of the comber. Specifically, when adjusting the nipper gauge G, the adjuster bolt 40 is loosened when the comber is in a stopped state, so that the fastening of the first joint member 35 and the second joint member 36 by the adjuster bolt 40 is removed. In this state, the first joint member 35 and the nipper shaft 22 are rotated relative to the second joint member 36 and the output shaft 28 by a required adjustment amount. Thereafter, the adjuster bolt 40 is fastened again, so that the adjustment of the nipper gauge G is completed. The adjustment amount for making the amount of cotton waste an appropriate value is obtained in advance, and the nipper gauge G is adjusted to have an adequate value that corresponds to the spinning conditions based on the data.

[0033] Fig. 4(a) shows a state in which the nipper gauge G is narrow, and Fig. 4(b) shows a state in which the nipper gauge G is wide. From the state of a narrow nipper gauge G shown in Fig. 4(a), the nipper shaft 22 is pivoted clockwise when the nipper shaft 22 is allowed to pivot relative to the output shaft 28, to adjust the nipper gauge G. Then, the nipper frame drive arm 23 is rotated integrally with the nipper shaft 22, so that the support arm 24 is pivoted clockwise about the cylinder shaft 15a via the nipper frame 18. As a result the nipper gauge G is widened as shown in Fig. 4(b). When the nipper shaft 22 is rotated in this manner, the cylinder shaft 15a is in a stopped state. Thus, even if the support arm 24 is pivoted, the combing cylinder 15 is not pivoted. That is, the position of the combing segment 15b is not changed. As the nipper gauge adjustment is performed in this manner, the positional relationship between the nipper device 14 and the combing segment 15b is changed. This changes the amount of cotton waste during operation of the comber.

[0034] The present embodiment has the following advantages.

(1) The nipper shaft driving portion 25 of the comber has the output shaft 28, which is pivoted in a reciprocating manner coaxially with the nipper shaft 22 in synchronization with the combing cylinder 15. The first end 28a, which is the end of the output shaft 28 closer to the nipper shaft 22, protrudes to the outside of the gear box 26. The nipper gauge adjusting mechanism 34 is located between the first end 28a of the output shaft 28, which protrudes to the outside of the gear box 26, and the nipper shaft 22. The nipper gauge adjusting mechanism 34 is configured such that the nipper shaft 22 and the output shaft 28 can be switched between a state in which the shafts 22, 28 are integrally rotatable and a state in which the shafts 22, 28 are allowed to rotate relative to each other. Specifically, the state where the shafts 22, 28 are allowed to rotate relative to each other refers to a state where the nipper shaft 22 is allowed to rotate relative to the output shaft 28 when the output shaft 28 stationary. This facilitates assembly of the nipper gauge adjusting mechanism 34. Also, the manufacturability of the nipper device, which includes the nipper shaft driving portion 25, is improved.

(2) The nipper gauge adjusting mechanism 34 has the joint portion 37, which joins the nipper shaft 22 to the output shaft 28. The joint portion 37 is formed by the first joint member 35, which is fixed to and rotates integrally with the output shaft 28, and the second joint member 36, which is fixed to and rotates integrally with the nipper shaft 22. The second joint member 36 has the elongated hole 38, which extends in the circumferential direction of the nipper shaft 22. When a fastener (the adjuster bolt 40) passed through the elongated hole 38 is fastened, the first joint member 35 and the second joint member 36 are fixed with respect to each other. In contrast, when the fastener is loosened, the first joint member 35 and the second joint member 36 are allowed to pivot with respect to each other. Therefore,

the nipper gauge adjusting mechanism 34 can be manufactured independently from the nipper shaft driving portion 25 and the nipper shaft 22. Further, the nipper gauge adjusting mechanism 34 can be retrofitted to the nipper shaft driving portion 25 and the nipper shaft 22.

(3) The axis aligning portion 43 is located between the first joint member 35 and the second joint member 36. Therefore, even if the nipper shaft 22 and the second joint member 36 are pivoted relative to the first joint member 35 to adjust the nipper gauge, the coaxial arrangement of the output shaft 28 and the nipper shaft 22 is maintained.

(4) The axis aligning portion 43 is formed by the substantially annular protrusion 44 formed on the first joint member 35 and the substantially annular recess 45 formed in the second joint member 36 to be engaged with the annular protrusion 44. The annular protrusion 44 is formed in an inner circumferential portion on the end face of the first joint member 35 that faces the second joint member 36. The annular recess 45 is formed in an inner circumferential portion on the end face of the second joint member 36 that faces the first joint member 35. Therefore, compared to, for example, a case where an axis aligning portion 43 is formed as a component separate from a first joint member 35 and a second joint member 36, the number of components is reduced.

(5) The joint portion 37 of the nipper gauge adjusting mechanism 34 includes the insertion holes 35a, 36a into which the output shaft 28 and the nipper shaft 22 are inserted, the communication grooves 35b, 36b that connect the insertion holes 35a, 36a with the outer circumferential surface of the joint portion 37, the first fastening bolts 35c and the second fastening bolts 36c perpendicular to the communication grooves 35b 36b. The joint portion 37 is fixed to the output shaft 28 and the nipper shaft 22 by fastening the first fastening bolts 41 and the second fastening bolts 42 threaded to the first fastening bolt holes 35c and the second fastening bolt holes 36c. Therefore, compared to a configuration in which a joint portion is formed by two or more separable parts that sandwich the output shaft 28 or the nipper shaft 22, the number of components is smaller and the installment is facilitated.

[0035] Fig. 5 shows a second embodiment of the present invention. The second embodiment is different from the first embodiment in the structure of a nipper gauge adjusting mechanism. 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.

[0036] As shown in Fig. 5(a), a nipper gauge adjusting mechanism 50 includes a joint portion 51. The joint portion 51 includes a fixed portion 51 a, which is fixed to and rotates integrally with the output shaft 28, and a joint portion 51 b, which is switched between a state where the joint portion 51 b is rotatable relative to the nipper shaft 22 and a state where the joint portion 51 b is not rotatable relative to the nipper shaft 22. As shown in Fig. 5(b), the joint portion 51 b has an elongated hole 52, which extends in the circumferential direction of the nipper shaft 22. An internal thread portion 22a is formed in the circumferential surface of the nipper shaft 22. The elongated hole 52 is formed at a position that faces the internal thread portion 22a. An adjuster bolt 40 is passed though the elongated hole 52 and threaded to the internal thread portion 22a. When the adjuster bolt 40 is fastened, the joint portion 51 b is not rotatable relative to the nipper shaft 22. In contrast, when the adjuster bolt 40 is loosened, the joint portion 51 b is rotatable relative to the nipper shaft 22.

[0037] In this embodiment, the nipper gauge adjusting mechanism 50 is movable relative to the output shaft 28 when the first fastening bolts 41 are loosened. When the adjuster bolt 40 and the second fastening bolts 42 are both loosened, the nipper shaft 22 is allowed to rotate with respect to the joint portion 51. When the adjuster bolt 40 is removed from the internal thread portion 22a, and the second fastening bolt 42 is loosened, the joint portion 51 is movable axially relative to the nipper shaft 22.

[0038] When installing the nipper gauge adjusting mechanism 50 between the nipper shaft 22 and the output shaft 28, the joint portion 51 b is attached to the nipper shaft 22 with both of the first fastening bolts 41 and the second fastening bolts 42 loosened. Then, the adjuster bolt 40 is threaded to the internal thread portion 22a. Then, with the nipper shaft 22 and the output shaft 28 arranged coaxially, the nipper shaft 22 is moved such that the first joint member 35 is inserted into the fixed portion 51 a. Thereafter, the first fastening bolt 41 and the second fastening bolt 42 are fastened.

[0039] The second embodiment has the following advantage in addition to the advantages (1), (5) of the first embodiment.

(6) Compared to the joint portion 37 of the first embodiment, which is formed by the axially separable first and second joint members 35, 36, the joint portion 51 has fewer components.

[0040] The present invention is not restricted to the illustrated embodiments but may be embodied in the following forms.

[0041] As shown in Fig. 6, in place of the annular protrusion 44, the first joint member 35 may have an annular recess 46 that is coaxial with and has the same diameter as the annular recess 45 of the second joint member 36. The axis aligning portion 43 may be formed by the annular recesses 45, 46 and a ring 47, which is fitted in the annular recess 45, 46.

[0042] The first joint member 35 and the second joint member 36 each may be formed by separable parts that can sandwich the output shaft 28 or the nipper shaft 22. Also, the joint portion 51 may be formed by separable parts that can sandwich the output shaft 28 or the nipper shaft 22. In these cases, the nipper gauge adjusting mechanisms 34, 50 can be installed after the nipper shaft 22 is arranged at the final installed position. That is, the nipper gauge adjusting mechanisms 34, 50 can be installed after the nipper shaft 22 is arranged coaxially with the output shaft 28 and at a position at a predetermined distance from the output shaft 28. One advantage of this configuration is that, when replacing the nipper gauge adjusting mechanisms 34, 50, the nipper shaft 22 does not need to be moved a position where the nipper gauge adjusting mechanisms 34, 50 can be removed from the nipper shaft 22 and the output shaft 28.

[0043] The annular protrusion 44 of the axis aligning portion 43 between the first joint member 35 and the second joint member 36 may be formed in the second joint member 36. That is, the annular recess 45 may be formed in the first joint member 35.

[0044] The output shaft 28 may be configured such that the second end 28b also protrudes the outside of the gear box 26. That is, both ends of the output shaft 28 may protrude to the outside of the gear box 26.

[0045] An elongated hole 38 may be formed in the first projection 35d of the first joint member 35. That is, a threaded hole 39 may be formed in the second projection 36d of the second joint member 36.

[0046] The structure in which the first joint member 35 or the fixed portion 51 a fastens the output shaft 28 and the structure in which the second joint member 36 or the joint portion 51 b fastens the nipper shaft 22 are not limited to the structure in which the first fastening bolts 41 or the second fastening bolts 42 are threaded to the first fastening bolt holes 35c or the second fastening bolt holes 36c. For example, a structure may be employed in which a bolt is passed through a bolt hole having no internal thread and is threaded to a nut.

[0047] A nipper shaft driving portion (25) has an output shaft (28), which is pivoted in a reciprocating manner coaxially with a nipper shaft (22) in synchronization with a combing cylinder (15). The output shaft (28) has a first end, which is relatively close to the nipper shaft (22), and a second end, which is opposite to the first end. At least the first end of the output shaft (28) is arranged to protrude outside of a gear box (26). A nipper gauge adjusting mechanism (34) is provided between the first end of the output shaft (28) and one end of the nipper shaft (22). The nipper gauge adjusting mechanism (34) is configured to permit the nipper shaft (22) and the output shaft (28) are to be switched between a state where the shafts are integrally rotatable and a state where the nipper shaft (22) can rotate relative to the output shaft (28).

Claims

1. A comber having a plurality of combing heads (11), each combing head (11) having a nipper frame (18), wherein, when a common nipper shaft (22) is rotated in a reciprocating manner with respect to the nipper frames (18), the nipper frames (18) of all the combing heads (11) are swung back and forth in synchronization, and the nipper shaft (22) is rotated in a reciprocating manner in synchronization with a combing cylinder (15) by a nipper shaft driving portion (25) located in a gear box (26), **characterized in that**
the nipper shaft driving portion (25) has an output shaft (28) arranged coaxially with the nipper shaft (22),
the output shaft (28) is rotated in a reciprocating manner in synchronization with the combing cylinder (15),
the output shaft (28) has a first end (28a), which is relatively close to the nipper shaft (22), and a second end (28b), which is opposite to the first end (28a),
at least the first end (28a) of the output shaft (28) protrudes to the outside of the gear box (26),
a nipper gauge adjusting mechanism (34, 50) is provided between the first end (28a) of the output shaft (28) and one end of the nipper shaft (22), and
the nipper gauge adjusting mechanism (34, 50) is configured to permit the nipper shaft (22) and the output shaft (28) to be switched between a state where the nipper shaft (22) and the output shaft (28) rotate integrally and a state where the nipper shaft (22) is allowed to rotate relative to the output shaft (28).

2. The comber according to claim 1, wherein the nipper gauge adjusting mechanism (34) has a joint portion (37) that is formed by:

a first member (35) fixed to and integrally rotatable with the output shaft (28); and
a second member (36) fixed to and integrally rotatable with the nipper shaft (22), **characterized in that**
the second member (36) has an elongated hole (38), which extends in the circumferential direction of the nipper shaft (22),
a fastener (40) is passed through the elongated hole (38),
when the fastener (40) is fastened, the first member (35) and the second member (36) are fixed relative to each other, and
when the fastener (40) is loosened, the first member (35) and the second member (36) are allowed to pivot relative to each other.

3. The comber according to claim 2, **characterized in that** an axis aligning portion (43) is provided between the first member (35) and the second member (36).

4. The comber according to claim 3, **characterized in that**

the first member (35) and the second member (36) each have a facing end,
the facing ends face each other, and
the axis aligning portion (43) is formed by:

a protrusion (44) formed on one of the pair of the facing ends; and
a recess (45) formed on the other one of the pair of the facing ends.

5. The comber according to claim 3, **characterized in that**
the first member (35) and the second member (36) each have a facing end,
the facing ends face each other, and
the axis aligning portion (43) is formed by:

annular recesses (45, 46) formed in the facing ends; and
a ring (47) fitted to both of the annular recesses.

6. The comber according to claim 1, **characterized in that**
the nipper gauge adjusting mechanism (50) has a joint portion (51) that includes:

a fixed portion (51a) fixed to and integrally rotatable with the output shaft (28); and
a joint portion (51 b) that can be switched between a state where the joint portion (51) is rotatable relative to the nipper shaft (22) and a state where the joint portion (51 b) is fixed relative to the nipper shaft (22),

an internal thread portion (22a) is formed in the circumferential surface of the nipper shaft (22);
the joint portion (51 b) has an elongated hole (52), which extends in the circumferential direction of the nipper shaft (22);
the elongated hole (52) is formed at a position that faces the internal thread portion (22a);
a bolt (40), which is passed through the elongated hole (52), is threaded to the internal thread portion (22a);
when the bolt (40) is fastened, the joint portion (51 b) is fixed relative to the nipper shaft (22); and
when the bolt (40) is loosened, the joint portion (51 b) is allowed to rotate relative to the nipper shaft (22).

7. The comber according to any one of claims 2 to 6, **characterized in that** the joint portion (37, 51) includes:

an insertion hole (35a, 36a) into which the output shaft (28) and the nipper shaft (22) are inserted;
a groove (35b, 36b) that connects the insertion hole (35a, 36a) with the outer circumferential surface of the joint portion (37, 51); and
a bolt hole (35c, 36c) perpendicular to the groove (35b, 36b),

a fastening bolt (41, 42) is threaded to the bolt hole (35c, 36c), and
when the fastening bolt (41, 42) is fastened, the joint portion (37, 51) is fixed to the output shaft (28) and the nipper shaft (22).

Fig.1

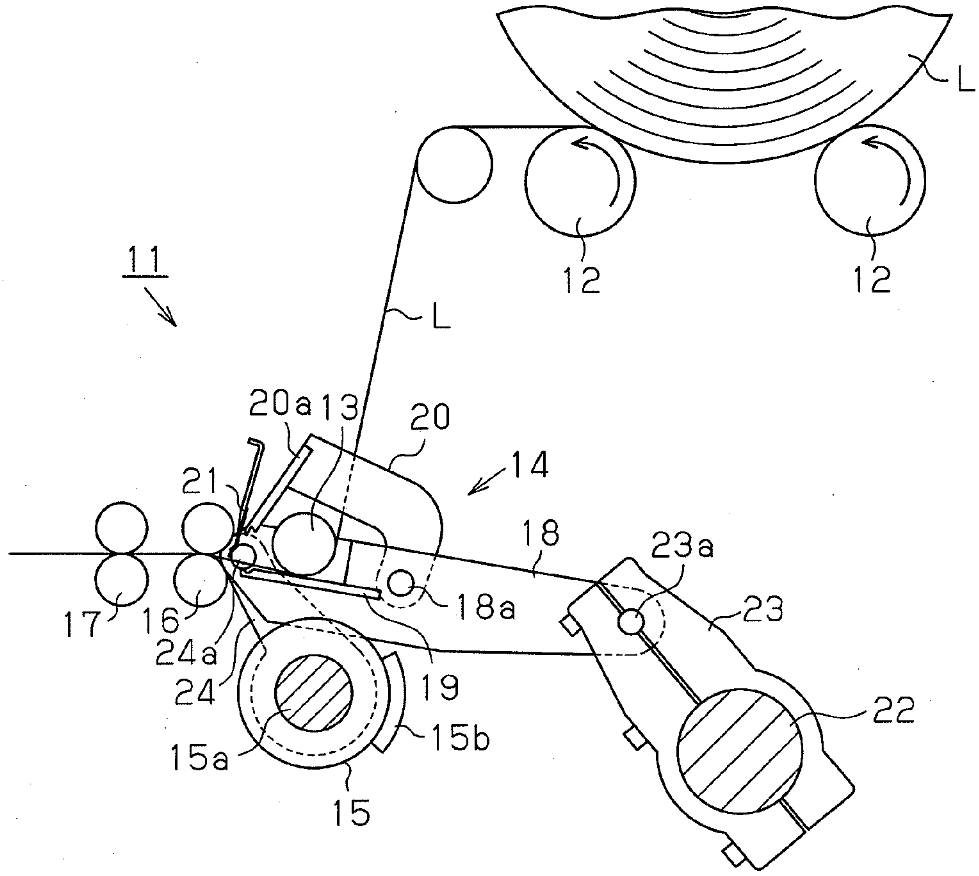


Fig.2(a)

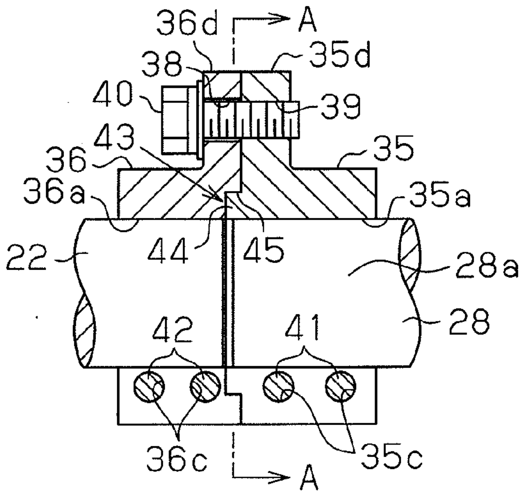
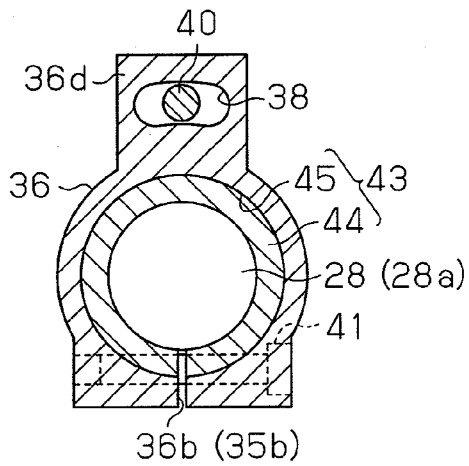


Fig.2(b)



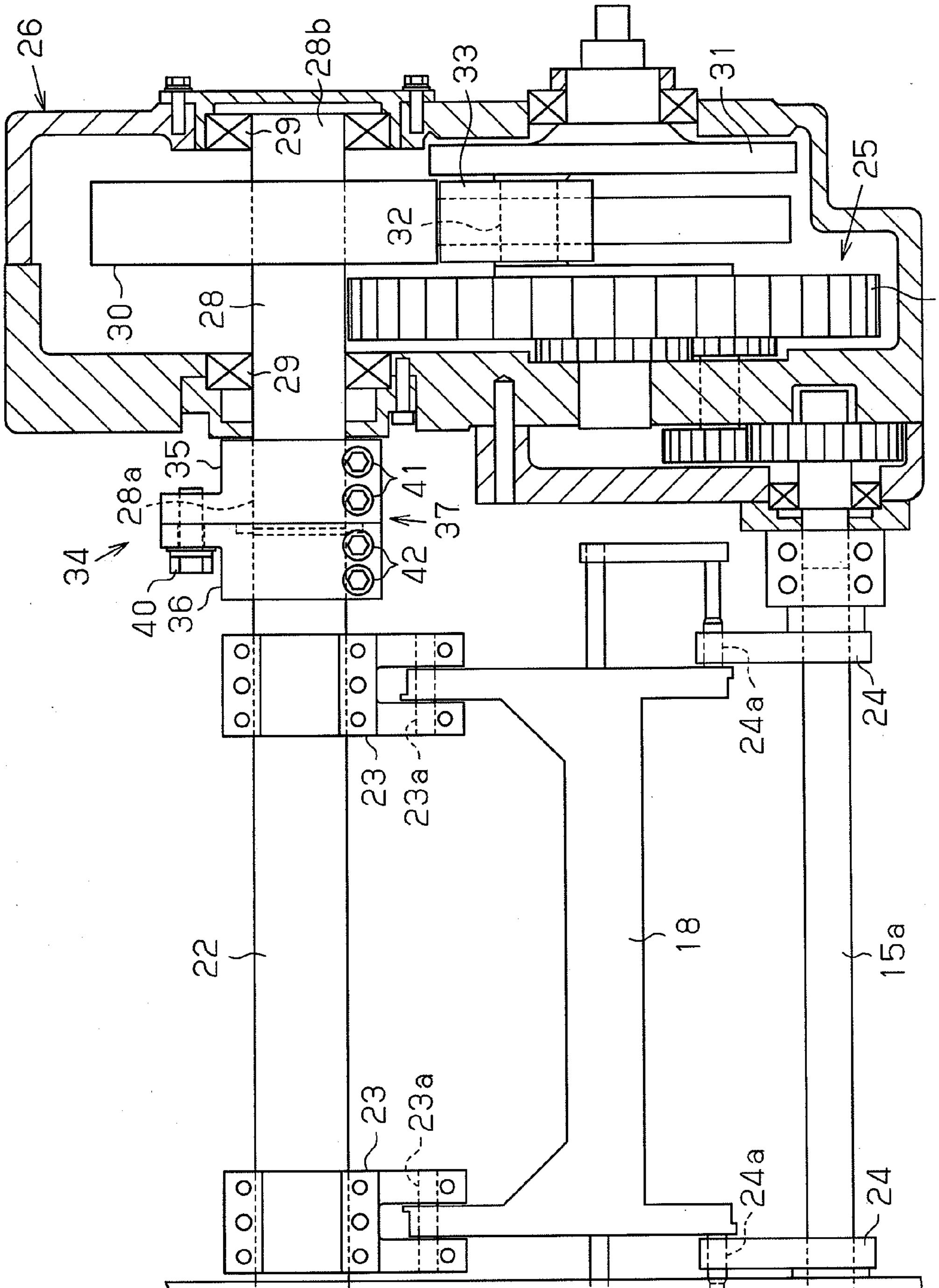

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Fig.3

Fig.4(a)

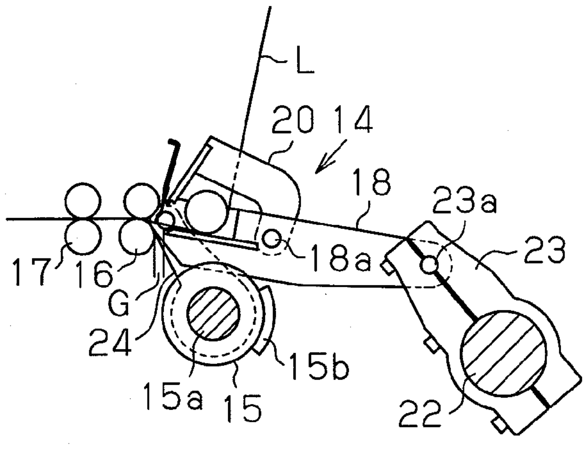


Fig.4(b)

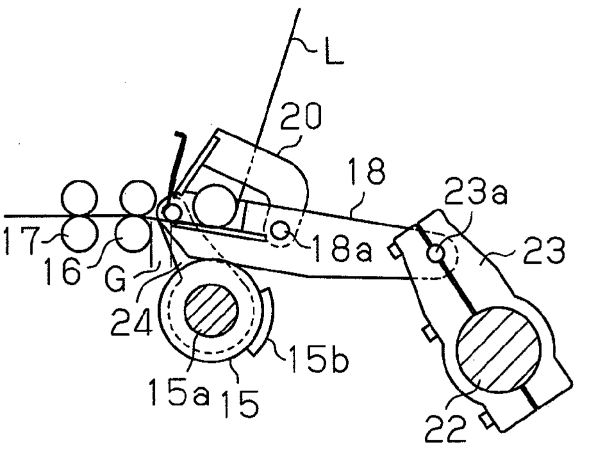


Fig.5(a)

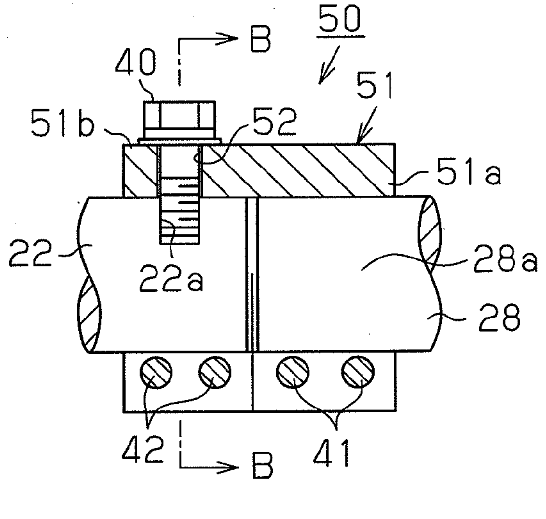


Fig.5(b)

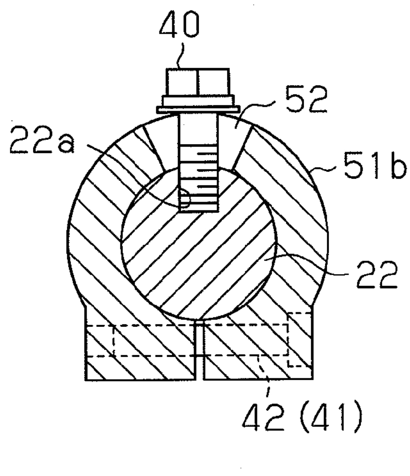


Fig.6

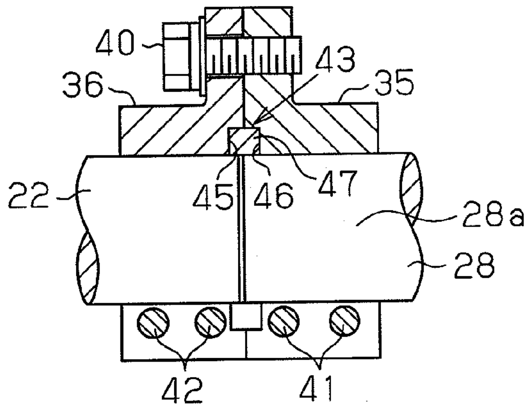
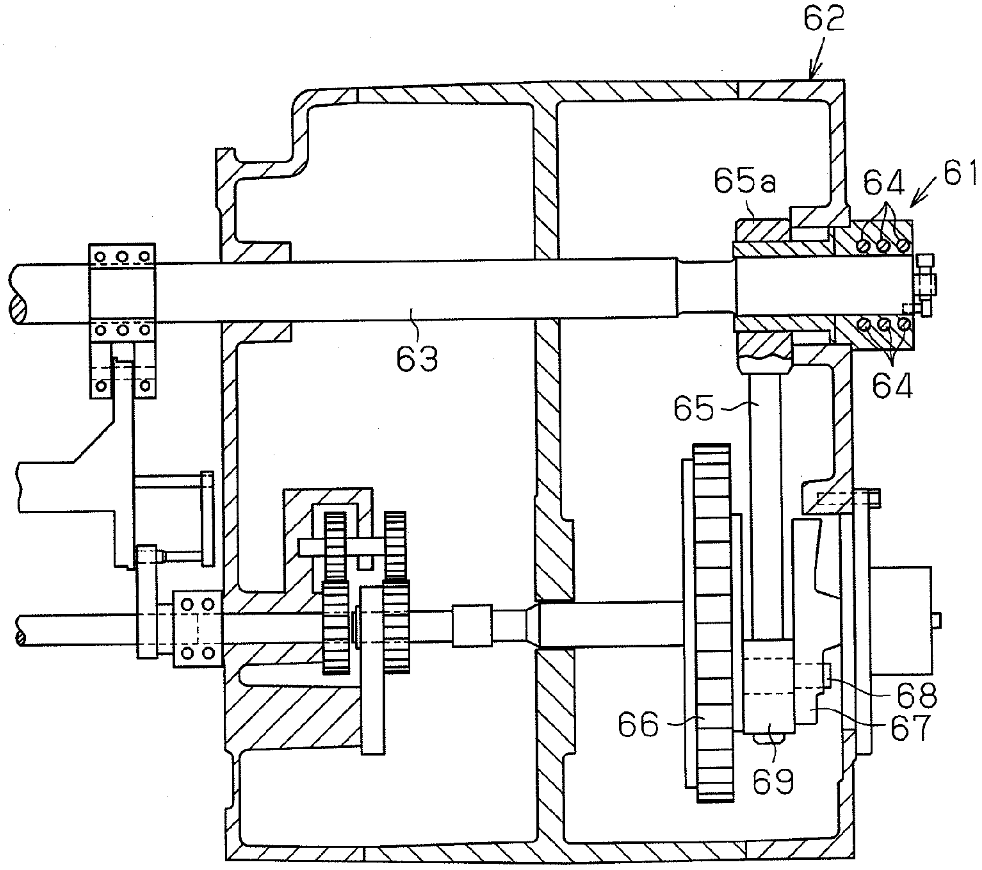


Fig.7



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EUROPEAN SEARCH REPORT

Application Number
EP 11 18 8544

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GB 856 369 A (RIETER JOH JACOB & CIE AG) 14 December 1960 (1960-12-14) * claim 1; figure 1 * -----	1-7	INV. D01G19/10 D01G19/16 D01G19/26
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D01G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 February 2012	Dupuis, Jean-Luc

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