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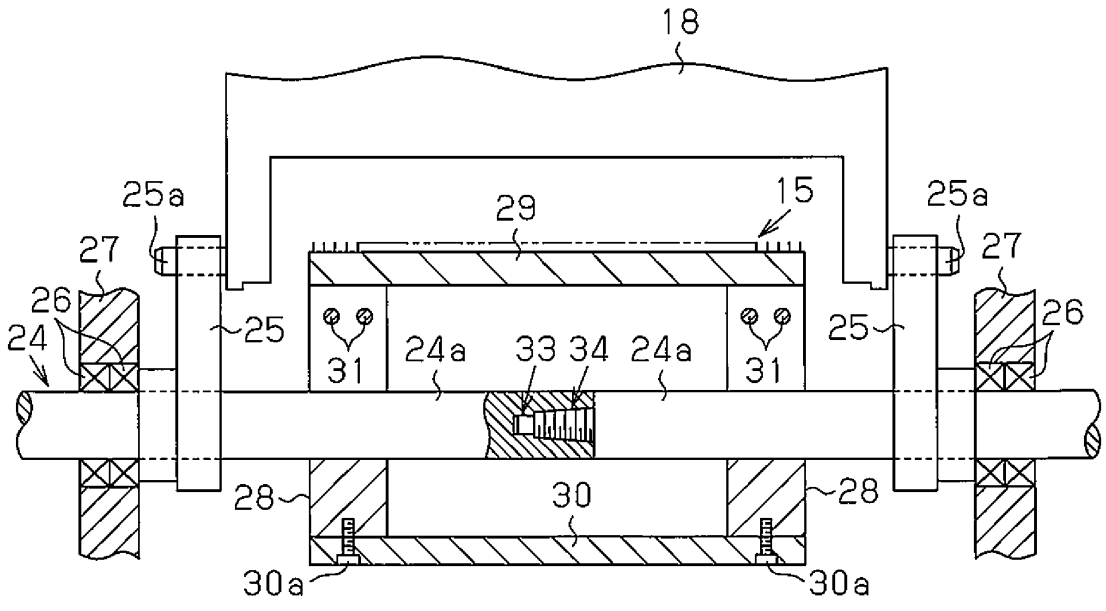
(54) **Comber**

(57) A comber includes a plurality of combing heads (11) each including a combing portion (15) and a cylinder shaft (24) adapted to rotate all of the combing portions (15). Each combing portion includes a plurality of brackets (28), which are fixed to the cylinder shaft (24) and rotatable integrally with the cylinder shaft (24), and a circular comb (29) and a counterweight (30), which are fixed to the cylinder shaft (24) by the brackets (28). The cylinder shaft (24) is divided in a longitudinal direction into a plurality of shaft portions (24a) such that a joint between the shaft portions (24a) is located in a position that faces one of the combing portions (15). The joint is located between the brackets (28).

Fig.2



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a comber.

[0002] A comber includes an operation portion, which includes a plurality of (eight in general) combing heads. Each combing head operates to form a sliver from a lap. Lap rollers and feed rollers feed a lap by a predetermined amount at a time. A combing portion combs the distal end of the lap held by a nipper unit including a bottom nipper and a top nipper. The nipper unit is moved forward to move the combed fleece toward detaching rollers. At the same time, the detaching rollers reverse to move the fleece that has received earlier (preceding fleece) rearward. The front end of the newly combed fleece (succeeding fleece) is placed over the rear end of the preceding fleece. Then, the detaching rollers rotate forward to receive the succeeding fleece from the nipper unit, and the top comb combs the rear end of the fleece. The fleece produced at each combing head by repeating this process is bunched and drafted. Then, calender rollers compress the fleece to form a sliver.

[0003] German Patent Application Publication No. 10163663A1 describes a combing portion that includes a cylinder shaft and a plurality of bosses (brackets), which are fixed to the cylinder shaft and rotated integrally with the cylinder shaft. A circular comb and a counterweight are fixed to the bosses.

[0004] Further, Japanese Laid-Open Patent Publication No. 2012-117157 describes a coupler that couples a cylinder shaft to an output shaft of a driving portion located at an end of a base.

SUMMARY OF THE INVENTION

[0005] When a cylinder shaft is a single undivided shaft, the cylinder shaft is too long to process on a general lathe and needs a special lathe designed for long shafts. Alternatively, a cylinder shaft may be divided in the longitudinal direction into portions that are coupled to each other by a coupler and rotate integrally. In this case, if the joint between the portions is arranged between adjacent combing heads, the cylinder shaft needs to be lengthened to provide space for arranging the coupler. However, a longer cylinder shaft is disadvantageous when increasing the operation speed of the comber.

[0006] The lengthening of the cylinder shaft can be avoided by placing the joint of the cylinder shaft in a position that faces a combing portion. However, in this case, the combing portion that faces the joint faces the coupler. Thus, when the combing portion is structured as described in the '663 publication and the joint of the cylinder shaft and the coupler are arranged in a position that faces a combing portion, the joint and the coupler are arranged between the brackets.

[0007] However, the coupler arranged between the brackets interferes with the counterweight. This results in modification of the shape of the counterweight. Thus, the shape of the counterweight of the combing portion that faces the coupler differs from the shape of counterweight of the combing portion that does not face the coupler. The cylinder shaft is not rotated at a fixed speed and driven to accelerate and decelerate. In addition, the load on the cylinder shaft changes when the combing portions comb fleeces, causing a significant change in torque between rotations in the positive and reverse directions. Thus, the difference in the rotation balance of the coupling portion between the combing head with the coupler and the combing head without the coupler increases the vibrations of the cylinder shaft.

[0008] It is an object of the present invention to provide a comber that includes a cylinder shaft divided in the longitudinal direction without lengthening the cylinder shaft or causing variation in the rotation balance among combing heads.

[0009] To achieve the above object, one aspect of the present invention is a comber that includes a plurality of combing heads each including a combing portion and a cylinder shaft adapted to rotate all of the combing portions. Each combing portion includes a plurality of brackets, which are fixed to the cylinder shaft and rotatable integrally with the cylinder shaft, and a circular comb and a counterweight, which are fixed to the cylinder shaft by the brackets. The cylinder shaft is divided in a longitudinal direction into a plurality of shaft portions such that a joint between the shaft portions is located in a position that faces one of the combing portions. The joint is located between the brackets.

[0010] Other aspects and advantages of the present 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

[0011] 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 perspective side view showing a combing head;

Fig. 2 is a schematic cross-sectional view showing a joint of a cylinder shaft and a combing portion;

Fig. 3 is an enlarged view showing coupling portions of shaft portions of the cylinder shaft of Fig. 2;

Fig. 4 is a side view showing the combing portion of Fig. 2; and

Fig. 5 is a partial cross-sectional view showing coupling portions of shaft portions of another embodiment.

DETAILED DESCRIPTION OF THE INVENTION

[0012] Referring to Figs. 1 to 4, one embodiment will now be described.

[0013] In general, a comber includes an operation portion including eight combing heads 11. As shown in Fig. 1, each combing head 11 includes two lap rollers 12, a nipper unit 14 including a feed roller 13, a combing portion 15, two rear detaching rollers 16, and two front detaching rollers 17. The nipper unit 14 includes a nipper frame 18 that swings back and forth above the combing portion 15. A bottom nipper 19 is arranged at the bottom of the nipper frame 18. A support shaft 18a rotatably couples the nipper frame 18 to a nipper arm 20. A top nipper 20a is fixed to the distal end of the nipper arm 20. The top nipper 20a holds a lap L in cooperation with the bottom nipper 19 by opening and closing at predetermined timing in synchronization with the frontward and rearward swinging of the nipper frame 18. In addition, the nipper frame 18 is coupled to a top comb 21 located in front of the bottom nipper 19. The top comb 21 moves in a predetermined manner in synchronization with the nipper frame 18.

[0014] A nipper shaft 22, which rotates forward and rearward, is arranged behind the combing portion 15 and below the nipper frame 18. The nipper shaft 22 is fixed to one end of a nipper frame drive arm 23 so that the nipper frame drive arm 23 pivots integrally with the nipper shaft 22. The other end of the nipper frame drive arm 23 rotatably supports the rear end of the nipper frame 18 through a support shaft 23a. The front end of the nipper frame 18 is rotatably supported by the distal end of a support arm 25 through a support shaft 25a. The support arm 25 is rotatably supported by a cylinder shaft 24. Forward and rearward rotation of the nipper shaft 22 moves the nipper frame 18 back and forth so that the distal end of the bottom nipper 19 moves toward and away from the detaching rollers 16 and 17. Rotation of a driving shaft, which is driven by a main motor (not shown), is transmitted to the cylinder shaft 24 and the nipper shaft 22 through mechanical systems including gears and cranks. The nipper unit 14 and the combing portion 15 are driven in synchronization.

[0015] The details of the combing portion 15 and the cylinder shaft 24 will now be described.

[0016] As shown in Fig. 2, a frame 27 rotatably supports, through bearings 26, the sections of the cylinder shaft 24 that correspond to the opposite ends of the combing portion 15. The combing portion 15 includes a plurality of brackets 28, which are fixed to and rotate integrally with the cylinder shaft 24, and a circular comb 29 and a counterweight 30, which are fixed to the brackets 28. That is, the brackets 28 fix the circular comb 29 and the counterweight 30 to the cylinder shaft 24.

[0017] As shown in Fig. 4, each bracket 28 is circular and includes a central section including an insertion hole 28a into which the cylinder shaft 24 is fitted. The bracket 28 includes a slit 28b that extend radially to connect the insertion hole 28a and the periphery of the bracket 28. The bracket 28 also includes two symmetrical holes 28c arranged on the opposite sides of the slit 28b. Each hole 28c extends perpendicular to the slit 28b and includes a step. A bolt 31 and a nut 32 inserted in the holes 28c clamp the bracket 28 to fix bracket 28 to the cylinder shaft 24, which is inserted in the insertion holes 28a. A plurality of bolts 29a fixes the circular comb 29 to the bracket 28. A bolt 30a fixes the counterweight 30 to the bracket 28.

[0018] As shown in Fig. 2, the cylinder shaft 24 is divided in the longitudinal direction into a plurality of shaft portions 24a such that the joint between the shaft portions 24a is located in a position that faces one of the combing portions 15. In addition, the joint of the cylinder shaft 24 is located between the brackets 28. As shown in Figs. 2 and 3, each shaft portions 24a includes a thread portion 34. The shaft portions 24a are coupled to each other by the engagement between the thread portions 34. Each shaft portion 24a includes a coupling portion including a fitting joint portion 33 for coaxial alignment. In the present embodiment, the cylinder shaft 24 is divided into three shaft portions 24a.

[0019] As shown in Fig. 3, the thread portions 34 include tapered threads. One of the adjacent shaft portions 24a includes one end including a male thread portion 34a and a cylindrical protrusion 33a extending from the distal end of the male thread portion 34a. The male thread portion 34a includes a proximal end having a smaller diameter than the shaft portion 24a. The protrusion 33a has a smaller diameter than the distal end of the male thread portion 34a. The male thread portion 34a and the protrusion 33a are formed coaxially. The other of the adjacent shaft portions 24a includes one end including a female thread hole 34b, which engages with the male thread portion 34a, and a cylindrical recess 33b into which the protrusion 33a is fitted. The recess 33b is coaxially connected to the female thread hole 34b. The protrusion 33a and the recess 33b form the fitting joint portion 33.

[0020] The length of the protrusion 33a is shorter than the depth of the recess 33b. When the male thread portion 34a and the female thread hole 34b engage with each other, an end surface 34c of the shaft portion 24a that surrounds the proximal end of the male thread portion 34a is in contact with an end surface 34d of the adjacent shaft portion 24a that surrounds the female thread hole 34b. That is, when the shaft portions 24a are coupled to each other, the end surface 34c and the end surface 34d, which function as opposing surfaces, are in contact with each other.

[0021] The operation of the present embodiment will now be described.

[0022] During operation of the comber, the driving portion, which is driven by the main motor (not shown), rotates the nipper shaft 22. The rotation of the nipper shaft 22 swings the nipper frame 18 and the bottom nipper 19 back and forth. This moves the top nipper 20a upward and downward to hold and release the lap L with the distal end of the bottom nipper 19. The circular comb 29 of the

combing portion 15 combs the distal end of the lap L held by the nipper unit 14.

[0023] The combing portion 15 is rotated at a predetermined speed in accordance with the spinning conditions. The circular comb 29 passes under the bottom nipper 19 at predetermined time intervals. The rotation of the nipper shaft 22, which is in synchronization with the rotation of the combing portion 15, swings the nipper frame 18 back and forth in a predetermined range.

[0024] The cylinder shaft 24 is divided in the longitudinal direction into a plurality of shaft portions 24a. The shaft portions 24a are coupled to each other and rotate integrally. Unlike a cylinder shaft that is not divided, the cylinder shaft 24 is divided into the shaft portions 24a having a length that allows processing on a general lathe. Thus, the cylinder shaft 24 of the present embodiment does not need a special lathe designed for long cylinder shafts.

[0025] The joint of the cylinder shaft 24 is located between the brackets 28, which form the combing portion 15. Thus, unlike when the joint is located between adjacent combing portions 15, it is not necessary to lengthen the cylinder shaft 24. In addition, instead of using a dedicated coupler to couple the shaft portions 24a of the cylinder shaft 24 such that the shaft portions 24a rotate integrally, the brackets 28, the circular comb 29, and counterweight 30, which form the combing portion 15, function as a coupler. This eliminates the need for a dedicated coupler and enables the counterweight 30 of the combing portion 15 that includes a joint of the cylinder shaft 24 to have the same shape as the counterweight 30 of the combing portion 15 that does not include the joint. Thus, the combing head 11 with the joint and the combing head 11 without the joint have the same rotation balance in the combing portions 15. This limits the vibrations of the cylinder shaft 24.

[0026] The present embodiment has the advantages as described below.

(1) The comber includes a plurality of combing heads 11, each including a combing portion 15, and the cylinder shaft 24 that rotates all of the combing portions 15. Each combing portion 15 includes a plurality of brackets 28, which are fixed to the cylinder shaft 24 and rotatable integrally with the cylinder shaft 24, and the circular comb 29 and the counterweight 30, which are fixed to the cylinder shaft 24 by the brackets 28. The cylinder shaft 24 is divided in the longitudinal direction into a plurality of shaft portions 24a such that the joint between the shaft portions 24a is located in a position that faces one of the combing portions 15. The joint is located between the brackets 28. Thus, the use of the cylinder shaft 24, which is divided in the longitudinal direction, does not lengthen the cylinder shaft 24 or vary the rotation balance among the combing heads 11. In addition, the present embodiment uses fewer components since a dedicated coupling is not needed at the joint.

(2) The shaft portions 24a are coupled to each other by the engagement between thread portions 34. Such coupling produces higher coupling strength than a keyed joint and requires fewer costs for manufacturing than a spline joint.

(3) The shaft portions 24a are coupled to each other with the opposing surfaces at the ends in contact with each other. Thus, compared to a structure in which the opposing surfaces are separated, the friction between the opposing surfaces resists loosening of the thread portions 34.

(4) Each shaft portion 24a includes a coupling portion including a fitting joint portion 33 for coaxial alignment. Thus, compared to a structure that lacks the fitting joint portion 33, the coaxial arrangement of the shaft portions 24a is facilitated when coupling the shaft portions 24a.

(5) The cylinder shaft 24 is divided into three or more shaft portions 24a. In general, a comber includes an even number of combing heads 11. Thus, if the cylinder shaft 24 is divided into two shaft portions 24a, the shaft portions 24a need to have different lengths to place the joint between the brackets 28 of a combing portion 15. If the shaft portion 24a is half the length of the cylinder shaft 24, it is difficult or impossible to process the shaft portion 24a on a general lathe. The division of the cylinder shaft 24 into three or more shaft portions 24a ensures that each shaft portion 24a has a length that can be processed on a general lathe.

(6) The thread portions 34, which couple the shaft portions 24a to each other, include tapered threads. This allows the protrusion 33a of the fitting joint portion 33 to be shorter than the male thread portion 34a.

[0027] 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 present invention may be embodied in the following forms.

[0028] It is not necessary for the shaft portions 24a to be coupled to each other by the engagement between the thread portions 34. For example, as shown in Fig. 5, the shaft portions 24a may be coupled to each other with the protrusion 33a and the recess 33b of fitting joint portion 33 fitted to each other and the opposing surfaces at the ends in contact with each other.

[0029] A keyed joint or a spline joint may be used to couple the shaft portions 24a to each other and limit relative rotation between the shaft portions 24a.

[0030] The protrusion 33a and the recess 33b of the fitting joint portion 33 may be frustoconical.

[0031] Instead of the tapered thread, the thread portion 34 may include a normal thread.

[0032] The shaft portions 24a may be coupled to each other with the opposing surfaces at the ends separated from each other.

[0033] The bracket 28 and the counterweight 30 may be formed integrally.

[0034] The single combing portion 15 may include three or more brackets 28.

[0035] In the present embodiment, the bracket 28 is fixed to the cylinder shaft 24 using the bolt 31 and the nut 32. Alternatively, one of the opposite portions of the bracket 28 divided by the slit 28b may include a thread hole, and the bolt 31 may engage with the thread hole to fix the bracket 28 to the cylinder shaft 24.

[0036] 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.

[0037] A comber includes a plurality of combing heads each including a combing portion and a cylinder shaft adapted to rotate all of the combing portions. Each combing portion includes a plurality of brackets, which are fixed to the cylinder shaft and rotatable integrally with the cylinder shaft, and a circular comb and a counterweight, which are fixed to the cylinder shaft by the brackets. The cylinder shaft is divided in a longitudinal direction into a plurality of shaft portions such that a joint between the shaft portions is located in a position that faces one of the combing portions. The joint is located between the brackets.

Claims

1. A comber comprising:

a plurality of combing heads (11) each including a combing portion (15); and
a cylinder shaft (24) adapted to rotate all of the combing portions (15), the comber being **characterized in that**
each combing portion (15) includes a plurality of brackets (28), which are fixed to the cylinder shaft (24) and rotatable integrally with the cylinder shaft (24), and a circular comb (29) and a counterweight (30), which are fixed to the cylinder shaft (24) by the brackets (28),
the cylinder shaft (24) is divided in a longitudinal direction into a plurality of shaft portions (24a) such that a joint between the shaft portions (24a) is located in a position that faces one of the combing portions (15), and
the joint is located between the brackets (28).

2. The comber according to claim 1, wherein
each shaft portion (24a) includes a coupling portion including a thread portion (34), and
the shaft portions (24a) are coupled to each other by engagement between the thread portions (34).

3. The comber according to claim 2, wherein
each shaft portion (24a) includes an end including an opposing surface (34c, 34d), and
the shaft portions (24a) are coupled to each other with the opposing surfaces (34c, 34d) in contact with each other.

4. The comber according to claim 2 or 3, wherein the thread portion (34) includes a tapered thread.

5. The comber according to any one of claims 1 to 4, wherein each coupling portion includes a fitting joint portion (33) for coaxial alignment.

6. The comber according to any one of claims 1 to 5, wherein the cylinder shaft (24) is divided into three or more shaft portions (24a).

Fig.1

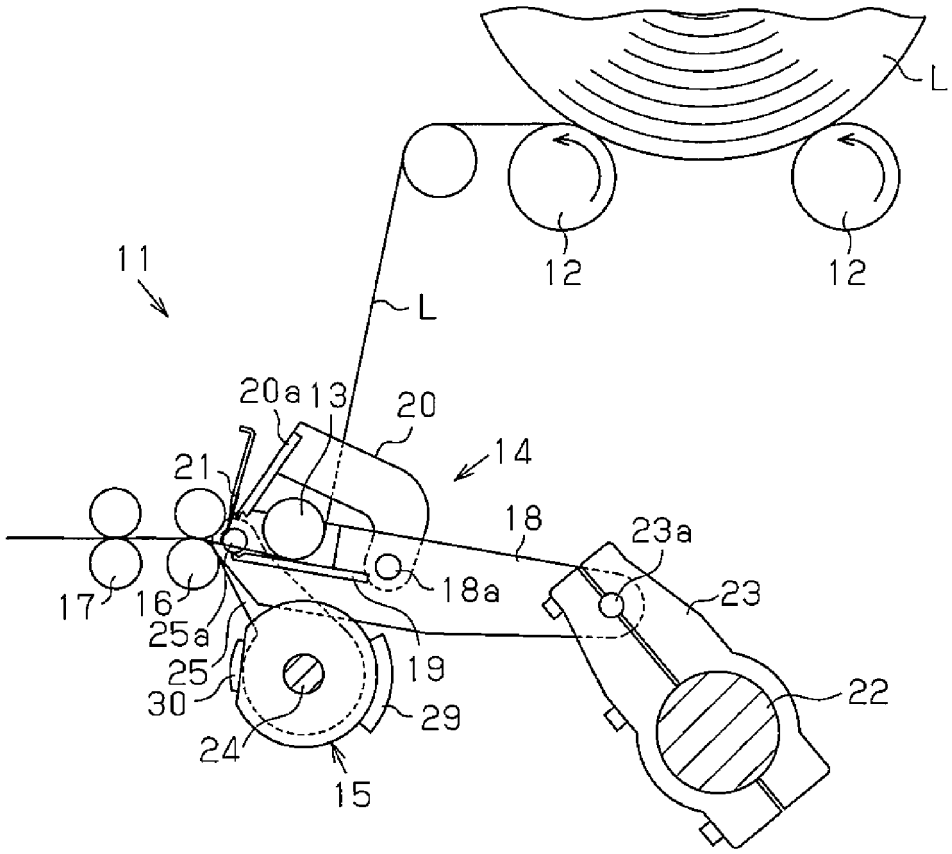
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Fig.2

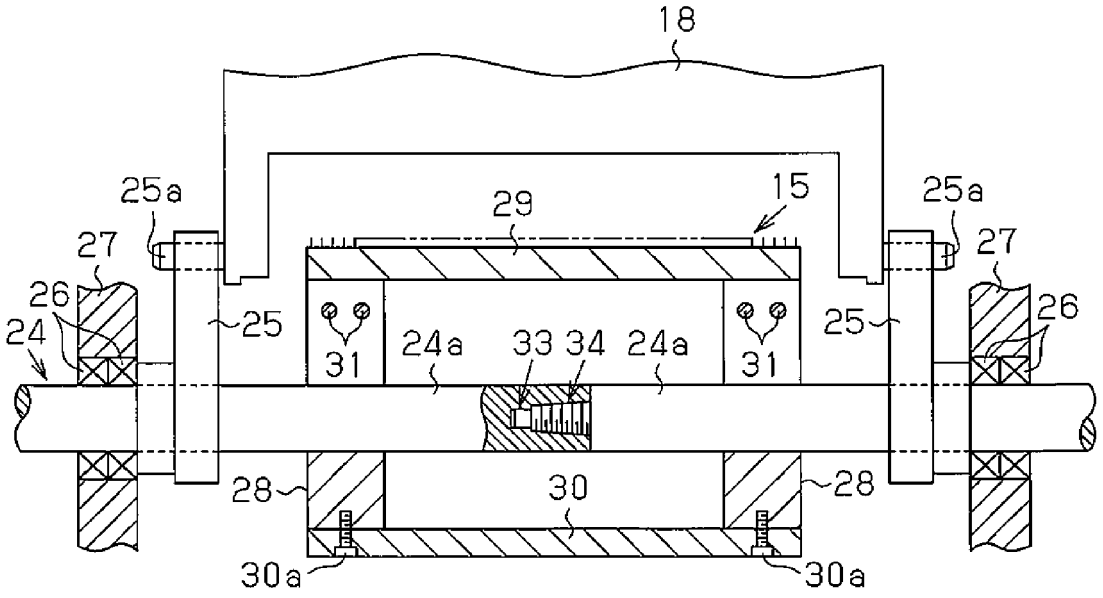
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Fig.3

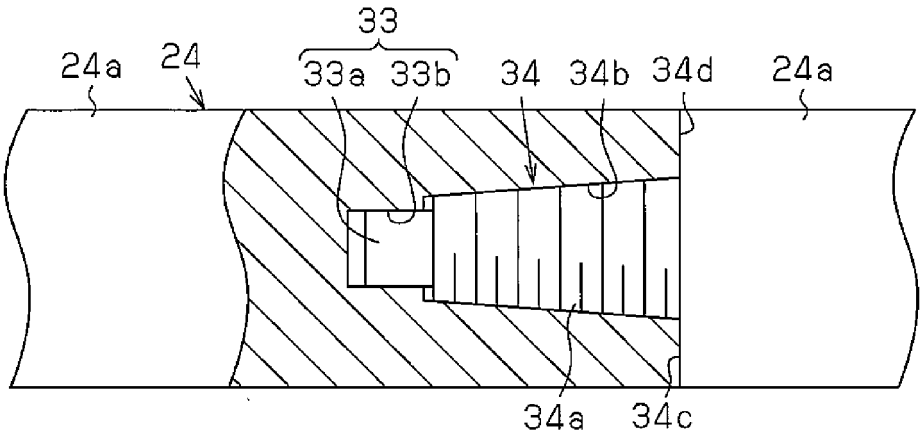


Fig.4

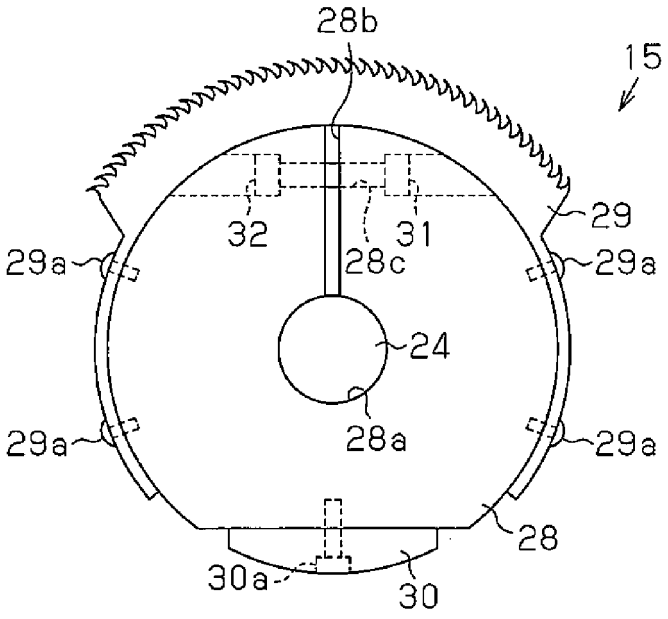
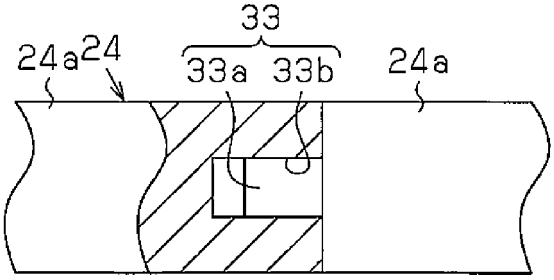


Fig.5



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EUROPEAN SEARCH REPORT

Application Number
EP 14 16 9445

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	DE 101 63 663 A1 (RIETER AG MASCHF [CH]) 3 July 2003 (2003-07-03) * abstract * -----	1	INV. D01G19/10

TECHNICAL FIELDS SEARCHED (IPC)

D01G
F16C
F16D
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 October 2014	Humbert, Thomas

CATEGORY OF CITED DOCUMENTS

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10-10-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 10163663 A1	03-07-2003	CN 1427099 A	02-07-2003
		DE 10163663 A1	03-07-2003

EPO FORM P0459

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

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Patent documents cited in the description

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- JP 2012117157 A **[0004]**