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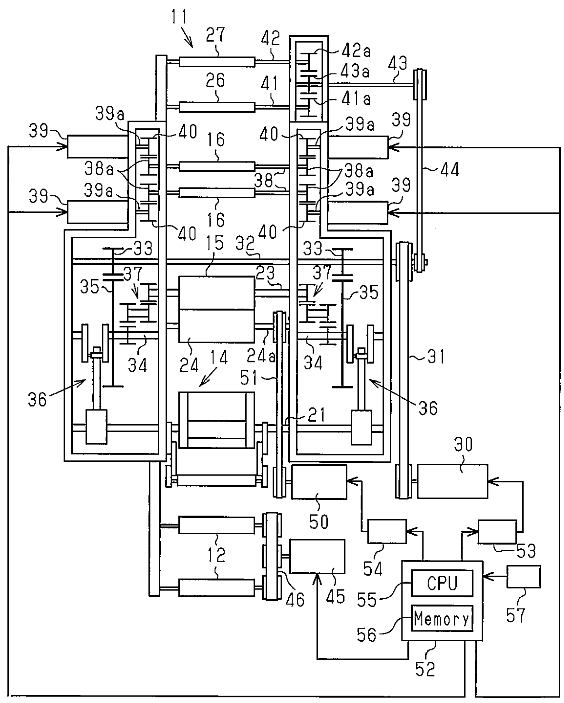
(54) **COMBER**

(57) A comber includes a brush for cleaning a comb of a combing cylinder, a cylinder driving motor, which is configured to drive the combing cylinder, a variable speed driving motor, which is configured to drive the brush and is arranged independently from the cylinder driving motor, and a speed controller, which is configured to drive the variable speed driving motor. The speed controller is configured to control the variable speed driving motor such that a circumferential speed of a distal end of the brush is lower at least in an acceleration period and a deceleration period of the combing cylinder than in normal operation of the comber.

Fig.1



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a comber and, more particularly, a comber having characteristics in control of a brush for cleaning a comb of a combing cylinder.

[0002] A comber includes a nipper device, which grips a lap supplied from a supply source and a combing cylinder, which combs the distal end of the lap. The comber combs the lap, which is gripped by the nipper device, by means of the combing cylinder, to remove noil such as impurities and short fibers from the lap, thus producing fleece. A combing brush (hereinafter, referred to simply as a brush) brushes short fibers and the like from a comb of the combing cylinder. When the comber is in operation, the brush and the combing cylinder rotate in the same direction and the brush cleans waste cotton from the comb using the speed difference between the brush and the comb.

[0003] In a typical comber, a combing cylinder and a nipper device are driven by a main motor and a brush is driven by a motor for a brush. With reference to Fig. 4, the brush is driven at a constant speed, despite the fact that the rotation speed of the comb is changed in an acceleration period from when the comber is started to when a certain operating speed (a normal operating speed) is achieved and in a deceleration period from when the comber is operated at the certain operating speed to when the comber is stopped.

[0004] When the brush wears and the diameter of the brush decreases, the rotation speed of the brush is increased. For example, the brush is separated from the machine to measure the brush diameter. If the brush diameter is smaller than a predetermined value, the driving pulley is replaced by a pulley with a greater diameter to increase the rotation speed of the brush.

[0005] There may be a case in which a comb cleaning time is set for operation of the comber to decrease the operating speed of the comber (the rotation speed of the comb) without changing the rotation speed of the brush.

[0006] Japanese Laid-Open Patent Publication No. 3-146725 discloses a device for automatically compensating for wear of a circular brush, which is arranged in a rectilinear comber. The device has a variable speed electric motor and, by controlling the rotation speed of the circular brush using the electric motor, adjusts the rotation speed of the circular brush in correspondence with wear of the brush. In this manner, the circumferential speed of a peripheral section of the circular brush is maintained constant.

[0007] To ensure desirable cleaning of a comb using a brush, the circumferential speed of the brush must be higher than the circumferential speed of the comb. Therefore, simply to improve cleaning performance, it is preferable to increase the rotation speed of the brush. However, this correspondingly increases air flows accompanying rotation of the brush (hereinafter, referred to as "brush-accompanying air flows"). When the comber is in normal operation, air flows accompanying rotation of the comb (hereinafter, referred to as "comb-accompanying air flows") restrain the brush-accompanying air flows. However, when the speed of the comb decreases, equilibrium is canceled and turbulence occurs in air flows in the peripheries of the brush and the comb, thus causing disarrangement of fleece. If the rotation speed of the brush is controlled to a constant speed corresponding to the cylinder speed in the normal operation of the comber, the circumferential speed of the brush becomes excessively higher than the circumferential speed of the comb in the acceleration period and the deceleration period of the combing cylinder. This causes disarrangement of fleece caused by the brush-accompanying air flows in, particularly, the deceleration period.

[0008] Japanese Laid-Open Patent Publication No. 3-146725 discloses controlling of the rotation speed of the circular brush using a variable speed electric motor to adjust the rotation speed of the circular brush in correspondence with wear of the brush. In this manner, the circumferential speed of the peripheral section of the circular brush is maintained constant. However, the technique described in this publication does not address issues regarding the acceleration period and the deceleration period of the combing cylinder.

SUMMARY OF THE INVENTION

[0009] Accordingly, it is an objective of the present invention to provide a comber capable of preventing disarrangement of fleece caused by air flows accompanying a brush in an acceleration period and a deceleration period of a combing cylinder.

[0010] To achieve the foregoing objective and in accordance with one aspect of the present invention, a comber is provided that includes a brush for cleaning a comb of a combing cylinder, a cylinder driving motor, which is configured to drive the combing cylinder, a variable speed driving motor, which is configured to drive the brush and is arranged independently from the cylinder driving motor, and a speed controller, which is configured to drive the variable speed driving motor. The speed controller is configured to control the variable speed driving motor such that a circumferential speed of a distal end of the brush is lower at least in an acceleration period and a deceleration period of the combing cylinder than in normal operation of the comber.

[0011] 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

[0012] 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 representing a driving system of an embodiment of a comber;

Fig. 2 is a side view schematically showing a combing head;

Fig. 3 is a graph representing speed changes of a combing cylinder and a brush when the comber is in operation; and

Fig. 4 is a graph representing speed changes of a combing cylinder and a brush when a comber of a conventional technique is in operation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] One embodiment of the present invention will now be described with reference to Figs. 1 to 3.

[0014] A comber includes an operating portion in which a plurality of combing heads 11 is arranged. Fig. 1 illustrates only one of the combing heads 11. As shown in Fig. 2, the combing head 11 includes a pair of lap rollers 12, a nipper device 14 including a feed roller 13, a combing cylinder 15, and two pairs of detaching rollers 16, which are arranged adjacently in the front-rear direction of the combing head 11. The nipper device 14 has a nipper frame 17, which is arranged in a manner reciprocally swingable in the front-rear direction at a position above the combing cylinder 15. The nipper frame 17 has a bottom nipper 18 in the bottom section of the nipper frame 17. A nipper arm 19 is pivotally arranged in the nipper frame 17 with a support shaft 17a. A top nipper 19a is fixed to the distal end of the nipper arm 19. The top nipper 19a selectively opens and closes at certain timings synchronously with swinging movement of the nipper frame 17, thus clamping a lap L between the top nipper 19a and the bottom nipper 18. A top comb 20 is attached to the nipper frame 17 at a position forward from the bottom nipper 18 to perform certain movement synchronously with the nipper frame 17.

[0015] A nipper shaft 21 is arranged rearward from the combing cylinder 15 and below the nipper frame 17 in a reciprocally pivotal manner. A first end of a nipper frame driving arm 22 is fixed to the nipper shaft 21 in an integrally pivotal manner. The rear end of the nipper frame 17 is pivotally supported by a second end of the nipper frame driving arm 22 with a support shaft 22a. The nipper frame 17 swings in the front-rear direction through reciprocal pivoting (swinging movement) of the nipper shaft 21 such that the distal end of the bottom nipper 18 selectively approaches and separates from the detaching rollers 16.

[0016] The combing cylinder 15 includes a comb 15a (a combing segment) and is supported by a cylinder shaft 23 in an integrally rotational manner. Through driving of the cylinder shaft 23, the distal end of the lap L, which is gripped by the nipper device 14, is combed by the comb 15a. The amount of waste cotton removed by combing the lap L by means of the comb 15a changes depending on the timings at which the comb 15a combs the lap L, which is gripped by the nipper device 14.

[0017] A brush 24, which cleans the comb 15a of the combing cylinder 15, is arranged below the combing cylinder 15. A suction duct 25 is arranged below the brush 24. After having been removed from the lap L by the combing cylinder 15 and the top comb 20, short fibers and nep are drawn into the suction duct 25.

[0018] A pair of delivery rollers (pull-out rollers) 26 and a pair of calendar rollers 27 are arranged forward from the detaching rollers 16 (leftward as viewed in Fig. 2).

[0019] A driving mechanism of the combing heads 11 will hereafter be described with reference to Fig. 1. Although only one of the combing heads 11 is shown in Fig. 1, the multiple combing heads 11 are arranged in the longitudinal direction of the comber (the left-right direction as viewed in Fig. 1) and are driven by a common drive shaft (a main drive shaft 32, which will be described later) for all of the combing heads 11.

[0020] With reference to Fig. 1, the driving mechanism includes a main motor 30, a belt transmission device 31, and the main drive shaft 32, which is driven by the main motor 30 with the belt transmission device 31. Gears 33 are fixed to the main drive shaft 32 on opposite sides of the combing head 11 in an integrally rotational manner. Rotation of each of the gears 33 is transmitted to a middle shaft 34 through a corresponding gear 35. A conversion mechanism 36, which converts rotation of each of the middle shafts 34 in one direction into swinging movement (reciprocal pivoting) of the nipper shaft 21, is arranged between the middle shaft 34 and the nipper shaft 21. Each middle shaft 34 is coupled to the cylinder shaft 23 through a corresponding gear row 37. That is, the main motor 30 functions as a cylinder driving motor for driving the combing cylinder 15.

[0021] Referring to Fig. 1, corresponding two servomotors 39 are arranged on opposite sides of a detaching roller shaft 38 of each of the detaching rollers 16. A driving gear 40, which is meshed with a gear 38a fixed to either end of each of the detaching roller shafts 38, is fixed to an output shaft 39a of the corresponding one of the servomotors 39 in an integrally rotational manner. That is, each detaching roller shaft 38 is driven by the two corresponding servomotors 39 from the opposite sides.

[0022] Rotation of the main drive shaft 32 is transmitted to a rotary shaft 43 through a belt transmission device 44. The rotary shaft 43 transmits rotation to a delivery roller shaft 41 and a calendar roller shaft 42. The rotation of the rotary shaft 43 is transmitted to the delivery roller shaft 41 through a gear 43a and a gear 41 a and to the calendar roller shaft 42 through the gear 43a and a gear 42a. The lap rollers 12 are driven by a lap roller motor 45 through a belt transmission device 46.

[0023] As illustrated in Fig. 1, the driving mechanism includes a brush motor 50, which drives a brush shaft

24a through a belt transmission device 51. A controller 52, which serves as a speed controller, is connected to the main motor 30 and the brush motor 50 through an inverter 53 and an inverter 54, respectively. The main motor 30 and the brush motor 50 are driven by the corresponding inverters 53, 54, which are controlled based on commands from the controller 52. That is, the variable speed driving motor (the brush motor 50) is arranged independently from the cylinder driving motor (the main motor 30), which drives the combing cylinder 15, and drives the brush 24 for cleaning the comb 15a of the combing cylinder 15. The controller 52 is connected to the servomotors 39 and the lap roller motor 45 through non-illustrated inverters and controls the servomotors 39 and the lap roller motor 45.

[0024] The controller 52 includes a CPU 55 and a memory 56. The memory 56 stores various types of control programs necessary for driving the main motor 30, the servomotors 39, the lap roller motor 45, and the brush motor 50 and various types of data, maps, and relational expressions necessary for executing the programs. The memory 56 stores data such as relational expressions, diagrams, and tables representing the proper speed of the brush 24 with respect to the rotation speed of the combing cylinder 15 (the operating speed of the comber), which ensures a predetermined speed ratio A of the circumferential speed of the distal end of the brush 24 with respect to the circumferential speed of the distal end of the comb 15a. When the comber is in normal operation, the controller 52 drives and controls the brush motor 50, using the data stored in the memory 56, to achieve the proper speed corresponding to the rotation speed of the combing cylinder 15 (the operating speed of the comber). The speed ratio A is set in the range of 1.5 to 2.

[0025] The controller 52 controls the brush motor 50 such that, at least in an acceleration period and a deceleration period of the combing cylinder 15, the circumferential speed of the distal end of the brush 24 is lower than the circumferential speed in the normal operation. In the present embodiment, the controller 52 controls the brush motor 50 using the average rotation speed per rotation of the combing cylinder 15 as the rotation speed of the combing cylinder 15. The controller 52 controls such that the speed ratio of the circumferential speed of the distal end of the brush 24 with respect to the circumferential speed of the distal end of the comb 15a in the acceleration period and the deceleration period of the combing cylinder 15 becomes equal to the speed ratio A in the normal operation of the comber.

[0026] A sensor 57 detects the diameter of the brush 24 and functions as a brush diameter detector. The controller 52 receivers a detection signal from the sensor 57. The sensor 57 automatically detects the brush diameter and outputs a detection signal to the controller 52. The controller 52 controls the brush motor 50 based on the detection signal input from the sensor 57, which is, in other words, the brush diameter. That is, the brush diameter detected by the sensor 57 is fed back to control of the brush motor 50 by the controller 52.

[0027] The controller 52 also controls the servomotors 39 and the lap roller motor 45.

[0028] Operation of the comber, which is configured in the above-described manner, will hereafter be described.

[0029] When the comber operates, the controller 52 drives the main motor 30 through the inverter 53 to cause swinging movement (reciprocal pivoting) of the nipper shaft 21. Such swing of the nipper shaft 21 causes front-rear swing of the bottom nipper 18 together with the nipper frame 17 and up-down swing of the top nipper 19a. In this manner, the lap L is gripped and released alternately by the top nipper 19a and the distal end of the bottom nipper 18. Also, the distal end of the lap L, which is gripped by the nipper device 14, is combed by the comb 15a of the combing cylinder 15 (is subjected to combing). Short fibers and the like adhering to needles of the comb 15a due to such combing of the lap L by the comb 15a are then brushed from the comb 15a through rotation of the brush 24. Afterwards, the short fibers are drawn into the suction duct 25 by suction force and collected by a noil collecting portion.

[0030] With reference to Fig. 3, in the acceleration period and the deceleration period of the combing cylinder 15 (in other words, in starting operation and stopping operation of the comber), the brush motor 50, which drives the brush 24, is driven and controlled by the controller 52 such that the circumferential speed of the distal end of the brush 24 becomes lower than the corresponding speed in the normal operation of the comber. As a result, in the acceleration period and the deceleration period of the combing cylinder 15, the circumferential speed of the distal end of the brush 24 is prevented from becoming excessively higher than the circumferential speed of the distal end of the comb 15a.

[0031] When the brush 24 rotates at a high speed, accompanying air flows are generated in the vicinity of the brush 24. If the combing cylinder 15 also rotates at a high speed as in the normal operation of the comber, the air flows accompanying the comb 15a restrain the air flows accompanying the brush 24. This prevents disarrangement of fleece caused by the air flows accompanying the brush 24.

[0032] If the brush motor 50 is driven such that, even in the starting period and the stopping period of the comber, the rotation speed of the brush 24 becomes as high as in the normal operation of the comber like the conventional technique represented in Fig. 4, the air flows accompanying the comb 15a cannot restrain the air flows accompanying the brush 24. The air flows accompanying the brush 24 thus cause disarrangement of fleece.

[0033] However, referring to Fig. 3, the brush motor 50 is driven and controlled by the controller 52 such that, in the starting period or the stopping period of the comber, the circumferential speed of the distal end of the brush 24 becomes lower than in the normal operation of the comber. The circumferential speed of the distal end of the brush 24 is thus prevented from becoming excessively higher than the circumferential speed of the distal end of the comb 15a in the acceleration period and the deceleration period of the combing cylinder 15. As a result, disarragement of fleece caused by the air flows accompanying the brush 24 is prevented.

[0034] In response to input of a signal representing the brush diameter detected by the sensor 57 to the controller 52, the controller 52 feeds back the input signal, which is the detected brush diameter, to control of the brush motor 50. That is, when the brush diameter is decreased by wear of the brush 24 and the circumferential speed of the distal end of the brush 24 becomes insufficient if the rotation speed is constant, the controller 52 controls the brush motor 50 at a rotation speed determined with the wear of the brush 24 taken into consideration such that the circumferential speed of the distal end of the brush 24 becomes equal to the circumferential speed of the distal end of the brush 24 before the wear.

[0035] The present embodiment has the advantages described below.

(1) The comber includes the brush 24 for cleaning the comb 15a of the combing cylinder 15, the main motor 30 (the cylinder driving motor) for driving the combing cylinder 15, the variable speed driving motor (the brush motor 50), which is arranged independently from the main motor 30 and drives the brush 24, and the controller 52 (the speed controller) for driving the brush motor 50. The controller 52 controls the brush motor 50 such that, at least in the acceleration period and the deceleration period of the combing cylinder 15, the circumferential speed of the distal end of the brush 24 becomes lower than the corresponding circumferential speed in the normal operation of the comber. This configuration prevents the circumferential speed of the distal end of the brush 24 from becoming excessively higher than the circumferential speed of the distal end of the comb 15a in the acceleration period and the deceleration period of the combing cylinder 15. Disarrangement of fleece caused by the air flows accompanying the brush 24 is thus prevented. As a result, disarrangement of fleece caused by the air flows accompanying the brush 24 is prevented in the acceleration period and the deceleration period of the combing cylinder. Also, the embodiment ensures the relative circumferential speeds of the comb 15a and the brush 24 corresponding to the rotation speed of the comb 15a to improve the quality of the sliver spun by the comber.

(2) The controller 52 controls the brush motor 50 such that the speed ratio of the circumferential speed of the distal end of the brush 24 with respect to the circumferential speed of the distal end of the comb 15a in the acceleration period and the deceleration period of the combing cylinder 15 becomes equal to the speed ratio A in the normal operation of the comber. It is thus unnecessary to set speed ratios separately for the acceleration and deceleration periods and the normal operation. Control is thus facilitated.

(3) The controller 52 includes the brush diameter detector (the sensor 57) for detecting the diameter of the brush 24 and controls the brush motor 50 based on the brush diameter, which is detected by the sensor 57. Conventionally, the brush diameter is detected after the brush 24 is separated from the machine, which complicates detection of the brush diameter. However, the sensor 57 simplifies the detection of the brush diameter. Also, the detected brush diameter is fed back to control of the brush motor 50. The rotation speed of the brush 24 is thus controlled to be an appropriate rotation speed in correspondence with the state of wear of the brush 24.

(4) As the brush diameter detector, the sensor 57, which is capable of automatically detecting the brush diameter, is arranged. A detection result of the sensor 57 is input directly to the controller 52. Therefore, the operator does not need to input the brush diameter detected by the brush diameter detector to the controller 52.

[0036] The embodiment is not restricted to the illustrated form but may be embodied in the forms described below.

[0037] The brush diameter detector is not restricted to the configuration in which the sensor 57 detects the outer diameter of the brush 24. For example, the brush 24 may be fixed to a certain attachment portion of the comber through a non-illustrated bracket in a manner allowing adjustment of the distance between the rotation axis of the brush 24 and the rotation axis of the combing cylinder 15. That is, the bracket, which supports the brush 24, is fixed in a manner allowing position changes of the bracket with respect to the attachment portion of the comber. In this case, a scale representing the fixing positions of the bracket, which supports the brush 24, may be arranged. The operator reads the value on the scale, subtracts the amount of wear of the brush 24 from the read value of the brush diameter, and inputs the determined value to the controller 52. Measurement of the brush diameter, which is reading of the scale, may be performed at, for example, regular inspections of the machine. In this case, the scale configures the brush diameter detector.

[0038] The controller 52 may control the brush motor 50 such that the rotation speed of the brush motor 50 is constantly synchronized with the rotation speed of the combing cylinder 15. The combing cylinder 15 is controlled by the controller 52 such that, in one cycle of rotation, the rotation speed of the combing cylinder 15 is changed to be different between a state in which the comb 15a combs the lap L (a state in which the comb 15a is engaged with the lap L) and a state in which the comb 15a is disengaged from the lap L. Therefore, cleaning performance is improved by changing the rotation speed of the brush 24 in correspondence with the speed change of the combing cylinder 15 in one cycle of rotation, instead of changing the rotation speed of the brush 24 in correspondence with the average speed of the combing cylinder 15 per rotation.

[0039] Depending on the fiber length or fineness (the diameter) of the fiber configuring the lap L, the speed ratio of the circumferential speed of the distal end of the brush 24 with respect to the circumferential speed of the distal end of the comb 15a may be changed. Fine fiber tends to be easily influenced by air flows and long and fine fiber tends to be further easily influenced by air flows. Therefore, for fine fiber, it is desirable to decrease the aforementioned speed ratio.

[0040] Various shafts arranged in the combing head 11 may be either two-side or one-side drive shafts.

[0041] The lap roller 12 and the detaching roller 16 may be driven by the main drive shaft 32 through a belt transmission device or a gear row.

[0042] The speed ratio of the circumferential speed of the distal end of the brush 24 with respect to the circumferential speed of the distal end of the comb 15a may be lower in the acceleration period and the deceleration period than in the normal operation. However, to maintain the cleaning performance, it is desirable that the speed ratio be greater than 1. Also, if the circumferential speed of the distal end of the brush 24 is lower in the acceleration period and the deceleration period than in the normal operation, the speed ratio of the circumferential speed of the distal end of the brush 24 with respect to the circumferential speed of the distal end of the comb 15a may be higher in the acceleration period and the deceleration period than in the normal operatin.

[0043] A comber includes a brush for cleaning a comb of a combing cylinder, a cylinder driving motor, which is configured to drive the combing cylinder, a variable speed driving motor, which is configured to drive the brush and is arranged independently from the cylinder driving motor, and a speed controller, which is configured to drive the variable speed driving motor. The speed controller is configured to control the variable speed driving motor such that a circumferential speed of a distal end of the brush is lower at least in an acceleration period and a deceleration period of the combing cylinder than in normal operation of the comber.

Claims

1. A comber comprising:

a brush for cleaning a comb of a combing cylinder;
a cylinder driving motor, which is configured to drive the combing cylinder;
a variable speed driving motor, which is configured to drive the brush and is arranged independently from the cylinder driving motor, and
a speed controller, which is configured to drive the variable speed driving motor,

the comber being **characterized in that** the speed controller is configured to control the variable speed driving motor such that a circumferential speed of a distal end of the brush is lower at least in an acceleration period and a deceleration period of the combing cylinder than in normal operation of the comber.

2. The comber according to claim 1, wherein the speed controller controls the variable speed driving motor such that a speed ratio of the circumferential speed of the distal end of the brush and a circumferential speed of a distal end of the comb in the acceleration and deceleration periods of the combing cylinder is equal to that in the normal operation of the comber.

3. The comber according to claim 1 or 2, further comprising a brush diameter detector, which is configured to detect a diameter of the brush,
wherein the speed controller is configured to control the variable speed driving motor based on a brush diameter detected by the brush diameter detector.

4. The comber according to claim 3, further comprising a support bracket, which supports the brush, wherein the support bracket is fixed to the comber such that the position of the support bracket is changeable so that a distance between a rotation axis of the brush and a rotation axis of the combing cylinder is changeable, and
the brush diameter detector is a scale, which represents positions at which the support bracket is fixed to the comber.

5. The comber according to claim 1 or 2, wherein
the combing cylinder is driven such that the rotation speed of the combing cylinder changes in one turn of rotation, and
the speed controller controls the variable speed driving motor such that the rotation speed of the brush changes synchronously with a speed change of the combing cylinder in one turn of rotation.

Fig.1

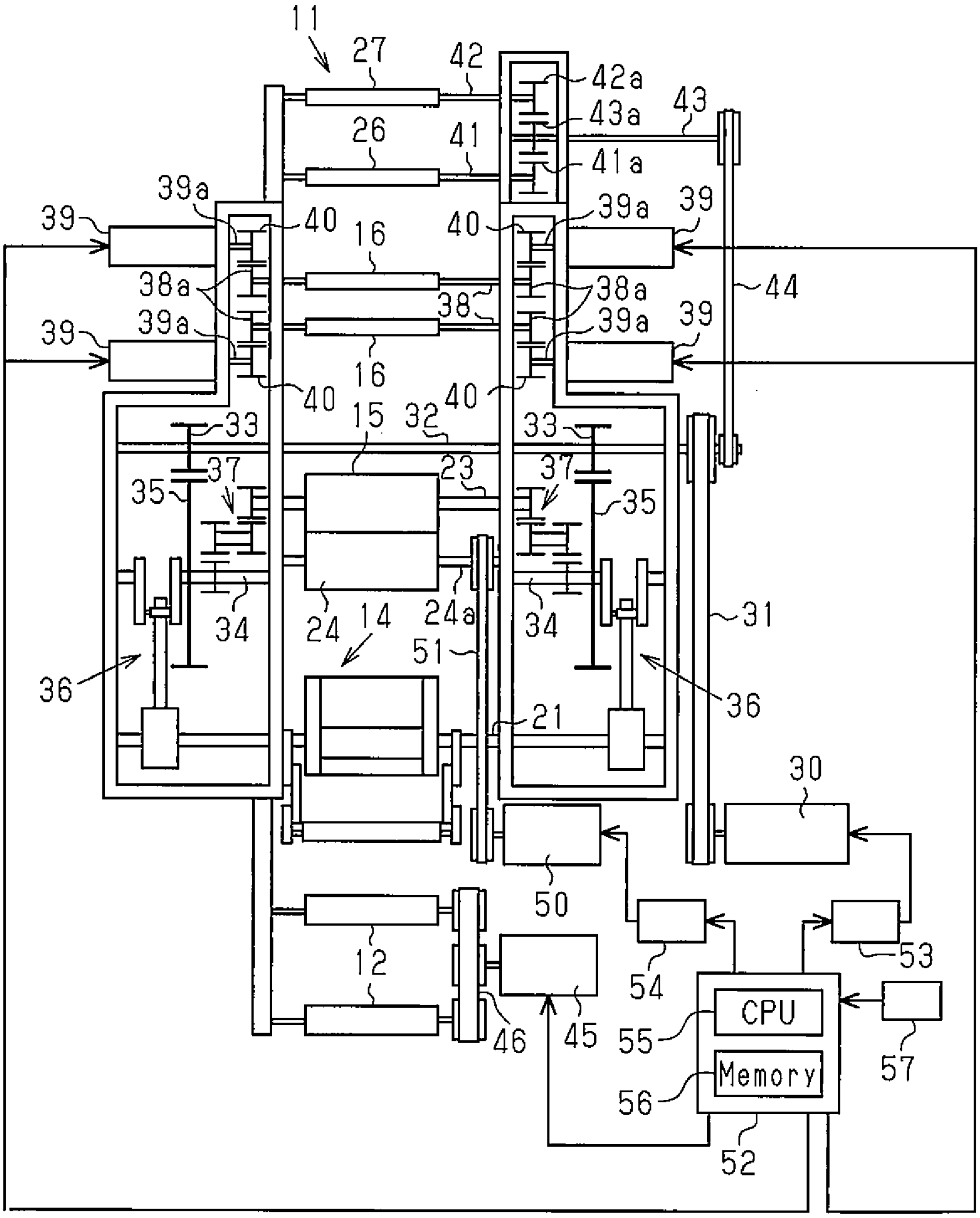
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Fig.2

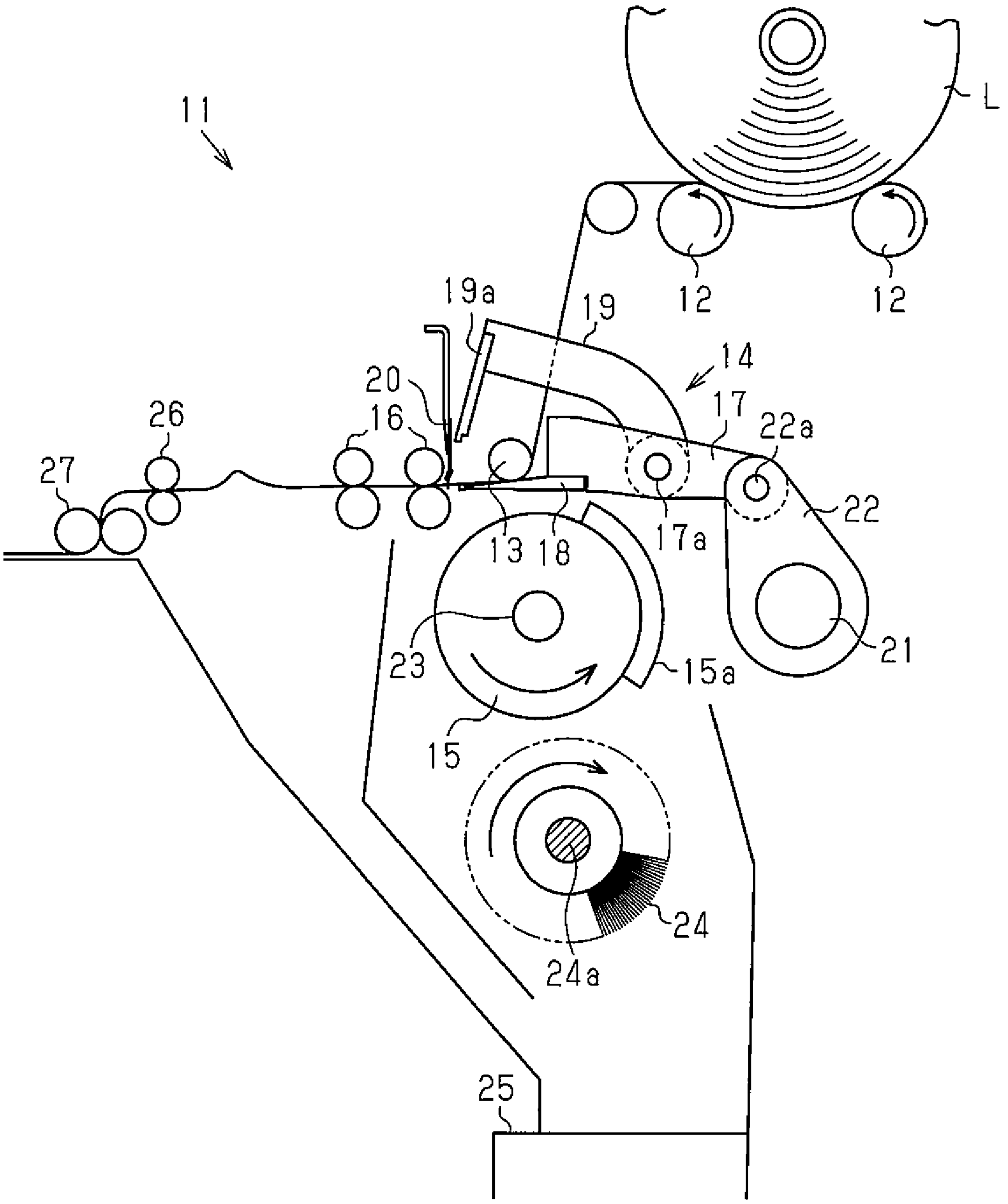
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Fig.3

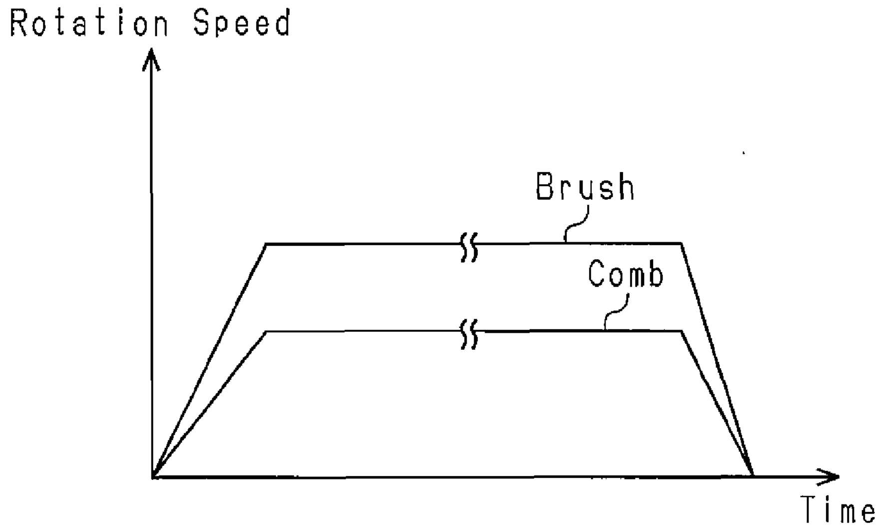
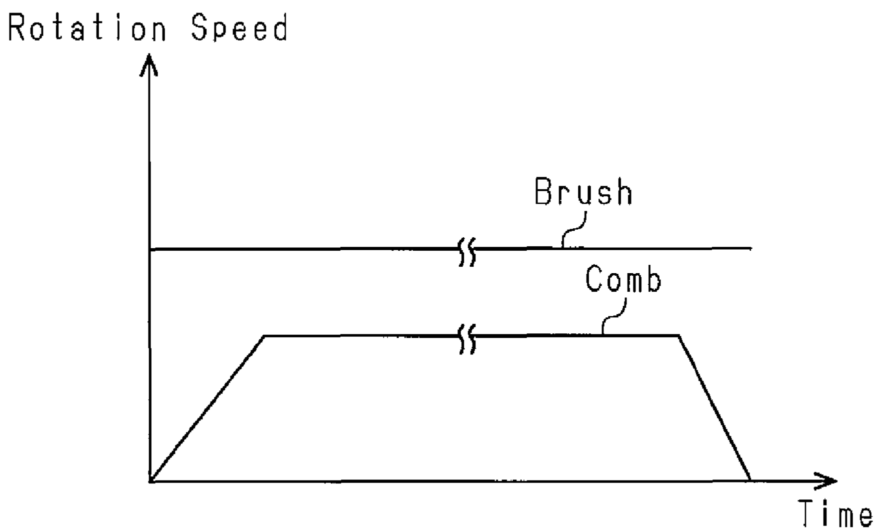

Rotation Speed
Brush
Comb
Time

Fig.4


Rotation Speed
Brush
Comb
Time

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EUROPEAN SEARCH REPORT

Application Number
EP 16 18 1608

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 690 11 018 T2 (SCHLUMBERGER CIE N [FR]) 30 March 1995 (1995-03-30) * page 1, lines 5-8,19-27; figures 1-3 * * page 2, lines 7-22 * * page 3, lines 15-23 * * page 4, line 9 - page 11, line 33 * -----	1-5	INV. D01G19/22
A	US 3 735 446 A (LORENZ H ET AL) 29 May 1973 (1973-05-29) * column 1, lines 4-7; figure 1 * * column 1, lines 39-51 * * column 1, line 62 - column 2, line 51 * -----	1-5	
A	DE 698 04 233 T2 (SCHLUMBERGER CIE N [FR]) 21 November 2002 (2002-11-21) * page 1, lines 6-12; figures 1,11 * * page 2, lines 6-23 * * page 6, line 14 - page 7, line 13 * * page 16, lines 13-31 * -----	1-5	

TECHNICAL FIELDS SEARCHED (IPC)

D01G

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	18 November 2016	Wendl, Helen

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 18 1608

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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18-11-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 69011018 T2	30-03-1995	DD 297672 A5	16-01-1992
		DE 69011018 D1	01-09-1994
		EP 0417021 A1	13-03-1991
		ES 2060994 T3	01-12-1994
		FR 2651512 A1	08-03-1991
		JP 2573408 B2	22-01-1997
		JP H03146725 A	21-06-1991
US 3735446 A	29-05-1973	NONE	
DE 69804233 T2	21-11-2002	DE 69804233 D1	18-04-2002
		DE 69804233 T2	21-11-2002
		EP 1016742 A1	05-07-2000

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 3146725 A **[0006] [0008]**