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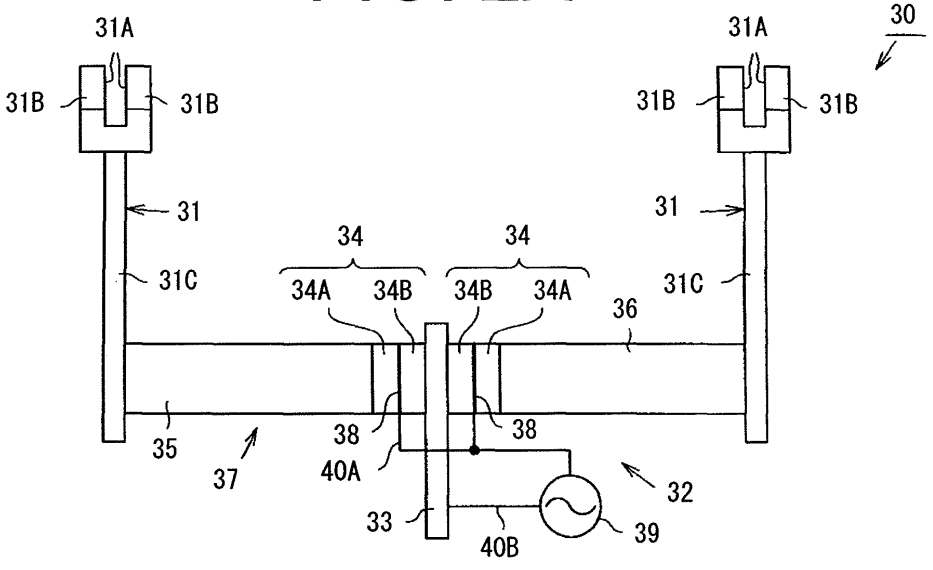
(54) Fiber bundle guiding device for a spinning machine

(57) A fiber bundle guiding device (30) for a spinning guides a fiber bundle to reduce the width of the fiber bundle. The fiber bundle guiding device includes guide members (31) which have a guide surface (31A) whose width is reduced along the moving direction of the fiber bundle to be guided. The guide members are disposed at an interval corresponding to the spaced distance between at least two adjacent spindles. A connecting member (35,36) connects the guide members and has a rod like shape extending in the direction perpendicular to the guide members. An electronic component (34) is used for vibrating the connecting member longitudinally and arranged at the intermediate portion of the connecting member. A vibrating mechanism (32) vibrates the guide members to generate a sound pressure for reducing the width of the fiber bundle. The vibrating mechanism includes the connecting member (35,36) and the electronic component (34).

FIG. 2A



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a fiber bundle guiding device for a spinning machine and, more particularly, to a fiber bundle guiding device for a spinning machine in which a fiber bundle is guided to reduce the width of the fiber bundle with the fiber bundle guiding device.

[0002] There have been proposed various types of fiber bundle collecting devices for use in a ring spinning machine for collecting a drafted fiber bundle before twisting for the purpose of improvement of yarn quality by reducing unevenness and fluff in the fiber bundle. For collecting the fiber bundles, a method which utilizes a mechanical guide (or a collector) and a method in which suction air stream is applied to a fiber bundle moving on a perforated belt (or an air-permeable apron) are generally used.

[0003] According to these methods, since a fiber bundle is guided in contact with a guide member, there has been a need to take measures to reduce the friction between the fiber bundle and the surface of the guide member for preventing orderly arrangement of the fiber bundle from being disturbed. Even if such measures are taken, the performance of the guide member is reduced over time. To solve the problem, Unexamined Japanese Patent Publication No. 2007-9391 discloses a fiber bundle guiding device that can guide a fiber bundle without contact with the fiber bundle. Thus, the fiber bundle guiding device of the Publication prevents deterioration of the guide surface of the guide member over time due to abrasion and collection of foreign matters. According to the above Publication, the fiber bundle guiding device has two plates as guide members each having a guide surface whose width is reduced along the moving direction of the fiber bundle to be guided and vibrated by its own vibrator.

[0004] The fiber bundle guiding device disclosed in the above Publication, in which each plate is vibrated by its own vibrator, is hard to be downsized and to ensure a space for providing a guide member in a passage for the fiber bundle at each spindle of a ring spinning machine.

[0005] As shown in Fig. 8 as the background art, one vibrator 52 vibrates one guide member 51 in a fiber bundle guiding device. In the structure, the guide member 51 is fixed to a piezoelectric unit 53 of the vibrator 52 on one side thereof, and the bracket 54 is mounted to the end of the piezoelectric unit 53 on the other side thereof. According to this structure, only one vibrator 52 is required for each spindle, although the structure has a relatively high impedance and the energy efficiency of the vibrating mechanism including a vibrating device (not shown) is relatively low.

[0006] The present invention, which has been made in view of the above problems, is directed to provide a fiber bundle guiding device for a spinning machine . The fiber bundle guiding device can enhance the energy efficiency of the vibrating mechanism for vibrating the guide member which is used for guiding a fiber bundle to reduce the width of the fiber bundle and also ensure a space for installation of the guide member.

SUMMARY OF THE INVENTION

[0007] In accordance with an aspect of the present invention, a fiber bundle guiding device for a spinning machine has a draft device and a spindle and guides a fiber bundle to reduce the width of the fiber bundle. The fiber bundle guiding device includes guide members which have a guide surface whose width is reduced along the moving direction of the fiber bundle to be guided as installed in the spinning machine. The guide members are disposed at an interval corresponding to the spaced distance between at least two adjacent spindles. A connecting member connects the guide members and has a rod like shape extending in the direction perpendicular to the guide members. An electronic component is used for vibrating the connecting member longitudinally and arranged at the intermediate portion of the connecting member. A vibrating mechanism is used for vibrating the guide members to generate a sound pressure for reducing the width of the fiber bundle. The vibrating mechanism includes the connecting member and the electronic component.

[0008] 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

[0009] 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. 1A is a side view of a draft device having a fiber bundle guiding device according to a first preferred embodiment of the present invention;

Fig. 1B is a fragmentary schematic top view showing a relationship between a guide member and a bottom roller;

Fig. 2A is a front view of the fiber bundle guiding device according to the first preferred embodiment of the present invention;

Fig. 2B is an exploded front view of a vibrator of the fiber bundle guiding device according to the first preferred embodiment of the present invention;

Fig. 3A is a fragmentary front view of a fiber bundle guiding device according to a second preferred embodiment of the present invention;

Fig 3B is a side view of a plate of the fiber bundle guiding device according to the second preferred embodiment of the present invention;

Fig. 4A is a fragmentary top view showing a relationship among a bracket, a piezoelectric unit and connecting members of a fiber bundle guiding device according to an alternative embodiment of the present invention;

Fig. 4B is an exploded perspective view of a bracket of a fiber bundle guiding device according to an another alternative embodiment of the present invention;

Fig. 5 is an exploded schematic view illustrating connecting members of a fiber bundle guiding device according to a further alternative embodiment of the present invention;

Fig. 6A is a side view of a plate of a guide member according to a still further alternative embodiment of the present invention;

Fig. 6B through Fig. 6D are front views of guide members according to respective alternative embodiments of the present invention;

Fig. 7 is a fragmentary schematic front view of a fiber bundle guiding device according to still further alternative embodiment of the present invention; and

Fig. 8 is a fragmentary front view of the above-described fiber bundle guiding device of the background art having one guide member vibrated by one vibrator.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] The following will describe a first preferred embodiment as applied to a spinning machine with reference to Fig. 1 and Fig. 2. As shown in Fig. 1A, the draft device 11 of the spinning machine is of a four-line type including a final delivery roller pair located downstream of the three-line draft section as viewed in the moving direction of fiber bundle F. The three-line draft section includes a front bottom roller 12, a middle bottom roller 13, and a back bottom roller 14. The middle bottom roller 13 and the back bottom roller 14 are supported by a roller stand 15 forming a part of the frame of the draft device 11 through support brackets 16, 17. The support brackets 16, 17 are fixed to the roller stand 15 in such a manner that the positions of the support brackets 16, 17 are adjustable in the fiber bundle moving direction relative to the roller stand 15.

[0011] The three-line draft section further includes a front top roller 21, a middle top roller 22, and a back top roller 23. The front top roller 21, the middle top roller 22 and the back top roller 23 are supported by the frame 20B of a weighting arm 20 through top roller support members at positions corresponding to the front bottom roller 12, the middle bottom roller 13 and the back bottom roller 14. The weighting arm 20 has a lever 20A pivotable between the pressing position and the releasing position. When the lever 20A is in contact with the frame 20B of the weighting arm 20 as shown in Fig. 1A, the weighting arm 20 is at pressing position. The lever 20A is maintained in a locked state at the pressing position (or spinning position) where the weighting arm 20 presses the top rollers 21, 22, 23 supported by the weighting arm 20 toward the bottom rollers 12, 13, 14. When the lever 20A is pivoted from the pressing position as shown in Fig. 1A upward to the releasing position, the lever 20A is released from the locked state.

[0012] The final delivery roller pair 26 includes a bottom nip roller 26A and a top nip roller 26B. The bottom nip roller 26A is supported by the roller stand 15. The top nip roller 26B is supported by the weighting arm 20 through a top nip roller support member. Specifically, the top nip roller 26B is supported by the weighting arm 20 through the top nip roller support member for every two spindles in the same manner as the front top roller 21 of the draft device 11.

[0013] As shown in Fig. 1A, the fiber bundle guiding device 30 is located between the final delivery roller pair 26 and its immediately preceding roller pair of the front bottom roller 12 and the front top roller 21. As shown in Fig 2A, the fiber bundle guiding device 30 includes guide members 31 and a vibrating mechanism 32 for vibrating the guide members 31.

[0014] As shown in Fig. 2A, the vibrating mechanism 32 includes a bracket 33, two piezoelectric units 34 and two connecting members 35, 36. The bracket 33 is connected to the frame of the draft device 11. The piezoelectric unit 34 is an electronic component and the two piezoelectric units 34 are disposed on the opposite sides of the bracket 33 so as to sandwitch the bracket 33. The vibrator 37 of the vibrating mechanism 32 is arranged in such a way that the bracket 33 and the piezoelectric units 34 are sandwiched by the connecting members 35, 36. The connecting members 35, 36 are in a shape of rod made of metal. The vibrator 37 is of a Langevin type. Each piezoelectric unit 34 has a pair of annular piezoelectric elements 34A, 34B and an annular electrode plate 38 which is provided between the elements 34A, 34B of each pair.

[0015] As shown in Fig. 2B, one connecting member 35 has an internally threaded hole 35A, and the other connecting member 36 has a rod portion 36B. The internally threaded hole 35A of the connecting member 35 is formed so as to extend axially internally from the end

surface thereof which faces the piezoelectric unit 34. The rod portion 36B of the connecting member 36 is formed to project axially from the end surface of the connecting member 36 which faces the piezoelectric unit 34 and to have an externally threaded portion 36A. The externally threaded portion 36A of the connecting member 36 extends through the piezoelectric unit 34, the electrode plate 38 and a hole (not shown) of the bracket 33. Then, the externally threaded portion 36A of the connecting member 36 is screwed into the internally threaded hole 35A of the connecting member 35. Thus, the connecting members 35, 36 are supported by the bracket 33 in such a manner that the piezoelectric units 34 and the electrode plates 38 are fastened together to the bracket 33.

[0016] Each guide member 31 includes a pair of plate-like guides 31 B and a plate-like support portion 31C. The paired guides 31 B are disposed so as to face each other thereby to form guide surfaces 31A. The support portion 31C is formed continuously with the guides 31 B. The support portions 31C are fixed at the proximal ends thereof to the outer ends of the connecting members 35, 36. The support portions 31C may be fixed to the connecting members 35, 36 by any suitable means such as brazing. As shown in Fig. 1B, the paired guides 31 B are formed so that the clearance between the facing guide surfaces 31A is wider at the upstream end than the downstream end as viewed in the moving direction of the fiber bundle F. More specifically, the guides 31 B are formed so that the clearance between the guides 31 B is gradually widened from the center toward the upstream end of the guide surfaces 31A, and substantially constant from the center toward the downstream end. Though depending on the spinning conditions, the guides 31 B are formed so that the clearance between the guide surfaces 31A of the guides 31 B at the downstream end is about 1 mm or less.

[0017] The vibrator 37 is connected to a vibrating device 39. The electrode plates 38 are connected to the vibrating device 39 through a wire 40A. The ground terminal of the vibrating device 39 is connected to the bracket 33 through a wire 40B. One surface of each piezoelectric unit 34 is in contact with the bracket 33. The other surface of each piezoelectric unit 34 is in contact with the appropriate one of the connecting members 35, 36 which is electrically connected to the bracket 33 through the rod portion 36B having the externally threaded portion 36A. Thus, the electric potential difference between the surfaces of each piezoelectric unit 34 is substantially zero. The vibrating device 39 causes the vibrator 37 to vibrate in such a way that the bracket 33 is located at a node of the vibration and the ends of the connecting members 35, 36 to which the guide members 31 are fixed is located at an antinode of the vibration. In addition, the vibrating device 39 vibrates the vibrator 37 so that the guide member 31 is vibrated at a frequency that is higher than a sound frequency in the human audible range.

[0018] The following will describe the operation of the fiber bundle guiding device 30 as constructed above. Before operation of the spinning frame, the middle bottom roller 13 and the back bottom roller 14 are set to appropriate positions by adjusting the positions of the support brackets 16, 17 depending on the material for spinning. Then, the middle top roller 22 and the back top roller 23 are set appropriately relative to the positions of the middle bottom roller 13 and the back bottom roller 14.

[0019] In operation of the spinning frame, the fiber bundle F is drafted at the three-line draft section of the draft device 11 and move to the nip of the final delivery roller pair 26 while the fiber bundle F is guided by the guide surfaces 31A of the guide member 31. Then, the drafted fiber bundle F is delivered from the final delivery roller pair 26. During the spinning operation, the vibrator 37 is vibrated by the vibrating device 39 at a predetermined resonance frequency (for example, around 30 kHz), with the result that the connecting members 35, 36 are vibrated longitudinally and the guide members 31 are vibrated flexurally. The guide members 31 are vibrated to generate a sound pressure for reducing the width of the fiber bundle F. Therefore, the fiber bundle F passes the space between the guide surfaces 31A and then collected. After the fiber bundle F passes through the nip of the bottom nip roller 26A and the top nip roller 26B, the fiber bundle F is moved further downstream while the fiber bundle F is twisted, and then wound on a bobbin (not shown). The final delivery roller pair 26 is rotated at a surface speed that is slightly faster than the surface speed of the front bottom roller 12 and the front top roller 21. After the fiber bundle F passes through the nip of the final delivery roller pair 26 with appropriate tension, the fiber bundle F is turned to move downstream while the fiber bundle F is twisted.

[0020] The fiber bundle F drafted at the three-line draft section is compressed to a thickness of 1 mm or less while the fiber bundle F is passing between the guide surfaces 31A. Then, the fiber bundle F is guided to the final delivery roller pair 26 and pass through the nip of the final delivery roller pair 26. Thus, as compared to the spinning frame equipped with a three-line draft device having no fiber bundle guiding device such as the fiber bundle guiding device 30, generation of fluff and fly is reduced and, therefore, the yarn quality is improved.

[0021] In the fiber bundle guiding device 30, any two adjacent guide members 31 disposed at an interval corresponding to the spaced distance between any two adjacent spindles of the spinning frame are connected to each other through the connecting members 35, 36. The guide members 31 are vibrated longitudinally by the vibration of the piezoelectric units 34 which are interposed between the connecting members 35, 36. The guide members 31 are fixed to the opposite outer ends of the respective connecting members 35, 36 and the piezoelectric units 34 are fixed to the other ends of the respective connecting members 35, 36. The guide members 31 are caused to vibrate flexurally. Thus, the guides 31 B of each pair are vibrated ultrasonically, so that the guides 31 B generate a sound pressure which reduces the width

of the fiber bundle F. In comparison to a structure wherein a connecting member is fixed to only one side of a piezoelectric unit and vibrated longitudinally thereby to vibrate one guide member, the piezoelectric unit 34 can vibrate both connecting members 35, 36 by effectively utilizing the vibrational energy. Therefore, the energy efficiency of the vibrating mechanism 32 for vibrating the guide members 31 for guiding the fiber bundle F may be improved. Additionally, the fiber bundle guiding device 30 is easy to ensure a space for installation of the fiber bundle guiding device 30 in comparison to a structure in which the guide member 31 is vibrated by each individual vibrating mechanism 32.

[0022] According to the above embodiment, the following advantageous effects are obtained.

[0023] (1) The fiber bundle guiding device 30 as installed in the spinning machine includes the guide member 31 and the vibrating mechanism 32. The guide member 31 has a guide surface 31A. The width of the guide surface 31A is reduced along the moving direction of the fiber bundle F to be guided. The vibrating mechanism 32 is used for vibrating the guide member 31, thereby to generate a sound pressure for reducing the width of the fiber bundle F. The guide members 31 are disposed at an interval corresponding to the spaced distance between any two adjacent spindles. The connecting members 35, 36 have a rod-like shape extending in the direction perpendicular to the guide member 31. The guide members 31 are connected to each other through the connecting members 35, 36. The piezoelectric units 34 are interposed between the connecting members 35, 36 for vibrating the connecting members 35, 36 longitudinally. Thus, the piezoelectric units 34 can cause both connecting members 35, 36 to vibrate by effectively utilizing the vibrational energy. Therefore, the energy efficiency of the vibrating mechanism 32 for vibrating the guide members 31 for guiding a fiber bundle F is increased. It is easy to ensure a space for installation of the fiber bundle guiding device 30 in comparison to the structure in which the guide member 31 is vibrated by the each individual vibrating mechanism 32.

[0024] (2) The bracket 33 is provided at a position corresponding to the node of the longitudinal vibration of the connecting members 35, 36 and the piezoelectric units 34 are disposed on each side of the bracket 33 so as to sandwich the bracket 33. With the fiber bundle guiding device 30 installed in the spinning machine, unwanted vibration is hardly transmitted to the bracket 33, so that unnecessary vibration is hardly transmitted to other parts and, therefore, extra energy for such vibration is not required.

[0025] (3) Each of the piezoelectric units 34 provided on both sides of the bracket 33 so as to sandwich the bracket 33 includes a pair of annular piezoelectric elements 34A, 34B. An annular electrode plate 38 is provided between the piezoelectric elements 34A, 34B of each pair. The annular piezoelectric elements 34A, 34B are electrically connected at the opposite ends thereof as viewed the ends which face the electrode plate 38 to the bracket 33 and the connecting members 35, 36 to have the same potential level. The electrode plates 38 are connected to the vibrating device 39 through a wire 40A. The ground terminal of the vibrating device 39 is connected to the bracket 33 through a wire 40B. Thus, the fiber bundle guiding device 30 may be easily installed in the spinning machine with the bracket 33 and the connecting members 35, 36 grounded to have substantially zero electrical potential difference.

[0026] (4) The vibrating device 39 causes the vibrator 37 to make longitudinal vibration so that the end portions of the connecting members 35, 36 to which the guide members 31 are fixed are located at antinode of the longitudinal vibration, respectively. Thus, the guide member 31 is vibrated flexurally with high efficiency.

[0027] The following will describe a fiber bundle guiding device of the second preferred embodiment according to the present invention with reference to Fig. 3. The fiber bundle guiding device of the second preferred embodiment differs from that of the first preferred embodiment in that the guide member 31 of the first preferred embodiment is modified. The rest of the structure of the fiber bundle guiding device of the second preferred embodiment is substantially the same as that of the first preferred embodiment. Therefore, common or similar elements or parts are designated by the same reference numerals as those used in the first preferred embodiment and the description thereof will be omitted.

[0028] The guide member 41 of the second embodiment is provided by two plates 42 connected to each other through a spacer 43 as shown in Fig 3A. More specifically, the two plates 42 are connected to each other through the spacer 43 at base portions 42A of the plates 42. Also, the connecting members 35, 36 are fastened together by means of bolts 44 (only one bolt being shown in the drawing) which are inserted through the plates 42 and the spacer 43 and screwed into a threaded hole (not shown) of the connecting members 35, 36. Thus, the plates 42 are fastened securely to the connecting members 35, 36 by means of the bolt 44. It is noted that the guide member 41 which is composed of two plates 42 and connected to the outer end of the connecting member 36, the vibrating device 39 and the wires 40A, 40B are not illustrated in Fig. 3A for the sake of convenience of illustration.

[0029] As shown in Fig. 3B, the plate 42 includes a base portion 42A, a middle portion 42B and a guide portion 42C. The width of the middle portion 42B as measured in the direction that is perpendicular to the longitudinal direction thereof is smaller than the width of the base portion 42A. The guide portion 42C is provided to extend in a direction perpendicular to the longitudinal direction of the middle portion 42B. The clearance between the plates 42 of each pair or between the guide portions 42C thereof is determined by the thickness of the spacer 43. The guide portions 42C of each pair have surfaces which face each other to serve as a pair of the guide

surfaces. The guide surfaces guide a fiber bundle F to reduce the width of the fiber bundle F. Thus, the guide member 41 according to the second preferred embodiment is formed by two plates each having the base portion 42A, the middle portion 42B and the guide portion 42C. The guide portion 42C is formed continuously with the middle portion 42B. The base portion 42A and the middle portion 42B serve as a support portion for connection with the vibrating mechanism 32.

[0030] The guide portions 42C of the guide member 41 on each side of the joined connecting members 35, 36 has straight portions which are disposed on the downstream side thereof, and tapered portions which are formed on the upstream side thereof. The straight portion of the guide portions 42C is formed in such a manner that a clearance between the facing surfaces of the guide portions 42C serving as a guide surface is substantially constant. The tapered portions are formed such that the clearance between the facing surfaces is widened toward the upstream end of the tapered portions. The tapered portion of the guide portion 42C is not illustrated in Fig. 3A for the sake of convenience of illustration.

[0031] According to the second preferred embodiment, the vibrator 37 is vibrated by the vibrating device 39 at a predetermined resonance frequency (for example about 30 kHz) of the guide member 41 in the same manner as in the case of the first preferred embodiment. Accordingly, the connecting members 35, 36 are longitudinally vibrated in such a manner that antinode of the longitudinal vibration are positioned at the ends of the connecting members 35, 36 to which the guide members 31 are fixed. The guide member 41 is vibrated flexurally through the connecting members 35, 36. The guide member 41 is vibrated to generate a sound pressure for reducing the width of the fiber bundle F. The fiber bundle F passes through a space between the guide portions 42C and then the fiber bundle F is collected. After passing through nip of the bottom nip roller 26A and the top nip roller 26B, the fiber bundle F is turned to move while being twisted and then wound on bobbin.

[0032] According to the second preferred embodiment, the following effects, as well as the same effects as described earlier with reference to the first preferred embodiment, are obtained.

[0033] (5) The guide member 41 includes two plates which are connected to each other through the spacer 43 and the guide member 41 is vibrated at the portion thereof to which the spacer is connected. Therefore, the manufacture of the guide member 41 is relatively easy in comparison to the case which requires casting and machining of the guide member 31 having only the guides 31 B formed by a pair of plates facing each other. Furthermore, it is easier to vibrate the guide portion 42C with an efficiently larger amplitude, in comparison to the guide member in which the major part thereof connected to the vibrating device and caused to vibrate flexurally is made of a single plate or rod.

[0034] (6) Each guide member 41 is composed of two plates 42 which are not fixed to the spacer 43 by brazing, but detachably fastened to the connecting members 35, 36 by the bolt 44 extending through the plates 42 and the spacer 43 to be screwed into any one of the connecting members 35, 36. Thus, if the guide member 41 needs to be modified by changing the clearance of the guide portion 42C depending on the spinning condition, the modification is achieved by replacement of only the spacer 43. The spinning condition is for example a change of the count from fine count to low count, or a change of the hand (fluff condition) of a yarn to be spun or the like.

[0035] The present invention is not limited to the above-described preferred embodiments, but it may be practiced in various alternative embodiments as exemplified below. In the above second preferred embodiment, two piezoelectric units 34 are provided on both lateral sides of the bracket 33 so as to sandwich the bracket 33. Alternatively, the piezoelectric units 34 are connected to the connecting members 35, 36 such that the piezoelectric unit 34 having a pair of the piezoelectric elements 34A, 34B is sandwiched by the connecting members 35, 36, as shown in Fig. 4A and Fig. 4B. More specifically, the piezoelectric elements 34A, 34B and an electrode plate 38 held therebetween are fastened together by means of the connecting members 35, 36 and a bolt. The bolt extends through the piezoelectric elements 34A, 34B and the electrode plate 38 and into the connecting members 35, 36. Thus, the piezoelectric elements 34A, 34B and the electrode plate 38 are supported by the bracket 45.

[0036] The bracket 45 includes a body 46 and two fixing members 47. The body 46 is formed with a pair of arcuate surfaces 46A and one arcuate surface 46B located between the arcuate surfaces 46A. The arcuate surfaces 46A have the same curvature radius as the circumferential surface of the connecting members 35, 36. The arcuate surface 46B has a larger curvature radius than the arcuate surface 46A. Each fixing members 47 has arcuate surface which has the same curvature radius as the arcuate surface 46A. The two fixing members 47 are fastened to the body 46 by means of the bolts 48. As shown in Fig. 4A, the elements 34A, 34B and the electrode plate 38 are fitted in the arcuate surface 46B, and the connecting members 35, 36 are fitted on the arcuate surface 46A. Then, the fixing members 47 are fastened to the body 46 by means of the bolts 48 such that the fixing members 47 are fitted on the connecting members 35, 36. Thus, the piezoelectric unit 34 and the electrode plate 38 are held in place without contact with the body 46 and the fixing members 47. The electrode plate 38 is connected to the vibrating device 39 through a wire 40A. The ground terminal of the vibrating device 39 is connected to the bracket 33 through a wire 40B. That is, the piezoelectric unit 34 is grounded through the bracket 45.

[0037] In the above alternative embodiment, the vibrator 37 is vibrated with the node of longitudinal vibration positioned at the center of the piezoelectric unit 34 and the antinodes at the ends of the connecting members 35,

36 adjacent to the guide members 41. Thus, very little vibration is transmitted to the bracket 45, so that unwanted vibration is hardly transmitted to other parts and, therefore, unnecessary energy will not be consumed. In addition, the number of the piezoelectric unit 34 for use in this alternative embodiment may be easily reduced. For example, a pair of piezoelectric unit 34 is sufficient to one unit.

[0038] In the first preferred embodiment, the connection between the connecting members 35, 36 is not limited to the structure in which the externally threaded portion 36A of the connecting member 36 is screwed into the internally threaded hole 35A of the connecting member 35. As shown in Fig. 5, the connecting member 36 may be formed also with an internally threaded hole 36C, and the connecting members 35, 36 may be connected to each other through a rod member 49 having externally threaded portions 49A on the both sides thereof. In this structure, the vibrator 37 may be made symmetrical and hence well balanced in comparison to the structure in which a rod portion 36B having the externally threaded portion 36A is formed in the connecting member 36. Thus, the vibrator 37 may cause both guide members 31 to vibrate uniformly. Therefore, the impedance of the vibrating system in the above alternative embodiment may be reduced, and the vibrator 37 may be vibrated with increased efficiency.

[0039] The guide member 41 of the second preferred embodiment includes two plates 42 which are connected to each other through the spacer 43. In the above structure, the spacer 43 is not limited to be formed separately from the plates 42. For example, as shown in Fig. 6A, 6B, the spacers 43 may be formed integrally with both plates 42 of the guide member 41 extending from the base portions 42A of the plates 42. The thickness of the spacer 43 may be set so that the total thickness of the spacers 43 extending from both plates 42 is substantially the same as the clearance between the guide portions 42C, and the spacers 43 do not need to have same thickness. When the spacers 43 are provided integrally with the plates 42, the number of parts may be reduced, but also the impedance of the vibrating system may be reduced in comparison to the structure in which the spacer 43 is separately formed from the plate 42. Therefore, only a lower voltage is required for operation of the fiber bundle guiding device.

[0040] When forming the spacers 43 integrally with the plates 42, the spacers 43 do not necessarily have to be made to be in contact with each other at the proximal end surfaces thereof, as shown in Fig. 6B. For example, the spacers 43 may have a thickness corresponding to the clearance between the guide portions 42C and be located on the base portions 42A of the plates 42 at different vertical positions, as shown in Fig. 6C. As shown in Fig. 6D, it may be so arranged that two spacers 43 and one spacer 43 are provided on the plates 42, respectively. The two spacers 43 are provided one above the other on one of the plates 42 with a predetermined vertical space formed therebetween, and the one spacer 43 having a width substantially the same as the above vertical space is formed on the other plate 42. In this case, the spacers 43 serve as a positioning portion for positioning the plates 42 properly relative to each other in the longitudinal direction of the guide member 41 in arranging and then connecting the plates 42.

[0041] The fiber bundle guiding device of the present invention is not limited to a structure in which one vibrator vibrates simultaneously two guide members 31, 41 located at an interval corresponding to two spindles. It may be so arranged that one vibrator vibrates simultaneously three or more guide members located at the interval corresponding to two spindles. For example, one vibrator 37 may vibrate four guide members 31, as shown in Fig. 7 (only two guide members 31 being shown in the drawing). The vibrator 37 is formed horizontally symmetrically with respect to the bracket 33. The vibrator 37 is formed with, in addition to the connecting members 35, 36 of the first preferred embodiment, connecting members 50. Each connecting member 50 has a length corresponding to the spaced distance between any two adjacent spindles of the spinning machine and are connected to the connecting members 35, 36 so as to sandwich the support portion 31C of the guide member 31. It is noted that the guide member 31 on the side of the connecting member 36, the vibrating device 39, the wires 40A, 40B and the connecting member 50 are not illustrated in Fig. 7. The support portions 31C of the guide members 31 are connected to the connecting members 35, 36, 50 by any suitable means such as brazing. The vibrator 37 is vibrated at a predetermined resonance frequency of the guide member 31 (for example about 30 kHz). This determines the shapes and the diameters of the connecting members 35, 36, 50 such that the antinodes of the longitudinal vibration of the vibrator 37 is located at the ends of the connecting members 35, 36, 50 to which the guide members 31 are fixed. By so setting, the guide member 31 is vibrated flexurally efficiently through the connecting members 35, 36. As is obvious from the above description, the number of parts for the fiber bundle guiding device according to this alternative embodiment may be further reduced. The guide member 31 may be substituted with a guide member 41 having two plates 42 connected together through the spacer 43 may be used instead of the guide member 31.

[0042] When the guide members 31, 41 are arranged so that one vibrator 37 covers four or more spindles, the bracket 33 may be arranged at the center of the vibrator 37 so as to be sandwiched by the piezoelectric units 34. Alternatively, the bracket 33 may be arranged at the node of longitudinal vibration of the vibrator 37 and away from the piezoelectric units 34. In this case, the vibrator 37 may be supported by two brackets 33 provided at two different positions to be more stable in comparison with one bracket 33 provided at one position.

[0043] The side surface of the guide portion 42C is not limited to a shape in which the width (height) of the up-

stream side portion and the downstream side portion is smaller than the width of the center portion. Alternatively, the side surface of the guide portion 42C may have a shape in which the width is substantially constant from upstream to downstream or throughout the entire length.

[0044] In vibrating the vibrator 37, the position of the connecting members 35, 36, 50 at which they are connected to guide members 31, 41 does not necessarily have to be the antinode of longitudinal vibration. Alternatively, the positions of connections between the connecting members 35, 36, 50 and the guide members 31, 41 may be located away from the antinode of longitudinal vibration. However, the guide members 31, 41 are arranged with the antinodes of longitudinal vibration located at the connection between the guide members 31, 41 and the connecting members 35, 36, 40. Therefore, the guide members 31, 41 may be vibrated under a desirable condition by a smaller amount of drive energy than the arrangement wherein the connection is located away from the antinode of longitudinal vibration. If the connection is located away from the antinode of longitudinal vibration, the distance between the antinode and the connecting member 35, 36, 50 should be less than 20% of the distance between any two adjacent node and antinode.

[0045] The guide members 31, 41 may be fixed to the connecting members 35, 36, 50 by any means other than brazing, such as soldering, adhering by adhesive or fastening by bolt. The piezoelectric unit 34 as the vibrating mechanism 32 may be substituted by a magnetostrictor or a super magnetostrictor.

[0046] The fiber bundle guiding device 30 of the present invention is not limited to an application in which the fiber bundle guiding device 30 is disposed between the final delivery roller pair 26 and its immediately preceding roller pair (the front bottom roller 12 and the front top roller 21) for spinning of high quality yarn so-called "compact yarn". In a draft device of a spinning machine, the fiber bundle guiding device 30 may be disposed between the back rollers and the middle rollers around which an apron is wound. There has been a demand for spinning at a higher draft than the current draft in the spinning machine. If the draft between the back roller and middle roller is increased with an attempt to achieve the above drafting of demand, the width of the fiber bundle is increased between the back rollers and the middle rollers. If such the fiber bundle with increased width passes through the middle rollers, favorable draft can hardly be achieved. The fiber bundle guiding device 30 is disposed between the back rollers and the middle rollers, however, the fiber bundle is reduced to the desired width before entering the middle rollers around which the apron is wound. Therefore, the draft in the back roller zone is improved over the conventional draft. As a result, if the draft device is operated such that the draft is improved, favorable draft is achieved in the apron zone.

[0047] Therefore, the present examples and embodiments are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein but may be modified within the scope of the appended claims.

[0048] A fiber bundle guiding device for a spinning guides a fiber bundle to reduce the width of the fiber bundle. The fiber bundle guiding device includes guide members which have a guide surface whose width is reduced along the moving direction of the fiber bundle to be guided. The guide members are disposed at an interval corresponding to the spaced distance between at least two adjacent spindles. A connecting member connects the guide members and has a rod like shape extending in the direction perpendicular to the guide members. An electronic component is used for vibrating the connecting member longitudinally and arranged at the intermediate portion of the connecting member. A vibrating mechanism vibrates the guide members to generate a sound pressure for reducing the width of the fiber bundle. The vibrating mechanism includes the connecting member and the electronic component.

Claims

1. A fiber bundle guiding device (30) for a spinning machine having a draft device (11) and a spindle, the fiber bundle guiding device (30) for guiding a fiber bundle to reduce the width of the fiber bundle comprising:

   guide members (31, 41) having a guide surface (31A) whose width is reduced along the moving direction of the fiber bundle to be guided as installed in the spinning machine, the guide members (31, 41) disposed at an interval corresponding to the spaced distance between at least two adjacent spindles,

   characterized in that a connecting member (35, 36, 50) connects the guide members (31, 41) and has a rod like shape extending in the direction perpendicular to the guide members (31, 41),
   in that an electronic component (34) is used for vibrating the connecting member (35, 36, 50) longitudinally and arranged at the intermediate portion of the connecting member (35, 36, 50),
   in that a vibrating mechanism (32) is used for vibrating the guide members (31, 41) to generate a sound pressure for reducing the width of the fiber bundle, and
   in that the vibrating mechanism (32) includes the connecting member (35, 36) and the electronic component (34).

2. The fiber bundle guiding device (30) according to claim 1, **characterized**
   in that the electronic component (34) is a piezoelectric unit.

3. The fiber bundle guiding device (30) according to claim 1 or 2,
characterized in that the end portion of the connecting member (35, 36, 50) to which the guide member (31, 41) is fixed is located at antinode of the longitudinal vibration.

4. The fiber bundle guiding device (30) according to any one of claims 1 through 3, **characterized in that** a bracket (33) is connected to the frame of the draft device (11).

5. The fiber bundle guiding device (30) according to claim 4, **characterized**
in that
the bracket (33) is provided at a position corresponding to the node of the longitudinal vibration of the connecting member (35, 36, 50), and
in that the electronic component (34) are disposed on each side of the bracket so as to sandwich the bracket (33).

6. The fiber bundle guiding device (30) according to claim 4, **characterized in that**
the connecting member (35, 36, 50) includes at least two connecting members (35, 36, 50),
in that the electronic component (34) is connected to the connecting members (35, 36, 50) such that the electronic component (34) is sandwiched by the connecting members (35, 36, 50), and
in that the connecting members (35, 36, 50) are supported by the bracket (33) at the portion of the connecting members (35, 36, 50) which face the electronic component (34).

7. The fiber bundle guiding device (30) according to any one of claims 1 through 6,
characterized in that a spacer (43) is used for determining a clearance between two plates (42), and
in that the guide member (31, 41) includes the two plates (42) which are connected to each other through the spacer (43) and is vibrated at the portion of the guide member (31, 41) to which the spacer (43) is connected.

8. The fiber bundle guiding device (30) according to claim 7, **characterized in that** the spacers (43) may be formed integrally with both plates (42) of the guide member (31, 41) extending from the base portions (42A) of the plates (42).

9. The fiber bundle guiding device (30) according to claim 8, **characterized in that** the spacers (43) are in contact with each other at the proximal end surfaces of the spacers (43).

10. The fiber bundle guiding device (30) according to claim 8, **characterized in that** the spacers (43) are located on the plates (42) at different vertical positions.

11. The fiber bundle guiding device (30) according to claim 8, **characterized in that** the two spacers (43) are provided on one of the plates (42) with predetermined vertical space apart from each other formed between the two spacers (43), and the one spacer (43) having a width substantially the same as the above vertical space is formed on the other plates (42).

12. The fiber bundle guiding device (30) according to any one of claims 1 and 3 through 11, **characterized in that** a rod member (49) has externally threaded portions (49A) on the both sides of the rod member (49) and extends through the electronic component (43),
in that the connecting member (35, 36) includes at least two connecting members (35, 36),
in that the connecting members (35, 36) have the internally threaded holes (35A, 36A) formed on the end surfaces of the connecting members (35, 36, 50) which faces the electronic component (34), and
in that the externally threaded portions (49A) of the rod member (49) are screwed into the internally threaded holes (35A, 36A) of the connecting members (35, 36) so that the connecting members (35, 36) are connected each other so as to sandwich the electronic component (34).

13. The fiber bundle guiding device (30) according to any one of claims 1 and 3 through 12, **characterized in that** the electronic component (34) is a magnetostrictor.

14. The fiber bundle guiding device (30) according to any one of claims 1 and 3 through 12, **characterized in that** the electronic component (34) is a super magnetostrictor.

FIG. 1A

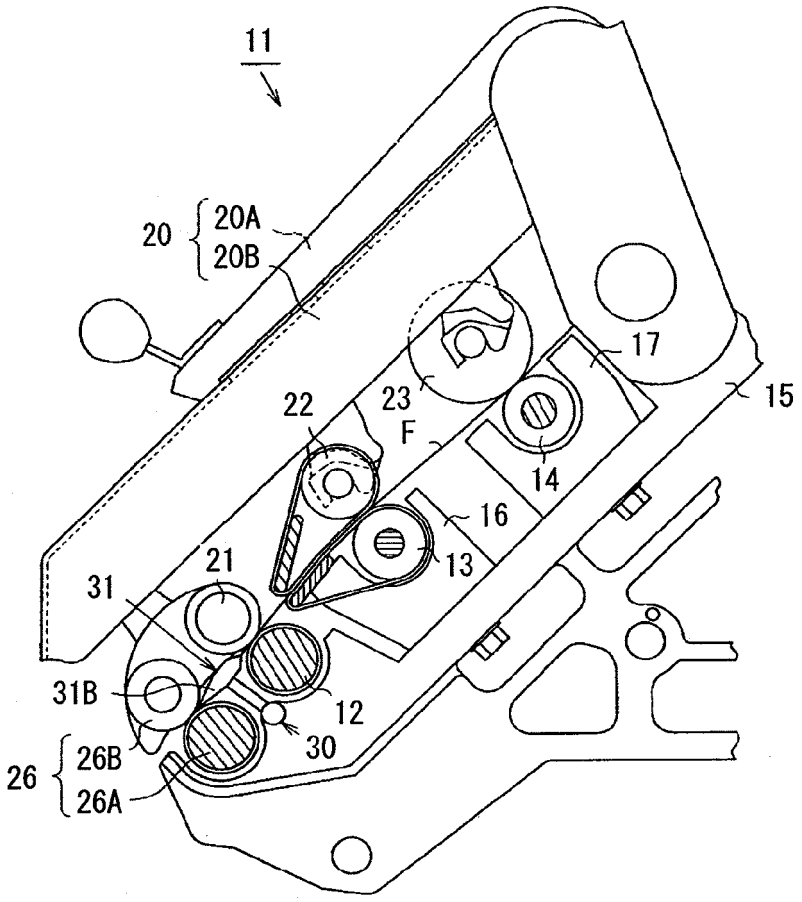

11
20
20A
20B
17
15
22
23
F
14
16
13
21
31
31B
12
30
26
26B
26A

FIG. 1B

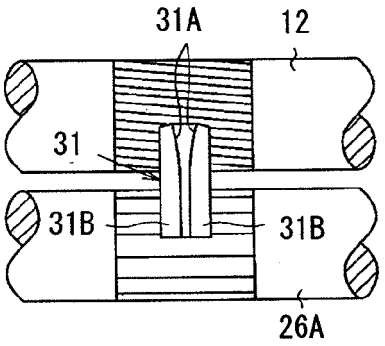

31A
12
31
31B
31B
26A

FIG. 2A

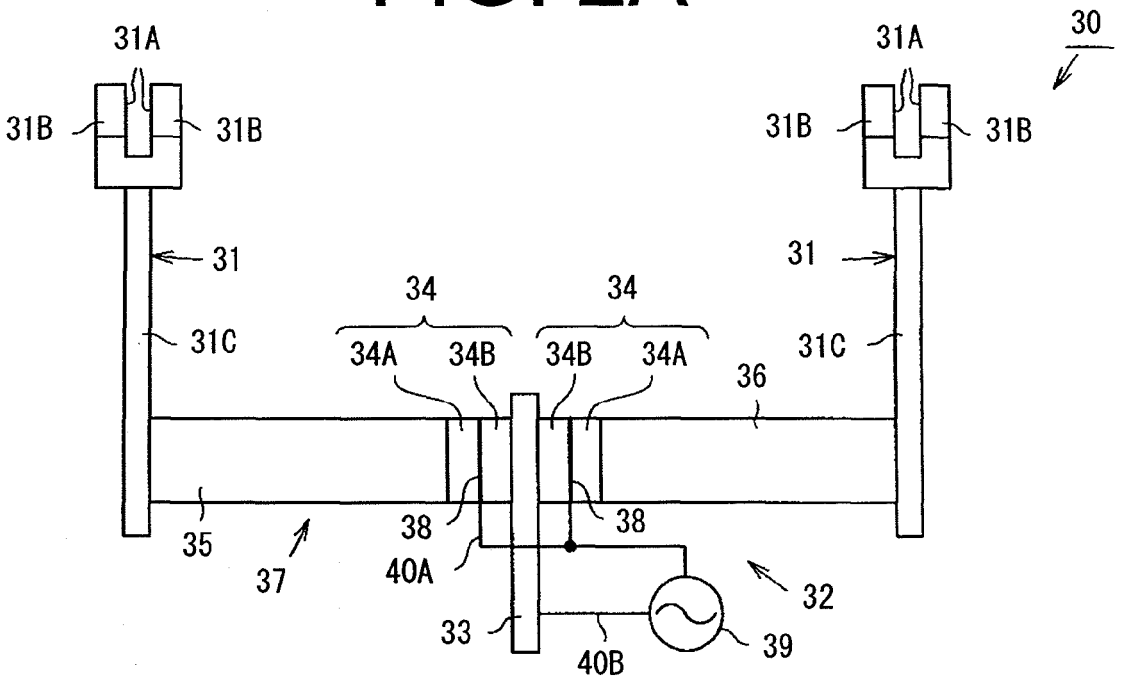

31A
31A
30
31B
31B
31B
31B
31
31
34
34
31C
31C
34A
34B
34B
34A
36
35
37
38
38
40A
32
33
39
40B

FIG. 2B

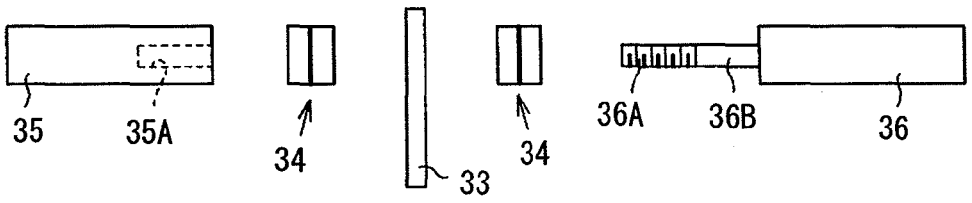

35
35A
34
34
33
36A
36B
36

FIG. 3A

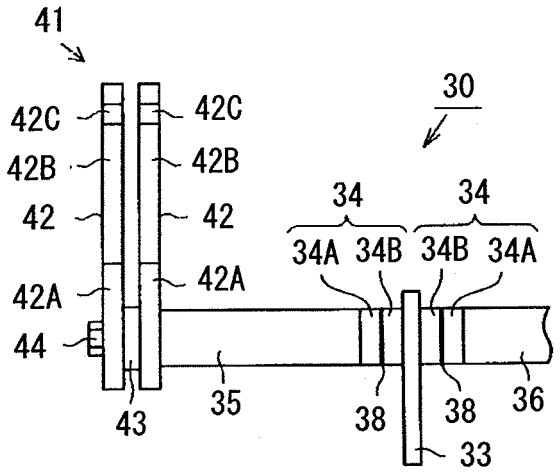
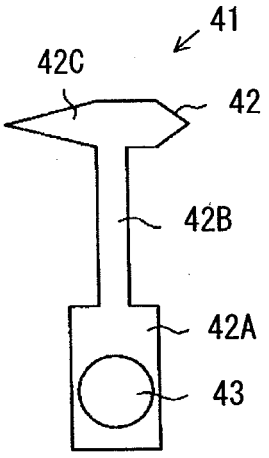

41
42C
42B
42
42A
44
43
42C
42B
42
42A
35
30
34
34A
34B
38
34B
34A
38
36
33

FIG. 3B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42C
42
42B
42A
43

FIG. 4A

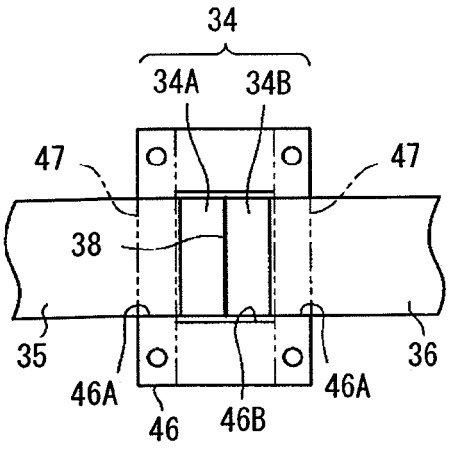

34
34A
34B
47
47
38
35
36
46A
46A
46
46B

FIG. 4B

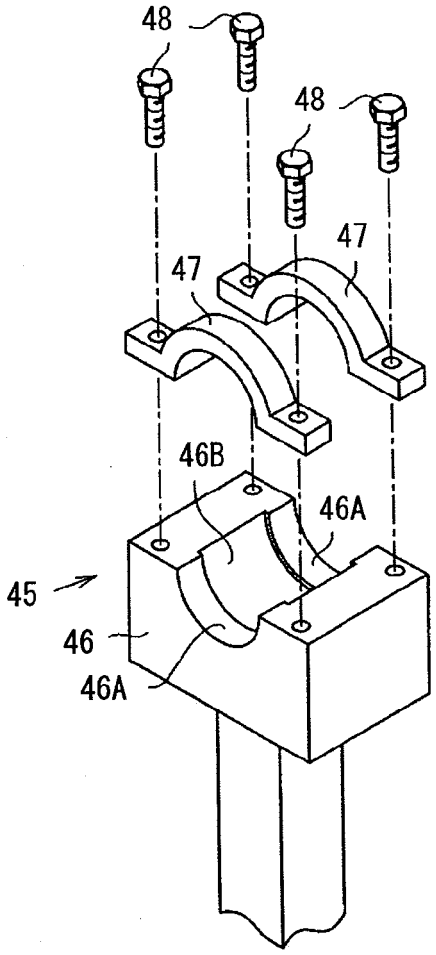

48
48
47
47
46B
46A
45
46
46A

FIG. 5

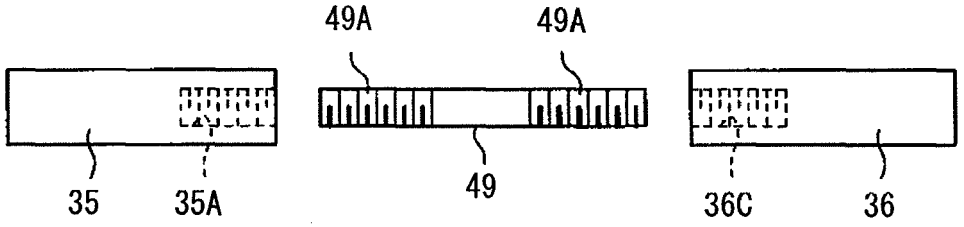


FIG. 6A

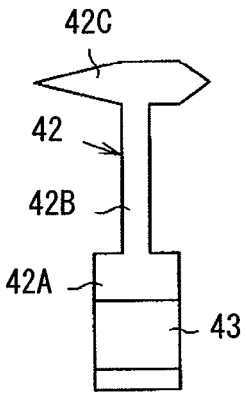


FIG. 6B

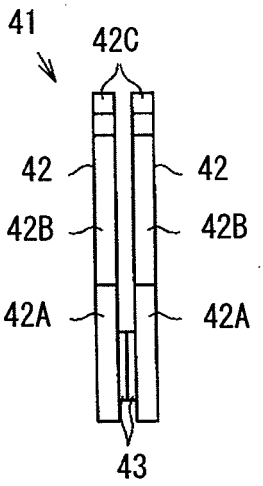


FIG. 6C

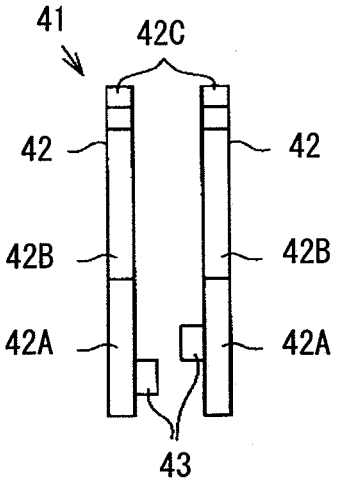


FIG. 6D

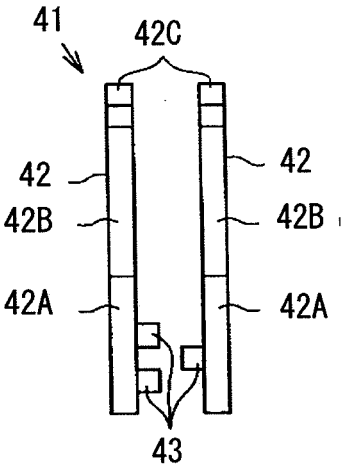


FIG. 7

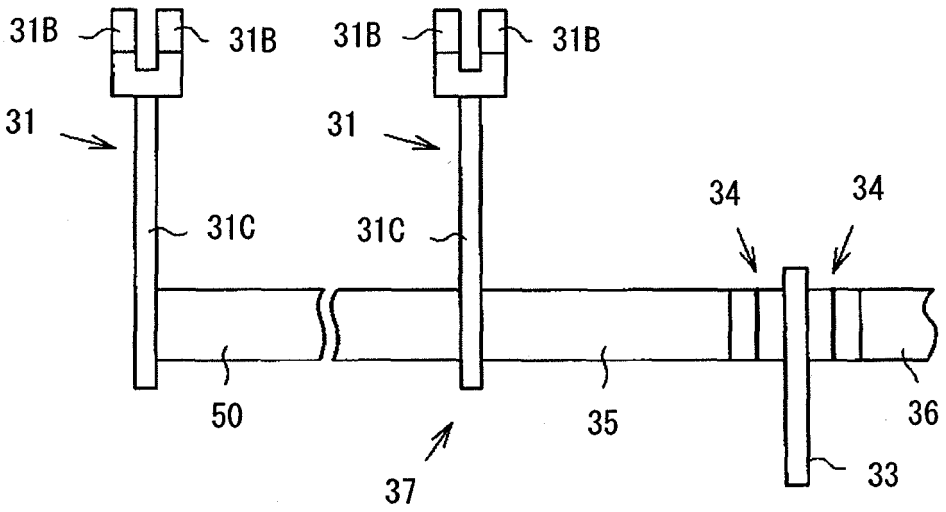
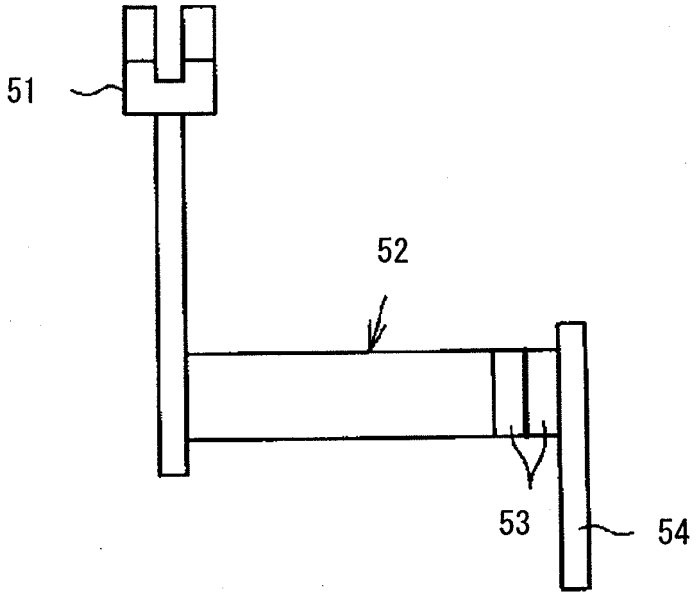


FIG. 8
(Background Art)



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EUROPEAN SEARCH REPORT

Application Number
EP 08 15 7270

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D01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 November 2008	Dreyer, Claude

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3

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13-11-2008

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