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(71) Applicant: **KABUSHIKI KAISHA TOYOTA JIDOSHOKKI**
Kariya-shi, Aichi 448-8671 (JP)

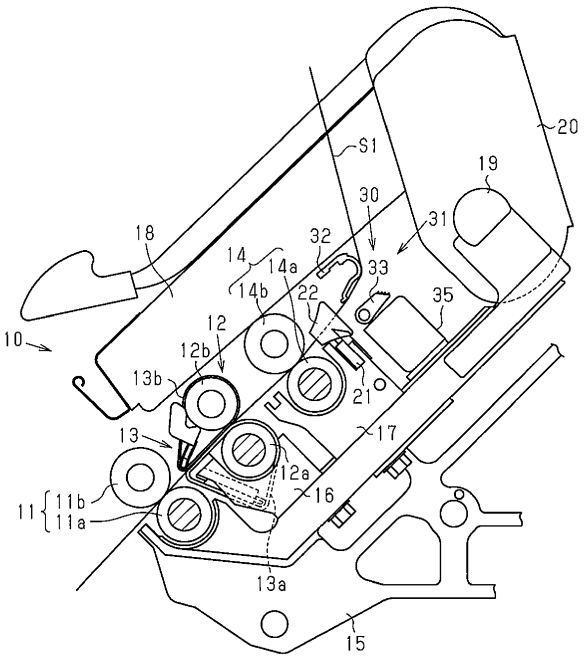
(72) Inventors:
- **FUJII, Yoshimasa**
  Kariya-shi, Aichi 448-8671 (JP)
- **ISHII, Takahisa**
  Kariya-shi, Aichi 448-8671 (JP)
- **NAKANO, Tsutomu**
  Kariya-shi, Aichi 448-8671 (JP)

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

(54) FIBER BUNDLE FEED STOPPING DEVICE FOR SPINNING FRAME

(57) A fiber bundle feed stopping device for a spinning frame. The fiber bundle feed stopping device stops feeding a drafting device with a fiber bundle and is provided with an untwisting mechanism including a fiber bundle guide and teeth. The fiber bundle guide is located at an upstream side of a back roller of the drafting device in a feed direction of the fiber bundle to guide the fiber bundle to the back roller. The teeth are arranged next to one another in a direction intersecting the feed direction of the fiber bundle. The teeth pierce the fiber bundle to an intermediate part of the fiber bundle without extending out of the fiber bundle in a state in which the fiber bundle guide regulates where the fiber bundle is positioned.

Fig.1



EP 3 115 489 A1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a fiber bundle feed stopping device for a spinning frame that stops feeding a drafting device with a fiber bundle.

[0002] A spinning frame spins yarn from a roving or a sliver. In the spinning frame, spinning is simultaneously performed by a plurality of spindles. During spinning, when a yarn breaks, spinning is stopped at the spindle where the yarn was broken (hereafter referred to as "the yarn-broken spindle") but continued at the other spindles. One type of a spinning frame continues to feed a drafting device that corresponds to the yarn-broken spindle with a fiber bundle that is drawn in and collected when discharged from the drafting device. There is another type of spinning frame that includes a stopping device to stop feeding the drafting device that corresponds to the yarn-broken spindle with a fiber bundle. As one type of such a stopping device, Japanese Laid-Patent Publication No. 48-4727 describes a roving cutting device that includes a plurality of long tapered needles.

[0003] In the roving cutting device of Japanese Laid-Open Patent Publication No. 48-4727, to stop feeding a roving to the drafting device corresponding to the yarn-broken spindle, the roving is cut at the upstream side of the drafting device in the feed direction of the roving. More specifically, the roving cutting device performs an operation in which the tapered needles pierce the roving fed to the drafting device corresponding to the yarn-broken spindle at the upstream side of the drafting device. In this case, the drafting device is continuously driven, and the roving is moved along the tapered needles toward the base of each needle. This keeps the tapered needles in the roving so that the roving is not released from the needles. The roving at the upstream side of the tapered needles is blocked (obstructed) by the tapered needles, and the roving at the downstream side of the tapered needles is pulled by the drafting device and cut by the tapered needles. This stops feeding the drafting device of the yarn-broken spindle with the roving.

[0004] In the roving cutting device of Japanese Laid-Open Patent Publication No. 48-4727, the tapered needles pierce the roving and block the fed roving with the tapered needles to cut the roving. Accordingly, the movement resistance produced between the roving and the tapered needles increases the load applied to the tapered needles. Thus, when the roving passes through the tapered needles, the tapered needles are apt to deform and break. Further, since the tapered needles pierce the roving, fibers of the roving has a tendency to collect between adjacent tapered needles. This results in the need to often remove the collected fibers from between the adjacent tapered needles and lowers the maintenance efficiency of the roving cutting device.

SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to provide a fiber bundle feed stopping device for a spinning frame that allows for easy cutting of a fiber bundle and improves the maintenance efficiency by resisting breakage and reducing the collected fibers.

[0006] One aspect of the present invention is a fiber bundle feed stopping device for a spinning frame. The fiber bundle feed stopping device stops feeding a drafting device with a fiber bundle and is provided with an untwisting mechanism including a fiber bundle guide and teeth. The fiber bundle guide is located at an upstream side of a back roller of the drafting device in a feed direction of the fiber bundle to guide the fiber bundle to the back roller. The teeth are arranged next to one another in a direction intersecting the feed direction of the fiber bundle. The teeth pierce the fiber bundle to an intermediate part of the fiber bundle without extending out of the fiber bundle in a state in which the fiber bundle guide regulates where the fiber bundle is positioned.

[0007] 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

[0008] The invention, together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

Fig. 1 is a schematic side view showing a drafting device in one embodiment;
Fig. 2 is an enlarged schematic side view of an untwisting mechanism;
Fig. 3A is a schematic side view of an untwisting member;
Fig. 3B is a partial plan view of the untwisting member;
Fig. 4A is a schematic side view showing the teeth of the untwisting member piercing a roving;
Fig. 4B is a partial enlarged view of Fig. 4A; and
Fig. 5 is a schematic plan view showing a roving that is being untwisted.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0009] One embodiment of a fiber bundle feed stopping device 30 for a spinning frame will now be described with reference to Figs. 1 to 5. The fiber bundle feed stopping device 30 stops feeding a drafting device 10 with a roving S1, which serves as a fiber bundle.

[0010] Referring to Fig. 1, the drafting device 10 is of

a three-roller configuration and includes front rollers 11, aprons 13 that run around middle rollers 12, and back rollers 14. The front rollers 11 include a front bottom roller 11 a and a front top roller 11 b. The middle rollers 12 include a middle bottom roller 12a and a middle top roller 12b. A bottom apron 13a runs around the middle bottom roller 12a, and a top apron 13b runs around the middle top roller 12b. The back rollers 14 include a back bottom roller 14a and a back top roller 14b.

[0011] The front bottom roller 11 a is supported by a roller stand 15. The middle bottom roller 12a is supported on the roller stand 15 by a middle bottom roller support 16 and a bearing (not shown). The back bottom roller 14a is supported on the roller stand 15 by a back bottom roller support 17 and a bearing (not shown). The middle bottom roller support 16 and the back bottom roller support 17 are each fixed to the roller stand 15 in a manner allowing for adjustment of the positions of the middle bottom roller support 16 and the back bottom roller support 17 relative to the roller stand 15 in the front-rear direction of the frame (lateral direction in Fig. 1).

[0012] A support shaft 19, which is supported by the roller stand 15, supports a weighting arm 18 with a bracket 20. The front top roller 11 b, the middle top roller 12b, and the back top roller 14b are respectively supported by top roller supports (not shown) on the weighting arm 18.

[0013] A support bar 21 extends behind and parallel to the back bottom roller 14a. A trumpet 22 is fixed to the support bar 21 to guide the roving S1. The roving S1 is fed from a roving winding, which is suspended from a creel (not shown), through the trumpet 22 and to the back rollers 14.

[0014] Afiber bundle feed stopping device 30 is arranged at the rear of the trumpet 22 (back rollers 14). The fiber bundle feed stopping device 30 includes an untwisting mechanism 31 located at the upstream side of the back rollers 14 in the feed direction of the roving S1 to untwist the roving S1 that is fed to the drafting device 10. The untwisting mechanism 31 includes a fiber bundle guide 32 at the upstream side of the back rollers 14 in the feed direction of the roving S1. The fiber bundle guide 32 guides the roving S1 to the back rollers 14.

[0015] Referring to Fig. 2, the fiber bundle guide 32 is generally bow-shaped as a whole in a side view. The fiber bundle guide 32 includes a curved portion 32a that is curved like an arc and bulged toward the outer side. The curved portion 32a and the trumpet 22 (back rollers 14) are directed toward opposite directions. Further, the fiber bundle guide 32 includes a recessed portion 32b and a flanged portion 32c. The recessed portion 32b is continuous with one end (lower end in Fig. 2) of the curved portion 32a and recessed inwardly from a line extending along the outer circumferential surface of the curved portion 32a, and the flanged portion 32c is continuous with the end of the recessed portion 32b at the opposite side of the curved portion 32a and projects toward the trumpet 22. Thus, the recessed portion 32b is located between the curved portion 32a and the flanged portion 32c. The fiber bundle guide 32 also includes an extending portion 32d that is continuous with the end (upper end in Fig. 2) of the curved portion 32a at the opposite side of the recessed portion 32b. The recessed portion 32b is supported by a support (not shown) on the weighting arm 18.

[0016] The roving S1 contacts the outer circumferential surface of the curved portion 32a near the recessed portion 32b and the edge of the flanged portion 32c near the recessed portion 32b. Accordingly, the fiber bundle guide 32 includes two contact portions that contact the roving S1. The two contact portions, namely, the curved portion 32a and the flanged portion 32c, are spaced apart from each other in the feed direction of the roving S1. Tension is applied to the roving S1 to urge the roving S1 toward the fiber bundle guide 32 and abut against the two locations, namely, the curved portion 32a and the flanged portion 32c. In this manner, the fiber bundle guide 32 regulates the position of the roving S1.

[0017] As shown in Figs. 3Aand 3B, the untwisting mechanism 31 includes an untwisting member 33 provided with rows of teeth 33a. Each row of teeth 33a extends in a direction orthogonal to the feed direction of the roving S1. The untwisting member 33 includes a main body 33c. The main body 33c includes the teeth 33a and a flat surface (base surface 33b) from which the teeth 33a project. The main body 33c also includes a rotation shaft 33d. Rotation of the rotation shaft 33d pivots the untwisting member 33 about the rotation axis of the rotation shaft 33d.

[0018] A plurality of (four in the present embodiment) teeth rows are arranged next to one another in the feed direction of the roving S1 on the base surface 33b. The teeth 33a in each teeth row is shifted by one-half of a teeth pitch relative to the teeth 33a in the teeth row that is adjacent in the feed direction. Accordingly, in a plan view, the teeth 33a are in a zigzagged arrangement on the base surface 33b.

[0019] The projecting length H1 of the teeth 33a from the base surface 33b is 1.0 mm. The projecting length H1 is the length of a straight line connecting the base surface 33b and the distal end of a tooth 33a over the minimum distance. The roving S1 of the present embodiment shown in Fig. 2 has a thickness of 2.0 mm.

[0020] Referring to Figs. 4A and 4B, the untwisting member 33 is pivotal between a fiber bundle release position, which is shown by the broken lines, and a fiber bundle pierce position, which is shown by the solid lines. At the fiber bundle pierce position, the teeth 33a pierce the portion of the roving S1 located between the curved portion 32a and the flanged portion 32c in the feed direction of the roving S1. The untwisting mechanism 31 includes a switching device 35 (refer to Fig. 1) used to switch the untwisting member 33 between the fiber bundle release position and the fiber bundle pierce position. A controller (not shown) controls the switching device 35 based on a detection signal from a yarn breakage sensor (not shown). The configuration of the switching device

35 is not particularly limited. The switching device 35 need only be configured to switch the untwisting member 33 between the fiber bundle release position and the fiber bundle pierce position under the control of the controller based on the detection signal of the yarn breakage sensor.

[0021] When the untwisting member 33 is pivoted to the fiber bundle pierce position, the teeth 33a pierce the roving S1. The teeth 33a pierce the roving S1 to an intermediate part of the roving S1 but do not extend out of the roving S1. In the present embodiment, the gap H3 between the distal ends of the teeth 33a and the fiber bundle guide 32 is 1.0 mm. In correspondence with the thickness H2 of the roving S1, the projecting length H1 of the teeth 33a from the base surface 33b and the positions of the fiber bundle guide 32 and the untwisting member 33 are set in advance so that the gap H3 is 1.0 mm between the distal ends of the teeth 33a and the fiber bundle guide 32.

[0022] Each tooth 33a includes a ridgeline 331a extending along the upstream side in the feed direction of the roving S1 when pierced into the roving S1. In the present embodiment, the angle $\theta 1$ is 90 degrees between the ridgeline 331a and the base surface 33b at the upstream side in the feed direction of the roving S1.

[0023] The operation of the present embodiment will now be described.

[0024] When there are no broken yarns, the untwisting member 33 is held at the fiber bundle release position. A state in which there are no broken yarns includes a state in which spinning is performed when the roving S1 is fed via the fiber bundle guide 32 to the drafting device 10 and a state before spinning starts in which the roving S1 is not yet fed to the drafting device 10. In a state before spinning starts, the controller does not determine whether or not a yarn has broken since the yarn breakage sensor does not yet detect for a yarn breakage, and the switching device 35 does not pivot the untwisting member 33 to the fiber bundle pierce position.

[0025] When the spinning frame starts to operate, the roving S1 is guided from the roving winding, which is suspended from the creel (not shown), to the fiber bundle guide 32 and the trumpet 22 and fed to the back rollers 14. The roving S1 fed to the back rollers 14 is drafted into fleece between the back rollers 14 and the aprons 13 and between the aprons 13 and the front rollers 11. Yarn is formed from the fleece. The yarn is guided to a snail wire (not shown) and a traveler (not shown) and wound around a bobbin (not shown).

[0026] When a yarn breakage occurs, the yarn-broken spindle is located from the detection signal of each wire breakage sensor, and the controller drives the switching device 35 of the untwisting mechanism 31 corresponding to the yarn-broken spindle. The switching device 35 pivots the untwisting member 33 from the fiber bundle release position to the fiber bundle pierce position, and the teeth 33a pierce the portion of the roving S1 located between the curved portion 32a and the flanged portion 32c in the feed direction of the roving S1. The tension applied to the portion of the roving S1 between the curved portion 32a and the flanged portion 32c allows the teeth 33a to easily pierce this portion.

[0027] The fiber bundle guide 32 regulates the position of the roving S1. Thus, the teeth 33a remain in a state piercing the roving S1 to the intermediate part and do not extend out of the roving S1. This keeps the roving S1 on the teeth 33a. Further, as the drafting device 10 continues to operate and the roving S1 passes through the teeth 33a, the teeth 33a comb and untwist the roving S1.

[0028] As shown in Fig. 5, the teeth 33a in each teeth row is shifted by one-half of a teeth pitch relative to the teeth 33a in the teeth row that is adjacent in the feed direction of the roving S1. This facilitates the separation of fibers S2 in the roving S1 with the teeth 33a and efficiently untwists the roving S1. Further, the teeth 33a weaken the bonding of the fibers S2 and decrease the strength of the roving S1. Thus, the roving S1 pulled by the drafting device 10 is cut between the back rollers 14 and the untwisting mechanism 31. This stops feeding the roving S1 to the drafting device 10 of the spindle where a yarn was broken.

[0029] The above embodiment has the advantages described below.

(1) The fiber bundle feed stopping device 30 includes the untwisting mechanism 31. The untwisting mechanism 31 includes the fiber bundle guide 32, which is located at the upstream side of the back rollers 14 of the drafting device 10 and guides the roving S1 to the back rollers 14, and the teeth 33a, which are arranged in a direction orthogonal to the feed direction of the roving S1. The teeth 33a pierce the roving S1, the position of which is regulated by the fiber bundle guide 32, to an intermediate part of the roving S1 and do not extend out of the roving S1. This keeps the roving S1 on the teeth 33a, which pierce the roving S1 to the intermediate part without extending out of the roving S1. Further, as the drafting device 10 continues to operate and the roving S1 passes through the teeth 33a, the roving S1 is combed and untwisted by the teeth 33a. This weakens the bonding of the fibers S2 in the roving S1 and decreases the strength of the roving S1. Thus, the roving S1 pulled by the drafting device 10 is easily cut between the back rollers 14 and the untwisting mechanism 31. This stops feeding the roving S1 to the drafting device 10 of the spindle where a yarn was broken. Further, the teeth 33a piercing the roving S1 do not extend out of the roving S1. This decreases the moving resistance produced when the roving S1 moves between the teeth 33a as compared with the moving resistance produced when the teeth extend out of the roving S1. Further, since the teeth 33a do not extend out of the roving S1, less fibers S collect between adjacent teeth 33a. Accordingly, the roving S1 is easily cut and the maintenance efficiency is

improved since the teeth 33a resist breakage and collected fibers are reduced.

(2) The fiber bundle guide 32 includes two contact portions that contact the roving S1, namely, the curved portion 32a and the flanged portion 32c. This structure allows tension to easily be applied to the portion of the roving S1 between the curved portion 32a and the flanged portion 32c and facilitates the piercing of the roving S1 by the teeth 33a where the tension is applied. Thus, the teeth 33a pierce the roving S1 more easily than when the teeth 33a pierce a portion of the roving S1 where tension is not applied. As a result, the combing of the roving S1 with the teeth 33a is facilitated, and the roving S1 is efficiently untwisted.

(3) The rows of the teeth 33a are arranged next to one another in the feed direction of the roving S1. Thus, when the drafting device 10 is driven and the roving S1 passes through the teeth 33a, the teeth rows further facilitate the combing of the roving S1. This further efficiently untwists the roving S1.

(4) The teeth 33a in each teeth row is shifted by one-half of a teeth pitch relative to the teeth 33a in the teeth row that is adjacent in the feed direction of the roving S1. Thus, when the drafting device 10 is driven and the roving S1 passes through the teeth 33a, the teeth rows facilitate the separation of the fibers S2. This further efficiently untwists the roving S1.

(5) The upstream side of each tooth 33a in the feed direction of the roving S1 when piercing the roving S1 includes the ridgeline 331 a, and the angle $\theta 1$ is 90 degrees between the ridgeline 331 a and the base surface 33b at the upstream side in the feed direction of the roving S1. Thus, the ridgeline 331 a of each tooth 33a obstructs the movement of the roving S1 more easily than when the angle $\theta 1$ is greater than 90 degrees between the ridgeline 331 a and the base surface 33b at the upstream side in the feed direction of the roving S1. This further facilitates combing of the roving S1 with the teeth 33a. Thus, the roving S1 can be untwisted further efficiently.

[0030] The above embodiment may be modified as described below.

[0031] In the above embodiment, the angle $\theta 1$ between the ridgeline 331a of each tooth 33a and the base surface 33b at the upstream side in the feed direction of the roving S1 need only be 90 degrees or less. For example, the angle $\theta 1$ may be smaller than 90 degrees.

[0032] In the above embodiment, the angle $\theta 1$ between the ridgeline 331a of each tooth 33a and the base surface 33b at the upstream side in the feed direction of the roving S1 may be greater than 90 degrees.

[0033] In the above embodiment, the teeth 33a in each teeth row do not have to be shifted by one-half of a teeth pitch relative to the teeth 33a in the teeth row that is adjacent in the feed direction of the roving S1. The teeth 33a of each teeth row may be arranged without being shifted from the teeth 33a in other teeth rows.

[0034] In the above embodiment, there may be two or three teeth rows arranged next to one another in the feed direction of the roving S1. Alternatively, there may be five or more teeth rows arranged next to one another in the feed direction of the roving S1.

[0035] In the above embodiment, there may be only one teeth row.

[0036] In the above embodiment, the teeth 33a only need to be arranged next to one another in a direction intersecting the feed direction of the roving S1 and do not have to be arranged in a direction orthogonal to the feed direction of the roving S1.

[0037] In the above embodiment, the projecting length H1 of the teeth 33a from the base surface 33b and the positions of the fiber bundle guide 32 and the untwisting member 33 may be changed in accordance with the thickness H2 of the roving S1. The teeth 33a need only pierce the roving S1 without extending out of the roving S1 when the untwisting member 33 is arranged at the fiber bundle pierce position.

[0038] In the above embodiment, the untwisting member 33 pivots between the fiber bundle release position and the fiber bundle pierce position. For example, the untwisting member 33 may be moved straight between the fiber bundle release position and the fiber bundle pierce position.

[0039] In the above embodiment, the fiber bundle is not limited to the roving S1 and may be a sliver. For example, the fiber bundle feed stopping device 30 may be used in a ring spinning frame that spins yarns from a sliver with a drafting device, which drafts a fiber bundle at a draft ratio that is much larger than the typical three-roller drafting device.

[0040] In the above embodiment, the spinning frame is not limited to a ring spinning frame and may be, for example, a fascinated yarn spinning machine or a friction spinning machine.

[0041] In the above embodiment, the spinning frame may be a roving frame.

[0042] 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 and equivalence of the appended claims.

[0043] A fiber bundle feed stopping device for a spinning frame. The fiber bundle feed stopping device stops feeding a drafting device with a fiber bundle and is provided with an untwisting mechanism including a fiber bundle guide and teeth. The fiber bundle guide is located at an upstream side of a back roller of the drafting device in a feed direction of the fiber bundle to guide the fiber bundle to the back roller. The teeth are arranged next to one another in a direction intersecting the feed direction of the fiber bundle. The teeth pierce the fiber bundle to an intermediate part of the fiber bundle without extending out of the fiber bundle in a state in which the fiber bundle guide regulates where the fiber bundle is positioned.

Claims

1. A fiber bundle feed stopping device (30) for a spinning frame, wherein the fiber bundle feed stopping device (30) stops feeding a drafting device (10) with a fiber bundle (S1), the fiber bundle feed stopping device (30) being **characterized by**:

   an untwisting mechanism (31) including

   a fiber bundle guide (32) located at an upstream side of a back roller (14) of the drafting device (10) in a feed direction of the fiber bundle (S1) to guide the fiber bundle (S1) to the back roller (14), and
   teeth (33a) arranged next to one another in a direction intersecting the feed direction of the fiber bundle (S1),

   wherein the teeth (33a) pierce the fiber bundle (S1) to an intermediate part of the fiber bundle (S1) without extending out of the fiber bundle (S1) in a state in which the fiber bundle guide (32) regulates where the fiber bundle (S1) is positioned.

2. The fiber bundle feed stopping device (30) according to claim 1, being **characterized in that**:

   the fiber bundle guide (32) includes two contact portions (32a, 32c) that contact the fiber bundle (S1), wherein
   the two contact portions (32a, 32c) are arranged spaced apart from each other in the feed direction of the fiber bundle (S1), and
   the teeth (33a) pierce the fiber bundle (S1) at a location between the two contact portions (32a, 32c).

3. The fiber bundle feed stopping device (30) according to claim 1 or 2, being **characterized in that** the fiber bundle guide (32) includes a recessed portion (32b) between the two contact portions (32a, 32c).

4. The fiber bundle feed stopping device (30) according to any one of claims 1 to 3, being **characterized in that** the teeth (33a) are arranged in a plurality of teeth rows laid out next to each other in the feed direction of the fiber bundle (S1).

5. The fiber bundle feed stopping device (30) according to claim 4, being **characterized in that** the teeth (33a) in each teeth row is shifted by one-half of a teeth pitch relative to the teeth (33a) in the teeth row that is adjacent in the feed direction of the fiber bundle (S1).

6. The fiber bundle feed stopping device (30) according to any one of claims 1 to 5, being **characterized in that**:

   the untwisting mechanism (31) includes a main body (33c), and the main body (33c) includes a flat surface (33b) from which the teeth (33a) project;
   the teeth (33a) each include a ridgeline (331 a) extending along an upstream side in the feed direction of the fiber bundle (S1) when pierced into the fiber bundle (S1); and
   an angle ($\theta 1$) between the ridgeline (331 a) and the flat surface (33b) at an upstream side in the feed direction is 90 degrees or less.

Fig.1

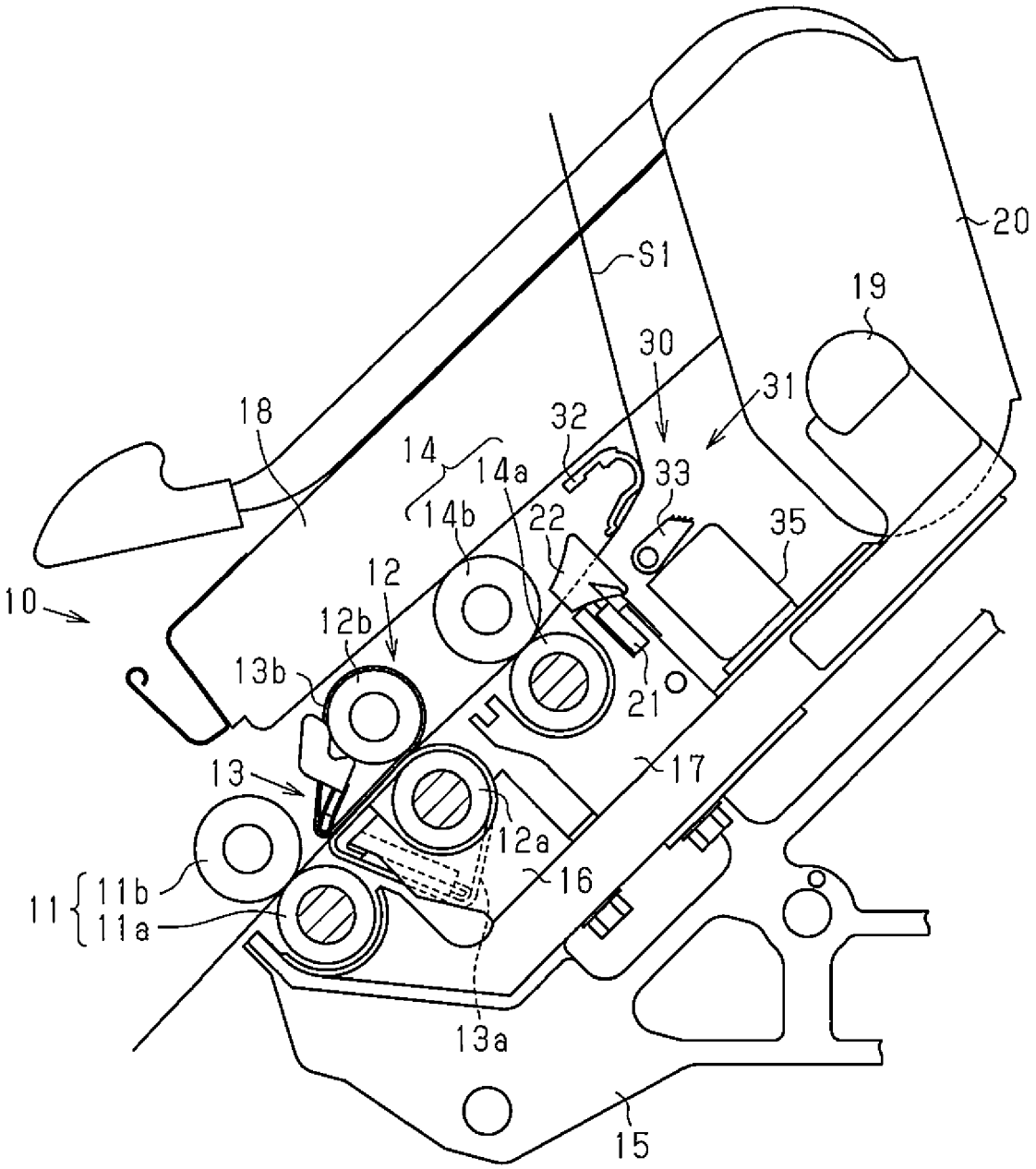

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Fig.2

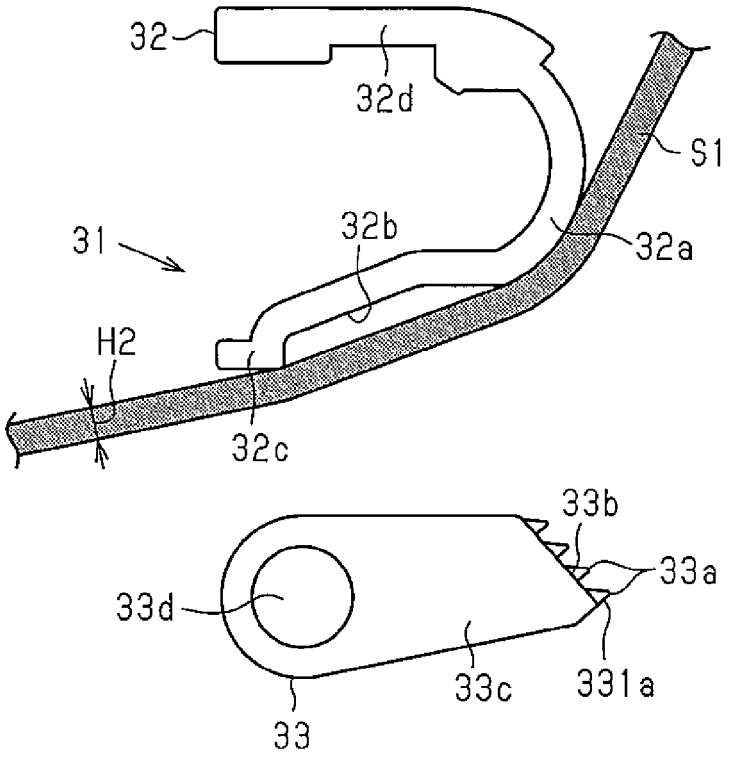

Fig.3A

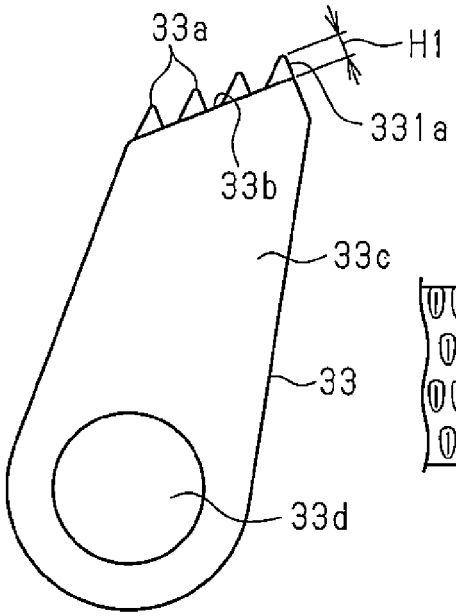

Fig.3B

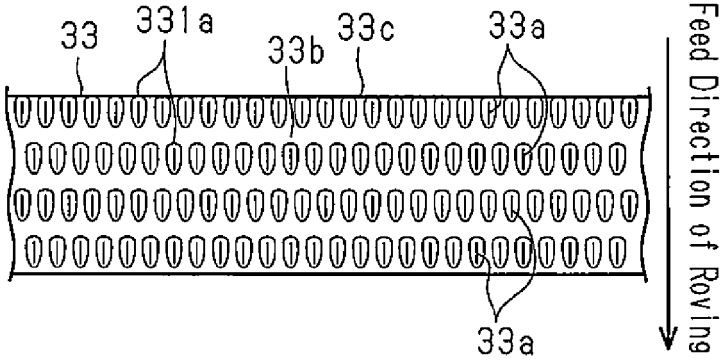

Fig.4A

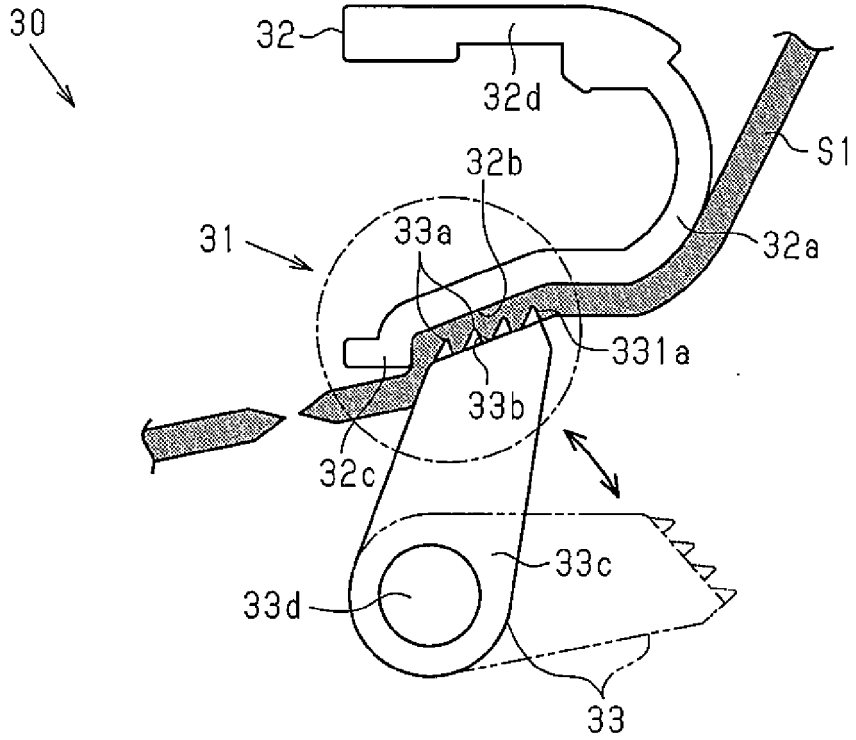
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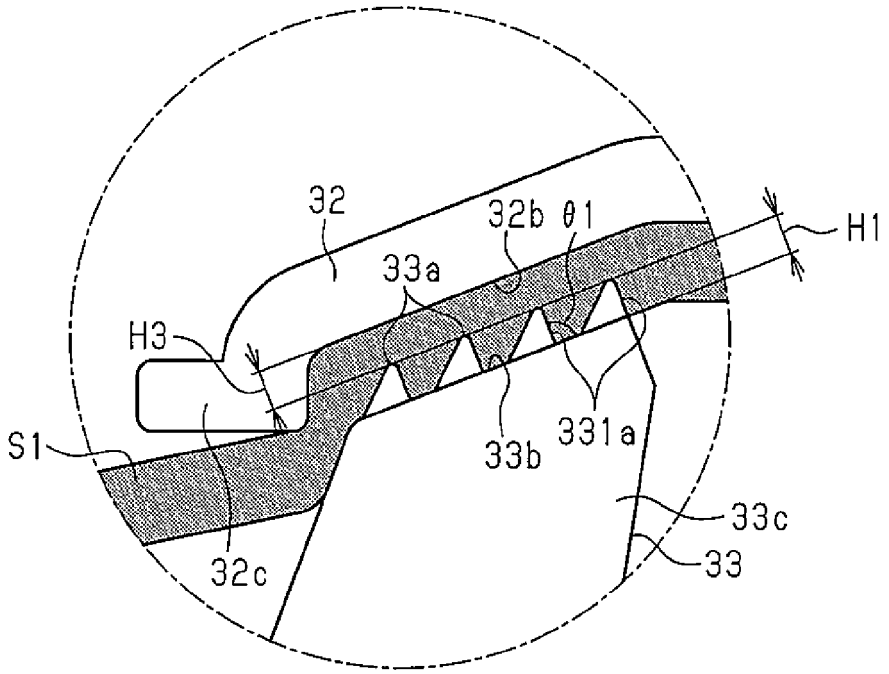
Fig.4B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H1
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H3
S1
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331a
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32c
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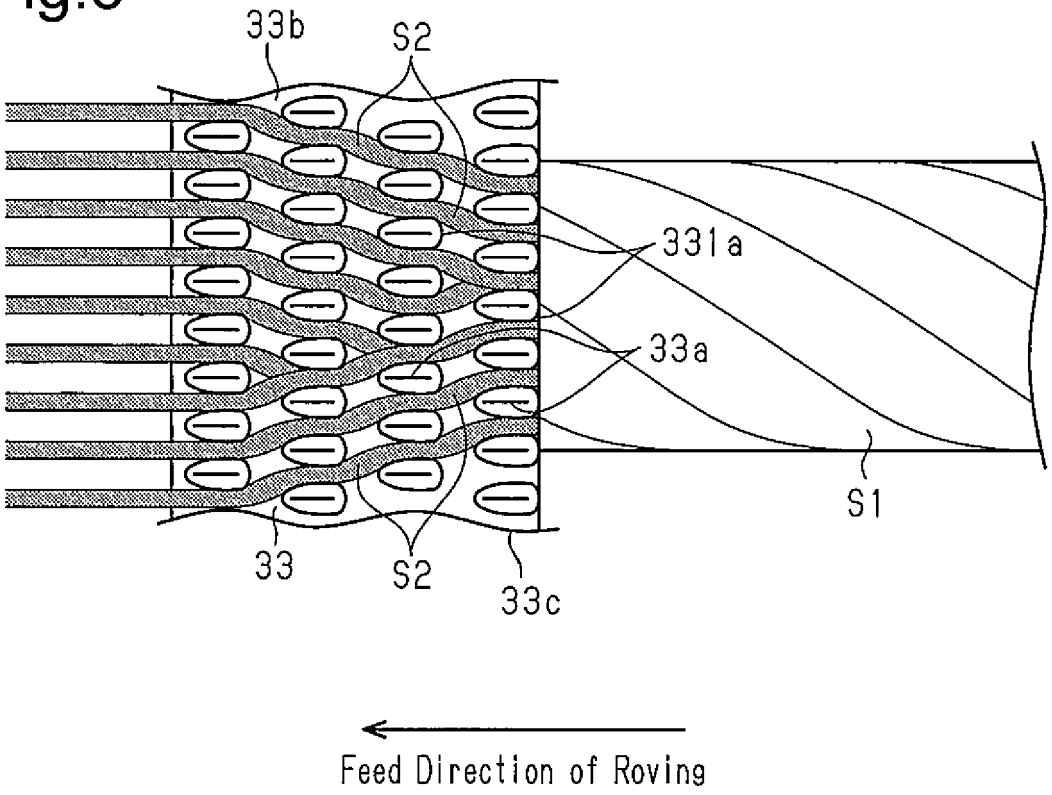
Fig.5



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EUROPEAN SEARCH REPORT

Application Number
EP 16 17 5183

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 1 305 540 A (RALPH E. HANSCOM AND MAURICE J. GRIFFIN) 3 June 1919 (1919-06-03) * page 1, line 6 - line 19 * * page 2, line 27 - line 30 * * figures 1,2,7 * -----	1,4 5	INV. D01H13/18
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