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(54) Title: FEED ROLLER WIRE AND FEED ROLLER COVERED WITH IT

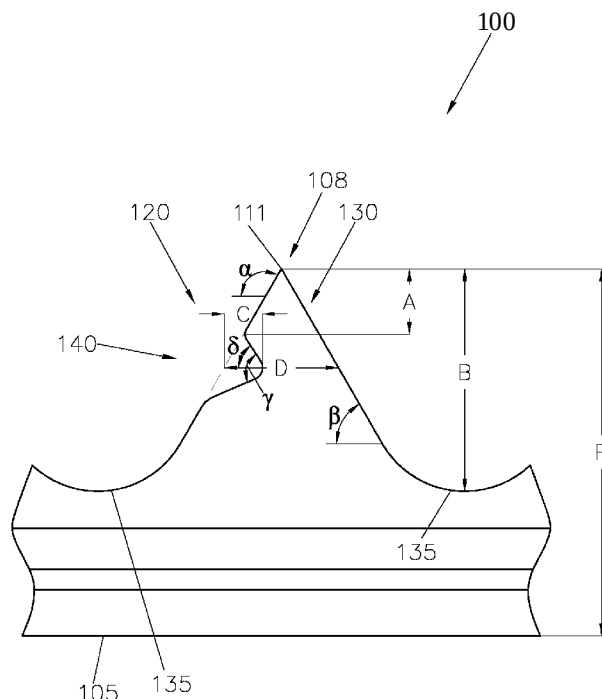


Fig. 1

(57) Abstract: The invention discloses a feed roller wire for a feed roller of a card carding fibers or for a feed roller of a fiber opening machine. The feed roller wire comprises an elongated rib and teeth along the longitudinal direction of the feed roller wire. The teeth comprise a tip, and in the longitudinal direction of the feed roller wire a front portion of the tooth and a back portion of the tooth. The front portion and the back portion extend from the tip in the direction of the rib. An interconnecting section connects the back portion of a tooth to the front portion of the next tooth. The front portion is provided with an undercut segment.

MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG). ~ ofrntvntorshrp (Rule 4.17(rv))

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a patent (Rule 4.17(H))

Feed roller wire and feed roller covered with it**Description****Technical Field**

- [1] The invention relates to the field of feed roller wires, to feed rollers and to feed roller systems for fiber opening machines, for revolving flat cards and for roller cards.

Background Art

- [2] Cards, whether revolving flat cards or roller cards, and fiber opening machines are equipped with rollers clothed with card wire; and are possibly provided with additional carding elements such as fixed flats or revolving flats also covered with card wire. Fiber opening machines and cards have the task to open tufts of fibers, by tearing the fiber tufts apart into smaller fiber tufts or even into individual fibers. This is achieved in a number of consecutive steps, with in each step the relative movement between two objects clothed with card wire: tufts held by one or more teeth of the card wire of the first object are opened because teeth of the card wire of the second object are pulling smaller tufts or individual fibers out of the tufts held on the first object. Such objects can be rollers or flats. Examples are the interaction between lickerin and carding segments mounted on a lickerin roller, the interaction between lickerin and cylinder, the interaction between cylinder and revolving flats, the interaction between cylinder and doffer and the interaction on a roller card between cylinder and worker rollers.
- [3] Several shapes of card wires for the rollers of revolving flat cards and/or roller cards have been described. The use of card wires with striations - side grooves at one or both sides of the blade of the card wire - is known. WO00/26450 discloses a specific shape of card wire teeth especially for use on doffers and workers. WO201 1/138322 describes an alternative tooth shape for a card wire that can be advantageously used on a worker or doffer roller. WO201 2/01 9841 discloses yet an alternative tooth shape especially suited for condenser rollers of roller cards for the production of

nonwoven fabrics.

The objective of the carding or opening is - through the interaction of subsequent pairs of objects clothed with card wires - to have an effective and efficient reduction of tuft size or even individualizing the fibers.

- [4] In order for the opening or the carding to be possible, the fibers need to be fed into the fiber opening machine or into the card. This is traditionally achieved by feeding a lap of fibers to a first roller of the card or fiber opening machine. Such first roller is frequently called a lickerin or takerin roller. The lap of fibers can be made in a separate process step, or can be made on the card or opening machine itself by means of a chute feed. The lap is then presented to the first roller (lickerin roller) of the card or of the fiber opening machine by means of a feed roller system. The feed roller system comprises at least one roller, which presents the fiber lap to the action of the lickerin wire on the lickerin teeth while the fiber lap is held between the at least one roller and a second object. The second object can be a roller, but in most systems today it is a feed plate, which can have a nose. The lickerin wire pulls tufts of fibers out of the fiber lap that is held between the feed roller and the second object (roller or feed plate). Therefore, the feeding action is a complex combination of interactions between the feed roller, the second object (another roller or a feed plate) and the lickerin roller with its lickerin (card) wire. Frequently, the feed roller is provided with a feed roller wire, which is a wire with sturdy teeth. Alternatively however, feed rollers can be provided with a fluted or knurled surface, achieved via a machining process. The objective of the feed system is to have a regular and correct feeding of fibers into the card or fiber opening machine. Such a feed roller system, with a feed roller that can be clothed with feed roller wire, is e.g. shown in US 4,001,916.
- [5] Frequently, feed roller wire with pyramidal shape teeth is mounted on feed rollers.
- [6] It is a problem of feed roller wire, feed rollers and feed roller systems of the prior art that they can pose problems in terms of irregular feeding of fibers to the lickerin roller of the card or of the fiber opening machine.

Disclosure of the Invention

- [7] The primary object of the invention is to improve the feeding of fibers to a card or fiber opening machine. It is a specific objective to increase the range of fiber and fiber types that can be reliably fed into a card.
- [8] A first aspect of the invention is a feed roller wire for a feed roller of a card carding fibers or for a feed roller of a fiber opening machine,
- the feed roller wire comprises an elongated rib and teeth along the longitudinal direction of the feed roller wire;
 - the teeth comprise a tip, and in the longitudinal direction of the feed roller wire a front portion of the tooth and a back portion of the tooth, the front portion and the back portion extend from the tip in the direction of the rib; and an interconnecting section connecting the back portion of a tooth to the front portion of the next tooth.
- The front portion is provided with an undercut segment. With undercut segment is meant that a segment is cut out of the expected edge line of the front portion.
- [9] The feed roller wire according to the invention allows to have - during a long functional lifetime of the feed roller wire - improved regularity of feeding fibers to cards or to fiber opening machines, even when feeding difficult fibers. This is achieved as the undercut provides for a controlled release of fibers from between the feed roller and the second object between which the fiber lap is held when the teeth of a lickerein wire interact with the fiber lap that is fed.
- [10] Preferably, the undercut starts, as measured from the tip of the feed roller wire, at a depth of at least 20%, more preferably at a depth of at least 30%, e.g. at a depth of between 20 and 50%, e.g. at a depth between 30% and 40% of the punching depth of the feed roller wire. The punching depth is the distance, perpendicularly to the longitudinal direction of the feed roller wire, between the tip and the deepest point of the interconnecting section connecting the back portion of a tooth to the front portion of the

next tooth of the feed roller wire. Such embodiments are preferred for optimum performance of the feed roller system on which the feed roller wire is used. The optimal performance is achieved in terms of reliable feeding of fibers during a long lifetime of the feed roller wire. It is believed that the longer functional lifetime is obtained because the tips of the feed rollers wire break off less easily.

- [11] Preferably, every tooth has in its front portion only one undercut segment.
- [12] Preferably the back portion is devoid of undercuts and/or devoid of embossments.
- [13] Preferably the maximum length of the undercut in the longitudinal direction of the feed roller wire is 10% to 75% of the remaining tooth width at that height of the tooth, more preferably between 40% to 60% of the tooth width, e.g. about 54%. Such ranges provide an optimal feed roller wire performance in terms of functionality over a long lifetime.
- [14] Preferably the back angle (which is the angle of the back portion) of the feed roller wire is lower than 90°. The back angle is measured with the longitudinal direction of the feed roller wire and measured from the front. More preferably, the back angle is between 50° and 90°, even more preferably between 55° and 80°. Preferably the tangent of the back portion has over the full length of the back portion an angle higher than 50°, and preferably lower than 80° and more preferably lower than 70°. The angle is measured with the longitudinal direction of the feed roller wire and measured from its front.
- [15] A preferred range of the front angle, which is the angle between the front portion - without consideration of the undercut segment - and the longitudinal direction of the wire, is 60° to 130°, preferably 80° to 130°, more preferably 90° to 130°, more preferably between 110° and 130°.
- [16] Preferably, the blade of the wire has at the tips of the teeth a thickness (perpendicular to the longitudinal direction of the wire) of at least 0.2 mm, more preferably of at least 0.3 mm, even more preferably of at least 0.5

mm, even more preferably of at least 0.7 mm, even more preferably of at least 1 mm.

- [17] Preferably the wire has a height between 5 and 7.5 mm.
- [18] Preferably, the rib of the wire has a thickness between 2 and 5 mm, plain rib or interlocking wire (e.g. interlocking V-wire).
- [19] Preferably, the feed roller wire has a pitch (which is the distance in the longitudinal direction of the feed roller wire between two consecutive teeth) between 3 and 15 mm, more preferably between 5 and 13 mm.
- [20] In a preferred embodiment, the tangent to the front portion of the feed roller wire has, without consideration of the undercut segment, over the full front portion an angle with the longitudinal direction of the wire of at least 80°, more preferably of at least 90°, more preferably of at least 100°, more preferably of at least 110°, and preferably of less than 130°.
- [21] In a preferred embodiment, the front portion and the back portion of the feed roller wire form together a pyramidal shape, wherein in the front portion the undercut segment provided. With the front portion and the back portion form together a pyramidal shape is meant that the feed roller wire has over its full front portion, except for in the undercut segment, a front angle (which is the angle between the longitudinal direction of the feed roller wire and the tangent to the front portion) that is higher than 90° and preferably higher than 100° and preferably lower than 135°; combined with over its full back portion a back angle smaller than 90°, preferably smaller than 80° and preferably higher than 50°. The back angle is measured from the longitudinal direction of the card wire and from the front.
- [22] In a preferred embodiment, the smallest angle between the longitudinal direction and a tangent to the part of the undercut segment that is going from the tip down inwards from the front portion of the card wire, is within the range of 30° to 70°, more preferably between 40° and 65°, even more preferably between 45° and 60°.

- [23] In a preferred embodiment, the undercut segment has a triangular shape, preferably with rounded tips of the triangular shape, preferably rounded with a radius of curvature of at least 0.2 mm.
- Preferably, the triangular shape undercut segment has an included angle between 40° and 90°, more preferably between 60° and 90°, even more preferably between 70° and 90°, even more preferably between 75° and 85°.
- [24] Preferably, the angle between the longitudinal direction of the feed roller wire and the part of the triangular shape undercut segment that is going from the tip down inwards from the front portion of the card wire, is within the range of 0° to 70°, preferably within the range of 20° to 65°, more preferably within the range of 50° to 65°, more preferably between 55 and 65°.
- [25] Preferably, the triangular shape undercut segment has a shorter side towards the tip than the side towards the rib of the wire. More preferably, the length of side towards the rib of the triangular shape undercut segment is 30% to 100% larger than the length of the side towards the tip of the triangular shape undercut segment.
- [26] In a preferred embodiment of the invention, the undercut segment has the shape of a scallop.
- [27] A second aspect of the invention is a feed roller for a card carding fibers or for a fiber opening machine, wherein the feed roller is clothed with a feed roller wire as in the first aspect of the invention. Preferably, the feed roller covered with feed roller wire has a teeth density of between 20 and 50 ppsi (points per square inch).
- [28] A third aspect of the invention is a feed roller system for feeding a lap of fibers to the lickering roller of a card or of a fiber opening. The feed roller system comprises:
- a feed roller as in the second aspect of the invention, rotatably mounted in the feed roller system, e.g. with suitable means to rotate the feed roller. E.g. the feed roller is driven by an electromotor or via gears and or belts

from a main motor.

- a second object, e.g. a second roller or a feed plate, preferably having a nose.

The feed roller system is provided with means to transport a fiber lap by the feed roller, between the feed roller and the second object, via rotation of the feed roller in the direction of the feeding of the lap of fibers, for presenting the lap of fibers to the card wire on a lickerin roller while the lap is held between the feed roller and the second object.

The front portions of the teeth of the feed roller wire on the feed roller are downstream of the direction of rotation of the feed roller when feeding the fiber lap.

Subsequently, the card wire on a lickerin is taking fibers and/or fibers tufts from the fiber lap presented by the feed roller system.

- [29] When a feed plate is used, the feed plate can be positioned over the feed roller. Alternatively, the feed plate can be positioned under the feed roller. The feed roller system can also comprise a number of consecutive pairs of feed rollers, e.g. 2 pairs, e.g. 3 pairs of feed rollers. A feed roller wire according to the first aspect of the invention can be mounted on one or on both feed rollers of the last pair of feed rollers before the fibers are taken by the lickerin. It is also possible to mount a feed roller wire according to the first aspect of the invention on one or on both feed rollers of the one but last pair of feed rollers. Preferably, the feed roller covered with feed roller wire has a teeth density of between 20 and 50 ppsi (points per square inch).

Brief Description of Figures in the Drawings

- [30] Figure 1 shows an example of a feed roller wire according to the invention. Figure 2 shows another example of a feed roller wire according to the invention. Figure 3 shows an example of a feed roller system according to the second aspect of the invention. Figures 4, 5 and 6 show examples of tips of feed roller wire teeth that can be used in the invention.

Mode(s) for Carrying Out the Invention

[31] Figure 1 shows an example of a feed roller wire 100 according to the invention. The feed roller wire 100 comprises an elongated rib 105 and teeth 108 along the longitudinal direction of the feed roller wire. The teeth 108 comprise a tip 111, and in the longitudinal direction of the feed roller wire a front portion 120 of the teeth and a back portion 130 of the teeth. The front portion 120 and the back portion 130 extend from the tip 111 in the direction of the rib 105. An interconnecting section 135 connects the back portion 130 of a tooth to the front portion 120 of the next tooth. The front portion 120 is provided with an undercut segment 140, in figure 1 a triangular shaped undercut segment, preferably with rounded tips, e.g. with rounded tips with a radius of curvature of at least 0.2 mm. In the example, the triangular shape undercut segment has a shorter side towards the tip than the side towards the rib of the wire. E.g. the side towards the tip has a length of 0.90 mm and the side towards the rib of the wire has a length of 1.35 mm.

The teeth 108 of feed roller wire 100 of figure 1 have a pyramidal shape, wherein in the front portion the undercut segment 140 is provided. The feed roller wire 100 e.g. has a front angle α of 120° . The feed roller wire 100 e.g. has a back angle β of 60° . In the example, the front angle α is constant over the full front portion (except for in the undercut segment) and the back angle β is constant over the full back portion. However, this does not need necessarily to be the case.

The triangular shape undercut segment 140 e.g. has an included angle γ of 80° .

The angle δ between the longitudinal direction of the feed roller wire and the part of the triangular shape undercut segment 140 that is going from the tip down inwards from the front portion of the card wire is e.g. 57° .

As an example the undercut 140 starts, as measured from the tip of the feed roller wire, at a depth A of between 20 and 50%, more preferably between 30% and 40% of the punching depth B of the feed roller wire. Preferably the maximum length C of the undercut in the longitudinal

direction of the feed roller wire is 10% to 75% of the remaining tooth width D at that height of the tooth, more preferably between 40% to 60% of the tooth width, e.g. about 54%.

The feed roller wire 100 can e.g. be an interlocking wire, e.g. with a rib width of 4.23 mm (V6 wire) and a pitch of e.g. 7.50 mm. The blade thickness at the tip of the feed roller wire can e.g. be 1.0 mm, and the wire has e.g. a total height F of 7.5 mm.

- [32] The feed roller wire of the invention offers an improved regularity of feeding fibers to cards or to fiber opening machines, during a long functional lifetime of the feed roller wire and allows to feed a broader range of fiber types in an excellent way.
- [33] Figure 2 shows another example of a feed roller wire 200 according to the invention. The feed roller wire is similar to the feed roller wire of figure 1, with the exception that it has a scallop shape undercut segment 247 in the front portion instead of a triangular shape undercut segment as shown in figure 1.
- [34] Figure 3 shows an example of a feed roller system 300 according to the second aspect of the invention. The feed roller system 300 comprises a feed roller 310, clothed with feed roller wire 315 according to the first aspect of the invention. The feed roller wire 315 is mounted so that the undercut segment is located downstream of the direction of rotation of the feed roller 310 when the feed roller system 300 is in use. The feed roller system 300 comprises a second object, e.g. a plate 320 with a nose 323. The second object can be positioned over or under the feed roller 310. A lap of fibers 330 is fed by the rotation of the feed roller 310 and held between the feed roller 310 and the second object 320, towards the lickerein 340 of a card or a fiber opening machine. The lickerein 340 is provided with lickerein wire 350. The rotation of the lickerein 340, at higher surface speed than the feed roller, results in it that the teeth of the lickerein wire 350 pull out tufts of fibers from the lap of fibers 330 held effectively between the inventive feed roller wire 315 on the feed roller 310 and the second object 320.

As an alternative to a plate 320, the second object can be another feed roller, which can be provided with a feed roller wire of the first aspect of the invention or which can be a prior art feed roller wire.

- [35] The tip of the feed roller wire of the invention can have different shapes. The tip can be a pointed tip (41 1 in figure 4), a rounded tip (51 1 in figure 5) or a tip with a flat segment (61 1 in figure 6), preferably with a flat segment parallel with the longitudinal direction of the feed roller wire.

Claims

1. A feed roller wire for a feed roller of a card carding fibers or for a feed roller of a fiber opening machine,
 - wherein said feed roller wire comprises an elongated rib and teeth along the longitudinal direction of said feed roller wire,
 - wherein said teeth comprise a tip, and in the longitudinal direction of said feed roller wire a front portion of the tooth and a back portion of the tooth, said front portion and said back portion extend from said tip in the direction of said rib; and an interconnecting section connecting the back portion of a tooth to the front portion of the next tooth;characterized in that said front portion is provided with an undercut segment.
2. The feed roller wire as in claim 1, wherein the tangent to the front portion has, without consideration of the undercut segment, over the full front portion an angle with the longitudinal direction of the wire of at least 80°.
3. The feed roller wire as in any of the preceding claims, wherein the front portion and the back portion form together a pyramidal shape, wherein in said front portion said undercut segment provided.
4. The feed roller wire as in any of the preceding claims, wherein the smallest angle between the longitudinal direction and a tangent to the part of the undercut segment that is going from the tip down inwards from the front portion of the card wire, is within the range of 30° to 70°.
5. The feed roller wire as in any of the preceding claims, wherein said undercut segment has a triangular shape, preferably with rounded tips of the triangular shape.
6. The feed roller wire as in claim 5, wherein the angle between the longitudinal direction of the feed roller wire and the part of said triangular shape undercut segment that is going from the tip down inwards from the front portion of the card wire, is within the range of 0° to 70°.

7. The feed roller wire as in claims 4 to 6, wherein said triangular shape undercut segment has a shorter side towards the tip than the side towards the rib of the wire.
8. The feed roller wire as in claims 1 to 4, wherein said undercut segment has the shape of a scallop.
9. A feed roller for a card carding fibers or for a fiber opening machine, wherein the feed roller is clothed with feed roller wire as in any of the claims 1 to 8.
10. Feed roller system for feeding a lap of fibers to the lickerin roller of a card or of a fiber opening machine, comprising
 - a feed roller as in claim 9, rotatably mounted in said feed roller system;
 - a second object, e.g. a second roller or a feed plate, preferably having a nose;wherein said feed roller system is provided with means to transport a fiber lap by the feed roller between the feed roller and the second object, via rotation of the feed roller in the direction of the feeding of the lap of fibers, for presenting said lap of fibers to the card wire on a lickerin roller while the lap is held between said feed roller and said second object;
wherein the front portion of the teeth of the feed roller wire on said feed roller are downstream of the direction of rotation of the feed roller when feeding the fiber lap.

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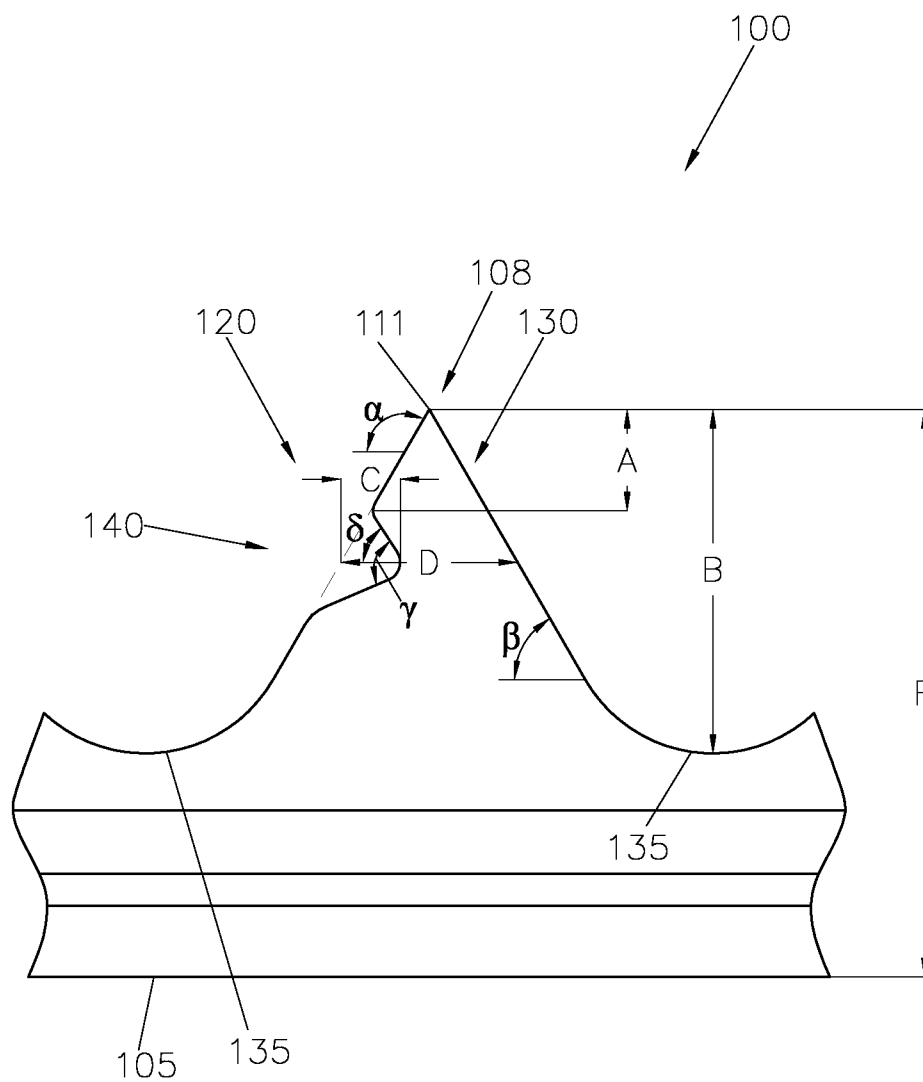


Fig. 1

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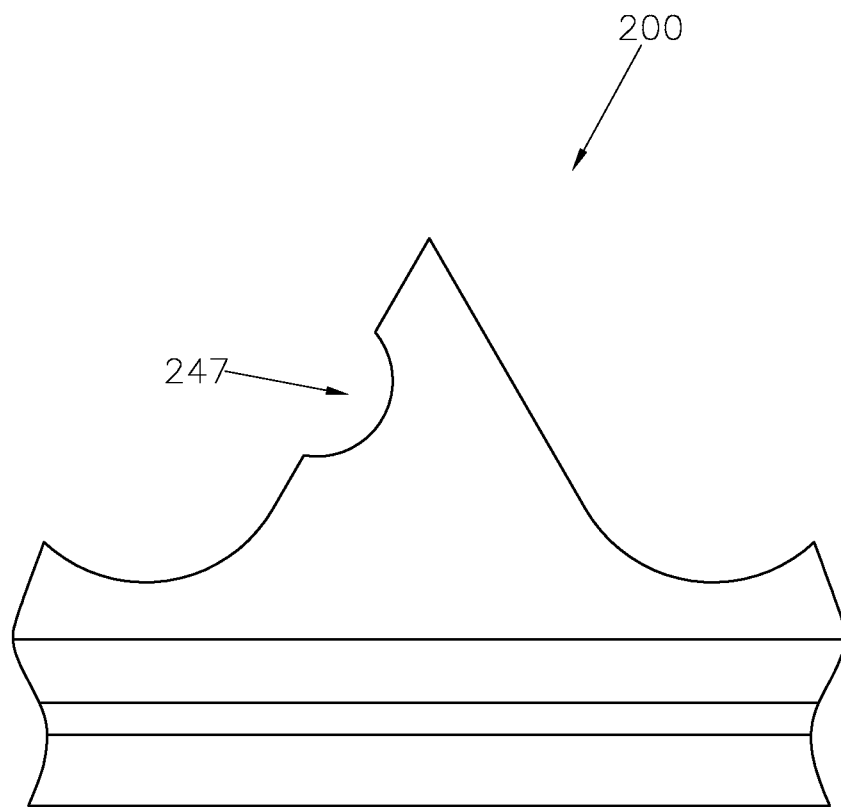


Fig. 2

3 / 4

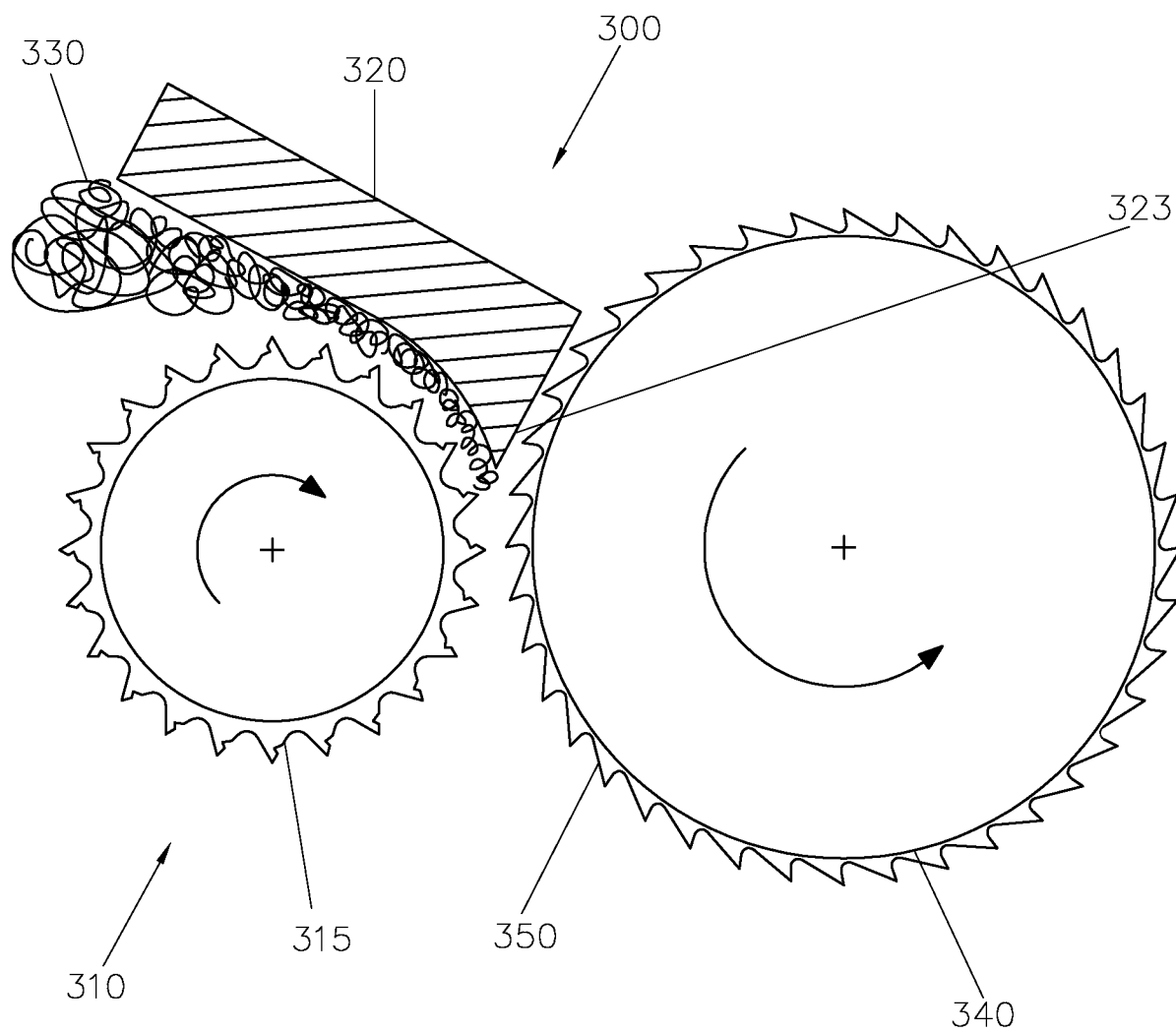


Fig. 3

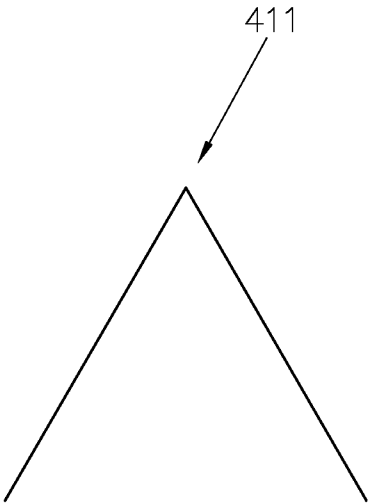


Fig. 4

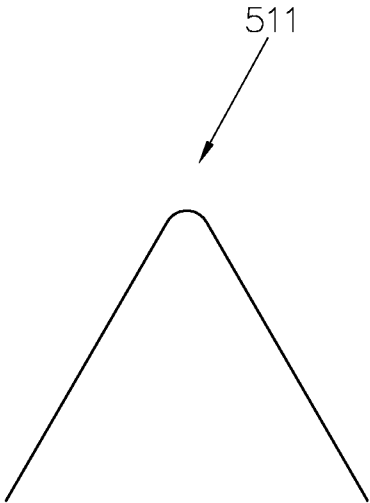


Fig. 5

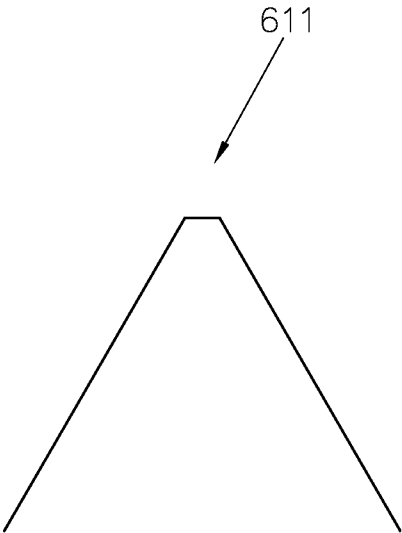


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/058187

A. CLASSIFICATION OF SUBJECT MATTER
INV. D01G15/88
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D01G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP S52 12230 U (NO NAME) 28 January 1977 (1977-01-28)	1-9
Y	figure 2	10
Y	----- US 4 001 916 A (GRIMSHAW KEITH ET AL) 11 January 1977 (1977-01-11) cited in the application claim 1; figure 1	10
A	----- FR 2 821 863 AI (ECC PLATT SA [FR]) 13 September 2002 (2002-09-13) claim 1; figure 5 -----	1-10



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search

13 August 2014

Date of mailing of the international search report

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2014/058187

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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