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(54) **EXTRACTION ROLLER**

(57) The present invention relates to an extraction roller (1) for mechanically opening fiber bales, the extraction roller comprising a shaft axis (2) and spacing parts (3) arranged along the shaft axis (2), wherein the spacing parts (3) each have two opposing end surfaces (4, 5) that are arranged to have an angle of inclination α with respect to the shaft axis (2). A circular cog (6) is inserted between

two spacing parts (3), and the cog (6) is formed by two half disks (7, 8) and is provided with teeth (9) on the outer periphery thereof. Every two adjacent spacing parts (3) are connected to each other by means of bolts, wherein the bolts (10) run through the cogs (6) arranged between the spacing parts (3).

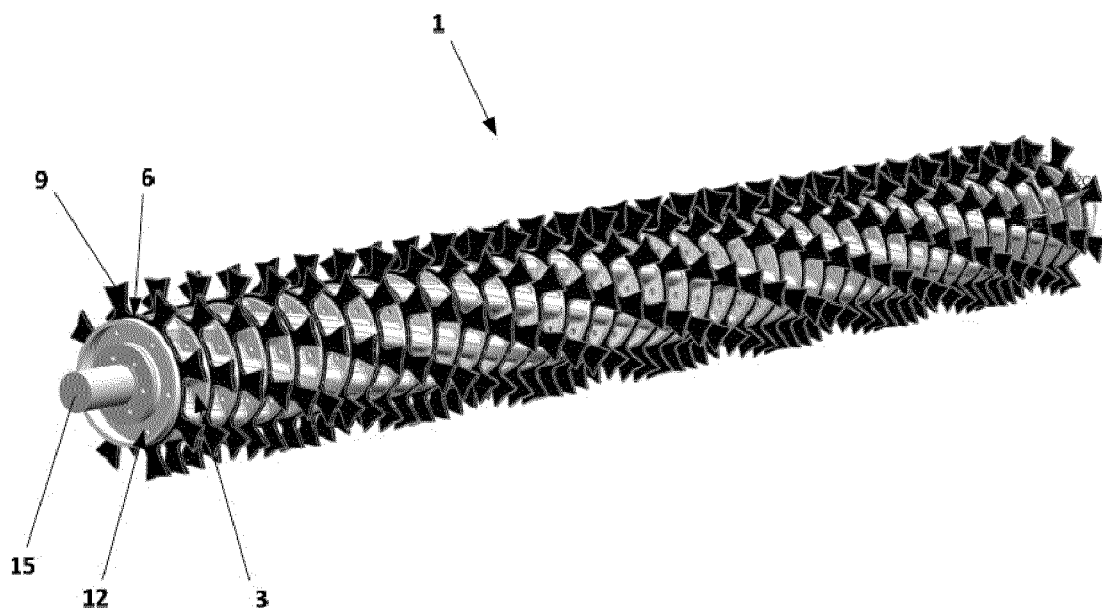


FIG. 1

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Description

Technical Field

[0001] The present invention relates to an extraction roller for mechanically opening fiber bales (Faserballen).

Background

[0002] Extraction rollers are used in so-called fiber bale-opening machines or fiber bale openers for opening fibers or fiber flocs from compressed fiber bales. For this reason, one or more extraction rollers are made to move on fiber bales. The prior art provides the following fiber bale opener, i.e., one that makes extraction rollers to move on fiber bales with fixed positions.

[0003] Here, teeth of the extraction rollers are engaged into the fiber bales, and due to the rotation of the extraction rollers, break up or pull out fibers or fiber flocs from fiber bales. When a mobile production line in a preparation area (cleaning workshop) of a textile factory starts, a fiber bale-opening machine is used to process a fiber product, such as cotton, synthetic fiber, or a mixture thereof, and has a decisive impact on the continuity of the process within the preparation area of the textile factory. In the fiber bale-opening machine, the fiber product is provided by means of pulling out fiber flocs from fiber bales so as to loosen fiber bales, and the fiber product is transported to a pneumatic conveying system. The pneumatic conveying system sends fiber flocs to a subsequent cotton cleaning machine via a pipeline.

[0004] A grid plate (Rost) is typically provided between extraction rollers and fiber bales. Teeth of an extraction roller go through the grid plate. Here, the grid plate is used as a holding part for fiber bales. The grid plate part on the surface of fiber bales prevents the teeth of an extraction roller from breaking overly big or nonuniform fiber flocs from fiber bales.

[0005] According to the prior art, there are a plurality of known implementation manners of extraction rollers. For example, the reference EP 0 058 781 discloses an extraction roller, in which cogs are fixed onto a semi-circular shell. Two half shells each include the axis of the extraction roller and are fixed to each other in this way, so that press fit is achieved between the half shells and the axis.

[0006] The disadvantages of the disclosed extraction roller structure are that the half shell structure is complicated, the fixation of cogs through press fit may get loose, and the fixation may also get loose during operations.

[0007] The reference EP 2 836 630 A1 discloses another implementation manner of the extraction roller, in which cogs are constructed to be circular and have an elliptic central recess. The cogs are pushed onto the axis and connected to the axis while preventing rotation. The disadvantage of this structure is that it is impossible to replace individual cogs. Tooth breaking always exists, or the wear of teeth is stronger in certain regions than in

other regions.

Summary of the Invention

[0008] The objective of the present invention is to achieve an extraction roller with a simple structure and with cogs capable of being simply and individually replaced.

[0009] The objective is achieved through an extraction roller having features set forth in the independent claims.

[0010] To achieve the objective, a novel extraction roller is proposed. The extraction roller comprises a shaft axis and spacing parts arranged along the shaft axis, wherein the spacing parts each have two opposing end surfaces that are arranged to have an angle of inclination α with respect to the shaft axis; moreover, the extraction roller has circular cogs respectively inserted between two spacing parts, and the cogs are respectively formed by two half disks and are provided with teeth on the outer periphery thereof. Two adjacent spacing parts are connected to each other by means of bolts, wherein the bolts run through the cogs arranged between the spacing parts.

[0011] To achieve simple assembly, the spacing parts may be pushed to an auxiliary pipe. The cogs, i.e., half disks, are respectively inserted between adjacent spacing parts when the spacing parts are connected by bolts. Opposing spacing parts are connected by bolts, so that the cogs, i.e., half disks, are clamped between the spacing parts. Here, through openings formed in the cogs are used for positioning, and the bolts of the spacing parts run through the through openings.

[0012] When the cogs are replaced, the implementation manner that one cog is formed by two half disks has the following advantage: there is no need to take off the entire extraction roller, which could damage the rotation symmetry thereof. It is only necessary to loosen bolts involved with a single half disk. After this half disk is replaced, associated spacing parts are connected to each other again, and then the second half disk is replaced. With this implementation manner of the extraction roller, it is also not necessary to dismantle the extraction roller from a machine. Single cog is replaced when the extraction roller is in an installed state.

[0013] In a preferred implementation manner, the cogs are arranged to rotate radially by a determined angle β relative to each other in the order thereof along the shaft axis. Individual cogs sequentially arranged on the shaft have the same structure. However, to achieve better friction features for the extraction roller, there are a variety of radial arrangements of cogs, thereby achieving that not all cogs engage teeth thereof simultaneously into a fiber bale. Through radial rotation, it is achieved that teeth of the first cog engage in the fiber bale, and only after the shaft continues to rotate, are teeth of subsequent cogs engaged. As a result, as observed from the entire length of the extraction roller, fibers are continuously broken out of a fiber bale. The staggered engagement of

individual cogs reduces vibration transfer.

[0014] Advantageously, the end surfaces of the spacing parts are constructed to be flanges, and through holes are formed in the flanges for connecting opposing spacing parts by means of bolts, wherein the through holes in the two flanges of a spacing part are arranged on a center circle that is concentric with the shaft axis and are deviated relative to each other by the angle β on the center circle. When the cogs are implemented in the same way, opposing cogs rotate by the angle β relative to each other according to this arrangement that the through holes are deviated relative to each other.

[0015] More advantageously, since the two end surfaces of the spacing parts are arranged to have an angle of inclination α with respect to the shaft axis, and two end surfaces of the spacing parts are arranged to be twisted by the angle β relative to each other along the shaft axis, a second spacing part of two adjacent spacing parts needs to be twisted by the angle β relative to a first spacing part thereof when the two adjacent spacing parts are in close engagement. This arrangement of end surfaces of the spacing parts has an advantage, in addition to that all cogs are the same, that all spacing parts may also be constructed into the same shape.

[0016] In an alternative implementation manner, the end surfaces of the spacing parts are constructed to be flanges, and through holes are formed in the flanges for connecting opposing spacing parts by means of bolts, wherein the through holes in the two flanges of a spacing part are arranged on a center circle that is concentric with the shaft axis and overlapped when observed in the direction of the shaft axis, and the cogs are provided with groove-shaped through openings for the connecting bolts of the spacing parts to run through. With the groove-shaped through openings in the cogs for the bolts of the spacing parts, opposing cogs can be similarly introduced between the spacing parts in the same manner of radial turning.

[0017] Advantageously, end parts are provided on two ends of the extraction roller, and the end parts have a first end surface arranged to be parallel to the inclined end surfaces of the opposing spacing parts and a second end surface arranged to be in a plane perpendicular to the shaft axis. Preferably, the end parts are provided with a protrusion, the protrusion is connected into a spacing part, which achieves accurate and matching positioning for the end parts and the arrangement that the end parts are rotationally symmetric with respect to the spacing parts. By setting a plane perpendicular to the shaft axis to be the end portion of the extraction roller, simple support parts can be fixed onto the end parts. What is also advantageous here is that the support parts are connected into the end parts via the protrusion. The support parts have a shaft end, and the extraction roller can use this shaft end to be held rotatably in a corresponding support portion.

[0018] Preferably, the end parts and the support parts are implemented to be integral pieces. As a result, further

fixation will not affect the rotational symmetry about the shaft axis due to the tolerance of end parts and the support parts.

[0019] With this structural form, a preferred structural form of the extraction roller can be achieved, wherein the extraction roller comprises the spacing parts connected by means of bolts, the end parts, the cogs maintained between the spacing parts and between the end parts and the spacing parts, and the support parts mounted on corresponding end parts. Here, the actual shaft may be omitted. For simple assembly, individual members are pushed onto an auxiliary pipe. However, after the spacing parts and the end parts are assembled with the cogs, the auxiliary pipe is taken off again. In this way, the profile of the spacing parts is formed, so that a self-bearing structure is obtained. Here, individual spacing parts and end parts may be made through casting or through turning. To reduce weight, aluminum or aluminum alloys are preferred to steel in implementations.

[0020] In an alternative implementation manner, the spacing parts and the end parts are arranged on the shaft. In such arrangement, support parts are omitted. However, the end parts must be additionally set to be axially fixed in the direction of the shaft axis. According to the applied scheme of the shaft, the spacing parts may be constructed to be wearing parts, as individual parts may be supported on the shaft.

[0021] In a preferred implementation manner, the cogs are inclined by the angle of inclination α of 5 to 20 degrees with respect to the shaft axis. This angle of inclination is measured relative to the longitudinal plane perpendicular to the shaft axis. Here, the angle of inclination α may be measured in one or another direction. The magnitude of the angle of inclination α is determined through the profile of end surfaces of the spacing parts. Preferably, the spacing parts of the extraction roller are made with the same inclination, i.e., the same angle of inclination α . However, it can be envisioned that the inclination of a single spacing part or between regions of the extraction roller may be changed. The opening width of individual cogs is further determined through the inclination of the cogs, which affects the structural form of a grid plate. Namely, with the distance between individual grid plate parts, teeth of the cogs run through the grid plate parts. If the cogs of the extraction roller are fixed on the shaft at different angles of inclination α , correspondingly matching grid plates are used. Particularly preferably, all cogs of the extraction roller are arranged to have the same angle of inclination α of 9 degrees.

[0022] The radial rotation between two consecutive cogs is preferably set to have the angle β between 6 and 36 degrees. Therefore, one whole circle is achieved after the number of cogs is determined. For example, when the rotation angle β is 36 degrees, the tenth cog and the first cog are arranged in the same manner. The rotation angle β is selected according to the number of cogs on the entire extraction roller, thereby obtaining a lot of spiral threads. Particularly preferably, individual cogs rotate by

the angle β relative to each other, and the angle β corresponds to $1/n$ of 360° or an integer multiple of 360° , wherein n represents a number of the cogs on the extraction roller. As a result, the dynamic imbalance as a result of the inclination of the cogs is balanced. As compensation, for every cog, there is a cog that is inclined in an opposite way. Here, the cogs may also be arranged on the shaft in a manner of mirror symmetry, wherein the rotation direction is changed after one circle of rotation. Cogs on external ends of the extraction roller may also rotate in a different way from that of cogs arranged at the center of the shaft.

[0023] Advantageously, the cogs each comprise four to twelve teeth, and the teeth are evenly distributed on the periphery of the cogs. The teeth are arranged on the outer periphery of the cogs. The outer periphery of the cogs is constructed to be circular. As a result, the teeth are arranged in a rotationally symmetric manner. Preferably, the cogs have six teeth. The teeth are thermally treated on the external surface thereof, so as to have specific wear resistance. Tempering or quenching may be used as the thermal treatment. However, other methods for improving wear resistance, such as coating, may also be conceived to replace the thermal treatment. In particular, corresponding materials may be selected for the cogs to achieve sufficient wear resistance.

[0024] Preferably, the teeth have an external profile for the extraction roller to operate in two directions. As a result, the extraction roller can move to a fiber bale and open the fiber bale in two directions.

[0025] In addition, the present invention requests to protect a cog for use in the above-described extraction roller.

Brief Description of the Drawings

[0026] The present invention will be described in detail with reference to exemplary embodiments and the accompanying drawings.

FIG. 1 is an exemplary perspective view of the extraction roller.

FIG. 2 is a schematic diagram of a partial side view of the extraction roller.

FIG. 3 is a schematic diagram of a perspective along the direction X in FIG. 2.

FIG. 4 is a schematic cross-sectional view of an end portion of the extraction roller.

Detailed Description

[0027] FIG. 1 is an exemplary perspective view of the extraction roller 1. The extraction roller 1 comprises a row of spacing parts 3 that are arranged concentrically and side by side. A cog 6 is inserted between every two

spacing parts 3. The cog 6 is provided with a plurality of teeth 9 on the periphery thereof. End parts 12 are mounted on corresponding ends of the extraction roller 1. The end parts 12 respectively comprise support parts 15.

[0028] FIG. 2 is a schematic diagram of a partial side view of the extraction roller 1 having a shaft axis 2. On the shaft axis 2, two opposing spacing parts 3 are concentrically illustrated. The spacing parts 3 each have a first end surface 4 and a second end surface 5, wherein the end surfaces 4 and 5 are arranged to have an angle of inclination α with respect to a plane perpendicular to the shaft axis 2. The cog 6 is inserted between two spacing parts 3. The cog 6 is hereby clamped between the first end surface 4 of a first spacing part 3 and the second end surface 5 of an opposing second spacing part 3. The opposing spacing parts 3 are pulled tightly toward each other by bolts 10, thereby holding the cog 6 there between at its position.

[0029] Moreover, advantageously, the end surface 4 and the end surface 5 are, for example, arranged to be twisted by an angle β relative to each other along the shaft axis 2. Therefore, when the end surfaces 4 and 5 of two opposing spacing parts 3 are in close engagement with each other, one of the spacing parts must be twisted by the angle β relative to the other spacing part along the shaft axis 2. The advantage thereof is, in addition to that all cogs are the same, that all spacing parts may also be constructed into the same shape.

[0030] FIG. 3 is a schematic diagram of a perspective along the direction X in FIG. 2.

[0031] The spacing parts 3 arranged on the axis 2 carry the cogs 6 formed by a first half disk 7 and a second half disk 8. The cog 6, i.e., the half disks 7 and 8, is provided with the teeth 9 on the outer periphery thereof. In the illustrated embodiment, each of the half disks 7 and 8 comprises three teeth 9. The half disks 7 and 8 are fixed on the spacing parts 3 by the bolts 10. The bolts 10 are arranged on the center circle 11, wherein the bolts 10 are arranged with the longitudinal axis thereof in parallel to the shaft axis 2. The half disks 7 and 8 are arranged, in the order thereof in the direction of the shaft axis 2, to have radial rotation by the angle β . Since all the half disks 7 and 8 are constructed in the same way, the angle β is also obtained from the misalignment of the teeth 9 of consecutive cogs 6 in the rotation by the angle β . With a combination of the angle of inclination α and the rotation angle β , visible varying inclination of the cog 6 relative to the axis 2 is achieved (see FIG. 1). The reason thereof is because the plane where the inclined cogs 6 are located similarly rotates about the axis 2 due to the rotation of two consecutive cogs 6. Since the cogs 6 are inclined by α , the cogs 6 sweep over an operating area along the longitudinal direction of the axis 2 on the periphery of the extraction roller. In the dimensions thereof, the operating area corresponds to the inner width between two grid plate parts, the cogs 6 run through the grid plate parts by means of the teeth 9 thereof, wherein, at two sides, a gap is provided between the grid plate parts and the cogs

6 that matches the operation mode of the machine.

[0032] FIG. 4 is a schematic cross-sectional view of an end portion of the extraction roller 1. In the illustrated embodiment, the spacing parts 3 having the first end surface 4 and the second end surface 5 are located on an axis 17. The axis 17 is shown as a hollow axis. In an alternative implementation manner, the axis 17 may be taken out after individual parts are assembled. The end surfaces 4 and 5 are arranged to have an angle of inclination α with respect to a plane perpendicular to the shaft axis 2. Corresponding to the first end surface 4 of a spacing part 3, an end part 12 having a first end surface 13 and a second end surface 14 is arranged on the axis 17. A cog 6 is provided between the first end surface 13 of the end part 12 and the first end surface 4 of the spacing part 3. The end part 12 and the spacing part 3 are pulled tightly together by the bolts 10. Here, the bolts 10 run through the cog 6, so that the cog 6 is clamped between the end part 12 and the spacing part 3.

[0033] The support parts 15 are fixed onto the second end surfaces 14 of the end parts 12 by means of the fixing parts 16. The support parts 15 are configured to rotatably accommodate the extraction roller 1 in a corresponding device of a fiber bale opener. The axis 17 may, for example, also be used for only acting on an assembly auxiliary part that makes the cogs 6 and the spacing parts 3 to be arranged in rows, and taken off again before the support parts 15 are installed. Here, a self-bearing structure of the extraction roller 1 is obtained, which comprises the spacing parts 3, the cogs 6, the end parts 12, and the support parts 15.

List of reference symbols

[0034]

- 1 extraction roller
- 2 shaft axis
- 3 spacing part
- 4 first end surface of a spacing part
- 5 second end surface of a spacing part
- 6 cog
- 7 first half disk
- 8 second half disk
- 9 teeth
- 10 bolt
- 11 center circle
- 12 end part
- 13 first end surface of an end part
- 14 second end surface of an end part
- 15 support part
- 16 fixing part
- 17 axis 13

- α angle of inclination
- β rotation angle.

Claims

1. An extraction roller (1) for mechanically opening fiber bales, the extraction roller comprising a shaft axis (2) and spacing parts (3) arranged along the shaft axis (2), wherein the spacing parts (3) each have two opposing end surfaces (4, 5) that are arranged to have an angle of inclination (α) with respect to the shaft axis (2); moreover, the extraction roller (1) has circular cogs (6) respectively inserted between two spacing parts (3), and the cogs (6) are respectively formed by two half disks (7, 8) and are provided with teeth (9) on the outer periphery thereof, **characterized in that** two adjacent spacing parts (3) are connected to each other by means of bolts, wherein the bolts (10) run through the cogs (6) arranged between the spacing parts (3).
2. The extraction roller (1) according to claim 1, **characterized in that** the cogs (6) are arranged to rotate radially by a determined angle β relative to each other in the order thereof along the shaft axis (2).
3. The extraction roller (1) according to claim 2, **characterized in that** the end surfaces (4, 5) of the spacing parts (3) are constructed to be flanges, and through holes or internal threads are formed in the flanges for connecting opposing spacing parts (3) by means of bolts, wherein the through holes or internal threads in the two flanges of a spacing part (3) are arranged on a center circle (11) that is concentric with the shaft axis (2) and are deviated relative to each other by the angle β on the center circle (11).
4. The extraction roller (1) according to any one of claims 1-3, **characterized in that** the end surface (4) and the end surface (5) of the spacing part (3) are arranged to be twisted by the angle β relative to each other along the shaft axis (2).
5. The extraction roller (1) according to claim 2, **characterized in that** the end surfaces (4, 5) of the spacing parts (3) are constructed to be flanges, and through holes or internal threads are formed in the flanges for connecting opposing spacing parts (3) by means of bolts, wherein the through holes or internal threads in the two flanges of a spacing part (3) are arranged on a center circle (11) that is concentric with the shaft axis (2) and overlapped when observed in the direction of the shaft axis (2), and the cogs are provided with groove-shaped through openings for the connecting bolts (10) of the spacing parts (3) to run through.
6. The extraction roller (1) according to any one of the preceding claims, **characterized in that** end parts (12) are provided on two ends of the extraction roller (1), and the end parts (12) have a first end surface

(13) arranged to be parallel to the inclined end surfaces (4, 5) of the opposing spacing parts (3) and a second end surface (14) arranged to be in a plane perpendicular to the shaft axis (2).

to any one of claims 1-15.

7. The extraction roller (1) according to any one of the preceding claims, **characterized in that** the cogs (6) are inclined by the angle of inclination α of 5 to 20 degrees with respect to the shaft axis (2).

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8. The extraction roller (1) according to any one of claims 2-7, **characterized in that** the radial rotation between two consecutive cogs (6) is set to have the angle β between 6 and 36 degrees.

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9. The extraction roller (1) according to any one of claims 2-8, **characterized in that** the angle β of the radial rotation between two consecutive cogs (6) corresponds to $1/n$ of 360° or an integer multiple of 360° , wherein n represents a number of the cogs (6) on the extraction roller (1).

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10. The extraction roller (1) according to any one of the preceding claims, **characterized in that** the cogs (6) each comprise four to twelve teeth (9), and the teeth are evenly distributed on the periphery of the cogs (6).

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11. The extraction roller (1) according to any one of the preceding claims, **characterized in that** the teeth (9) are thermally treated on the external surface thereof.

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12. The extraction roller (1) according to any one of the preceding claims, **characterized in that** the teeth (9) have an external profile for opening fiber bales in two rotation directions through the extraction roller (1).

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13. The extraction roller (1) according to any one of claims 6-12, **characterized in that** the extraction roller (1) comprises the spacing parts (3) connected by means of bolts, the end parts (12), the cogs (6) maintained between the spacing parts (3) and between the end parts (12) and the spacing parts (3), and support parts (15) mounted on corresponding end parts (12) through fixing parts (16).

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14. The extraction roller (1) according to claim 13, **characterized in that** the corresponding end parts (12) and the support parts (15) are integral pieces.

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15. The extraction roller (1) according to any one of claims 6-12, **characterized in that** the spacing parts (3) and the end parts (12) are arranged on an axis (17).

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16. A cog (6) for use in the extraction roller (1) according

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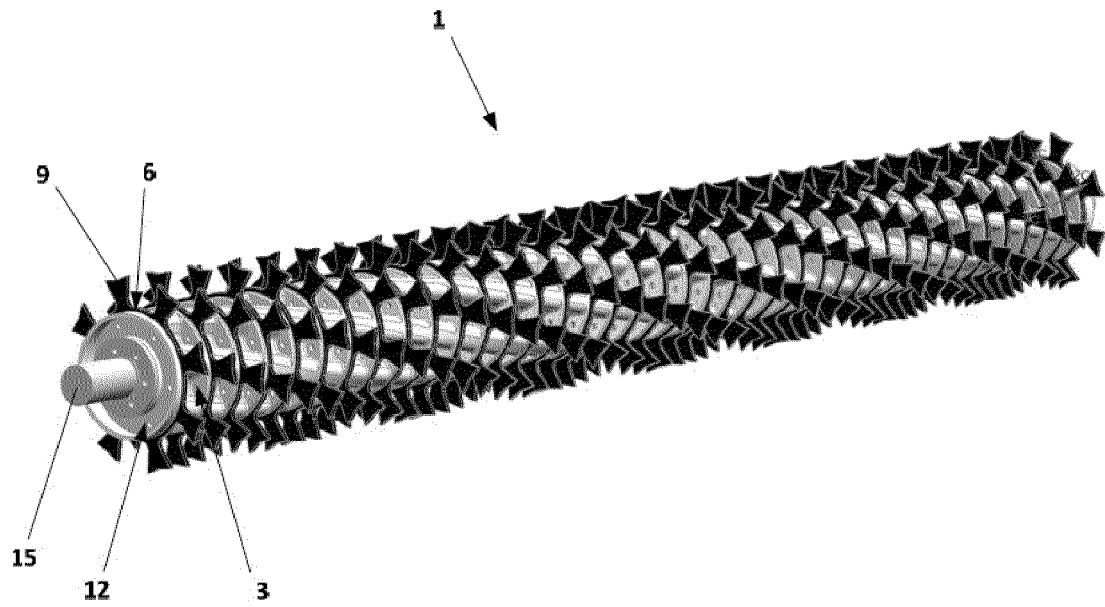


FIG. 1

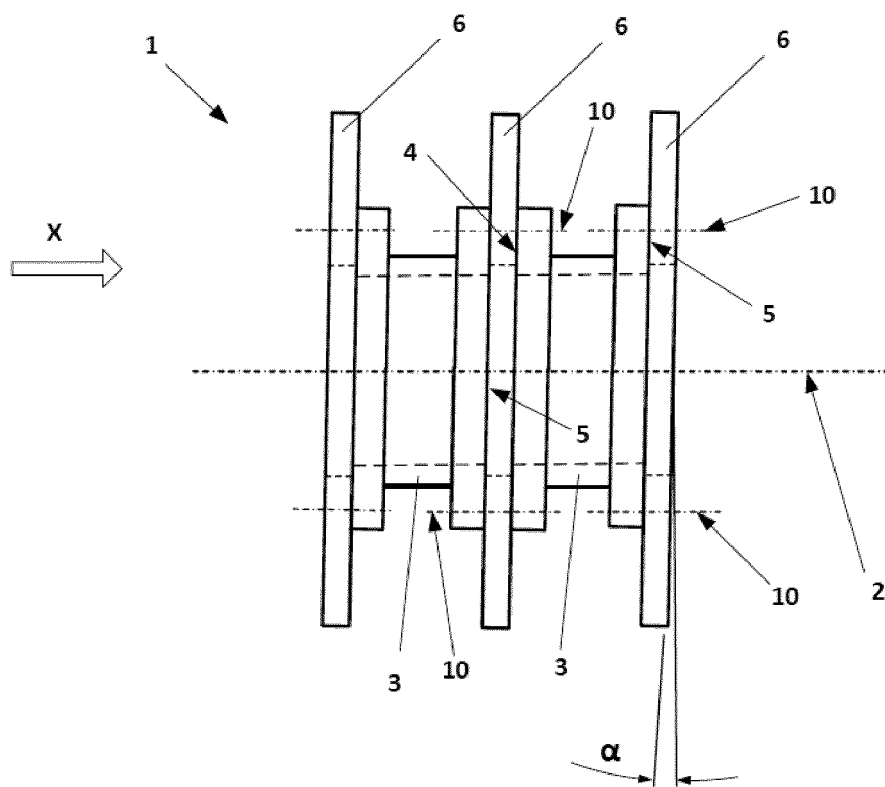


FIG. 2

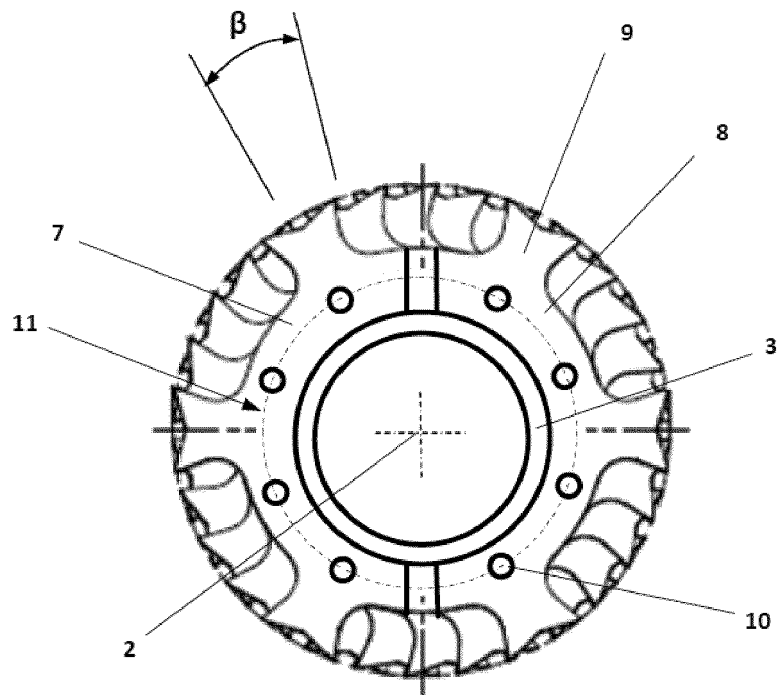


FIG. 3

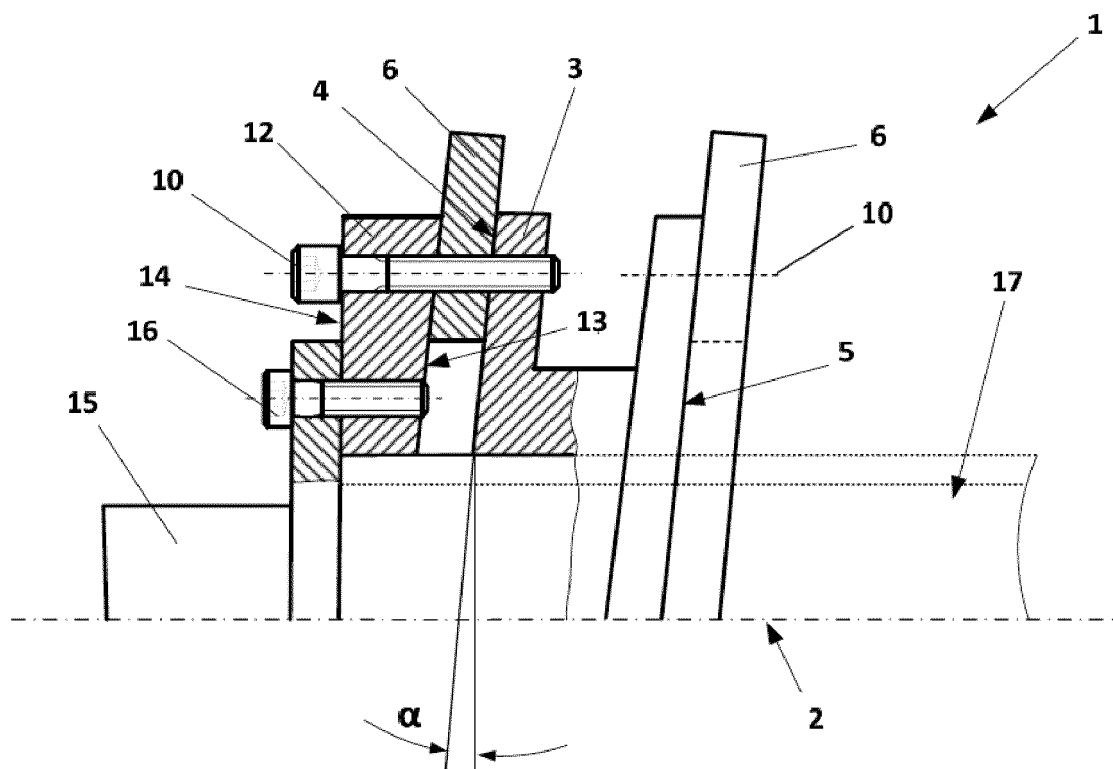


FIG. 4



EUROPEAN SEARCH REPORT

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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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