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(54) Device and pressure rib for cutting fibres into pieces

(57) A device for cutting fibres into pieces, wherein a fibre (10) is divided into pieces (11) by pressing a knife (7) against the fibre (10), said device including a knife roller (2) comprising several substantially axially oriented knives (7) and pressure ribs (8) which are present between the knives (7), and a pressure roller (3), which rollers (2, 3) can be driven in opposite directions at the same peripheral velocity, wherein the knife roller (2) is provided with substantially axially extending mounting sections (19), and in that the pressure ribs (8) are provided on the radially inward side with a recess corresponding to the mounting section (19), which engages round said mounting section (19).

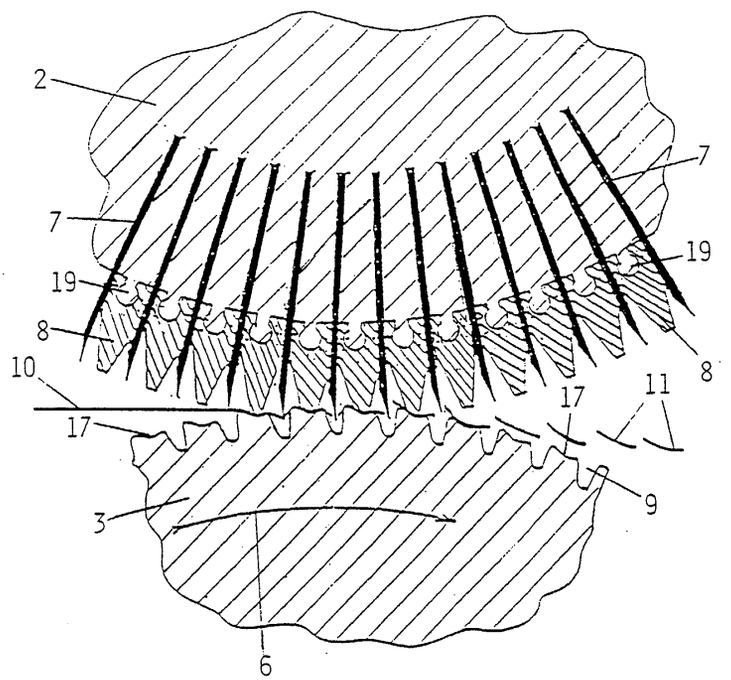

Fig 6

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Description

[0001] The invention relates to a method for cutting fibres, in particular mineral fibres such as glass fibres, into pieces, wherein a fibre is divided into pieces by pressing a knife against the fibre.

[0002] The fibre can thereby be clamped down between two rollers, that is, a knife roller on which knives are mounted and a pressure roller, which exerts a counterpressure on the fibre. The counterpressure of the pressure roller enables the knife to exert so large a force on the fibre that said fibre is cut through.

[0003] The knife is pressed against the pressure roller thereby, which will result in wear on the knife and on the pressure roller. This makes it necessary to replace the knives and the pressure roller frequently. In addition, this method requires relatively much energy.

[0004] Usually, the circumferential surface of the pressure roller is coated with an elastomer, in particular polyurethane, which prevents excess wear on the knives. There will be wear on the polyurethane coating on the pressure roller, however, as a result of which the pressure roller needs to be replaced regularly.

[0005] The object of the invention is to provide a method for dividing fibres into pieces, which method is more efficient than existing methods and which causes less wear and requires less energy.

[0006] In order to accomplish that objective, the fibre is according to the invention divided into pieces by pressing a knife against the fibre without exerting an, at least substantial, counterpressure on the other side of the fibre where the knife is present. Preferably, the knife will not come into contact with the pressure roller thereby. During cutting, the fibre preferably does not abut against the pressure roller at the location of the knife. The fibre is divided into pieces in that the fibre is bent round the cutting edge of the fibre, whereby the fibre material will give way at the location where it is bent.

[0007] In one preferred embodiment, the fibre is led between a knife roller, which is fitted with several, substantially axially oriented knives, and a pressure roller, which rollers are driven in opposite directions at the same peripheral velocity, wherein the fibre is clamped down between pressure ribs, which are present between the knives on the knife roller, and the pressure roller, whereby a knife cuts through the fibre substantially without counterpressure from the pressure roller. During cutting, the knife can extend into a groove in the pressure roller, to a depth some distance from the bottom of said groove.

[0008] In this manner, the fibre can be engaged in two places by the two rollers, whilst the knife is pressed against the fibre between said two places. The piece of fibre between said two places is longer than the distance between said two places, so that the fibre can be bent round the cutting edge of the knife without much force being exerted, after which it will break.

[0009] Preferably, the pressure rib deforms more than the pressure roller at the location where said clamping down takes place. This can be effected by forming the pressure rib to a certain shape, which enables the rib to deform without a great deal of force being required. In one preferred embodiment, the material of which the pressure ribs are made is more flexible than the material of which the surface of the pressure roller is made, so that the pressure rib will readily deform. In another embodiment, one or more cavities or recesses are present in the material of the pressure rib. Preferably, said cavities or recesses are filled with a different kind of material, such as a foam or other very flexible and/or compressible material.

[0010] In one preferred embodiment, the pressure rib tapers off, seen in cross-sectional view, at least near the part which extends radially outwards. The pressure rib may include a substantially flat tangentially oriented part, which adjoins two sloping lateral surfaces, which extend as far as the knives. As a result, the space between the pressure ribs and the knives diverges in outward direction, so that dirt can easily be removed.

[0011] Preferably, the radially outwardly extending part of the pressure rib is positioned closer to the cutting edge of the preceding knife than to the cutting edge of the next knife, seen in the direction of movement. In practice it has become apparent that this enables an improved cutting operation of the knife.

[0012] Preferably, the knives are fixedly mounted on the knife roller, and the pressure ribs between the knives extend substantially as far in radially outward direction as the knives, and the pressure ribs are pressed between the cutting knife and the knives adjacent thereto during cutting, to a position wherein they extend less far in radially outward direction than the cutting knife, the difference preferably being 0.3 mm or more, more preferably 0.7 mm or more, and even more preferably 1.2 or more. As a result, the knife is capable of moving the fibre a substantial distance, so that the fibre can be bent round the cutting edge of the knife at a relatively large angle.

[0013] Preferably, the knife roller is provided with a substantially axially extending mounting section, and the pressure rib is provided on the radially inward side with a recess corresponding to the mounting section, which engages round the mounting section. The mounting section is a strip mounted on the knife roller, which strip comprises a widened portion at its radial outer edge, around which the pressure rib engages.

[0014] In practice it has become apparent that this enables a reliable attachment of the pressure rib to the knife roller, especially when the pressure rib is made of a flexible material, the width of which material is greater than that of the space between the knives, so that the pressure rib is clampingly engaged between the knives under deformation.

[0015] Preferably, the surface of the pressure roller is made of a metal or other hard material. When the pressure roller is made of an electrically conducting material,

there is no risk of a static load developing, and any static load on the pressure ribs is discharged before the fibres are cut, thus reducing the risk of fouling of the device by bits of fluff from adhering pieces of fibre.

[0016] Preferably, the pressure rib presses the fibre against the pressure roller at a location where the surface of the pressure roller is concave, seen in cross-sectional view. In practice it has become apparent that this is conducive towards a proper engagement of the pressure ribs to the pressure roller.

[0017] Furthermore, the pressure rib preferably presses the fibre against the pressure roller at a location where the surface of the pressure roller extends substantially obliquely with respect to the tangential plane. As a result, the cut-off pieces of fibre are not in line, but they extend at an angle with respect to each other once they have been cut off and are still clamped between the pressure rib and the pressure roller. The pieces will not hook together in that case, and they will fall separately from the pressure roller. It must be considered thereby that the length of the cut-off pieces of fibre is greater than the spacing between the pressure ribs.

[0018] Preferably, said obliqueness is such that the forwardly extending part of said surface, seen in the direction of movement, is positioned closer to the axis of rotation of the pressure roller than the rearwardly extending part. This enables the pressure rib to move perpendicularly to the surface of the pressure roller upon approaching the pressure roller.

[0019] In one preferred embodiment, the circumferential surface of the pressure roller is provided with substantially axially extending grooves, wherein the edge between the side wall of the groove and the adjoining part of the circumferential surface of the pressure roller is rounded, the radius thereof being larger than that of the cutting edge of the knife, said radius preferably being larger than 0. 1 mm, more preferably larger than 0.2 mm. As a result, the fibres are loaded less heavily, except at the location where they are cut through.

[0020] The invention furthermore relates to a device for cutting fibres into pieces, wherein a fibre is divided into pieces by pressing a knife against the fibre, said device including a knife roller comprising several substantially axially oriented knives, and a pressure roller, which rollers can be driven in opposite directions at the same peripheral velocity, whereby the knives are so arranged and the pressure roller is so formed that the knives are capable of pressing against the fibre present between the rollers during cutting, without coming into contact with the pressure roller thereby.

[0021] In order to explain the invention more fully, a few embodiments of a device for cutting fibres will now be described in more detail with reference to the drawing.

Figure 1 is a side elevation of a device for cutting fibres;

Figure 2 is a top plan view of said device;

Figures 3, 4 and 5 show various embodiments of a knife roller and a pressure roller;

Figure 6 shows another embodiment of a knife roller and a pressure roller;

Figure 7 shows a detail of the pressure roller of Figure 6;

Figure 8 shows various embodiments of a pressure rib; and

Figures 9, 10 and 11 show an embodiment of a knife roller.

[0022] The figures are merely schematic representations, wherein like parts are numbered alike.

[0023] The device which is shown in Figure 1 comprises a frame 1, in which a knife roller 2 and a pressure roller 3 are rotatably supported by means of bearings 4 and 5, respectively. The two rollers can rotate in opposite directions at the same peripheral velocity, as is indicated by arrows 6.

[0024] Knife roller 2 is circumferentially provided with knives 7, which extend in axial direction with respect to roller 2. Mounted between knives 7 are flexible pressure ribs 8, which likewise extend in axial direction along the circumferential surface. Figure 1 shows only a few of the knives 7 and pressure ribs 8.

[0025] The pressure roller 3 is circumferentially provided with grooves 9, which extend in axial direction with respect to roller 3. Figure 1 also shows only a few of the grooves 9.

[0026] During rotation of rollers 2, 3, the knives 7 pass the pinch between the two rollers 2,3, whilst knives 7 extend into grooves 9. The pressure ribs 8 thereby press against the circumferential surface of the pressure roller 3, at the location where said circumferential surface extends between grooves 9.

[0027] Figure 1 shows a fibre 10 which is passed between rollers 2, 3 from above. Fibre 10 is clamped down in the pinch of rollers 2, 3 between pressure ribs 8 and the circumferential surface of pressure roller 3, and is pressed into grooves 9 by knives 7, whereby fibre 10 will break, or be cut through, so that pieces of fibre 11 will exit the pinch (indicated by a dashed line).

[0028] In this embodiment, pressure roller 3 is made of a metal, as are knives 7, and pressure ribs 8 are made of a flexible plastic. Since the cutting edge of the knives 7 does not come into contact with the bottom of grooves 9, the amount of wear, in particular on pressure roller 3, is extremely small. A proper cutting action is nevertheless obtained, due to the fact that the fibre 10 is firmly clamped down during cutting.

[0029] Figure 2 is a top plan view of the device of Figure 1. Mounted on shaft 12 of knife roller 2 is a gear 13, which gear meshes with gear 14 mounted on shaft 15 of pressure roller 3. Gears 13, 14 have the same diameter as the respective roller 2, 3, so that rollers 2, 3 will rotate at the same peripheral velocity. Shafts 12, 15 are supported in frame 1 by means of bearings 4, 5, and shaft 15 of pressure roller 3 is connected to a driving

shaft 16 for driving rollers 2, 3.

[0030] Figures 3 - 6 all schematically illustrate the pinch between rollers 2, 3, showing the knife roller 2 positioned above pressure roller 3. Arrows 6 indicate the direction of rotation.

[0031] Figure 3 shows the simplest embodiment. The figure shows that fibre 10 is engaged, on the left-hand side of the pinch, by the pressure rib 8 after said fibre has already been pressed slightly into groove 9 by knife 7. After clamping down the fibre, the knife will move further into the groove, cutting through the fibre. On the right-hand side of the pinch, the pieces of fibre 11 thus formed exit the pinch.

[0032] Figure 4 shows a pressure roller 3, wherein the circumferential surface between the grooves does not extend cylindrically, but obliquely, that is, it includes an angle with the tangential direction. These portions of the circumferential surface are indicated at 17. Because of this arrangement, the ends of successive pieces of fibre 11 will not come into contact with each other as long as the pieces of fibre 11 are clamped down. This prevents said ends from getting damaged. Moreover, the pieces of fibre 11 will fall separately from the pinch.

[0033] Figure 5 shows an embodiment wherein the pressure rib 8 is provided with a recess 18, which enables the knife to move further into the groove, because the pressure ribs 8 can be compressed further without this leading to a strongly increased pressure force.

[0034] Figure 6 shows an embodiment wherein the circumferential surface 17 of the pressure roller 3 between grooves 9 not only extends obliquely, as is the case in Figure 4, but in addition is concave. This is conducive towards a proper engagement of fibre 10, since pressure roller 8 remains stably positioned in the deepest portion of the concave shape.

[0035] Figure 7 is a more detailed view of the shape of pressure roller 3 of Figure 6, wherein the oblique position of groove 9 is clearly shown, which appears to function well in practice. Figure 7 furthermore shows that the edge 32, which forms the transition between groove 9 and surface 17, has a relatively large radius, so that fibre 10, which is stretched over said edge 32 during cutting, will not be damaged and will not break.

[0036] Figure 6 furthermore shows an advantageous way of mounting pressure rib 8. Knife roller 2 is to that end provided with mounting sections 19, which extend in axial direction between knives 7. Before knives 7 are mounted in knife roller 8, the pressure ribs 8 are placed onto mounting sections 19, which is possible because they are made of a flexible material. By subsequently placing knives 7 into slots formed in knife roller 2 for that purpose, the pressure ribs 8 are slightly compressed in lateral direction, as a result of which they cannot become detached from mounting sections 19.

[0037] Figure 8 shows a number of embodiments of the pressure rib 8 in elevation, which pressure ribs 8 are mounted on a mounting section 19. Said pressure ribs are provided with recess 18 (embodiments B, C and D) and/or cavities 20 (embodiments A and C), which makes them more easily compressible. Recesses 18 or cavities 20 may be filled with a flexible and/or compressible material, such as a foam material. Figure 8 (E) is a side elevation of the mounting section 19 with pressure rib 7 of Figure 8 (D).

[0038] Figure 9 shows a knife roller 2 in longitudinal sectional view. The knife roller 2 is mounted on a shaft 12, which shaft comprises a portion 21 having a larger diameter present within knife roller 2, on which portion 21 the knife roller 2 is mounted by means of a key 22. The parts of knife roller 2 that are mounted on shaft 12 are shown in exploded view in Figure 10. They include two end flanges 23, 24 with a knife disc 25 positioned therebetween. In Figure 11 said knife disc 25 is shown in elevation according to line XI - XI in Figure 10. Figure 11 shows the slots 26 into which the knives 7 can be moved, and the mounting sections 19 positioned therebetween. Figure 11 furthermore shows a knife 7, which knife 7 is shown in side elevation.

[0039] Line X - X in Figure 11 indicates the section along which knife disc 25 is shown in Figure 10. It will be apparent that the knives 7 can be moved into slots 26 after the pressure ribs 8 have been placed onto the mounting sections 19. Then the knife disc 25 is mounted on portion 21 of shaft 12, after which the two end flanges 23, 24 are mounted in position by means of bolts (not shown), which extend through holes 27 and which are screwed into threaded holes 28. Knives 7 are retained by the ends 29 of knives 7, which extend into recesses 20 of the end flanges.

Preferred features:

[0040] A method for cutting fibres into pieces, wherein a fibre (10) is divided into pieces by pressing a knife (7) against the fibre (10) without exerting a substantial counterpressure on the other side of the fibre (10) where the knife (7) is present.

[0041] The fibre (10) is led between a knife roller (2), which is fitted with several, substantially axially oriented knives (7), and a pressure roller (3), which rollers (2, 3) are driven in opposite directions at the same peripheral velocity, wherein the fibre (10) is clamped down between pressure ribs (8), which are present between the knives (7) on the knife roller (2), and the pressure roller (3), wherein a knife (7) cuts through the fibre (10) substantially without counterpressure from the pressure roller (3).

[0042] The knife (7) extends into a groove in the pressure roller (3) during cutting, to a depth some distance from the bottom of said groove (9).

[0043] Said pressure rib (8) deforms more than the pressure roller (3) at the location where said clamping down takes place.

[0044] The material of which the pressure ribs (8) are made is more flexible than the material of which the surface (17) of the pressure roller (3) is made.

[0045] A cavity (20) or recess (18) is present in the material of the pressure rib (8).

[0046] Said pressure rib (8) tapers off, seen in cross-sectional view, at least near the part which extends radially outwards.

[0047] Said pressure rib (8) includes a substantially flat tangentially oriented part, which adjoins two sloping lateral surfaces, which extend as far as the knives (7).

[0048] The radially outwardly extending part of the pressure rib (8) is positioned closer to the cutting edge of the preceding knife (7) than to the cutting edge of the next knife (7), seen in the direction of movement.

[0049] The knives (7) are fixedly mounted on the knife roller (2), and the pressure ribs (8) between the knives (7) extend substantially as far in radially outward direction as the knives (7), and in that the pressure ribs (8) are pressed between the cutting knife (7) and the knives (7) adjacent thereto during cutting, to a position wherein they extend less far in radially outward direction than the cutting knife (7), the difference preferably being 0.3 mm or more, more preferably 0.7 mm or more, and even more preferably 1.2 or more.

[0050] The knife roller (2) is provided with a substantially axially extending mounting section, and in that the pressure rib (8) is provided on the radially inward side with a recess corresponding to the mounting section (19), which engages round said mounting section (19).

[0051] Said mounting section (19) is a strip mounted on the knife roller (2), which strip comprises a widened portion at its radial outer edge, around which the pressure rib (8) engages.

[0052] The pressure rib (8) is made of a flexible material, the width of which material is greater than that of the space between the knives (7), so that the pressure rib (8) is clampingly engaged between the knives (7) under deformation.

[0053] The surface of the pressure roller (3) is made of a metal or other hard material.

[0054] The pressure rib (8) presses the fibre (10) against the pressure roller (3) at a location where the surface (17) of the pressure roller (3) is concave, seen in cross-sectional view.

[0055] The pressure rib (8) presses the fibre (10) against the pressure roller (3) at a location where the surface (17) of the pressure roller (3) extends substantially obliquely with respect to the tangential plane.

[0056] Said obliqueness is such that the forwardly extending part of said surface, seen in the direction of movement, is positioned closer to the axis of rotation of the pressure roller (3) than the rearwardly extending part.

[0057] The circumferential surface of the pressure roller (3) is provided with substantially axially extending grooves, wherein the edge (32) between the side wall of the groove (9) and the adjoining part (17) of the circumferential surface of the pressure roller (3) is rounded, the radius thereof being larger than that of the cutting edge of the knife (7), said radius preferably being larger than 0.1 mm, more preferably larger than 0.2 mm.

[0058] A device for cutting fibres into pieces, wherein a fibre (10) is divided into pieces (11) by pressing a knife (7) against the fibre (10), said device including a knife roller (2) comprising several substantially axially oriented knives (7), and a pressure roller (3), which rollers (2, 3) can be driven in opposite directions at the same peripheral velocity, whereby the knives (7) are so arranged and the pressure roller (3) is so formed that the knives (7) are capable of pressing against the fibre (10) present between the rollers (2, 3) during cutting, without coming into contact with the pressure roller (3) thereby.

[0059] The circumferential surface of the pressure roller (3) is provided with substantially axially oriented grooves (9), into which the knives (7) can extend during cutting.

[0060] The material of which the pressure ribs (8) are made is more flexible than the material of which the surface of the pressure roller (3) is made.

[0061] A cavity (20) or recess (18) is present in the material of said pressure rib.

[0062] Said pressure rib (8) tapers off, seen in cross-sectional view, at least near the part which extends radially outwards.

[0063] Said pressure rib (8) includes a substantially flat tangentially oriented part, which adjoins two sloping lateral surfaces, which extend as far as the knives (7).

[0064] The radially outwardly extending part of the pressure rib (8) is positioned closer to the cutting edge of the preceding knife (7) than to the cutting edge of the next knife (7), seen in the direction of movement.

[0065] The knives (7) are fixedly mounted on the knife roller (2), and the pressure ribs (8) between the knives (7) can extend substantially as far in radially outward direction as the knives (7), and in that the pressure ribs (8) are pressed between the cutting knife (7) and the knives (7) adjacent thereto during cutting, to a position wherein they extend less far in radially outward direction than the cutting knife (7), the difference preferably being 0.5 mm or more, more preferably 1 mm or more.

[0066] The knife roller (2) is provided with a substantially axially extending mounting section, and in that the pressure rib (8) is provided on the radially inward side with a recess corresponding to the mounting section (19), which engages round said mounting section (19).

[0067] The mounting section (19) is a strip mounted on the knife roller (2), which strip comprises a widened portion at its radial outer edge, around which the pressure rib (8) engages.

[0068] The pressure rib (8) is made of a flexible material, the width of which material is greater than that of the space between the knives (7), so that the pressure rib (8) is clampingly engaged between the knives (7) under deformation.

[0069] The surface of the pressure roller (3) is made of a metal or other hard material.

[0070] The pressure rib (8) presses the fibre (10) against the pressure roller (3) at a location where the

surface (17) of the pressure roller (3) is concave, seen in cross-sectional view.

[0071] The pressure rib (8) presses the fibre (10) against the pressure roller (3) at a location where the surface (17) of the pressure roller (3) extends substantially obliquely with respect to the tangential plane.

[0072] Said obliqueness is such that the forwardly extending part of said surface, seen in the direction of movement, is positioned closer to the axis of rotation of the pressure roller (3) than the rearwardly extending part.

[0073] The circumferential surface of the pressure roller (3) is provided with substantially axially extending grooves, wherein the edge (32) between the side wall of the groove (9) and the adjoining part (17) of the circumferential surface of the pressure roller (3) is rounded, the radius thereof being larger than that of the cutting edge of the knife (7), said radius preferably being larger than 0.1 mm, more preferably larger than 0.2 mm.

Claims

1. A device for cutting fibres into pieces, wherein a fibre (10) is divided into pieces (11) by pressing a knife (7) against the fibre (10), said device including a knife roller (2) comprising several substantially axially oriented knives (7) and pressure ribs (8) which are present between the knives (7), and a pressure roller (3), which rollers (2, 3) can be driven in opposite directions at the same peripheral velocity, **characterized in that** the knife roller (2) is provided with substantially axially extending mounting sections (19), and **in that** the pressure ribs (8) are provided on the radially inward side with a recess corresponding to the mounting section (19), which engages round said mounting section (19).

2. A device according to claim 1, **characterized in that** the material of which the pressure ribs (8) are made is more flexible than the material of which the surface of the pressure roller (3) is made.

3. A device according to claims 1 or 2, **characterized in that** a cavity (20) or recess (18) is present in the material of said pressure rib (8).

4. A device according to any one of the claims 1 - 3, **characterized in that** said pressure rib (8) tapers off, seen in cross-sectional view, at least near the part which extends radially outwards.

5. A device according to claim 4, **characterized in that** said pressure rib (8) includes a substantially flat tangentially oriented part, which adjoins two sloping lateral surfaces, which extend as far as the knives (7).

6. A device according to any one of the claims 1 - 5, **characterized in that** the radially outwardly extending part of the pressure rib (8) is positioned closer to the cutting edge of the preceding knife (7) than to the cutting edge of the next knife (7), seen in the direction of movement.

7. A device according to any one of the claims 1 - 6, **characterized in that** the knives (7) are fixedly mounted on the knife roller (2), and the pressure ribs (8) between the knives (7) can extend substantially as far in radially outward direction as the knives (7), and **in that** the pressure ribs (8) are pressed between the cutting knife (7) and the knives (7) adjacent thereto during cutting, to a position wherein they extend less far in radially outward direction than the cutting knife (7), the difference preferably being 0.5 mm or more, more preferably 1 mm or more.

8. A device according to any one of the claims 1 - 7, **characterized in that** said mounting section (19) is a strip mounted on the knife roller (2), which strip comprises a widened portion at its radial outer edge, around which the pressure rib (8) engages.

9. A device according to any one of the claims 1 - 8, **characterized in that** the pressure rib (8) is made of a flexible material, the width of which material is greater than that of the space between the knives (7), so that the pressure rib (8) is clampingly engaged between the knives (7) under deformation.

10. Pressure rib (8) for mounting on a substantially axially extending mounting sections (19) between substantially axially oriented knives (7) of a knife roller (2) of a device for cutting fibres into pieces, wherein a fibre (10) is divided into pieces (11) by pressing the knives (7) against the fibre (10), said device further comprising a pressure roller (3), which rollers (2, 3) can be driven in opposite directions at the same peripheral velocity, wherein the pressure rib (8) is provided on the radially inward side with a recess corresponding to the mounting section (19), which engages round said mounting section (19).

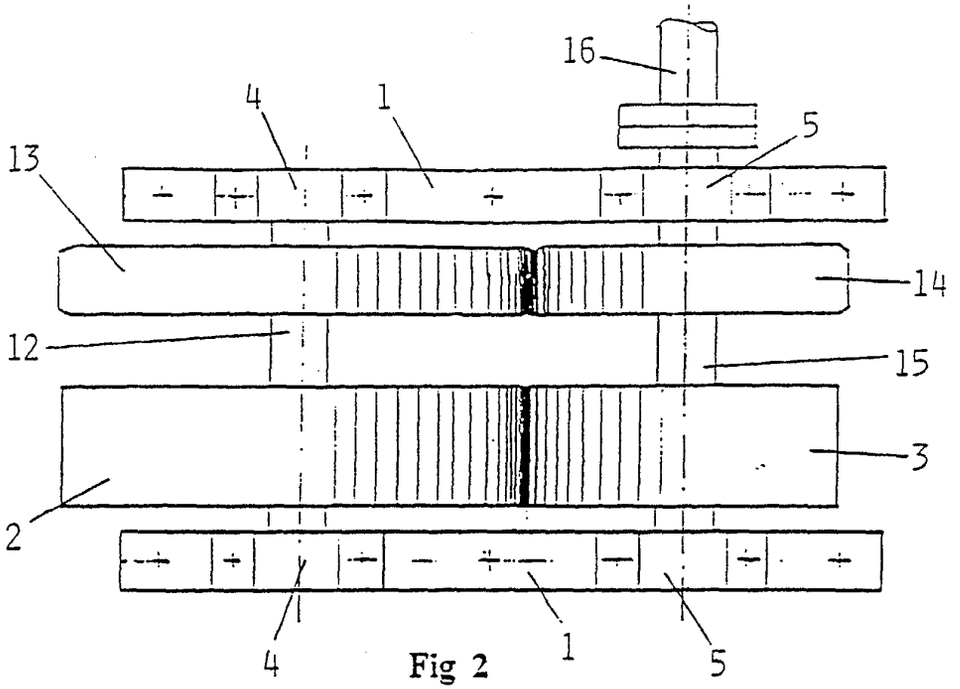

Fig 2

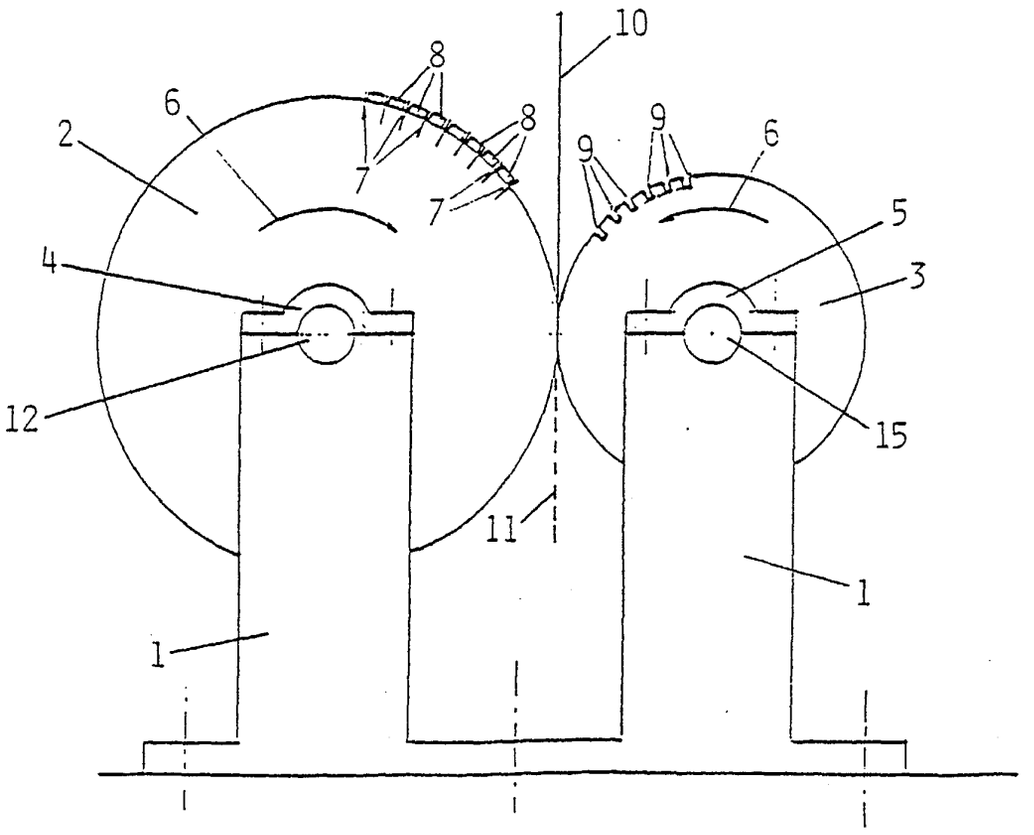

Fig 1

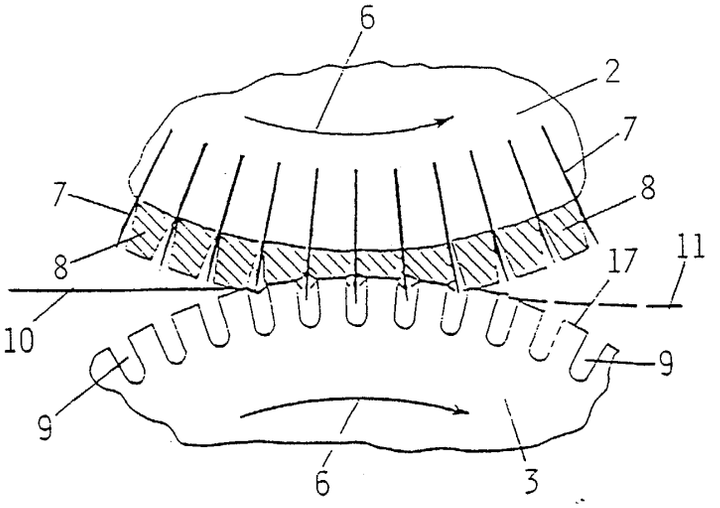

Fig 3

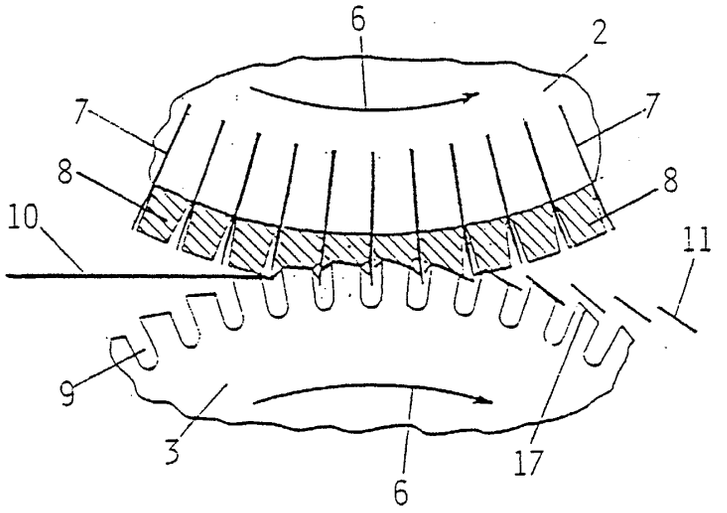

Fig 4

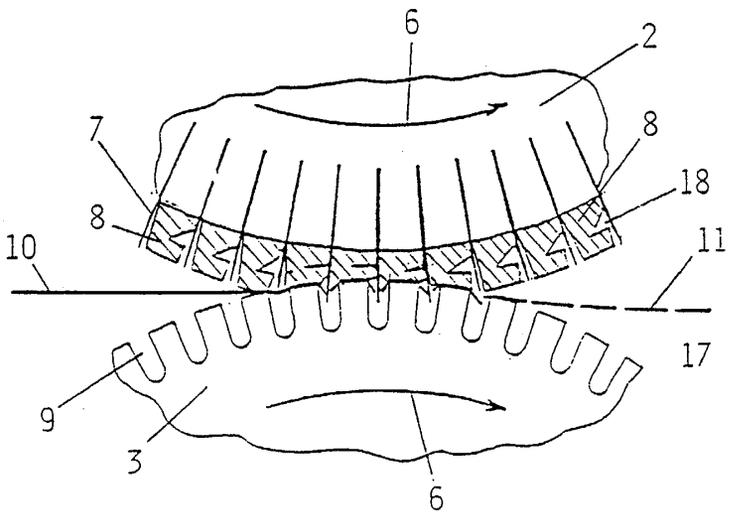

Fig 5

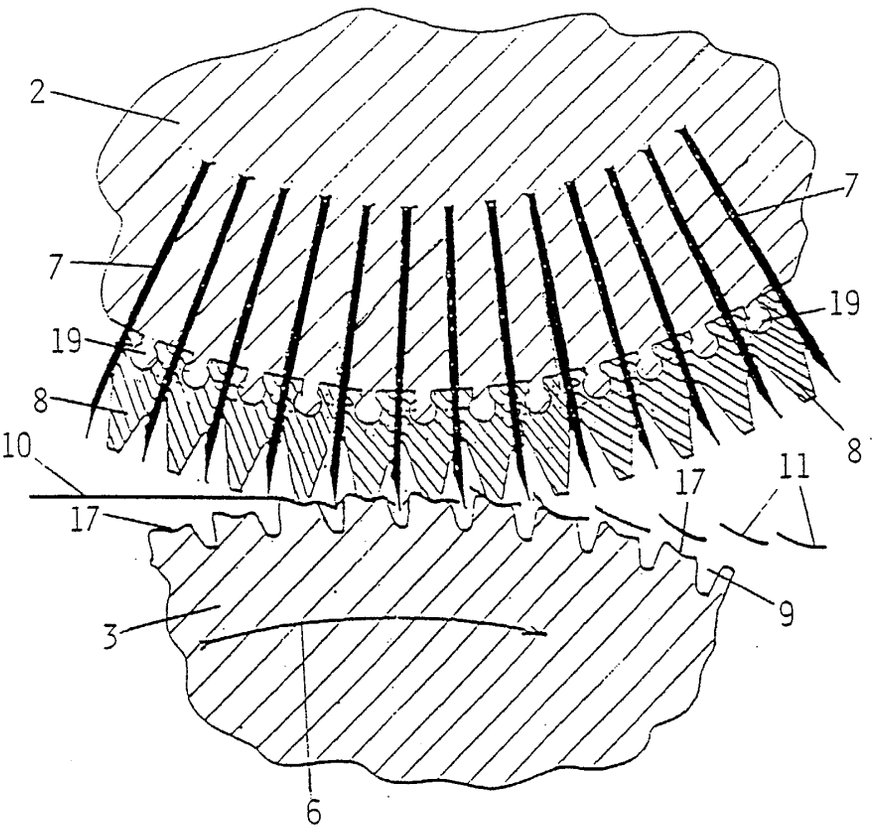

Fig 6

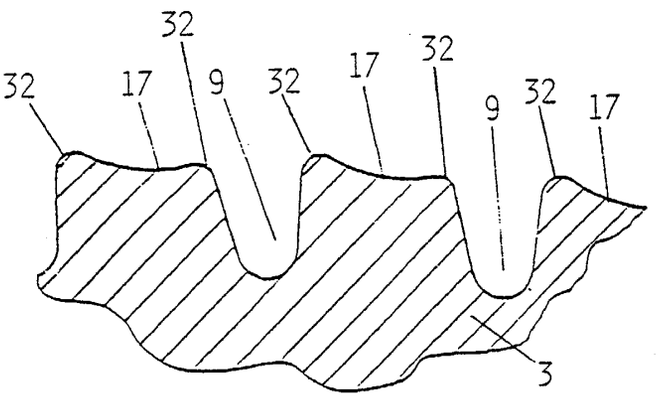

Fig 7

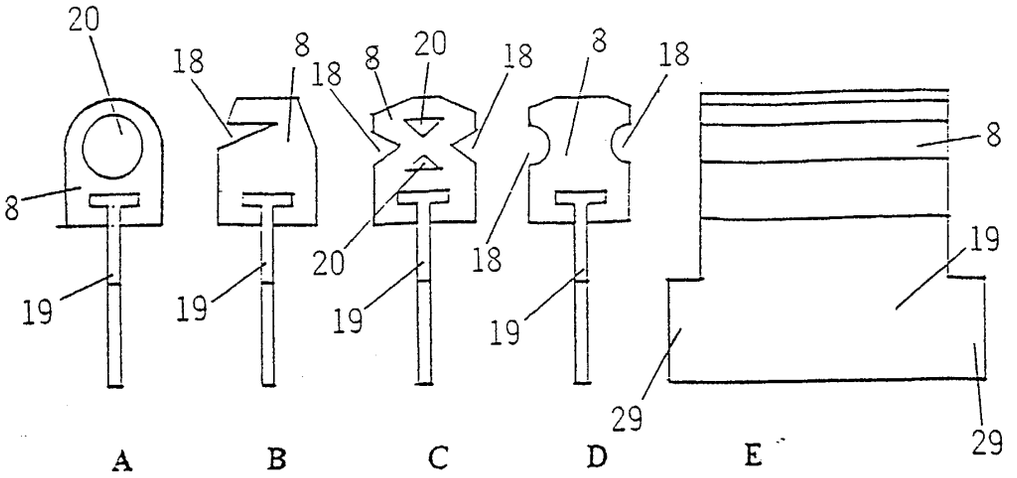
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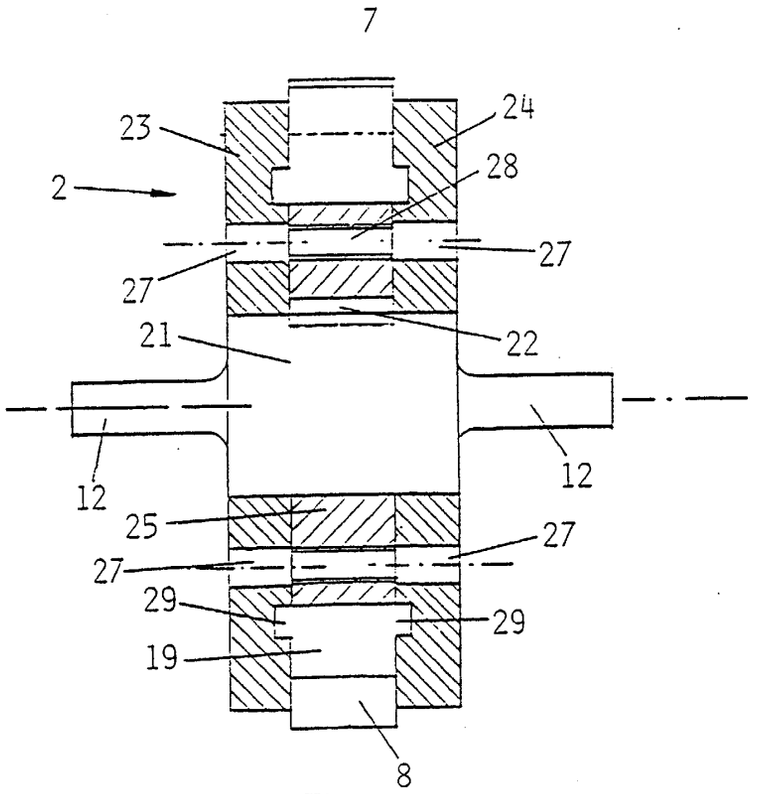
Fig 8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19
8

Fig 9

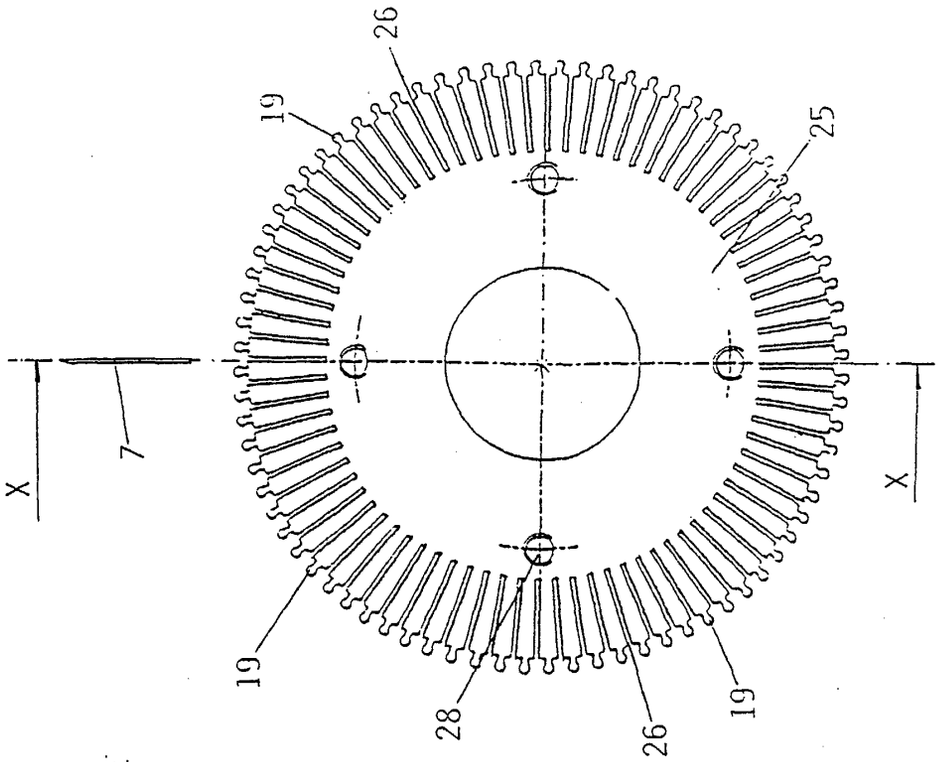
26
19
25
X
7
X
19
28
26
19

Fig 11

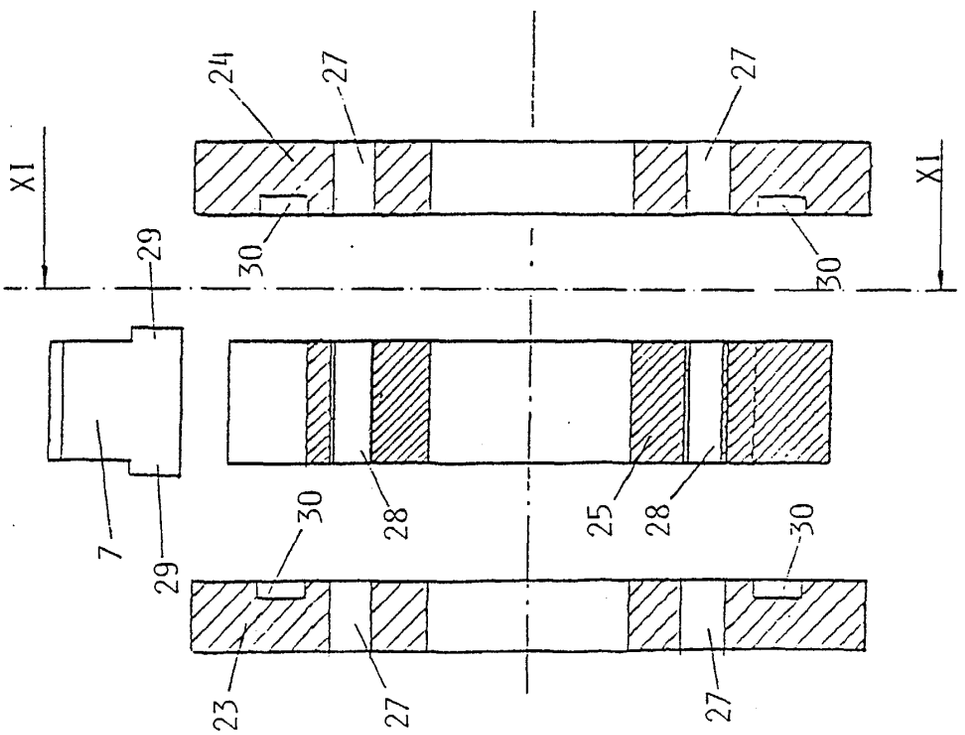
24
27
27
X1
X1
29
30
30
7
29
30
28
25
28
30
23
27
27

Fig 10