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(54) METHOD AND DEVICE FOR GRINDING STRAND-LIKE FIBROUS MATERIAL

VERFAHREN UND VORRICHTUNG ZUM SCHLEIFEN EINES STRANGFÖRMIGEM
FASERMATERIALS

PROCÉDÉ ET DISPOSITIF DE BROYAGE D'UNE MATIÈRE FIBREUSE DU TYPE BRIN

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Description

FIELD OF THE INVENTION

[0001] The disclosure relates to a method for grinding strand-like fibrous material according to the preamble of Claim 1 as filed, and to a device for performing the method according to the preamble of Claim 8 as filed.

BACKGROUND OF THE INVENTION

[0002] It is generally known that, in order to manufacture a non-woven fabric using an airlaid process, the fibers and fibrous shreds used in the process are produced beforehand by grinding a strand-like fibrous material. Notably, natural fibers such as those made from cellulose are manufactured from this type of fibrous web. The grinding and shredding preferably takes place in what are referred to as hammer mills, where the fibrous material is fed onto the transversely aligned cutting edge of a cutting mechanism and wherein several striking elements arranged on a drum strike one end of the fibrous material projecting over the cutting edge.

[0003] A device of this type and a method of this type are, for example, already known from DE 22 45 819 A1. In the known device, the cutting edge is formed into a casing by a slotted inlet opening which encases a drum body with a plurality of striking elements. In this process, the striking elements are advanced to the inner end of the slot leaving a narrow clearance, such that the incoming fibrous material is ground by the rotating drum body. Devices of this type have the great disadvantage that very irregular fibrous shreds are produced where relatively elastic fibrous materials are used. Due to the elasticity of the fibrous material, the breaks in the fibrous material occur primarily beyond the cutting edge.

[0004] In the prior art, therefore, a method and a device are known with which the fibrous material is immobilized by an additional clamping mechanism in the region of the cutting edge. The known method and the known device are described in EP 0 386 017 B1. Here, the fibrous material is fed to the cutting edge of the cutting mechanism. A clamping mechanism is arranged at a short distance from the cutting mechanism, which features two opposing clamping jaws that grip on the lower surface and the upper surface of the fibrous material. One of the clamping jaws is designed to be moveable and this results in the fibrous material being clamped in an oscillating manner. Hence, this lends additional stability to the fibrous material during grinding.

[0005] The known method and the known device, however, have a great disadvantage insofar as the point in time at which the fibrous material is clamped and the point in time at which the fibrous material is ground must be synchronized with each other in order to obtain fibrous shreds in defined sizes. Furthermore, it is impossible with the known method and device to produce very fine fibrous shreds because of the interval as designed between the

cutting mechanism and the clamping mechanism.

[0006] Thus, the object of the disclosure is to develop a generic method for grinding fibrous materials and a generic device for performing the method, such that the fibrous material can be continuously ground into very fine fibrous shreds.

[0007] A further aim of the disclosure is to produce an optimally continuous grinding process with a continuous material feed.

SUMMARY OF THE INVENTION

[0008] This object is achieved according to the present disclosure with a method in which the fibrous material is fed through a clamping gap between the clamping mechanism and the cutting mechanism, which is designed to oscillate, wherein the clamping mechanism is guided in a back and forth clamping movement relative to the cutting mechanism.

[0009] In the device according to the present disclosure, the solution is achieved by the clamping mechanism and the cutting mechanism being arranged opposite one another in a clamping plane in order to form a clamping gap, wherein the clamping mechanism may be guided in a back and forth clamping movement relative to the cutting mechanism.

[0010] Further advantageous refinements of the disclosure are defined by the features and feature combinations of the respective dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a schematic view of a first embodiment of the device according to the present disclosure for carrying out the method according to the present disclosure.

FIG. 2 is a schematic view of a further embodiment of the device according to the present disclosure.

FIG. 3 is a schematic cross-sectional view of a further embodiment of the device according to the present disclosure.

FIG. 4 is a schematic plan view of the embodiment in FIG. 3.

FIG. 5 is a schematic cross-sectional view of the clamping mechanism of the embodiment in FIG. 3.

FIG. 6 is a schematic cross-sectional view of the drive shaft of the embodiment of the clamping mechanism in FIG. 5.

DETAILED DESCRIPTION OF THE INVENTION

[0012] The disclosure has a particular advantage insofar as the fibrous material is immobilized directly at the cutting edge of the cutting mechanism during grinding. Consequently, the fibrous material may be ground uniformly into very fine fibrous shreds. Undefined breaks in

the material beyond the cutting edge are prevented.

[0013] The cutting mechanism and the clamping mechanism act on the fibrous material in one clamping plane such that the fibrous material is immobilized on its upper surface and on its lower surface in the region of the cutting edge. Depending on the lay direction, the cutting edge can be formed on the upper surface or on the lower surface of the fibrous material. Accordingly, the clamping mechanism would be arranged on the lower surface or the upper surface of the fibrous material.

[0014] In order to maintain a continuous process with ground fibers exhibiting optimally uniform fiber quality in spite of the fibrous material being clamped, the method variation is particularly preferred in which the fibrous material is also transported by a feeding movement of the clamping mechanism relative to the cutting mechanism. Advantageously, the fibrous material may be continuously advanced in the phases in which there is no clamping.

[0015] In order to perform the variation according to the present disclosure, a further modification of the device according to the present disclosure features a mechanical linkage by which the clamping mechanism is guided in order to perform a superimposed advancing movement. Hence, multiple degrees of freedom of movement at the clamping mechanism may be produced by a drive.

[0016] In order to guarantee optimally consistent material feeding and consistent clamping of the fibrous material, it is preferable to use the variant method in which the fibrous material is clamped in the clamping gap by multiple movable clamping jaws of the clamping mechanism opposite the cutting mechanism, wherein a number of the clamping jaws are moved asynchronously in parallel and a number of the clamping jaws are moved synchronously. Thus, the clamping movements and the advancing movements of the clamping jaws may be made by the clamping jaws moving asynchronously. The synchronously moving clamping jaws, which are spread advantageously over the width of the clamping gap, guarantee immobilization as well as a continuous grinding of the fibrous material at the cutting edge of the cutting mechanism.

[0017] The device according to the present disclosure features a cutting mechanism for this purpose with multiple clamping jaws which may be moved in parallel, wherein the clamping jaws are divided into a number of drive units and where the clamping jaws of adjacent drive units may be moved asynchronously and the clamping jaws of one of the drive units may be moved synchronously. Dividing the clamping jaws into multiple drive units has the particular advantage that the interaction of the advancing movement and the clamping movement may be produced evenly distributed over the width of the fibrous material. Hence, very large working widths of fibrous material may also be advantageously ground into fibrous shreds.

[0018] In order to produce a uniform movement of the fibrous material, the variation of the method of the dis-

closure is particularly advantageous in which each of the clamping jaws of the clamping mechanism are moved for clamping and for transporting the fibrous material on an elliptical guide path. Hence, the clamping jaws may accomplish a cyclic movement, with which the fibrous material may be continually advanced in the clamping gap. Here, the advancing movement of the clamping jaws essentially determines the length of the ellipse.

[0019] Hence, according to a further advantageous modification of the device according to the present disclosure, the mechanical linkage to the clamping jaw drive is designed so that that each of the clamping jaws of the clamping mechanism are movable on an elliptical guide path.

[0020] In order to be able to produce a predetermined quantity of fibers per unit time where fibrous materials and fibrous shreds differ each time, it is also provided that the movement of the clamping jaws of the clamping mechanism is produced by a powered drive shaft with a controllable electric motor. Hence, the actual advancing movement of the fibrous material may be easily adjusted via a rotational speed control for the drive shaft input speed.

[0021] In order to perform the method variation according to the present disclosure, the modification of the device of the present disclosure features a drive shaft connected to the mechanical linkage, which is connected to a controllable electric motor and a controller. The drive shaft, and hence the mechanical linkage, may be operated at a predetermined rotational speed using the controller and the electric motor.

[0022] In order to be able to grind different fibrous materials, a variation of the method is preferably used, in which the clamping gap between the cutting mechanism and the clamping mechanism is adjusted by setting the spacing for the clamping mechanism to the particular thickness of the fibrous material. Hence, notably, the clamping forces acting on the fibrous material may be adjusted such that, along with immobilization, advancing the fibrous material in the clamping gap is also possible.

[0023] In order to fragment the fibrous material, a variation of the method is particularly advantageous in which the fibrous material is fragmented at the cutting edge of the cutting mechanism by multiple striking elements attached to a rotating drum, which passes at a short distance from the cutting edge. Hence, fine fibrous shreds may also be produced where the feeding movements of the fibrous material are relatively high. The striking elements may be operated with a relatively high striking frequency, relative to the cutting edge of the cutting mechanism.

[0024] In order to convey the fibrous material in the clamping gap right up to the cutting edge, the clamping jaws of the clamping mechanism are preferably designed according to a further advantageous modification of the device according to the present disclosure, in which the clamping jaws feature a guide section and a clamp section. Here, the clamp section of the clamping jaw extends

parallel to a knife plate forming the cutting edge of the cutting mechanism, where, however, the guide section of the clamping jaw is connected to gear elements of the mechanical linkage by multiple pivots.

[0025] One of the gear elements is preferably designed as a connecting rod, which is connected to the drive shaft via an eccentric plate, and to the clamping jaw via the pivot. This advantageously allows an oscillating advancing movement to be produced at the clamping jaw. In the process, the superimposed clamping movement is advantageously transferred to the clamping jaw via a cam disk, which cooperates with a guide surface at the guide section of the clamping jaw.

[0026] In order to maintain the movement of the clamping jaw in a straight alignment to the clamping gap, provision has also been made for the guide section of the clamping jaw to be connected via a further pivot on one lead end to one of multiple sliding blocks, which is guided on a guide rail.

[0027] The clamping jaws are advantageously designed as bars such that one clamp end on the clamp section faces the lead end of the guide section. In this respect, to adjust the clamping gap, it is advantageous for the guide rail of the sliding blocks to be cradled in a height-adjustable rail support whose height determines the distance between one clamp end of the clamping jaw and the knife plate.

[0028] The method according to the present disclosure and the device according to the present disclosure are particularly suitable for producing very fine fibers from fibrous materials relatively quickly with a high degree of uniformity. Hence, the fibrous shreds produced are particularly suitable for laying down as a mat of fibers immediately after grinding. The strand-like fibrous material may be produced as a lap or as a stack of fiberboards.

[0029] The disclosure is explained in greater detail below by means of a number of embodiments of the device according to the present disclosure for performing the method according to the present disclosure, with reference to the attached figures.

[0030] In FIG. 1, a first embodiment of the device according to the present disclosure for carrying out the method according to the present disclosure for grinding a strand-like fibrous material is shown schematically in a cross-sectional view. The embodiment features a fixed cutting mechanism 1, on one free end of which is formed a cutting edge 3. In this embodiment, the cutting mechanism 1 is designed as a knife plate 2, on one free end of which the cutting edge 3 is formed. The knife plate 2 is arranged on a plate support 4.

[0031] A clamping gap 10 is formed by arranging a movable clamping mechanism 8 on the cutting mechanism 1. In this embodiment, the clamping mechanism 8 is designed as an oblong clamping jaw 9, which together with the opposing knife plate 2 forms the clamping gap 10. The clamping jaw 9 extends essentially as far as the cutting edge 3 of the knife plate 2. The clamping jaw 9 is connected to a clamp drive 11, which, in this embodiment,

is designed as a linear drive 12. The linear drive 12 guides the clamping jaw 9 in a back and forth clamping movement relative to the knife plate 2, such that the fibrous material 13 advanced between the knife plate 2 and the clamping jaw 9 is clamped in an oscillating manner.

[0032] Associated with the cutting mechanism 1 is a striking mechanism 5, which is positioned a short distance from the cutting edge 3. In this embodiment, the striking mechanism 5 is formed by a drum 7 and a plurality of striking elements 6, which are uniformly arranged about the circumference of the drum 7. The striking elements 6 are moved by the drum 7 on a revolving guide plane at a short distance from the cutting edge 3 of the cutting mechanism 1.

[0033] A feed mechanism 14, by which the fibrous material 13 is advanced into the clamping gap 10 between the cutting mechanism 1 and the clamping mechanism 8, is arranged on the cutting mechanism 1, on the side opposite the striking mechanism 5. The feed mechanism 14 is designed as two powered feed drums 15, which act on the fibrous material 13 in a conveyor gap.

[0034] In the embodiment of the device according to the present disclosure for carrying out the method of grinding strand-like fibrous material according to the present disclosure shown in FIG. 1, the fibrous material 13 is initially fed into the cutting mechanism 1 via the feed drums 15. The fibrous material 13 is fed through the clamping gap 10 towards the striking mechanism 5. Here, the free end of the fibrous material 13 is continuously broken up and ground into shreds by the striking elements 6 positioned on the drum 7. In order to obtain an optimally defined reduction and degradation of the fibrous shreds, the clamping mechanism 8 facing the cutting edge 3 is oscillated back and forth, such that the fibrous material is immobilized by oscillating clamping, right to the cutting edge 3 in the clamping gap 10. Here, a clamping frequency predetermined by the clamp drive 11 may be synchronized with a striking frequency determined by the drive of the drum 7, such that the striking elements 6 always strike the free end of the fibrous material 13 in a clamped condition. In the phase in which the clamping jaw 9 is guided by the linear drive in a reverse movement, the free end of the fibrous material 13 is repositioned by the advance of the feed mechanism 14. In this respect, a continual process for grinding the fibrous material takes place.

[0035] A further embodiment of the device according to the present disclosure for carrying out the method according to the present disclosure for grinding strand-like fibrous materials is shown schematically in cross-section in FIG. 2. The design of the cutting mechanism 1 and of the striking mechanism 5 in this embodiment is identical to those in the above-mentioned embodiment, such that no further explanation is required for this purpose and reference is made to the above description.

[0036] Likewise, the clamping mechanism 8 is in the form of a clamping jaw 9, which, together with the knife plate 12, forms the clamping gap 10 for immobilizing the

fibrous material 13. In the embodiment shown in FIG. 2, the clamp drive 11 features a drive shaft 17 and a mechanical linkage 16, wherein one of the gear elements is connected to the clamping jaw 9. The mechanical linkage 16 is connected to the drive shaft 17 and the clamping jaw 9 via the gear elements 18, such that the clamping jaw 9 performs a superimposed advancing movement in addition to a clamping movement. Hence, the clamping jaw 9 is guided on an elliptical guide path 20 relative to the knife plate 2. Hence, in addition to clamping the fibrous material 13 in the clamping gap 10, the oscillating movement of the clamping jaw 9 simultaneously causes the material to advance. The striking mechanism 5 may be operated at a higher striking frequency compared with the clamping frequency of the clamp drive 11.

[0037] In order to be able to accomplish substantially consistent clamping and consistent feed at the fibrous material 13, preferably multiple clamping jaws 9 are arranged in parallel side by side within a working width and powered by separate mechanical linkages in the embodiment shown in FIG. 2, wherein the adjacent mechanical linkages of the clamping jaws are driven one after the other.

[0038] A clamp drive for the clamping mechanism of this type is illustrated in greater detail below in an embodiment of the device according to the present disclosure in FIG. 3 and FIG. 4. In FIG. 3, the embodiment is shown in a schematic cross-sectional view and in FIG. 4, in a schematic plan view. Where no explicit reference is made to one of the figures, the following description applies to both figures.

[0039] The embodiment of the device according to the present disclosure for carrying out the method according to the present disclosure for grinding strand-like fibrous material shown in FIG. 3 is particularly suitable for larger working widths.

[0040] In the embodiment shown in FIG. 3 and 4, the striking mechanism 5 is arranged inside a casing 21, whereby the striking mechanism is in the form of a powered drum 7 with a plurality of striking elements 6 projecting radially on the circumference of the drum 7. The ends of the drum 7 are rotatably mounted in the casing 21, with one end being connected to a drum drive 36.

[0041] On one side of the casing 21, a casing slot 22 extends parallel to the drum 7. The knife plate 2 of the cutting mechanism 1 is located in the casing slot 22 and the cutting edge 3 thereof projects inwards into the casing 21. The cutting edge 3 of the knife plate 2 terminates at a short distance from the striking elements 6. Here, the knife plate 2 is preferably designed to be adjustable, in order to be able to set a defined clearance between the cutting edge and the striking element 6.

[0042] Within the casing slot 22, a plurality of individually movable clamping jaws 9 are arranged at the knife plate 2. The clamping jaws 9 are designed identically and each is connected to a clamp drive 11.

[0043] For further explanation of the clamp drive 11, reference is also made to FIG. 5 and 6. A schematic

cross-sectional view of the clamp drive 11 is shown in FIG. 5. FIG. 6 shows a schematic cross-sectional view of the drive shaft of the clamp drive in FIG. 5. Where no explicit reference is made to one of the figures, the following description applies to both figures.

[0044] The clamping jaws 9 are arranged in parallel side by side and each is separately connected to the clamp drive 11. The connection of the individual clamping jaws 9 to the clamp drive 11 is expressly shown in the depiction in FIG. 5. In this respect, the connection of the clamping jaws 9 to the clamp drive 11 is first described in greater detail in the following, using the example of one of the clamping jaws 9. The clamping jaw 9 is designed as a bar and a clamp section 24 thereof projects into the casing slot 22. Together with the opposing knife plate 2, the clamp section 24 of the clamping jaw 9 forms the clamping gap 10. The clamp section 24 of the clamping jaw 9 features a clamp end 31 which extends to the cutting edge 3.

[0045] The clamping jaw 9 is connected to the clamp drive 11 via a guide section 25. The guide section 25 and the clamp section 24 are designed in this embodiment as a single piece.

[0046] In this embodiment, the clamp drive 11 is likewise formed by a mechanical linkage 16 with multiple gear elements 18, which are powered via a drive shaft 17. This produces a superimposed clamping movement and an advancing movement at the clamp jaw 9 via the mechanical linkage 16. Hence, the clamp section 24 is guided in an oscillating manner on an elliptical guide path 20. In order to initiate the advancing movement at the clamping jaw 9, the guide section 25 of the clamp jaw 9 is connected to the drive shaft 17 via a connecting rod 26 and an eccentric plate 27. The eccentric plate 27 is fixed to the drive shaft 17. The connecting rod 26 engages the guide section 25 of the clamping jaw 9 via a pivot 19.1. This allows an essentially vertically oriented advancing movement of the clamping jaw 9 to be produced.

[0047] In this example, a superimposed clamping movement is achieved by a cam disk 28 on the perimeter of the drive shaft 17, which acts upon a guide surface 37 of the guide section 25. The cam disk 28 is fixed to the drive shaft 17. Due to the design of the cam disk 28, the clamping jaw 9 may essentially be guided back and forth in a horizontally oriented clamping movement.

[0048] In order to enable a linear movement of the clamp section 24 for the advancing movement of the clamping jaw 9, a sliding block 29 is arranged on a lead end 30 of the guide section 25, which is connected to the guide section 25 of the clamping jaw 9 via a further pivot 19.2. The sliding block 29 moves along a guide rail 32, which is located on a rail support 33.

[0049] The height-adjustable rail support 33 is suspended in a machine frame 34. In this embodiment, the rail support 33 is supported on a diagonal surface of the machine frame 34, wherein the position of the rail support 33 may be changed by means of an adjustment mechanism 40. In addition, the clearance between the clamp

section 24 and the knife plate 2 is defined by the height adjustment of the rail support 33, such that the clamping gap 10 may be adjusted by adjusting the guide rail 32.

[0050] As can be particularly seen in the illustration in FIG. 6, the clamp jaws 9 are arranged in parallel, divided into multiple drive units which are operated one after the other by the drive shaft 17. By way of example, two drive units 35.1 and 35.2 for the clamping jaws 9 for this purpose are shown in FIG. 6. Each of the drive units, 35.1 and 35.2 respectively, is formed by three adjoining clamping jaws 9. The clamping jaws 9 of one of the drive units 35.1 or 35.2 are synchronously powered via the corresponding eccentric plates 27 and cam disks 28. The adjacent clamping jaws 9 of the adjacent drive unit 35.2, by contrast, are powered one after the other, such that the clamping jaws 9 of the drive unit 35.2 move asynchronously with the clamping jaws 9 of the drive unit 35.1. For this purpose, the corresponding eccentric plates 27 and cam disks 28 are attached to the circumference of the drive shaft 17 in their angular position, offset by a delay angle. Consequently, the plurality of clamping jaws 9 may be divided into multiple drive units distributed over a working width, such that the fibrous material is both immobilized and transported.

[0051] As can be seen in the illustration in FIG. 4, the drive shaft 17 of the clamp drive 11 is powered by an electric motor 38 and a controller 39. The drive shaft 17 may be driven via the controller 39 and the electric motor 38 at various rotational speeds, such that the feed and the clamping frequency are infinitely variable. Here, the clamping frequency is independent of the striking frequency of the striking mechanism 5 since a continuous immobilization predominates across the working width of the fibrous material.

[0052] Fibrous materials in a wide variety of widths, thicknesses or densities may be advantageously ground into fine fibers and shreds using the embodiments of the device according to the present disclosure shown. Immobilizing and clamping the fibrous material right up to the cutting edge of the cutting mechanism prevents larger, undefined end pieces of the fibrous material from being produced by the striking mechanism. Hence, the combination of the cutting mechanism and the clamping mechanism enables fibrous materials to be ground into uniform and defined shreds. This allows, in particular, for processing of plate-shaped fibrous materials.

List of Reference Numerals:

[0053]

1	Cutting mechanism
2	Knife plate
3	Cutting edge
4	Plate support
5	Striking mechanism
6	Striking element
7	Drum

8	Clamping mechanism
9	Clamping jaw
10	Clamping gap
11	Clamp drive
5 12	Linear drive
13	Fibrous material
14	Feed mechanism
15	Feed drums
16	Mechanical linkage
10 17	Drive shaft
18	Gear elements
19, 19.1, 19.2	Pivot
20	Elliptical guide path
21	Casing
15 22	Casing slot
23	Fiber outlet
24	Clamp section
25	Guide section
26	Connecting rod
20 27	Eccentric plate
28	Cam disk
29	Sliding block
30	Lead end
31	Clamp end
25 32	Guide rail
33	Rail support
34	Machine frame
35.1, 35.2	Drive unit
36	Drum drive
30 37	Guide surface
38	Electric motor
39	Controller
40	Adjustment mechanism

[0054] The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as "40 mm" is intended to mean "about 40 mm."

Claims

1. A method of grinding strand-like fibrous material, in which the strand-like fibrous material (13) is fed to a cutting edge of a cutting mechanism (1), in which at least one movable striking mechanism (5) for grinding the fibrous material (13) cooperates with the cutting mechanism (1) and in which a movable clamping mechanism (8) is arranged at the cutting mechanism, by means of which the fibrous material is clamped in an oscillating manner, wherein the fibrous material is fed through an oscillating clamping gap (10) formed between the clamping mechanism (8) and the cutting mechanism (1), and wherein the clamping mechanism (8) is moved in a back and forth

clamping movement relative to the cutting mechanism (1).

2. A method according to Claim 1, wherein the fibrous material is transported by an advancing movement of the clamping mechanism (8) relative to the cutting mechanism (1). 5
3. A method according to any one of Claims 1 or 2, wherein the clamping of the fibrous material is achieved in the clamping gap (10) by multiple movable clamping jaws (9) of the clamping mechanism (8) opposite the cutting mechanism (1), wherein a number of the clamping jaws (9) are moved asynchronously side by side, and wherein a number of the clamping jaws (9) are moved synchronously side by side. 10 15
4. A method according to Claim 3, wherein each of the clamping jaws (9) of the clamping mechanism (8) for clamping and transporting fibrous material are moved on an elliptical guide path. 20
5. A method according to Claim 4, wherein the movements of the clamping jaws (9) of the clamping mechanism (8) are produced by a powered driveshaft (17) with a controllable electric motor (38). 25
6. A method according to any one of the preceding claims, wherein the clamping gap (10) between the cutting mechanism (1) and the clamping mechanism (8) is adjusted by setting the clearance of the clamping mechanism (8) to the respective thickness of the fibrous material (13). 30 35
7. A method according to any one of the preceding claims, wherein the fibrous material (13) at the cutting edge (3) of the cutting mechanism (1) is ground by multiple striking elements (6) located on a rotating drum (7), which are moved at a short distance from the cutting edge (3). 40
8. A device for performing the method for grinding strand-like fibrous material according to any one of the Claims 1 to 7, having a cutting mechanism (1) which features a cutting edge (3) extending transversely to the fibrous material (13), a movable striking mechanism (5), which cooperates with the cutting mechanism (1) to grind the fibrous material (13) at a short distance from the cutting edge (3), and a clamping mechanism (8) arranged at the cutting mechanism (1), by means of which the fibrous material (13) are clamped in an oscillating manner, wherein the clamping mechanism (8) and the cutting mechanism (1) are arranged opposite one another in a clamping plane to form a clamping gap (10), wherein the clamping mechanism (8) is moved back and forth relative to the cutting mechanism (1) in a 45 50 55

clamping movement.

9. A device according to Claim 8, wherein the clamping mechanism (8) is guided by a mechanical linkage (16) for producing a superimposed advancing movement. 5
10. A device according to any one of Claims 8 or 9, wherein the clamping mechanism (8) is formed by multiple adjacent movable clamping jaws (9), in that the clamping jaws (9) are divided into multiple drive units (35.1, 35.2), and the clamping jaws (9) of adjacent drive units are moved asynchronously and the clamping jaws (9) of one of the drive units (35.1, 35.2) are moved synchronously. 10 15
11. A device according to Claim 10, wherein the clamping jaws (9) of the clamping mechanism (8) in each case may be moved in an elliptical guide path (20) by the mechanical linkage (16). 20
12. A device according to any one of Claims 9-11, wherein the mechanical linkage (16) may be powered by a drive shaft (17) and a controllable electric motor (38), which is connected to a controller (39). 25
13. A device according to any one of Claims 9-12, wherein the clamping jaws (9) feature a clamp section (24) and a guide section (25), in that the clamp section (24) of the clamping jaw (9) is oriented parallel to a knife plate (2) forming the cutting edge (3) of the cutting mechanism (1) and that the guide section (25) of the clamping jaw (9) is connected to gear elements (18) of the mechanical linkage (16) by multiple pivots (19.1, 19.2). 30 35
14. A device according to Claims 12 and 13, wherein the drive shaft (17) features multiple eccentric plates (27) and multiple cam disks (28), in that one of the eccentric plates (27) on each clamping jaw (9) is connected to one of the pivots (19.1, 19.2) by a connecting rod (26) of the clamping jaw (9), and in that one of the cam disks (28) on each clamping jaw (9) cooperates with a guide surface (37) formed on the guide section (25) of the clamping jaw (9). 40
15. A device according to any one of Claims 13 or 14, wherein in each case, the guide sections (25) of the clamping jaws (9) are connected to one of a multiple sliding blocks (29), which are moved along a guide rail (32), by a further pivot (19.1, 19.2) on a lead end (30). 45 50 55
16. A device according to Claim 15, wherein the guide rail (32) for the sliding blocks (29) is attached by a height-adjustable rail support (33), wherein a clearance between the clamp section (24) of the clamping jaw (9) and the knife plate (2) of the cutting mechanism (1) is adjustable. 60 65

nism (1) may be adjusted by adjusting the guide rails (32).

17. A device according to any one of Claims 8-16, wherein the striking mechanism (5) is formed by multiple striking elements (6) arranged on a rotating drum (7), which are distributed on the circumference of the drum (7) and which are positioned at a short distance from the cutting edge (3) of the cutting mechanism (1).

Patentansprüche

1. Verfahren zum Mahlen eines strangartigen Fasermaterials, wobei das strangartige Fasermaterial (13) einer Schneidkante eines Schneidmechanismus (1) zugeführt wird, wobei mindestens ein beweglicher Schlagmechanismus (5) zum Mahlen des Fasermaterials (13) mit dem Schneidmechanismus (1) zusammenarbeitet, und wobei ein beweglicher Klemmmechanismus (8) an dem Schneidmechanismus angeordnet ist, mit dessen Hilfe das Fasermaterial oszillierend festgeklemmt wird, wobei das Fasermaterial durch einen oszillierenden Klemmspalt (10) geführt wird, der zwischen dem Klemmmechanismus (8) und dem Schneidmechanismus (1) gebildet ist, und wobei der Klemmmechanismus (8) im Verhältnis zum Schneidmechanismus (1) in einer Rückwärts- und Vorwärts-Klemmbewegung bewegt wird.
2. Verfahren nach Anspruch 1, wobei das Fasermaterial durch eine fortschreitende Bewegung des Klemmmechanismus (8) im Verhältnis zum Schneidmechanismus (1) transportiert wird.
3. Verfahren nach einem der Ansprüche 1 oder 2, wobei das Klemmen des Fasermaterials in dem Klemmspalt (10) durch mehrere bewegliche Klemmbacken (9) des Klemmmechanismus (8) gegenüber dem Schneidmechanismus (1) erreicht wird, wobei eine Anzahl der Klemmbacken (9) asynchron nebeneinander bewegt wird, und wobei eine Anzahl der Klemmbacken (9) synchron nebeneinander bewegt wird.
4. Verfahren nach Anspruch 3, wobei jede der Klemmbacken (9) des Klemmmechanismus (8) zum Klemmen und Transportieren des Fasermaterials auf einem elliptischen Führungsweg bewegt werden.
5. Verfahren nach Anspruch 4, wobei die Bewegungen der Klemmbacken (9) des Klemmmechanismus (8) durch eine motorisierte Antriebswelle (17) mit einem steuerbaren Elektromotor (38) erzeugt werden.
6. Verfahren nach einem der vorhergehenden Ansprüche, wobei der Klemmspalt (10) zwischen dem

Schneidmechanismus (1) und dem Klemmmechanismus (8) durch Einstellen des Abstands des Klemmmechanismus (8) an die entsprechende Dicke des Fasermaterials (13) angepasst wird.

7. Verfahren nach einem der vorhergehenden Ansprüche, wobei das Fasermaterial (13) an der Schneidkante (3) des Schneidmechanismus (1) durch mehrere Schlagelemente (6) gemahlen wird, die sich an einer rotierenden Walze (7) befinden und in einer kurzen Entfernung von der Schneidkante (3) bewegt werden.
8. Vorrichtung zum Durchführen des Verfahrens zum Mahlen des strangartigen Fasermaterials nach einem der Ansprüche 1 bis 7, aufweisend einen Schneidmechanismus (1), der eine Schneidkante (3) aufweist, die sich quer zum Fasermaterial (13) erstreckt, einen beweglichen Schlagmechanismus (5), der mit dem Schneidmechanismus (1) zusammenarbeitet, um das Fasermaterial (13) in einer kurzen Entfernung von der Schneidkante (3) zu mahlen, und einen Klemmmechanismus (8), der an dem Schneidmechanismus (1) angeordnet ist, mit dessen Hilfe das Fasermaterial (13) in einer oszillierenden Weise geklemmt wird, wobei der Klemmmechanismus (8) und der Schneidmechanismus (1) in einer Klemmebene einander gegenüber angeordnet sind, um einen Klemmspalt (10) zu bilden, wobei der Klemmmechanismus (8) in einer Klemmbewegung vorwärts und rückwärts im Verhältnis zum Schneidmechanismus (1) bewegt wird.
9. Vorrichtung nach Anspruch 8, wobei der Klemmmechanismus (8) durch eine mechanische Verbindung (16) geführt wird, um eine überlagerte fortschreitende Bewegung zu erzeugen.
10. Vorrichtung nach einem der Ansprüche 8 oder 9, wobei der Klemmmechanismus (8) durch mehrere benachbarte bewegliche Klemmbacken (9) in der Weise gebildet ist, dass die Klemmbacken (9) auf mehrere Antriebseinheiten (35.1, 35.2) verteilt sind und die Klemmbacken (9) benachbarter Antriebseinheiten asynchron bewegt werden und die Klemmbacken (9) einer der Antriebseinheiten (35.1, 35.2) synchron bewegt werden.
11. Vorrichtung nach Anspruch 10, wobei die Klemmbacken (9) des Klemmmechanismus (8) durch die mechanische Verbindung (16) in jedem Fall auf einem elliptischen Führungsweg (20) bewegt werden können.
12. Vorrichtung nach einem der Ansprüche 9 bis 11, wobei die mechanische Verbindung (16) durch eine Antriebswelle (17) und einen steuerbaren Elektromotor (38) angetrieben werden kann, der mit einer Steu-

ereinheit (39) verbunden ist.

13. Vorrichtung nach einem der Ansprüche 9 bis 12, wobei die Klemmbacken (9) einen Klemmenabschnitt (24) und einen Führungsabschnitt (25) in der Weise aufweisen, dass der Klemmenabschnitt (24) der Klemmbacke (9) parallel zu einer Messerplatte (2) ausgerichtet ist, die die Schneidkante (3) des Schneidmechanismus (1) bildet, und dass der Führungsabschnitt (25) der Klemmbacke (9) durch mehrere Drehzapfen (19.1, 19.2) mit Getriebeelementen (18) der mechanischen Verbindung (16) verbunden ist. 5
14. Vorrichtung nach Anspruch 12 und 13, wobei die Antriebswelle (17) mehrere exzentrische Platten (27) und mehrere Nockenscheiben (28) in der Weise aufweist, dass eine der exzentrischen Platten (27) an jeder Klemmbacke (9) durch eine Verbindungsstange (26) der Klemmbacke (9) mit einem der Drehzapfen (19.1, 19.2) verbunden ist und dass eine der Nockenscheiben (28) an jeder Klemmbacke (9) mit einer Führungsfläche (37) zusammenarbeitet, die am Führungsabschnitt (25) der Klemmbacke (9) gebildet ist. 10
15. Vorrichtung nach einem der Ansprüche 13 oder 14, wobei die Führungsabschnitte (25) der Klemmbacken (9) in jedem Fall mit einem von mehreren Gleitblöcken (29) verbunden sind, die durch einen weiteren Drehzapfen (19.1, 19.2) an einem Führungsende (30) entlang einer Führungsschiene (32) geführt werden. 20
16. Vorrichtung nach Anspruch 15, wobei die Führungsschiene (32) für die Gleitblöcke (29) durch eine höhenverstellbare Schienenhalterung (33) angebracht ist, wobei ein Abstand zwischen dem Klemmenabschnitt (24) der Klemmbacke (9) und der Messerplatte (2) des Schneidmechanismus (1) durch Verstellen der Führungsschienen (32) angepasst werden kann. 25
17. Vorrichtung nach einem der Ansprüche 8 bis 16, wobei der Schlagmechanismus (5) durch mehrere Schlagelemente (6) gebildet ist, die auf einer rotierenden Walze (7) angeordnet, am Umfang der Walze (7) verteilt und in einem kurzen Abstand von der Schneidkante (3) des Schneidmechanismus (1) positioniert sind. 30

Revendications

1. Procédé de broyage d'un matériau fibreux de type fil, dans lequel le matériau fibreux de type fil (13) est alimenté à un bord de coupe d'un mécanisme de coupe (1), dans lequel au moins un mécanisme de 55

frappe mobile (5) pour broyer le matériau fibreux (13) coopère avec le mécanisme de coupe (1) et dans lequel un mécanisme de serrage mobile (8) est arrangé au niveau du mécanisme de coupe, au moyen duquel le matériau fibreux est serré d'une manière oscillante, dans lequel le matériau fibreux est alimenté à travers un écartement de serrage oscillant (10) formé entre le mécanisme de serrage (8) et le mécanisme de coupe (1), et dans lequel le mécanisme de serrage (8) est déplacé dans un mouvement de serrage vers l'arrière et vers l'avant par rapport au mécanisme de coupe (1).

2. Procédé selon la revendication 1, dans lequel le matériau fibreux est transporté par un mouvement d'avance du mécanisme de serrage (8) par rapport au mécanisme de coupe (1).
3. Procédé selon l'une quelconque des revendications 1 ou 2, dans lequel le serrage du matériau fibreux est obtenu dans l'écartement de serrage (10) par plusieurs mâchoires de serrage mobiles (9) du mécanisme de serrage (8) opposées au mécanisme de coupe (1), dans lequel un certain nombre des mâchoires de serrage (9) sont déplacées de façon asynchrone côte à côte, et dans lequel un nombre des mâchoires de serrage (9) sont déplacées de façon synchrone côte à côte.
4. Procédé selon la revendication 3, dans lequel chacune des mâchoires de serrage (9) du mécanisme de serrage (8) pour le serrage et le transport du matériau fibreux est déplacée sur une trajectoire de guidage elliptique.
5. Procédé selon la revendication 4, dans lequel les mouvements des mâchoires de serrage (9) du mécanisme de serrage (8) sont produits par un arbre de transmission motorisé (17) avec un moteur électrique réglable (38).
6. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'écartement de serrage (10) entre le mécanisme de coupe (1) et le mécanisme de serrage (8) est ajusté en réglant le dégagement du mécanisme de serrage (8) à l'épaisseur respective du matériau fibreux (13).
7. Procédé selon l'une quelconque des revendications précédentes, dans lequel le matériau fibreux (13) au niveau du bord de coupe (3) du mécanisme de coupe (1) est broyé par plusieurs éléments de frappe (6) situés sur un tambour rotatif (7), lesquels sont déplacés à une courte distance du bord de coupe (3).
8. Dispositif pour exécuter le procédé de broyage d'un matériau fibreux de type fil selon l'une quelconque des revendications 1 à 7, possédant un mécanisme

- de coupe (1) qui comporte un bord de coupe (3) s'étendant transversalement au matériau fibreux (13), un mécanisme de frappe mobile (5), qui coopère avec le mécanisme de coupe (1) pour broyer le matériau fibreux (13) à une courte distance du bord de coupe (3), et un mécanisme de serrage (8) arrangé au niveau du mécanisme de coupe (1), au moyen duquel le matériau fibreux (13) est serré d'une manière oscillante, dans lequel le mécanisme de serrage (8) et le mécanisme de coupe (1) sont arrangés de manière opposée l'un par rapport à l'autre dans un plan de serrage de façon à former un écartement de serrage (10), dans lequel le mécanisme de serrage (8) est déplacé vers l'arrière et vers l'avant par rapport au mécanisme de coupe (1) dans un mouvement de serrage.
9. Dispositif selon la revendication 8, dans lequel le mécanisme de serrage (8) est guidé par une tringlerie mécanique (16) pour produire un mouvement d'avance superposé.
10. Dispositif selon l'une quelconque des revendications 8 ou 9, dans lequel le mécanisme de serrage (8) est formé par plusieurs mâchoires de serrage mobile adjacentes (9), en ce sens que les mâchoires de serrage (9) sont divisées en plusieurs unités d'entraînement (35.1, 35.2), et les mâchoires de serrage (9) d'unités d'entraînement adjacentes sont déplacées de façon asynchrone et les mâchoires de serrage (9) d'une des unités d'entraînement (35.1, 35.2) sont déplacées de façon synchrone.
11. Dispositif selon la revendication 10, dans lequel les mâchoires de serrage (9) du mécanisme de serrage (8) peuvent dans chaque cas être déplacées dans une trajectoire de guidage elliptique (20) par la tringlerie mécanique (16).
12. Dispositif selon l'une quelconque des revendications 9 à 11, dans lequel la tringlerie mécanique (16) peut être alimentée par un arbre d'entraînement (17) et un moteur électrique réglable (38), qui est relié à un contrôleur (39).
13. Dispositif selon l'une quelconque des revendications 9 à 12, dans lequel les mâchoires de serrage (9) comportent une section de pince (24) et une section de guide (25), en ce sens que la section de pince (24) de la mâchoire de serrage (9) est orientée parallèle à une plaque tranchante (2) formant le bord de coupe (3) du mécanisme de coupe (1) et que la section de guide (25) de la mâchoire de serrage (9) est reliée à des éléments d'engrenage (18) de la tringlerie mécanique (16) par plusieurs pivots (19.1, 19.2).
14. Dispositif selon la revendication 12 et 13, dans lequel l'arbre d'entraînement (17) comporte plusieurs plaques excentriques (27) et plusieurs disques à cames (28), en ce sens qu'une des plaques excentriques (27) sur chaque mâchoire de serrage (9) est reliée à un des pivots (19.1, 19.2) par une tige de raccordement (26) de la mâchoire de serrage (9), et en ce qu'un des disques à cames (28) sur chaque mâchoire de serrage (9) coopère avec une surface de guidage (37) formée sur la section de guide (25) de la mâchoire de serrage (9).
15. Dispositif selon l'une quelconque des revendications 13 ou 14, dans lequel, dans chaque cas, les sections de guide (25) des mâchoires de serrage (9) sont reliées à un parmi plusieurs blocs coulissants (29), qui sont déplacés le long d'un rail de guidage (32), par un autre pivot (19.1, 19.2) sur une extrémité d'attaque (30).
16. Dispositif selon la revendication 15, dans lequel le rail de guidage (32) pour les blocs coulissants (29) est fixé par un support de rail réglable en hauteur (33), dans lequel un dégagement entre la section de pince (24) de la mâchoire de serrage (9) et la plaque tranchante (2) du mécanisme de coupe (1) peut être ajusté en réglant les rails de guidage (32).
17. Dispositif selon l'une quelconque des revendications 8 à 16, dans lequel le mécanisme de frappe (5) est formé par plusieurs éléments de frappe (6) arrangés sur un tambour rotatif (7), lesquels sont répartis sur la circonférence du tambour (7) et lesquels sont positionnés à une courte distance du bord de coupe (3) du mécanisme de coupe (1).

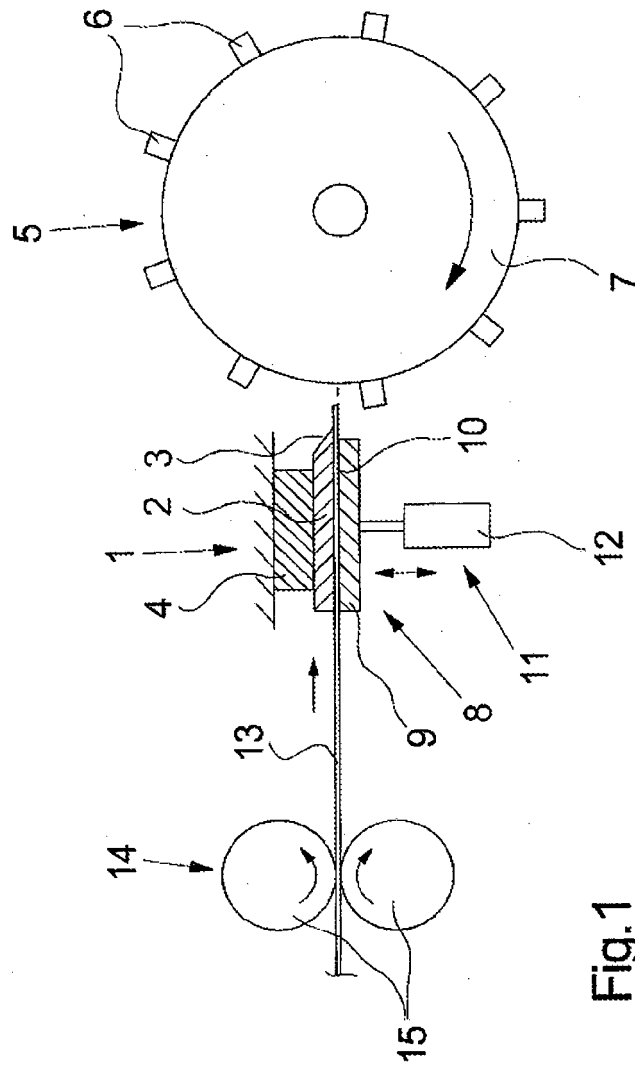


Fig.1

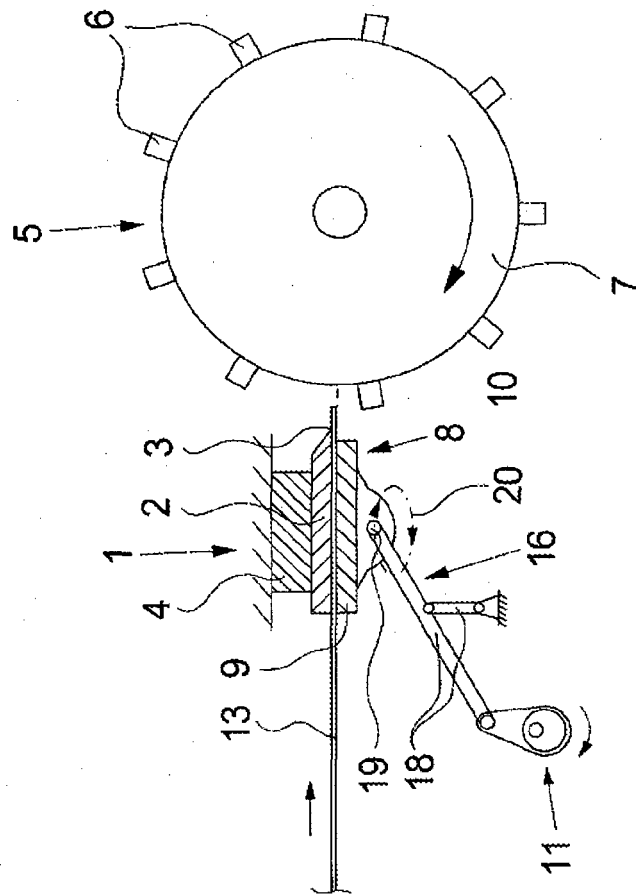
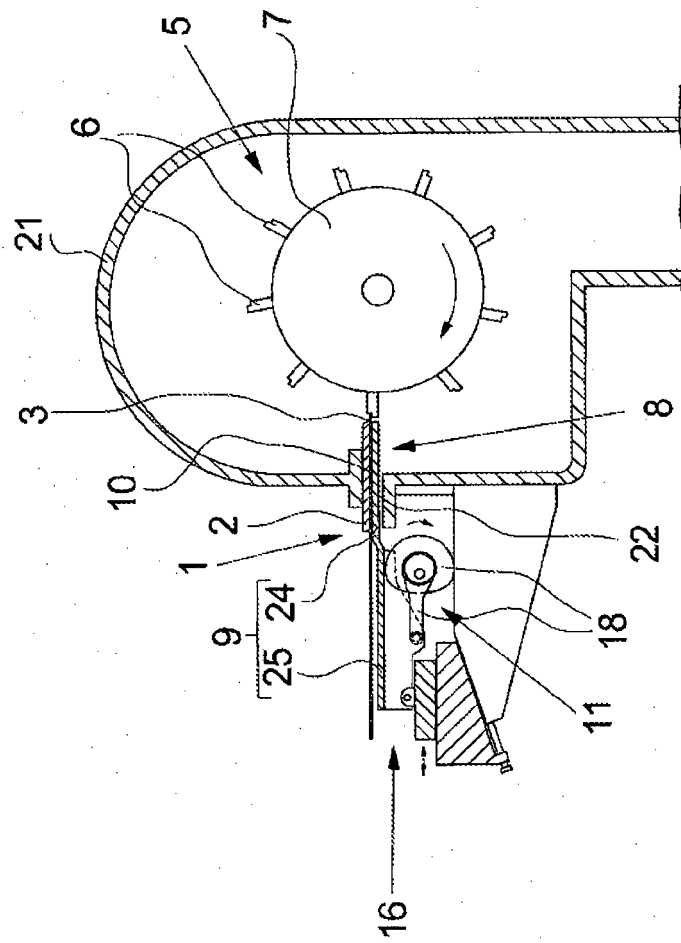


Fig.2



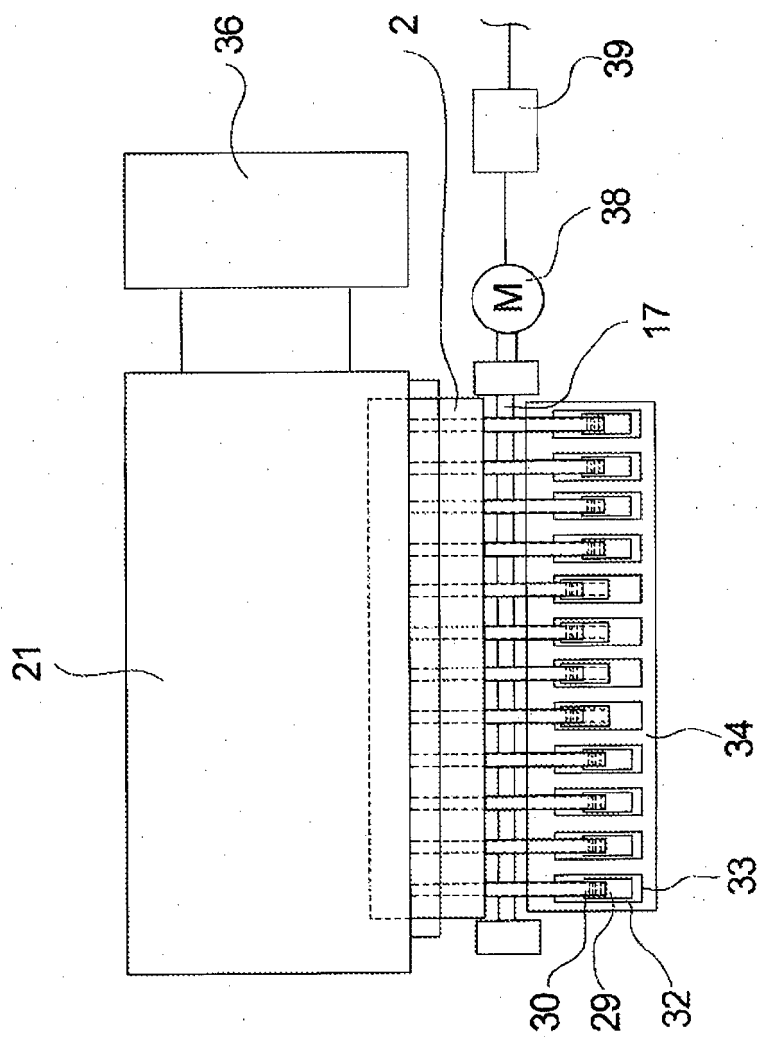


Fig.4

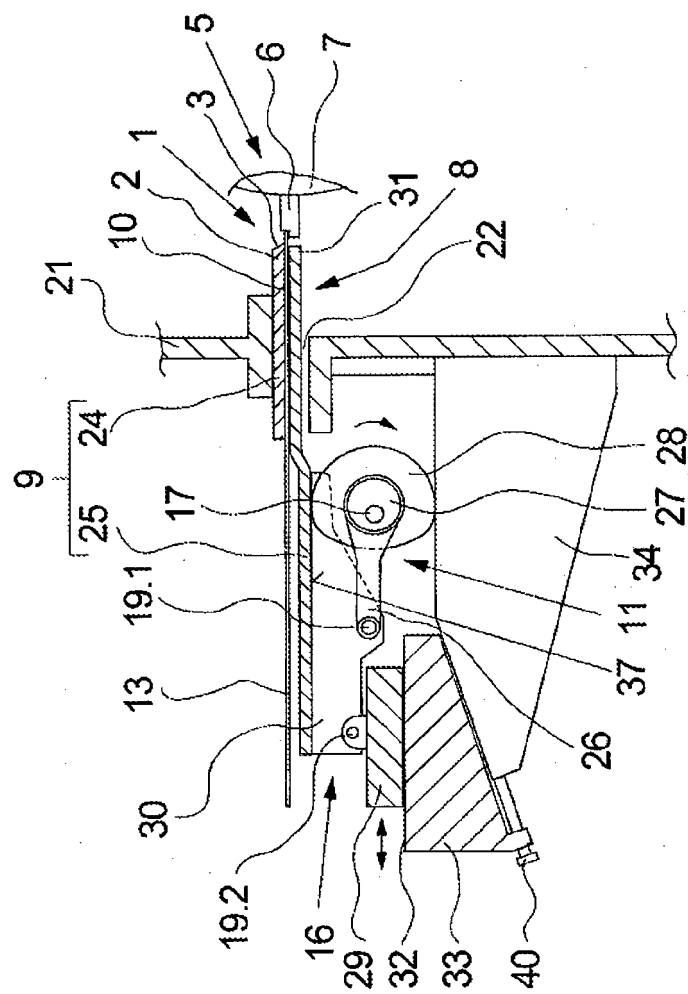


Fig.5

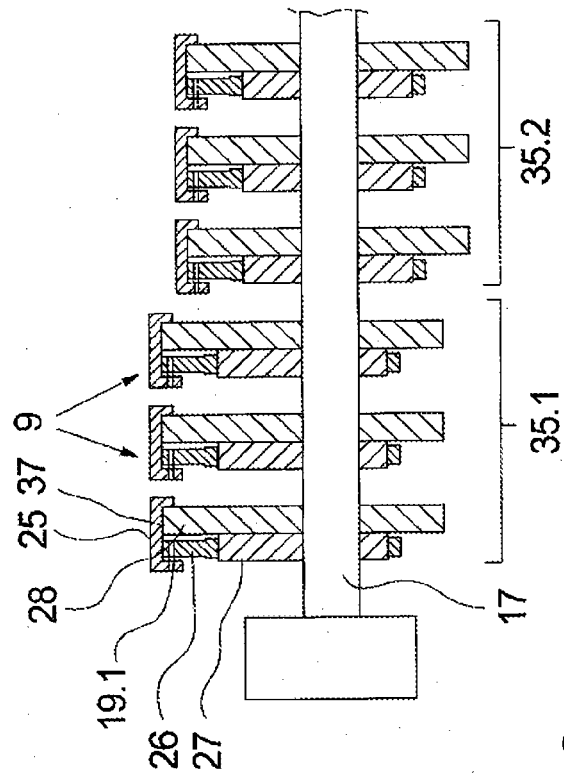


Fig.6

REFERENCES CITED IN THE DESCRIPTION

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