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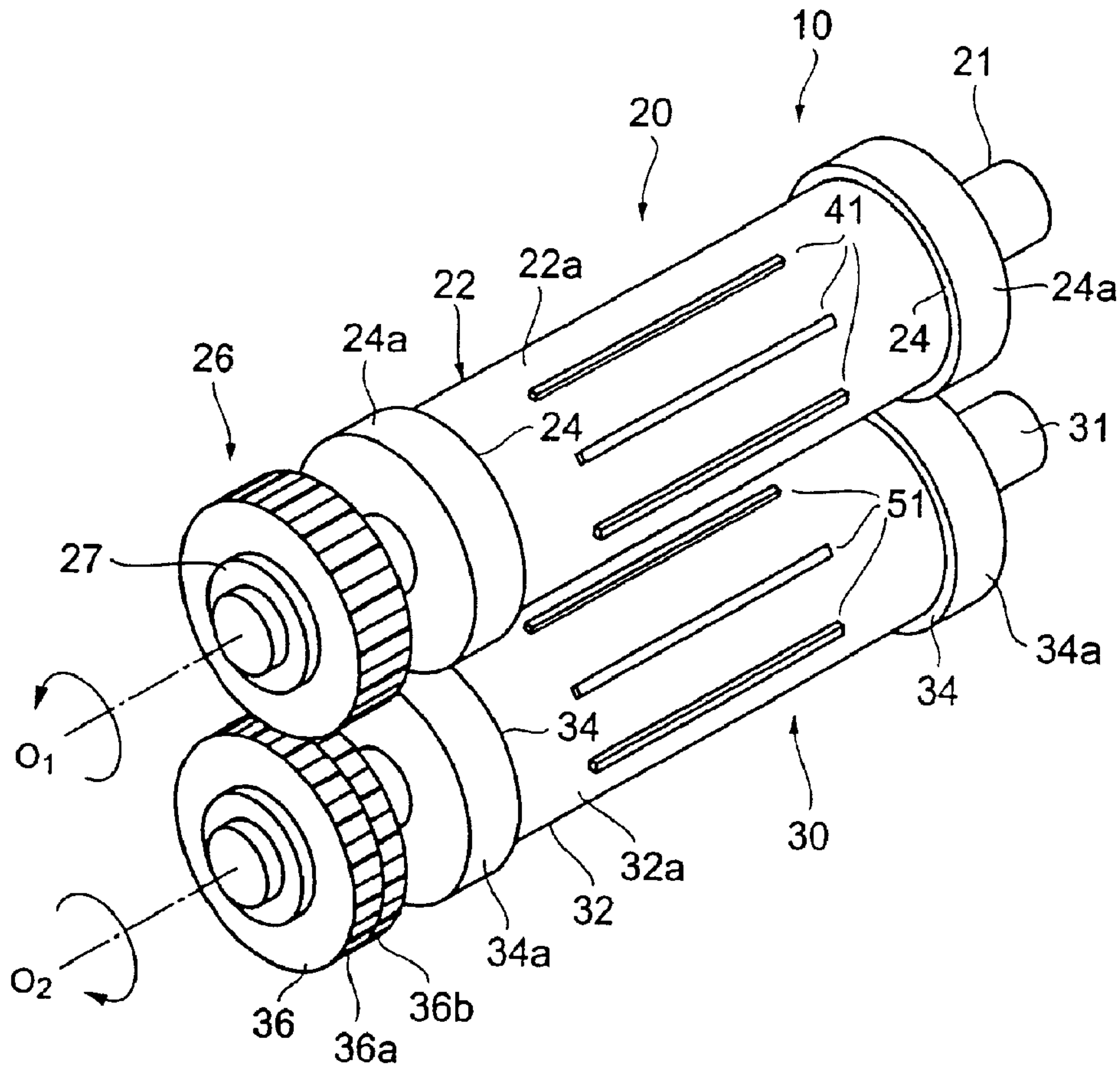
(54) Titre : COUPEUSE ROTATIVE ET METHODE DE FABRICATION DE PRODUITS FIBREUX A L'AIDE DE CETTE MACHINE
(54) Title: ROTARY CUTTER AND METHOD FOR MANUFACTURING FIBROUS PRODUCT USING THE SAME



(57) Abrégé/Abstract:
A method for manufacturing a fibrous product comprising rotating in synchronism, a first roll having a first cutting blade and a first abutment and a second roll having a second cutting blade and a second abutment so that the first cutting blade is opposed to the

(57) Abrégé(suite)/Abstract(continued):
second abutment and the first abutment is opposed to the second cutting blade. The first and second rolls are in parallel with each other to have roll axes a distance apart from each other. A fibrous product is fed between the first and second rolls so that the product is cut only halfway through the thickness from one side thereof with the product held between the first cutting blade and the second abutment and the product is also cut only halfway through the thickness from the other side thereof with the product held between the first abutment and the second cutting blade.

ABSTRACT

A method for manufacturing a fibrous product comprising rotating in synchronism, a first roll having a first cutting blade and a first abutment and a second roll having a second cutting blade and a second abutment so that the first cutting blade is opposed to the second abutment and the first abutment is opposed to the second cutting blade. The first and second rolls are in parallel with each other to have roll axes a distance apart from each other. A fibrous product is fed between the first and second rolls so that the product is cut only halfway through the thickness from one side thereof with the product held between the first cutting blade and the second abutment and the product is also cut only halfway through the thickness from the other side thereof with the product held between the first abutment and the second cutting blade.

ROTARY CUTTER AND METHOD FOR MANUFACTURING FIBROUS PRODUCT USING THE SAME

This application is a divisional application of Canadian Patent Application No. 2,455,195 filed January 14, 2004.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a rotary cutter which comprises two rolls for holding a workpiece such as fibrous sheet therebetween so as to make cuts in the workpiece only halfway through its thickness from both sides thereof, and also relates to a method for manufacturing a fibrous product using the rotary cutter.

Description of the Related Art

Rotary cutters comprising two rolls have been widely used for making a desired pattern of cuts in fibrous products such as a nonwoven fabric, a stack of nonwoven fabrics, a stack of a nonwoven fabric and a fiber bundle layer, etc.

Fig. 9 is a perspective view showing a conventional rotary cutter 1 of this kind.

The rotary cutter 1 comprises a die roll 2 and an anvil roll 3 with their axes arranged parallel with each other. The die roll 2 includes a rotary shaft 4, a periphery 5 formed with a desired radius about the roll axis of the rotary shaft 4, and a plurality of cutting blades 6 projecting radially from the periphery 5. The die roll 2 is provided at its axially opposite ends with contact peripheries 7 and 7, which are formed with a radius slightly larger than the radius of the periphery

5. The cutting blades 6 project slightly beyond the peripheries 7 and 7 to have their edges located radially outside the peripheries 7 and 7. On the other hand, the anvil roll 3 includes a rotary shaft 8 and a periphery 9 formed with a desired radius about the roll axis of the rotary shaft 8.

In this construction, the distance between the roll axis of the die roll 2 and the roll axis of the anvil roll 3 can be kept constant with the contact peripheries 7 and 7 kept in contact with the periphery 9 of the anvil roll 3. In addition, the cutting blades 6 provided on the die roll 2 can be pressed with desired force against the periphery 9 of the anvil roll 3 by pressing the contact peripheries 7 and 7 against the periphery 9 of the anvil roll 3 with desired force.

When the die roll 2 and the anvil roll 3 are driven to rotate in the directions of the arrows in synchronism with each other and a workpiece W is fed between the die roll 2 and the anvil roll 3, the workpiece W is locally cut by the cutting blades 6 with the workpiece W held between the edges of the cutting blades 6 of the die roll 2 and the periphery 9 of the anvil roll 3.

For example, the workpiece W comprises a substrate sheet W_a such as nonwoven fabric and fiber bundle layers W_b disposed on two sides of the substrate sheet W_a. The fiber bundle layer W_b is a bundle of fibers which individually extend continuously in a feed direction of the workpiece W. In other words, the individual fibers constituting the fiber bundle layer W_b extend in MD without interruption, before cutting with the cutter roller

1. The fiber bundle layers W_b are bonded to the substrate sheet W_a at bond lines W_c which are arranged at regular intervals in the feed direction (MD). When fed between the die roll 2 and the anvil roll 3, the workpiece W is held between the cutting blades 6 and the periphery 9 at positions between adjacent bond lines W_c, whereby the substrate sheet W_a is cut together with the fiber bundle layers W_b, forming cut lines W_d.

Thus, the fiber bundle layers W_b on two sides of the substrate sheet W_a are individually cut into separate portions each of which is fixed to the substrate sheet W_a at one bond line W_c so as to have ends obtained by formation of the cut lines W_d function as free ends. The resulting workpiece W can be used as a cleaning article for wiping the floor and the like, wherein the fiber bundle layers W_b are expected to have an effect of collecting dust like a brush.

In the rotary cutter 1 shown in Fig. 9, however, since the cutting blades 6 project radially beyond the contact peripheries 7 and 7 to have the edges strongly pressed against the periphery 9 of the anvil roll 3 so that the substrate sheet W_a can be cut together with the fiber bundle layers W_b, the edges of the cutting blades 6 tend to generate heat due to high pressure between the cutting blades 6 and the periphery 9. Therefore, if the fiber bundle layers W_b are formed of thermoplastic resin fibers, the fibers constituting the fiber bundle layers W_b may be thermally fusion-bonded to each other or to the substrate sheet W_a along the cut lines W_d.

This results in that the individual fibers constituting the fiber bundle layers W_b are hardly separated from each other in the workpiece W having passed through the cutting process, so that when used as a cleaning article, for example, the fiber bundle layers W_b cannot take on a suitable brush-like form, whereby an expected duct collecting effect cannot be obtained.

In order to prevent the individual fibers constituting the fiber bundle layers W_b from being thermally fusion-bonded to each other along the cut lines W_d, accordingly, the workpiece W may be cut by adopting a so-called half-cut technique in which a workpiece is cut from one side only halfway through its thickness, instead of cutting the substrate sheet W_a and the fiber bundle layers W_b all together under high pressure. In this case, since the cutting force acts on only one of the fiber bundle layers W_b, thermal fusion-bonding between individual fibers can be eliminated or suppressed.

Japanese Unexamined Patent Publication No. 10-76494 discloses such a half-cut technique. In the technique disclosed in the above-identified Patent Publication, the edges of the cutting blades 6 of the rotary cutter shown in Fig. 9 are formed with a radius smaller than the radius of the contact peripheries 7 and 7 so that the blade edges do not come into contact with the periphery 9. When the workpiece W is fed between the die roll 2 and the anvil roll 3, accordingly, the cutting blades 6 penetrate halfway through the thickness of the workpiece W.

However, if the half-cut technique disclosed in the above-identified Patent Publication is adopted to cut the workpiece W shown in Fig. 9, the two fiber bundle layers W_b disposed on two sides of the substrate sheet W_a cannot be cut at once.

SUMMARY OF THE INVENTION

The present invention has been worked out in view of the shortcomings in the prior art set forth above. It is therefore an object of the present invention to provide a rotary cutter, in which cutting of a workpiece halfway through the thickness from both sides thereof can be done at once, and a method for manufacturing a fibrous product using the rotary cutter.

According to a first aspect of the present invention, there is provided a rotary cutter comprising a first roll rotatable about a first roll axis and a second roll rotatable about a second roll axis which is parallel to the first roll axis,

the rotary cutter further comprising:

a first cutting blade and a first abutment which are provided on a periphery of a roll body of the first roll and a second cutting blade and a second abutment which are provided on a periphery of a roll body of the second roll;

synchronizing means for synchronizing rotations between the first roll and the second roll so that the first cutting blade is opposed to the second abutment and the first abutment is opposed to the second cutting blade; and

distance setting means for setting a distance between the first cutting blade and the second abutment and between the first abutment and the second cutting blade.

In the rotary cutter according to the first aspect of the present invention, the first roll and the second roll are driven to rotate in synchronism with each other so that the first cutting blade can be opposed to the second abutment at a distance apart and the first abutment can be opposed to the second cutting blade at a distance apart. When a workpiece is fed between the first roll and the second roll, the first cutting blade can penetrate only halfway through the workpiece from one side thereof and at the same time, the second cutting blade can penetrate only halfway through the workpiece from the other side thereof.

The rotary cutter according to the first aspect of the present invention may be constructed such that a first rib is provided to project radially from the periphery of the roll body of the first roll and the first cutting blade and the first abutment are formed in the first rib, and a second rib is provided to project radially from the periphery of the roll body of the second roll and the second cutting blade and the second abutment are formed in the second rib.

With the ribs each having one cutting blade and one abutment being provided on both the first roll and the second roll so as to be opposed to each other, a cut formed in one side of a workpiece having passed between the rolls can be located adjacent a cut formed in the other side of the workpiece. Accordingly, a completed product looks as if the two sides of the workpiece were cut at vertically opposed positions.

Preferably, the first and second abutments have a larger width than the edges of the first and second cutting blades.

With the width of the abutments being larger than that of the edges of the cutting blades, the abutments can serve as anvils, so that when the workpiece is held between the cutting blades and the abutments, the cutting blades easily penetrate halfway through the workpiece.

The rotary cutter according to the first aspect of the present invention may also be constructed such that the distance setting means includes a first contact periphery which is formed on the first roll with a radius larger than the periphery of the roll body of the first roll and a second contact periphery which is formed on the second roll with a radius larger than the periphery of the roll body of the second roll, wherein a distance between the first roll axis and the second roll axis is set by contact between the first contact periphery and the second contact periphery.

With the first contact periphery and the second contact periphery being kept in contact with each other, the distance between the first roll axis and the second roll axis can be optimally set.

According to a second aspect of the present invention, there is provided a method for manufacturing a fibrous product comprising:

rotating a first roll having a first cutting blade and a first abutment and a second roll having a second cutting blade and a second abutment in synchronism with each other so that the first cutting blade is opposed to the second abutment and the first abutment is opposed to the second cutting blade, the first roll and the second roll being installed in parallel with each other to have roll axes a distance apart from each other; and

feeding a fibrous product between the first roll and the second roll so that the fibrous product is cut only halfway through the thickness from one side thereof with the fibrous product held between the first cutting blade and the second abutment and the fibrous product is also cut only halfway through the thickness from the other side thereof with the fibrous product held between the first abutment and the second cutting blade.

In this method, for example, the fibrous product includes a substrate sheet and two fiber bundle layers disposed on and locally bonded to two sides of the substrate sheet, respectively, wherein one of the fiber bundle layers is cut by the first cutting blade and the other is cut by the second cutting blade. The fibrous product may be a cleaning article in which the fiber bundle layers thus cut have an effect of collecting dust.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood more fully from the detailed description given hereinafter and from the accompanying drawings of the preferred embodiment of the present invention, which, however, should not be taken to be limitative to the invention, but are for explanation and understanding only.

In the drawings:

Fig. 1 is a perspective view showing a rotary cutter according to one embodiment of the present invention;

Fig. 2 is an enlarged sectional view taken along a plane perpendicular to roll axes, showing how cutting blades are opposed to abutments in the rotary cutter of Fig. 1;

Fig. 3 is an enlarged sectional view showing the cutting blade and the abutment provided on one roll;

Fig. 4 is an enlarged sectional view showing a process of cutting a workpiece between the cutting blades and the abutments;

Fig. 5 is an enlarged sectional view showing the workpiece formed with cuts;

Fig. 6 is a perspective view showing the workpiece after the cutting process;

Fig. 7 is a perspective view showing another workpiece after the cutting process;

Fig. 8 is a sectional view showing the workpiece after the cutting process; and

Fig. 9 is a perspective view showing a process of cutting a fibrous product with a conventional rotary cutter.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention will be discussed hereinafter in detail in terms of the preferred embodiment according to the present invention with reference to the accompanying drawings. In the following description, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be obvious, however, to those skilled in the art that the present invention may be practiced without these specific details. In other instance, well-known structures are not shown in detail in order to avoid unnecessary obscurity of the present invention.

Fig. 1 is a perspective view showing a rotary cutter according to one embodiment of the present invention; Fig. 2 is an enlarged sectional view taken along a plane perpendicular to roll axes, showing how cutting blades are opposed to abutments in the rotary cutter of Fig. 1; Fig. 3 is an enlarged sectional view showing the cutting blade and the abutment provided on one roll; Fig. 4 is an enlarged sectional view showing a process of cutting a workpiece between the cutting blades and the abutments; and Fig. 5 is an enlarged sectional view showing the workpiece formed with cuts.

Fig. 1 shows a rotary cutter 10 comprising a first roll 20 and a second roll 30. Both the rolls 20 and 30 are made of a steel material such as die steel.

The first roll 20 has a rotary shaft 21 and a roll body 22 secured to the rotary shaft 21. The rotary shaft 21 has an axis that is referred to as first roll axis O_1. The roll body 22 has a periphery 22a that is a cylindrical surface formed with a radius about the first roll axis O_1. On the periphery 22a of the roll body 22, there are disposed several first ribs 41. The individual first ribs 41 project radially from and extend axially on the periphery 22a so that adjacent first ribs 41 are parallel to each other.

Axially opposite side rings 24 and 24 are formed integral with the first roll 20 to have the first ribs 41 located therebetween. The side rings 24 and 24 have peripheries that are referred to as first contact peripheries 24a and 24a. The first contact peripheries 24a and 24a have a larger radius than the periphery 22a.

The second roll 30 has a rotary shaft 31, whose axis is referred to as second roll axis O_2. The second roll 30 has a roll body 32, whose periphery 32a is a cylindrical surface formed with a radius about the second roll axis O_2. The radius of the periphery 32a of the second roll 30 is identical to the radius of the periphery 22a of the first roll 20. Several second ribs 51 are disposed on the periphery 32a to project radially therefrom. The individual second ribs 51 extend axially so that adjacent second ribs 51 are parallel to each other.

Axially opposite side rings 34 and 34 are formed integral with the second roll 30 to have the second ribs 51 located therebetween. The side rings 34 and 34 have peripheries that are referred to as second contact peripheries 34a and 34a. The second contact peripheries 34a and 34a have a larger radius than the periphery 32a about the second roll axis O_2. The radius of the second contact peripheries 34a and 34a is identical to the radius of the first contact peripheries 24a and 24a of the first roll 20.

The first contact peripheries 24a and 24a are pressed against the second contact peripheries 34a and 34a with a force applied to the first roll 20 and the second roll 30 so that the roll axes O_1 and O_2 approach each other, which results in keeping the first roll axis O_1 and the second roll axis O_2 in parallel with each other and at a constant distance apart from each other. Thus, the first contact peripheries 24a and 24a of the first roll 20 and the second contact peripheries 34a and 34a of the second roll 30 constitute distance setting means.

A synchronous gear 26 is secured to the rotary shaft 21 of the first roll 20, while a synchronous gear 36 is provided on the rotary shaft 31 of the second roll 30. The synchronous gears 26 and 36 are of the same pitch circle and in meshing engagement with each other. The synchronous gear 36 is composed of two spur gears 36a and 36b, wherein one spur gear 36a is secured to the rotary shaft 31 while the other spur gear 36b is biased circumferentially by means of spring. With the two spur gears 36a and 36b being circumferentially repelled from each other by means of spring and meshing with the synchronous gear 26, the backlash between the synchronous gears 26 and 36 is eliminated.

Between the rotary shaft 21 of the first roll 20 and the synchronous gear 26, a phase adjusting mechanism 27 is further provided. With this phase adjusting mechanism 27, the phase of the rotary shaft 21, which is secured to the roll body 22, in the rotational direction can be adjusted with respect to the phase of the synchronous gear 26 in the rotational direction, and the rotary shaft 21 can be locked to the synchronous gear 26 in the adjusted position. By adjusting the phases between the synchronous gear 26 and the roll body 22 in a state where the synchronous gears 26 and 36 are in meshing engagement with each other, each first rib 41 and its corresponding second rib 51 can be certainly opposed to each other in a plane containing the first and second roll axes O_1 and O_2, as the first and second rolls 20 and 30 are driven to rotate.

To this end, the first ribs 41 and the second ribs 51 are circumferentially arranged at the same pitch on the first roll 20 and the second roll 30, respectively. The first ribs 41 and the second ribs 51 are of the same length in the axial direction.

As shown in Fig. 2, each first rib 41 has a first cutting blade 42 positioned forward in the rotational direction and a first abutment 43 positioned rearward in the rotational direction. The first cutting blade 42 has a blade edge 42a extending in the axial direction of the first roll 20. On the other hand, the first abutment 43 is formed at its top with a receiving surface 43a extending in the axial direction of the first roll 20. The receiving surface 43a is a flat surface or a surface curved with center at the roll axis O_1. Between the first cutting blade 42 and the first abutment 43, furthermore, a first groove 44 is formed to extend in the axial direction.

As shown in the sectional view of Fig. 2, the first rib 41 and the second rib 51 are symmetrical about a point (rotationally symmetrical), wherein each second rib 51 has a second abutment 52 positioned forward in the rotational direction and a second cutting blade 53 positioned rearward in the rotational direction. The second abutment 52 is formed at its top with a flat or curved receiving surface 52a extending in the axial direction, while the second cutting blade 53 is formed at its top with a blade edge 53a extending in the axial direction. Between the second abutment 52 and the second cutting blade 53, furthermore, a second groove 54 is formed to extend in the axial direction.

In the first roll 20, both the blade edge 42a of the first cutting blade 42 and the receiving surface 43a of the first abutment 43 are located closer to the roll axis O_1 than the first contact peripheries 24a. Also in the second roll 30, both the receiving surface 52a of the second abutment 52 and the blade edge 53a of the second cutting blade 53 are located closer to the roll axis O_2 than the second contact peripheries 34a.

A projecting dimension H1 of the blade edge 42a and the receiving surface 43a as measured radially from the periphery 22a is equal to a projecting dimension H2 of the blade edge 53a and the receiving surface 52a as measured radially from the periphery 32a. A distance δ between the blade edge 42a of the first cutting blade 42 and the receiving surface 52a of the second abutment 52 and between the receiving surface 43a of the first abutment 43 and the blade edge 53a of the second cutting blade 53 is from 0.01 to 0.03 mm.

As the first roll 20 and the second roll 30 are driven to rotate in synchronism with each other, each first rib 41 is momentarily opposed to its corresponding second rib 51 as shown in Fig. 2. At that moment, the center (axially extending centerline) of the blade edge 42a of the first cutting blade 42 and the center (axially extending centerline) of the receiving surface 52a of the second abutment 52 are in one plane V_1, while the center of the receiving surface 43a of the first abutment 43 and the center of the blade edge 53a of the second cutting blade 53 are in another plane V_2. These planes V_1 and V_2 are parallel to each other with a distance Δ of 1 to 2 mm.

The first cutting blade 42 and the second cutting blade 53 are of the same sectional shape and of an included angle $\theta 1$ to have an increasing width from the blade edge 42a/53a toward the bottom. The included angle $\theta 1$ is about 20 to 70 degrees. On the other hand, the blade edge 42a of the first cutting blade 42 and the blade edge 53a of the second cutting blade 53 are of a width T_1 in the range of 0.01 to 0.06 mm. The receiving surface 43a of the first abutment 43 and the receiving surface 52a of the second abutment 52 are of a width T_2 which is larger than the width T_1 of the blade edge and in the range of 0.08 to 1.0 mm.

Fig. 4 is a sectional view showing a process of cutting a workpiece W_A with the rotary cutter 10; Fig. 5 is a sectional view showing the workpiece W_A formed with cuts; and Fig. 6 is a perspective view showing the workpiece W_A after the cutting process.

The workpiece W_A is a fibrous product, in which fiber bundle layers W_b, W_b are disposed on two sides of a substrate sheet W_a. Prior to the cutting process with the rotary cutter 10, the fiber bundle layers W_b, W_b are bonded to the substrate sheet W_a at bond lines W_c which are arranged at regular intervals in the feed direction (MD) of the workpiece W_A to extend linearly in a direction (CD) perpendicular to MD.

The substrate sheet W_a is nonwoven fabric comprising thermoplastic fibers, such as spunbonded, meltblown or spunlaced nonwoven fabric. On the other hand, the fiber bundle layer W_b is a bundle of fibers which are unbonded to each other unless otherwise noted. For example, the fiber bundle layer W_b may be a fiber bundle obtained by opening tow, wherein individual fibers extend continuously in MD. The fibers constituting the fiber bundle layer W_b may be sheath/core bicomponent fibers of which the sheath is a low-melting resin such as polyethylene (PE) and the core is polyethylene terephthalate (PET) or polypropylene (PP).

Since both the substrate sheet W_a and the fiber bundle layers W_b contain thermoplastic fibers, the bond lines W_c can be formed by thermal fusion-bonding of the fibers constituting the substrate sheet W_a and the fibers constituting the fiber bundle layers W_b.

When the workpiece W_A is fed between the first roll 20 and the second roll 30 that are rotating in synchronism with each other, the workpiece W_A is held between the first rib 41 and the second rib 51 at a position between adjacent bond lines W_c.

As shown in Fig. 4, the first cutting blade 42 is pressed against the upper side of the workpiece W_A with the lower side received by the receiving surface 52a of the second abutment 52. Since the width T_2 of the receiving surface 52a is sufficiently large and the blade edge 42a is pressed against a portion of the workpiece W_A supported by the receiving surface 52a, the workpiece W_A is cut halfway through its thickness from the upper side. Thus, the fiber bundle layer W_b disposed on the upper side of the substrate sheet W_a is formed with a cut W_e.

Immediately after the formation of the cut W_e, furthermore, the workpiece W_A is cut from the lower side with the blade edge 53a of the second cutting blade 53 while the upper side is supported by the receiving surface 43a of the first abutment 43. Thus, the fiber bundle layer W_b disposed on the lower side of the substrate sheet W_a is formed with a cut W_f.

Fig. 6 shows the workpiece W_A after the cutting process, wherein several cuts W_e are formed at positions between adjacent bond lines W_c in the fiber bundle layer W_b disposed on the upper side of the substrate sheet W_a. Although not shown in Fig. 6, several cuts W_f are also formed at positions between adjacent bond lines W_c in the fiber bundle layer W_b disposed on the lower side of the substrate sheet W_a. It should be noted that the cuts W_e and W_f are formed without cutting the substrate sheet W_a. Since the fiber bundle layers W_b are not cut together with the substrate sheet W_a but cut only halfway unlike the conventional ones, thermal fusion-bonding of the fibers constituting the fiber bundle layers W_b hardly occurs at the cuts W_e, W_f. In the fiber bundle layers W_b, W_b thus cut into separate portions each of which is fixed to the substrate sheet W_a at one bond line W_c to have ends obtained by formation of the cuts W_e, W_f function as free ends, therefore, the individual fibers are allowed to easily separate from each other at the free ends, as shown in Fig. 8, so that the fiber bundle layers W_b, W_b have an effect of collecting dust like a brush.

Accordingly, the fibrous product is suitable for use as a cleaning article for wiping the floor and the like.

In the fibrous product, furthermore, since each cut W_e formed in the fiber bundle layer W_b disposed on the upper side of the substrate sheet W_a is very close to its corresponding cut W_f formed in the fiber bundle layer W_b disposed on the lower side of the substrate sheet W_a, these cuts W_e and W_f look as if they were formed at the same position on the upper and lower sides. Accordingly, the fibrous product looks like having identical brush portions on both the upper and lower sides thereof.

It should be noted that although both the first ribs 41 provided on the first roll 20 and the second ribs 51 provided on the second roll 30 extend axially continuously in the embodiment shown in Fig. 1, it is also possible that the first ribs 41, the second ribs 51, or all the first ribs 41 and the second ribs 51 are formed to extend axially intermittently.

Fig. 7 shows a workpiece W_B that is processed with a rotary cutter having such intermittently extending ribs, wherein the fiber bundle layer W_b disposed on the upper side is intermittently cut between adjacent bond lines W_c, and although not shown in Fig. 7, the fiber bundle layer W_b disposed on the lower side is similarly cut.

The workpieces W_A and W_B may have nonwoven fabric layers in place of the fiber bundle layers W_b, W_b and these nonwoven fabric layers may be cut with a rotary cutter according to the present invention.

According to the present invention, as has been described hereinabove, cutting of a workpiece halfway through the thickness from both sides thereof can be done at once. Therefore, the rotary cutter according to the present invention is suitable for manufacturing a fibrous product having brush portions of fiber bundle layers on both sides thereof, for example. Furthermore, since thermal fusion-bonding of fibers at cuts is eliminated, a fibrous product having a dust collecting effect due to fluffing can be certainly obtained.

Although the present invention has been illustrated and described with respect to exemplary embodiment thereof, it should be understood by those skilled in the art that the foregoing and various other changes, omission and additions may be made therein and thereto, without departing from the spirit and scope of the present invention. Therefore, the present invention should not be understood as limited to the specific embodiment set out above but to include all possible embodiments which can be embodied within a scope encompassed and equivalent thereof with respect to the feature set out in the appended claims.

WHAT IS CLAIMED IS:

1. A method for manufacturing a fibrous product comprising:

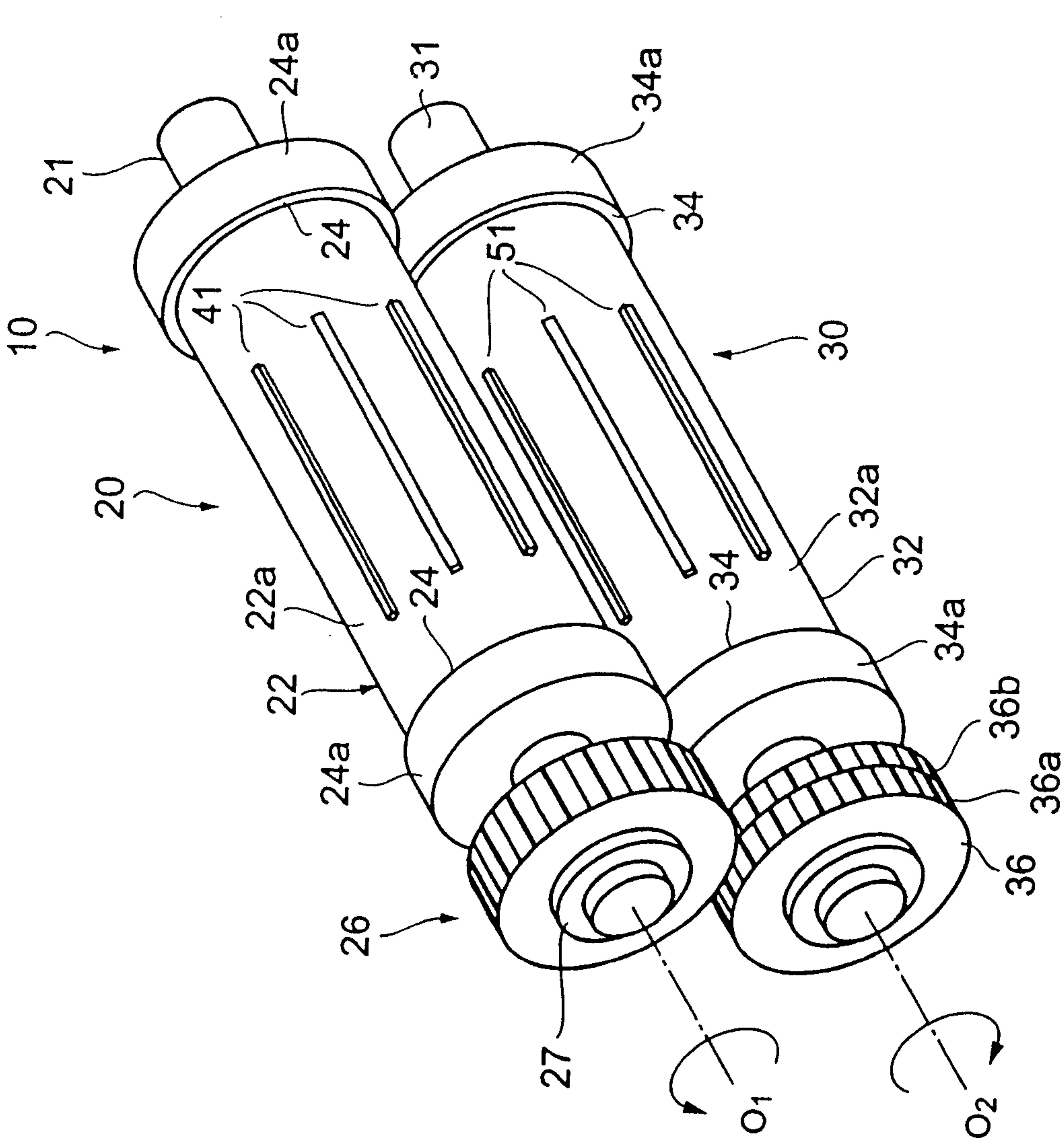
rotating a first roll having a first cutting blade and a first abutment and a second roll having a second cutting blade and a second abutment in synchronism with each other so that the first cutting blade is opposed to the second abutment and the first abutment is opposed to the second cutting blade, the first roll and the second roll being installed in parallel with each other to have roll axes a distance apart from each other; and

feeding a fibrous product between the first roll and the second roll so that the fibrous product is cut only halfway through the thickness from one side thereof with the fibrous product held between the first cutting blade and the second abutment and the fibrous product is also cut only halfway through the thickness from the other side thereof with the fibrous product held between the first abutment and the second cutting blade.

2. The method for manufacturing a fibrous product according to claim 1, wherein the fibrous product includes a substrate sheet and two fiber bundle layers disposed on and locally bonded to two sides of the substrate sheet, respectively, wherein one of the fiber bundle layers is cut by the first cutting blade and the other is cut by the second cutting blade.

3. The method for manufacturing a fibrous product according to claim 2, wherein the fibrous product is a cleaning article in which the fiber bundle layers thus cut have an effect of collecting dust.

Fig. 1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20
21
22
22a
24
24a
26
27
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32
32a
34
34a
36
36a
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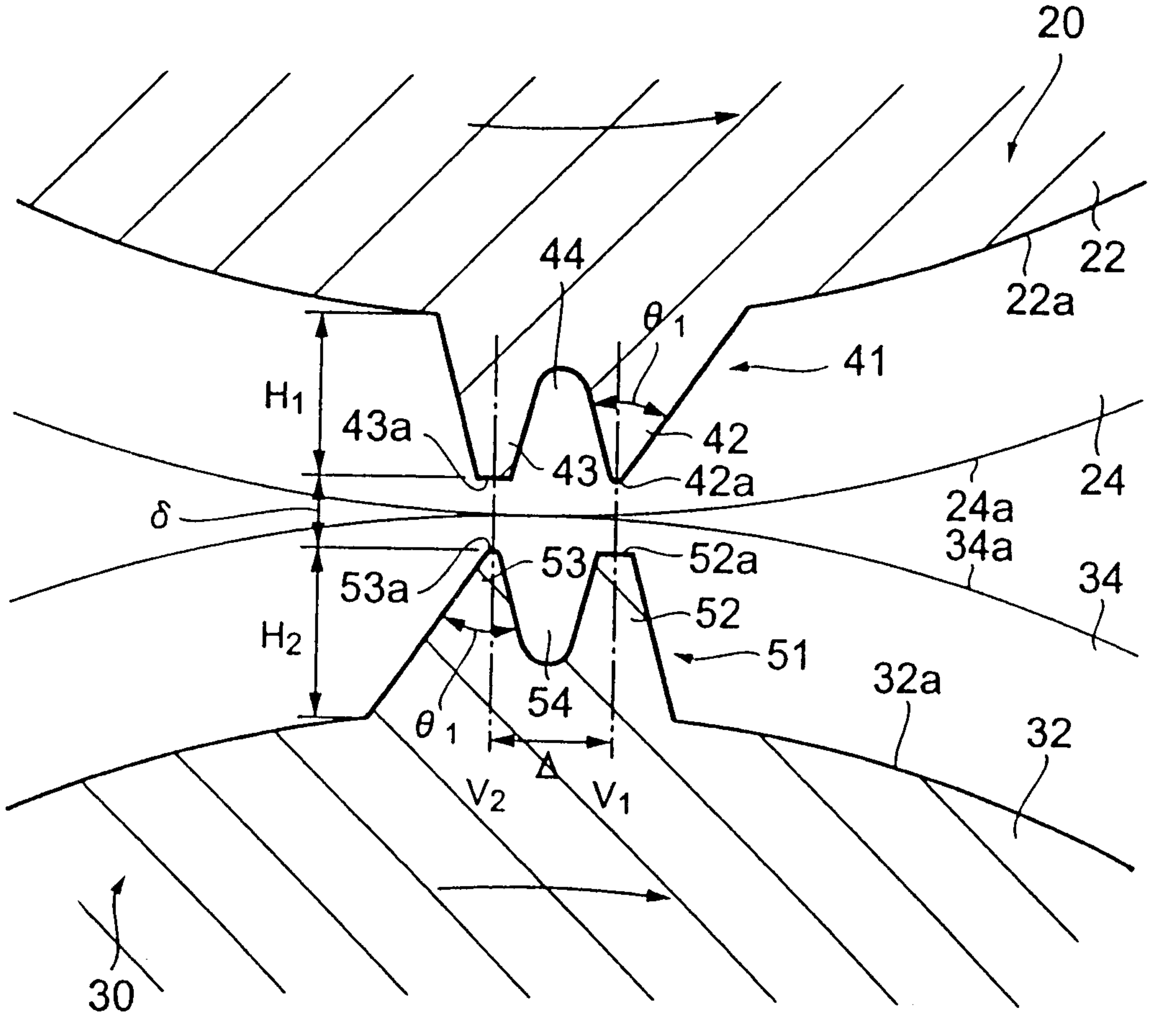
51
O_1
O_2

Fig. 2


20
22
22a
44
θ1
41
H1
43a
42
24
43
42a
δ
24a
34a
53a
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H2
52
34
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54
32a
θ1
32
V2
Δ
V1
30

Fig. 3

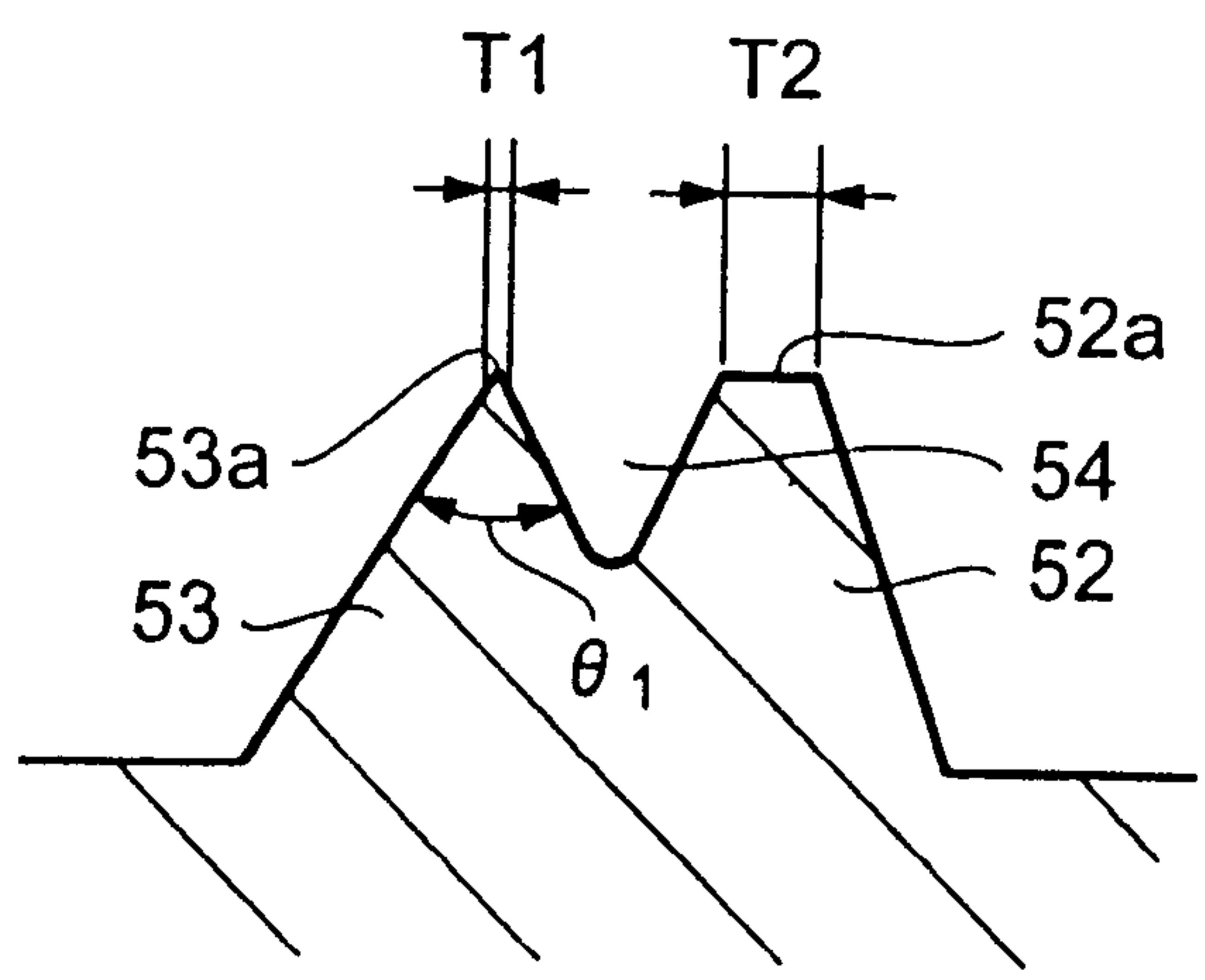

T1
T2
52a
53a
54
52
53
θ1

Fig. 4

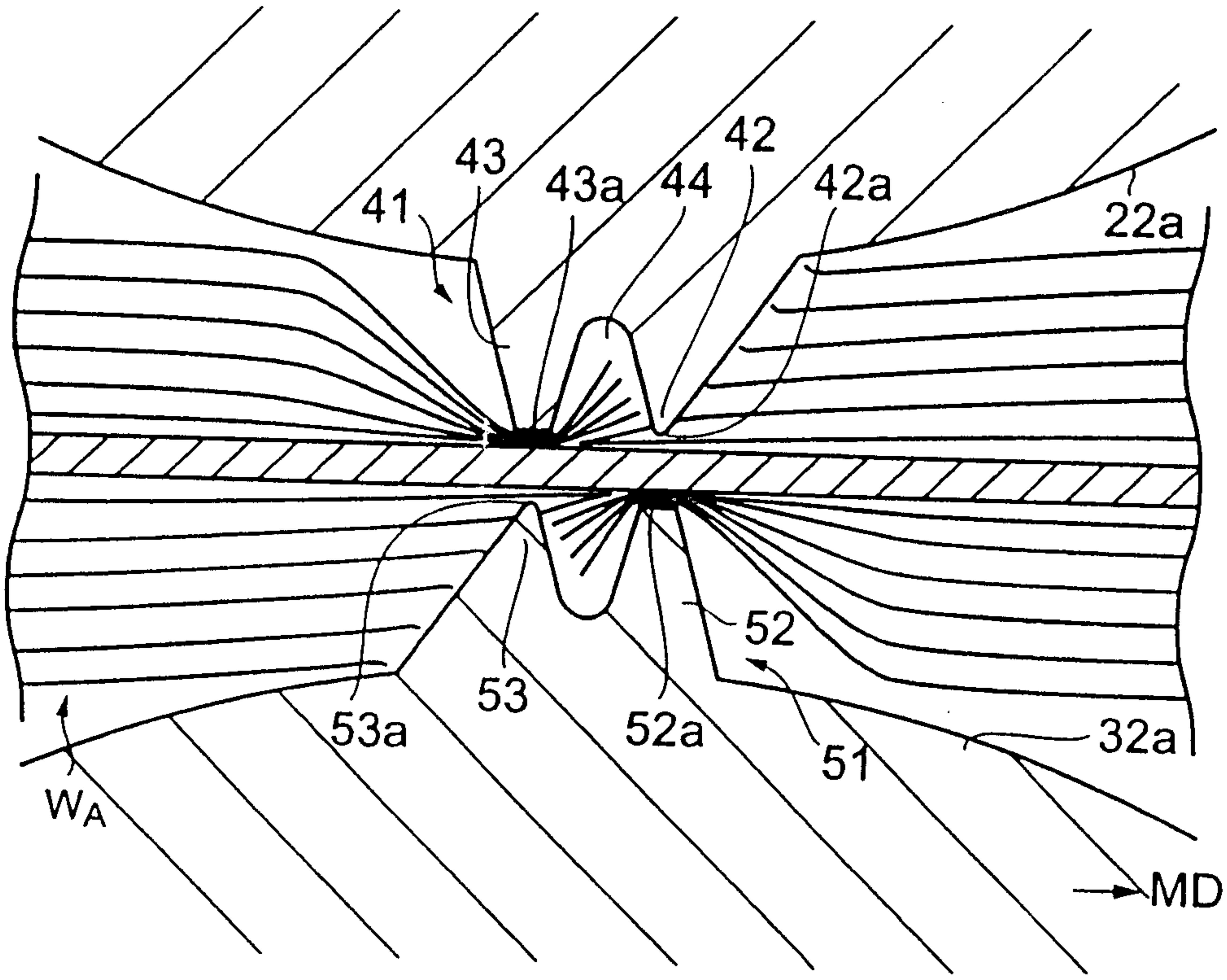
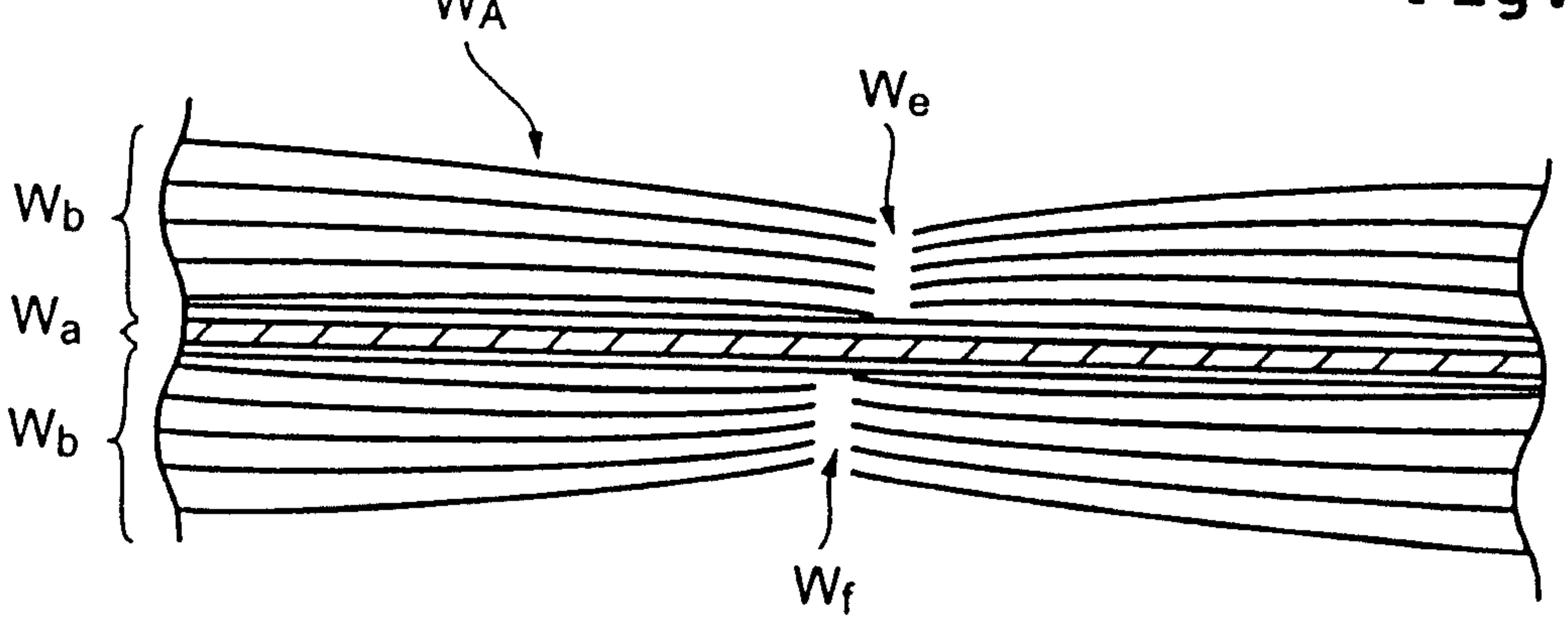

43
43a
44
42
42a
41
22a
Wb
Wa
Wb
52
53
53a
52a
51
32a
WA
MD

Fig. 5


WA
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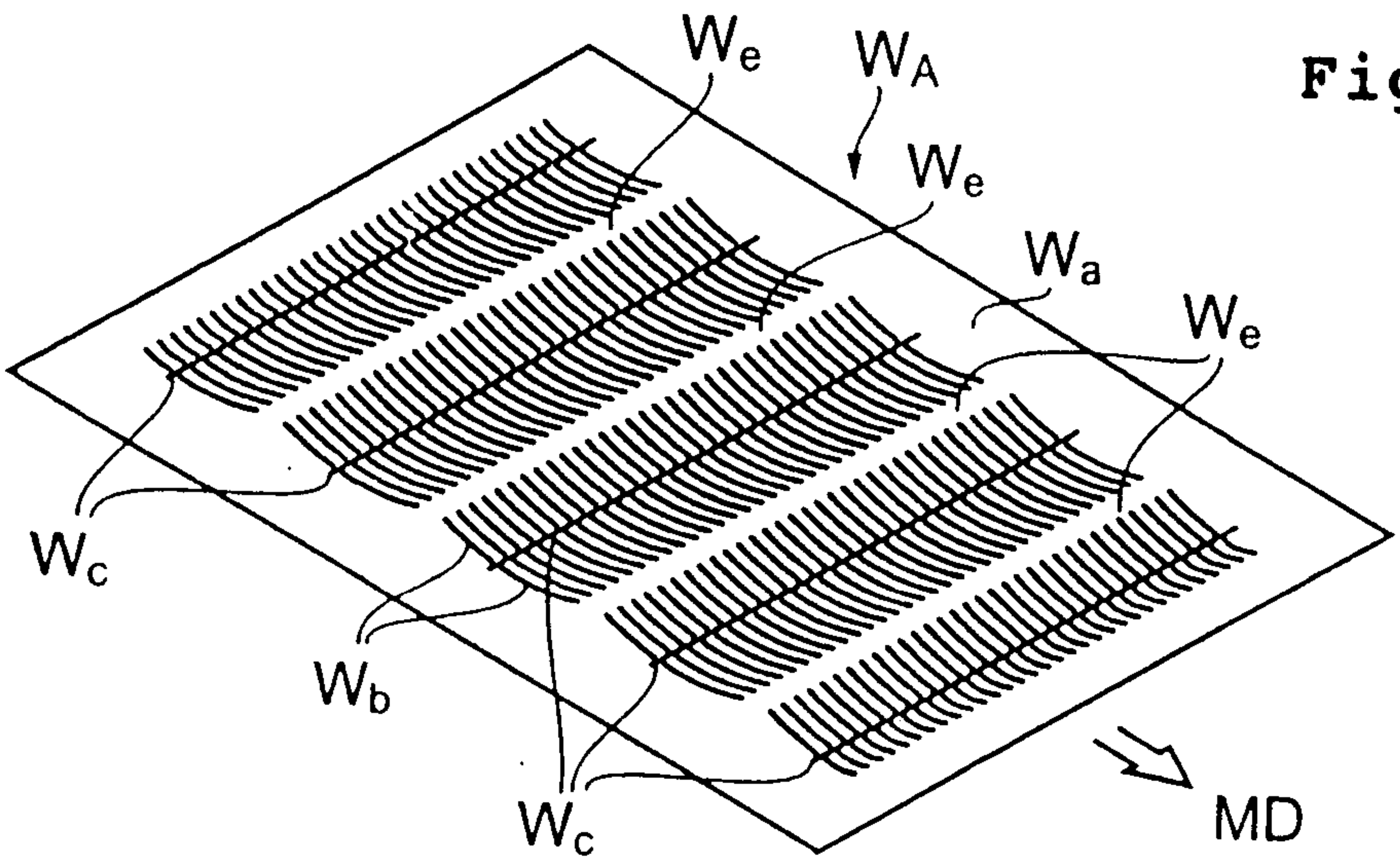


Fig. 6

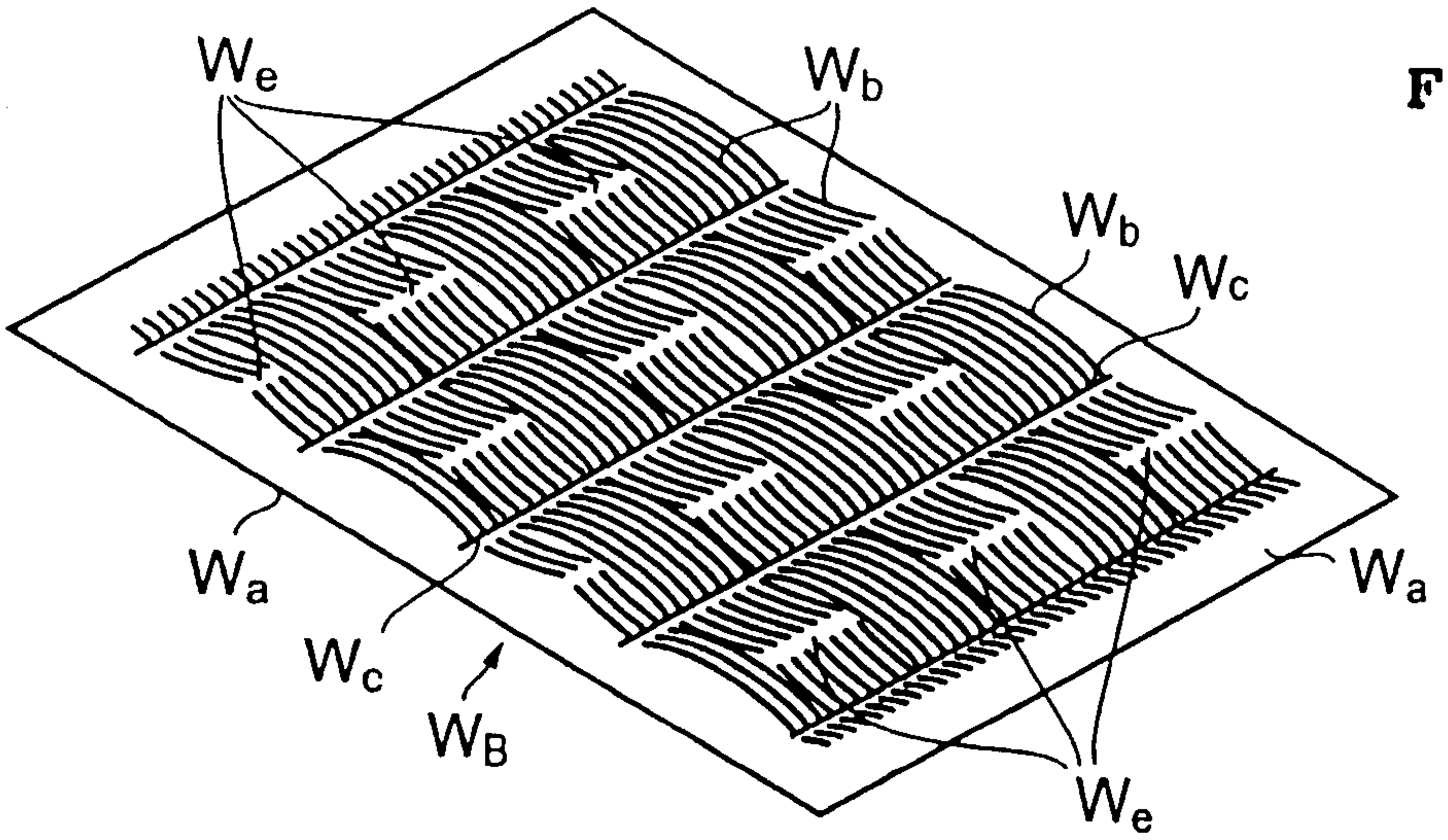


Fig. 7

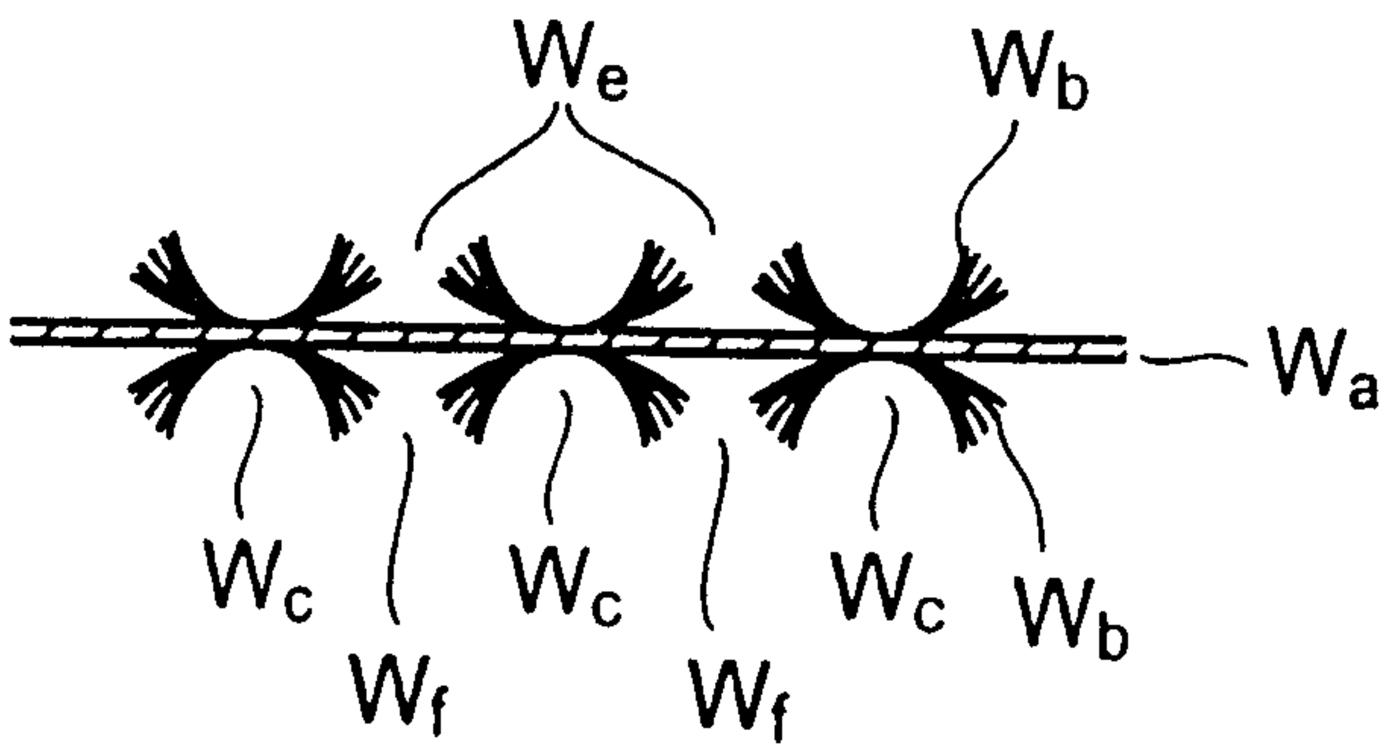
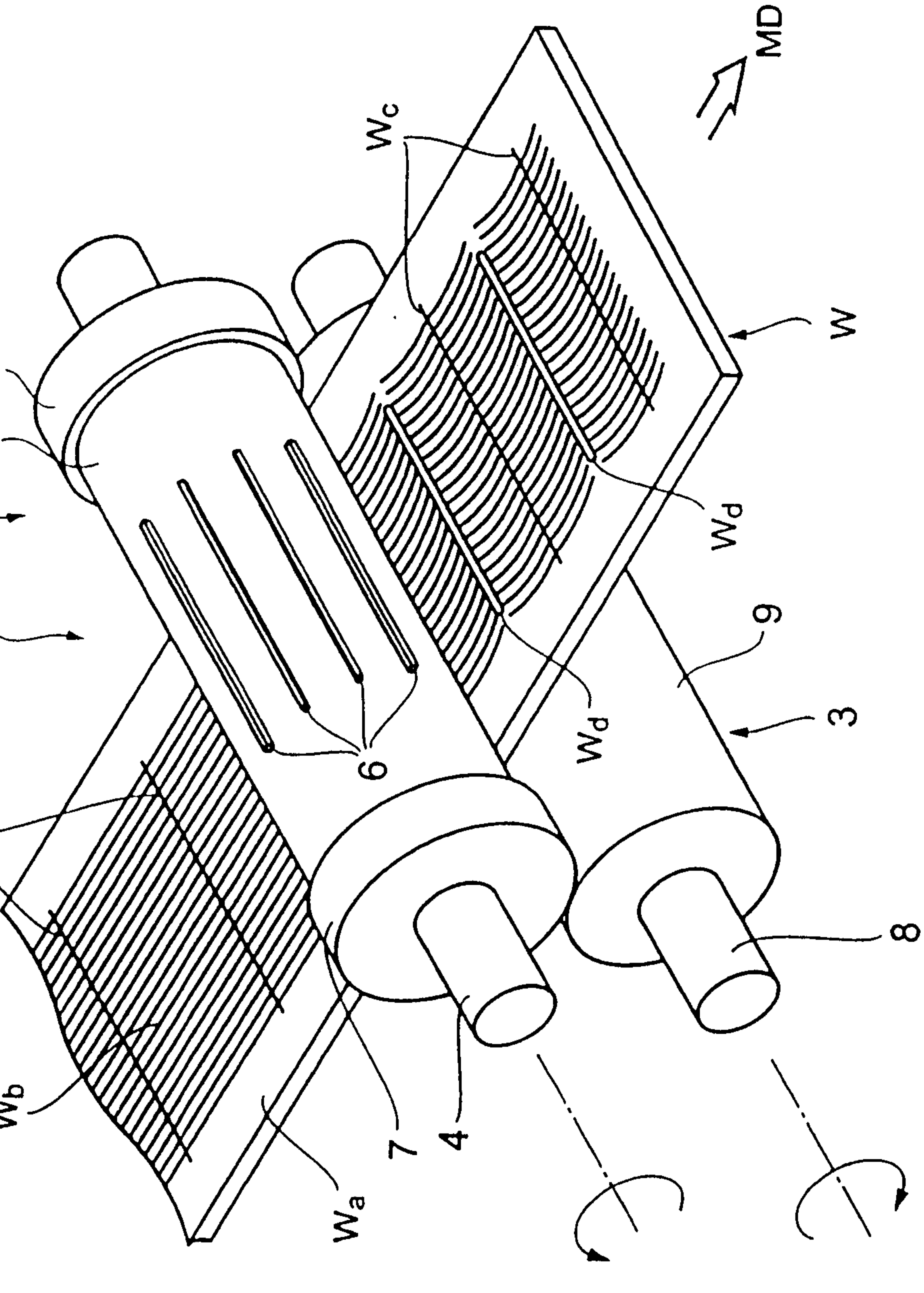
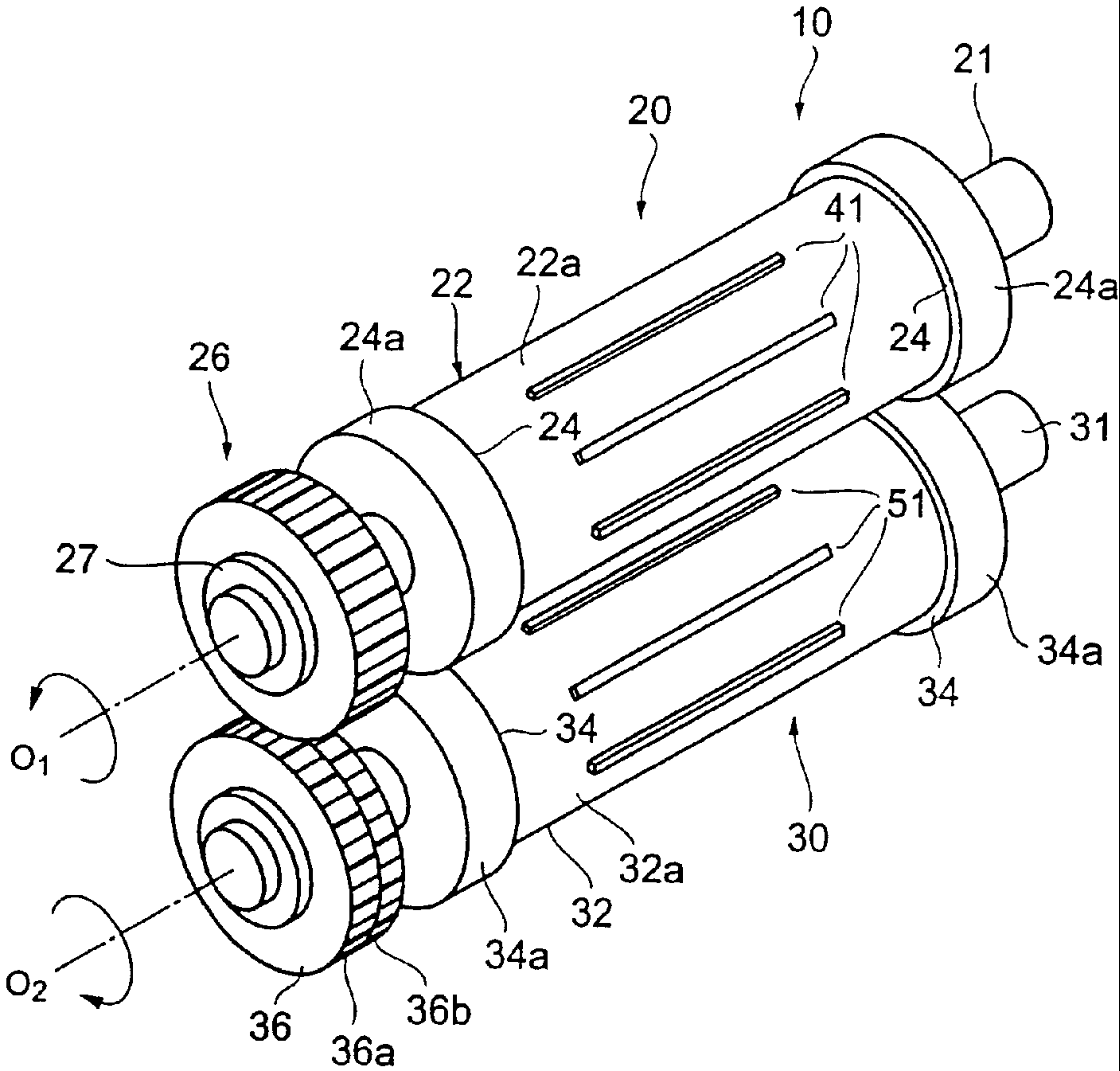


Fig. 8

Fig. 9

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34a
O_2
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36b
36a