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(54) METHOD OF OPENING FIBERS USING A MODIFIED DISPERSER PLATE

Verfahren um Fasern aufzumachen bei Anwendung der geänderten Verteilerplatte

PROCEDE D'OUVERTURE DE FIBRES AU MOYEN D'UNE PLAQUE DE DISPERSION MODIFIEE

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DescriptionFIELD OF THE INVENTION

5 The invention relates to a method for opening fibers. In particular, the invention relates to improving the web quality of air-laid textile staple fibers by providing a modified disperser plate having a specific rib spacing and exposed rib length.

BACKGROUND OF THE INVENTION

10 Textile fibers used to make spun yarns, sheet materials and fibrous batts typically come to the process in compressed bales weighing several hundred pounds. Before yarn spinning or web forming operation can begin, the fibers in these bales must first be separated or "opened". Thus, opening must precede other basic operations necessary to making product.

15 It is common industry practice to accomplish fiber opening by passing the compressed fibers through a series of opening steps wherein the fibers are "combed" repeatedly in an attempt to separate individual fibers. The devices used, commonly referred to as "openers", can be classified generally as endless path, gripping or rotating assemblies. Particular examples of opening devices are disclosed in W. Klein, "The Technology of Short-staple Spinning", The Textile Institute - Manual of Textile Technology, pp. 10-17 (1987). These devices vary in effectiveness since the degree

20 of opening one can achieve is limited by a number of factors related to both fiber properties and equipment design. An example of a rotating assembly is set forth in U.S. Patent 3,797,074 (Zafiroglu) wherein a process and apparatus for high speed production of uniform webs from feed batts of staple fibers are disclosed. The batt is fed into a space between a toothed disperser roll, rotating at a surface speed of at least 914 m (3,000 feet) per minute, and a stationary, curved disperser plate which is closely-spaced from the disperser roll teeth to hold the fibers close to the roll until a

25 fiber-doffing position is reached at the tip of the disperser plate. At this location the fibers are projected, by tangential ejection from the roll, through an opening into duct means. An air supply directs a stable stream of air, of uniform velocity, low turbulence and low vorticity, through the duct in the direction of movement of the roll surface so that the fibers are projected into the air stream at an angle of less than 25 degrees, preferably less than 12 degrees, to the direction of air flow through the duct. The fibers are carried in the air stream to condenser means which separates the

30 fibers from the air to form webs weighing from 3.4 to 340 g/m² from (0.1 to 10 ounces per square yard) as determined by the relative speeds of the fiber feed and condenser means.

The process of the Zafiroglu patent provides webs which are of relatively high quality. However, the webs produced are still subject to basis-weight variations which show up as non-uniformities in non-woven fabrics prepared from the webs. It has been found that the variations are caused by non-uniformities in the flow of air through the space between

35 the disperser roll and the disperser plate. Hot wire anemometer measurements show a predominant aerodynamic pulsation in the slit between the roll and plate which is at a frequency equal to the roll speed. This air pulsation causes uniformly spaced, cross-directional lines in the web, called chatter marks. Flow vortices having axes along the roll circumference cause machine direction streaks in the web. Non-uniform fiber separation or segregation of fibers into clumps causes blotches in the web.

40 U.S. Patent 3,932,915 (Contractor et al.) discloses an apparatus for reducing all three types (i.e., blotches, streaks and chatter marks) of web variations normally caused by the Zafiroglu process. The Contractor et al. apparatus allows for the production of relatively uniform webs at increased production speeds. However, Contractor et al. is not concerned with the "openess" of the fibers making up the webs and thus does not address the problem of defects which manifest themselves as "married fibers" or chips. Chips, although not as great a problem when higher denier fibers are used,

45 are a particular problem in web formation and overall sheet quality when lower denier fibers are used. Defects are caused by unopened fiber chips being deposited by air-laydown during web formation.

SUMMARY OF THE INVENTION

50 The invention seeks to solve the problem of how to improve the web quality of air-laid textile staple fibers.

According to a first aspect of the invention, that problem is solved by the method of claim 1.

According to a further aspect of the invention that problem is solved by the method of claim 7.

The improved web quality of air-laid textile staple fibers is realized according to the invention by the fibers being sufficiently opened before laydown.

55 The invention is also directed to a web of staple fibers formed by the method of claim 7.

when the opened fibers obtained by the inventive method are formed into a web, the web is capable of having a defect level of less than 21 (2) unopened fiber chips per m² (square foot) of web.

Preferably, the ribs in the disperser plate are formed by semicircular grooves and extend continuously across the

plate such that they are present over substantially the entire surface of the disperser plate. Most preferably, the disperser plate has an exposed rib length of between 0.25 and 0.762 mm (0.01 and 0.03 inches) and a rib spacing of between 3.81 and 7.62 mm (0.15 and 0.30 inches).

5 BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a longitudinal vertical section of a form of air-laydown machine.

Figure 2 is a fragmented longitudinal vertical section of the top portion of the fiber dispersing and opening section, showing the fiber dispersing roll and the modified ribbed disperser plate.

10 Figure 3 is an enlarged diagrammatic view showing the ribbed surface of the disperser plate in detail.

Figures 4A-4E show various configurations of ribs in ribbed disperser plates suitable for use in the method of the present invention.

Figure 5 shows rib configurations used in disperser plates suitable for use in the method of the present invention.

15 Figure 6 is a graph relating release opportunities and defect characteristics versus disperser plate geometry. Exposed rib length is plotted against rib spacing to show the number of defects and release opportunities.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

20 As used herein, "exposed rib length" means that portion of the disperser plate rib length available for impact by a tangentially released fiber chip.

As used herein, "release opportunities" means the number of times a given fiber chip is capable of being thrown off the disperser roll by centrifugal force before exiting the disperser plate.

As used herein, "defect level" or "defects" means the number of unopened fiber chips or clumps per square foot of web.

25 As used herein, "rib spacing" means the distance between the faces of adjacent ribs. This distance is measured across the grooved area between the faces of adjacent ribs.

As used herein, "rib width" means the thickness of the rib measured across the top surface of the rib.

As used herein "rib tip" means to the top surface of the rib.

30 Referring now to the drawings, wherein like reference numerals indicate like elements, Figure 1 shows a fiber feeding means consisting, in this embodiment, of a conveyor belt 2, feed roll 3, compressing roll 4 and shoe 5 for supplying fiber 1 to disperser roll 8. The fiber feeding means is designed to feed a batt of staple fibers having a weight, in ounces per square yard, which is about 3 to 150 times the weight of the web to be produced. The disperser roll separates the fibers and carries them mixed with the air adjacent to the roll surface through the space between the roll and disperser plate 10, and discharges this mixture centrifugally into duct 20 at Zone A. A shroud or casing 9
35 extends around the disperser roll from the lower edge of doff-bar 12 to feed-roll 3. The fibers projected from the disperser roll form a thin fiber stream 22 in air flowing through the duct and are then separated from the air as web 24 on condenser screen 26.

40 Although the disperser plate is preferably used in the high-speed production of highly uniform webs, it will be understood that the disperser plate is also capable of being used strictly for opening fibers in other unrelated opening operations. For example, it is contemplated that the disperser plate could be used to separate and open fiber bales in the initial operation stages basic to making a fibrous product. Thus, the disperser plate could be used solely in opening operations which must precede other operations necessary to making finished product.

45 In the preferred embodiment, air is supplied from air passage 14, which has larger cross-sectional dimensions than the duct 20. The parallel walls 16 of the air passage are connected to the duct walls 20 by converging section 18 of the flow nozzle configuration. Screens 38 and 42, and honeycomb structure 40, provide a uniform flow substantially free of turbulence and vorticity. Air is blown into the air passage by one or more fans 36, through a duct system 33, shown diagrammatically.

50 The fibers are opened and deposited to form a web on continuous, moving screen 26 which is driven and supported by rolls 28 and 30. The air flows through the screen and is withdrawn through vacuum duct 34. The air may be filtered to remove any particles passing screen 26 and then recirculated to fan 36. Several fans in series or an open air system with one or more fans supplying the air and one or more fans exhausting the air can also be used. The screen 26 is sealed against the fiber duct 20 and the vacuum duct 34 by sealing means 32 as a plate of polyethylene.

55 Figure 2 shows the disperser roll 8 and ribbed disperser plate 10 in greater detail. In the Figure, dashed line 58 is the tangent to the outer edge of the disperser roll teeth 7. The upper edge 54 of disperser plate 10 can be placed on the tangent line 58 or can be somewhat below the tangent line, e.g., 12-7 mm (1/2 inch) below. In the Figure, disperser plate 10 is shown to be provided with semicircular grooves 50 spaced uniformly, starting from the bottom of disperser plate 51 and ending as close as possible in the extreme tip 52 of the plate. Preferably, the ribs are present over the entire face, indicated generally at 56, of the plate except for the region 53, which extends 12.7 to 19 mm (1/2 to 3/4-inch)

from the extreme tip 52, to avoid weakening the tip. Preferably the extreme tip 52 of the disperser plate is essentially concentric with the disperser roll in its overall contour, i.e., not considering the ribs. The clearance 55 between the rib tips 56 and the tips of the roll teeth 7 should be less than 3.175 mm (0.125 inch) in order to avoid premature turbulent mixing of air and fiber under the plate in an uncontrolled manner which would result in agglomeration of fibers into clumps. Preferably, a clearance of between about 0.254 to 1.524 mm (0.01 and 0.06 inch) is used.

Referring to Figure 3, the dimensions of the ribbed surface for the most preferred embodiment are shown in greater detail. The ribs are continuous in the lateral direction of the plate 10 and are spaced along the arc of the plate such that there are 0.2 to 2.4 ribs per cm (0.5 to 6 ribs per inch) of arc; groove depth 60 is between 0.51 and 0.51 mm (0.02 and 0.20 inches) and rib spacing 61 is between 3.8 and 51 mm (0.15 and 2.0 inch); the rib width 62 is between 0.51 and 2.54 mm (0.020 and 0.10 inches). Figures 4A through 4E show other configurations of ribs in disperser plates found to open fibers and improve web quality.

The disperser roll 8 is of conventional design and is usually about 12.7 to 127 cm (5 to 50 inches) in diameter. It is usually of hollow construction. The cylindrical outer surface of the roll is usually provided with low rake, fine metallic wire clothing 7 (Figure 2) formed by spirally winding one or several saw-tooth strips about the roll and anchoring it. The sharp tips of the teeth are located so that the tips lie in a substantially true cylinder about the axis of rotation of roll 8. Typical disperser roll arrangements are disclosed in U.S. Patent 3,932,915, the entire contents of which are incorporated herein.

The disperser plate 10 and the doff bar 12 can be constructed of any suitable materials, such as plastic or metal, that will maintain the close clearance with the disperser roll 8 at the high speeds used. The disperser plate and doff bar are preferably fabricated of aluminum and coated with a fiber-friendly coating. The preferred coating comprises a ceramic coating composition of 40 wt.% titanium dioxide and 60 wt.% aluminum oxide. The coating should have a minimum hardness of 65 Rockwell C and a snag free surface finished to 10-15 AA roughness. The coating helps to prolong the life of the disperser plate and doff bar. The disperser plate should have a length corresponding to 45 degrees to 90 degrees or more of the arc of the disperser roll. Although a unitary disperser plate and doff bar are shown in Figure 1, it will be understood that both parts can be fabricated of a number of sections with suitable attachments.

Figure 5 shows a disperser plate profile for various geometric rib configurations. The profile is divided into Zones A and B. Zone A shows the ribs and grooves of a disperser plate having too small a rib spacing and exposed rib length to mechanically stop the fibers. In this Zone, the standard rib has an exposed rib length of about 0.102 mm (0.004 inches) and thus merely deflects the fiber chips when they are released from the disperser roll. Zone B shows ribs having a rib spacing and exposed rib length in accordance with the invention. In this Zone, the design provides enough rib spacing and exposed rib length to mechanically stop the released fiber chips.

Figure 6 is a graph relating the exposed rib length, the defect level and the maximum number of fiber chip releases in the disperser plate length to the disperser plate geometry. In the area to the left of the dashed vertical line, the fiber chips are merely deflected by the disperser plate when they are released from the disperser roll. In the area to the right of the dashed line, sufficient rib length is exposed to mechanically stop the released fiber chips, allowing them to be picked up again by succeeding disperser roll teeth. This area is representative of disperser plates used according to the invention.

The invention provides a method for opening textile staple fibers wherein the number of unopened fiber chips is significantly reduced in many final opening operations. As noted before, the inventive method can be adapted to most opening operations, as well as integrated into airlay designs. Instead of mechanically combing the fibers, the method utilizes the energy dispersed by the impact of groups of high velocity, unopened fiber chips against a fixed surface.

Specifically, the supply means feeds a loosely opened, uniform layer of fibers onto the high speed (i.e., 2000 rpm), rotating toothed disperser roll which carries the fibers over the closely-spaced, curved disperser plate having a plurality of longitudinal grooves and ribs. Due to air drag and surface friction, individual fibers remain "pinned" to the roll teeth. However, groups of unopened fiber chips which have sufficient mass to be thrown off by centrifugal force are thrown off so that they impact the ribbed disperser plate. Succeeding roll teeth pick up the discharged fiber chips and the method is repeated until the mass of unopened fiber chips is reduced to the point where the drag/friction forces keep them on the disperser roll or the end of the disperser plate is reached.

In practice, one must first determine the disperser roll surface speed needed to develop the centrifugal force required to discharge the clumps of unopened fiber chips. The key to success, however, is in determining the optimum plate rib geometry (rib spacing and exposed rib length) necessary to catch the discharged fiber chips, stop them momentarily, and then present them to succeeding disperser roll teeth.

By using a specific disperser plate rib spacing and exposed rib length, a mechanical barrier is provided to eliminate fiber chips rather than just deflecting those chips. The violent contact or series of contacts between the fibers and the ribbed disperser plate causes the unopened fiber chips to break up and separate from one another. The dimensions of the disperser plate ribs are a function of the disperser roll diameter. The relationship can be expressed by the following equation:

$$L = \sqrt{(R)^2 + \left(\sqrt{(R+C)^2 - R^2} + W \right)^2} - R - C$$

where:

L = exposed rib length for fiber opening

R = disperser roll radius

C = clearance between rib tips and tips of roll teeth

W = rib spacing

It has been determined that at comparable feed rates on the same fiber lot, the number of unopened, married fibers (i.e., defects or fiber chips) can be reduced by a factor of about 20. The degree of opening achieved without overworking the fibers (causing neps and tangles) is significantly higher than with methods or apparatus using different disperser plate rib dimensions. This occurs because only the unopened fiber chips have sufficient mass to eject from the roll, resulting in their contact with the stationary ribs. Once the fibers are opened, drag/friction forces keep them on the roll and no further work is performed on these fibers. The inventive method requires the use of only a single disperser roll and plate instead of numerous rolls and combs to obtain the desired level of opening.

All fiber types can be run using the inventive method. Although crimped fibers are more preferable, uncrimped fibers can also be processed. It is to be noted that uncrimped fibers cannot normally be opened with prior art methods of mechanical combing. Generally, higher denier fibers are not subject to the chip problem experienced with lower denier fibers but they can also benefit from the invention.

The relationship between rib spacing and exposed rib length is demonstrated by the following Table and set forth in Figure 6 described hereinbefore. In the Table, Sample A refers to a disperser plate having rib dimensions outside of the invention while sample #'s 1-4 refer to rib dimensions according to the invention. As noted above, Figure 6 plots the exposed rib length, the defect level and the maximum number of fiber chip releases in the disperser plate length to the disperser plate geometry.

TABLE

#	Roll Radius (cm)	Clear- ance (mm)	Rib Spacing (mm)	Exposed Rib Length (mm)	# Releases	\$ D2D * Defects	D6Y ** Defects
A	30	0.76	1.5	0.1	16.5	301	140
1	30	0.76	3.8	0.28	15.0	194	108
2	30	0.76	6.35	0.508	13.6	21	11
3	30	0.76	13	1.17	11.0	43	32
4	30	0.76	25.4	2.82	9.1	86	65

\$ refers to the number of release opportunities for a given fiber chip

* refers to the number of unopened polyester fiber chips of merge lot D2D per square meter of air-laid web

** refers to the number of unopened polyester fiber chips of merge lot D6Y per square meter of air-laid web. Both merge lots (D2D and D6Y) used the same type of polyester staple fibers. The operating conditions were the same and the only variable was the disperser plate.

The Table and Figure 6 show that there is an optimum range for rib spacing and exposed rib length. Examination of the data reveals that when a semicircular groove is used between adjacent ribs, a 3.175 mm (0.125 inch) radius groove provides the optimum exposed rib length and rib spacing for maximum opening. A groove radius of about 0.76 mm (0.03 inches), having an exposed rib length of less than 0.25 mm (0.01 inches), results in a large number of defects (e.g., 301 (28) unopened fiber chips per m² (square foot) of web) since the exposed rib length and rib spacing are not sufficient to stop the fiber chips being thrown from the disperser roll. As the exposed rib length is increased beyond about 0.76 mm (0.03 inches), the number of defects begins to increase again. Once an exposed rib length of about 5.1 mm (0.2 inches) is exceeded, the number of defects approaches that obtained using exposed rib lengths less than 0.254 mm (0.01 inches). This occurs because the number of release opportunities decreases as the rib spacing and the exposed rib length are increased.

Claims

1. A method for opening fibers comprising the steps of:

(a) supplying fibers to a rotating toothed disperser roll wherein the roll carries the fibers over a closely-spaced, stationary curved disperser plate having a plurality of longitudinal grooves and ribs extending across the plate in a direction transverse to the rotational direction of the roll, wherein the disperser plate has an exposed rib length of between (0.254 to 5.1 mm) and a rib spacing of between (3.81 to 51 mm);
 (b) pinning individual fibers to the teeth of the roll;
 (c) centrifugally throwing unopened fiber chips of sufficient mass off the roll and onto the ribbed disperser plate;
 (d) momentarily stopping, and not merely deflecting, the thrown unopened fiber chips using the exposed rib length of the ribs such that the impact of the unopened fiber chips with the exposed rib length of the ribs causes the unopened fiber chips to break up and separate from one another; and
 (e) repeating steps (b) through (d) until either the mass of unopened fibers is reduced to the point where the drag and friction forces on the fibers are greater than the centrifugal forces on the fibers or the fibers reach the end of the disperser plate.

2. The method of claim 1 wherein the disperser plate has an exposed rib length of between (0.254 and 0.76 mm).

3. The method of claim 1 wherein the disperser plate has a rib spacing of between (3.81 and 7.62 mm).

4. The method of claim 1 wherein the ribs are formed by semicircular grooves and extend continuously across the plate.

5. The method of claim 4 wherein the ribs are present over substantially the entire surface of the disperser plate.

6. The method of claim 1 wherein the disperser plate is coated with a fiber-friendly ceramic coating comprising about 40 wt.% titanium dioxide and about 60 wt.% aluminum oxide.

7. A method for opening staple fibers used in the production of highly-uniform webs, comprising the steps of:

(a) supplying a loosely opened, uniform layer of fibers to a rotating toothed disperser roll wherein the roll carries the fibers over a closely-spaced, stationary curved disperser plate having a plurality of longitudinal grooves and ribs extending across the plate in a direction transverse to the rotational direction of the roll, wherein the disperser plate has an exposed rib length of between (0.254 to 5.1 mm) and a rib spacing of between (3.81 to 51 mm); (b) pinning individual fibers to the teeth of the roll; (c) centrifugally throwing unopened fiber chips of sufficient mass off the roll and onto the ribbed disperser plate;
 (d) momentarily stopping, and not merely deflecting, the thrown unopened fiber chips using the exposed rib length of the ribs such that the impact of the unopened fiber chips with the exposed rib length of the ribs causes the unopened fiber chips to break up and separate from one another; and
 (e) repeating steps (b) through (d) until either the mass of unopened fibers is reduced to the point where the drag and friction forces on the fibers are greater than the centrifugal forces on the fibers or the fibers reach the end of the disperser plate.

8. The method of claim 7 wherein the disperser plate has an exposed rib length of between (0.254 and 0.762 mm).

9. The method of claim 7 wherein the disperser plate has a rib spacing of between (3.81 and 7.62 mm).

10. The method of claim 7 wherein the ribs are formed by semicircular grooves and extend continuously across the plate.

11. The method of claim 10 wherein the ribs are present over substantially the entire surface of the disperser plate.

12. The method of claim 7 wherein the disperser plate is coated with a fiber-friendly ceramic coating comprising about 40 wt.% titanium dioxide and about 60 wt.% aluminum oxide.

13. A web of staple fibers formed by the method of claim 7 wherein the web has a defect level of less than 21 unopened fiber chips per square meter of web.

Patentansprüche

1. Verfahren zur Öffnung von Fasern mit den folgenden Schritten:

- 5 (a) Liefern von Fasern zu einer sich drehenden, gezahnten Verteilerwalze, wobei die Walze die Fasern über eine eng beabstandete stationäre gekrümmte Verteilerplatte mit einer Mehrzahl von Längsnuten und -rippen fördert, die sich quer zur Drehrichtung der Walze über die Platte erstrecken, wobei die Verteilerplatte eine freiliegende Rippenlänge von 0,254 bis 5,1 mm und einen Rippenabstand von 3,81 bis 51 mm hat;
- 10 (b) Anheften einzelner Fasern an die Zähne der Walze;
- (c) durch Fliehkraft erfolgreiches Wegschleudern von nicht geöffneten Faserteilchen mit ausreichender Masse von der Walze auf die gerippte Verteilerplatte;
- 15 (d) kurzzeitiges Anhalten und nicht nur Ablenken der weggeschleuderten, nicht geöffneten Faserteilchen unter Verwendung der freiliegenden Rippenlänge der Rippen derart, daß der Zusammenstoß der nicht geöffneten Faserteilchen mit der freien Rippenlänge der Rippen ein Aufbrechen und voneinander Trennen der nicht geöffneten Faserteilchen bewirkt; und
- 20 (e) Wiederholen der Schritte (b) bis (d) bis entweder die Masse der nicht geöffneten Fasern bis zu dem Punkt herabgesetzt ist, wo die auf die Fasern wirkenden Mitnahme- und Reibungskräfte größer als die auf die Fasern wirkenden Fliehkräfte sind oder die Fasern das Ende der Verteilerplatte erreichen.

25 2. Verfahren nach Anspruch 1, wobei die Verteilerplatte eine freiliegende Rippenlänge von 0,254 bis 0,76 mm hat.

3. Verfahren nach Anspruch 1, wobei die Verteilerplatte einen Rippenabstand von 3,81 bis 7,62 mm hat.

4. Verfahren nach Anspruch 1, wobei die Rippen durch halbkreisförmige Rillen gebildet sind und sich kontinuierlich über die Platte erstrecken.

30 5. Verfahren nach Anspruch 4, wobei die Rippen auf im wesentlichen der gesamten Oberfläche der Verteilerplatte vorgesehen sind.

35 6. Verfahren nach Anspruch 1, wobei die Verteilerplatte mit einem faserfreundlichen Keramiküberzug mit ungefähr 40 Gew.-% Titandioxid und ungefähr 60 Gew.-% Aluminiumoxid beschichtet ist.

7. Verfahren zur Öffnung von Stapelfasern, das bei der Herstellung von sehr gleichmäßigen Bahnen verwendet wird, enthaltend die folgenden Schritte:

40 (a) Liefern einer locker geöffneten gleichmäßigen Lage von Fasern zu einer rotierenden gezahnten Verteilerwalze, wobei die Walze die Fasern über eine eng beabstandete stationäre gekrümmte Verteilerplatte mit einer Mehrzahl von Längsrillen und -rippen fördert, die sich über die Platte quer zur Drehrichtung der Walze erstrecken, wobei die Verteilerplatte eine freiliegende Rippenlänge von 0,254 bis 5,1 mm und einen Rippenabstand von 3,81 bis 51 mm hat;

45 (b) Anheften einzelner Fasern an die Zähne der Walze;

(c) durch Fliehkraft erfolgreiches Wegschleudern von nicht geöffneten Faserteilchen mit ausreichender Masse von der Walze auf die gerippte Verteilerplatte;

50 (d) kurzzeitiges Anhalten und nicht nur Ablenken der weggeschleuderten, nicht geöffneten Faserteilchen unter Verwendung der freiliegenden Rippenlänge der Rippen derart, daß der Zusammenstoß der nicht geöffneten Faserteilchen mit der freien Rippenlänge der Rippen ein Aufbrechen und voneinander Trennen der nicht geöffneten Faserteilchen bewirkt; und

55 (e) Wiederholen der Schritte (b) bis (d) bis entweder die Masse der nicht geöffneten Fasern bis zu dem Punkt herabgesetzt ist, wo die auf die Fasern wirkenden Mitnahme- und Reibungskräfte größer als die auf die Fasern wirkenden Fliehkräfte sind oder die Fasern das Ende der Verteilerplatte erreichen.

8. Verfahren nach Anspruch 7, wobei die Verteilerplatte eine freiliegende Rippenlänge von 0,254 bis 0,762 mm hat.
9. Verfahren nach Anspruch 7, wobei die Verteilerplatte einen Rippenabstand von 3,81 bis 7,62 mm hat.
- 5 10. Verfahren nach Anspruch 7, wobei die Rippen durch halbkreisförmige Rillen gebildet sind und sich über die Platte erstrecken.
11. Verfahren nach Anspruch 10, wobei die Rippen auf im wesentlichen der gesamten Oberfläche der Verteilerplatte vorgesehen sind.
- 10 12. Verfahren nach Anspruch 7, wobei die Verteilerplatte mit einem faserfreundlichen Keramiküberzug mit ungefähr 40 Gew.-% Titandioxid und ungefähr 60 Gew.-% Aluminiumoxid beschichtet ist.
- 15 13. Vlies aus Stapelfasern, hergestellt nach dem Verfahren von Anspruch 7, wobei das Vlies eine Fehlerhäufigkeit von weniger als 21 ungeöffneten Faserteilchen pro Quadratmeter des Vlieses hat.

Revendications

- 20 1. Un procédé d'ouverture des fibres comprenant les étapes suivantes:
 - (a) introduction des fibres dans un cylindre de dispersion denté tournant dans lequel le cylindre transporte les fibres sur une plaque de dispersion courbe fixe coopérante à faible distance, comportant des sillons et des
 - 25 côtes s'étendant sur toute la plaque suivant une direction transversale au sens de rotation du cylindre, la plaque de dispersion présentant une longueur de côte exposée comprise entre 0,254 et 5,1 mm et un écartement des côtes compris entre 3,81 et 51 mm;
 - (b) accrochage des fibres individuelles sur les dents du cylindre;
 - (c) expulsion centrifuge des boules de fibres non-ouvertes de masse suffisante hors du cylindre sur les côtes de la plaque de dispersion;
 - 30 (d) arrêt momentané des boules de fibres non-ouvertes expulsées en utilisant la longueur des côtes exposée des côtes de telle sorte que les boules de fibres non ouvertes se brisent et que les fibres se séparent les unes les autres; et
 - (e) répétition des étapes (b) à (d) soit jusqu'à ce que la masse des fibres non ouvertes soit réduite au point où les forces d'entraînement et de frottement exercées sur les fibres soient supérieures aux forces centrifuges exercées sur les fibres, soit jusqu'à ce que les fibres atteignent l'extrémité de la plaque de dispersion.
- 35 2. Le procédé selon la revendication 1, dans lequel la plaque de dispersion présente une longueur de côte exposée comprise entre 0,254 et 0,76 mm.
- 40 3. La plaque de dispersion présente un écartement de côtes compris entre 3,81 et 7,62 mm.
4. Le procédé selon la revendication 1, dans lequel les côtes sont formés par des sillons semi-circulaires et s'étendent en continu sur toute la plaque.
- 45 5. Le procédé selon la revendication 4 dans lequel les côtes sont présentes sur pratiquement toute la surface de la plaque de dispersion.
6. Le procédé selon la revendication 1 dans lequel la plaque de dispersion est recouverte d'un revêtement en céramique respectant les fibres comprenant environ 40% en poids de dioxyde de titane et environ 60% en poids d'oxyde
- 50 d'aluminium.
7. Un procédé d'ouverture de fibres coupées utilisées dans la formation de nappes hautement uniformes, comprenant les étapes suivantes:
 - 55 (a) introduction d'une couche uniforme de fibres ouvertes et peu serrées dans un cylindre de dispersion denté tournant dans lequel le cylindre transporte les fibres sur une plaque de dispersion courbe fixe coopérant à courte distance présentant une pluralité de sillons et des côtes s'étendant sur toute la plaque suivant une direction transversale au sens de rotation du cylindre, dans lequel la plaque de dispersion présente une lon-

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gueur de côte exposée comprise entre 0,254 et 5,1 mm et un écartement de côtes compris entre 3,81 et 51 mm;
(b) accrochage des fibres individuelles aux dents du cylindre;
(c) expulsion centrifuge des boules de fibres non ouvertes d'une masse suffisante hors du cylindre et sur la plaque de dispersion côtelée;

5 (d) arrêt momentané et non pas simplement déviation des boules de fibres non ouvertes expulsées en utilisant la longueur des côtes exposée de telle sorte que des boules de fibres non ouvertes sur la longueur des côtes exposée occasionnent la déségragation des boules de fibres non ouvertes et la séparation des fibres les unes des autres, et
10 (e) répétition des étapes (b) à (d) soit jusqu'à ce que la masse des fibres non ouvertes soit abaissées au point que les forces de traînée et le frottement exercés sur les fibres soient supérieures aux forces centrifuges exercées sur les fibres, soit jusqu'à ce que les fibres atteignent l'extrémité de la plaque de dispersion.

8. Le procédé selon la revendication 7 dans lequel la plaque de dispersion présente une longueur des côtes exposée comprise entre 0,254 et 0,762 mm.

15 9. Le procédé selon la revendication 7, dans lequel la plaque de dispersion présente un écartement de côtes compris entre 3,81 et 7,62 mm.

20 10. Le procédé selon la revendication 7, dans lequel les côtes sont formées par les sillons semi-circulaires et s'étendent en continu sur toute la plaque.

11. Le procédé selon la revendication 10, dans lequel les côtes sont présentes sensiblement sur toute la surface de la plaque de dispersion.

25 12. Le procédé selon la revendication 7, dans lequel la plaque de dispersion est recouverte d'un revêtement céramique respectant les fibres et comprenant environ 40% en poids de dioxyde de titane et environ 60% en poids de dioxyde d'aluminium.

30 13. Une nappe de fibre coupée formée par le procédé selon la revendication 7, dans laquelle la nappe présente un taux de défaut inférieur à 21 boules de fibres non ouvertes par mètre carré de nappe.

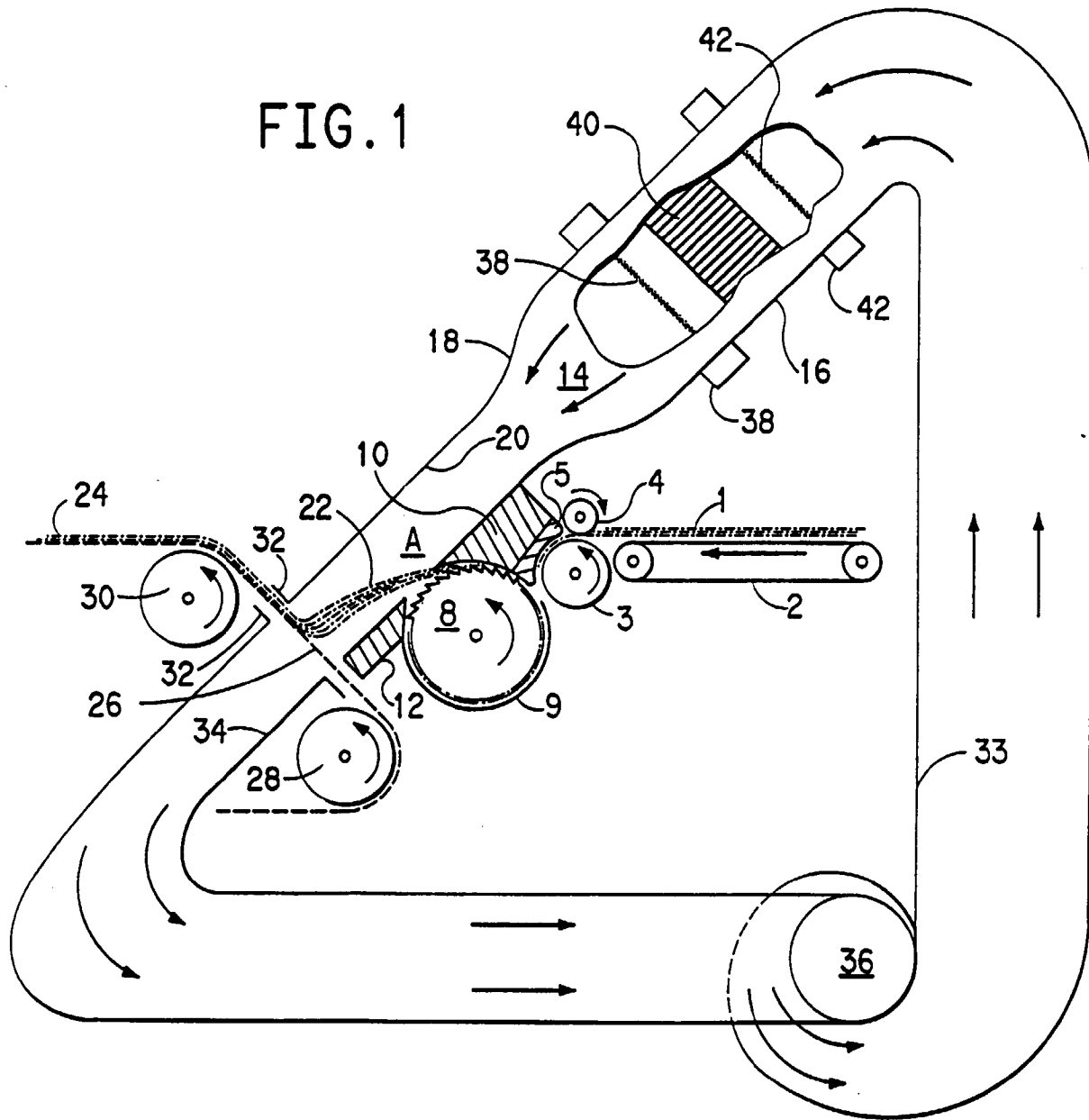
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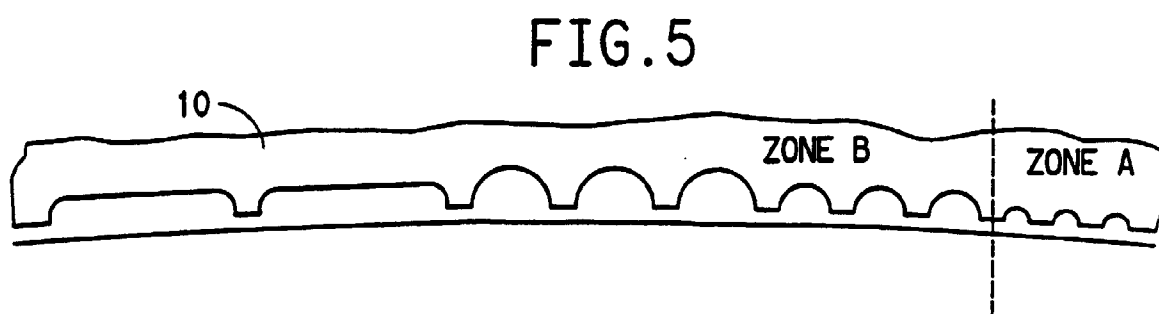
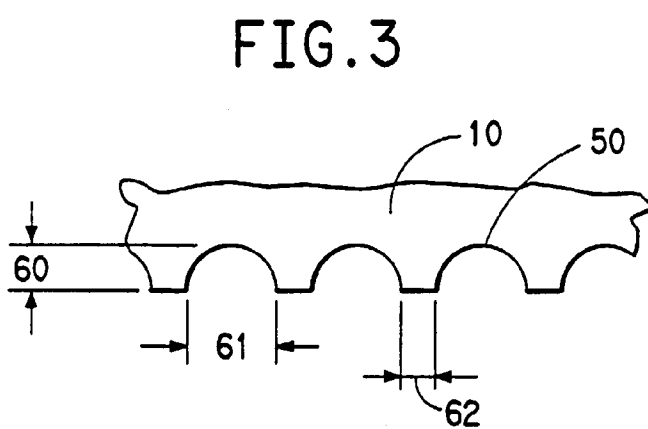
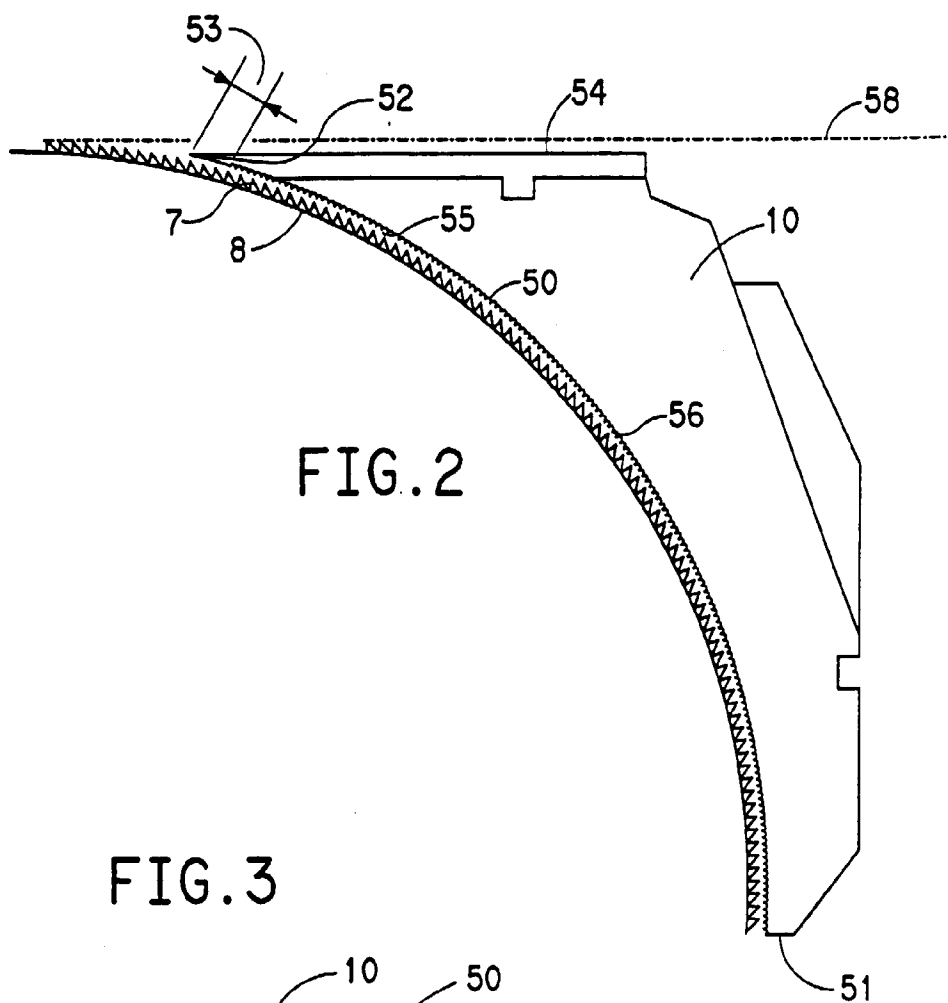


FIG. 4A

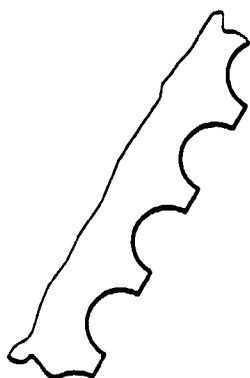


FIG. 4B

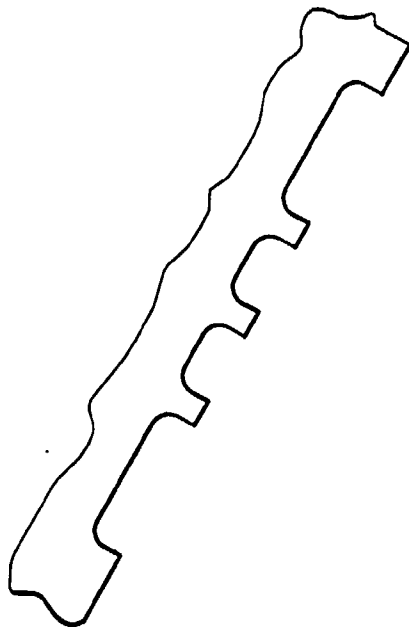


FIG. 4C

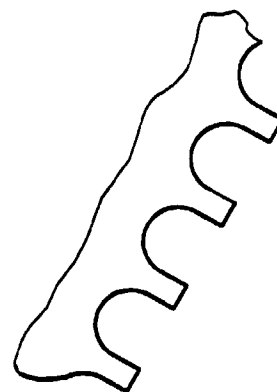


FIG. 4D

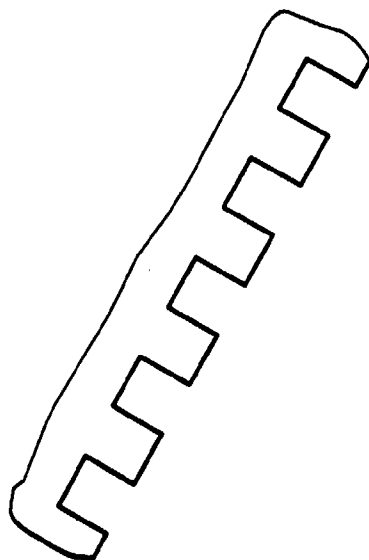


FIG. 4E

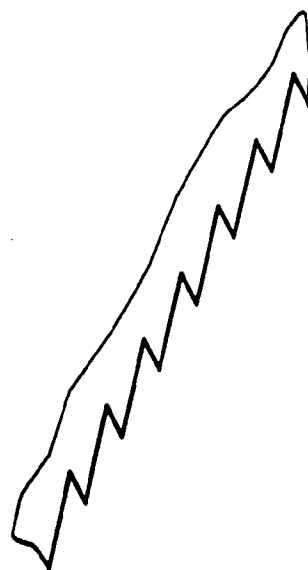


FIG. 6

