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(54) **MECHANICAL PARTIAL NEUTRALIZATION OF HYDROGEN BONDS FOR PRODUCTION OF A SOFTER AND MORE SILKY AIR-LAID FIBROUS PRODUCT**

MECHANISCHE TEILNEUTRALISATION VON WASSERSTOFFBRÜCKEN ZUR HERSTELLUNG EINES WEICHEREN, SEIDIGEREN, LUFTGELEGTEN FASERPRODUKTS

NEUTRALISATION MECANIQUE PARTIELLE DE LIAISONS HYDROGENE POUR LA PRODUCTION D'UN PRODUIT FIBREUX PLUS DOUX ET PLUS SOYEUX FORME PAR VOIE SECHE

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EP-A- 0 077 005
CH-A- 557 927

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Description

This invention concerns a method for production of a soft and silky air-laid fibrous sheet having fibers and groups of fibers bonded to other fibers and other groups of fibers, having the steps of passing a stream of gas containing suspended organic natural fibers through a gas-permeable forming surface to form a fibrous sheet thereon, applying binder agent onto the sheet, and drying the fibrous sheet, and curing said binder, and an apparatus for production of a soft and silky air laid fibrous sheet comprising means for dry-laying a fibrous sheet in a dry state via an air stream onto a forming surface, means for applying a binder solution onto the fibrous sheet in order to establish a combination of brittle bonds and elastic bonds, means for drying the fibrous web by application of heat, means for curing the web after the fibers have been dried. The invention is in particular concerned with the manufacture of such fibrous sheet in which the soft and silky effect is obtained through a neutralizing or at least a partly neutralizing of the brittle bonds which may be provided in the form of hydrogen bonds or casein bonds.

It is customary to apply a binder solution onto a dry laid sheet of fibrous material in order to form an effective bond between individual fibers and groups of fibers. After the air-lying of the organic natural fibers onto a forming surface the binder solution is applied onto the soformed fibrous sheet. After the applying of such solution in one or several application stations the web is led through a drying unit and then through a curing unit.

When applying the binder solution a combination of brittle hydrogen bonds and elastic latex bonds are provided. The hydrogen bonds are valuable in a fibrous sheet although they are generally brittle. However, the hydrogen bonds are not brittle when they only stay in groups of several fiber agglomerations or between single fibers and groups of fibers. These hydrogen bonds make the overall sheet stronger. However, due to the brittleness of the hydrogen bonds the fibrous sheet would appear as a rather stiff web having a poor hand and feel. Also the drapability would be poor.

The elastic latex bonds are valuable as they will provide a web being soft and silky.

Such web would also have a good hand and feel. However, the latex is applied in a suspension of water, and accordingly, the hydrogen bonds would also be provided when providing latex bonds.

From CH-A-557,927 it is known to produce a fibrous sheet. It is described that a sheet is made in which binding is effected according to a pattern covering a part of the surface in that embosser rollers being provided with latex is brought into contact with the web. Hereby the latex is incorporated in separate points. Hereby the product contains a good absorbency and would also have a good strength against tearing. This patent does not disclose the possibility of using an evenly aqueous latex solution in a manufacture for producing a soft and silky air-laid fibrous fiber sheet.

In EP-A-0,077,005 the manufacture of a dry-laid fibrous web is disclosed. In said publication a web is described in which the absorbency is enhanced by compressing and densifying portions of the web. It is also disclosed that it is possible to emboss such web. However, the publication does not disclose the possibility of producing a soft and silky air-laid fibrous sheet which is manufactured by the use of an evenly distributed aqueous latex binder.

Accordingly, the prior art does not disclose a solution which makes it possible to manufacture a soft and silky air-laid fibrous fiber sheet which is manufactured by the use of an aqueous binder solution, which product will simultaneously be a strong product.

It is an object of the present invention to manufacture a soft and silky air laid fibrous sheet in which the fibers and groups of fibers are bonded to other fibers and other groups of fibers via a combination of brittle and elastic bonds, however, with a dividing of the brittle bonds into separate groups being connected with other corresponding groups by areas only containing elastic bonds.

According to the present invention a method of and an apparatus for production of a soft and silky air laid fibrous sheet as described in claims 1 and 6 are provided wherein the brittle bonds in the dry laid web of the organic material fibers are neutralized or partly neutralized by stretching. The brittle bonds are preferably neutralized in a pattern which separates the remaining hydrogen bonds in small groups which could be compared with small islands being separated by breaking lines in which the brittle bonds are neutralized whereas the elastic bonds are maintained. Said elastic bonds connect the islands in which the brittle bonds are maintained totally or partly. Thereby a product is obtained being soft and silky. Moreover, the product will have a good hand and feel. Accordingly, the product will be suitable for the manufacture of wet-tissues, diapers, tissues and other products which should be soft.

Hydrogen bond is unavoidably because the latex solution is suspended in so much water that the hydrogen bond is all over and through the dry formed product. According to this invention the hydrogen bond will remain in very small areas or islands which have not been subjected to the neutralization stretching process. Thus the strong coherence of the product will be maintained in said areas or islands and in the connected islands.

It is noted that the hydrogen bonds due to their brittleness are fragile, whereas latex bonds due to their elasticity would be maintained even if the web is stretched in such a degree that the hydrogen bonds are neutralized. As the dry formed sheet consists of agglomerated fibers arranged in groups being in contact or connection with the other agglomerates or groups of fibers then the sheet will result as a product being stronger than a product having only single fibers being in mutually contact or connection with other single fibers. Accord-

ingly, a product having agglomerates of fibers being interconnected through the hydrogen bonds and which agglomerates at their side are interconnected with each other through the latex bonds then the resulting sheet will not only be soft but also a strong product.

The neutralization is preferably effected by stretching the sheet at least in two directions, however, also a stretching in three or four directions is possible. Thereby wrecking lines are established in the brittle bonds. Said wrecking lines may be compared to the randomly orientated cracking occuring in the earth during spill of droughts. Thus a more or less randomly orientated pattern is obtained in which the brittle bonds, viz. the hydrogen bonds are neutralized. However, due to the elasticity the latex bonds may be stretched without cracking in the pattern. Hereby an advantageous sheet is obtained having groups of interconnected fibers instead of single fibers. The final product will have soft quality, be strong and have a good and feel and a good drapability.

It could be said that a mini-mosaic is obtained in which each of the mosaic sections contain small groups of fibers being interconnected by the hydrogen bonds and possibly also the casein bonds. Said sections being separated by a fine network of lines in which the hydrogen bonds and possible also the casein bonds, if any, are neutralized or released from their tension. Thereby a very strong and very soft product is obtained.

The effect of the neutralization of the hydrogen bonds is not visible in the final sheet, however, the quality of the final sheet has remarkable new qualities.

Preferably the stretching is effected by use of a series of at least two rollers having thread-formed surfaces. The rollers are provided with alternating left handed and right handed threads and the web is urged against the threads, however, without the use of any pressure roller. Due to the action of the threads the sheet is stretched cross-wise. The stretching rollers are provided with smooth threads whereon the sheet is able to slide by creating a possibility of having a small increase in the width of the web formed. This is effected in the longitudinal direction of the rollers, viz. cross-wise to the machine direction of the sheet formed. The increase might have a value of 2 to 4 % of the original width.

Preferably successively rollers are driven with a higher surface velocity thereby establishing a stretching in the longitudinal direction of the sheet. At least two rollers are used, however, it is recommended to use a series of more than 4 rollers. The difference in the surface velocity from one roller to the next roller is the order of ½ to 1%. Hereby a stretching in the longitudinal direction is established which together with the stretching in the cross-wise direction provides a random pattern of breacking lines giving the sheet produced the above-mentioned remarkable good qualities. The stretching might increase the length of between 2 and 4% of the original length.

The use of threaded rollers may be supplemented by use of bombarded rollers. Alternatively, it is possible to use a series of bombarded rollers only to effect the stretching. Thereby a stretching orientated diagonal or cross-wise is effected from one roller to the following roller. In case only bombarded rollers are used, they should also be driven with a successively higher surface velocity in order to effect a stretching in the longitudinal direction of the sheet, viz. in the machine direction.

It is noted that the product might be provided with an embossing before it is introduced into the series of bombarded rollers or just before the curing process takes place of the latex. In this situation the embossing pattern will be maintained during the passage passing the bombarded rollers.

As an alternative to the thread formed roller it is possible to use rollers or at least one roller having smooth protuberances in its surface. The web is urged against this surface and thereby establishing a multi-directional stretching. As the sheet is urged against the roller a stretching is provided in a local area in front of each protuberance. Thereby the random pattern of breacking lines is provided.

It is also possible to use rollers having other forms, e.g. those known from the manufacture of corrugated paper. Thus it is possible to use a pair of rollers where each pair of rollers alternately is provided with round-going grooves and longitudinal orientated grooves. However, it is noted that the sheet when passing through such pair of rollers may not be nipped. Thus it should be possible for the paper to slide between the pair of rolles. Thus it is only necessary to urge the web against the profile roller. When using rollers of this type it is possible to provide a pattern of breacking lines being more well defined, and thereby it is possible to manufacture a final product having more specific properties in the machine direction and in the cross-wise direction.

Although it is preferred to use stretching rollers having a smooth surface it is also possible to make use of rollers provided with sandpaper-like surface.

After the neutralization process the fibrous sheet would have fiber groups of say from 2 to 10 fibers instead of single fibers and instead of a continuation of the fibers being interconnected by hydrogen bonds. It is possible to variate the size of the fiber group depending on the stretching effect. Thus a higher degree of stretching would provide minor fiber groups and a lower degree of stretching would fiber groups having a higher number of hydrogen interconnected fibers. Thus it is possible to determine the qualities of the product produced dependend on the intended use of the final product.

Further features and advantages of the present invention will be understood by reference to the attached drawings taken in conjunction with the ensuing discussion.

DESCRIPTION OF THE DRAWING

In the drawings,

Fig. 1-3 illustrate diagrammatically three embodiments of an apparatus according to the present invention,

Fig. 4 an diagrammatically enlarged view of a fibrous product without the use of a method according to the present invention,

Fig. 5 a view corresponding to the one shown in Fig. 4, however, having the fibrous product produced by a method according to the present invention, and

Fig. 6 a schematically view for illustrating the mini-mosaic of the invisible flexibility line in the fibrous product illustrated in Fig. 5.

Preferred embodiments for an apparatus according to the present invention is diagrammatically illustrated in Figs. 1-3. In these Figures identical or corresponding elements are designated with same reference numbers and will only be explained in details in connection with Fig. 1.

The apparatus includes a fiber distributor 1, a suction box 2, and an endless foraminous forming wire 3 passing there between the endless forming wire consisting e.g. of a mesh net constructed using bronze wires. The forming wire 3 is driven by suitable means (not shown) such that it will continously pass between the distributor 1 and the suction box 2. The forming wire 3 moves in direction of an arrow 4.

The suction box 2 includes a suction pipe 5 which is connected to a fan (not shown) for the creation of a vacuum therein. The forming wire 3 passes through the nip of a pair of rollers 6,7 and below a nozzle 8 spraying a binder solution onto the product formed. The nozzle 8 is connected with a mixing box 10 and the mixing box 10 is connected with supplying means 11 and 12.

An endless band 13 is arranged in continuation of the forming wire 3. The band 13 is driven in direction of the arrow 14. A further endless band 15 is provided above the forming wire 4 and the endless band 13. The endless band 3 is a gas permeable band wounded on three rollers 16, 17, and 18. From the roller 17 a wall 19 is provided thereby dividing the interior space of the gas permeable band 15 into two compartments 20 and 21. In the compartment 20 a vacuum is created through a fan (not shown) thereby lifting the fibrous product 22 free of the forming wire 3. In the compartment 21 a overpressure is created e.g. by means of the same fan which creates the vacuum in compartment 20. Thereby the fibrous product 22 is transferred and deposited onto the endless band 13.

The apparatus also comprises two sets of rollers 23,24 and 25,26, respectively, and a further nozzle 8 which is mounted between said sets of rollers and to which a binder solution is supplied from the mixing box 10. The rollers 24 and 26 may preferably be heated rollers. Furthermore, the apparatus comprises a drying unit 27, a stretching unit 28, a curing unit 29 and a roller 30 for binding the final product.

The stretching unit 28 shown in Fig. 1 comprises a series of four bombarded rollers 31. Between the bombarded rollers 31 turning and tighten rollers 32 are provided. The turning and tighten rollers 32 are movable along the arrows 33 in order to urge the fibrous product 22 against the bombarded rollers 31 with different forces thereby effecting different degrees of stretching.

The apparatus illustrated in Figs. 2 and 3 differs only from the apparatus illustrated in Fig. 1 by the use of other stretching units 28.

The stretching unit in Fig. 2 comprises a single roller 34 having a surface provided with small protuberances thus providing a surface which corresponds to the surface known from a corncob, however, each protuberance is much smaller as compared to a corngrain. Furthermore, the stretching unit 28 comprises two turning and tighten rollers 35 being movable along arrows 36 in order to urge the fibrous product 22 against the roller 34 with different forces thereby effecting different degrees of stretching.

The stretching unit 28 illustrated in Fig. 3 comprises a series of four rollers 37 and 38. The rollers 37 and 38 comprise a left hand thread and a right hand thread, respectively. The fibrous product 22 is led according to a sine-formed path through the series of rollers 37,38 alternately being urged into contact with a left hand thread and a right hand thread thereby establishing a stretch as the fibrous product 22 is urged against the rollers 37,38 in a tightened manner. The threads provided on the rollers 37,38 are rounded thereby allowing the fibrous product 22 to slide on the top of the threads.

The apparatus shown in different Figures operates in the following manner:

When the forming wire 3 is advanced in the above-mentioned path a fiber material is deposited on the forming wire 3 on which it is moved in direction of arrow 4 and forms a fiber layer when air is sucked away through the suction box 2. The fiber layer thus formed is rolled when passing the nip of the rollers 6,7 and a binder solution 9 is the applied to one side of the layer by means of the nozzle 8. The product thus formed has such a strength that it can be removed from the forming wire 3 by means of the gas permeable endless band 15. Due to the vacuum in the chamber 20 the fibrous product 22 is lifted free of the forming wire 3 and is then deposited onto the band 13 due to the overpressure in the compartment 21.

The fibrous product 22 is then passed through the set of rollers 23,24 and passes the nozzle 28 at which a binder solution 9 is applied on the side of the product facing downwards on the forming wire 3. When the material has passed the set of rollers 25,26 it is led through a drying unit 27. The rollers 24 and 26 are preferably heated so as to remove a part of the moisture supplied together with the binder solution. Thus is might be possible to obviate a use of a separate drying unit 27.

After having passed through the drying unit 27 the fibrous product 22 is led to a step in which the softening

treatment according to the invention is effected. Thus, the product 22 is passed through the stretching unit 28 in which the product is stretched at least in two directions. The effect on the stretching would be explained in more detail below. Before the product 22 is wound on the roller 30 it is led through a curing unit 29.

If it is desired it is possible to provide a nozzle for adjusting the moisture content of the product before it is wound on the roller 40.

The nozzles 8 are provided with a binder solution from a mixing box 10. The mixing box 10 comprises preferably mixing means in order to effect a intimate mixing by a whipping process. The product to be mixed in the mixing box 10 is provided from supply means 11 and 12.

The supply means 12 contain a latex binder which preferably is a SBR latex binder in an aqueous suspension which is known in the art. It is noted that it is also possible to use other binders which are well-known in the art.

The latex binder solution might be modified by introducing a softener product from the supply means 11. The introduction of a softener product into the latex binder suspension has given surprisingly improvements in the qualities of the final product obtained in that it is more soft and silky and also stronger than normal after the stretching operation effecting in the stretching unit 28.

The modification of the latex binder solution is preferred in order to obtain the soft and silky product which is provided after the mechanical neutralizing process according to the present invention.

The stretching unit 28 comprises bombarded rollers 31 which are well-known. However, so far bombarded rollers 21 have been used for smoothening a fibrous product. According to the present invention the fibrous product 22 is urged against the bombarded rollers 31 through the influence from the turning and tiedend rollers 32 thereby applying the fibrous product 22 onto the rollers 31 with a force sufficient to effect a stretching. Preferably, each succeeding bombarded roller is driven with a higher surface velocity than a before going roller 31 in order to effect a stretching in the longitudinal direction of the product 22. Due to the stretching it is possible to obtain a fine pattern of invisible neutralization lines to be explained below.

When using the corncob-shaped roller 34 illustrated in Fig. 2 it is possible to obtain a stretching around the smooth protuberances in the surface. The fibrous product 22 is also urged against the surface thereof by means of the turning and tighten rollers 35. Due to the great number of fine distributed and small protuberances a multi-directional stretching is obtained due to the force with which the fibrous product 22 is urged against the surface of the roller 34.

If desired the roller 34 may be followed by one or more bombarded rollers for effecting a smoothening. However, such smoothening process would not be necessary for the production of most products. The roller 34 might have protuberances having a height of between 2 mm and 3 mm and having a mutual distance between protuberances of between 5 mm and 20 mm.

When using the thread-provided rollers 37,38 illustrated in Fig. 3 it is possible to stretch the product in order to obtain said mosaic of neutralization lines in the product 22. The thread is formed by a sine-shaped surface of the roller in which each sine-wave has a height of between 5 and 10 mm and having a mutual distance between the waves of between 10 and 15 mm. The roller may have a diameter of between 0.4 and 0.6 m. The same diameters could also be used for the rollers 31 and 34.

In Fig. 4 a fragmentary enlarged view of a fibrous product 22 is illustrated. It is seen that the single fibers 39 are distributed with a normal air-forming distribution of the fibers 39 in all positions and with hydrogen bonds and latex bonds at cross-linking points of the individual fibers.

Fig. 5 illustrates greatly enlarged a fibrous product 22 corresponding to that illustrated in Fig. 2, however, treated with a modified latex binder and subjected to a stretching process as described above. In the view a mosaic of lines 41 is illustrated separating the product in mosaic sections 42 in which the hydrogen bonds are maintained. In the lines 41 the brittle hydrogen bonds and casein bonds are neutralized whereas the elastic latex bonds are maintained even after the stretching of the product 22. The product will all over its surface maintain the latex bonds. Thus the product is obtained having groups of interconnected fibers 39 in the mosaic sections 42 when said groups of fibers are interconnected with other groups of fibers or single fibers through the latex bonds. Accordingly, a final product is obtained having a good hand and feel and a good drapability.

In Fig. 6 the mosaic pattern of the lines 41 is illustrated without the illustration of the fibers 39. This is only for illustrative reasons as the lines 41 would be invisible in the final product even if it is studied through a three-dimensional microscope.

Claims

1. A method for production of a soft and silky air-laid fibrous sheet (22) having fibers and groups of fibers bonded to other fibers and other groups of fibers, having the steps of passing a stream of gas containing suspended organic natural fibers through a gas-permeable forming surface (3) to form a fibrous sheet thereon, applying binder agent (9) onto the sheet, and drying the fibrous sheet (22), and curing said binder, **characterized** in that said method consists essentially of the sequential steps of applying only a single binder solution (9) onto the fibrous sheet (22), said binder solution comprising a latex binder contained in a water suspension, thereby providing a combination of brittle bonds in the form of hydrogen bonds and elastic bonds in the form of

latex bonds between the fibers (39) therein, and that after the drying step a stretching of the web is effected by stretching means (28) to neutralize at least a part of the brittle bonds.

2. A method according to claim 1, **characterized** in that the hydrogen bonds are neutralized in a pattern (41) which separates the web in small areas (42) in which fibers (39) and groups of fibers have hydrogen bonds maintained whereas the pattern only comprises elastic bonds.

3. A method according to claim 2, **characterized** in that the stretching means (28) comprise rollers (31,34,37,38) effecting a two-directional stretching of the sheet thereby establishing a pattern of breaking lines (41) in the brittle bonds.

4. A method according to claim 3, **characterized** in that a series of at least two rollers (37,38) is used having thread-formed surfaces having alternating left handed and right handed threads against which the web is urged in order to establish a cross-wise stretching said rollers are driven with successively higher surface velocity thereby establishing a simultaneous stretching in the longitudinal direction.

5. A method according to claim 1, **characterized** in that said stretching comprises a multi-directional stretching effected by at least one roller (34) having smooth protuberances in its surface against which the web is urged.

6. An apparatus for production of a soft and silky air laid fibrous sheet (22) comprising means (1) for dry-laying a fibrous sheet in a dry state via an air stream onto a forming surface (3), means for applying a binder solution onto the fibrous sheet (8), means (27) for drying the fibrous web by application of heat, means (29) for curing the web after the fibers have been dried, **characterized** in comprising means (28) arranged after the drying means for stretching the web (22) at least in two directions.

7. An apparatus according to claim 6, **characterized** in that said stretching means comprise at least one roller (34) having a surface being provided with protuberances.

8. An apparatus according to claim 6, **characterized** in that said stretching means comprise a series of rollers (37,38) alternating provided with left hand and right hand thread each successive roller being driven with a higher rotational velocity than a beforegoing roller.

9. An apparatus according to claim 8, **characterized** in that said rollers (37,38) have a length of between 3 and 4 meters, a diameter of between 0.4 and 0.6 meter, and wherein the thread is formed by a sine-shaped surface in which the sine wave has a height of between 5 and 10 mm and having a distance between the sine waves of between 10 and 15 mm.

Patentansprüche

1. Verfahren zur Herstellung einer weichen und seidigen, geblasenen Faserschicht (22) mit Fasern und Gruppen von Fasern, die mit anderen Fasern und Gruppen von Fasern verbunden sind, aufweisend die Schritte des Leitens eines Gasstromes, welcher suspendierte, organische Naturfasern enthält, durch eine gasdurchlässige Formoberfläche (3), um auf ihr eine Faserschicht zu bilden, Aufbringen eines Bindemittels (9) auf die Schicht und Trocknen der Faserschicht (22) und Aushärten des Binders, **dadurch gekennzeichnet**, daß das Verfahren im wesentlichen die aufeinanderfolgenden Schritte des Aufbringens nur einer einzigen Binderlösung (9) auf die Faserschicht (22) enthält, wobei die Binderlösung einen in einer Wassersuspension enthaltenen Latexbinder aufweist, wodurch eine Kombination von brüchigen Bindungen in Form von Wasserstoffbrückenbindungen und elastischen Bindungen in Form von Latexbindungen zwischen den sich darin befindenden Fasern (39) bereitgestellt wird, und dadurch, daß nach dem Trocknungsschritt ein Strecken des Gewebes durch Streckmittel (28) ausgeführt wird, um zumindest einen Teil der brüchigen Bindungen zu neutralisieren.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet**, daß die Wasserstoffbrückenbindungen in einem Muster (41) neutralisiert werden, das das Gewebe in kleine Bereiche (42) aufteilt, in denen Fasern (39) und Gruppen von Fasern aufrechterhaltene Wasserstoffbrückenbindungen haben, wohingegen das Muster nur elastische Bindungen aufweist.

3. Verfahren nach Anspruch 2, **dadurch gekennzeichnet**, daß die Streckmittel (28) Walzen (31, 34, 37, 38) aufweisen, die ein Strecken der Schicht in zwei Richtungen ausführen, wodurch ein Muster von Bruchlinien (41) in den brüchigen Bindungen aufgebaut wird.

4. Verfahren nach Anspruch 3, **dadurch gekennzeichnet**, daß eine Serie von mindestens zwei Walzen (37, 38) verwendet wird, welche gewindegeformte Oberflächen mit abwechselnden Links- und Rechtsgewinden aufweisen, gegen die das Gewebe gedrückt wird, um eine Streckung über Kreuz durchzuführen, wobei die Walzen nacheinander jeweils mit einer höheren Oberflächengeschwindig-

keit betrieben werden, wodurch eine gleichzeitige Streckung in Longitudinalrichtung durchgeführt wird.

5. Verfahren nach Anspruch 1, **dadurch gekennzeichnet**, daß das Strecken ein Strecken in mehreren Richtungen umfaßt, das durch mindestens eine Walze (34) mit leichten Erhebungen in ihrer Oberfläche ausgeführt wird, gegen die das Gewebe gedrückt wird.

6. Vorrichtung zur Herstellung einer weichen und seidigen, geblasenen Faserschicht (22), aufweisend Mittel (1) zum Trockenblasen einer Faserschicht in einem trockenen Zustand durch einen Luftstrom auf eine Formoberfläche (3), Mittel zum Aufbringen einer Binderlösung auf die Faserschicht (8), Mittel (27) zum Trocknen des Fasergewebes durch Wärmezufuhr, Mittel (29) zum Fixieren des Gewebes nachdem die Fasern getrocknet sind, **dadurch gekennzeichnet**, daß sie Mittel (28) aufweist, die nach den Trocknungsmitteln zum Strecken des Gewebes (22) in mindestens zwei Richtungen angeordnet sind.

7. Vorrichtung nach Anspruch 6, **dadurch gekennzeichnet**, daß die Streckmittel mindestens eine Walze (34) mit einer mit Erhebungen versehenen Oberfläche aufweisen.

8. Vorrichtung nach Anspruch 6, **dadurch gekennzeichnet**, daß die Streckmittel eine Serie von Walzen (37, 38) aufweisen, die abwechselnd mit Links- und Rechtsgewinden versehen sind, wobei jede nachfolgende Walze mit einer höheren Rotationsgeschwindigkeit als die vorausgehende Walze angetrieben wird.

9. Vorrichtung nach Anspruch 8, **dadurch gekennzeichnet**, daß die Walzen (37, 38) eine Länge zwischen 3 und 4 Meter, einen Durchmesser zwischen 0,4 und 0,6 Meter haben, wobei das Gewinde durch eine sinusförmige Oberfläche gebildet ist, in der die Sinuswelle eine Höhe zwischen 5 und 10 mm hat und wobei zwischen den Sinuswellen ein Abstand zwischen 10 und 15 mm besteht.

Revendications

1. Procédé pour produire une bande fibreuse (22), molle et soyeuse, appliquée en couche par jet d'air, qui a des fibres et des groupes de fibres reliées à d'autres fibres et à d'autres groupes de fibres, comportant les étapes consistant à faire passer un courant de gaz contenant des fibres naturelles organiques en suspension à travers une surface de façonnage (3) perméable aux gaz afin de former une bande fibreuse sur cette dernière, à appliquer un liant (9) sur la bande, à faire sécher la bande fibreuse (22) et à faire durcir ledit liant, caractérisé en ce que ledit procédé comprend essentiellement des étapes successives consistant à n'appliquer qu'une seule solution liante (9) sur la bande fibreuse (22), ladite solution liante comprenant un liant au latex contenu dans une suspension aqueuse, pour y réaliser ainsi une combinaison de liaisons fragiles sous la forme de liaisons hydrogène et de liaisons élastiques sous la forme de liaisons latex entre les fibres (39), et en ce que, après l'étape de séchage, un étirement de la bande continue est effectué par les moyens d'étirement (28) pour neutraliser au moins une partie des liaisons fragiles.

2. Procédé selon la revendication 1, caractérisé en ce que les liaisons hydrogène sont neutralisées selon un motif (41) qui sépare la bande continue en petites zones (42) dans lesquelles les fibres (39) et les groupes de fibres ont des liaisons hydrogène maintenues, alors que le motif ne comprend que des liaisons élastiques.

3. Procédé selon la revendication 2, caractérisé en ce que les moyens d'étirement (28) comprennent des rouleaux (31, 34, 37, 38) qui effectuent un étirement bidirectionnel de la bande, réalisant ainsi un motif de lignes de défibrage (41) dans les liaisons fragiles.

4. Procédé selon la revendication 3, caractérisé en ce qu'on utilise une série d'au moins deux rouleaux (37, 38) qui ont des surfaces à fils comportant en alternance des fils à gauche et à droite contre lesquels la bande continue est poussée afin de réaliser un étirement croisé, et lesdits rouleaux sont entraînés avec une vitesse superficielle successivement plus élevée, réalisant ainsi un étirement simultané dans la direction longitudinale.

5. Procédé selon la revendication 1, caractérisé en ce que ledit étirement comprend un étirement multidirectionnel effectué par au moins un rouleau (34) qui a des protubérances lisses à sa surface, contre laquelle la bande continue est poussée.

6. Appareil pour produire une bande fibreuse (22), molle et soyeuse, appliquée en couche par jet d'air, comprenant des moyens (1) pour appliquer en couche à sec une bande fibreuse à l'état sec, par l'intermédiaire d'un courant d'air, sur une surface de façonnage (3), des moyens pour appliquer une solution liante sur la bande fibreuse (8), des moyens (27) pour sécher la bande continue fibreuse par application de chaleur, des moyens (29) pour faire durcir la bande continue après que les fibres ont été séchées, caractérisé en ce qu'il comprend des

moyens (28) disposés après les moyens de séchage en vue d'étirer la bande continue (22) au moins dans deux directions.

7. Appareil selon la revendication 6, caractérisé en ce que lesdits moyens d'étirement comprennent au moins un rouleau (34) qui comporte une surface pourvue de protubérances.

8. Appareil selon la revendication 6, caractérisé en ce que lesdits moyens d'étirement comprennent une série de rouleaux (37, 38) pourvus, en alternance, d'un fil à droite et à gauche, chaque rouleau successif étant entraîné avec une vitesse de rotation supérieure à celle du rouleau précédent.

9. Appareil selon la revendication 8, caractérisé en ce que lesdits rouleaux (37, 38) ont une longueur comprise entre 3 et 4 mètres, un diamètre compris entre 0,4 et 0,6 mètre, et dans lesquels le fil est formé par une surface en forme de sinus sur laquelle l'onde sinusoïdale a une hauteur comprise entre 5 et 10 mm et qui a une distance entre les ondes sinusoïdales comprise entre 10 et 15 mn.

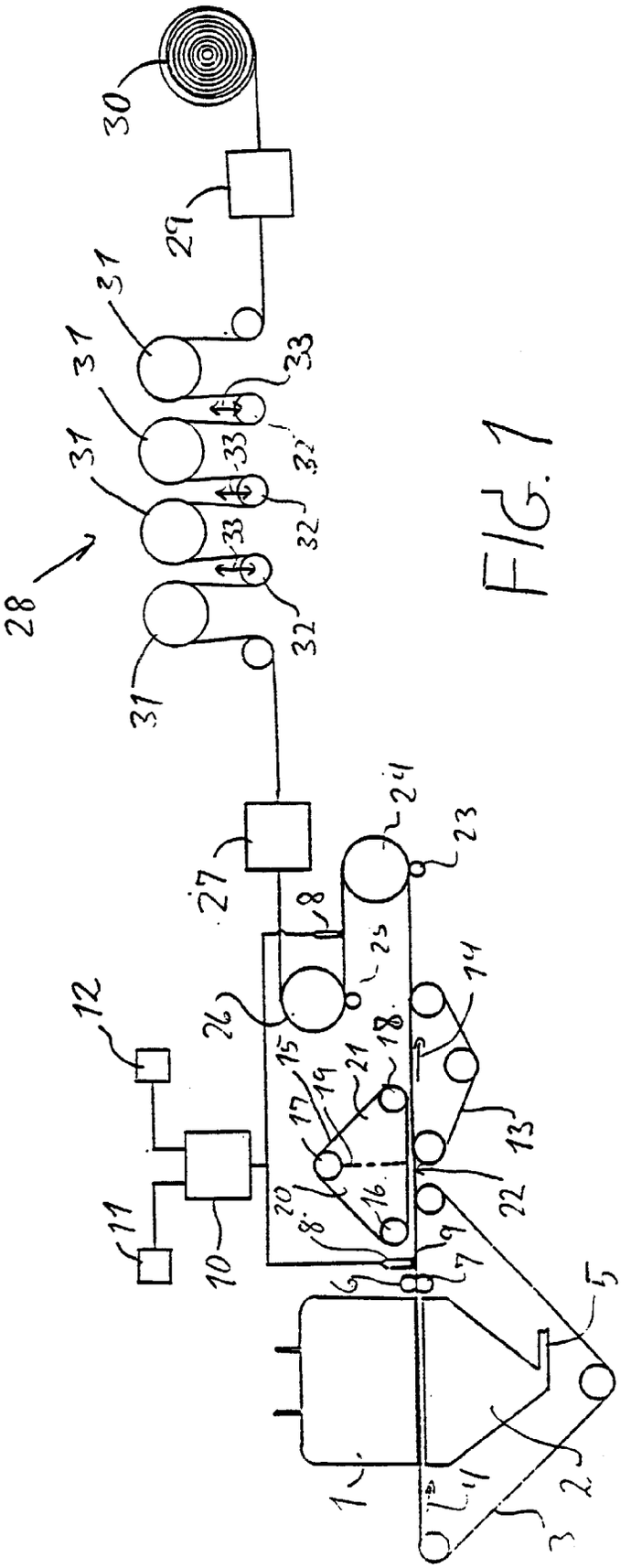

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FIG. 1

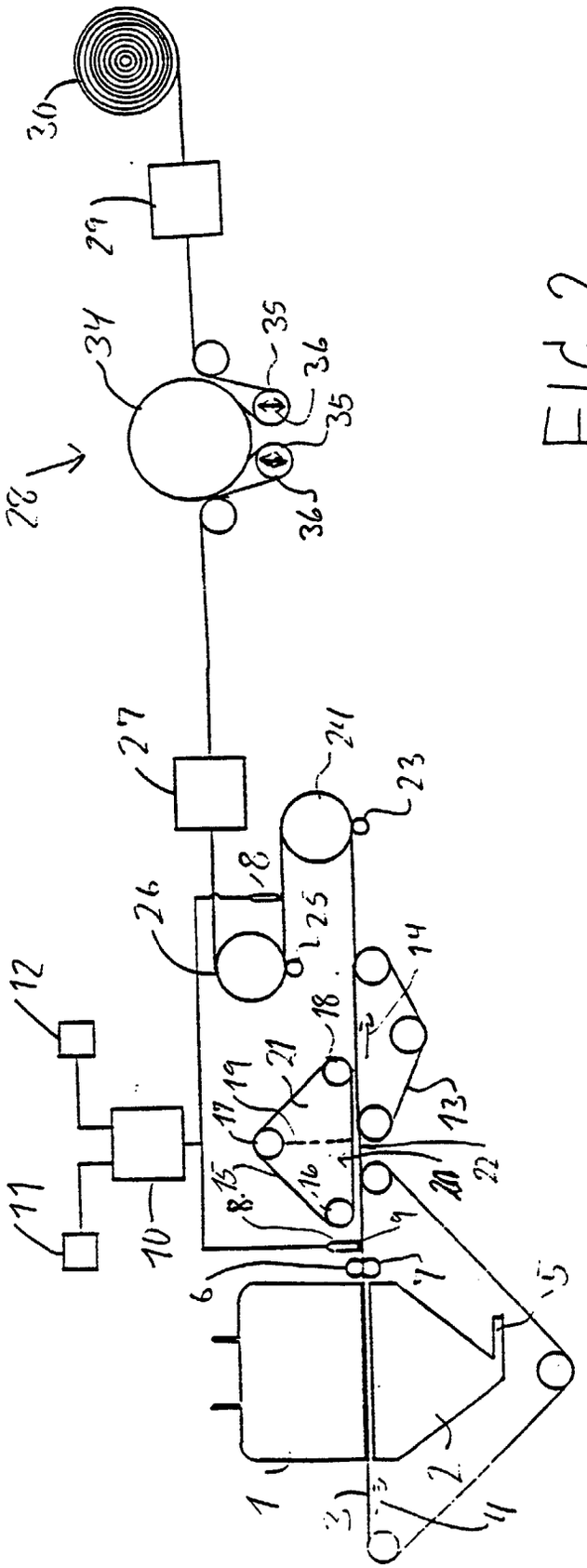

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FIG. 2

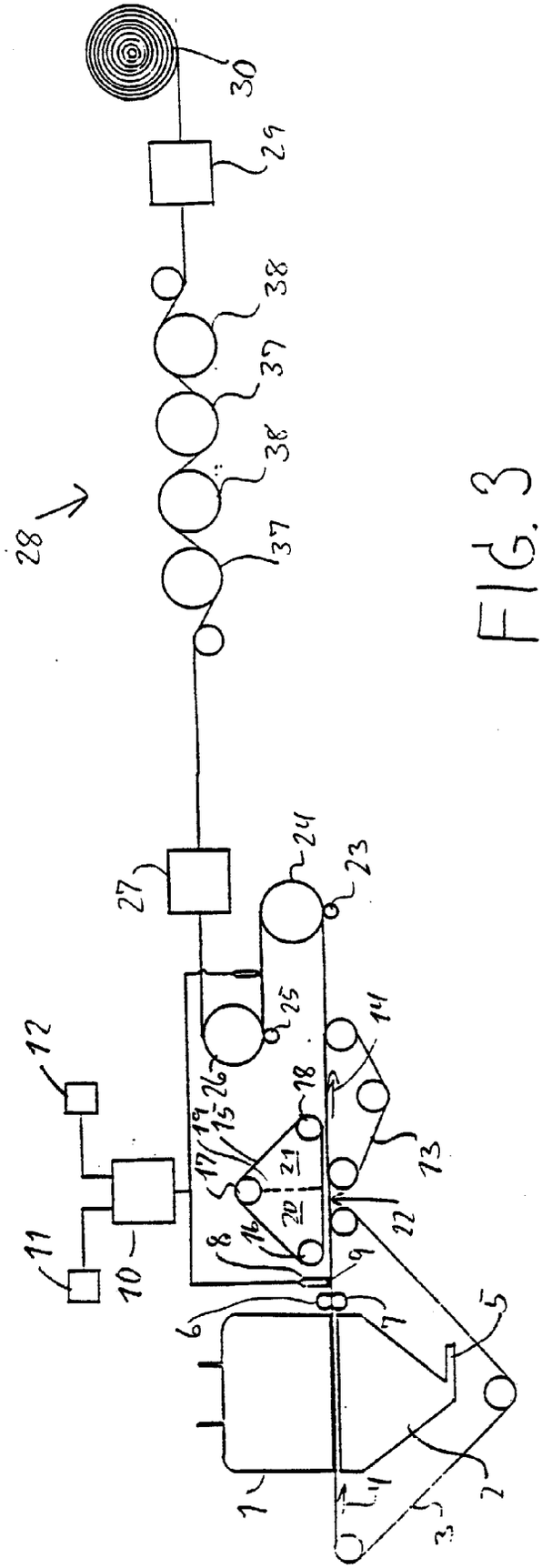

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FIG. 3

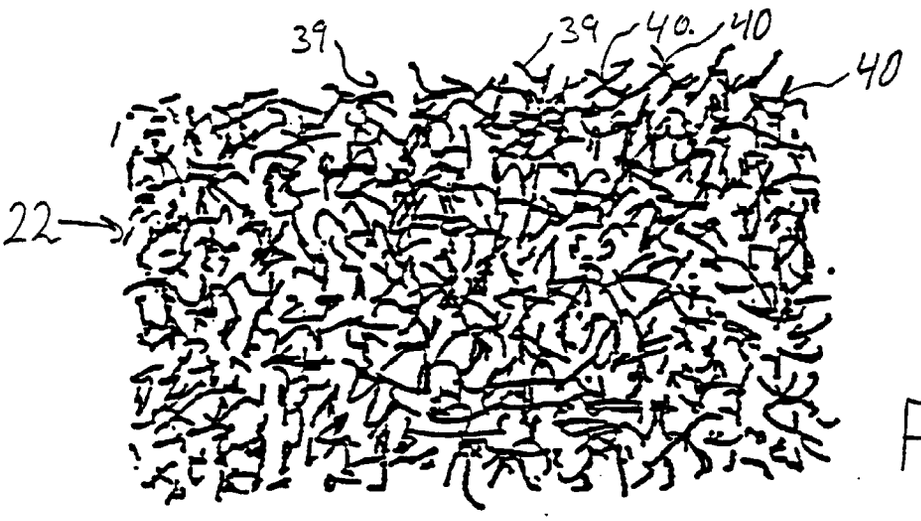


FIG. 4

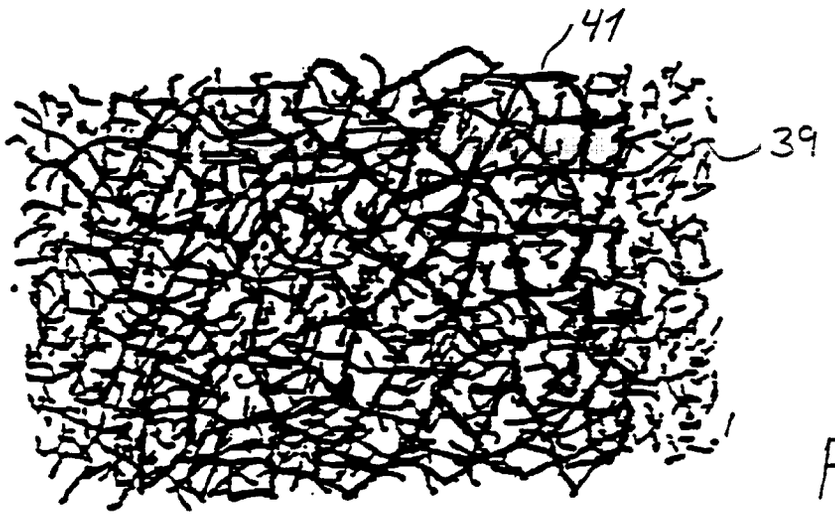


FIG. 5

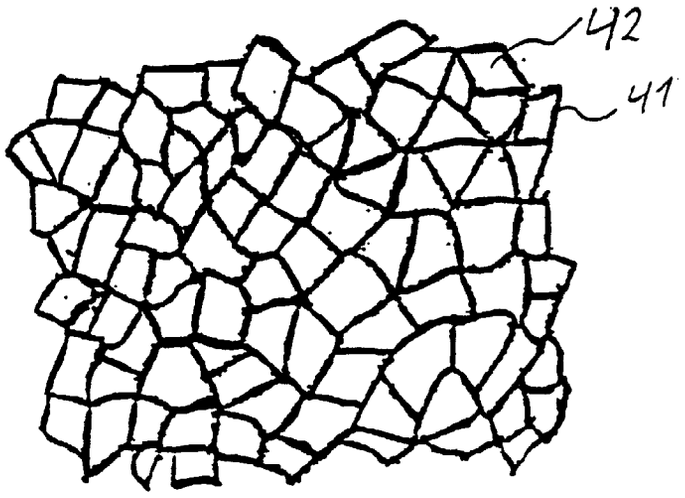


FIG. 6