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(54) Titre : PROCÉDE DE FABRICATION D'UN MATERIAU NON TISSE EN FEUILLES AYANT UNE COUCHE IMPERMEABLE SUR UNE FACE ET UN REVETEMENT ANTIDERAPANT SUR L'AUTRE FACE  
(54) Title: PROCESS FOR MANUFACTURING A NONWOVEN SHEET MATERIAL HAVING AN IMPERMEABLE LAYER ON ONE SIDE AND AN ANTI-SLIP COATING ON THE OTHER SIDE

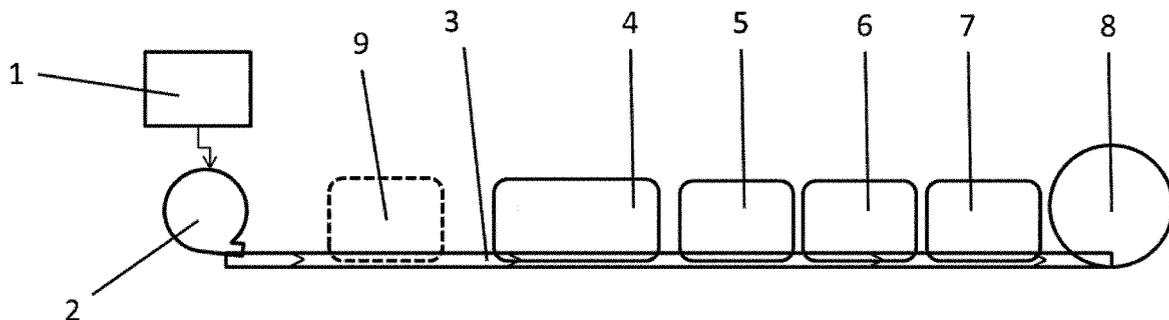


Figure 2

(57) **Abrégé/Abstract:**

The process comprises the steps of: carding (2) fibers (1) with a common general orientation and forming a web; bonding (4) the fibers into a nonwoven sheet material; applying (7) an anti-slip coating onto one surface of the material; applying a polymer onto the second surface of the nonwoven material and maintaining the orientation of the fibers over the whole process.

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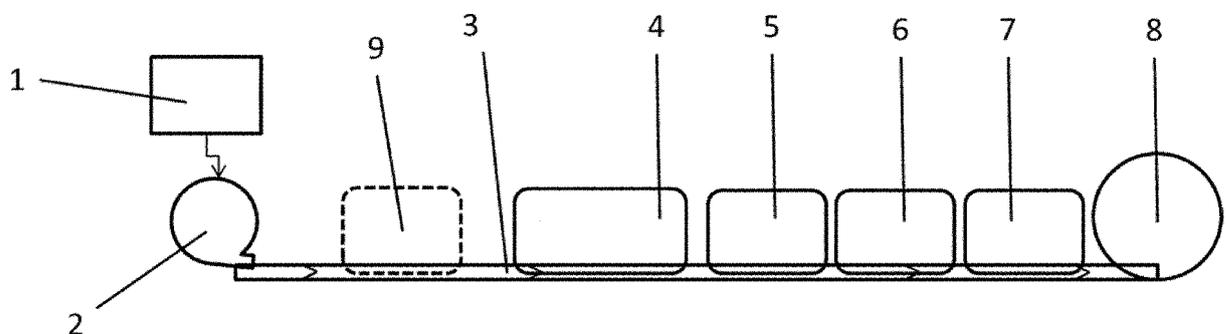


Figure 2

(57) **Abstract:** The process comprises the steps of: carding (2) fibers (1) with a common general orientation and forming a web; bonding (4) the fibers into a nonwoven sheet material; applying (7) an anti-slip coating onto one surface of the material; applying a polymer onto the second surface of the nonwoven material and maintaining the orientation of the fibers over the whole process.



WO 2019/110098 A1

**Process for manufacturing a nonwoven sheet material having an impermeable layer on one side and an anti-slip coating on the other side**

5 The invention relates to the field of temporary protection used to protect surfaces during activities susceptible of splashing liquid or deteriorate these surfaces.

Disposable or single use protections to temporarily protect  
10 surfaces, like floors, pieces of furniture, stairs or glass windows, during for instance renovation works or children activities, have been on the market for over twenty years. In particular, impermeable and anti-slip fleeces or sheet materials are very popular. They are made of three layers, namely a  
15 central layer of nonwoven material, a top layer of an impermeable barrier or liquid impervious or waterproof film and a bottom layer of an anti-slip coating.

Such an impermeable, anti-slip sheet material needs to be  
20 resistant to tear, and support individuals walking on it as well as working equipment being installed on it, such as for example ladders. To some extent, the material should also be resistant enough to be re-used several times. Impermeability also needs to be ensured over the lifetime of the product. The quality of the  
25 anti-slip coating is of utmost importance for the safety of its users. Impermeability should however not prevent the material to be breathable.

Up to now, such a three layer material is manufactured according  
30 to the following process.

In a first step, the nonwoven layer is manufactured. A web of more or less parallelly oriented fibers is prepared in a carding machine from staple fibers. The web then goes into a crosslapper, continuously folding and piling layers of web on  
35 top of each other while the bottom pile is slowly shifted in a

perpendicular direction (figure 1). The crosslapping ensures on one hand, the continuity of the material, and, on another hand, a simultaneous longitudinal and lateral resistance of the nonwoven. Indeed, after this operation, the fibers are disposed  
5 according to random orientations. The resulting web is then bonded, by a mechanical, chemical and/or thermal operation, resulting in a nonwoven material usually having a weight over around 120g/m<sup>2</sup>.

In a second step, an anti-slip coating is applied on one surface  
10 of the nonwoven material. Usually an acrylic binder is sprayed onto the nonwoven, with or without tackifiers.

In the last step, a polymer impermeable layer is laminated, from a film or foil, onto the second surface of the nonwoven material.

15 This production method is called a L-process, as the crosslapper induces a 90° angle deviation in the arrangement of the equipment of the production line.

While this process enables the manufacture of a very resistant impermeable, anti-slip sheet material, it is very limited in its  
20 production output. The crosslapping step is limited to an output speed of about 25 m/min. A similar limitation applies to the lamination step, which is usually performed by means of hotmelt and an infrared heater.

25 In view of the high demand for such impermeable, anti-slip products, the applicant has judged necessary to look for a new production process which could improve the production rate or speed, and consequently reduce the production cost.

30 Solution of the invention

To this effect, the applicant proposes a process for manufacturing a nonwoven sheet material having an impermeable layer on one side and an anti-slip coating on the other side,  
35 process comprising the steps of:

- carding fibers and forming a web, wherein the fibers have a common general orientation;
  - bonding the fibers into a nonwoven sheet material and
  - applying an anti-slip coating onto one surface of the nonwoven sheet material,
- 5
- characterized in that it further comprises the step of
- applying a polymer onto the second surface of the nonwoven sheet material and
  - maintaining the orientation of the fibers over the whole
- 10 process.

The process of the instant invention case can thus be named parallel or inline process, or even a unidirectional process, meaning that there is no crosslapping applied to the fibers web before bonding. No angle is therefore introduced in the series of equipment involved in the process, equipment for carding,

15 bonding, applying the antislip and the impermeable polymer being aligned.

The inline manufacture of nonwoven sheet material has been known for several years. While it enables to run a manufacturing process at over 200 m/min, it leads to the production of much lighter nonwoven material sheets than the ones usually used in impermeable anti-slip protection, i.e. having a minimal weight of, but not limited to, around 100 g/m<sup>2</sup> or around 120 g/m<sup>2</sup> and up to, but not limited to, 180 g/m<sup>2</sup> or even higher, when using

20 up to three parallel carding machines to overlap three layers before bonding. Moreover, the fibers in such nonwoven material sheets are essentially parallel, resulting in a significant loss of lateral strength of the material.

Historically, as the manufacturing process of the impermeable, anti-slip material was anyway limited in speed by the lamination

30 of the impermeable barrier, it had never been considered to replace the L-process to manufacture the nonwoven material by an inline process, as only disadvantages, like a loss of lateral strength, would have resulted from the replacement.

Only recently, techniques for industrially applying a polymer onto a large surface at a speed up to 200 m/min became available. For example, the impermeable polymer can be applied by high speed lamination, using for example electromagnetic  
5 heating, ultrasonication, hotmelt adhesives or wide web spray lamination. The impermeable polymer can also be applied by spraying an extruded/melted polymer on the nonwoven material. Other techniques enabling application of a polymer at high speed may also be or become available and should also be encompassed  
10 in the scope of the claimed invention.

High speed should be understood as a speed of the line higher than the current speed of 25m/min currently used, for example higher than 50m/min, and preferably higher than 100m/min.

When replacing, in combination, both the L-process to  
15 manufacture the nonwoven material by an inline process and the standard lamination of the impermeable layer by high speed techniques as described above, it was found that the resulting impermeable barrier confers sufficient resistance to the final product to compensate for the loss of lateral strength of the  
20 nonwoven layer.

By daring to replace two steps in a process, meaning two pieces of equipment in the production line, the applicant has overcome the prejudice that the final product would lose in quality. The new proposed process hereby enables to increase by up to around  
25 10 times the speed of production of impermeable anti-slip nonwoven sheet material, to decrease the density/weight of the central nonwoven layer below about 120 g/m<sup>2</sup> while maintaining very good resistance of the final product in all directions. This is why the process of the instant case involves the  
30 required inventive step.

Additionally, up to now, the anti-slip layer was an acrylic binder applied by a spray-dry technique, which also contributed to a limitation in speed of the process. The applicant has also looked into replacing this step by techniques enabling a faster  
35 output and found that other materials, like for example, but not

limited to, polyurethane coating, could be applied at speed up to 200 m/min.

An advantage of using an inline process is that several carding machines, usually up to three, can operate in parallel, the parallel webs being overlapped just before bonding. Though the webs can be made with similar fibers, it is interesting to be able to use a different blend of fibers for each web, each blend conferring to the resulting bonded nonwoven material specific properties. One blend of fibers could, for example, have flame retardant properties; another blend could confer hydrophobic properties.

For the sake of security for the applicant, the product obtained by the process is also claimed, said product being a nonwoven sheet material having an impermeable layer on one side and an anti-slip coating on the other side, characterized in that the fibers of the nonwoven sheet material have a common general orientation.

The common general direction referred to is the machine direction (MD) as known to the person skilled in the art.

The product is entirely linked to the claimed process by the unique inventive concept of maintaining the fibers along a common general orientation.

The invention will be better understood with the following description of several examples, referring to the accompanying drawing on which:

figure 1 is a bloc diagram illustrating the L-process according to the prior art;

figure 2 is a bloc diagram illustrating an implementation of the process of the invention;

figure 3 illustrates a section of a product of the invention, and

figure 4 illustrates a section of a product of the invention comprising additional layers.

Referring to figure 2, in a first step, raw fibers contained in a bale opener 1 are introduced in a carding machine 2 where they are carded in one direction into a web. The web is then moved  
5 along the line by means of a conveyor belt 3. In a second step, the fibers of the web are bonded in an oven 4 before going through a cooling zone 5. In a next step, the nonwoven material resulting from the bonding is sprayed on one of its surface with extruded polymer, i.e., melted polymer in an extruder 6. In a  
10 final step, an anti-slip coating is sprayed on its other surface with an antislip coating in a coating machine 7. The resulting product is here further rolled up by a rolling up equipment 8. An optional needling module 9 is here inserted between the carding and the bonding steps.

15 For clarity of the figure, only one bale opener 1 and one carding machine is illustrated, however, as would be obvious to a person skilled in the art, there can be several bale openers, as well as multiple carding machines implemented, depending on the specifications of the material to manufacture.

20

The implementation of this process leads to the manufacture of article 10, as illustrated in figure 3. A nonwoven material layer 11, made from multiple fibers 14, is covered on one side by an impermeable layer 12 and on its other side by an anti-slip  
25 coating 13.

Carding is a mechanical process that disentangles, cleans and intermixes fibres to produce a continuous web suitable for subsequent processing. This is achieved by passing the fibers  
30 between differentially moving surfaces covered with card clothing. It breaks up locks and unorganized clumps of fibers and then aligns the individual fibers to be parallel with each other. The fibers not being straight elements, they are not strictly parallel, but globally orientated in a common general  
35 direction, as illustrated on figure 3. The fact that the fibers

are not straight elements also enables some contact points between fibers, these contact points being the bonding points during the bonding step.

5 Depending on the thickness and/or weight expected for the nonwoven material, several layers of carded fibers, of a same or of different compositions, can be overlaid before bonding, using techniques and equipment well known to a person skilled in the art. Using several carding machines in parallel, usually up to  
10 three, allows to work at high speed. The resulting webs are then overlapped before bonding, or before needling in case it is implemented in the process. This also presents the advantage of being able to combine the different properties of several fiber blends.

15 In this inline configuration, the overall thickness of the nonwoven depends on the thickness of the web issued from each carding machine and of the number of carding machines operating in parallel. In general, no more than three parallel carding machines are used, limiting the weight of the resulting nonwoven  
20 to about 200 g/m<sup>2</sup>, preferably 120 g/m<sup>2</sup>, though these figures are not limiting. Moreover, the general orientation conferred to the fibers in the carding step is maintained in the bonding step, resulting in a nonwoven having a high longitudinal resistance to tear, longitudinal meaning parallel to the general orientation  
25 of the fibers, and a lower lateral resistance to tear.

This is to be distinguished from the L-process of the prior art (figure 1), where the crosslapping step can lead to overlapping ten or more layers of web of carding fibers, and additionally imprinting a deviation in the general orientation of the fibers,  
30 which is different between two consecutive overlap. The crosslapping therefore results in a much thicker nonwoven material than when using the inline process, typically over 120 g/m<sup>2</sup>. The resulting nonwoven is also more resistance to tear in all directions.

35

The optional step of needling results in entangling or mixing up the fibers in the vertical dimension and is especially recommended when more than one carding machine is used. The vertical dimension here refers to a direction perpendicular to the longitudinal and lateral dimensions disclosed in the previous paragraphs, i.e. a direction crossing the various layers of webs. Needling enables to obtain a better adhesion of the web layers, by entangling the fibers. Hydroentanglement could also be used instead of or additionally to needling. Needling and hydroentangling are techniques well known from the person skilled in the art. Other reinforcing techniques can also be used like, for example, chemical bonding, either by extrusion of a polymer, knife over roll or any suitable coating technique, as known to the person skilled in the art.

Bonding of the fibers to finalize the nonwoven layer can be performed using different techniques, like mechanical or chemical bonding. In the present case, bonding preferably includes a step of thermal bonding, either alone, or in combination with another technique. Preferably, the nonwoven of the invention is a drylaid thermobonded nonwoven. A combination of mechanical, chemical and thermo-bonding is also an option.

The fibers used for the nonwoven material can be any type or any blend, in any suitable combination and are for example a blend of 100% PET fibers, wherein fiber thickness ranges between 1.7dt to 17dt; blend of 100% PET fibers containing bonding fiber bico PET/CoPET with thicknesses of 2, 4, 6 or 15dn; a blend of 100% PLA fibers which are bio degradable fibers; a blend of PET structural fibers with other bico-fibers made of alternative polymers like PET/PP, PET/PE, PP/PE; a blend of PET and viscose fibers; a blend of PET and cellulose fibers or any blend as previously cited additionally containing PA fibers. As already mentioned, each carded layer can be made of a different blend of fibers, or of a same blend of fibers. Any combinations can be

performed depending on the final expected characteristics of the nonwoven material layer.

The heat treatment usually applied to the carded fibers ranges  
5 between temperatures of 30°C and 250 °C, preferably between 130°C and 140 °C, depending on the nature of the fibers and the temperature needed for bonding.

Nonwoven materials resulting from the previous steps usually have a weight of below around 180 g/m<sup>2</sup>, but can, in some cases  
10 have a higher weight.

Spray extrusion of polymer to form the impermeable layer can for example be performed with PET, PE, PP, PU, PTFE, TPU, PLA or PVC. The polymer is sprayed at a temperature above its melting  
15 or glass transition temperature or a combination thereof, by hot-melt extrusion. This temperature also enables a good adhesion with the nonwoven, as the resulting polymer layer becomes also "bonded" with the fibers at the surface of the nonwoven layer. The polymer impermeable layer typically has  
20 thickness in the range of 10 to 60 µm, preferably 20 to 40 µm and still preferably around 30 µm. The same polymers can be used for high speed lamination.

Apparatus to perform this step are available on the market, like for example the laminating and/or coating systems sold by the  
25 company LACOM GmbH.

The anti-slip coating applied to the remaining surface is for example made of polyurethane, an acrylic binder, a PVA binder, EVA, rubber, polyolefine or PA. It can also be a pressure  
30 sensitive adhesive. It can also contain fillers, resins, antistatic additives, crosslinkers, or any other suitable additive. The spraying can be performed by hotmelt techniques or by spraying the polymers dissolved in water or another solvent. Chemical bonding is also a suitable technique to apply the anti-  
35 slip coating, using for example polymer extrusion, knife over

roll or any suitable coating system, as known to a person skilled in the art.

5 The steps of anti-slip coating can also be performed before the polymer extrusion of the impermeable layer. The order of these steps is not an essential feature of the process of the invention.

10 The manufacture of a three layered product has been described above. However, it is possible that the sheet material has more than three layers, additional layers being applied on top of the impermeable surface. The nonwoven sheet material of the invention can comprise, on top of the impermeable layer, one or more additional nonwoven sheet material and/or one or more  
15 additional polymer layer.

In particular, one or more additional nonwoven sheet materials, wherein the fibers have a common general orientation, can be applied onto the impermeable layer. The one or more additional  
20 nonwoven sheet materials can have the same composition as the first nonwoven sheet material, or a different composition, in order to bring additional properties to the final product.

One or more additional polymer layers can also be applied, either directly onto the impermeable layer or onto an additional  
25 nonwoven material. The one or more additional polymer layers can be of any kind, for example any polymer material described above, permeable or impermeable. Several additional polymer layers, having the same or different characteristics, can also be applied on top of each other.

30 It should be understood that the invention relates to a nonwoven sheet material having an impermeable layer on one side and an anti-slip coating on the other side, wherein the fibers of the nonwoven sheet material have a common general orientation and wherein additional nonwoven and/or polymer layers can optionally  
35 be applied onto the impermeable layer. The additional nonwoven

and/or polymer layers can be alternated to confer specific characteristics to the product.

For example, as illustrated in figure 4, a nonwoven material  
5 layer 41, made from multiple fibers 44, is covered on one side by an impermeable layer 42 and on its other side by an anti-slip coating 43. A second nonwoven layer 45 is applied onto the impermeable layer 42. A second polymer layer 46 is applied onto the second nonwoven layer 45.

10 The second nonwoven layer is here represented with fibers having a general common orientation. The fibers of both nonwoven layers can be of the same nature, or of different nature, depending on the applications.

The second polymer layer 46 can be here, for example a permeable  
15 layer, which would let liquid from a spillage go through. The nonwoven layer 45 underneath could for example favor absorption and dispersion of the liquid, leaving a dry appearance at the surface of the product.

20 A second polymer layer could for example also have anti-slip properties and/or could have a particular color which would help the user to properly place the sheet material.

Any combination of additional nonwoven and/or additional polymer  
25 layer can be envisaged, suitable for a particular intended use of the product.

## 12

## Claims

1. Process for manufacturing a nonwoven sheet material having an impermeable layer on one side and an anti-slip coating on the other side, process comprising the steps of:
- 5
- carding fibers and forming a web, wherein the fibers have a common general orientation;
  - bonding the fibers into a nonwoven sheet material and
  - applying an anti-slip coating onto one surface of the
- 10 nonwoven sheet material,
- characterized in that it further comprises the step of
- applying a polymer onto the second surface of the nonwoven sheet material and
  - maintaining the orientation of the fibers over the whole
- 15 process.
2. Process according to claim 1, wherein at least two webs of carded fibers are overlapped and bonded together in the bonding step.
3. Process according to one of claims 1 and 2, wherein the
- 20 anti-slip coating is applied by hot-melt coating.
4. Process according to one of claim 1 to 3, wherein applying a polymer onto the second surface is performed at high speed.
- 25
5. Process according to claim 4 wherein the polymer is applied by high speed lamination or by spraying an extruded/melted polymer on the nonwoven sheet material.
- 30
6. Process according to one of claims 1 to 5, wherein the impermeable coating is applied by hot-melt extrusion.
7. Process according to one of claim 1 to 6, further comprising applying onto the impermeable layer one or more
- 35 additional nonwoven sheet materials.

8. Process according to claim 7, further comprising applying, onto an additional sheet material, one or more polymer layers.
- 5 9. Process according to one of claim 1 to 6, further comprising applying onto the impermeable layer one or more polymer layer.
- 10 10. Nonwoven sheet material having an impermeable layer on one side and an anti-slip coating on the other side, characterized in that the fibers of the nonwoven sheet material have a common general orientation.
- 15 11. Nonwoven sheet material according to claim 10, wherein the nonwoven sheet material has a weight of 180 g/m<sup>2</sup> or less.
- 20 12. Nonwoven sheet material according to one of claims 10 and 11, wherein the nonwoven sheet material comprises at least one blend of fibers.
- 25 13. Nonwoven sheet material according to claim 12, wherein at least one blend of fibers is selected from the group comprising a blend of 100% PET fibers containing bonding fiber bico PET/CoPET with thicknesses of 2, 4, 6 or 15dn, a blend of 100% PLA fibers which are bio  
30 degradable fibers, a blend of PET structural fibers with other bico-fibers, a blend of PET and viscose fibers or a blend of PET and cellulose fibers.
- 35 14. Nonwoven sheet material according to one of claims 10 to 13, comprising, on top of the impermeable layer, one or

14

more additional nonwoven sheet material and/or one or more additional polymer layer.

- 5 15. Article for protecting surfaces made from the nonwoven sheet material according to one of claims 10 to 14.

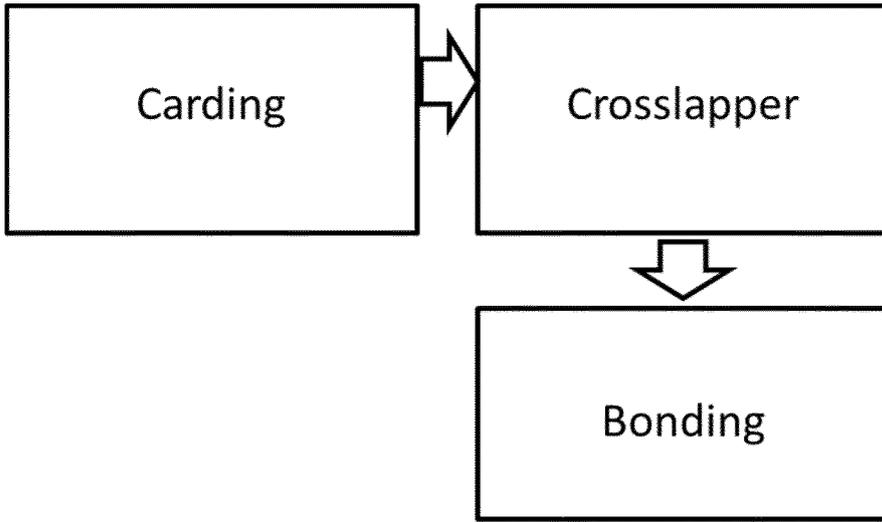


Figure 1

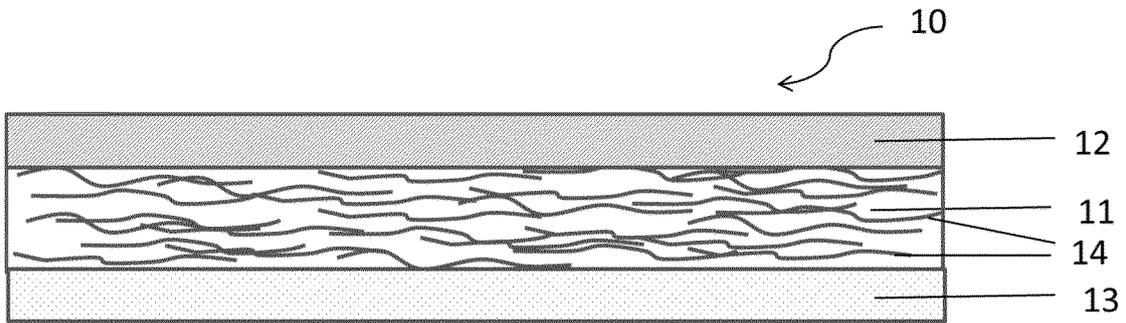


Figure 3

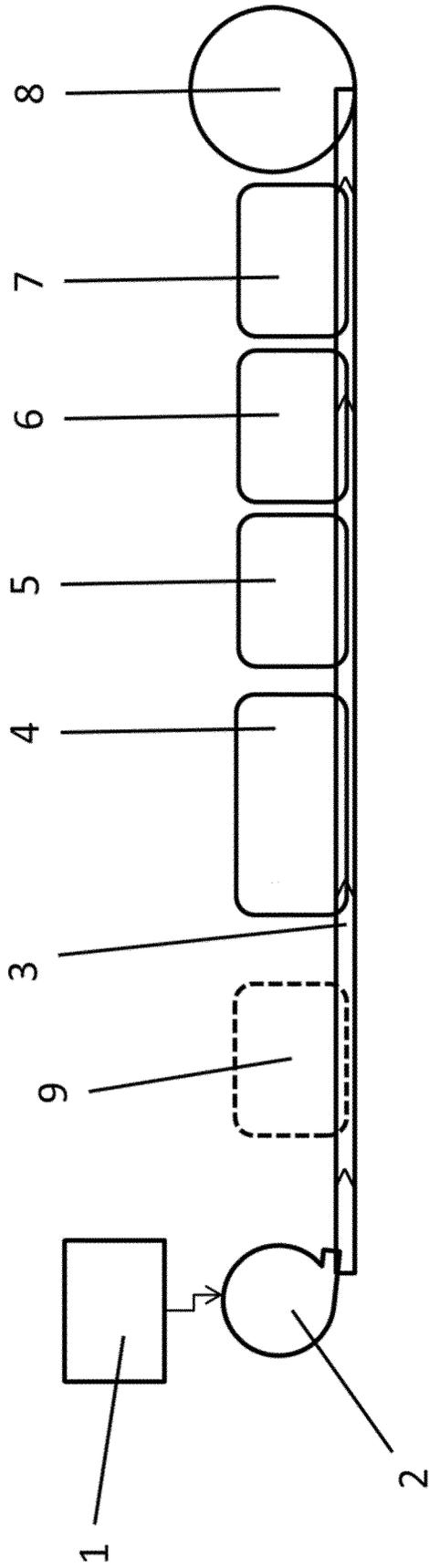


Figure 2

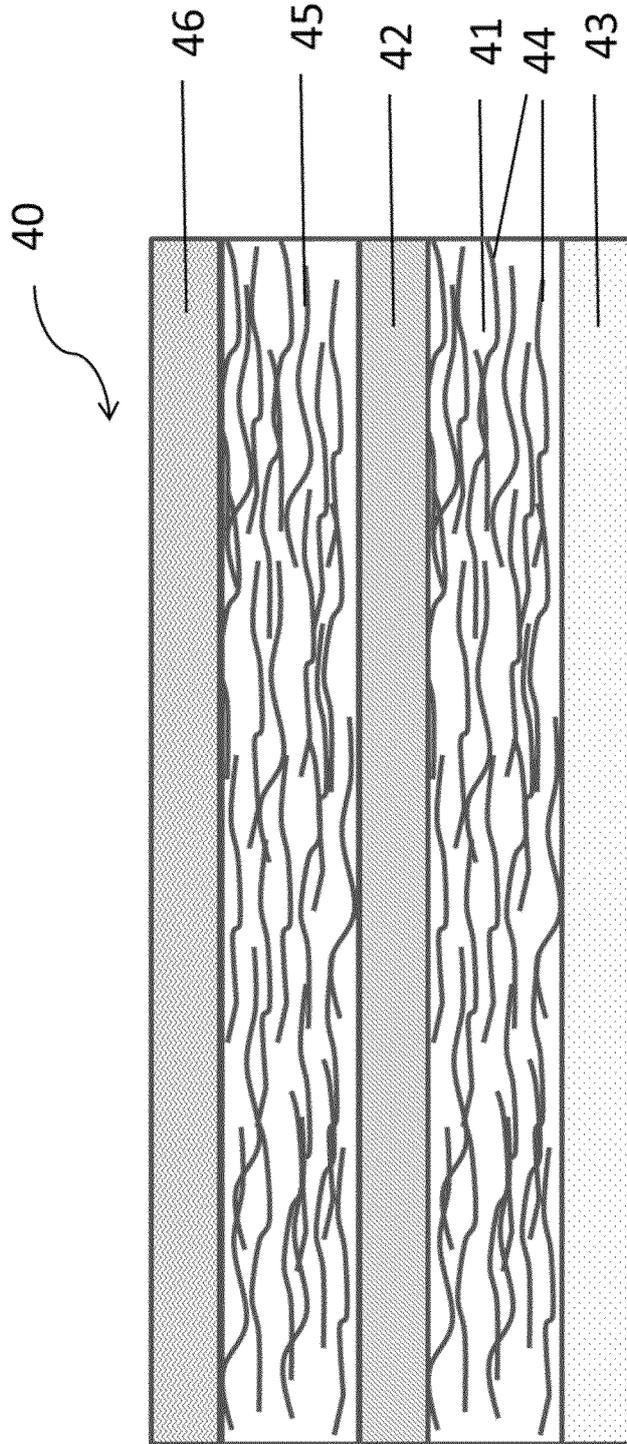


Figure 4

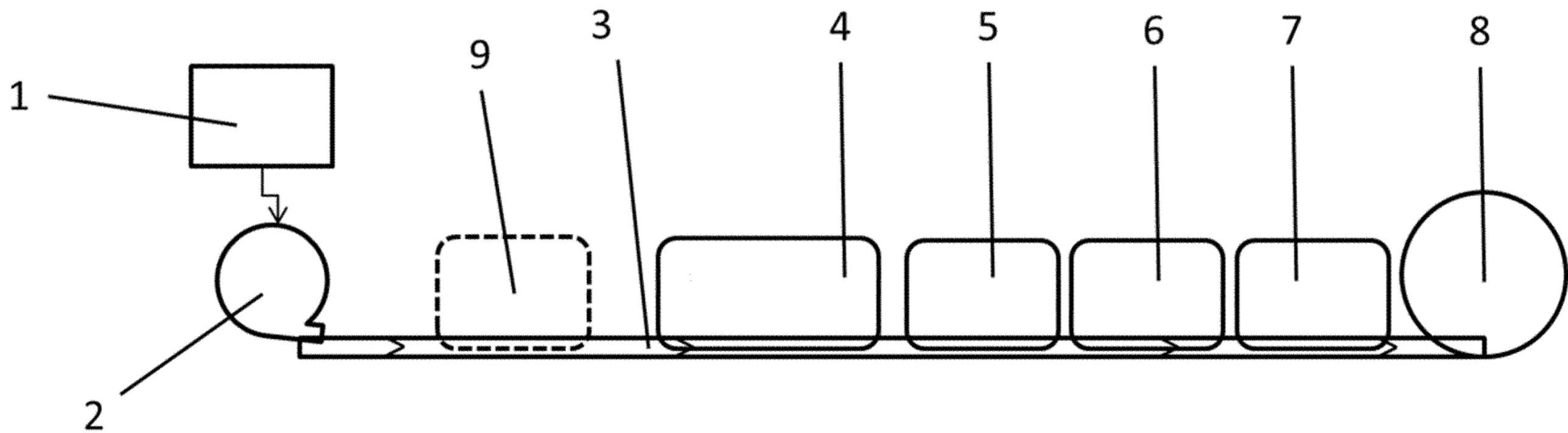


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