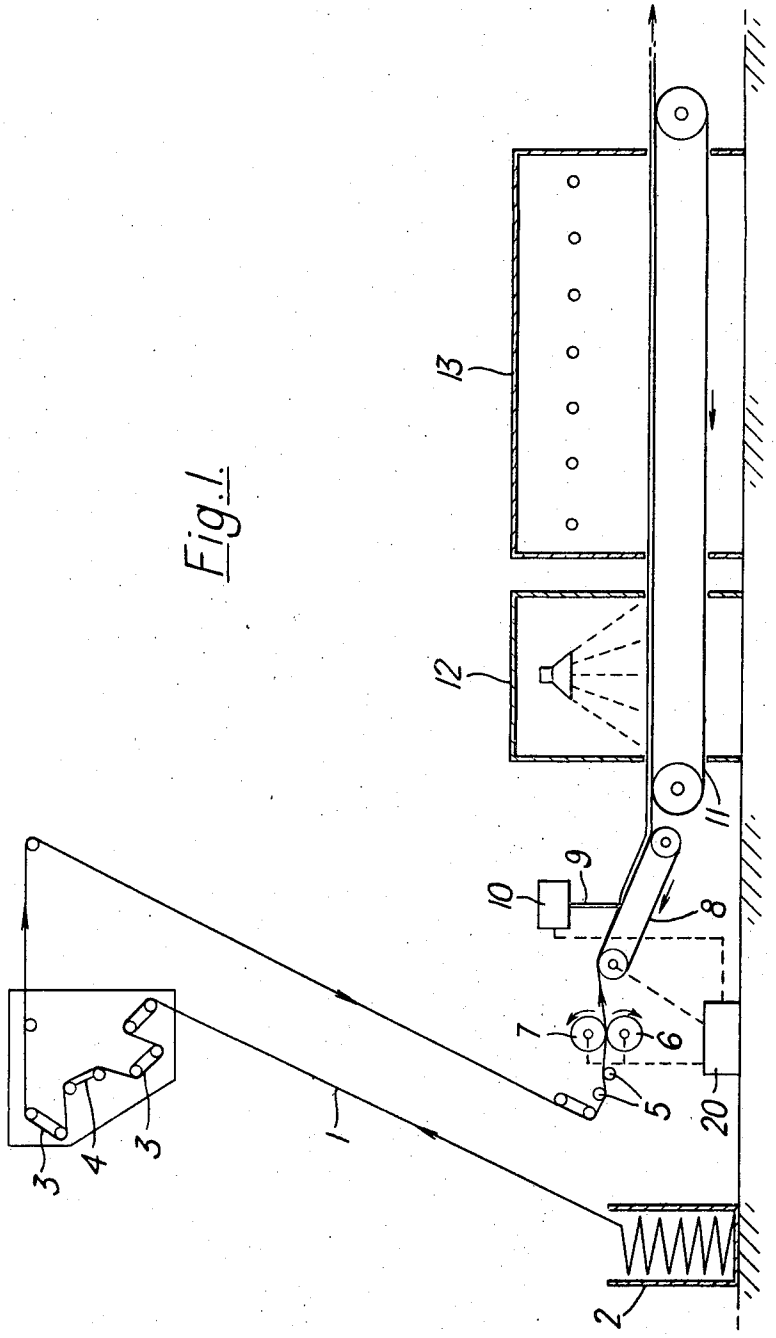
Sept. 5, 1972 R. BOLLIAND ET AL 3,689,344

METHOD OF PREPARING A NON-WOVEN FIBROUS WEB

Filed April 2, 1969 2 Sheets-Sheet 1

Fig. 1.



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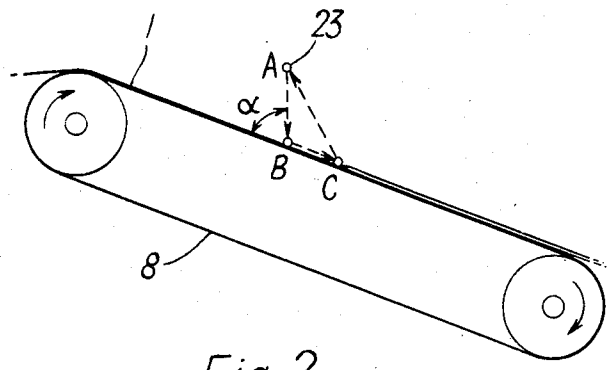

Fig. 2

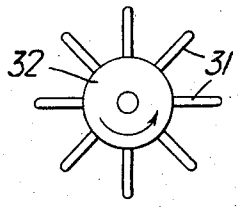

Fig. 3

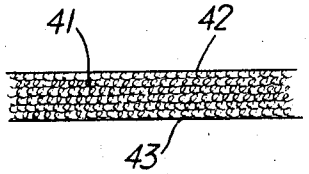

Fig. 4

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METHOD OF PREPARING A NON-WOVEN FIBROUS WEB

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U.S. Cl. 156—181 4 Claims

ABSTRACT OF THE DISCLOSURE

The specification describes a method and apparatus for forming a non-woven fibrous web, e.g. suitably for padding or stuffing. A tow is spread and fed without tension by two rollers, rotating at different speeds, onto a conveyor belt, and a pusher blade extending over the full width intermittently presses on the tow and moves faster than the belt. The resulting web is sprayed with a bonding agent which is then cured.

The present invention relates to a method and apparatus for the preparation of a non-woven fibrous web material.

In the present description, the expression "non-woven fibrous webs" refers to material, generally of a homogeneous nature, which may have large dimensions in two directions relatively to the third and which may be constituted by continuous filaments or discontinuous fibres, alone or in a mixture, distributed unidirectionally or at random and the cohesion of which is obtained by mechanical, physical or chemical means, or by a combination of such means.

For some decades, such material has been successfully used for many purposes, e.g., trimming or lining, wadding, covers or blankets, garments, covering means for floors and walls, felts, filters and backings. Material of this kind, if it is subjected to further subsequent treatment, such as needling and/or calendering, may be utilised for purposes other than lining or stuffing. For example, it could also be used as a wall covering, a covering for the ground, a coating backing or for garments.

When used as a lining or stuffing material in which it is more or less compressible and slightly elastic or resilient, this material is utilised for the stuffing of furnishing articles, such as pillows, cushions, eiderdowns, sleeping bags and the like. For this purpose use has long been made of natural materials, such as down, feathers or horsehair. It has also been proposed to employ discontinuous, crimped chemical fibres, for example synthetic fibres, introduced alone or in a mixture, in the form of wadding or a lap. Unfortunately, in course of time and notably after washing, these fibres tend to protrude through the enveloping material and to agglomerate in the form of compact balls, which it is impossible to dissociate.

Recently, there has been proposed a novel stuffing material constituted by a highly, corrugated web of continuous chemical filaments, directed substantially in the same direction and wherein the undulations or corrugations are fixed with the aid of an appropriate resin.

The method for the preparation of such webs consisted in passing, under tension, a tow of continuous filaments between two smooth rollers driven at different peripheral velocities, taking up substantially without tension the corrugated web thus formed, spraying a bonding agent on the said undulating lap and, finally, curing the bonding agent thus deposited.

The method for the spreading out and undulation of the tow of continuous filaments, which may or may not be crimped, by passage between two rollers rotating at different peripheral velocities does not permit the production of webs which have relatively plane external surfaces, such as is desirable for the stuffing material or wadding used for stuffing coverlets or bedspreads or quilted articles.

According to the invention there is provided a method of preparing a non-woven fibrous web, such method comprising feeding a tow substantially without tension to a conveyor belt to which a continuous advancing movement is imparted, displacing a pusher blade spaced from said conveyor belt in the same direction and at a higher velocity than said conveyor belt, periodically to exert pressure on the entire width of said tow and to subject said tow to local friction and thereby form a web, taking up the web thus formed substantially without tension, spraying a bonding agent on the web and curing the bonding agent.

Preferably, the bonding substance is a crosslinkable resin which is cured by thermal treatment.

The previous spreading out of the tow may be effected by any appropriate means, notably by passage between two rollers rotating at different peripheral velocities.

In the following description, the expression pusher blade will be used to designate any means permitting the simultaneous exertion on the spread-out tow of pressure and also of friction. The tow used has substantially no twist or interlacing and includes a large number of continuous filaments which may or may not be crimped. For example, use may be made of any kind of tow manufactured from any artificial or synthetic chemical material. Advantageously use is made of crimped synthetic filament tows, such as those based on polyamides (polyamide 6, 6.6, 6.10, 11, etc.) on polyolefines (polypropylene) or on the vinyl substances and derivatives. Moreover, good results have been obtained with tows based on polyester filaments (ethylene polyterephthalate) or acrylic filaments. In practice, the tow may be stuffer crimped. Similarly, use may be made of tows comprising low-stretch filaments.

The invention also provides apparatus for preparing a non-woven fibrous web, such apparatus comprising a conveyor belt, means for moving said belt at a given velocity, means for spreading a tow formed from continuous filaments, and for feeding said tow onto said conveyor belt, a pusher blade spaced from said conveyor, means for urging said pusher blade towards said conveyor belt and for moving it parallel to said belt at a velocity higher than said given velocity, means for removing the web thus formed from said conveyor belt, means for spraying a bonding agent onto the thus formed web, and means for curing the bonding agent.

Finally the invention provides material produced by the method, using the apparatus, according to the invention.

In order that the invention may more readily be understood, the following description is given, merely by way

of example, reference being made to the accompanying drawings, in which:

FIG. 1 is a side elevation of one embodiment of apparatus according to the invention;

FIG. 2 is a diagrammatic view of a portion of the apparatus of FIG. 1, showing the movement and action of the pusher blade on the tow;

FIG. 3 shows modification of the pusher blade arrangement; and

FIG. 4 is a diagrammatic illustration of the web obtained.

Referring to FIG. 1, a tow **1** is doffed from a conventional storage carton **2**, and it is progressively converted to a web of filaments, with the aid of spreaders having curved bars **3** and tensioners **4**. Subsequently, by braking the tow, notably with the aid of a series of bars **5**, the tow is introduced under tension between two cylinders or rollers **6** and **7**, the spacing of which is adjustable as a function of the nature and thickness of the fibrous web and the degree of tension which it is desired to impart thereto, the said cylinders rotating at different peripheral velocities so as to complete the spreading; then, the web thus formed is received, preferably without tension, on a conveyor belt **8** displaced at constant velocity and on which it adheres under the influence of friction. Preferably, a belt will be used, the surface of which is made of a material having a high coefficient of friction.

The web conveyed by the belt **8** is then subjected to the action of a pusher blade **9** which intermittently exerts pressure on the web over the entire width thereof and subjects it to localised friction, the pusher blade being displaced in the same direction but at a higher velocity than the belt. The movement of the pusher blade is imparted by any appropriate means such as cams, illustrated diagrammatically as a drive assembly **10** in the figure. The thus formed web then leaves the conveyor belt **8** and is taken up, practically without tension, on a second conveyor belt **11** the velocity of which is regulated as a function of the output velocity of the web on the conveyor **8**. It then travels into a spraying chamber **12** where there is deposited an appropriate resin which is subsequently cured by passage through a heating chamber or oven **13**. Advantageously, it will be possible to spray or atomise the bonding substance on the two faces of the lap. The proportion of resin in the lap is small and preferably does not exceed 10% of the weight of the lap.

The movement of the pusher blade **9** is shown diagrammatically in FIG. 2, wherein **1** represents the open tow, **8** the conveyor belt and **23** the lower end of the pusher blade to which is imparted a movement, the extreme positions of which are designated A, B and C.

Depending on the textile material utilised, the angle of attack α of the pusher blade on the conveyor belt is adjustable, as is also the amplitude B–C. Similarly, by modifying the travel path A–B, it becomes possible to increase or diminish the pressure exerted by the pusher blade on the web **1**. Finally, the selection of the material from which the end of the pusher blade is manufactured depends, to a considerable extent, on the textile material to be processed. Good results are obtained with a pusher blade made of natural or synthetic rubber having a Shore hardness between 35 and 80°.

In practice, the angle α varies between 30 and 70°, the amplitude B–C between 1 mm. and 60 mm. and the number of cycles A–B–C between 20 and 200 per minute. Drive to the rollers **6** and **7**, to the conveyor belt **8** and to the drive assembly **10**, may be derived from a common drive motor **20**.

In a modification illustrated in FIG. 3, a series of pusher blades **31** act successively on the web, the pusher blades being mounted radially on a common spindle **32** to which a movement of continuous rotation is imparted by the drive motor **20**, the distance between the spindle and conveyor belt **8** being adjustable relatively to the conveyor belt.

FIG. 4 is a diagrammatic illustration of the textile web formed in accordance with the invention. It will be seen that the filaments **41** exhibit a helical crimp and that the external surfaces **42** and **43** of the web are substantially planar.

Although, generally, a single thus-treated web is utilised, it would also be possible, for certain applications, to superpose a multiplicity of the said webs. Similarly, it may be subjected to further treatment processes, such as needling and/or calendering, and the article obtained may be employed for purposes other than stuffing.

The following example, which is given purely by way of non-limitative illustration, shows the manner in which the invention may be applied.

EXAMPLE

The installation shown in FIG. 1 was fed with a tow the total count of which was 222,222 dtex (200,000 denier), of ethylene polyterephthalate filaments having a unit count of 1.65 dtex (1.5 denier), and a crimp of 3–4 (number of undulations per centimetre). The feed velocity of the tow was 15 metres/min. After passage through the spreaders **3**, the tensioners **4** and the bars **5**, the web formed had an average width of 200 mm. Opening was completed by passage between two cylinders **6** and **7** covered with a layer of rubber having a Shore hardness of 65° rotated at peripheral velocities of 2 metres/min. and 18 metres/min., the spacing thereof being adjusted at 0.2 mm. Then, the undulated web was deposited without tension on a conveyor belt **8** made of rubber and travelling at a velocity of 4 metres/min. It was then subjected to the action of the pusher blade **9** the end of which was made of rubber having a Shore hardness of 65° and the minimum distance of which relatively to the conveyor belt was 0.1 mm. The angle of attack α was approximately 50° and the amplitude of displacement in a plane substantially parallel to that of the belt **8** was 40 mm. The velocity of the pusher blade was regulated in such manner that it performed 100 cyles A–B–C (as shown in FIG. 2) per minute, the end of the pusher blade being displaced at a velocity close to 20 metres/min. The web thus formed was received, without tension, on the conveyor belt **11** at a velocity of 5 metres/min. It weighed 50 g./square metre, was 1 metre wide and 5 mm. thick, exhibited good cohesion and had substantially plane outer faces. After being received on the belt **11**, it was continuously sprayed, at a rate of 10 g./square metre, dry product, with a non-plasticised, crosslinkable acrylic resin in a 40% (dry extract) dispersion, in water containing an anionic surface-active agent. The crosslinking of the resin thus deposited was effected by drying, for 4 minutes at 150° C. The lap was then wound-up on a spindle.

We claim:

1. A method of preparing a non-woven fibrous web, said method comprising the steps of:

(a) providing a conveyor belt;

(b) imparting a continuous advancing movement to said conveyor belt at a given velocity;

(c) feeding a tow substantially without tension to said conveyor belt;

(d) intermittently displacing a pusher blade means spaced from said conveyor belt in the same direction and at a controlled velocity which is higher than that of said conveyor belt, for effectively exerting periodical pressure on the entire width of said tow, at axially displaced positions along the path of travel of said tow, to subject the filaments of said tow to local friction, and thereby form a web having helically crimped filaments;

(e) taking up the web thus formed substantially without tension;

(f) spraying a bonding agent on said web; and

(g) curing the bonding agent thus deposited.

2. The method in claim **1**, wherein the spacing from the conveyor belt and the velocity of said pusher blade are adjustable.

3. The method defined in claim 1, wherein said web thus formed is subjected to subsequent calendering.

4. The method defined in claim 1, wherein said thus formed web is subjected to subsequent needling.

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U.S. Cl. X.R.

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