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PROCESS OF AND APPARATUS FOR DRAWING BATTING

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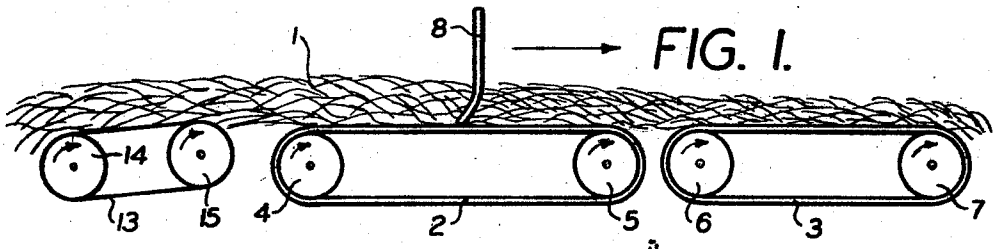


FIG. 1.

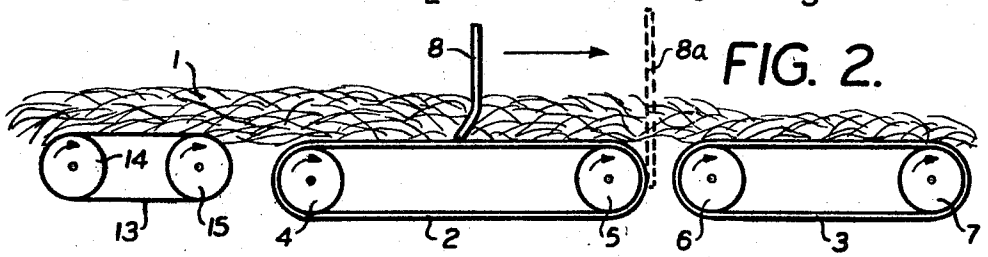


FIG. 2.

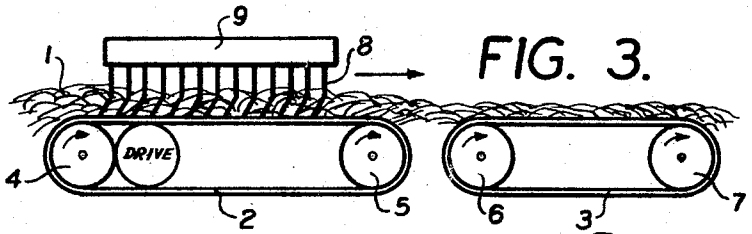


FIG. 3.

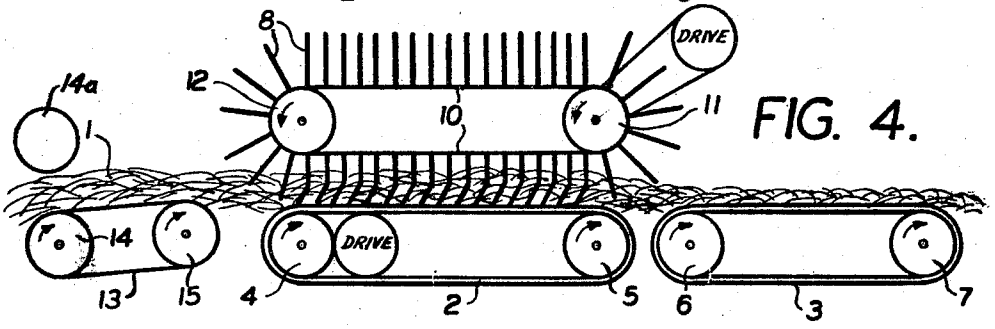


FIG. 4.

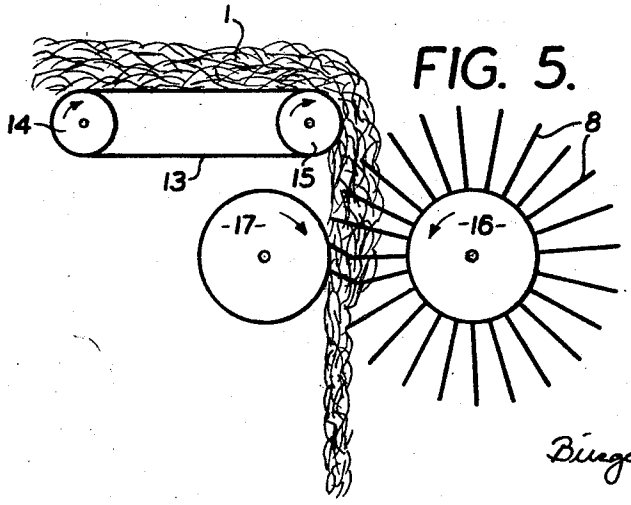


FIG. 5.

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PROCESS OF AND APPARATUS FOR DRAWING BATTING

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Int. Cl. D04h *11/08*
U.S. Cl. 19—161 7 Claims

ABSTRACT OF THE DISCLOSURE

This specification describes a novel process of drawing non-woven batting to elongate the batting and reduce its thickness. This process involves the production of non-woven batting; passing this batting, on a suitably moving supporting means, between a multiplicity of bent, springy needles and the supporting means, with the needles pressed against the supporting means and traveling in the same direction as the supporting means; permitting the bent needles to springingly straighten at the end of the supporting means, thus causing some of the fibers of the batting to be propelled thereby; and taking up the thus drawn batting at a rate commensurate with its new drawn physical parameters.

Non-woven batting is a well-known commodity. It has and can be made of substantially any textile fiber. Many descriptions are available in the literature for the production of batting; see, for example, U.S. Patents 2,719,802; 2,719,803; 2,719,806; and 2,719,795.

As shown by these references, a batt is often formed by the superposition of a plurality of thin slivers. This is done, for example, with a so-called "cross laying" device, such as the one described in the book, "Textilverbundstoffe," by Dr. Radko Krema, VEB Fachhuchverlag, Leipzig, 1963, p. 69. After the batt has been formed by one or more cross layers, the batt is carried on open pallets to an impregnating bath.

Impregnation can be done faster than a batt of a certain thickness can be formed by a cross layer. To prevent the speed of the entire process from being limited by the speed of the slowest part of the process, i.e., the formation of a batt by the cross layer, it has long been the practice to arrange a plurality of cross layers in series, thereby producing a batt of very great thickness. This batt is then run through two pairs of rolls, the speed of the second pair being higher than that of the first pair (i.e., the pair of rolls into which the batt first runs). In this manner, the excessively thick batt is drawn out to a fraction of its thickness, e.g., half, so that the length of the batts is increased proportionately, e.g., doubled. The batt, now having the desired thickness, is then fed to the impregnating bath.

In this type of drawing, however, the structure of the batt is often adversely affected. An excessively great draft can even produce holes in the batt. It has been sought to improve this technique by feeding the batt through a whole series of pairs of rolls, so arranged that each succeeding roller pair is operated at a higher speed. Thus,

the speed of the second pair is slightly higher than that of the first, the speed of the third pair is only slightly higher than that of the second, and the speed of the fourth pair is slightly higher than that of the third, and so on. In this manner, a considerable over-all draft can be obtained in the final effect, even though the draft accomplished by each pair of roll pairs is relatively slight. It has been found that this technique results in better uniformity in the drawn batt.

It is an object of this invention to provide an improved batt-drawing method.

It is another object of this invention to provide a novel batt-drawing apparatus.

Other and additional objects of this invention will become apparent from a consideration of this entire specification, including the drawing and the claims hereof.

In accord with and fulfilling these objects, one aspect of this invention resides in an apparatus adapted to use in the drawing of non-woven fibrous batting. This apparatus comprises a supporting means adapted to carry and convey a fibrous batt; a multiplicity of needles in operative association with said supporting means, carried on a needle support means movable in a direction parallel to said batt-supporting means and spaced therefrom, on the side thereof adapted to carry said batt, a distance less than the length of said needles; and means to move at least said needle-supporting means together with the needles supported thereby.

According to the process of this invention, the needle-supporting means is driven, whereby the needles successively press against the batt-supporting means. Since the space between these two supporting means is less than the needle length, the needles are bent upon contact with the batt-supporting means in a direction away from the direction of travel. The batt-supporting means may be driven by the pressed needles, or may be independently driven, as desired, at substantially the same linear speed as the needle-supporting means. A batt, of suitable size and fiber content, is fed into the apparatus at the point where the needles first engage the batt-supporting means and proceed through the apparatus with the needles pressed therethrough. After some distance of travel, the needle-supporting means and the batt-supporting means separate in such manner and at such speed that the needles springly straighten out with their tips moving in the direction of travel of the batt at a much higher linear speed than the batt is traveling. This needle tip movement causes some of the fibers of the batt to be propelled forward at a speed which is higher than the over-all speed of the batt, thus causing the batt as a whole to be drawn in length and reduced in thickness.

Understanding of this invention will be facilitated by reference to the accompanying drawing in which:

FIG. 1 is a schematic representation of the process and apparatus of this invention, illustrated with a single needle;

FIG. 2 is similar to FIG. 1, showing the position of the single needle as it reaches the end of the batt-supporting means;

FIG. 3 is similar to FIG. 1, showing a multiplicity of needles;

FIG. 4 is similar to FIG. 3, showing a continuous needle-supporting means; and

FIG. 5 is similar to FIG. 4, showing the use of an alternate form of needle-supporting means.

Reference will now be made to the drawing for further description and illustration of this invention.

FIGURE 1 shows a batt **1** which is conveyed from left to right on two conveyor belts **2** and **3** (conveyor belt **2** runs continuously around rollers **4** and **5**, and belt **3** runs around rollers **6** and **7**). To achieve a drawing of the batt, an elastic steel needle **8** is pressed onto the batt **1** lying on conveyor belt **2** in such a manner that the needle is bent in the manner shown. Then, the needle is moved to the right, while maintaining the bending pressure with the conveyor belt **2** moving with it. At the instant in which the bent needle **8** passes over the roller **5**, it springs back into its original position (since the counter-pressure of the conveyor belt has been removed). In this manner, some of the fibers of the batt are pulled forward, resulting in a drawing of the batt.

FIG. 2 shows the needle **8** in solid lines, in a position at which it is bent back. At the instant in which the needle **8** leaves the roller **5**, it springs back into its original state, as already mentioned. This state is shown in broken lines in FIG. 2 under the reference number **8***a*.

In practice, of course, a needle board **9** will be used, rather than a single needle (see FIG. 3). This needle board **9**, which is something like a wire hair brush, is pressed firmly against the batt **1** lying on conveyor belt **2**, in such a manner that all of the needles are bent back. Then, the needle board **9** is moved rightward. In the instant in which the needles of needle board **9** pass successively over the roller **5**, they snap back into original state and, at the same time, stretch the batting.

If it is desired to operate continuously, a needle-covered conveyor belt **10** will be used instead of the needle board **9**, this belt running continuously about the rollers **11** and **12** in the manner previously described (see FIG. 4). Since the distance between needle belt **10** and conveyor belt **2** is shorter than the length of the needles **8** on needle belt **10**, the needles are bent back in the desired direction as soon as they come in contact with the batt. Their contact pressure drives conveyor belt **2** along with them. The needles snapping back into their original state between cylinders **5** and **11** continuously produce a uniform draft in batt **1**, which is then carried away on another conveyor belt **3**.

It is also possible, of course, to use a pair of rollers, one of them being equipped with needles. This embodiment is shown in FIG. 5. The batt **1** runs, as usual, on a conveyor belt **13**, which, in turn, continuously revolves about the rollers **14** and **15**, while the batt moves toward the pair of rollers **16** and **17**. Roller **16** is equipped with steel needles which press against the counter-roller **17** and thereby drive the latter along with them. The batt **1**, upon leaving conveyor belt **13**, passes downward into the gap between rollers **16** and **17**. In the instant in which the needles **8** snap away from the counter roller, the batt is, again, continuously drawn.

In this manner, a draft amounting to as much as five-fold can be achieved, together with a uniform batt structure. The amount of draft depends on the length and elasticity of the needles. In other words, with shorter needles, a lesser draft is achieved, and with longer needles, a greater draft is achieved. The needles cannot, of course, be made excessively long, since in that case they would have less elasticity in the snap-back. It has been determined by experiment that steel needles having a length of about 2 to 10 cm., and preferably having a length of 5 cm., give the best results.

It is furthermore recommended to pass very bulky batts through a pair of smooth rollers **14** and **14***a* in FIG. 4 before they are contacted by the needles, so as to reduce their thickness. It has developed that the thinner the batt is, the more uniform the batt structure will be after drawing. Since the needles, upon encountering batt **1**, automatically reduce its thickness, preliminary pressing by means of a pair of smooth rollers is necessary only when very thick batts have to be drawn. In general, the thickness of the batt before stretching should amount to only about 10 to 20% of the length of the elastic needles. In the case of greater thicknesses, the top side of the batt is stretched less than the bottom side, which would, of course, have an adverse effect on uniformity.

By means of the method of the invention and the corresponding apparatus, all batts made of cardable fibers can be drawn. Only when the fiber length is shorter than the spacing between two needles is it impossible to achieve draft, since the fiber slips between the two needles. Excessively long fibers get tangled between the rollers. It has been found by experiment that all fibers of a length between about 3 and 150 mm. can be used in this process. It is preferred to utilize fibers having about 60 to 70 denier in this process.

The drawing method of the invention achieves more than mere uniformity. Much more important, perhaps, is the fact that now the card can be operated at full speed. At first, of course, it delivers a batt that is too thick for the manufacture of batt material. This excessively thick batt, after it has been laid down by the cross layer, is now drawn, according to the invention, to the desired thickness.

What is claimed is:

1. Apparatus comprising a substantially imperforate batt-supporting means; means cooperative with said batt-supporting means for moving such, and thereby move a fibrous batt thereon; needle-supporting means in proximity to said batt-supporting means; means for driving said needle supporting means in the same direction as said batt-supporting means; and a multiplicity of needles about 2 to 10 cm. long, mounted on said needle-supporting means directed toward said batt-supporting means at the point where said needle supporting means and said batt-supporting means are closest; wherein the closest distance between said needle-supporting means and said batt-supporting means is less than the length said needles protrude from said needle-supporting means.

2. Apparatus as claimed in claim **1**, wherein at least said needle-support means is a wheel.

3. Apparatus as claimed in claim **1**, wherein said needles are steel and about 5 cm. long.

4. Apparatus comprising a substantially imperforate batt-supporting means; needle-supporting means in proximity to said batt-supporting means; means for driving said needle-supporting means; a multiplicity of needles, each about 2 to 10 cm. long, mounted on said needle-supporting means at the points where said needle-supporting means and said batt-supporting means are closest, wherein the closest distance between said needle-supporting means and said batt supporting means is less than the length said needles protrude from said needle-supporting means, wherein said needles contact said batt-supporting means, and wherein said needles drive said batt-supporting means in the same direction as said needle-supporting means is driven.

5. Process of drawing a non-woven, fibrous batt whereby to substantially uniformly decrease the thickness of said batt, which process comprises providing said batt on a moving surface for conveying said batt in the direction of movement; providing a multiplicity of needles disposed adjacent to, and impressed upon, said moving surface, and so positioned as to be bent in a substantially uniform direction on said moving surface; moving said needles and said supporting surface in substantially the same direction such that said needles move at least the same speed as said moving surface, whereby said needles are bent away from the direction of movement, and causing said bent needles to starighten, whereby the bent portions thereof straighten, whereby drawing said batt upon said straightening.

6. Process as claimed in claim 5, wherein said batt is fed, having a thickness of about 10 to 20% of the length of said needles.

7. Process as claimed in claim 5, wherein said batt is compressed prior to introduction to said apparatus.

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DORSEY NEWTON, Primary Examiner

U.S. Cl. X.R.

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