

- [54] **TEXTILE, WEB NEEDLING DEVICE**
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Related U.S. Application Data

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[52] U.S. Cl.28/4 R
[51] Int. Cl.D04h 18/00
[58] Field of Search28/4 R, 72.2

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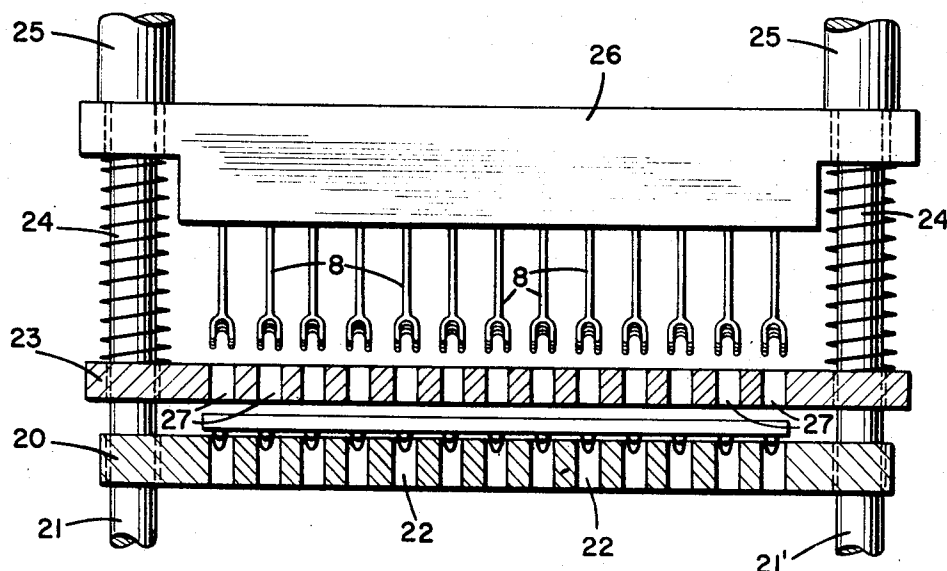
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[57] **ABSTRACT**

A needle loom for producing a napped or tufted surface upon a non-woven textile fabric which includes a movable support for a web of stretchable textile filaments of fibers to be needled said support being provided with a plurality of needle-receiving cavities in the surface thereof, a movable head spaced from said support and provided with a plurality of needles complementary to the needle-receiving cavities in the surface of the support, the needles each having a smooth shaft and at least two terminal points separated by a recess adapted to receive one or more filaments of a web being needled, and means for moving the head relative to the support whereby the needles penetrate the web and enter the complementary cavities.

2 Claims, 10 Drawing Figures



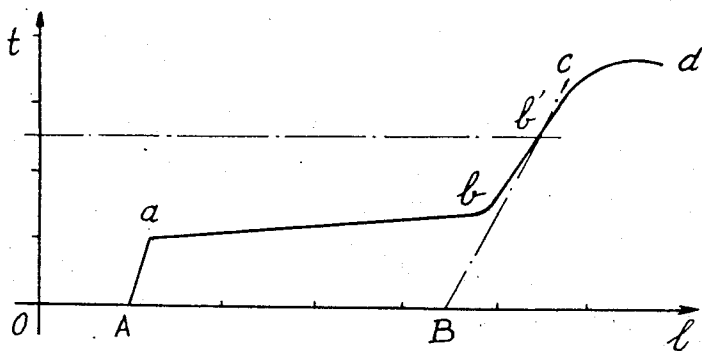


Fig. 1

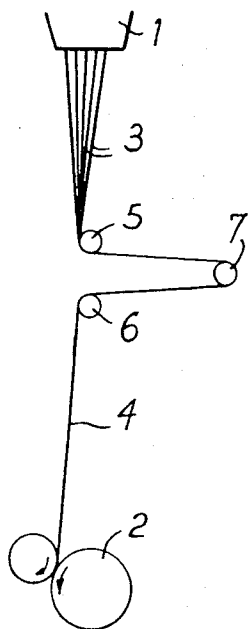


Fig. 2

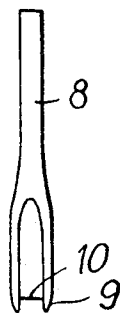


Fig. 3



Fig. 4

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Fig. 5

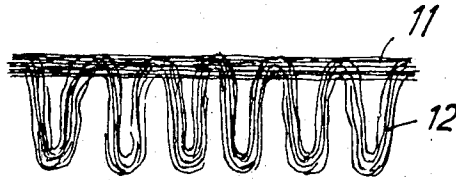


Fig. 6

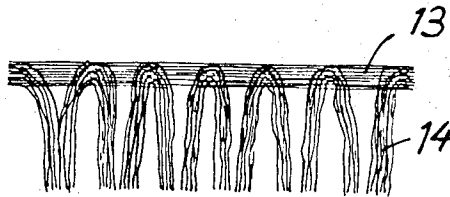


Fig. 7

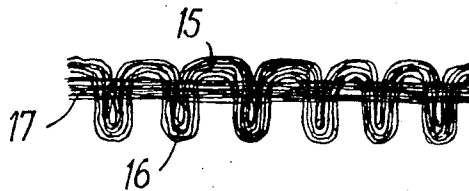
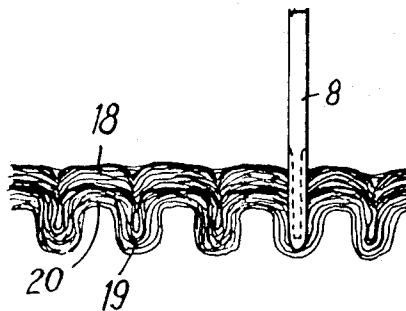
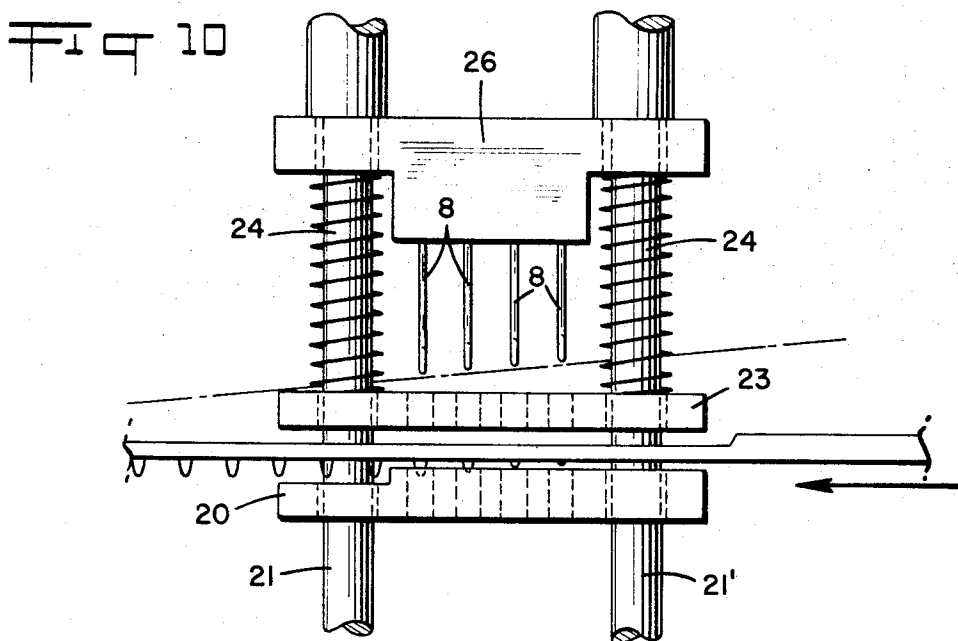
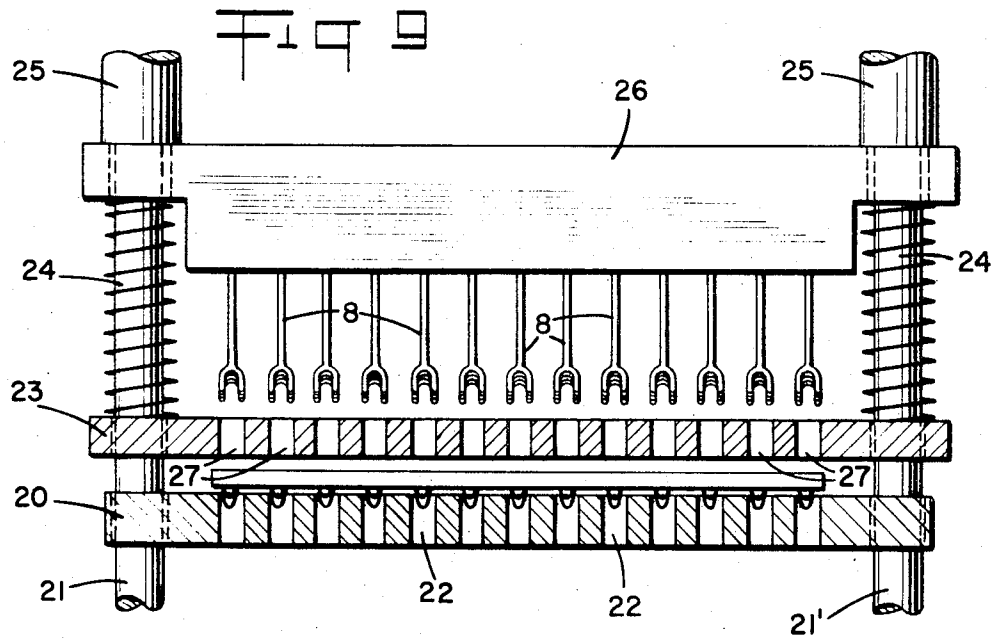


Fig. 8



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TEXTILE, WEB NEEDLING DEVICE

This application is a division of copending application Ser. No. 633,073, filed Apr. 24, 1967, now U.S. Pat. No. 3,579,763, issued May 25, 1971.

The present invention relates to non-woven fabrics, formed by a tangled mass of threads or fibers, having on one of their faces a tufted, hairy or looped appearance.

It has long been known to make felts of synthetic materials from tangled fibers or filaments consolidated by various means, of which the most usual is needling.

There are thus obtained dense felts, relatively flat and firm and having rough or sometimes fluffy surfaces, which, however, lack the qualities of softness of fur, for example, or of piled or looped materials used in the manufacture of carpets.

Numerous processes are known for making non-woven materials having such a piled or looped appearance and soft feel. In some methods there are forced through a suitable support, such as a cloth, felt, or paper, or a foam of plastic or rubber, continuous threads forming loops of which the tops can afterwards be cut and torn to produce hair like fibers. The thread is stitched through the support for example by machines called tufting machines. This thread is expensive however since it must be quite free from faults. Further, tufting machines have a relatively slow output rate.

In other known processes, there are forced, through a support, discontinuous fibers providing a fibrous layer, by needling the fibers through the support. These discontinuous fibers come out of the surface of the support in the form of tufts of pile and it is thus the fibrous web itself which produces them. There are obtained, in this manner, non-woven needled cloths having a certain softness. It is even possible to separate, thereafter, the support and the fibrous web in order to obtain a needled piled felt without intermediate support.

Finally, it has already been proposed to make a non-woven piled material by needling tufts of pile from a "generating" web of discontinuous fibers through a "foundation" web also formed from tangled fibers.

The piled felts thus obtained are not very stable, however, because the fibers having free ends in a tuft of pile easily become detached from the needled web due to their short length. It is consequently necessary to subject this kind of article to a complementary treatment in order to reinforce the adherence of the tufts of fiber to their generating web.

In order to eliminate this inconvenience it has been proposed to make piled felts by using instead of discontinuous fibers, continuous strands or filaments issuing directly from a tangled web of such fibers.

It is known, in effect, to make ordinary felts, consisting of a multitude of tangled continuous synthetic filaments previously stretched in order to provide mechanical resistance, wherein cohesion is enhanced by needling. It is also known that this operation engenders a supplementary stretching of the filaments.

Among the advantages of these sorts of articles, it will be observed that the formation of a felted web directly from continuous and previously stretched synthetic threads or filaments enables the usual operations of crimping or cutting the filaments to be omitted, these being necessary only when using discontinuous

fibers. Moreover, a felted web of drawn continuous filaments offers greater resistance to wear, since the filaments have a tearing resistance clearly superior to that of discontinuous fibers.

However, experience shows that such webs do not lend themselves to the formation of tufts of filaments issuing from the web itself, which tufts are for improving the external appearance and hand or feel of the webs.

This feature can be explained by the fact that the formation of long tufts by forcing the continuous filaments of a felted web through the web itself by means of needles requires a deeper penetration of the needles than in the case of a normal needling for simply reinforcing the cohesion in a web by orientating certain filaments perpendicularly to the plane of the latter. The filaments thus deeply driven break before a satisfactory aesthetic effect is obtained on the web face from which the needles protrude.

With respect to this prior art, the main object of the present invention is to provide a new type of product, constituted by a non-woven fabric, having the appearance of a carpet or fur, which can be simply and rapidly made, and combines the qualities of good mechanical strength, good resistance to wear, an aesthetic appearance and soft feel.

According to the present invention, a process for making a non-woven fabric is characterized in that there is formed a web of synthetic substantially continuous filaments, incompletely stretched i.e., possessing a certain capacity for further permanent elongation, and very tangled, and in that some of the filaments of this web are driven through the web itself and at the same time stretched, to cause them to protrude in the form of loops from one of the faces of the web, the capacity for initial permanent elongation of the filaments being chosen according to the depth to which the filaments are to be driven and the number of loops which it is desired to produce over a given surface area.

Another aspect of the invention is the realization of a needling device for penetrating a textile web guided by a movable support, said device comprising a movable head furnished with needles and a corresponding supporting surface for the textile web provided with cavities opposite to the needles, characterized in that the needles have a shaft with a smooth surface and at least two terminal points separated by a recess.

A further aspect of the invention in the realization of a non-woven fabric having the appearance of a carpet or a fur, composed of at least one web of tangled substantially continuous synthetic filaments, characterized in that the filaments of this web are orientated through the said web and form loops whose length is of the order of the thickness of the web, on at least one face of the latter.

It will be seen that in carrying out the invention, an agreeable effect can be obtained by forcing loops of filaments through the web from which they extend, without however, neglecting to stretch as completely as possible the filaments of this web in order that the finished product may benefit from the favorable mechanical characteristics normal to stretched filaments.

The following detailed description of the invention is referred to the accompanying drawings in which:

FIG. 1 is a graph showing the curve of elongation against pull which can be obtained with a synthetic continuous filament;

FIG. 2 schematically illustrates a thread drawing apparatus;

FIGS. 3 and 4 show a needle according to the invention;

FIGS. 5 and 6 diagrammatically illustrate two variants of the fabric obtained according to the invention;

FIGS. 7 and 8 diagrammatically illustrate two articles including a fabric made in accordance with the invention; and

FIGS. 9 and 10 show an apparatus equipped with needles represented in FIGS. 3 and 4.

When needling is carried out using barbed needles on any given web of fibers, the needles produce, in a direction perpendicular to this web, tufts of fibers on the face of the web from which protrude the needles as small lumps of fibers. There is obtained in this way a further considerable tangling of the fibers which constitute the base web, particularly on the face through which the needles enter which thus acquires a substantial cohesive strength. In contrast, the majority of fibers initially in the lower parts of the web are only slightly subjected to the action of the needles, and thus do not become as strongly intertangled as the fibers in the upper surface, of which a large part have been forced to penetrate through the mass of material. The surface at which the needles enter is therefore generally much more solid than the exit surface which has often to be reinforced by impregnations of plastic materials.

When, for any reason, and particularly aesthetic reasons, it is not desired to thusly impregnate the needle exit face, one is faced with a weakness of this face of the material. It has been attempted to compensate for this weakness by increasing the penetration of the needles, i.e. by producing tufts or lumps of fibers of greater volume, but in this case, the fibers which appear in perpendicular position on the surface, and even outside the surface, easily become detached because the degree of their attachment to the material is insufficient.

It could thus be thought that it would be desirable to subject to penetration by needles a web composed of continuous filaments instead of discontinuous filaments, the driven-out portions of the filaments, even from deep within the web, being tightly attached to the latter by their extensions. Tests have been carried out with known webs of continuous stretched filaments, but, it has been found that the action of a strong needle penetration had the effect of rupturing the filaments before the desired effect was obtained, these filaments being stretched by the needles beyond their breaking point.

According to the present invention, it is proposed to drive filaments of a web of non-stretched, or more exactly incompletely stretched filaments, through this web, in such a manner as to avoid breaking of the filaments. Thus, further stretchability of the thread driven in the form of loops through the web is utilized in order to avoid reaching the breaking point of the threads. The less the thread is stretched, the more the loop passing through the web can be elongated without breaking thereof.

However, in order more precisely to define the invention, it will be more clearly stated what is intended by the expression "incompletely stretched."

Synthetic threads such as for example polyamide, polyester, or polypropylene, have the property, once solidified after the thread forming operation, of being capable of withstanding, without rupture but with a modification of their structure, considerable degree of permanent elongation. This permanent elongation can be realized up to a limit which is more or less defined, beyond which the thread is said to be stretched and can hardly be elongated further and only elastically before breaking. This "stretched" state, well known by specialists, and which results in an orientation of the molecules of the product is in general sought and obtained industrially by an operation called drafting, because it is this which gives the thread its best mechanical characteristics.

Several methods enable this state of a synthetic thread coming out of the spinneret to be determined, such as the study by X-rays of the molecules, carried out in the laboratory or the examination of a stress-deformation graph which is used more easily in practice. This method will be used here in order to characterize the state of a thread by the permanent elongation to which it can be subjected before arriving at the stretched state.

The diagram of FIG. 1 represents the elongation up to breaking point of a synthetic thread coming out of the spinneret as a function of the tension applied thereto. The tension t is shown as the ordinate and the length l as the abscissa.

The part ab of the curve corresponds to the stretching phase proper, i.e. to the permanent deformation of the thread which is realized under practically constant tension. The part bc corresponds to an elastic deformation, a property which it is easy to check by slackening off the tension from the point b' : it will be seen that the relation of deformation to tension is shown by the straight line $b'B$. The part cd corresponds to a permanent deformation preceding the breaking point with destruction of the connections between the molecules, the diminution in cross-section and breaking of the filament occurring at d .

The capacity for permanent elongation of the filament will be defined here by the ratio: AB/OB , i.e. the ratio between the increase in length of the initial filament without tension and the length of the stretched filament without tension. The determination of this capacity for permanent elongation is made easy by the presence of the elastic zone bc ; in effect, the pull exerted to effect stretching can be largely indeterminate provided it is situated in this zone.

The extent of the variation AB/OB depends essentially on the polymer and on the manner in which it is stretched. For "NYLON 6" for example, of relative viscosity 2, 8, this value can vary from 0.80 to 0 as a function of the conditions existing when the filament was made.

Thus, by "incompletely stretched" is meant the state of a filament of which the capacity for permanent elongation is other than zero.

The possession of a simple manner of determination of this capacity for permanent elongation enables the initial value for filaments used in the manufacture of

textile material to be regulated; it is possible thereafter to determine experimentally to what depth filaments can be driven through the web in order that a certain percentage of the filaments have a capacity for permanent elongation after the operation as close to zero as possible, that is to say practically stretched.

Many different methods of regulating the initial state of the filament, i.e., the value of its capacity for permanent elongation can be used. It is possible, for example, to use well known drafting frames, of which the speeds are regulated experimentally to obtain the desired capacity for permanent elongation.

Such a regulation can also be performed at the outlet if the spinnerets, where the filament is formed from melted polymer. At the spinneret outlet the threads are cooled, all the threads of a same spinneret being drawn at high speed by a takeup machine, or by a blowing nozzle fed by compressed air. The drawing means are located at a considerable distance from the spinneret so that the threads do not stick together in the plastic state, and form what is called a multiple thread.

The term "spinning ratio" refers to the ratio between the driving speed of the thread and the speed of flow of liquid polymer through one of the holes of the spinneret. In practice, the drawing speed of the thread is always much greater than the flow speed of the liquid into a hole of the spinneret, and this results in a considerable narrowing of the thread while it is being drawn in the plastic state.

This narrowing is accompanied by a modification of the structure as is shown in the following table resulting from experimental measurements which illustrate a correlation between the spinning ratio and the capacity for permanent elongation

Delta	50	56	62	69	75	81	87,5	94	100	106	112
AB	0,73	0,70	0,68	0,61	0,54	0,47	0,40	0,36	0,30	0,23	0,19
OB											

However, for a determined diameter of the holes of the spinneret, the spinning ratio fixes the size or the denier of the thread. The capacity for permanent elongation cannot, therefore, be completely regulated by varying the spinning ratio.

In order to diminish the stretching capacity beyond fixed limits with respect to the thread forming, and independently of the size of the thread, the latter being the size at point A in FIG. 1, that is to say without tension on the bobbin or in the receiving can, the following expedient may be used: a thread stretching device is placed on the thread between the spinneret 1 and the drawing device 2 placed in a position where the threads 3 of the multiple filament 4 are still hot but no longer sticky, in such a manner as to perform the stretching under optimum conditions. An example of an embodiment of this thread stretching device, shown in FIG. 2, consists of two deflecting pulleys 5 and 6 and an intermediate pulley 7 to which is applied a braking couple of which the value is a function of the elongation which it is desired to produce in the thread between these pulleys and the drawing machine.

For example, in the case of a spinning ratio equal to 56, the capacity for permanent elongation can be varied by varying the speed of the stretching device, without changing the final denier value. By using the ratio V/V_1 of the winding speed to the speed of the pul-

ley 7 of the stretching device, there are obtained experimentally capacities for permanent elongation specified in the table hereunder:

V/V_1	1	1,5	2	2,5	3	3,5
AB/OB	0,70	0,58	0,47	0,33	0,24	0,18

When the drawing device is a blowing nozzle, it is possible to cause the capacity for permanent elongation to vary not only by means of deflecting rollers whose speed is maintained constant, but also by regulating the air pressure in the blowing tube in such a way that it produces an elongation of the thread between the entry and the exit of the said blowing nozzle.

EXAMPLE

Starting with a spinneret having 200 holes discharging 280 g/m of polyamide 6, a multiple filament was produced which was blown in a blowing nozzle fed by compressed air at 6 kg/cm² and placed at 1,80 m below the spinneret. The speed of the thread at the exit of the blowing nozzle was in the region of 4.200 m/mn and the size of the thread discharged without tension about 3 deniers. The capacity for permanent elongation of the threads of the multiple filament was 0,08.

Finally, it is possible to make directly at the exit of the spinneret, a multiple filament collected by a suitable device, and of which the denier (total and by thread) as well as the capacity for permanent elongation AB/OB are fixed in advance. Thereafter, in order to carry out the invention there is formed, with the multiple filaments of which the capacity for permanent elongation and also the denier are known, a homogeneous web, having substantially constant apparent density and thickness and of which all the elementary filaments are tangled to a very high degree, so as to give the web a certain coherence.

Methods for forming such a web already exist in both the glass fiber and artificial textile industries. Generally speaking, these webs can be obtained from distributors of individual filaments or multiple filaments discharging the thread onto an endless receiving table which moves at a speed clearly less than that at which the thread arrived thereon. Auxiliary devices for blowing air and for reciprocally driving the distributors transversally with respect to the receiving table enable the tangling of the threads to be increased.

All the parameters such as the composition of the multiple threads, the speed of latter, the speed of the receiving table, the spacing between the distributing devices are determined experimentally with a view to obtaining a regular web of material whose weight per square meter is known in advance.

This web lacks cohesion however, and in order to reinforce the latter, the web is caused to pass, at the exit of the table on which it is forced, into a well known needle loom having barbed needles. This needling, being of relatively low density and low depth in order to avoid stretching the threads subjected to the action of the needles, is principally intended to facilitate the transport of the said web, or to enable it to be attached to one or more other webs according to requirements. The presence of a lubricant or pulverized preparation, at the entrance to the needle loom facilitates this operation.

According to the invention, an attractive effect is sought by forcing loops of filaments through this web,

without however neglecting to stretch the filaments of this web as completely as possible in order to obtain a finished product which benefits from the excellent mechanical characteristics of stretched filaments.

To this end, the web is subjected to a very deep needle penetration which causes the filaments of the web to be driven through the web itself, and at the same time stretches them.

The portions of the filaments which are pushed by the needling through the web, will be more stretched than those which remain implanted in the web. It is, however, possible to provide an apparatus and a method to carry out this operation wherein such a high percentage of the filaments are completely stretched.

The web can be subjected to a very deep needling, that is to say in which the needles largely pass through the other face of the web. However, if this needling is carried out with known barbed needles, it only produces rather poor loops in the filaments, with such loops being of uncertain height and having a very variable number of strands.

In order to obtain loops of presentable appearance, regularly formed, it is desirable to always drive the same quantity of threads through the web, and always to the same depth for a given adjustment of the machine. For this reason, it is preferable to use the apparatus represented in FIGS. 9 and 10 equipped with needles represented in FIGS. 3 and 4.

The apparatus comprises a supporting plate 20 mounted on chains 21 and 21', the said supporting plate comprising spaces 22. In operating the apparatus, the web is conveyed between the supporting plate 20 and stripper grid 23 by any suitable means, the stripper grid 23 being mounted on rods support 24. Rods 24 pass upwardly through guide bushings 25. While feeding the web through the apparatus, the needles 8 fixed on a needle board 26 which is slidably mounted on rods 24, are driven downwardly through the spaces 27 in the stripper grid 23 and through the web and then into the spaces 22 of the supporting plate 20. Each needle has a shaft 8 having a smooth surface, terminating in two parallel pointed portions 9 and separated by a recess 10 which pulls the filaments during its passage through the web and stretches them, the filaments remaining in the form of loops when the needle is pulled out. By virtue of these needles, the filaments form loops, which are all at the same height, and have substantially the same number of strands.

These needles can be placed in a known needle loom in a single row. In one embodiment, they have a diameter in the order of 3 mm and their distance from axis to axis is in the order of 5 mm, this distance naturally being variable according to the effect which is desired.

The supporting plate of the needle loom, that is to say the apertured plate on which rests the web and which serves to support it at the moment when the needles of the needling head penetrate it, can advantageously have, instead of holes opposite each needle, longitudinally disposed slots, in order to facilitate advancing the web.

The advancement of the web takes place in steps in a rhythm which is in step with the movement of the needles and at a rate which is controlled by a governing roller at the exit of the machine for the spacing of the rows of loops. In general, the latter is of the same order as the distance between two neighboring loops of a

were spaced apart 2 to the cm and the advancement of the machine is adjusted to 6 mm at a time.

However, and this applies especially when the distance between two neighboring rows is small, it is observed that the operation of forming a row of loops has a tendency to destroy the preceding row because of slipping of the filaments in the web. In order to avoid this phenomenon, in the case in which it is considered a nuisance, it is advantageous to needle the web with the aid of two or more transverse rows of aligned needles, the spacing of which corresponds to the rate of advancement of the needle loom.

Thus, the use of several rows of needles enables not only the portions of filaments constituting the loops to be stretched, but also the stretching of those which remain between two loops.

Moreover, when several rows of needles are used, and when it is desired to make very high loops, it is advantageous to locate the rows of needles according to the heights which increase in the direction of the movements of the web, each row of needles thus effecting a part of the stretching and of the formation of a row of loops. There is obtained in this way a relatively progressive stretching of the filaments.

Another method of forming the loops consists in using a cylinder provided with needles according to the invention over the whole of its periphery, and to pass the web between this cylinder and a counter cylinder having circular channels opposite each row of needles. This method has the advantage of providing a slow rate of penetration of the needles into the web, and of ensuring a progressive and regular stretching of the filaments.

Before commencing the operation of forming the loops, it is advantageous to heat the web to the optimal stretching temperature, which temperature depends upon the polymer. Thus, for example, with polyamide 6, the loops can be formed at a temperature of 120° to 150° centigrade, and this greatly facilitates the operation of the machine, and provides fuller and more abundant loops, due to a diminution in the number of broken filaments. This heating can be effected by infrared radiation or by passage of the web through a heating tunnel. In certain cases, the penetration of the needles is facilitated when a lubricating agent is sprayed onto the web since this favors slipping between the threads, and avoids thread breakages, as is well known practice in the needling technique.

The web 11 thus treated has on one of its faces, thick loops 12 of which the height can be adjusted within a large range of values, and which can be clearly greater than 1 cm (see FIG. 5).

Practically all the filaments are stretched for the reasons explained above, provided, of course, that the initial capacity for permanent elongation of the filaments of the web has been appropriately chosen as a function of the height and spacing of the loops which it is desired to obtain, this being easy to determine in an empirical manner.

Moreover, the presence of a zone of elastic deformation after this zone of permanent deformation allows a certain latitude in the adjustment for this initial capacity for permanent elongation of the filaments, so that after penetration by the needles the threads are stretched or nearly so.

It will be observed, however, that in the present invention, this capacity for initial permanent elongation has great importance, particularly for the length of the loops.

Thus, in order to obtain loops having a height of 10 millimeters from a web of 500 grams per square meter of filaments whose capacity for permanent elongation AB/OB was 0.65, was used. This web was caused to pass through a needle loom having three rows of needles, each row having two needles per centimeter of width, the rows being spaced from one another by 6 millimeters. The penetration of the needles was adjusted in such a way that the lowest point of their movement was situated at 10 millimeters below the surface on which the web rested.

Loops having a height of 25 millimeters have also been made, from a web of 500 grams per square meter having filaments of which the capacity for permanent elongation AB/OB was 0.65. This web was passed into a needle loom having two rows of needles each row having one needle to the centimeter of width, these rows being spaced one from the other by 10 millimeters. The penetration of the needles was adjusted so that the lowest point of their movement was located at 25 millimeters below the supporting surface of the web.

Moreover, loops having a height of 5 millimeters have been made from a web of 300 grams per square meter having filaments whose capacity for permanent elongation AB/OB was 0.50. This layer was passed through a needle loom having two rows of needles each row having two needles to the centimeter of width and the rows being spaced one from the other by 6 millimeters. The penetration of the needles was regulated so that the lower point of their movement was located at 5 millimeters below the surface on which the web rested.

In these three cases, after analyzing the final product it was observed that at least 80 percent of the filaments had a capacity for permanent elongation in the neighborhood of zero.

According to an interesting variation of the invention, a capacity for initial permanent elongation and a needle penetration were chosen such that the filaments constituting the loops were pulled, by the penetration of the needles beyond their breaking point; breakage of the filaments at the top of the loops was thus provoked, and a carpet with the cut hairs or pile 14 having the appearance of a velvet was produced. The filaments thus broken in the loops nevertheless remain very solidly gripped in the web 13 from which they project without any further treatment being necessary.

For example, a pile carpet was made starting from a web of 300 grams per square meter, constituted by filaments having a capacity for permanent elongation AB/OB of 0.50. The web was passed through a needle loom having three rows of needles, each row having two needles per centimeter of width, the rows being spaced from the other by 6 millimeters, and the penetration of the needles being adjusted so that the lowest point of their movement was located at 22 millimeters below the supporting surface of the web. The finished product had a pile of an average height of 8 millimeters.

Everything which has just been described, for continuous filaments which have not been cut at the spinneret outlet, can be applied to long fibers adapted for

the formation of a large number of loops, and, for this reason, to act as truly continuous filaments.

In order to define the field of application of the invention, the meaning of the expression "substantially continuous filaments" must be extended to include fibers which are very long with respect to the thickness of the web which they make up.

The fabric resulting from the needling can very advantageously be treated with moist heat with a view to stabilizing the filaments. This treatment can be performed during the coloring or printing of the web, by means of steam or by water under pressure, or even in the absence of any coloring operation at all, if the filaments were previously colored throughout their mass. This treatment, whilst fixing the colorants, also reinforces the cohesiveness of the fabric by causing the filaments to contract slightly and stabilizes the crystalline structure of the polymers. The filaments then acquire a better resistance, in particular in the zones where they are incompletely stretched.

Nevertheless, if the fabric is intended for heavy duty use, as for example in floor coverings, it is advantageous to reinforce it and to improve its dimensional stability with the aid of another web forming a reinforcement and formed with continuous filaments made in the same way as those of the fabric that is by previously being stretched with a ratio AB/OB in the vicinity of zero.

The loops 16 of the web 15 of incompletely stretched filaments are forced through the web 17 of stretched threads (FIG. 7), after the two webs have been slightly needled together. It is clearly possible to carry out this operation continuously with the rest of the process by causing two series of thread distributors, one fed by a stretched thread the other by an incompletely stretched thread, to discharge onto the same receiving table.

By way of example, a carpet of this kind has been made by employing a web comprising continuous stretched filaments of "NYLON 66" of a weight per square meter of 300 grams, on which there was placed a web of continuous incompletely stretched filaments of "NYLON 66" of a weight per square meter of 550 grams, the two webs being slightly needled together and thereafter subjected to a needle penetration according to the invention, certain filaments of incompletely stretched thread being forced through the web of stretched thread.

It is surprising to find that excellent results can also be obtained by operating on the two webs in the reverse direction, i.e. by causing the needle to enter, according to the invention, the web 18 of stretched filaments to cause them to emerge as loops 19 on the opposite face of the web 20 of incompletely stretched filaments (FIG. 8). The resistance and stability of a carpet obtained in this way are remarkable.

Finally, for certain applications of such an article composed of one or several webs, the reverse side is coated with a plastic or rubber material. In the fabrics according to the invention, the reverse side is constituted by the entry face of the special needles described above and, by reason of their substantial diameter and of their form, these needles left in the web a series of holes. These holes are so many channels in which the usual coating materials preferentially engage. If one tries to solidly fasten these materials to the

web, it is observed that they pass through the fabric by means of these holes and this is clearly undesirable and does not happen with traditional needle fabrics.

During the practice of the invention, it was found that it was advantageous to coat the reverse side of the carpet with a mechanically foamed plastisol of polyvinyl chloride. This foam, obtained by mechanically beating the latex or the plastisol before coating and gelling is used preferably with other porous materials, the expansion of which during gelling is caused by a chemical expanding agent which decomposes under the effect of heat; in effect a foam formed during heating has the same fault as a non-cellular coating: it finds its way into the channels left by the passage of the needles, forming hard vertical parts, in the thickness of the carpet.

On the contrary, the mechanically foamed materials penetrate the interstices and channels, but subside during gelling without leaving hard parts in the channels.

The mechanically foamed material can be coated by means of a scraper or a cylinder and in a single or several applications. If of sufficient thickness, it constitutes a comfortable undercoat, which reinforces the dimensional stability of the product and endows it with an excellent rubbing coefficient, which are advantageous qualities for a floor covering.

Besides application to carpets, the fabric made according to the invention can have numerous other applications either alone, or in composite form, in combination with other webs, or in the form of a coating. Thus, it can be used for example for making wall coverings, blankets, household textiles such as fabrics

for seats, or for curtains, clothing textiles for linings or overcoats, fabrics for slippers, and all other products having the appearance of a carpet or a fur.

What is claimed is:

1. Apparatus for subjecting a textile web to needle penetration and for forming loops or tufts protruding on one side of said textile web, said apparatus comprising:

means for the step-wise advance movement of said textile web;

movable supporting means for needles disposed above said textile web;

a plurality of needles mounted on said movable supporting means in several transverse rows, each of said rows being spaced with respect to the next row by a distance equal to each step of said step-wise advance movement of said textile web and each of the needles of one needle row being aligned with needles of the other rows;

an apertured supporting plate for said textile web when the latter is pierced by said needles, said needles having shafts with a smooth surface and two terminal points separated by a recess; and

means for intermittently moving said needle supporting means relative to said web supporting plate so as to form loops or tufts on said textile web.

2. Apparatus as claimed in claim 1 wherein the needles of said transverse needle row have the same height and the height of said needles increases from one row to the other in the direction of said advance movement of said textile web.

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