April 7, 1970 A. M. C. ALEXANDRE 3,504,410

METHOD FOR THE MANUFACTURE OF ELASTIC TWISTED YARNS AND TEXTILE PRODUCTS

Filed May 31, 1967 4 Sheets-Sheet 1

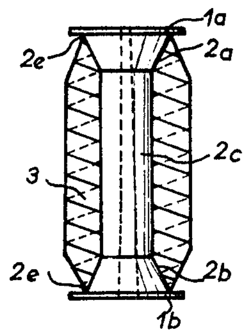


Fig. 1

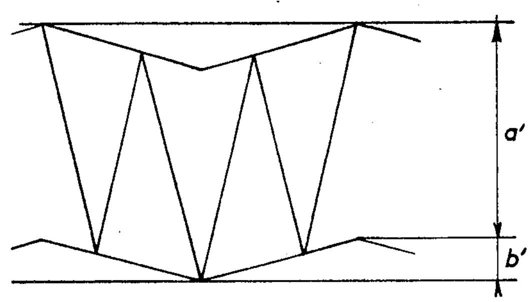


Fig. 2

Fig.: 5

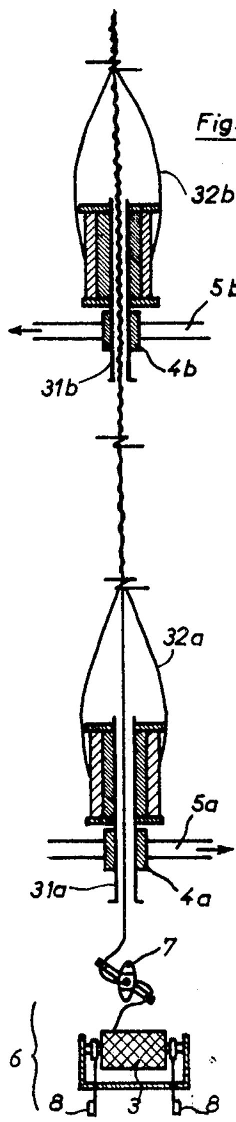
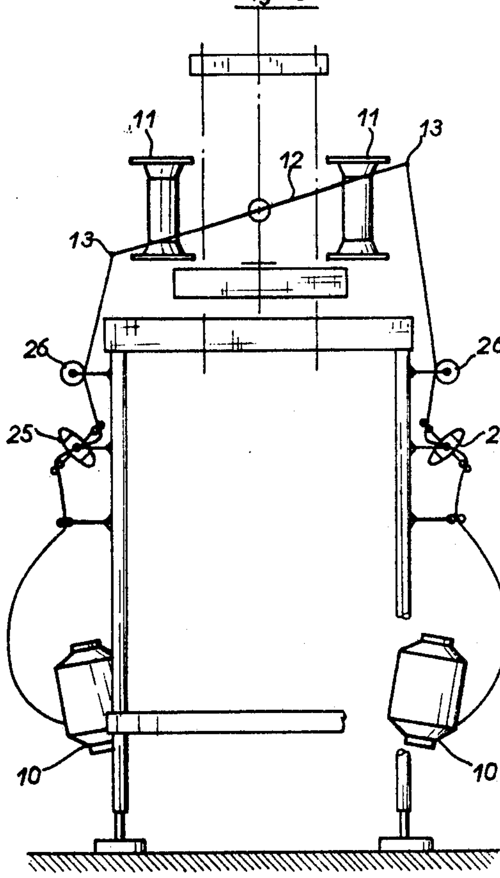
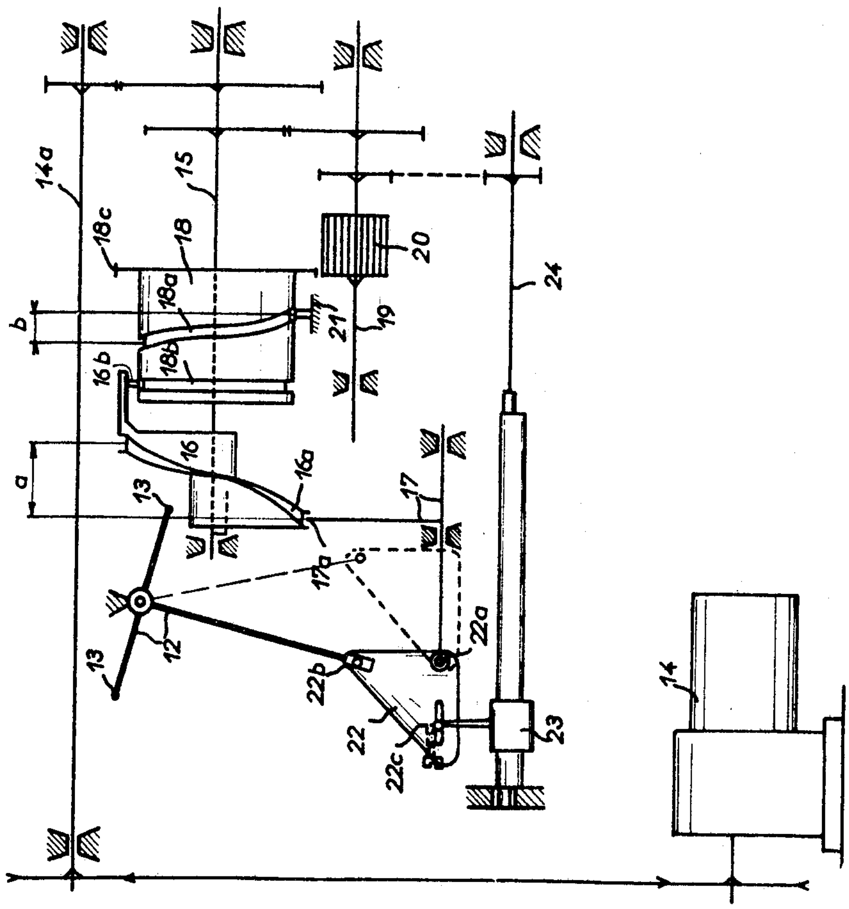


Fig.: 3




14a
15
18c
18
18a
18b
b
16b
16
16a
a
13
17
17a
12
22a
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22
22c
23
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20
21
19
14

Fig. 4

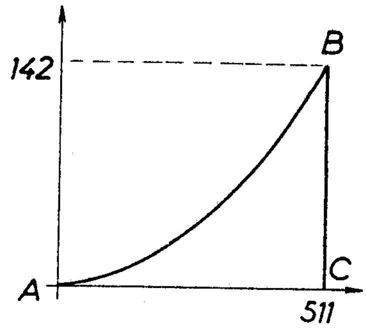

Fig.:6

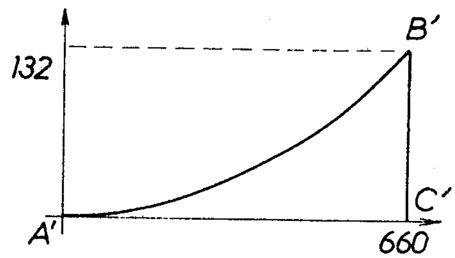

Fig.:7

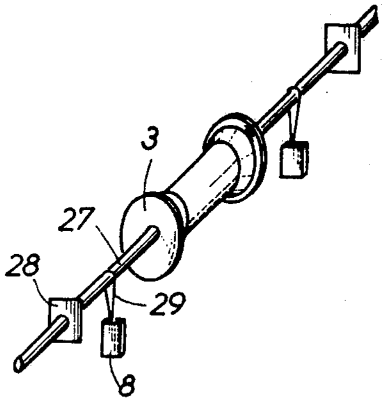

Fig.:11

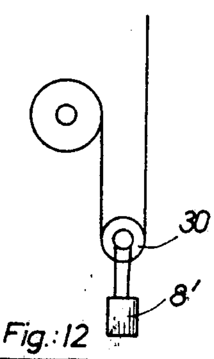

Fig.:12

Fig.:8

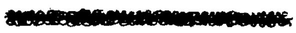

Fig.:9

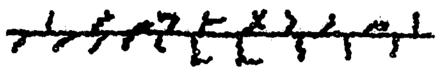

Fig.:10

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METHOD FOR THE MANUFACTURE OF ELASTIC TWISTED YARNS AND TEXTILE PRODUCTS

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Continuation-in-part of applications Ser. No. 357,443, Apr. 6, 1964, and Ser. No. 423,018, Jan. 4, 1965. This application May 31, 1967, Ser. No. 642,505
Claims priority, application France, Apr. 10, 1963, 931,017; Jan. 8, 1964, 959,728
Int. Cl. D02g 3/32
U.S. Cl. 28—72 11 Claims

ABSTRACT OF THE DISCLOSURE

A process for the manufacture of an elastic twisted yarn whereby an elastic material is twisted and covered by at least one covering yarn, after which the elastic material and yarn are shrunk by thermal treatment in a non-oxidizing atmosphere. An elastic twisted yarn having a twisted core of shrinkable elastic synthetic material covered by at least one covering yarn.

Cross-references to related applications

This application is a continuation in part of applicant's U.S. patent application Ser. No. 357,443 filed Apr. 6, 1964, and now abandoned and application Ser. No. 423,018 filed Jan. 4, 1965 and now abandoned.

Background of the invention

The present invention relates to the manufacture of elastic yarns and of textile products from such elastic yarns.

The manufacture of yarns which are naturally elastic, in contrast to yarns which are formed from inextensible fibres which may have an artificial elasticity due to the form of these fibres, rather than to the inherent nature of the material of which the said fibres are constituted, is particularly difficult, precisely by reason of the extensibility of the material used. Such manufacture is generally effected by the technique of lapping or "covering," which consists in winding at least one inextensible yarn or wrapping around an extensible yarn or core which is kept stretched. The wording "extensible yarns" includes any yarn which is naturally elastic, the other yarns being considered as inextensible. In particular the polyamide or polyester yarns, even if then are textured, are inextensible yarns. The wrapping has the function of limiting the extensibility of the composite yarn obtained and of delaying the ageing of the core when the latter consists of rubber or other material sensitive to the action of light, air and temperature during washing.

Success has recently been achieved in producing synthetic fibres which have great extensibility and excellent resistance to ageing and are also remarkable for the persistence of their power to "return," also called power of retention. Yarns formed of these fibres, however, are costly and are at least as difficult to produce and to use for the manufacture of textile products (woven and knitted fabrics) as conventional yarns having a rubber base, in particular by reason of their great extensibility and the changes in the physical properties of these fibres

which occur under the action of heat. These changes, which affect principally the extensibility of the fibres and, to a lesser degree, their length, will be covered hereinafter by the term "shrinkage," by analogy with the terminology employed in the case of fibres which are, for pracical purposes, inextensible, polyamides for example.

Summary of the invention

It is an object of the present invention to produce composite covered yarns having an elastic core, which can be used directly for the manufacture of textile products, that is to say, which are mechanically stable on the loom and remain thermally stable in the course of possible subsequent treatment of the product (the size of which is practically speaking invariable for given tension conditions), and can be dyed if need be.

The invention also has as object thereof, the production of elastic twisted yarns in which the core comprises a percentage of elastomer distinctly less than that which is general at the present time for given elasticity characteristics, and it is therefore particularly advantageous in its applications to the case of relatively costly synthetic materials such as fibers having a polyurethane base.

The invention also has, as a further object, the provision of at least partially elastic textile products in which such yarns are incorporated and which exhibit properties which are a distinct advance in comparison with the products manufactured by the present techniques, from the point of view of both the manufacturer and the user, particularly as regards appearance, "feel" and power of return.

According to the invention an elastic core is given a twist before assembling it with at least one wrapping yarn, which consists of any inextensible material whatsoever, and effecting a thermal shrinking treatment in a non-oxidizing atmosphere, preferably by means of saturated steam. The shrunk yarn obtained in this way can still be dyed before knitting or weaving, its stability thus being remarkable and facilitating adjustment of the loom, which is effected according to the product to be manufactured.

According to a particularly advantageous manner of carrying the invention into effect, the elastic core is first subjected to winding on a specially adapted machine, in the course of which it is received on special spools, although it is possible to use standard spools. It then passes on to a twisting frame before being assembled in a single operation with at least one wrapping yarn consisting of inextensible material, without any restriction as to nature, or with two wrapping yarns, which wrapping yarns are wound around the core, preferably in opposite directions, the assembling machine being constituted by an improved throwing machine equipped with standard or improved hollow spindles. The shrinking of the yarn is effected on floats or discs and this has the unexpected result of considerably increasing the extensibility of the twisted yarn, while also improving its power of return.

Finally, the known property possessed by elastomeric yarns, of having their extensibility reduced by a thermal treatment effected in the stretched state on strong bobbins may also be applied, according to the invention, for bringing the extensibility of an elastic twisted yarn at least temporarily into a range suited to the manufacturer or user of textile products.

The invention also embraces textile products obtained by using such elastic yarns.

Brief description of the drawing

FIGURE 1 is a diagrammatic diametral section of a spool used in the method of the invention, for winding the elastic core on a twisting frame;

FIGURE 2 is a diagram illustrating the details of the elastic yarn on this spool;

FIGURE 3 is a diagrammatic elevational view of a winding machine according to the invention;

FIGURE 4 shows in a similar manner, the special kinematic control system of the shaping apparatus which forms part of the machine shown in FIGURE 3;

FIGURE 5 is a diagram showing, in elevation, a throwing machine equipped with hollow spindles, which is adapted for assembling elastic twisted yarns with two wrapping yarns;

FIGURE 6 is a diagram showing the elongation of a twisted elastomeric yarn as a function of the tensile strength;

FIGURE 7 is a diagram showing the elongation of an untwisted elastomeric yarn as a function of the tensile strength;

FIGURES 8 to 10 represent on a considerably enlarged scale an elastic composite yarn according to the invention, in the free state, in a moderately stretched condition, and under its normal weaving or knitting tension, respectively;

FIGURES 11 and 12 show diagrammatically means for giving a practically constant tension to an elastomeric yarn.

Detailed description

Referring to the drawings, the production of an elastic twisted yarn by the method of the invention, from starting materials coming from the spinning process, commences with winding the elastic yarn on spools or bobbins such as that shown in FIGURE 1. These spools are characterised by the fact that the diameter of their cheeks or flanges **1***a*, **1***b* is scarcely larger than the diameter the ends **2***e* of the body (the difference being 40 mm. at the most and preferably only 20 mm.) and by the fact that the portions **2***a*, **2***b* of the body which are adjacent the ends form part of two conical surfaces which are opposed at their apices, the intermediate portions **2***c* being possibly cylindrical.

In carrying out the winding, considerable crossing is used, for example seven to twelve turns forward and back for a distance of 120 mm. between the cheeks, and a preferably slight tension is employed. The crossing results from the relative speeds at which the spools, on the one hand, and the yarn distributing apparatus, hereinafter called the "shaping apparatus," on the other hand, are driven. Modern winding machines have separate motor and reduction gear sets for driving the spools and the shaping apparatus.

Such a machine is shown diagrammatically in FIGURES 3 and 4, FIGURE 3 is an elevational view in which two bobbins or the like **10** filled with yarn from the spinning process are shown at the bottom, while at the top there are shown two spools or bobbins **11** with vertical axes, on to which the yarn passes as it is wound, and also a rocker **12** carrying guide eyes **13** for the yarns.

The use of an automatic tension regulator **25** enables a constant tension to be obtained.

At the output from this regulator there may be arranged a deeply grooved wheel **26** producing slight friction, which is preferably mounted on bearing balls and which has the effect of sparing the yarn by cutting off any friction force, and thereby of not modifying the tension at the output of the regulator and of bringing the final tension within the range sought, particularly in the case of an elastic yarn of high count.

FIGURE 4 illustrates an advantageous embodiment of the apparatus in which the rocker **12** is given a reciprocating movement suitable for distributing the yarn along the spools **11**. The motor **14** operating the shaping apparatus drives, through the medium of a shaft **14***a*, a first shaft **15** on which a cam **16** is mounted by means of a key or splines, so as to be slidable on the shaft **15** while being driven in rotation by it, the said cam having at its periphery a continuous helical groove **16***a*. The distance *a* between the two points of the groove **16***a* which are furthest apart in the direction parallel to the shaft **15**, determines the constant stroke *a'* of the guide eye **13**. A slide **17** carries a finger **17***a* engaging in the said groove and drives the depending arm of the rocker **12** in a manner which, for practical purposes, can be assumed to be a direct drive and which will be described in detail hereinafter.

As has been stated above, the helical cam **16** can slide on the shaft **15** which drives it in rotation. The cam carries a finger **16***b* engaging in a groove **18***b* in a part **18** mounted loosely on the shaft **15**. The part **18** is driven by a second shaft **19**, by means of a pinion **18***c* co-operating with a pinion **20** which has elongated generatrices and is fast with the shaft **19**. The part **18** is provided at its periphery with a closed helical groove **18***a* in which a fixed finger **21** is inserted. The distance *b* between the two points of the groove **18***a* which are the furthest apart in the direction parallel to the shaft **15** determines the displacement *b'* between the "dead" points of the yarn on a spool **11**, this being called hereinafter, the "cut-off" of the shaping apparatus. The distance *b'* is at least equal to ⅕ of the stroke *a'*. The ratio of the speeds of rotation of the helically grooved members **16** and **18** is advantageously ⅓, which is an exceptionally high value if it is compared with conventional values, which are of the order of 1/60.

If the periodic manner in which the yarn comes to the same distance from the cheeks of the bobbins were to assume too great a periodicity, this could cause irregularities of tension on the subsequent return of the yarn wound on the spool; accordingly the winding machine also comprises an angle piece **22** which provides a connection between the slide **17** and the rocker **12**, in parallel to that provided by the shafts **15** and **19**. This angle piece is articulated at **22***a* to the slide **17** and it carries at **22***b*, a finger which co-operates with a slide on the depending arm of the rocker. It also carries a third articulation point **22***c* which is advantageously adjustable in a direction perpendicular to the line **22***a*–**22***b*. The articulation **22***c* connects the angle piece **22** to a ring **23** engaged on a third shaft **24**. This shaft is eccentrically mounted, as shown in the drawing, and, moreover, it is driven in rotation from the shaft **15** by pinions which are designed in such manner that the speed ratio is very close to unity, with a difference of only a few percent. This difference is sufficient to produce a slow displacement of the dead points of the yarn on the spool. Of course, the total stroke of the guide eye is adjusted in such manner that at the end of the winding operation the yarn **3** comes close to the cheeks **1***a*, **1***b* without touching them.

For low amounts of twist, the external diameter of the spool, when loaded with yarn, is of only relative importance but, if the yarn of the spool is to be twisted in a single operation to a considerable value, which may reach 1,000 turns per metre, it is desirable that the external diameter of the spool, when loaded with yarn, should be at most equal to that of the cheeks. It is then sufficient to choose spools of rather large length or diameter, in order not to be hindered by these restrictions, it being understood that a distance of 120 mm. between the cheeks enables 300 grams of a conventional elastic yarn with a polyurethane base, of about 70 denier, to be wound under these conditions on a spool the body of which has a diameter of 50 mm. at the base **2***e* of the frustoconical parts **2***a*, **2***b* and 30 mm. at the top thereof.

The elastic yarn wound on the spool and intended to form the core of the elastic twisted yarn is then twisted on a twisting frame. The spools described above make it possible to obtain a remarkably regular tension during this operation, even if the speed of rotation of the spindles reaches 10,000 r.p.m., and to adjust easily the twist of the core obtained in this way. The regularity of tension on the twisting frame is due mainly to the exceptionally large amount of the cross-over and to the value of the coefficient of friction of the elastic core against the upper cheek of the spool, which latter value is kept very low. The reception of this core is preferably effected on tubes, made of very strong material, for example metal with a setting of the pineapple type. These tubes have a minimum diameter of 50 mm. so as to avoid fatiguing the elastomer.

Twisting the elastic core has the effect of regularizing the mechanical characteristics to the elastomeric yarn. The count of elastomeric yarns, which are available on the market at the present time, is very irregular and varies very much from one point to the other. The mechanical characteristics are shown on FIGURES 6 and 7 representing the elongation/tension curve of an elastomeric yarn, FIGURE 6 relating to a twisted yarn and FIGURE 7 to the same yarn maintained untwisted. Elongation is marked on the x-axis and tension on the y-axis.

The general shape of the two curves is the same. First the elongation increases with the tension which corresponds to the part AB of FIGURE 6 and A'B' of FIGURE 7. Then the elongation decreases suddenly on account of the breakage of the yarn; the abscissa of the point B or B' is equal to the maximum elongation, the ordinate being the breaking tension.

The curves of FIGURES 6 and 7 have been obtained experimentally by testing one elastomeric yarn. The results of the tests are as follows:

grams. This result is not surprising for the twist produces an increase of the count of the yarn together with a decrease of the breaking elongation. Then the divergence between the maximum and the minimum values of the elongation and the breaking tension are reduced, which proves that twisting the elastic yarn regularizes the mechanical characteristics of said elastomeric yarn.

The assembly of the elastic core and the wrappings of inextensible material which are to form the elastic twisted yarn is effected on a special throwing machine equipped with hollow spindles which is illustrated in FIGURE 5.

This throwing machine comprises two stages in which the hollow spindles **4***a* and **4***b*, which are as nearly as possible vertical, are coaxial in pairs and are spaced from one another by a distance which is advantageously greater than 30 cm. Each stage is provided with a driving device **5***a*, **5***b* for the spindles, which devices are independent in speed and in direction of rotation.

The lower stage comprises an unwinding device **6** for the elastic core material **3**, which is supplied wound on tubes and which passes through two spindles **31***a*, **31***b* in succession to receive its wrappings **32***a*, **32***b*. A constant unwinding tension can be obtained by means of an automatic tension regulator **7**. A deeply grooved wheel set just before the first hollow spindle can also be used. For the sake of simplicity, however, it is possible to use for all the spindles, counterweight-type braking or retarding means such as is usually employed in connection with unwinding apparatus, provided that the counterweights **8** which are employed all have accurate and identical calibrations.

The unwinding tension is as close as possible to the breakage tension of the elastic core. It naturally varies as a function of the initial twist previously imparted to the core material and of the local characteristics of the fibres. A maximum working tension is generally adopted, such as will provide a margin sufficient to prevent breakage due to local weaknesses in the core materials but which is

ELASTOMERIC YARN 140 DENIERS, TWIST: 300 TURNS PER METER

[Twist measured on stretched yarn]

	Test number							Arithmetical mean
	1	2	3	4	5	6	7	
Elongation, percent	600	425	500	525	530	500	500	511
Breaking tension (grams)	150	145	130	135	142	145	145	142

ELASTOMERIC YARN 140 DENIERS UNTWISTED

	Test number								Arithmetical mean
	1	2	3	4	5	6	7	8	
Elongation, percent	725	600	775	450	775	675	615	650	660
Breaking tension (grams)	130	150	135	120	150	125	115	135	132

The point B of FIGURE 6 corresponds to an elongation equal to 511%; the divergence between the maximum value and the minimum value is equal to 175%. The point B' of FIGURE 7 corresponds to an average elongation equal to 660%; the divergence between the maximum value and the minimum value is equal to 325%.

The average breaking tension is equal to 142 grams for the twisted yarn (point B), the divergence between the maximum value and the minimum value being equal to 20 grams. The average breaking tension is equal to 132 grams for the untwisted yarn (point B'); the divergence between the maximum value and the minimum value being equal to 35 grams.

Twisting elastic core has then several effects. First the average elongation decreases from 660% to 511% and the average breaking tension increases from 132 grams to 142 nevertheless high enough to be economic, by reason of reduction in the percentage by weight of elastic material in the twisted yarn. The latter is received on metal tubes carried by heavy spindles, so as to obtain a faultless drive.

As set forth previously, when assembling with the covering yarns, the elastic core is unwound with a tension which is practically constant and as close as possible to the breakage tension. FIGURES 11 and 12 show devices giving a practically constant tension to the elastic core.

According to FIGURE 11, the spool, on which the elastic core is wound, is fitted on a shaft **27** which revolves in bearings **28**. The yarn is drawn from this spool and is braked with counterweights **8** hung on wire loops **29** running over the shaft **27**.

According to FIGURE 12, the core is elongated by means of a counterweight **8'** hung on a pulley **30** around which the core runs after leaving the spool **3**.

It will be observed that a gradual increase in the twist of the elastic core involves a corresponding gradual increase in its maximum working tension and in its power of return, at least up to a certain value of the twist which can be brought close to the saturating twist of conventional yarns. At the same time, the extensibility of the said elastic core is reduced by a substantially constant value with respect to the extensibility of the elastomer when free from twist. This value is about equal to 23% for the elastomeric yarn 140 deniers which has been tested.

The covering yarns may be any yarns.

Of course it is possible:

To wind one covering yarn around the elastic core, for example by using the device shown on FIGURE 5 with one stage only;

To wind several parallel covering yarns around the elastic core for example by using the device shown on FIGURE 5 with one stage only, the covering yarns being previously assembled on the same spool;

To wind one covering yarn on each stage around the elastic core, by using the two stages of the device of FIGURE 5;

To wind several covering yarns previously assembled on a spool on each stage of the device of FIGURE 5;

To wind one covering yarn on the first stage around the elastic core and to wind several covering yarns around the obtained composite yarn on the first stage, the covering yarns of the second stage being previously assembled on a same spool, or vice-versa to wind several covering yarns on the first stage and one covering yarn on the second stage.

The composite yarns thus obtained have a characteristic appearance which depends on their tension as may be seen from FIGURE 8 to 10. In FIGURE 8 the yarn is in the relaxed condition and the covering yarns form a large number of loops. In FIGURE 9 the tension applied is moderate and the loops are still apparent. In FIGURE 10 the yarn is ready to be used on a loom, its tension is still higher and the loops are no more apparent.

For an extensibility of the composite covered yarn of at least 80%, the total count of the wrapping should not exceed six times the count of the core in the slack state. A count ratio of 2 appears to be the most advantageous.

The composite covered yarn can be subjected to a thermal shrinkage treatment. This treatment, which is also employed in the conventional technique, is effected using a twisted yarn previously placed on a float or on a bank, as it is done in the case of the usual yarns, and therefore in the slack state or on a deformable bobbin allowing shrinkage.

An autoclave is used from which the oxygen is carefully expelled by means of a vacuum pump with, if necessary, prior injections of steam. The treatment proper is carried out by means of steam, preferably saturated, which is injected in a quantity sufficient to obtain a rapid rise in temperature. The treatment lasts a few minutes, during which the temperature is maintained at a value about ten degrees at the most below the degradation temperature of the elastomeric synthetic fibres, which are generally the most fragile.

Cooling is carried out quickly, the composite yarn being removed from the autoclave at a low temperature, 50° C. for example.

According to a particularity of the invention, the composite covered yarns can be stabilized. For this purpose the covered yarns are maintained in a stretched state on rigid supports and they are submitted to a steam thermal treatment, preferably in an autoclave and in a non-oxidizing medium. This treatment is carried out slowly in the presence of saturated steam and under the following conditions:

Treatment temperatures comprised, for example, between 50 and 115° C.;

Treatment durations comprised, for example, between 5 and 120 minutes;

Cooling durations comprised, for example, between 20 and 60 minutes.

This treatment allows the elasticity of the composite yarn to be lowered, the yarn to be stabilized with suppression of the loops in the relaxed condition, and the wrapping yarns shrinkage ability to be limited when the wrapping yarns are made of a synthetic unshrunk material.

If such shrinking of the elastic twisted yarn in the stretched state, and a second shrinking without tension, are effected in succession, a final extensibility and a final power of return are obtained which depend on the temperature of the treatment in the stretched state.

EXAMPLE I

A composite covered yarn comprising a 70 denier elastomeric core and two covering yarns, each of them being an unshrunk 12 denier—4 filament polyamide 66 yarn, is made. The assembling of the core with the first covering yarn is made by winding said first covering yarn on the core in the S direction at a rate of 1200 turns/meter, and by winding in the Z direction at a rate of 1200 turns/meter for the second covering yarn. The composite covered yarn is treated to 110° C. during 10 minutes and is completely stabilized. Its elastic power is substantially reduced to zero, its weaving or knitting much easier, the final product recovering a certain elasticity when dyed.

EXAMPLE II

A composite covered yarn comprising a 70 denier elastomeric core and an unshrunk 150 denier—46 filament polyamide 66 covering yarn is made. The assembling of the core and the covering yarn is made by winding said covering yarn on the core in the S direction at a rate of 650 turns/meter. The composite covered yarn is subjected to a thermal treatment to 60° C. in a stretched state during 60 minutes, then slowly cooled during 60 minutes. A relatively inert yarn is obtained but the elasticity thereof in the fabric or knitwear is obsolutely not degraded; the shrinkage power of the covering yarn is still strongly high.

In the case where a naturally stable composite covered yarn is desired, the lapping winding presents a preferential value. When the single yarns constituting the composite covered yarn have an identical sense of twist and when the lapping winding is conventionally applied in the opposite sense, the preferential value is about 1700 turns per meter. When the single yarns have opposite sense of twist and when the lapping winding is made in the opposite sense to that of the most heavily twisted single yarn by the hollow-spindle process, this preferential value is about 650 turns per meter.

Of course by using the two stages device of FIGURE 5, the mechanical stability of the composite covered yarn is easily obtained. Also it is obvious that the spindles can be rotated in same or opposite senses, to equal or different speeds, the twist of the core and of the first covering yarn being the same or opposite.

By modifying the twist of at least one of the single yarns constituting the composite covered yarn, the elastic characteristics of said twisted yarn can be controlled. For example augmenting the twist of the elastic yarn alone and reducing the twist of the assembled yarn, at least separately, reduces the stretch of the composite covered yarn and increases its retention strength for a given elongation. Conversely, reducing the twist in the elastic yarn alone and incerasing that of the composite yarn, at least separately, increases the stretch and reduces the retention force of said composite covered yarn for a given elongation.

Of course the carrying into practice of the yarns is made easier when the workrooms are air-conditioned, due allowance to the fact that synthetic elastomeric yarns can be easily stretched on and above 25° C. The temperature of the workrooms is preferably equal to 25° C., and the hygrometrical ratio equal to 65%.

Weaving or knitting of such composite covered yarns is the easier as the yarns are stabilized with the hereinbefore conditions. Of course the fabric or knitting can then be subjected to a thermal treatment in a loose and unfolded condition, the temperature possibly reaching for a few tens of seconds the temperature producing the total shrinkage without damage to the less heat resistant textile fiber. The heating and the cooling are as quick as possible.

For manufacturing a textile product, by weaving or knitting, it is fo course possible to use composite covered yarns which are S- or Z-covered, or to use S- and Z-twisted composite yarns preferably perfectly symmetrical and produced under conditions identical from every standpoint (spindle rotation speeds, tension, adjustment of the overlap controlling devices, spool hardness). Using symmetrical S and Z twisted composite yarns enables the obtainment of uniform woven and knitted fabrics.

A thermal stabilization treatment of the composite covered yarns may be performed, preferably at a measured temperature in degrees centigrade on the celsius scale that is less than 40% of the temperature producing total shrinkage without damage to the most fragile synthetic fiber constituting the yarn and the thermal treatment of the woven or knitted fabric is performed in an autoclave.

Weaving or knitting can be performed in such a way that the tension force is equally distributed between the single yarns which form the composite covered yarn. It will be noted that the braking elongation is practically the same for the elastic core and the covering yarn.

EXAMPLE III

Using a synthetic elastomeric unshrunk multifilament 70 denier yarn a 2200 turns per meter S-twisted crepe yarn is made.

With the same yarn a 2200 turns per meter Z-twisted crepe yarn is made.

These crepe yarns are assembled and lapped with a polyamide yarn according to the following table.

Single yarns	Composite yarns
Lycra core (70 deniers 2,200 t./m. S) Nylon wrapping (70 deniers 650 t./m. Z)	650 t./m. Z.
Lycra core (70 deniers 2,200 t./m. Z) Nylon wrapping (70 deniers 650 t./m. S)	650 t./m. S.

It will be noted that both the elastic core and the inextensible wrapping are twisted before assembling and that the elastic core is more twisted than the covering yarn.

It will be also noted that the assembling twist of said core and said wrapping is of opposite sense to that of said elastic core whereby to form a mechanically stable composite yarn.

With these composite yarns a fabric is obtained, the warp comprising alternately a S-twisted yarn and Z-twisted yarn, the weft being made with wool yarns.

The fabric is heat treated to 118° C. for one minute, such temperature being obtained in 30 seconds.

EXAMPLE IV

A composite covered yarn is made according to the following table.

Single yarns	Composite yarns
Lycra core (70 deniers 650 t./m. Z) Nylon wrapping (70 deniers 2,200 t./m. S)	650 t./m. S.

A taffeta fabric is made; the warp is made with the composite yarn and the weft with polyester-viscose yarns. The fabric is then subjected to the same thermal treatment as in Example III.

EXAMPLE V

A composite covered yarn is made according to the following table

Single yarns	Composite yarns
Lycra core (70 deniers 650 t./m. Z) Nylon wrapping 150 deniers spinning twist	650 t./m. S.

The composite yarn is subjected to a thermal treatment to 60° C. during 60 minutes in a stretched state.

EXAMPLE VI

A composite covered yarn is made according to the following table

Single yarns	Composite yarns
Lycra core (650 t./m. Z, 70 deniers) First wrapping: Nylon 12 deniers spinning twist	1,200 t./m. S.
Second wrapping: Nylon 12 deniers spinning twist	1,200 t./m. Z.

The composite covered yarn is heat shrunk in a free state to 115° C. during 2 minutes.

EXAMPLE VII

A composite covered yarn is made according to the following table

Single yarns	Composite yarns
Lycra core (70 deniers 650 t./m. Z) First wrapping: Nylon 12 deniers spinning twist	1,200 t./m. Z.
Second wrapping: Nylon 12 deniers spinning twist	1,200 t./m. S.

The composite yarn is subjected to a thermal treatment up to 110° C. during 10 minutes in a stretched state. It is then subjected to another thermal treatment up to 115° C. during 2 minutes, in a free state.

Yarns which are not particularly elastic may be incorporated into the woven or knitted fabric.

The composite covered yarns according to the present invention may be utilized for knitting or weaving indifferently symmetrically, or not, and provide a wide variety of weave patterns. They may be alternated mutually or with conventional yarns.

In addition to the appearance peculiar to them, referred to precedingly, the woven or knitted fabrics obtained thus have adjustable degrees of elasticity. Obviously, if elasticity alone is sought without a crepe effect, the composite yarns specified in Example V will be most suitable. Such elasticity may correspond with a more or less large percentage of elasticity yarns used only in the weft or the warp of the textile product, possibly in alternation with different yarns. It could also correspond with more or less large percentages of elastic yarns utilized in both the weft and the warp of the textile, the percentages possibly differing in weft and warp.

The examples given in the following table have been chosen to illustrate the results which are obtained by using two covering yarns.

The primary twist is the initial twist of the wrapping yarn, and the spinning twist is the twist of the yarn obtained on a spinning frame at the output of a spinneret. This twist is very low (less than 20 turns/meter).

TABLE

Elastomer			Wrapping			Extensibility Tests		
Example	Count in denier	Twist	Nature and count in denier	Lapping winding	Primary twist	On leaving frame, percent	After 10 mins. at 85° C., percent	After 10 mins. at 110° C., percent
a	70	650 S	Polyamide, 2 x 150	650 Z	Spinning twist	30		130
			do	650 S	do			
b	70	650 S	Polyamide, 2 x 150	980 Z	do	20	15	
			do	980 S	do	20		90
			do		do	20	15	20
c	70	650 S	Polyamide, 2 x 20	980 Z	do	160	70	
			do	980 S	do	160		240
			do		do	160	70	165
d	70	650 S	Textured polyamide,[1] 2 x 63	350 Z	300 S	180		260
			do	305 S	300 Z			
e	70	650 S	Textured polyamides,[1] 2 x 63	680 Z	300 S	80	55	−6
			do.[1]	680 S	300 Z	80		160
			do			80	55	90
f	140	500 S	So-called "false twist textured" polyhexamethylene adipamide, 2 x 30.	650 Z	Spinning twist	240		260
			do	650 S	do			
g	140	500 S	Conventional textured 11-aminoundecanoic acid diamine, 2 x 63.	650 Z	Spinning twist	240		300
			do	650 S	do			
h	140	500 S	Conventional textured [1] polyhexamethylene adipamide, 1 x 63.	650 Z	do	240		290
			Conventional textured [1] polyhexamethylene adipamide, 1 x 45.	650 S	do			
i	70	650 S	Raw polyhexamethylene adipamide, 1 x 20, 7 filaments	650 Z	do	160		240
			Raw polyhexamethylene adipamide, 1 x 40, 13 filaments	650 S	do			
j	70	650 S	Polyamide, 1 x 150	650 Z	do			
		(650 Z)	do	(650 S)	do	60		160
k	70	650 S	Cotton, 2 x Nm 60	580 Z	1,100 S	70	40	
			do	580 S	1,100 Z	70		180
			do			70	40	110
l	70	650 S	Acrylic, 2 x Nm 60	700 Z	120 S	70	30	
			do	700 S	120 Z	70		200
						70	30	140
m	140	200 S	Wool, 2 x Nm 50	350 Z	1,000 S	120		260
			do	350 S	1,000 Z			
n	140	500 S	Raw polyhexamethylene adipamide, 1 x 70, 34 filaments	650 Z	Spinning twist	120		270
			Raw polyhexamethylene adipamide, 1 x Nm, 50 wool	650 S	970 Z			

[1] Multifilament, twisted, fixed by heat and untwisted in succession.

The table calls for the following further remarks and permits the following facts to be established:

In all the examples, the elastic core is a continuous multi-filament yarn of polyurethane base and having an S-twist, it being understood that the core can also be Z-twisted.

In Example *a*, the tension of the core during assembly is 35 grams, the lower spindle rotating at 7900 r.p.m. in the opposite direction to the core and the upper spindle rotating at 6500 r.p.m. in the same direction as the core. The shrinking treatment is effected on floats 1.40 metres in circumference by means of saturated steam.

The elasticity obtained after shrinking of the constituents of the elastic twisted yarn is quite remarkable, the weight of the elastic core amounting to only 4.5% of the total weight of the twisted yarn, which may be compared from the point of view of elasticity to a conventional textured 2/63 "mousse" synthetic polyamide yarn (the elasticity of which yarn arises from the fact that the multiple fibres from which it is formed, which may be regarded, for practical purposes, as inextensible, are twisted, fixed by heat and then untwisted in succession). The elastic yarn of the invention has a cost lower than that of the textured yarn, in spite of the twisting of the core prior to assembly.

A comparison of Examples *a* and *b* or *d* and *e* shows the influence of the lapping winding on the extensibility of the twisted yarn.

A comparison of Examples *b* and *c* shows the effect on the extensibility of the twisted yarn, of the count of the wrapping (which is advantageously limited, as has been stated above).

Examples *d* to *h* relate to yarns having wrappings which have been subjected to a texturing treatment, giving them artificially a limited extensibility. This treatment can be carried out in a plurality of operations, or on an improved machine, in which case one speaks of "false twist." The high value of the extensibility finally obtained will be observed from the table.

Two wrappings used together may have different counts, as illustrated by Examples *h* and *i*.

Example *j* relates to a yarn having one covering yarn, to which the shrinking treatment of the elastomeric yarn, which forms an important stage in the method of the invention, may also be applied.

Examples *k* to *n* relate to various natural and synthetic discontinuous wrappings. The yarn of Example *n* is shrunk under tension, which gives it a close appearance.

It will be understood that the invention is not limited to the embodiments which have been particularly described, but that it covers also modifications thereof which can be obtained, by the use of equivalent technical means.

What is claimed is:

1. A method of manufacturing elastic textile fabrics, comprising the successive steps of twisting a yarn made of a synthetic shrinkable elastic material, twisting a yarn of inextensible material a lesser degree than that of said elastic yarn, covering said elastic yarn while stretching it close to breakage with said inextensible yarn, said inextensible yarn being lapped around said elastic yarn in a direction opposite to the direction in which said elastic yarn is twisted to form a first composite covered yarn, preparing a second composite covered yarn in a similar way from a yarn made of a synthetic shrinkable elastic material and a yarn of inextensible material, said yarn of elastic material of said second composite covered yarn being twisted in a direction opposite to the direction in which the elastic yarn in said first composite covered yarn is twisted, manufacturing textile fabrics comprising said first and second composite covered yarns in an alternate manner, heating said textile fabrics in an unstretched state with steam to the temperature of total shrinkage of the synthetic shrinkable elastic materials for a period of at most a few minutes and in a non-oxidizing atmosphere, and rapidly cooling said textile fabrics.

2. The method as claimed in claim **1**, wherein said elastic and said inextensible yarns jointly constituting a composite covered yarn are twisted in the same direction, and wherein the lapping winding is about 1700 turns/meter.

3. The method as claimed in claim **1**, wherein said elastic and said inextensible yarns jointly constituting a composite covered yarn are twisted in opposite directions, and wherein the lapping winding is about 650 turns/meter.

4. The method as claimed in claim **1**, wherein said textile fabrics are manufactured on a loom while imparting to each composite covered yarn a tension which is equally distributed between its respectively elastic and inextensible constituent yarns.

5. The method as claimed in claim **1**, wherein said synthetic elastic yarn is free from any shrinkage prior to the beginning of the present method.

6. The method as claimed in claim **1**, further comprising the step of thermally treating said composite covered yarns in a stretched state with steam at a temperature less than 40% of the temperature which is applied during the subsequent step of heating said textile fabrics, as measured in degrees Centigrade on the celsius scale.

7. A method of manufacturing elastic textile fabrics, comprising the successive steps of twisting a yarn made of a synthetic shrinkable elastic material, twisting a yarn of inextensible material a lesser degree than that of said elastic yarn, covering said elastic yarn while stretching it close to breakage with said inextensible yarn, said inextensible yarn being lapped around said elastic yarn in a direction opposite to the direction in which said elastic yarn is twisted to form a composite covered yarn, manufacturing textile fabrics comprising said composite covered yarn, rapidly heating said textile fabrics in an unstretched condition with steam to the temperature of total shrinkage of the synthetic shrinkable elastic material for at most a few minutes and in a non-oxidizing atmosphere, and rapidly cooling said textile fabrics.

8. The method as claimed in claim **7**, wherein said elastic and said inextensible yarns jointly constituting the composite covered yarn are twisted in the same direction.

9. The method as claimed in claim **7**, wherein said synthetic elastic yarn is free from any shrinkage prior to the beginning of the present method.

10. The method of manufacturing an elastic composite yarn comprising the successive steps of twisting a yarn made of a synthetic shrinkable elastic material, covering said elastic yarn while stretching it close to breakage, with at least one covering yarn of an inextensible material to form a composite covered yarn, rapidly heating said composite covered yarn, in an unstretched condition with steam to the temperature of total shrinkage of the synthetic shrinkable elastic material for at most a few minutes and in a non-oxidizing atmosphere, and rapidly cooling said composite covered yarn.

11. The method as claimed in claim **10**, which further comprises, before the above-mentioned heating step, the step of thermally treating the composite covered yarn in a stretched state with steam at a temperature less than 40% of the temperature which is applied during the subsequent heating step, as measured in degrees Centigrade on the celsius scale.

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