

Description

Two-component loop sewing yarn and manufacture thereof

5 The present invention relates to a two-component loop sewing yarn for modern industrial sewing machines of high tenacity combined with low shrinkage, and to a process for manufacturing same.

10 A similar loop sewing yarn is known for example from EP-A-57,580. By the process described therein, a plurality of yarns having different shrinkages are plied by air jet texturing at different rates of overfeed to produce a loop yarn. The loop yarn is then allowed to shrink in a subsequent setting process which tightens up the loops of filament into bud-like projections. In an
15 improved form of this known process described in EP-A-123,479, the yarns are additionally twisted between loop formation and setting at about 100 to 300 turns per meter.

20 A disadvantage of these known processes lies in the fact that the ultimate tenacity of the ready-produced loop yarn is lower than would be expected from the tenacity of the feed yarns. The ultimate tenacity of these known sewing yarns is only between 25 and 40 cN/tex, the
25 ultimate tenacity here being defined as the ratio of the ultimate tensile strength and the ultimate linear density at break. Moreover, the filaments of these known yarns may shrink to widely differing extents, depending on the degree of binding. These differences then show up in
30 variable dyeability along a filament and are particularly marked from filament to filament if yarns having different shrinkage properties have been used.

There are also single-component loop sewing yarns whose ultimate tenacity is between 40 and 50 cN/tex. However, these yarns have inadequate sewing properties owing to



their small number of loops. They have been twisted like conventional sewing yarns to about 600 to 800 turns per meter, and the elongation at break is relatively high at over 18%.

5 The present invention provides a two-component loop sewing yarn which does not exhibit the above-described prior art disadvantages.

10 [The high-tenacity, low-shrinkage two-component loop sewing yarn according to the invention is formed from core and effect filaments made of synthetic polymers such as, for example, polyamides, polyacrylonitrile and polypropylene but preferably polyesters and in particular polyethylene terephthalate, and has an ultimate tenacity, i.e. an ultimate tensile strength per ultimate linear density at break, of above 40 cN/tex, preferably 48 to 60 cN/tex, a thermoshrinkage at 180°C of below 8%, preferably below 5%, and an ultimate tensile strength elongation of below 18%, preferably below 15%.

20 The ultimate tenacity is the ratio of the ultimate tensile strength to the ultimate linear density at break; the ultimate tensile strength elongation is elongation under the action of the ultimate tensile strength.]

25 The total count of the two-component loop sewing yarn according to the invention is in general 200 to 900 dtex. Higher and lower counts may likewise be manufactured, if they are of interest in a particular case, but are not the general rule. As mentioned above, the two-component loop sewing yarn according to the invention is composed of core filaments and effect filaments. Core filaments are on average much more oriented in the direction of the fiber axis than effect filaments, which are intermingled with and wrapped round the core filaments but in addition, owing to their greater length, form loops which stick out from the fiber assembly and hence are a significant factor in determining the textile properties and

30

35



performance characteristics of the yarn according to the invention. The total linear densities of the core and effect filaments making up the loop sewing yarn according to the invention are in a ratio of 95 : 5 to 70 : 30, preferably 90 : 10 to 80 : 20. }

5

Core filaments and effect filaments differ in linear density. The core filament linear density is 8 to 1.2, preferably 5 to 1.5, dtex, and the effect filament is 4.5 to 1, preferably 3 to 1.4, dtex. Within these linear density limits, the filament linear density of the core filaments is 1.2 to 6 times, in particular 1.5 to 3 times, the linear density of the effect filaments.

10

15 In principle, the two-component loop sewing yarns according to the invention can be produced from the abovementioned synthetic spinnable polymers and polycondensation products such as polyamide, polyacrylonitrile, polypropylene and polyester, but it is particularly advantageous to use polyester. Suitable polyesters are in particular those which are obtained essentially from aromatic dicarboxylic acids, for example phthalic acid or isophthalic acid, 1,4-, 1,5- and 2,6-naphthalenedicarboxylic acid, hydroxycarboxylic acids, for example para-(2-hydroxyethyl)benzoic acid, and aliphatic diols of 2 to 6, preferably 2 to 4, carbon atoms, for example ethylene glycol, 1,3-propanediol or 1,4-butanediol, by cocondensation. These polyester raw materials can also be modified by incorporation as cocondensed units of minor amounts of aliphatic dicarboxylic acids, for example glutaric acid, adipic acid or sebacic acid, or of polyglycols such as diethylene glycol (2,2-dihydroxydiethyl ether) or triethylene glycol (1,2-di(2-hydroxyethoxy)ethane), or else of minor amounts of higher molecular polyethylene glycols. A further possible modification, which affects in particular the dyeing properties of the two-component loop sewing yarns according to the invention, is modification by means of

20

25

30

35



sulfo-containing units, for example by the incorporation of sulfoisophthalic acid.

5 The upper limit of the ultimate tenacity of the loop sewing yarns according to the invention depends on the degree of condensation of the polymer material, in particular the polyester material, used. The degree of condensation of the polyester is evident in its viscosity. A high degree of condensation, i.e. a high viscosity, leads to particularly high ultimate tenacities of
10 the yarns according to the invention. Preference is therefore given to the manufacture of loop sewing yarns according to the invention from high molecular weight polyesters having an intrinsic viscosity (IV) of above 0.65 dl/g, in particular above 0.75 dl/g, measured in
15 solutions in dichloroacetic acid (DCA) at 25°C.]

A preferred polyester material for manufacturing the loop yarns according to the invention is polyethylene terephthalate.

20 The two-component (core/effect) filament loop sewing yarn according to the invention is manufactured by air jet texturing two feed yarn strands which have different total and filament linear densities and are supplied at different rates of overfeed but which both consist of high-tenacity, low-shrinkage and low-stretch filaments.

25 For the purposes of the present invention, high-tenacity, low-shrinkage and low-stretch filaments have an ultimate tensile strength per ultimate linear density of not less than 65 cN/tex, in general 65 to 90 cN/tex, preferably 70 to 80 cN/tex, an ultimate tensile strength elongation of
30 not less than 8%, in general 8 to 15%, preferably 8.5 to 12%, and a thermoshrinkage at 180°C of not more than 9%, in general 5 to 9%, preferably 6 to 8%.

35 In the air jet texturing of yarns, as will be known, the filament material is fed into the jet of compressed air at a higher rate than the rate with which it is drawn off



by the take-off rolls. The percentage by which the rate of feed is higher than the rate of take-off, based on the take-off speed, is referred to as the overfeed. In the process according to the invention, then, the two yarn strands to be mixed, which in the ready-produced yarn will then constitute the core or effect filaments, are supplied to the texturing jet at different rates of overfeed. The feed yarn strand which will ultimately form the core filaments of the yarn according to the invention is overfed into the air jet at an overfeed of 3 to 10%, while the feed yarn strand which will ultimately form the effect filaments of the yarn according to the invention is overfed at an overfeed of 10 to 60%. Owing to these different rates of overfeed, longer lengths of the effect filaments are tangled in the texturing jet with shorter lengths of the core filaments, the result being that the effect filaments in the ready-produced yarn according to the invention form substantially more pronounced curls and loops than the core filaments, which extend essentially in the direction of the fiber axis.

The total linear densities of the feed yarn strands forming the core filaments and the effect filaments are selected in such a way that they form a ratio of 95 : 5 to 70 : 30, preferably 90 : 10 to 80 : 20, and that, after entanglement, their blend has a linear density of 200 to 900 dtex.

It has to be noted here that the total linear density LD_{tot} of the intermingled yarn is not simply the sum of the linear densities of the feed yarns but that it is necessary here to take into account the overfeed of the two feed yarns. The total linear density LD_{tot} is accordingly given by the following formula:

$$LD_{tot} = LD_c \times \left(1 + \frac{OF_c}{100}\right) + LD_e \times \left(1 + \frac{OF_e}{100}\right)$$

where LD_c and OF_c are the linear density and overfeed of the core feed yarn and LD_e and OF_e are the linear density



and overfeed of the effect feed yarn.

5 The linear density of the filaments of the core feed yarn
is 8 to 1.2, preferably 5 to 1.5, dtex, and the linear
density of the filaments of the effect feed yarn is 4.5
to 1, preferably 3 to 1.4, dtex. Within the range of
these values, the filament linear densities of the feed
yarns are chosen in such a way that the linear density of
the core filaments is from 1.2 to 6 times, preferably
from 1.5 to 3.5 times, the linear density of the effect
10 filaments.

15 The feed yarns for manufacturing the two-component loop
sewing yarn according to the invention can be the high-
tenacity and low-shrinkage yarns described for example in
DE-B-1,288,734 and EP-A-173,200. Preferably, however, the
feed yarns required for the process according to the
invention are manufactured in an integrated step which
immediately precedes the air texturing step and in which
the feed yarns are obtained by drawing partially oriented
yarn material and an immediately subsequent, essentially
20 shrinkage-free heat treatment. Essentially shrinkage-free
is supposed to convey that, during the heat treatment,
the yarns are preferably kept at a constant length but
that a shrinkage of up to 4%, preferably not above 2%,
can be allowed. In this preferred embodiment of the
25 process according to the invention, therefore, two
partially oriented yarns having different total and
filament linear densities are drawn on separate drawing
systems, subjected to an essentially shrinkage-free heat
treatment and immediately thereafter fed into a texturing
30 jet of compressed air. The partially oriented yarns are
drawn at a temperature of 70 to 100°C, preferably over
heated godet rolls, under a drawing tension within the
range from 10 to 25 cN/tex, preferably from 12 to
17 cN/tex (each figure being based on the drawn linear
35 density). After drawing, the immediately following,
essentially shrinkage-free heat treatment of the yarns is
carried out at a yarn tension between 2 and 20 cN/tex,

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

preferably at 4 to 17 cN/tex, and at a temperature within the range from 180 to 250°C, preferably from 225 to 235°C. This heat treatment may in principle be carried out in any known manner, but it is advantageous to effect the heat treatment directly on a heated take-off godet.

Preferably, in the practice of the process according to the invention, the drawing conditions for the two partially oriented yarns are ideally kept the same. However, differences in the drawing conditions of up to $\pm 10\%$ can be tolerated.

If desired, the loop yarn emerging from the air-texturing jet may additionally be subjected to a setting process. This setting process can likewise be carried out in a conventional manner, but it is advantageous to subject the yarn at a constant length to a hot air treatment at temperatures of 200 to 320°C, preferably 240 to 300°C.

The two-component loop sewing yarn thus obtained surprisingly has a number of advantages over existing sewing yarns:

The loops in the individual filaments remain fully intact and, owing to the entrained air, give good sewing properties even at high sewing speeds. This advantage is particularly evident from the high values for the sewing length to break, determined by the method known from DE-A-3,431,832. The uniformly drawn filaments show uniform dyeability and hence a level appearance of the seam. The tenacity of the yarns thus manufactured is significantly higher than that of sewing yarns composed of filaments having different shrinkage properties.

The use of such feed yarns, moreover, simplifies the manufacturing process. If high-shrinkage feed yarns are used, it is first of all necessary for example to produce many more loops than are to be found in the ready-produced sewing yarn, since the process of shrinkage



reduces the number of loops. The two-component loop sewing yarn according to the invention need not be twisted during manufacture. It therefore is in the untwisted state and can also be used in the untwisted state as a sewing yarn. Usually, however, for example for better appearance, a relatively low twist of about 100 to 300 turns per meter is applied to it in the course of further processing.

Example:

L
10 An apparatus for manufacturing the two-component loop sewing yarn according to the invention can be constructed for example from the following elements: a package creel for the packages of core and effect feed yarn, two parallel drawing systems comprising heatable inlet and outlet godet rolls, a texturing jet incorporating separate feed rollers for the precise adjustment of the overfeed of the feed yarn strands, take-off rollers for precisely adjusting the take-off of the textured yarn, optionally a customary hot air setting means, and a wind-up package.

20 The package creel is equipped with a package of 380-dtex 40-filament (filament denier: 9.5 dtex) core feed yarn and a package of 83-dtex 24-filament (filament denier: 3.5 dtex) effect feed yarn. Both feed yarns are composed of polyethylene terephthalate of IV 0.68 dl/g, measured in DCA at 25°C.

30 The two feed yarns are fed to their separate drawing systems, where they are drawn in a ratio of 1 : 2 at an inlet godet roll temperature of 90°C. The drawing tension here was 15 cN/tex for the core feed yarn and 14 cN/tex for the effect feed yarn. The drawn yarns were guided in 10 coils round the hot outlet godet rolls of the drawing systems at 230°C. The yarn speed for the two drawing systems was separately adjusted in such a way that the inlet speed into the texturing jet was 315 m/min for the



5 core feed yarn and 420 m/min for the effect feed yarn. The air textured yarn was taken off downstream of the texturing jet at 300 m/min. The result was an overfeed of 5% (or 1.05) for the core yarn and 40% (or 1.40) for the effect yarn.

After emerging from the texturing jet, the loop yarn was set at 240°C by passing it through a hot air oven 160 cm in length.

10 The raw yarn thus obtained was wound up. It has a count designation of 243 dtex/64 filament, an ultimate tenacity of 50.7 cN/tex, an ultimate tensile strength elongation of 9.8% and a heat shrinkage at 180°C at 3.1%.

15 After dyeing, it had the following parameters: count designation 255 dtex/64 filament, ultimate tenacity 48 cN/tex, ultimate tensile strength elongation 13.2% and heat shrinkage at 180°C: 0.7%.

In a sewing test, its average sewing length is more than 4,000 stitches in forward sewing and more than 2,000 stitches in backward sewing.

20 The same method can be used to manufacture the yarns according to the invention specified in the following table:



This Sheet Has Been Replaced



Count designation of POY feed yarn			Take-off speed downstream of texturing jet (m/min)	Intrinsic viscosity of PET	Draw ratio		Overfeed		Setting temperature	Raw yarn data				Data of dyed yarn				Sewing test: average sewing length (stitches)
LD _C	LD _E				Core Yarn	Effect yarn	Core yarn	Effect yarn		Count designation	Ultimate tenacity	Ultimate tensile strength elongation	180°C shrinkage	Count	Ultimate tenacity	Ultimate tensile strength elongation	180°C shrinkage	
380 dtex 1 40	83 "	1 24	300	0,68	2,1	2,1	1,05	1,40	256°	247164	52,9	13,1	2,9	267	47,7	15	0,5	>4000 >2000
380 " 1 40	83 "	1 24	300	0,68	2,1	2,1	1,05	1,40	250°	244164	48,5	10,1	3,5	253	50,7	14,2	0,7	" "
380 " 1 40	83 "	1 24	300	0,68	2,1	2,1	1,05	1,40	240°	243164	51,3	11,5	3,6	252	50,8	13,8	0,6	" "
380 " 1 40	83 "	1 24	600	0,68	2,1	2,1	1,05	1,40	283°	244164	54,4	12,6	4,2	253	54,4	15,9	0,9	" "
380 " 1 40	83 "	1 24	900	0,68	2,1	2,1	1,05	1,20	301°	238164	56,5	12,2	4,3	257	51,5	13,9	1,2	" "
760 " 1 80	83 "	1 24	300	0,68	2,1	2,1	1,05	1,40	258°	4331104	56,5	12,0	4,2	455	52,6	13,8	0,5	" "
950 " 1 100	166 "	1 48	300	0,68	2,1	2,1	1,05	1,40	290°	6511148	49,5	12,4	4,4	679	47,0	14,0	0,7	" "
426 " 1 96	84 "	1 24	300	0,80	2,103	2,103	1,05	1,40	255°	2561120	56	9,7		269	56,8	14,0	1,1	" "
488 " 1 64	84 "	1 24	300	0,80	2,103	2,103	1,08	1,50	240°	304188	50	12,4		320	52,5	16,7	1,0	" "

THIS SHEET HAS BEEN REPLACED

Claims

1. A two-component loop sewing yarn composed of core and effect filaments of high tenacity and low shrinkage and made of synthetic polymers, having an ultimate tenacity of above 40 cN/tex, a thermo-shrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%.
2. A two-component loop sewing yarn as claimed in claim 1, having a total count of 200 to 900 dtex.
3. A two-component loop sewing yarn as claimed in either of claims 1 and 2, wherein the total linear densities of the core filaments and effect filaments are in a ratio of 95 : 5 to 70 : 30.
4. A two-component loop sewing yarn as claimed in at least one of claims 1 to 3, wherein the linear density of the core filament is 8 to 1.2 dtex and the linear density of the effect filament is 4.5 to 1 dtex, the linear density of the core filaments being 1.2 to 6 times the linear density of the effect filaments.
5. [A two-component loop sewing yarn as claimed in at least one of claims 1 to 4, wherein core and effect filaments are composed of a polyester.]
6. A two-component loop sewing yarn as claimed in claim 5, wherein the polyester has an IV of greater than 0.65 dl/g. }
7. A two-component loop sewing yarn as claimed in either of claims 5 and 6, wherein the polyester is polyethylene terephthalate.
8. A process for manufacturing a two-component loop sewing yarn as claimed in claim 1, composed of core

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

and effect filaments, by air jet texturing two feed yarn strands supplied to the texturing jet at different speeds, which comprises using feed yarn strands which have different total and filament linear densities but which both consist of high-tenacity, low-shrinkage and low-stretch filaments. }

9. The process as claimed in claim 8, wherein the core filaments are fed into the texturing jet at an overfeed of 3 to 10% and the effect filaments are fed into the texturing jet at an overfeed of 10 to 60%.
10. The process as claimed in either of claims 8 and 9, wherein the total linear densities of core and effect yarn strands are in the ratio of 95 : 5 to 70 : 30 and are chosen in such a way that, if the overfeed is taken into account, the total is 200 to 900 dtex.
11. The process as claimed in at least one of claims 8 to 10, wherein the linear density of the core filaments fed into the texturing jet is 8 to 1.2 dtex and the linear density of the effect filaments fed into the texturing jet is 4.5 to 1 dtex, the linear density of the core filament being 1.2 to 6 times the linear density of the effect filament.
12. The process as claimed in at least one of claims 8 to 11, wherein the high-tenacity, low-shrinkage and low-stretch filaments of the feed yarn strands are obtained by the drawing of a partially oriented yarn material and an immediately adjoining, essentially shrinkage-free heat treatment.
13. The process as claimed in at least one of claims 8 to 12, wherein the drawing conditions for core and effect filaments are essentially the same.

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

14. The process as claimed in at least one of claims 8 to 13, wherein the drawing is carried out at 70 to 100°C under a drawing tension of 10 to 25 cN/tex, based on the drawn linear density.
15. The process as claimed in at least one of claims 8 to 14, wherein the essentially shrinkage-free heat treatment carried out immediately after the drawing is carried out at a yarn tension of 2 to 20 cN/tex and at a temperature of 180 to 250°C.
16. The process as claimed in at least one of claims 8 to 15, wherein the yarn emerging from the texturing jet is set in a conventional manner at a temperature of 200 to 320°C.

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

Abstract

Two-component loop sewing yarn and manufacture thereof

Two-component loop sewing yarn composed of core and effect filaments of high tenacity and low shrinkage made of synthetic polymers, having an ultimate tenacity of above 40 cN/tex, a thermoshrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%, has a total count of 200 to 900 dtex, its core filaments and effect filaments being in a weight ratio of 95 : 5 to 70 : 30 with the linear density of the core filaments being 8 to 1.2 dtex and that of the effect filaments being 4.5 to 1 dtex.

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

Replacement
Stamp Date

9608527-1
EXTRA COPY

-1-

TWO-COMPONENT LOOP SEWING YARN AND MANUFACTURE THEREOF

Description

The present invention relates to a two-component loop sewing yarn for modern industrial sewing machines of high tenacity combined with low shrinkage, and to a process for manufacturing same.

A similar loop sewing yarn is known for example from EP-A-57 583. By the process described therein, a plurality of yarns having different shrinkages are plied by air jet texturing at different rates of overfeed to produce a loop yarn. The loop yarn is then allowed to shrink in a subsequent setting process which tightens up the loops of filament into bud-like projections. In an improved form of this known process described in EP-A-123 479, the yarns are additionally twisted between loop formation and setting at about 100 to 300 turns per meter.

A disadvantage of these known processes lies in the fact that the ultimate tenacity of the ready-produced loop yarn is lower than would be expected from the tenacity of the feed yarns. The ultimate tenacity of these known sewing yarns is only between 25 and 40 cN/tex, the ultimate tenacity here being defined as the ratio of the ultimate tensile strength and the ultimate linear density at break. Moreover, the filaments of these known yarns may shrink to widely differing extents, depending on the degree of binding. These differences then show up in variable dyeability along a filament and are particularly marked from filament to filament if yarns having different shrinkage properties have been used.

There are also single-component loop sewing yarns whose ultimate tenacity is between 40 and 50 cN/tex. However, these yarns have inadequate sewing properties owing to their small number of loops. They have been twisted like

REPLACEMENT SHEET

02 AUG 1997

conventional sewing yarns to about 600 to 800 turns per meter, and the elongation at break is relatively high at over 18%.

5 The present invention provides a two-component loop sewing yarn which does not exhibit the above-described prior art disadvantages.

10 The earlier but as yet unpublished applications EP-A-295 601 and EP-A-367 938 describe two-component loop sewing yarns. Concrete embodiments of these sewing yarns with ultimate tensile strength elongations of below 18% are not discernible from these publications. According to EP-A-295,601 the yarns are produced by jet entangling from a feed yarn which immediately prior to entangling is drawn using an unheated pin. According to EP-A-367,938,
15 the starting material used is at least one feed yarn made of a yarn material having a tenacity of from 60 to about 75 cN/tex, which is passed directly into the pretangling step without prior drawing.

20 The high-tenacity, low-shrinkage two-component loop sewing yarn of low ultimate tensile strength elongation according to the invention is formed from core and effect filaments made of synthetic polyers such as, for example, polyamides, polyacrylonitrile and polypropylene but preferably polyesters and in particular polyethylene
25 terephthalate, and has an ultimate tenacity, i.e. an ultimate tensile strength per ultimate linear density at break, of above 40 cN/tex, preferably 48 to 60 cN/tex, a thermoshrinkage at 180°C of below 8%, preferably below 5%, and an ultimate tensile strength elongation of below
30 18%, preferably below 15%.

The ultimate tenacity is the ratio of the ultimate tensile strength to the ultimate linear density at break; the ultimate tensile strength elongation is elongation under the action of the ultimate tensile strength.

REPLACEMENT SHEET

02 AUG 1997

The total linear density of the two-component loop sewing yarn according to the invention is in general 200 to 900 dtex. Higher and lower linear densities may likewise be manufactured, if they are of interest in a particular case, but are not the general rule. As mentioned above, the two-component loop sewing yarn according to the invention is composed of core filaments and effect filaments. Core filaments are on average much more oriented in the direction of the fiber axis than effect filaments, which are intermingled with and wrapped round the core filaments but in addition, owing to their greater length, form loops which stick out from the fiber assembly and hence are a significant factor in determining the textile properties and performance characteristics of the yarn according to the invention. The total linear densities of the core and effect filaments making up the loop sewing yarn according to the invention are in a ratio of 95 : 5 to 70 : 30, preferably 90 : 10 to 80 : 20.

Core filaments and effect filaments differ in linear density. The core filament linear density is 8 to 1.2, preferably 5 to 1.5, dtex, and the effect filament linear density is 4.5 to 1, preferably 3 to 1.4, dtex. Within these linear density limits, the filament linear density of the core filaments is 1.2 to 6 times, in particular 1.5 to 3.5 times, the linear density of the effect filaments.

In principle, the two-component loop sewing yarns according to the invention can be produced from the above-mentioned synthetic spinnable polymers and polycondensation products such as polyamides, polyacrylonitrile, polypropylene and polyesters, but it is particularly advantageous to use polyesters. Suitable polyesters are in particular those which are obtained essentially from aromatic dicarboxylic acids, for example (terephthalic acid or isophthalic acid, 1,4-, 1,5- and 2,6-naphthalenedicarboxylic acid, hydroxycarboxylic

REPLACEMENT SHEET

02 AUG 1997

acids, for example para-(2-hydroxyethyl)benzoic acid, and aliphatic diols of 2 to 6, preferably 2 to 4, carbon atoms, for example ethylene glycol, 1,3-propanediol or 1,4-butanediol, by cocondensation. These polyester raw materials can also be modified by incorporation as cocondensed units of minor amounts of aliphatic dicarboxylic acids, for example glutaric acid, adipic acid or sebacic acid, or of polyglycols such as diethylene glycol (2,2-dihydroxydiethyl ether) or triethylene glycol (1,2-di(2-hydroxyethoxy)ethane), or else of minor amounts of higher molecular polyethylene glycols. A further possible modification, which affects in particular the dyeing properties of the two-component loop sewing yarns according to the invention, is modification by means of sulfo-containing units, for example by the incorporation of sulfoisophthalic acid.

The upper limit of the ultimate tenacity of the loop sewing yarns according to the invention depends on the degree of condensation of the polymer material, in particular the polyester material, used. The degree of condensation of the polyester is evident in its viscosity. A high degree of condensation, i.e. a high viscosity, leads to particularly high ultimate tenacities of the yarns manufactured according to the invention. Preference is therefore given to the manufacture according to the invention of the loop sewing yarns from high molecular weight polyesters having an intrinsic viscosity (IV) of above 0.65 dl/g, in particular above 0.75 dl/g, measured in solutions in dichloroacetic acid (DCA) at 25°C. Loop sewing yarns which have the above-defined property profile and are based on polyesters having IV values above 0.65 dl/g form part of the subject matter of EP-B 363 798 and are excluded from the subject matter of the present application.

A preferred polyester material for manufacturing the loop yarns according to the invention is polyethylene terephthalate.

REPLACEMENT SHEET

02 AUG 1997

The two-component (core/effect) filament loop sewing yarn is manufactured according to the invention by air jet texturing two feed yarn strands which have different total and filament linear densities and are supplied at
5 different rates of overfeed but which both consist of high-tenacity, low-shrinkage and low-stretch filaments.

For the purposes of the present invention, high-tenacity, low-shrinkage and low-stretch filaments have an ultimate tensile strength per ultimate linear density of not less
10 than 65 cN/tex, in general 65 to 90 cN/tex, preferably 70 to 84 cN/tex, an ultimate tensile strength elongation of not less than 8%, in general 8 to 15%, preferably 8.5 to 12%, and a thermoshrinkage at 180°C of not more than 9%, in general 5 to 9%, preferably 6 to 8%.

15 In the air jet texturing of yarns, as will be known, the filament material is fed into the jet of compressed air at a higher rate than the rate with which it is drawn off by the take-off rolls. The percentage by which the rate of feed is higher than the rate of take-off, based on the
20 take-off speed, is referred to as the overfeed. In the process according to the invention, then, the two yarn strands to be mixed, which in the ready-produced yarn will then constitute the core or effect filaments, are supplied to the texturing jet at different rates of
25 overfeed. The feed yarn strand which will ultimately form the core filaments of the yarn according to the invention is fed into the air jet at an overfeed of 3 to 10%, while the feed yarn strand which will ultimately form the effect filaments of the yarn according to the invention
30 is fed at an overfeed of 10 to 60%. Owing to these different rates of overfeed, longer lengths of the effect filaments are tangled in the texturing jet with shorter lengths of the core filaments, the result being that the effect filaments in the ready-produced yarn according to
35 the invention form substantially more pronounced curls and loops than the core filaments, which extend essentially in the direction of the fiber axis.

REPLACEMENT SHEET

02 AUG 1997

The total linear densities of the feed yarn strands forming the core filaments and the effect filaments are selected in such a way that they form a ratio of 95 : 5 to 70 : 30, preferably 90 : 10 to 80 : 20, and that, after entanglement, their blend has a linear density of 200 to 900 dtex.

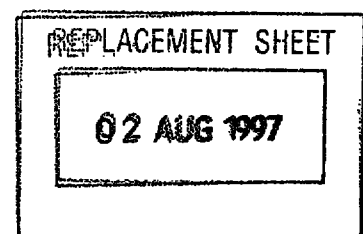
It has to be noted here that the total linear density LD_{tot} of the intermingled yarn is not simply the sum of the linear densities of the feed yarns but that it is necessary here to take into account the overfeed of the two feed yarns. The total linear density LD_{tot} is accordingly given by the following formula:

$$LD_{tot} = LD_C \times (1 + OF_C/100) + LD_E \times (1 + OF_E/100)$$

where LD_C and OF_C are the linear density and overfeed of the core feed yarn and LD_E and OF_E are the linear density and overfeed of the effect feed yarn.

The linear density of the filaments of the core feed yarn is 8 to 1.2, preferably 5 to 1.5, dtex, and the linear density of the filaments of the effect feed yarn is 4.5 to 1, preferably 3 to 1.4, dtex. Within the range of these values, the filament linear densities of the feed yarns are chosen in such a way that the linear density of the core filaments is from 1.2 to 6 times, preferably from 1.5 to 3.5 times, the linear density of the effect filaments.

The feed yarns for manufacturing the two-component loop sewing yarn according to the invention can be the high-tenacity and low-shrinkage yarns described for example in DE-B-2 88 734 and EP-A-173 200. The manufacture of the feed yarns required for the process according to the invention in an integrated step which immediately precedes the air texturing step and in which the feed yarns are obtained by drawing partially oriented yarn material and an immediately subsequent, essentially



shrinkage-free heat treatment forms part of the subject matter of EP-B 363 798 and is excluded from the subject matter of the present application.

5 In a preferred embodiment of the process according to the invention, partially oriented yarns are drawn at a temperature of 70 to 100°C, preferably over heated godet rolls, under a drawing tension within the range from 10 to 25 cN/tex, preferably from 12 to 17 cN/tex (each
10 figure being based on the drawn linear density). After drawing, the immediately following, essentially shrinkage-free heat treatment of the yarns is carried out at a yarn tension between 2 and 20 cN/tex, preferably at 4 to 17 cN/tex, and at a temperature within the range from 180
15 to 250°C, preferably from 225 to 235°C. This heat treatment may in principle be carried out in any known manner, but it is advantageous to effect the heat treatment directly on a heated take-off godet.

Essentially shrinkage-free is supposed to convey that,
20 during the heat treatment, the yarns are preferably kept at a constant length but that a shrinkage of up to 4%, preferably not above 2%, can be allowed.

Preferably, in the practice of the process according to the invention, the drawing conditions for the two par-
25 tially oriented yarns are ideally kept the same. However, differences in the drawing conditions of up to $\pm 10\%$ can be tolerated.

If desired, the loop yarn emerging from the air-texturing jet may additionally be subjected to a setting process.
30 This setting process can likewise be carried out in a conventional manner, but it is advantageous to subject the yarn at a constant length to a hot air treatment at temperatures of 200 to 320°C, preferably 240 to 300°C.

The two-component loop sewing yarn thus obtained surpri-
35 singly has a number of advantages over existing sewing

REPLACEMENT SHEET

02 AUG 1997

yarns:

The loops in the individual filaments remain fully intact and, owing to the entrained air, give good sewing properties even at high sewing speeds. This advantage is particularly evident from the high values for the sewing length to break, determined by the method known from DE-A-34 31 832. The uniformly drawn filaments show uniform dyeability and hence a level appearance of the seam. The tenacity of the yarns thus manufactured is significantly higher than that of sewing yarns composed of filaments having different shrinkage properties.

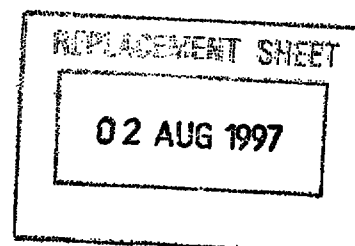
The use of such feed yarns, moreover, simplifies the manufacturing process. If high-shrinkage feed yarns are used, it is first of all necessary for example to produce many more loops than are to be found in the ready-produced sewing yarn, since the process of shrinkage reduces the number of loops. The two-component loop sewing yarn according to the invention need not be twisted during manufacture. It therefore is in the untwisted state and can also be used in the untwisted state as a sewing yarn. Usually, however, for example for better appearance, a relatively low twist of about 100 to 300 turns per meter is applied to it in the course of further processing.

REPLACEMENT SHEET

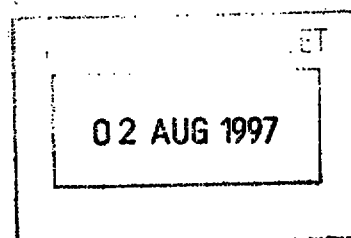
02 AUG 1997

Claims

1. A two-component loop sewing yarn composed of core and effect filaments of high tenacity and low shrinkage and made of synthetic polymers with the exception of polyester which has an intrinsic viscosity (measured in solutions in dichloroacetic acid at 25°C) of more than 0.65 dl/g, characterized by an ultimate tenacity of above 40 cN/tex, a thermoshrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%.
5
2. A two-component loop sewing yarn as claimed in claim 1, characterized in that its ultimate tensile strength elongation is less than 15%.
10
3. A two-component loop sewing yarn as claimed in at least one of claims 1 and 2, characterized in that its total linear density is 200 to 900 dtex.
15
4. A two-component loop sewing yarn as claimed in at least one of claims 1 to 3, characterized in that the total linear densities of the core filaments and effect filaments are in a ratio of 95 : 5 to 70 : 30.
20
5. A two-component loop sewing yarn as claimed in at least one of claims 1 to 4, characterized in that the linear density of the core filament is 8 to 1.2 dtex and the linear density of the effect filament is 4.5 to 1 dtex, the linear density of the core filaments being 1.2 to 6 times the linear density of the effect filaments.
25
6. A two-component loop sewing yarn as claimed in at least one of claims 1 to 5, characterized in that core and effect filaments are composed of a polyester.
30

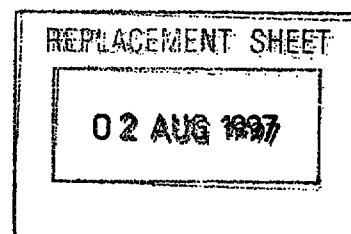


7. A two-component loop sewing yarn as claimed in claim 6, characterized in that the polyester is polyethylene terephthalate.
8. A process for manufacturing a two-component loop sewing yarn that is composed of core and effect filaments and has an ultimate tenacity of above 40 cN/tex, a thermoshrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%, wherein the core and effect filaments are intermingled with one another by air jet texturing two feed yarn strands supplied to the texturing jet at different speeds, characterized in that the feed yarn strands have different total and filament linear densities but both consist of filaments of synthetic polymers which have an ultimate tensile strength, based on the ultimate linear density, of at least 65 cN/tex, a thermoshrinkage at 180°C of at most 9% and an ultimate tensile strength elongation of at least 8%, it being excluded that the filaments of the feed yarn strands are obtained by drawing partially oriented yarn material immediately upstream of the air jet intermingling and by an immediately subsequent heat treatment in which a shrinkage of up to 4% can be allowed, but preferably no shrinkage takes place.
9. The process as claimed in claim 8, characterized in that both feed yarn strands consist of filaments of synthetic polymers which have an ultimate tensile strength, based on the ultimate linear density, of 70 to 84 cN/tex, a thermoshrinkage at 180°C of 6 to 8% and an ultimate tensile strength elongation of 8.5 to 12%.
10. The process as claimed in at least one of claims 8 and 9, characterized in that the core filaments are fed into the texturing jet at an overfeed of 3 to 10% and the effect filaments are fed into the



texturing jet at an overfeed of 10 to 60%.

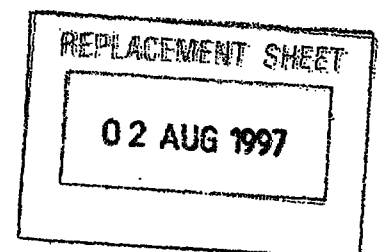
11. The process as claimed in at least one of claims 8 to 10, characterized in that the total linear densities of core and effect yarn strands are in the ratio of 95 : 5 to 70 : 30 and are chosen in such a way that, if the overfeed is taken into account, their sum is 200 to 900 dtex.
12. The process as claimed in at least one of claims 8 to 11, characterized in that the linear density of the core filaments fed into the texturing jet is 8 to 1.2 dtex and the linear density of the effect filaments fed into the texturing jet is 4.5 to 1 dtex, the linear density of the core filament being 1.2 to 6 times the linear density of the effect filament.
13. The process as claimed in at least one of claims 8 to 12, characterized in that the drawing conditions for core and effect filaments are essentially the same.
14. The process as claimed in at least one of claims 8 to 13, characterized in that the drawing is carried out at 70 to 100°C under a drawing tension of 10 to 25 cN/tex, based on the drawn linear density.
15. The process as claimed in at least one of claims 8 to 14, characterized in that the essentially shrinkage-free heat treatment carried out immediately after the drawing is carried out at a yarn tension of 2 to 20 cN/tex and at a temperature of 180 to 250°C.
16. The process as claimed in at least one of claims 8 to 15, characterized in that the yarn emerging from the texturing jet is set in a conventional manner at a temperature of 200 to 320°C.

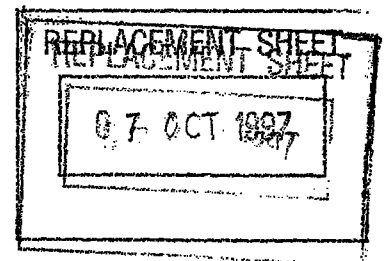


**TWO-COMPONENT LOOP SEWING YARN AND MANUFACTURE
THEREOF**

Abstract

Two-component loop sewing yarn composed of core and effect filaments of high tenacity and low shrinkage made of synthetic polymers, having an ultimate tenacity of above 40 cN/tex, a thermoshrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%, has a total count of 200 to 900 dtex, its core filaments and effect filaments being in a weight ratio of 95 : 5 to 70 : 30 with the linear density of the core filaments being 8 to 1.2 dtex and that of the effect filaments being 4.5 to 1 dtex.





-1-

TWO-COMPONENT LOOP SEWING YARN AND MANUFACTURE THEREOF

Description

The present invention relates to a two-component loop sewing yarn for modern industrial sewing machines of high tenacity combined with low shrinkage, and to a process for manufacturing same.

A similar loop sewing yarn is known for example from EP-A-57 583. By the process described therein, a plurality of yarns having different shrinkages are plied by air jet texturing at different rates of overfeed to produce a loop yarn. The loop yarn is then allowed to shrink in a subsequent setting process which tightens up the loops of filament into bud-like projections. In an improved form of this known process described in EP-A-123 479, the yarns are additionally twisted between loop formation and setting at about 100 to 300 turns per meter.

A disadvantage of these known processes lies in the fact that the ultimate tenacity of the ready-produced loop yarn is lower than would be expected from the tenacity of the feed yarns. The ultimate tenacity of these known sewing yarns is only between 25 and 40 cN/tex, the ultimate tenacity here being defined as the ratio of the ultimate tensile strength and the ultimate linear density at break. Moreover, the filaments of these known yarns may shrink to widely differing extents, depending on the degree of binding. These differences then show up in variable dyeability along a filament and are particularly marked from filament to filament if yarns having different shrinkage properties have been used.

There are also single-component loop sewing yarns whose ultimate tenacity is between 40 and 50 cN/tex. However, these yarns have inadequate sewing properties owing to their small number of loops. They have been twisted like

07 OCT 1997

- 2 -

conventional sewing yarns to about 600 to 800 turns per meter, and the elongation at break is relatively high at over 18%.

5 The present invention provides a two-component loop sewing yarn which does not exhibit the above-described prior art disadvantages.

10 The earlier but as yet unpublished applications EP-A-295 601 and EP-A-367 938 describe two-component loop sewing yarns. Concrete embodiments of these sewing yarns with ultimate tensile strength elongations of below 18% are not discernible from these publications. According to EP-A-295,601 the yarns are produced by jet entangling from a feed yarn which immediately prior to entangling is drawn using an unheated pin. According to EP-A-367,938,
15 the starting material used is at least one feed yarn made of a yarn material having a tenacity of from 60 to about 75 cN/tex, which is passed directly into the pretangling step without prior drawing.

20 The high-tenacity, low-shrinkage two-component loop sewing yarn of low ultimate tensile strength elongation according to the invention is formed from core and effect filaments made of synthetic polymers such as, for example, polyamides, polyacrylonitrile and polypropylene but preferably polyesters and in particular polyethylene
25 terephthalate, and has an ultimate tenacity, i.e. an ultimate tensile strength per ultimate linear density at break, of above 40 cN/tex, preferably 48 to 60 cN/tex, a thermoshrinkage at 180°C of below 8%, preferably below 5%, and an ultimate tensile strength elongation of below
30 18%, preferably below 15%.

The ultimate tenacity is the ratio of the ultimate tensile strength to the ultimate linear density at break; the ultimate tensile strength elongation is elongation under the action of the ultimate tensile strength.

07 OCT 1997

- 3 -

The total linear density of the two-component loop sewing yarn according to the invention is in general 200 to 900 dtex. Higher and lower linear densities may likewise be manufactured, if they are of interest in a particular case, but are not the general rule. As mentioned above, the two-component loop sewing yarn according to the invention is composed of core filaments and effect filaments. Core filaments are on average much more oriented in the direction of the fiber axis than effect filaments, which are intermingled with and wrapped round the core filaments but in addition, owing to their greater length, form loops which stick out from the fiber assembly and hence are a significant factor in determining the textile properties and performance characteristics of the yarn according to the invention. The total linear densities of the core and effect filaments making up the loop sewing yarn according to the invention are in a ratio of 95 : 5 to 70 : 30, preferably 90 : 10 to 80 : 20.

Core filaments and effect filaments differ in linear density. The core filament linear density is 8 to 1.2, preferably 5 to 1.5, dtex, and the effect filament linear density is 4.5 to 1, preferably 3 to 1.4, dtex. Within these linear density limits, the filament linear density of the core filaments is 1.2 to 6 times, in particular 1.5 to 3.5 times, the linear density of the effect filaments.

In principle, the two-component loop sewing yarns according to the invention can be produced from the above-mentioned synthetic spinnable polymers and polycondensation products such as polyamides, polyacrylonitrile, polypropylene and polyesters, but it is particularly advantageous to use polyesters. Suitable polyesters are in particular those which are obtained essentially from aromatic dicarboxylic acids, for example (terephthalic acid or isophthalic acid, 1,4-, 1,5- and 2,6-naphthalenedicarboxylic acid, hydroxycarboxylic

07 OCT 1997

- 4 -

acids, for example para-(2-hydroxyethyl)benzoic acid, and aliphatic diols of 2 to 6, preferably 2 to 4, carbon atoms, for example ethylene glycol, 1,3-propanediol or 1,4-butanediol, by cocondensation. These polyester raw materials can also be modified by incorporation as cocondensed units of minor amounts of aliphatic dicarboxylic acids, for example glutaric acid, adipic acid or sebacic acid, or of polyglycols such as diethylene glycol (2,2-dihydroxydiethyl ether) or triethylene glycol (1,2-di(2-hydroxyethoxy)ethane), or else of minor amounts of higher molecular polyethylene glycols. A further possible modification, which affects in particular the dyeing properties of the two-component loop sewing yarns according to the invention, is modification by means of sulfo-containing units, for example by the incorporation of sulfoisophthalic acid.

The upper limit of the ultimate tenacity of the loop sewing yarns according to the invention depends on the degree of condensation of the polymer material, in particular the polyester material, used. The degree of condensation of the polyester is evident in its viscosity. A high degree of condensation, i.e. a high viscosity, leads to particularly high ultimate tenacities of the yarns manufactured according to the invention. Preference is therefore given to the manufacture according to the invention of the loop sewing yarns from high molecular weight polyesters having an intrinsic viscosity (IV) of above 0.65 dl/g, in particular above 0.75 dl/g, measured in solutions in dichloroacetic acid (DCA) at 25°C. Loop sewing yarns which have the above-defined property profile and are based on polyesters having IV values above 0.65 dl/g form part of the subject matter of EP-B 363 798 and are excluded from the subject matter of the present application.

A preferred polyester material for manufacturing the loop yarns according to the invention is polyethylene terephthalate.

This Sheet Has Been Replaced

THIS SHEET HAS BEEN
REPLACED

07 OCT 1997

- 5 -

The two-component (core/effect) filament loop sewing yarn is manufactured according to the invention by air jet texturing two feed yarn strands which have different total and filament linear densities and are supplied at
5 different rates of overfeed but which both consist of high-tenacity, low-shrinkage and low-stretch filaments.

For the purposes of the present invention, high-tenacity, low-shrinkage and low-stretch filaments have an ultimate tensile strength per ultimate linear density of not less
10 than 65 cN/tex, in general 65 to 90 cN/tex, preferably 70 to 84 cN/tex, an ultimate tensile strength elongation of not less than 8%, in general 8 to 15%, preferably 8.5 to 12%, and a thermoshrinkage at 180°C of not more than 9%, in general 5 to 9%, preferably 6 to 8%.

15 In the air jet texturing of yarns, as will be known, the filament material is fed into the jet of compressed air at a higher rate than the rate with which it is drawn off by the take-off rolls. The percentage by which the rate of feed is higher than the rate of take-off, based on the
20 take-off speed, is referred to as the overfeed. In the process according to the invention, then, the two yarn strands to be mixed, which in the ready-produced yarn will then constitute the core or effect filaments, are supplied to the texturing jet at different rates of
25 overfeed. The feed yarn strand which will ultimately form the core filaments of the yarn according to the invention is fed into the air jet at an overfeed of 3 to 10%, while the feed yarn strand which will ultimately form the effect filaments of the yarn according to the invention
30 is fed at an overfeed of 10 to 60%. Owing to these different rates of overfeed, longer lengths of the effect filaments are tangled in the texturing jet with shorter lengths of the core filaments, the result being that the effect filaments in the ready-produced yarn according to
35 the invention form substantially more pronounced curls and loops than the core filaments, which extend essentially in the direction of the fiber axis.

07 OCT 1997

- 6 -

The total linear densities of the feed yarn strands forming the core filaments and the effect filaments are selected in such a way that they form a ratio of 95 : 5 to 70 : 30, preferably 90 : 10 to 80 : 20, and that, after entanglement, their blend has a linear density of 200 to 900 dtex.

It has to be noted here that the total linear density LD_{tot} of the intermingled yarn is not simply the sum of the linear densities of the feed yarns but that it is necessary here to take into account the overfeed of the two feed yarns. The total linear density LD_{tot} is accordingly given by the following formula:

$$LD_{tot} = LD_C \times (1 + OF_C/100) + LD_E \times (1 + OF_E/100)$$

where LD_C and OF_C are the linear density and overfeed of the core feed yarn and LD_E and OF_E are the linear density and overfeed of the effect feed yarn.

The linear density of the filaments of the core feed yarn is 8 to 1.2, preferably 5 to 1.5, dtex, and the linear density of the filaments of the effect feed yarn is 4.5 to 1, preferably 3 to 1.4, dtex. Within the range of these values, the filament linear densities of the feed yarns are chosen in such a way that the linear density of the core filaments is from 1.2 to 6 times, preferably from 1.5 to 3.5 times, the linear density of the effect filaments.

The feed yarns for manufacturing the two-component loop sewing yarn according to the invention can be the high-tenacity and low-shrinkage yarns described for example in DE-B-2 88 734 and EP-A-173 200. The manufacture of the feed yarns required for the process according to the invention in an integrated step which immediately precedes the air texturing step and in which the feed yarns are obtained by drawing partially oriented yarn material and an immediately subsequent, essentially

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

07 OCT 1997

- 7 -

shrinkage-free heat treatment forms part of the subject matter of EP-B 363 798 and is excluded from the subject matter of the present application.

5 In a preferred embodiment of the process according to the invention, partially oriented yarns are drawn at a temperature of 70 to 100°C, preferably over heated godet rolls, under a drawing tension within the range from 10 to 25 cN/tex, preferably from 12 to 17 cN/tex (each
10 figure being based on the drawn linear density). After drawing, the immediately following, essentially shrinkage-free heat treatment of the yarns is carried out at a yarn tension between 2 and 20 cN/tex, preferably at 4 to 17 cN/tex, and at a temperature within the range from 180
15 to 250°C, preferably from 225 to 235°C. This heat treatment may in principle be carried out in any known manner, but it is advantageous to effect the heat treatment directly on a heated take-off godet.

Essentially shrinkage-free is supposed to convey that,
20 during the heat treatment, the yarns are preferably kept at a constant length but that a shrinkage of up to 4%, preferably not above 2%, can be allowed.

Preferably, in the practice of the process according to the invention, the drawing conditions for the two par-
25 tially oriented yarns are ideally kept the same. However, differences in the drawing conditions of up to $\pm 10\%$ can be tolerated.

If desired, the loop yarn emerging from the air-texturing jet may additionally be subjected to a setting process.
30 This setting process can likewise be carried out in a conventional manner, but it is advantageous to subject the yarn at a constant length to a hot air treatment at temperatures of 200 to 320°C, preferably 240 to 300°C.

The two-component loop sewing yarn thus obtained surpri-
35 singly has a number of advantages over existing sewing

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

07 OCT 1997

- 8 -

yarns:

The loops in the individual filaments remain fully intact and, owing to the entrained air, give good sewing properties even at high sewing speeds. This advantage is particularly evident from the high values for the sewing length to break, determined by the method known from DE-A-34 31 832. The uniformly drawn filaments show uniform dyeability and hence a level appearance of the seam. The tenacity of the yarns thus manufactured is significantly higher than that of sewing yarns composed of filaments having different shrinkage properties.

The use of such feed yarns, moreover, simplifies the manufacturing process. If high-shrinkage feed yarns are used, it is first of all necessary for example to produce many more loops than are to be found in the ready-produced sewing yarn, since the process of shrinkage reduces the number of loops. The two-component loop sewing yarn according to the invention need not be twisted during manufacture. It therefore is in the untwisted state and can also be used in the untwisted state as a sewing yarn. Usually, however, for example for better appearance, a relatively low twist of about 100 to 300 turns per meter is applied to it in the course of further processing.

07 OCT 1997

- 9 -

Claims

1. A two-component loop sewing yarn composed of core and effect filaments of high tenacity and low shrinkage and made of synthetic polymers with the exception of polyester which has an intrinsic viscosity (measured in solutions in dichloroacetic acid at 25°C) of more than 0.65 dl/g, characterized by an ultimate tenacity of above 40 cN/tex, a thermoshrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%.
5
2. A two-component loop sewing yarn as claimed in claim 1, characterized in that its ultimate tensile strength elongation is less than 15%.
10
3. A two-component loop sewing yarn as claimed in at least one of claims 1 and 2, characterized in that its total linear density is 200 to 900 dtex.
15
4. A two-component loop sewing yarn as claimed in at least one of claims 1 to 3, characterized in that the total linear densities of the core filaments and effect filaments are in a ratio of 95 : 5 to 70 : 30.
20
5. A two-component loop sewing yarn as claimed in at least one of claims 1 to 4, characterized in that the linear density of the core filament is 8 to 1.2 dtex and the linear density of the effect filament is 4.5 to 1 dtex, the linear density of the core filaments being 1.2 to 6 times the linear density of the effect filaments.
25
6. A two-component loop sewing yarn as claimed in at least one of claims 1 to 5, characterized in that core and effect filaments are composed of a polyester.
30



This Sheet Has Been Replaced

THIS SHEET HAS BEEN
REPLACED

07 OCT 1997

- 10 -

7. A two-component loop sewing yarn as claimed in claim 6, characterized in that the polyester is polyethylene terephthalate.
8. A process for manufacturing a two-component loop sewing yarn that is composed of core and effect filaments and has an ultimate tenacity of above 40 cN/tex, a thermoshrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%, wherein the core and effect filaments are intermingled with one another by air jet texturing two feed yarn strands supplied to the texturing jet at different speeds, characterized in that the feed yarn strands have different total and filament linear densities but both consist of filaments of synthetic polymers which have an ultimate tensile strength, based on the ultimate linear density, of at least 65 cN/tex, a thermoshrinkage at 180°C of at most 9% and an ultimate tensile strength elongation of at least 8%, it being excluded that the filaments of the feed yarn strands are obtained by drawing partially oriented yarn material immediately upstream of the air jet intermingling and by an immediately subsequent heat treatment in which a shrinkage of up to 4% can be allowed, but preferably no shrinkage takes place.
9. The process as claimed in claim 8, characterized in that both feed yarn strands consist of filaments of synthetic polymers which have an ultimate tensile strength, based on the ultimate linear density, of 70 to 84 cN/tex, a thermoshrinkage at 180°C of 6 to 8% and an ultimate tensile strength elongation of 8.5 to 12%.
10. The process as claimed in at least one of claims 8 and 9, characterized in that the core filaments are fed into the texturing jet at an overfeed of 3 to 10% and the effect filaments are fed into the



* C L M S *

This Sheet Has Been Replaced

THIS SHEET HAS BEEN
REPLACED

07 OCT 1997

- 11 -

texturing jet at an overfeed of 10 to 60%.

11. The process as claimed in at least one of claims 8 to 10, characterized in that the total linear densities of core and effect yarn strands are in the ratio of 95 : 5 to 70 : 30 and are chosen in such a way that, if the overfeed is taken into account, their sum is 200 to 900 dtex.
12. The process as claimed in at least one of claims 8 to 11, characterized in that the linear density of the core filaments fed into the texturing jet is 8 to 1.2 dtex and the linear density of the effect filaments fed into the texturing jet is 4.5 to 1 dtex, the linear density of the core filament being 1.2 to 6 times the linear density of the effect filament.
13. The process as claimed in at least one of claims 8 to 12, characterized in that the drawing conditions for core and effect filaments are essentially the same.
14. The process as claimed in at least one of claims 8 to 13, characterized in that the drawing is carried out at 70 to 100°C under a drawing tension of 10 to 25 cN/tex, based on the drawn linear density.
15. The process as claimed in at least one of claims 8 to 14, characterized in that the essentially shrinkage-free heat treatment carried out immediately after the drawing is carried out at a yarn tension of 2 to 20 cN/tex and at a temperature of 180 to 250°C.
16. The process as claimed in at least one of claims 8 to 15, characterized in that the yarn emerging from the texturing jet is set in a conventional manner at a temperature of 200 to 320°C.

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

REPLACEMENT SHEET

07 OCT 1997

-12-

**TWO-COMPONENT LOOP SEWING YARN AND MANUFACTURE
THEREOF**

Abstract

Two-component loop sewing yarn composed of core and effect filaments of high tenacity and low shrinkage made of synthetic polymers, having an ultimate tenacity of above 40 cN/tex, a thermoshrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%, has a total count of 200 to 900 dtex, its core filaments and effect filaments being in a weight ratio of 95 : 5 to 70 : 30 with the linear density of the core filaments being 8 to 1.2 dtex and that of the effect filaments being 4.5 to 1 dtex.

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED

12 NOV 1997

CLAIMS

1. A two-component loop sewing yarn composed of core and effect filaments of high tenacity and low shrinkage and made of synthetic polymers with the exception of polyester which has an intrinsic viscosity (measured in solutions in dichloroacetic acid at 25°C) of more than 0.65 dl/g, characterized by an ultimate tenacity of above 40 cN/tex, a thermoshrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%.
2. A two-component loop sewing yarn composed of core and effect filaments of high tenacity and low shrinkage and made of a polyester which has an intrinsic viscosity (measured in solutions in dichloroacetic acid at 25°C) of more than 0.65 dl/g, which yarn has an ultimate tenacity of above 40 cN/tex, a thermoshrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%.
3. A two-component loop sewing yarn as claimed in claims 1 or 2, characterized in that its ultimate tensile strength elongation is less than 15%.
4. A two-component loop sewing yarn as claimed in claims 1 or 2, characterized in that its total linear density is 200 to 900 dtex.
5. A two-component loop sewing yarn as claimed in claims 1 or 2, characterized in that the total linear densities of the core filaments and effect filaments are in a ratio of 95 : 5 to 70 : 30.
6. A two-component loop sewing yarn as claimed in claims 1 or 2, characterized in that the linear density of the core filament is 8 to 1.2 dtex and the linear density of the effect filament is 4.5 to 1 dtex, the linear



12 NOV 1997

density of the core filaments being 1.2 to 6 times the linear density of the effect filaments.

7. A two-component loop sewing yarn as claimed in claims 1 or 2, characterized in that core and effect filaments are composed of a polyester.
8. A two-component loop sewing yarn as claimed in claim 7, characterized in that the polyester is polyethylene terephthalate.
9. A process for manufacturing a two-component loop sewing yarn that is composed of core and effect filaments and has an ultimate tenacity of above 40 cN/tex, a thermoshrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%, wherein the core and effect filaments are intermingled with one another by air jet texturing two feed yarn strands supplied to the texturing jet at different speeds, characterized in that the feed yarn strands have different total and filament linear densities but both consist of filaments of synthetic polymers which have an ultimate tensile strength, based on the ultimate linear density, of at least 65 cN/tex, a thermoshrinkage at 180°C of at most 9% and an ultimate tensile strength elongation of at least 8%, it being excluded that the filaments of the feed yarn strands are obtained by drawing partially oriented yarn material immediately upstream of the air jet intermingling and by an immediately subsequent heat treatment in which a shrinkage of up to 4% can be allowed, but preferably no shrinkage takes place.
10. A process for manufacturing a two-component loop sewing yarn that is composed of core and effect filaments and has an ultimate tenacity of above 40 cN/tex, a thermoshrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%, wherein the core and effect filaments are intermingled with one another by air jet texturing two feed



12 NOV 1997

yarn strands supplied to the texturing jet at different speeds, wherein the feed yarn strands used have different total and filament linear densities but both consist of filaments of synthetic polymers which have an ultimate tensile strength, in terms of the ultimate linear density, of at least 65 cN/tex, a thermoshrinkage at 180°C of at most 9% and an ultimate tensile strength elongation of at least 8%, and wherein the filaments of the feed yarn strands are obtained by subjecting a partially oriented yarn material to a drawing operation immediately upstream of the air jet intermingling and by subjecting the drawn material immediately thereafter to a heat treatment in which a shrinkage of up to 4% can be allowed, but preferably no shrinkage takes place.

11. The process as claimed in claims 9 or 10, characterized in that both feed yarn strands consist of filaments of synthetic polymers which have an ultimate tensile strength, based on the ultimate linear density, of 70 to 84 cN/tex, a thermoshrinkage at 180°C of 6 to 8% and an ultimate tensile strength elongation of 8.5 to 12%.
12. The process as claimed in claims 9 or 10, characterized in that the core filaments are fed into the texturing jet at an overfeed of 3 to 10% and the effect filaments are fed into the texturing jet at an overfeed of 10 to 60%.
13. The process as claimed in claims 9 or 10, characterized in that the total linear densities of core and effect yarn strands are in the ratio of 95 : 5 to 70 : 30 and are chosen in such a way that, if the overfeed is taken into account, their sum is 200 to 900 dtex.
14. The process as claimed in claims 9 or 10, characterized in that the linear density of the core filaments fed into the texturing jet is 8 to 1.2 dtex and the linear density of the effect filaments fed into the texturing jet is 4.5 to



12 NOV 1997

1 dtex, the linear density of the core filament being 1.2 to 6 times the linear density of the effect filament.

15. The process as claimed in claims 9 or 10, characterized in that the drawing conditions for core and effect filaments are essentially the same.
16. The process as claimed in claims 9 or 10, characterized in that the drawing is carried out at 70 to 100°C under a drawing tension of 10 to 25 cN/tex, based on the drawn linear density.
17. The process as claimed in claims 9 or 10, characterized in that the essentially shrinkage-free heat treatment carried out immediately after the drawing is carried out at a yarn tension of 2 to 20 cN/tex and at a temperature of 180 to 250°C.
18. The process as claimed in claims 9 or 10, characterized in that the yarn emerging from the texturing jet is set in a conventional manner at a temperature of 200 to 320°C.



12 NOV 1997

- 13 -

**TWO-COMPONENT LOOP SEWING YARN AND MANUFACTURE
THEREOF****Abstract**

Two-component loop sewing yarn composed of core and effect filaments of high tenacity and low shrinkage made of synthetic polymers, having an ultimate tenacity of above 40 cN/tex, a thermoshrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%, has a total count of 200 to 900 dtex, its core filaments and effect filaments being in a weight ratio of 95 : 5 to 70 : 30 with the linear density of the core filaments being 8 to 1.2 dtex and that of the effect filaments being 4.5 to 1 dtex.

acids, for example para-(2-hydroxyethyl)benzoic acid, and aliphatic diols of 2 to 6, preferably 2 to 4, carbon atoms, for example ethylene glycol, 1,3-propanediol or 1,4-butanediol, by cocondensation. These polyester raw materials can also be modified by incorporation as cocondensed units of minor amounts of aliphatic dicarboxylic acids, for example glutaric acid, adipic acid or sebacic acid, or of polyglycols such as diethylene glycol (2,2-dihydroxydiethyl ether) or triethylene glycol (1,2-di(2-hydroxyethoxy)ethane), or else of minor amounts of higher molecular polyethylene glycols. A further possible modification, which affects in particular the dyeing properties of the two-component loop sewing yarns according to the invention, is modification by means of sulfo-containing units, for example by the incorporation of sulfoisophthalic acid.

The upper limit of the ultimate tenacity of the loop sewing yarns according to the invention depends on the degree of condensation of the polymer material, in particular the polyester material, used. The degree of condensation of the polyester is evident in its viscosity. A high degree of condensation, i.e. a high viscosity, leads to particularly high ultimate tenacities of the yarns manufactured according to the invention. Preference is therefore given to the manufacture according to the invention of the loop sewing yarns from high molecular weight polyesters having an intrinsic viscosity (IV) of above 0.65 dl/g, in particular above 0.75 dl/g, measured in solutions in dichloroacetic acid (DCA) at 25°C.

REPLACEMENT SHEET

13 NOV 2001

4A

According to one aspect of the present invention, there is provided

a two-component loop sewing yarn composed of core and effect filaments of high tenacity and low shrinkage and made of a polyester which has an intrinsic viscosity (measured in solutions in dichloroacetic acid at 25°C) of more than 0.65 dl/g, which yarn has an ultimate tenacity of above 40 cN/tex, a thermoshrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%.

A preferred polyester material for manufacturing the loop yarns according to the invention is polyethylene terephthalate.

REPLACEMENT SHEET

13 NOV 2001

The total linear densities of the feed yarn strands forming the core filaments and the effect filaments are selected in such a way that they form a ratio of 95 : 5 to 70 : 30, preferably 90 : 10 to 80 : 20, and that, after entanglement, their blend has a linear density of 200 to 900 dtex.

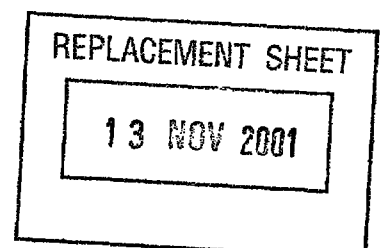
It has to be noted here that the total linear density LD_{tot} of the intermingled yarn is not simply the sum of the linear densities of the feed yarns but that it is necessary here to take into account the overfeed of the two feed yarns. The total linear density LD_{tot} is accordingly given by the following formula:

$$LD_{tot} = LD_C \times (1 + OF_C/100) + LD_E \times (1 + OF_E/100)$$

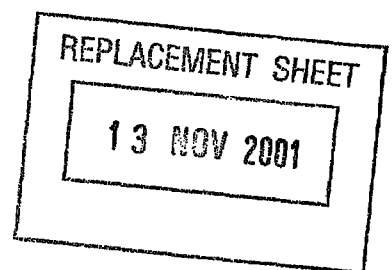
where LD_C and OF_C are the linear density and overfeed of the core feed yarn and LD_E and OF_E are the linear density and overfeed of the effect feed yarn.

The linear density of the filaments of the core feed yarn is 8 to 1.2, preferably 5 to 1.5, dtex, and the linear density of the filaments of the effect feed yarn is 4.5 to 1, preferably 3 to 1.4, dtex. Within the range of these values, the filament linear densities of the feed yarns are chosen in such a way that the linear density of the core filaments is from 1.2 to 6 times, preferably from 1.5 to 3.5 times, the linear density of the effect filaments.

The feed yarns for manufacturing the two-component loop sewing yarn according to the invention can be the high-tenacity and low-shrinkage yarns described for example in DE-B-2 88 734 and EP-A-173 200.



According to another aspect of the present invention, there is provided a process for manufacturing a two-component loop sewing yarn that is composed of core and effect filaments and has an ultimate tenacity of above 40 cN/tex, a thermoshrinkage at 180°C of below 8% and an ultimate tensile strength elongation of below 18%, wherein the core and effect filaments are intermingled with one another by air jet texturing two feed yarn strands supplied to the texturing jet at different speeds, wherein the feed yarn strands used have different total and filament linear densities but both consist of filaments of synthetic polymers which have an ultimate tensile strength, in terms of the ultimate linear density, of at least 65 cN/tex, a thermoshrinkage at 180°C of at most 9% and an ultimate tensile strength elongation of at least 8%, and wherein the filaments of the feed yarn strands are obtained by subjecting a partially oriented yarn material to a drawing operation immediately upstream of the air jet intermingling and by subjecting the drawn material immediately thereafter to a heat treatment in which a shrinkage of up to 4% can be allowed, but preferably no shrinkage takes place.



5 In a preferred embodiment of the process according to the invention, partially oriented yarns are drawn at a temperature of 70 to 100°C, preferably over heated godet rolls, under a drawing tension within the range from 10 to 25 cN/tex, preferably from 12 to 17 cN/tex (each
10 figure being based on the drawn linear density). After drawing, the immediately following, essentially shrinkage-free heat treatment of the yarns is carried out at a yarn tension between 2 and 20 cN/tex, preferably at 4 to 17 cN/tex, and at a temperature within the range from 180
15 to 250°C, preferably from 225 to 235°C. This heat treatment may in principle be carried out in any known manner, but it is advantageous to effect the heat treatment directly on a heated take-off godet.

Essentially shrinkage-free is supposed to convey that,
20 during the heat treatment, the yarns are preferably kept at a constant length but that a shrinkage of up to 4%, preferably not above 2%, can be allowed.

Preferably, in the practice of the process according to the invention, the drawing conditions for the two partially oriented yarns are ideally kept the same. However,
25 differences in the drawing conditions of up to $\pm 10\%$ can be tolerated.

If desired, the loop yarn emerging from the air-texturing jet may additionally be subjected to a setting process.
30 This setting process can likewise be carried out in a conventional manner, but it is advantageous to subject the yarn at a constant length to a hot air treatment at temperatures of 200 to 320°C, preferably 240 to 300°C.

The two-component loop sewing yarn thus obtained surprisingly has a number of advantages over existing sewing
35

REPLACEMENT SHEET

13 NOV 2001