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(54) **PROTECTIVE CUT-RESISTANT
SPORTSWEAR MATERIAL**

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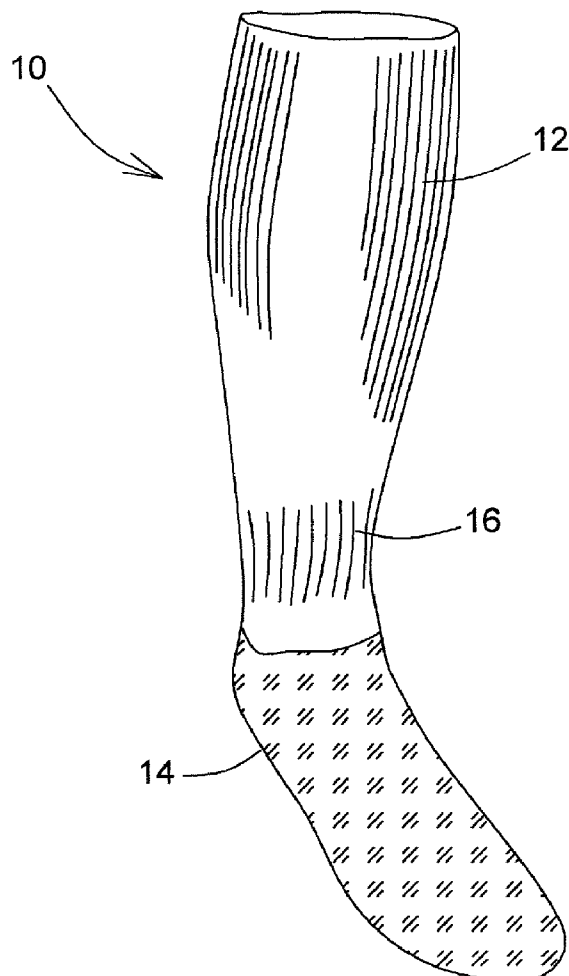
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(57)

ABSTRACT

A protective weaved sportswear material comprises two strands of 400 denier ultra-high molecular weight polyethylene (UHMWPE) yarns having the same lengths and being twisted together over their length. The sportswear material comprises a sock, a shin guard sleeve, a forearm sleeve or a neck guard.



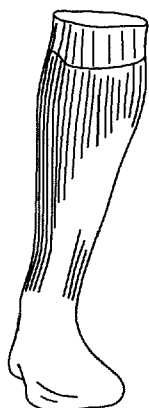


FIG. 1 (PRIOR ART)

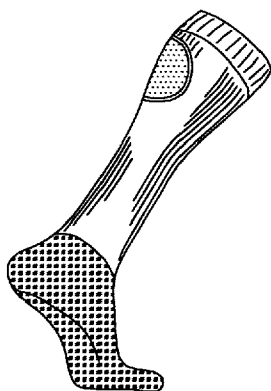


FIG. 2 (PRIOR ART)

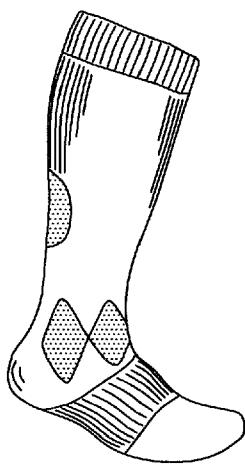


FIG. 3 (PRIOR ART)

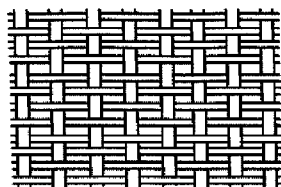


FIG. 4A



FIG. 4B

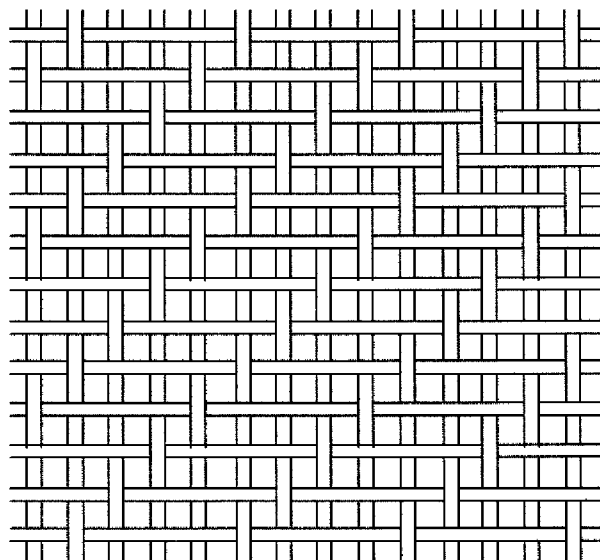


FIG. 5A



FIG. 5B

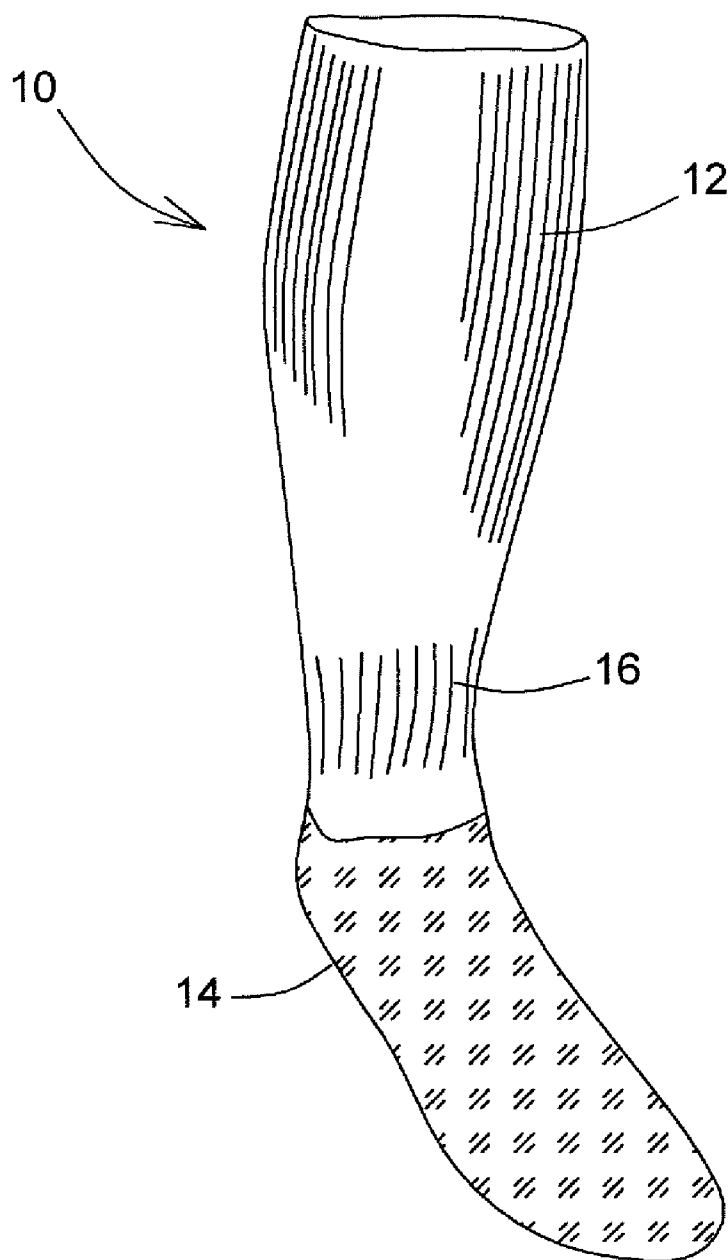


FIG.6

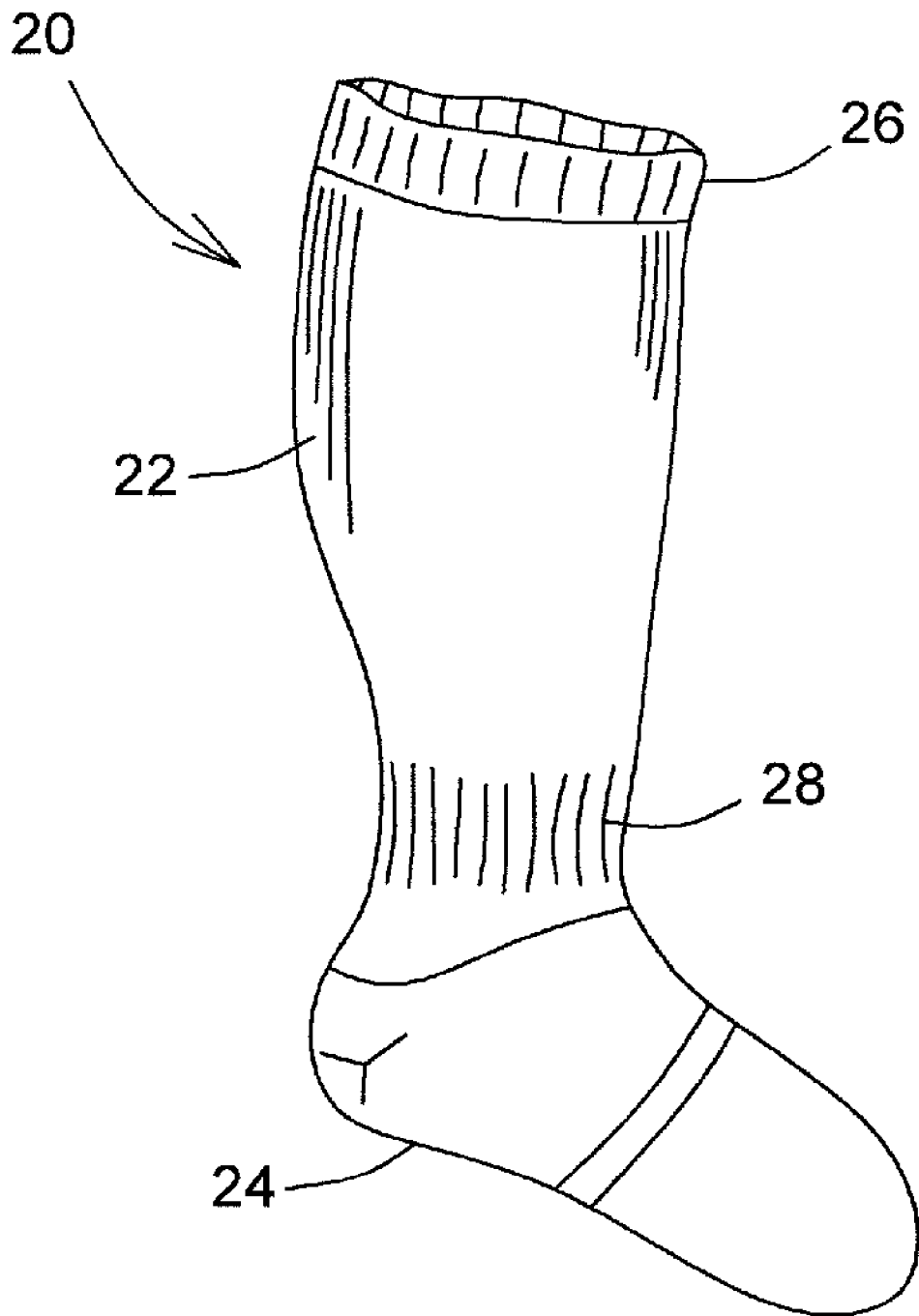


FIG.7

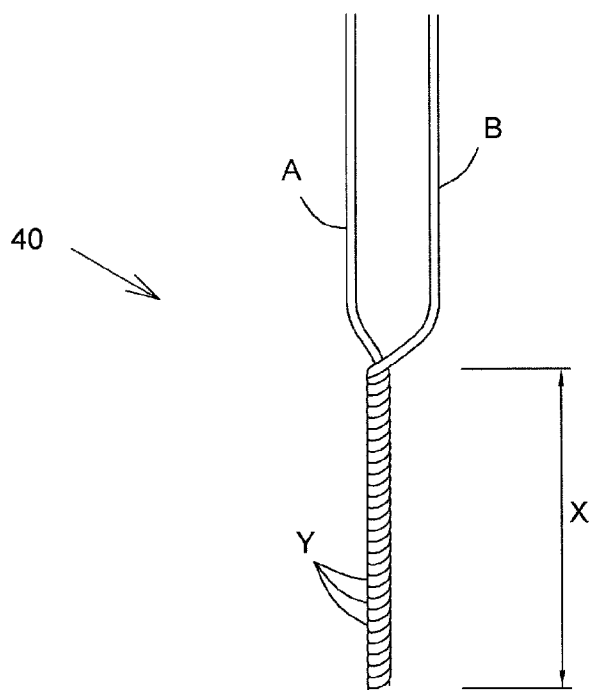


FIG. 8A

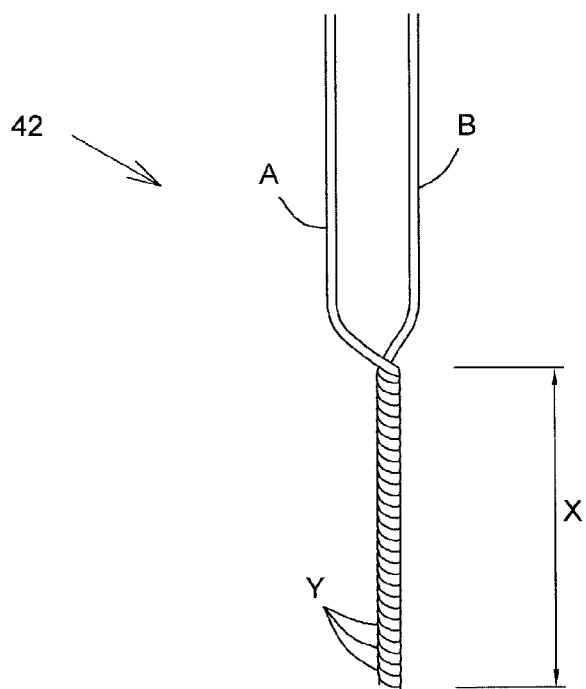


FIG. 8B

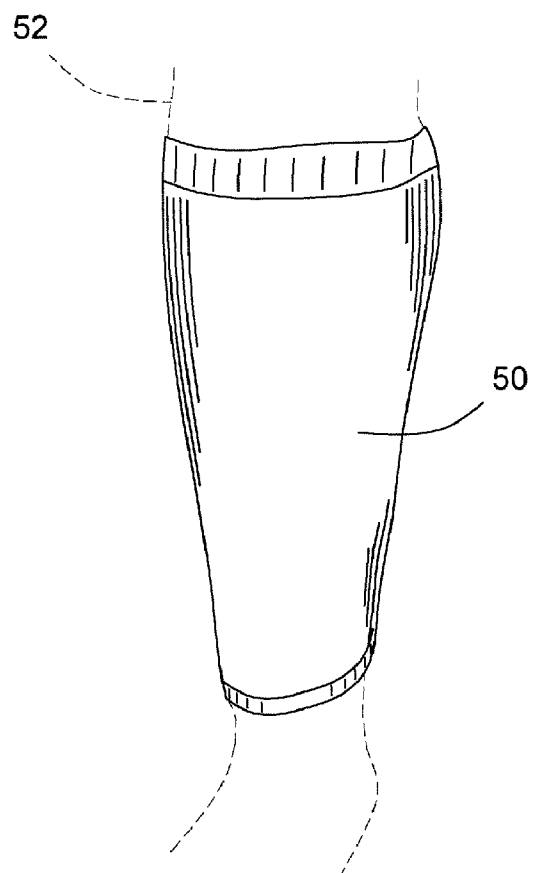


FIG.9

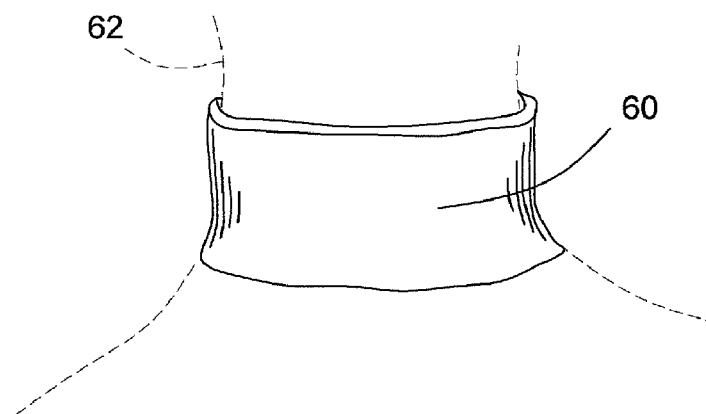


FIG.10

PROTECTIVE CUT-RESISTANT SPORTSWEAR MATERIAL

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application requests priority on U.S. Patent Application Ser. No. 61/480,275 filed on Apr. 28, 2011 and incorporated herein in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to sportswear. More specifically, but not exclusively, the present disclosure relates to protective cut-resistant sportswear material and a method for making such a material. More specifically but not exclusively, the present disclosure relates to a cut-resistant sock, to a cut-resistant shin guard or forearm sleeves and to a cut-resistant neck guard and a method of making the foregoing.

BACKGROUND

[0003] Cut-resistant socks, shin guard sleeves, forearm sleeves and neck guards are widely used in sports such as Hockey, where the blade of the ice skates can cause a serious injury to a player. These materials need to be cut-resistant as well as protective of the human flesh they cover all the while being comfortable for the wearer.

[0004] There are several sports apparel distributors and manufacturers offering their versions of cut resistant socks. Tuff n' Lite™ Hockey has a terry cloth knit or looped pile construction for their cut resistant sock. Due to the nature of this weave, once the sock is stretched over the leg, it seems that the sock will show vulnerability. The looped pile construction has a loose 3×1 rib knit in the leg and once stretched the yarns are further apart from one another causing gaps in the sock (See FIG. 1). The cushion foot is also bulkier versus a flat knit and not a very popular feature because it does not wick away moisture, rather it retains it much like a bath towel. Additionally, this sock is treated to provide an antimicrobial agent that virtually eliminates odor caused by bacteria. Tactics Armoured™ Hockey Socks is another cut resistant sock shown in FIG. 2. This sock is flat knit and cut resistant. The major component in this sock is Kevlar, an aramid that is not a breathable yarn/fabric. This does not allow for the removal of moisture such as sweat and does not efficiently remove heat either. Due to the fact that Kevlar is a rather rigid yarn/fabric, this sock does not have any compression characteristics and does not contour the leg or provide suppleness. antibacterial agents are added to the sock to combat bacteria and the like. Hogan™ Hockey provides a similar product to the Tactics Armoured™ sock (See FIG. 3). This sock however includes compression bands to hold the sock in place and have a mesh zone on top of the foot to eliminate heat. This sock also uses flat knit reinforced Kevlar cut resistant sock.

[0005] The prior socks do not provide a sufficiently cut-resistant sock that is conveniently supple. Moreover, consumers seek neck guards and shin guard or forearm sleeves that are more comfortable yet stronger than available products.

OBJECTS

[0006] An object of the present disclosure is to provide a protective cut resistant sportswear material.

[0007] An object of the present disclosure is to provide a protective cut resistant sock, shin guard sleeve, forearm sleeve and neck guard.

[0008] An object of the present disclosure is to provide a sock with a high level of cut resistance all the while allowing a smooth and very comfortable feel on the foot and lower leg of the user.

[0009] An object of the present disclosure is to provide a method of making a protective cut resistant sportswear material.

[0010] An object of the present disclosure is to provide a method of making a cut-resistant sock, shin guard sleeve, forearm sleeve and neck guard.

SUMMARY

[0011] In accordance with an aspect of the disclosure, there is provided a protective weaved sportswear material comprising two strands of 400 denier ultra-high molecular weight polyethylene (UHMWPE) yarns having the same lengths and being twisted together over their length.

[0012] In an embodiment, the two UHMWPE yarns are twisted once over every inch of their length. In an embodiment, the two UHMWPE yarns are twisted twice over every inch of their length. In an embodiment, the two UHMWPE yarns are twisted three times over every inch of their length.

[0013] In an embodiment, each of the UHMWPE yarns is characterized by a parallel orientation of greater than 95%. In an embodiment, each of the UHMWPE yarns is characterized by a level of crystallinity of 85%.

[0014] In an embodiment, the protective weaved sportswear material further comprises olefin. In an embodiment, the olefin comprises a strand of 150 denier olefin yarn. In an embodiment, the protective weaved sportswear material further comprises polyester. In an embodiment, the polyester comprises a strand of 150 denier polyester yarn. In an embodiment, the protective weaved sportswear further comprises spandex. In an embodiment, the spandex comprises a strand of 20 denier spandex yarn.

[0015] In an embodiment, the material comprises a sock. In an embodiment, the sock comprises a compression portion, the compression portion comprising a strand of 20 denier spandex yarn covering a strand of 150 denier polyester yarn. In an embodiment, the material comprises a sleeve. In an embodiment, the sleeve is selected from a shin guard sleeve and a forearm sleeve. In an embodiment, the material comprises a neck guard.

[0016] In accordance with an aspect of the disclosure, there is provided a method of making a protective sportswear material comprising: twisting two 400 denier weight ultra-high molecular weight polyethylene (UHMWPE) yarns having the same length under the same tension along their lengths; and weaving the twisted yarns.

[0017] In an embodiment, the yarns are twisted between one to three times over every inch of their length.

[0018] In an embodiment, there is provided sock comprising: ultra-high molecular weight polyethylene and olefin.

[0019] In an embodiment, there is provided a sock comprising two 400 denier weight ultra-high molecular weight polyethylene (UHMWPE) yarns, the two yarns being twisted together. In an embodiment, the sock further comprises olefin. In an embodiment, the sock further comprises polyester. In an embodiment, the polyester is 150 denier polyester. In an embodiment, the sock further comprises spandex. In an embodiment, the spandex is 20 denier spandex. In an embodiment, the spandex covers olefin. In an embodiment, the olefin comprises 150 denier olefin.

[0020] In an embodiment, there is provided a sock comprising fiber characterized by high parallel orientation and high level of crystallinity. In an embodiment, the fiber is characterized by a parallel orientation of greater than 95%. In an embodiment, the fiber is characterized by a level of crystallinity of up to 85%. In an embodiment, the fiber comprises ultra-high molecular weight polyethylene. In an embodiment, the sock further comprises olefin.

[0021] In accordance with an embodiment, the socks of the disclosure further comprise a compression portion. In an embodiment, the compression portion is provided by flat circular knitting.

[0022] In an embodiment, the cut-resistant sock comprises ultra-high molecular weight Polyethylene (“UHMWPE”) and olefin providing this sock a high level of cut resistance all the while allowing a smooth and very comfortable feel on the foot and lower leg of the user. The UHMWPE fiber comprises two 400 denier t UHMWPE yarns that are twisted together.

[0023] In accordance with an aspect of the present disclosure, there is provided a method of making a cut-resistant sock comprising: twisting together two denier 400 weight ultra-high molecular weight polyethylene yarns at given intervals Y along a length X of the yarns.

DEFINITIONS

[0024] “Weaves” are generally referred to and defined by a notation such as: 2×2, 4×4, and 3×1, for example. The first number in this set, for example, the 3 in 3×1, refers to how many strands are crossed “over” before going “under” the perpendicular strands (in a 90 degree weave). The second number refers to how many strands are crossed “under” before going back “over” the perpendicular strands (in a 90 degree weave). That is, a 3×1 weave would run: over, over, over, under, over, over, over, under, over, over, over, and so on and so forth. A 1×1 weave would run: over, under, over, under, over, under, and so one and so forth.

[0025] A “plain weave” is defined as a 1×1 weave; the weave is over, under, over under, over, under and so on and so forth (see FIGS. 4A and 4B). A plain weave is the tightest weave and as such it is the least likely to fray at the ends, the easiest to work with, and the most likely to sand evenly.

[0026] A “3×1” knit is a looser weave and is not as compressive as a 1×1 and when stretched over a leg you can see the separation of the weave (see FIGS. 5A and 5B).

[0027] “Denier” is, without limitation, a unit of fineness for yarn equal to the fineness of a yarn weighing one gram for each 9000 meters.

[0028] A “yarn” is, without limitation, a continuous often plied strand composed of either natural or man-made fibers or filaments and used in weaving and knitting clothes.

[0029] Other objects, advantages and features of the present disclosure will become more apparent upon reading of the following non-restrictive description of non-limiting illustrative embodiments thereof, given by way of example only with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] In the appended drawings, where like reference numerals denote like elements throughout and in where:

[0031] FIG. 1 is a perspective view of a prior art cut-resistant sock worn by a user;

[0032] FIG. 2 is a perspective view of another prior art cut-resistant sock worn by a user;

[0033] FIG. 3 is a perspective view of a further prior art cut-resistant sock worn by a user;

[0034] FIG. 4A is top of view of plain weaved material;

[0035] FIG. 4B is a sectional view of plain weaved material;

[0036] FIG. 5A is top view of 3×1 weaved material;

[0037] FIG. 5B is a sectional view of a 3×1 weaved material;

[0038] FIGS. 6 and 7 are respective perspective views of a cut-resistant sock in accordance with a non-limiting illustrative embodiments of the disclosure;

[0039] FIG. 8A shows a pair of strands of UHMWPE yarns being twisted in the clockwise direction to provide the protective cut resistant sportswear material in accordance with a non-limiting illustrative embodiment of the disclosure;

[0040] FIG. 8B shows a pair of strands of UHMWPE yarns being twisted in the counter-clockwise direction to provide the protective cut resistant sportswear material in accordance with a non-limiting illustrative embodiment of the disclosure;

[0041] FIG. 9 is a perspective view of a cut-resistant sleeve mounted to the calf of a user; and

[0042] FIG. 19 is a perspective view of a cut resistant neck guard mounted to the neck of user.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0043] Generally stated and in accordance with an embodiment of the disclosure, there is provided a protective weaved sportswear material comprising two strands of 400 denier ultra-high molecular weight polyethylene (UHMWPE) yarns having the same lengths and being twisted together over their length. The sportswear material comprises a sock, a shin guard sleeve, a forearm sleeve or a neck guard. With respect to the sock, the foregoing materials provide the sock a high level of cut resistance all the while allowing a smooth and very comfortable feel on the foot and lower leg of the user.

[0044] Ultra-high-molecular-weight polyethylene (UHMWPE or sometimes shortened to UHMW), also known as high-modulus polyethylene (HMPE) or high-performance polyethylene (HPPE), is a subset of the thermoplastic polyethylene. It has extremely long chains, with molecular weight numbering in the millions. The longer chain serves to transfer load more effectively to the polymer backbone by strengthening intermolecular interactions. This results in a very tough material with high impact strength, low density, low elongation at break, resistance to corrosive chemicals, low moisture absorption, low coefficient of friction. The material is self-lubricating and highly resistant to abrasion.

[0045] With respect to the sock, the comfort of the sock is provided by the low friction coefficient of the UHMWPE and the complement of remaining fibers that make up the sock. Since UHMWPE is used as the main component it

[0046] Production of UHMWPE fibers demands relatively little energy and uses no aggressive chemicals. The product can easily be recycled so environmental pollution from product and process is minimal.

[0047] Gel spinning, also known as dry-wet spinning, is used to obtain high strength or other special properties in the fibers. A polymer is in a “gel” state, only partially liquid, which keeps the polymer chains somewhat bound together.

[0048] These bonds produce strong inter-chain forces in the fiber, which increase its tensile strength. The polymer chains

within the fibers also have a large degree of orientation, which increases strength. The fibers are first air dried, then cooled further in a liquid bath.

[0049] Polyethylene molecules are not orientated and are easily torn apart. Therefore, in the gel spinning process the molecules are dissolved in a solvent and spun through a spinneret thereby providing a solution. The molecules in the solution that form clusters in the solid state become disentangled and remain in that state after the solution is cooled to give filaments. As the fiber is drawn, a very high level of macromolecular orientation is attained resulting in a fiber with a very high tenacity and modulus.

[0050] This fiber is characterized by a parallel orientation and high level of crystallinity. In one embodiment, this fiber is characterized by a parallel orientation greater than 95% and a level of crystallinity of up to 85%. This gives UHMWPE its unique properties such as its strength. The higher the content of UHMWPE in the material the greater the comfort.

[0051] Another fiber used in the manufacture of the sock, sleeve and neck guard is olefin. A synthetic fiber which is also polyethylene. Olefin is a very strong fiber, being abrasion, stain, sunlight, and chemical resistant and keeping its strength and resilience in wet or dry conditions. Olefin fiber is a synthetic fiber made from a polyolefin, such as polypropylene or polyethylene. It is used in wallpaper, ropes, and vehicle interiors. Olefin's advantages are its strength, colorfastness, comfort, stain, mildew, as well as its abrasion and sunlight resistance, and good bulk and cover.

[0052] In an embodiment, the sock, sleeve or neck guard of the present disclosure can be considered to be biologically inert as the fibers have excellent biological resistance. They neither stimulate undesired growth nor are sensitive to any attack by micro-organisms. As such, the sock, sleeve or neck guard is naturally antimicrobial in the sense that it is bacteria and fungus resistant.

[0053] In an embodiment, water absorption of the sock, sleeve or neck guard fibers is negligible and as a result they act as capillaries to channel sweat away from the body towards the surface for quick evaporation and breathability.

[0054] In an embodiment, the present sock sleeve or neck guard is capable of absorbing and transmitting heat thereby dispersing body heat quickly thus keeping the wearer cooler.

[0055] In an embodiment, the present sock is a compression sock. More particularly the sock comprises a portion thereof with an additional compression band around the ankle section of the sock, which compresses the leg, assisting in avoiding or at least attenuating muscular fatigue.

[0056] In an embodiment, the sock is manufactured at least partially by flat circular knitting. In an embodiment, the above-mentioned compression characteristic is provided by the flat circular knit of the present sock. More particularly, the tightness of the weave keeps the sock in place and allows it to better contour the leg thereby providing comfort as well as cut resistance.

[0057] In an embodiment, the UHMWPE is knitted into the sock thereby providing a softness and suppleness to the present sock.

[0058] In one embodiment, two 400 denier UHMWPE yarns instead of a single 800 denier UHMWPE yarn were twisted together.

[0059] The twisted smaller diameter 400 denier UHMWPE yarns are smaller in diameter individually but as a twisted pair they are stronger than a single 800 denier UHMWPE single

strand yarn. Both 400 denier UHMWPE yarns together however, have the same cross-sectional area as a single 800 denier UHMWPE strand yarn.

[0060] In one embodiment, the sock includes two individual 400 denier UHMWP single strand yarns knitted into the sock but this sock did not have the cut resistance of that was provided when twisting two 400 denier UHMWP yarns.

[0061] In one embodiment, the sock comprises two 400 denier (800) UHMWPE yarns that are twisted together, 150 denier polyester, 20 denier Spandex Covering one strand of 150 denier olefin yarn.

[0062] Turning now to FIG. 6, there is shown a sock **10** in accordance with a non-restrictive illustrative embodiment, comprising a leg portion **12** and a foot portion **14**. The leg portion **12** comprises twisted yarns while the foot portion **14** does not. The leg portion **14** also comprises a sub-portion **16** thereof which is a compression portion. In an embodiment, the leg portion **14** is a compression portion and the sub-portion **16** is an additional compression sub-portion of leg portion **14**.

[0063] FIG. 7 shows a another sock **20** having a flat knitted main body portion **22**, a flat knitted foot portion **24** with Y-stitch heel, a compression ankle section **26** including spandex and 1x1 weaved or plain weaved rib double welt portion **26**.

[0064] Turning now to FIG. 8A there is shown a pair **40** of two strands, namely A and B, of 400 denier UHMWP yarn being twisted over their length in the clockwise direction. The strands are twisted about one another Y times about a length X of the two yarns. The values of Y and X are determined by the skilled artisan based on the desired compression, comfort and strength of the final material depending on the needs and wants of the user. In one embodiment, the yarns are twisted once over every inch of length. In another embodiment, the yarns are twisted twice over every inch of length. In yet another embodiment, the yarns are twisted three times over every inch of length.

[0065] A variety of known twisting machines or ply yarn twistors are used to twist (or ply or wind) two separate strands of yarns together. Essentially two spools become one. It is important that when twisting strands together, they have the same length and same tension. In an embodiment, the two separate strands of yarn of 400 denier UHMWP each are twisted opposite the rotation of knitting. In an embodiment, a pair **42** of two 400 denier UHMWP yarns are twisted in a counter-clockwise fashion (see FIG. 8B).

[0066] In an embodiment, when knitting the material all yarns twisted and non-twisted need to be under the same tension in order to avoid bundling of the knit while maintaining a desirable compression.

[0067] In one embodiment, the composition of the sock comprises two twisted yarns of 400 denier (800) count UHMWPE, one yarn of 150 denier polyester, twenty 150 denier spandex strands covering the one 150 denier polyester. The sock includes a total of 1120 denier in the leg portion. The foot portion includes two yarns of 150 denier Olefin, one strand of 20 denier Spandex covered by one strand of 150 denier polyester. The arch area of the foot portion comprises elastic cover polyester.

[0068] FIG. 9 shows an example of a sleeve **50**, in this case a shin guard sleeve mounted to the calf of a user. Of course, a forearm sleeve would have a similar construction.

[0069] FIG. 10 shows an example of a neck guard **60** mounted to the neck **62** of a user. In one embodiment, the neck

guard comprises four strands of 400 denier (1600) count UHMWPE yarns. In this cases, two pairs of two twisted yarns of 400 denier UHMWPE yarns are knitted together. The neck guard further comprises a 20 denier spandex yarn covered by two 150 denier polyester strands, two 150 denier polyester strands and a 90 denier rubber strand knitted together with a 70 denier Polyester strand.

[0070] Testing of Materials

[0071] Test 1:

[0072] A product test was conducted on sock comprising 1 strand of 400 denier UHMWPE and spandex (Sock A). The test was conducted on May 18, 2010 in accordance with the ASTM F 1790-05 standard (Measuring Cut Resistance of Materials Used in Protective Clothing) protocol. The sample was conditioned at 21° C., 65% R.H. The apparatus was used was a Tomodynamometer TDM-100 (by IRRST). The cut direction was 45° in relation to the weave direction of the sock. The blade used was Gru-Gru #88-0121, Lot #3706 210 14 363163. The blade was validated and had a cut-through distance before and after of 17.60 mm and 19.42 mm. The blade sharpness correction factor was 1.0806 mm. The number of readings was 24 and the number of specimens used was 3. The weight needed to cut through the material with 25 mm of blade travel was 470.2 g.

[0073] Test 2:

[0074] Test 2.1

[0075] A product test was conducted on sock comprising 1 strand of 400 denier UHMWPE and spandex (sock A). The test was conducted on Sep. 16, 2010 in accordance with the CAN/BNQ 9415-370/2007 standard Neck Guard test protocol. This procedure tests the resistance of neck guards to the blade of an ice skate. The test was effectuated by the CRIQ (Centre de Recherche Industrielle du Québec). The blade that was used was from a Bauer Tuuk 270R Hockey Skate. The speed of impact was 25 Km/h. The test weight that was used was 215.70 lbs. The blade is actuated by a rig in accordance with the foregoing procedure.

[0076] In this test, the sock is mounted to a drum comprising metal cylinder having a 4.5 inch diameter with a 0.5 inch of foam thereon. The skilled artisan will appreciate that the foam used is an industry standard that is used to simulate human flesh. The standard is in accordance with the ACTMD3575-00 protocol. Therefore, the diameter of the drum on which the sock was mounted was 5.5 inches in total.

[0077] A first impact was effectuated with the blade being parallel to the weave direction of the sock. This resulted in the deformation of the sock material due to the blade passing over it. The foam was indented which means that there would be no skin removal but bruising would occur.

[0078] A second impact was effectuated with the blade being at a 90° angle to the weave direction with the sock being regularly stretched over the drum. This resulted in the sock being cut and the foam being compressed but not cut. This same impact was repeated but in this case, the sock was extremely stretched over the drum to simulate a larger human calf. The result was that the sock was cut and the foam was both deformed and cut.

[0079] A third impact was conducted with the blade at a 45° angle to the weave direction. This resulted in the sock being cut, while the foam was not cut but compressed. The compression signifies that there are good chances that the leg can be cut.

[0080] Test 2.2

[0081] Another set of tests was conducted on a sock comprising 1 strand of 400 denier UHMWPE yarn, spandex and a strand 150 denier polyester yarn (Sock B).

[0082] A first impact was conducted with blade being parallel to the weave direction. This resulted in a negligible cut on the sock and a slight compression on the foam.

[0083] A second impact was conducted with the blade at a 90° angle to the weave direction. The sock was normally stretched over the drum. This impact resulted in a slight abrasion of the sock with no cut. The foam was not cut but compressed. This impact was repeated with the sock being extremely stretched over the drum to simulate a larger calf. A cut occurred at the ankle compression area. The foam was lightly compressed but not cut.

[0084] A third impact was conducted with the blade at a 45° angle to the weave direction. The blade cut through the sock but the foam was slightly compressed and not cut.

[0085] Test 3

[0086] Test 3.1

[0087] A product test was conducted on a sock comprising 2 strands of 400 denier UHMPWE that were knitted together and spandex (Sock C). The test was conducted on Oct. 22, 2010 by the CRIQ and in accordance with the CAN/BNQ 9415-370/2007 standard Neck Guard test protocol which as previously mentioned tests the resistance of neck guards to the blade of an ice skate. The blade that was used was from a Bauer Tuuk 270R Hockey Skate. The speed of impact was 25 Km/h. The test weight that was used was 215.70 lbs. The drum was had a diameter of 5.5 inches with a 4.5 inch metallic cylindrical core and a 0.5 inch layer of foam in accordance the ACTMD3575-00 protocol.

[0088] A first impact was conducted with the blade being parallel to the weave direction. This impact was repeated three times at three different positions along the length of the sock, at the top extremity and the bottom extremity and in or about the middle. These impacts resulted in the sock not being cut at the top or bottom extremities, yet there was a slight negligible hole in the middle of the sock. The foam beneath the sock was deformed at all three positions but not cut.

[0089] A second impact was conducted with the blade being at a 90° angle to the weave direction. This impact was repeated three times at three different positions along the length of the sock, at the top extremity and the bottom extremity and in or about the middle. These impacts resulted in the sock not being cut at the top or bottom extremities, yet there were perforations in the middle of the sock. The foam beneath the sock was deformed at all three positions but not cut.

[0090] A third impact was conducted with the blade being at a 45° angle to the weave direction. This impact did not cut the sock; there were minimal markings on the sock and small indentations on the foam.

[0091] Test 3.2

[0092] A product test was conducted on a sock comprising 2 twisted strands of 400 denier UHMPWE and spandex (Sock D). In each impact below, the sock was impacted by the blade at three different positions along the length of the sock, at the top extremity and the bottom extremity and in or about the middle.

[0093] A first impact was conducted with the blade being parallel to the weave direction. There were no cuts on the sock and only minor abrasions to the foam.

[0094] A second impact was conducted with the blade being at a 90° angle to the weave direction. There were no cuts on the sock and only minor abrasions on the foam.

[0095] A third impact was conducted with the blade being at a 45° angle to the weave direction. There were no cuts to the sock and only minor deformations to the foam.

[0096] Test 4

[0097] The same test as test 3.2 was conducted on Dec. 7, 2011 and the results were confirmed.

CONCLUSION

[0098] The tests above show that the material having a composition that includes two strands of 400 denier UHMPWE (Sock D) having been twisted together are more cut resistant and provide greater protection to the human flesh beneath the material than the other compositions (Sock A, Sock B, Sock C). Moreover, the two twisted strands of 400 denier UHMPWE have greater malleability and less rigidity than a single strand of 800 denier UHMPWE yarn. As such, the materials provided herein improve the cut resistance of the protective sportswear (socks, neck guards and shin guard sleeves) and are comparable to greater denier UHMPWE yarns while at the same time maintaining the malleability and comfort that lesser denier and single strand yarns of UHMPWE provide.

[0099] More particularly, a material comprising one strand of 800 denier UHMPWE yarn provides greater protection than a material comprising either a single strand of 400 denier UHMPWE yarn or two non-twisted strands of 400 denier UHMPWE yarn. A material comprising two twisted strands of 400 denier UHMPWE yarn provides a similar protection to that of a material comprising a strand of 800 denier UHMPWE yarn. A material comprising a single strand of 400 denier UHMPWE yarn is far more malleable and comfortable than a material comprising a single strand of 800 denier UHMPWE yarn which is very rigid. A material comprising two twisted strands of 400 denier UHMPWE yarn provides a similar comfort level to a material comprising a single strand of 400 denier UHMPWE yarn.

[0100] The various materials disclosed herein can be used for socks, sleeves or neck guards. It should be noted that the various components and features of the embodiments described above can be combined in a variety of ways so as to provide other non-illustrated embodiments within the scope of the disclosure. As such, it is to be understood that the disclosure is not limited in its application to the details of construction and parts illustrated in the accompanying drawings and described hereinabove. The disclosure is capable of other embodiments and of being practiced in various ways. It is also to be understood that the phraseology or terminology used herein is for the purpose of description and not limitation. Hence, although the present disclosure has been described hereinabove by way of embodiments thereof, it can be modified, without departing from the spirit, scope and

nature of the subject disclosure as defined herein and in the appended claims.

1. A protective weaved sportswear material comprising: two strands of 400 denier ultra-high molecular weight polyethylene (UHMWPE) yarns having the same lengths and being twisted together over their length.
2. A protective weaved sportswear material according to claim 1, wherein the two UHMWPE yarns are twisted once over every inch of their length.
3. A protective weaved sportswear material according to claim 1, wherein the two UHMWPE yarns are twisted twice over every inch of their length.
4. A protective weaved sportswear material according to claim 1, wherein the two UHMWPE yarns are twisted three times over every inch of their length.
5. A protective weaved sportswear material according to claim 1, wherein each of the UHMWPE yarns is characterized by a parallel orientation of greater than 95%.
6. A protective weaved sportswear material according to claim 1, wherein each of the UHMWPE yarns is characterized by a level of crystallinity of 85%.
7. A protective weaved sportswear material according to claim 1, further comprising olefin.
8. A protective weaved sportswear material according to claim 7, wherein the olefin comprises a strand of 150 denier olefin yarn.
9. A protective weaved sportswear material according to claim 1, further comprising polyester.
10. A protective weaved sportswear material according to claim 9, wherein the polyester comprises a strand of 150 denier polyester yarn.
11. A protective weaved sportswear material according to claim 1, further comprising spandex.
12. A protective weaved sportswear material according to claim 11, wherein the spandex comprises a strand of 20 denier spandex yarn.
13. A protective weaved sportswear material according to claim 1, wherein the material comprises a sock.
14. A protective weaved sportswear material according to claim 13, wherein the sock comprises a compression portion, the compression portion comprising a strand of 20 denier spandex yarn covering a strand of 150 denier polyester yarn.
15. A protective weaved sportswear material according to claim 1, wherein the material comprises a sleeve.
16. A protective weaved sportswear material according to claim 15, wherein the sleeve is selected from a shin guard sleeve and a forearm sleeve.
17. A protective weaved sportswear material according to claim 1, wherein the material comprises a neck guard.
18. A method of making a protective sportswear material comprising: twisting two 400 denier weight ultra-high molecular weight polyethylene (UHMWPE) yarns having the same length under the same tension along their lengths; and weaving the twisted yarns.
19. The method of claim 18, wherein the yarns are twisted between one to three times over every inch of their length.

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