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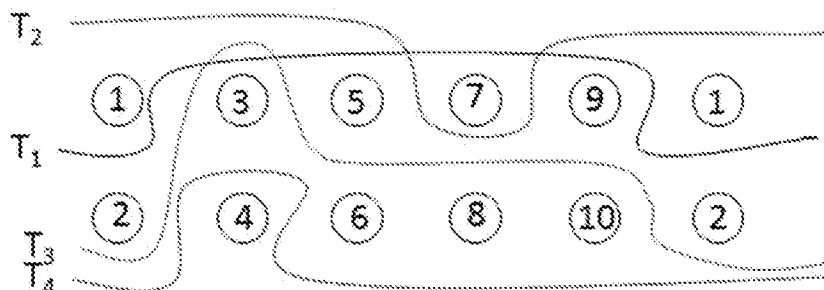
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FIG. 2

Protective fabric weft profile of example 2



○ = warp

— = T₁/T₂/T₃/T₄ weft

(57) **Abrégé/Abstract:**

A protective fabric is described, preferably for motorcyclist professional clothing, said monolayer or coupled fabric comprising at least two coupled fabrics which surprisingly meets all the requirements of the applicable reference standards for abrasion, cut and burst resistance, while maintaining unchanged exceptional characteristics of softness, breathability, comfort, washability.

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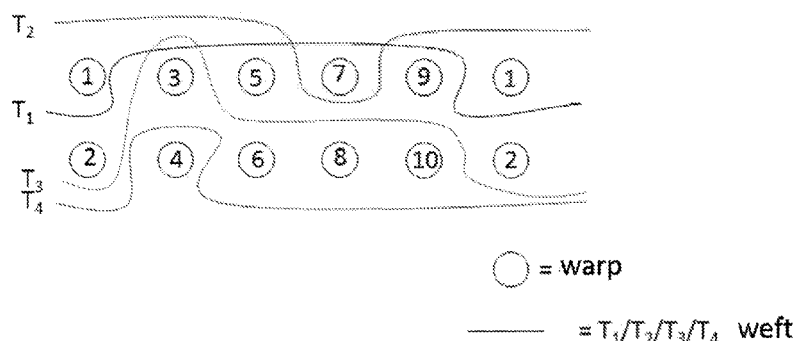
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(54) Title: TEXTILE ARTICLE FOR MOTORCYCLIST PROTECTIVE CLOTHING

FIG. 2

Protective fabric weft profile of example 2



(57) Abstract: A protective fabric is described, preferably for motorcyclist professional clothing, said monolayer or coupled fabric comprising at least two coupled fabrics which surprisingly meets all the requirements of the applicable reference standards for abrasion, cut and burst resistance, while maintaining unchanged exceptional characteristics of softness, breathability, comfort, washability.

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TEXTILE ARTICLE FOR MOTORCYCLIST PROTECTIVE CLOTHING

FIELD OF THE INVENTION

The present invention relates to the field of textile articles for clothing, in particular it refers to a textile article for motorcyclist protective clothing.

BACKGROUND

As is known in the accident prevention field, the anti-pierce, anti-cut, high abrasion resistant and anti-burst fabrics that are normally used in the safety footwear and safety clothing field (for example anti-pierce insoles, bulletproof vests, overalls for motorcycle clothing, etc.) are of particular importance, suitable to protect the user in case of accidents.

The EN 13595-1:2002 standard is the main standard in Europe that regulates protective clothing for professional motorcyclists. The norm provides for a division of the garments into 4 zones, wherein zones 1 and 2 correspond to the most exposed and most at risk parts (elbows, arms, shoulders, knees, hips), zones 3 and 4 correspond to parts less at risk, moreover 2 safety levels, wherein level 1 covers the minimum requirements and level 2 the highest requirements for more performing materials, so-called "racing".

Table 1 - Requirements according to standard EN 13595-1:2002

EN 13595-1:2002 (Protective Clothing For Professional Motorcyclists)	Zone	Level 1 requirements	Level 2 requirements
5.4 (Resistance to impact abrasion after 5 washes) (s)	1&2	≥ 4.0 s	≥ 7.0 s
	3	≥ 1.8 s	≥ 2.5 s
	4	≥ 1.0 s	≥ 1.5 s
5.5 (Resistance to impact cut after 5 washes)	1&2	≤ 25 mm	≤ 15 mm
	3	≤ 30 mm	≤ 25 mm
	4	≤ 35 mm	≤ 30 mm
5.6 (Resistance to impact burst after 5 washes)	1&2	≥ 700 Kpa	≥ 800 Kpa
	3	≥ 500 Kpa	≥ 600 Kpa
	4	≥ 400 Kpa	≥ 450 Kpa

Currently, protective clothing for professional (and not) motorcyclists are made of leather. The Bovine Leather (used for professional and non motorcycling clothing, in fact the bovine leather has a lower quality compared to the kangaroo which is

compulsorily used for the professional pilots overalls) normally it has a weight of 1000-1400 g/m², a thickness of 1.2-1.6 mm and demonstrates an abrasion resistance according to EN 13595 Standard > 4 seconds (level 1). The Kangaroo Leather (used for professional motorcycling overalls) normally presents a weight of 800-1000 gr/m², a thickness of 0.8-1.2 mm and demonstrates an abrasion resistance according to EN 13595 Standard > 4 seconds (level 1) . It is noted that in all the circuits for speed races it is NOT allowed by the internal regulations clothing DIFFERENT from the leather. The leather, however, has the following disadvantages: non-breathable, not washable, not thermally insulating (during the fall pilots burned for heat that develops), flammable, non-water repellent, little comfortable compared to a fabric, not Eco-friendly.

Table 2 - Test results according to EN 13595-1: 2002 for bovine and kangaroo skin

EN 13595-1:2002 (Protective Clothing For Professional Motorcyclists)	Zone	Bovine / kangaroo skin
5.4 (Resistance to impact abrasion after 5 washes) (s)	1&2	4/6
	3	1,8/2,2
	4	1,8/2,2
5.5 (Resistance to impact cut after 5 washes) (mm)	1&2	16.5-22
	3	20-28
	4	20-28
5.6 (Resistance to impact burst after 5 washes) (Kpa)	1&2	500/1000
	3	500/1000
	4	500/1000

The research in this field is always aimed to providing fabrics that, while ensuring the essential protective effect, are as soft, elastic and breathable as possible in order to minimize unwanted effects when worn.

Following the aforementioned perspective, it was attempted to increasingly decrease the weight and thickness of the fabrics used, while maintaining the desired protective effect, an example is the motorcyclist clothing fabric described in the Italian patent application n. 102015000051902 in the name of the same Applicant, said fabric wherein the threads constituting the weft have a diameter equal to or different from that of the threads which constituting the warp and wherein the titre of said threads is between 100-700 dtex and possibly colored, coated or resined. In

particular, a fabric consisting of a weft wherein the number of superimposed threads is 10 (corresponding to a weft in which the number of overlapping wefts is 5) and a warp whose number of overlapping wefts is 20 (corresponding to a warp in which the number of overlapping threads is 10) is described, wherein the yarns are in high
5 tenacity polyester elasticized for the weft having a titre of 580 dtex(PL HT) and for the warp, in high-tenacity polyester, a titre of 240-280 dtex. Such a fabric had a weight equal to about 1000 g/m² and a thickness of about 1.8 mm. Such fabric has been certified in class 2 according to the current EN ISO 13595-2002 Standard: – PROTECTIVE CLOTHING FOR PROFESSIONAL MOTORCYCLIST; however,
10 despite wearability and comfort were better than leather; the weight and thickness of the fabric compared to leather garments currently widely used by professional motorcyclist constituted a limit.

The aforementioned Standard provides for 2 security levels, Class 1 and Class 2, where for Class 1 the values of abrasion on the CAMBRIDGE ABRASION
15 MACHINE (the instrument required by the Standard to perform the abrasion resistance test) must be greater than 4 seconds, for Class 2 the values must be greater than 7 seconds. This type of test results to be extremely aggressive towards the tested materials, therefore, to achieve the requisites required by the Standard it has been necessary to create materials with important weight and thickness such
20 that they result in heavy and not very comfortable clothes. The traffic laws does not impose the obligation, in any Community country, to wear protective clothing that respect that Standard during the non-professional driving of motorbikes and motorcycles. Reason why the future Standard pr EN 17092 will see 3 new levels of security less restrictive, to induce habitual motorcyclists to wear garments that
25 provide minimal protection in the event of an accident.

The aforementioned patent application on behalf of the same applicant was been an important step forward in terms of both safety and portability and comfort, but the market, in parallel with the new revision project of the EN ISO 13595 Standard proposed to the European Commission, requires materials that are increasingly
30 lighter and thin, but at the same time safe and resistant. The new project pr EN 17092 of the Standard proposed to the European Commission, establish that the levels of protection established by the Standard itself become 5, wherein the first 2

levels "A+A+A and A+A" are the most important and the established requirements remained the same as the two classes of protection of the current Standard, which we will call RACING requirements, while other 3 levels of protection for urban motorcycling have been proposed, which we will call URBAN requirements, with
5 lower parameters than Racing, just to look for to induce who habitually use the motorcycle, to wear protective clothing.

Our research then turned to a structural and targeted improvement of the products made to date, to make available to the market suitable materials and in line with current and future European directives.

10 Object of the present invention is therefore to provide a textile article which possesses requirements corresponding to ISO 13595:2002 and subsequent modifications but characterized by weights and thicknesses (a weight of less than 1000 g/m² and a thickness of less than 1.5 mm) such as to guarantee even softness and comfort for the making of protective clothing or (possibly with a weight less than
15 or equal to 1500 g/m² and a thickness less than or equal to 2.0 mm) for use as reinforcement materials for the further protection of the most exposed areas.

SUMMARY OF THE INVENTION

Subject of the present invention is a protective fabric according to claim 1.

Object of the present invention is also a coupled protective fabric according to claim
20 6.

In fact, it has been surprisingly found that the protective fabric according to the invention is an evolved, light, fine, extremely comfortable, soft and incredibly resistant textile article able to resisting abrasion, cutting and bursting, able to, in fact, satisfying widely all the parameters imposed by the future EN ISO 13595 Standard
25 for the RACING class, further increasing the already exceptional properties of resistance, elasticity, softness and flexibility on the final product, that make it an innovative and extremely safe material for the production of professional motorcyclist clothing with all the advantages of breathability and comfort that only a fabric can give.

30 As compared to the fabric described in Italian patent n. 102015000051902 on behalf of the same Applicant, the protective fabric coupled or not of the present invention has reduced weight and thickness of 20-25%, the thing is particularly striking in the

case of the coupled fabric being a 2-body coupled fabric. Moreover, the mechanical-physical resistances of the finished product were found increased in a considerable manner, so for example, in one coupled embodiment thereof, it has demonstrated an abrasion resistance according to EN 13595 Standard > 16 seconds.

- 5 The protective fabric coupled or not of the present invention also shows several other advantages because it can be colored in all the desired colors by using the normal staining methods, whether in fiber, in the piece or by printing.

The protective fabric coupled or not according to the invention is machine-washable, breathable, eco-friendly because completely recyclable, if desired it can be
10 elasticized.

If desired, the fabric coupled or not of the invention can be subjected to coating or resin treatment with the known products and used for this purpose, for example to make antacid, waterproof, fireproof a fabric, etc. The aforesaid characteristics allow a great ease of use and a fabric according to the invention can therefore be easily
15 used to manufacture protective clothing (PPE - Personal protective equipment), especially for motorcycling, (such as overalls, trousers, jackets, vests, coats, etc.) or to manufacture sportswear which also requires a considerable ability to protect the user using the normal cutting, sewing and making procedures that are used in the sector. It can also be utilized as a reinforcement material in exposed areas and
20 most at risk.

Object of the present invention is also a method for the preparation of a coupled fabric according to the invention, said method comprising the coupling of the upper layer to the lower layer by means of known traditional coupling techniques or by quilting (seam of the 2 layers).

25 BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 - shows the weft profile of an embodiment (comparative example 1) of a fabric according to the state of the art.

FIG. 2 - shows the weft profile of an embodiment (example 2) of a fabric according to the invention.

30 FIG. 3 - shows the weft profile of an embodiment (example 3) of a fabric according to the invention.

FIG. 4 shows the weft profile of an embodiment (example 4) of a fabric according to the invention.

FIG. 5 shows the weft profile of an embodiment (example 4) of a lower fabric according to the invention.

5 DETAILED DESCRIPTION OF THE INVENTION

Protective fabric according to the invention

The protective fabric according to the invention consists of a weft in which the number of superposed wefts is 2-4, even more preferably 2 or 4 and a warp in which the number of overlapped threads is 10-50, preferably 10-16, even more preferably
10 10.

Any type of weave can be used for the construction of the upper fabric according to the invention (for example, double, double-double-sided, triple, quadruple, six-fold, eight-fold, etc.) and furthermore also the ligation is of the known type which is normally used in this field, for example a ligation in lowered, in raised or a
15 combination of the two or by inversion of the warps or of the wefts may be used.

The weft threads are inserted into the warp according to traditional techniques using the looms usually used for the weaving of this type of articles.

The threads constituting the warp preferably have a titre of 200-300 dtex, more preferably 220-280 dtex. The threads constituting the warp are preferably composed
20 of 40-100 filaments, preferably 40-60 or 60-80 filaments. The threads constituting the warp are preferably twisted and optionally elasticized. Preferably according to the present invention the threads constituting the warp of the protective fabric according to the invention are polyester or polyamide filaments (for example nylon), preferably high tenacity, and optionally elasticized with elastomers of known type.

The threads constituting the warp are preferably twisted and optionally elasticized
25 polyester (PL) HT or polyamide (PA) HT threads. Even more preferably, the threads constituting the warp have a dtex of 230-275 dtex or 230-270 dtex and a weight composition of 85-95% of PA and 0-15% or 5-15% of elastomer (EA).

Preferably the threads constituting the weft of the protective fabric according to the
30 invention are chosen from the group consisting of:

polyester or polyamide filaments, possibly with high tenacity,
high molecular weight polyethylene (UHMWPE) threads such as dyneema®
or derivatives,
fiber threads made of liquid crystal polymers (LCP) such as vectran® or
5 vectran® derivatives,
para-aramid (AR) fiber threads such as kevlar® or derivatives,
polytetrafluoroethylene (PTFE) fiber threads such as Teflon® or derivatives,
or
a mixture of the aforementioned threads;
10 said parallel or twisted and optionally elasticized threads with elastomers of a known
type.

The threads constituting the weft preferably have a titre of 530-630 dtex, more
preferably 550-610 dtex. The threads constituting the weft are preferably composed
of 50-150 filaments, preferably 90-110 filaments. The threads constituting the weft
15 are preferably twisted and elasticized polyester (PL) HT threads. Even more
preferably, the threads constituting the weft have a dtex of 560-600 dtex and a
weight composition of 90-98% PL and 2-10% elastomer (EA).

The fabric according to the invention preferably has 20-200 threads per cm in weft,
more preferably 45-85, even more preferably 80, and 20-200 threads per cm in
20 warp, more preferably 45-85, even more preferably 65.

With the particularly preferred specifications described above, it has been possible
to prepare a fabric having a weight of about 400-900 g/m², preferably 600-800 g/m²
and a thickness of about 0.7-1.5 mm, preferably 1-1.4 mm, which it has resulted
being extremely comfortable, light and workable, in FIGURE 2 the weft profile of a
25 preferred embodiment of the protective fabric according to the invention is shown.

COUPLED FABRIC

The coupled protective fabric according to the present invention is preferably
comprised of only two layers; an upper fabric and a lower fabric.

Preferably, the upper layer is different from the lower layer.

30 The threads constituting the weft of the upper fabric have a different diameter and
composition from those of the threads constituting the warp;

Preferably, the threads constituting the lower fabric weft have the same diameter and composition to that of the threads constituting the warp.

Upper fabric

The upper fabric is constituted by a weft wherein the number of superimposed wefts is 2-20, more preferably 2-6, still more preferably 2, 4 or 5 and a warp wherein the number of overlapping threads is 10-50, preferably 10-16, even more preferably 10.

Any type of weave can be used for the construction of the upper fabric according to the invention (for example, double, double-double-sided, triple, quadruple, six-fold, eight-fold, etc.) and moreover also the ligature is of the known type which is normally used in this sector, for example you can use a ligature in lowered, in raised or a combination of the two or by inversion of the warps or of the wefts. The weft threads are inserted into the warp according to traditional techniques using the looms usually used for weaving of this type of articles.

The threads constituting the warp have a titer of 200-300 dtex, more preferably 220-280 dtex. The wires that constitute the warp are preferably composed of 40-100 filaments, preferably 40-60 or 60-80 filaments. The threads constituting the warp are preferably twisted and optionally elasticized. Preferably, according to the present invention, the threads constituting the warp of the upper fabric are polyester or polyamide filaments (for example nylon), preferably at high-tenacity, and optionally elasticized with known type elastomers. The threads constituting the warp are preferably twisted and optionally elasticized polyester (PL) HT or polyamide (PA) HT threads. Even more preferably, the threads forming the warp have a dtex of 230-275 dtex o 230-270 dtex and a weight composition of 85-95% of PA and 0-15% o 5-15% of elastomer (EA).

Preferably, the threads constituting the weft of the upper fabric are selected in the group consisting of:

- filaments of polyester or polyamide, possibly at high tenacity,
- high molecular weight polyethylene threads (UHMWPE) such as dyneema® or derivatives,
- liquid crystal polymer fiber (LCP) threads as for example vectran® or vectran® derivatives,

para-aramid fiber (AR) threads, as for example kevlar® or derivatives,
polytetrafluoroethylene fiber threads (PTFE) as for example Teflon® or
derivatives, or

a mixture of the above threads;

- 5 said parallel or twisting threads and optionally elasticized with known type elastomers.

The threads constituting the weft have a titre of 530-630 dtex, more preferably 550-610 dtex. The threads constituting the weft are preferably composed of 50-150 filaments, preferably 90-110 filaments. The threads constituting the weft are
10 preferably twisted and elasticized polyester (PL) HT threads. Even more preferably, the threads constituting the weft have a dtex of 560-600 dtex and a weight composition 90-98% of PL and 2-10% of elastomer (EA).

The upper fabric according to the invention preferably has 20-200 threads per cm in weft, more preferably 45-85, still more preferably 65, and 20-200 threads per cm in
15 the warp more preferably 45-85, even more preferably 65.

With the particularly preferred specifications described above, it was possible to prepare a upper fabric having a weight of about 400-800 gr/m², preferably 600 gr/m² and a thickness of about 0.7-1.3 mm, preferably 1.0 mm, which turned out to be extremely comfortable, light and workable, in FIGURE 4 is shown the weft profile of
20 a preferred embodiment of the upper fabric layer.

Lower fabric

Preferably, according to the present invention, the threads constituting the warp and the weft of the lower fabric are preferably the same and selected in the group consisting of

- 25 polyester or polyamide threads, preferably at high-tenacity,
high molecular weight polyethylene threads (UHMWPE), such as dyneema® or derivatives,

liquid crystal polymer fiber (LCP) threads such as vectran® or derivatives,
para-aramid fiber (AR) threads such as kevlar® or derivatives,
30 polytetrafluoroethylene (PTFE) fiber threads such as Teflon® or derivatives,
or

a mixture of the above threads,

said parallel or twisted threads and preferably elasticized with known type elastomers.

Preferably, the lower fabric consists of a simple canvas wherein the threads forming the warp are the same as the threads constituting the weft and alternate with drawing 1A - 1B and wherein both A and B are selected from the listed fibers above. Clearly, various alternations are possible with the design of threads A and B, the preferred one is 1A-1B, but other possible ones are 2A-2B, 3A-3B, 1A-2B, 2A-1B, etc.

More preferably, the yarn in A is polyester HT and the yarn in B is polyamide/UHMWPE in mixture, both yarns in A and B are elasticized.

Preferably, the weight composition of the yarn A is 90-98% of PL and 2-10% of elastomer (EA). Preferably, the weight composition of the yarn B is 40-50% of UHMWPE, 45-55% of PA and 5-10% of elastomer (EA).

The weft threads are inserted into the warp according to traditional techniques using the looms usually used for the weaving of this type of articles.

The weave preferably used is a simple canvas, as illustrated in the warp profile in FIGURE 5.

Preferably the threads titre constituting the weft and the warp is 100-700 dtex, more preferably 350-650 dtex, preferably 550-600 dtex for the yarn A and 420-480 dtex for the yarn B; the warp threads may be parallel but preferably are twisted and elasticized, while those of the weft may be indifferently twisted or parallel and elasticized.

The threads constituting the weft may have the same diameter as the threads constituting the warp or different diameter.

The lower fabric according to the invention preferably has 10 to 200 threads per cm in weft, more preferably 10-30, still more preferably 18-24, most preferably 22; and 10-200 threads per cm in the warp preferably 10-30, more preferably 18-24, even more preferably 22.

With the particularly preferred specifications described above, it had been possible to prepare a lower fabric having a weight of about 150-500 g/m², preferably 300 g/m² and a thickness of about 0.2-0.6 mm, preferably 0.4 mm, which was found to be extremely comfortable, light and workable and surprisingly resistant.

Coupling

In the coupled fabric according to the invention, the two upper and lower fabrics are coupled by means traditional coupling techniques known by the application between the two fabrics of an adhesive means or by quilting, seam between them, of the 2 layers. Among the known coupling techniques, polyurethane (PU) or reactive polyurethane (PUR) coupling, powder coupling, PU film or PL coupling, web coupling, latex coupling are preferred.

The aforesaid adhesive means (also called glue) can be applied by blade, by points or by hot transfer, preferably according to the present invention the selected coupling is reactive polyurethane (PUR) by points, as it allows to maintain exceptional properties of breathability, elasticity, softness without minimally altering the gluing power between the layers, with tightness and resistance to all environmental aging (high temperatures, low temperatures, acid sweat, alkaline sweat, water, etc.) to which the material is subjected.

Preferably, both the upper fabric and the lower fabric, before proceeding to the final phase of PUR by point coupling, preferably in quantities of 30-50 g/m², take advantage of a good preparation to eliminate all the stiffening agents present on the fibers applied in phase spinning, warping and weaving and possible impurities present in the fibers or collected during the previous workings.

Preferably then, to eliminate all impurities present in the fabric and favor the re-entry and fibers closure, which may also be about 25% in both directions if there is the preferred presence of an elastomer both in the weft and in the warp, both the upper and lower fabrics are purged in width, procedure carried out with water and addition of possible detergent soaps, at a temperature of about 90°C. After washing, the fabric must be dried and thermofixed, preferably with a passage carrying out drying in ramosa at a temperature of 165°C, speed of 25 m/min, then always in ramosa thermofixing at a temperature of 180°C, speed of 25 m/min. The thermofixing serves to give permanent stability for all subsequent procedure (coupling, dyeing, printing, finishing, industrial washing or domestic washing, etc.). After the thermofixing we proceed with the equalization, a rolling operation with application of steam, to homogenize the surface and to make recover softness to the fabric, hardened and strain hardened by the thermofixing.

If the upper fabric and/or the lower fabric contain UHMWPE yarns (for example Dyneema®), the drying and thermofixing phase must be carried out in tumbler, the industrial equivalent of the domestic dryer, which works at temperatures below 100°C, but which performs an important mechanical action given by the centrifugation basket, which determines the maximum re-entry of the fibers, to obtain the same results in terms of dimensional stability of the ramosa. For fabrics in which dyneema® fiber (UHMWPE) is present tumbler drying is required because above 110°C said fiber starts to soften and then melts, completely losing the characteristics that make it one of the most resistant fibers to abrasion, cut and tear on the market. This operation in tumbler is more expensive and long compared to the thermofixing in ramosa, reason why, if not forced by technical reasons, it is preferably avoided.

Once the 2 fabrics have been prepared as described above, we can proceed with the reactive polyurethane (PUR) coupling to point.

This procedure is preferably carried out on cold, on a machine where the thermoplastic PUR is dissolved from the pressure plate heated to about 115°C (accessory external to the machine) and pushed through a pump to the micro-perforated cylinder for application on the fabrics. Immediately after the application of the glue, the 2 coupled fabrics are crushed by a calender which applies a pressure of about 2.5 tons and immediately rolled up to form a large roll, which remains stationary to cross-link in a heated environment where the temperature must never fall below 15°C (limit temperature which crystallizes the PUR rendering it ineffective). The cross-linking time depends on the external temperature, at 20°C 24 h of cross-linking are enough (the minimum time below which it can not be lowered), below 20°C the cross-linking time proportionally extends it with the decrease the temperature itself.

The advantage of this type of coupling is that once the cross-linking is completed, the PUR does not go back any more, neither with high nor with low temperatures, and gives a permanent seal to all the expected environmental aging and to all the domestic and industrial washings.

The present invention can be better understood in the light of the following embodiment examples.

EMBODIMENT EXAMPLES

EXAMPLE 1 (COMPARATIVE) - PROTECTIVE FABRIC

A fabric has been reproduced as described in the Italian patent application n. 102015000051902.

5 Warp yarn

Polyester (PL) HT 275 dtex 48 filaments 400 Z twists

Weft yarn

96 Polyester (PL) HT filaments 550 dtex arranged in a spiral pattern (330 twists per meter, TPM) around a 78 dtex elastomer (EA)

10 94% Polyester (PL) HT 550 dtex + 6% elastomer (EA) 78 dtex

Final titre 580 dtex

The fabric has been realized on looms usually used for the weaving of this type of articles, applying a multiple weave (double double-face) of 10 threads superimposed in the warp and 5 wefts superimposed in the weft as shown in figure 1.

15 The resulting fabric has a warp reduction of 70 threads/cm $\pm$ 5% and a weft reduction of 96 threads/cm $\pm$ 5%, a weight of 1000 g/m² and a thickness of 1.80 mm and has shown an abrasion resistance according to EN 13595 > 8 seconds (level 2).

The fabric is elasticized, machine washable, breathable, completely recyclable, can be dyed and printed in any color, you can make it waterproof, windproof, fireproof etc.

20

EXAMPLE 2 - PROTECTIVE FABRIC

Warp yarn

Polyester (PL) HT 275 dtex 48 filaments 400 Z twists

Weft yarn

25 96 Polyester filaments (PL) HT 550 dtex arranged in a spiral pattern (330 twists per meter, TPM) around a 78 dtex elastomer (EA)

94% Polyester (PL) HT 550 dtex + 6% 78 dtex elastomer (EA)

Final titre 580 dtex

30 The upper fabric has been made on looms usually used for the weaving of this type of articles, applying a multiple weave (double double-sided) of 10 threads superimposed in the warp and 5 wefts superimposed in the weft as shown in figure 2.

The resulting fabric has a warp reduction of 70 threads/cm $\pm 5\%$ and a weft reduction of 80 threads/cm $\pm 5\%$, a weight of 800 g/m² and a thickness of 1.40 mm and has shown a abrasion resistance according to EN 13595 > 5 seconds (level 1).

The fabric is elasticized, machine washable, breathable, completely recyclable, can be dyed and printed in any color, you can make it waterproof, windproof, fireproof etc.

EXAMPLE 3 - PROTECTIVE FABRIC

Warp yarn

Polyester (PL) HT 275 dtex 48 filaments 400 Z twists

10 Weft yarn

96 Polyester (PL) HT filaments 550 dtex arranged in a spiral pattern (330 twists per meter, TPM) around a 78 dtex elastomer (EA)

94% Polyester (PL) HT 550 dtex + 6% 78 dtex elastomer (EA)

Final titre 580 dtex

15 The fabric has been realized on looms usually used for weaving this type of article, applying a multiple (double) weave of 10 threads superimposed in the warp and 2 wefts superimposed in the weft as shown in Figure 3 with ligature in lowered.

The resulting fabric has a warp reduction of 70 threads/cm $\pm 5\%$ and a weft reduction of 62 threads/cm $\pm 5\%$, a weight of 600 g/m² and a thickness of 1.1 mm and shown an abrasion resistance according to EN 13595 > 4 seconds (level 1).

The fabric is elasticized, machine washable, breathable, completely recyclable, can be dyed and printed in any color, you can make it waterproof, windproof, fireproof etc.

EXAMPLE 4 - PROTECTIVE FABRIC

25 Warp yarn

68 filaments of Polyamide (PA) HT 220 dtex arranged in a spiral around an elastomer (EA) of 78 dtex

91% Polyamide (PA) HT 220 dtex + 9% elastomer (EA) 78 dtex

Final titer 250 dtex

30 Weft yarn

96 filaments of Polyester (PL) HT 550 dtex arranged in a spiral (330 twists per meter, TPM) around an elastomer (EA) of 78 dtex

94% Polyester (PL) HT 550 dtex + 6% elastomer (EA) 78 dtex

Final titer 580 dtex

The fabric has been made on looms usually used for the weaving of this type of articles, applying a multiple weave of 2 superimposed threads in the weft and 10 superimposed threads in the warp as shown in figure 4 with ligature in up.

The resulting fabric has a warp reduction of 65 threads/cm $\pm 5\%$ and a weft reduction of 65 threads/cm $\pm 5\%$, a weight of 600 g/m² and a thickness of 1.00 mm and demonstrated an abrasion resistance in accordance with EN 13595 < 4 seconds.

The fabric is elasticized, machine washable, breathable, completely recyclable, can be dyed and printed in any color, you can make it waterproof, windproof, fireproof etc.

Table 3 - Test results according to EN 13595-1: 2002 for the fabrics of the invention according to examples 1-4

EN 13595-1:2002 (Protective Clothing For Professional Motorcyclists)	Zone	Ex.1 (COMP)	Ex.2	Ex.3	Ex.4
5.4 (Resistance to impact abrasion after 5 washes) (s)	1&2	8.2	5.4	4.1	3.5
	3	8.2	5.4	4.1	3.5
	4	8.2	5.4	4.1	3.5
5.5 (Resistance to impact cut after 5 washes) (mm)	1&2	18.2	24.8	25	n.d.
	3	13.3	16.5	20	n.d.
	4	13.3	16.5	20	n.d.
5.6 (Resistance to impact burst after 5 washes) (Kpa)	1&2	>1200	>1200	>1200	n.d.
	3	>1200	>1200	>1200	n.d.
	4	>1200	>1200	>1200	n.d.

15 EXAMPLE 5 - COUPLED FABRIC

UPPER FABRIC

The upper fabric is constituted by a protective fabric according to the invention, in particular coupled protective fabrics have been realized in which the upper fabric is constituted by the fabric according to examples 1 and 4.

20 LOWER FABRIC

Yarn A of warp and weft

96 filaments of Polyester (PL) HT 550 dtex arranged in a spiral (330 twists per meter, TPM) around an elastomer (EA) of 78 dtex

94% Polyester (PL) HT 550 dtex + 6% elastomer (EA) 78 dtex

Final titer 580 dtex

Yarn B of warp and weft

130 filaments of UHMWPE (Dyneema®)/ Polyamide (PA) arranged in a spiral
5 around an elastomer (EA) of 78 dtex

44% UHMWPE + 48% PA + 8% EA

Final titer 450 dtex

The lower fabric has been made on looms usually used for weaving this type of articles, applying a simple canvas weave and inserting the yarns A and B to design

10 1A - 1B as shown in figure 2.

The resulting lower fabric has a warp reduction of 22 threads/cm and a weft reduction of 22 threads/cm, a weight of 300 g/m² and a thickness of 0.40 mm.

Coupling

The upper fabric is purged in width, operation carried out with water and addition of
15 possible detergent soaps, at a temperature of 90°C, to eliminate all impurities present in the fabric and favor the re-entry and closure of the fibers, that in this case can be very high thanks to the preferred presence of the elastomer both in the weft and in the warp, about 25% in both directions, after washing it is dried with a passageway in ramosa at a temperature of 165°C, speed of 25 m/min, then always
20 in ramosa it is thermofixed at a temperature of 180°C, a speed of 25 m/min, to give permanent stability for all subsequent procedures (coupling, dyeing, printing, finishing, industrial washing or domestic washing, etc.); after thermofixing, proceed with the equalization, a roll-up operation with application of steam, to homogenize the surface and allow the fabric to recover soft, hardened and strain hardened by
25 the thermofixing.

The lower fabric is purged in width exactly as described above for the upper fabric, but the drying and thermofixing phase is carried out in tumbler, the industrial equivalent of the domestic dryer, which works at temperatures below 100°C, but with a important mechanical action given by the centrifuge basket, which determines
30 the maximum re-entry of the fibers, to obtain the same results in terms of dimensional stability of the ramosa. For this fabric tumbler drying is required when the dyneema® fiber (UHMWPE) is present inside the fabric, because above 110°C

it starts to soften and then melts, completely losing the characteristics that make it one of the fibers more resistant to abrasion, cut and tear on the market. This operation is more expensive and lengthy compared to the thermofixing in ramosa, reason why, if not required for technical reasons, it is preferably avoided.

- 5 Once the 2 tissues have been prepared as described above, we can proceed with reactive polyurethane (PUR) coupling by point using an amount of PUR equal to 30-50 g/m².

This operation is carried out on cold, on a machine where the thermoplastic PUR is melted from the pressing plate heated to about 115°C (accessory external to the machine) and pushed by a pump to the micro-perforated cylinder for application on the fabrics, immediately after the application of the glue, the 2 coupled fabrics are crushed by a calender that applies a pressure of about 2.5 tons and immediately rolled up to form a large roll, which remains stationary to cross-link in a heated environment where the temperature must never fall below 15°C (limit temperature that crystallizes the PUR making it ineffective), the cross-linking time depends on the external temperature, at 20°C 24 h of cross-linking is enough (the minimum time below which it cannot be lowered), below the 20°C the cross-linking time proportionally lengthens with decreasing temperature.

15 The resulting coupled fabric has, in the case of coupling with upper fabric as ex. 4, a weight of less than 1000 g/m² and a thickness of less than 1.5 mm and has demonstrated an abrasion resistance according to EN 13595 Standard >16 seconds.

Table 4 - Test results according to EN 13595-1:2002 coupled fabrics realized with upper fabric as in ex. 1 and 4

EN 13595-1:2002 (Protective Clothing For Professional Motorcyclists)	Zone	Coupled es.1	Coupled es.4
5.4 (Resistance to impact abrasion after 5 washes) (s)	1&2	12	16.6
	3	12	16.6
	4	12	16.6
5.5 (Resistance to impact cut after 5 washes) (mm)	1&2	12.3	19.3
	3	6	11.5
	4	6	11.5
5.6 (Resistance to impact burst after 5 washes) (Kpa)	1&2	>1200	>1200
	3	>1200	>1200
	4	>1200	>1200

The fabric is elasticized, machine washable, breathable, completely recyclable, can be dyed and printed in any color, you can make it waterproof, windproof, fireproof etc.

CLAIMS

1. A protective fabric consisting of:
 - wires in the warp having titre 200-300 dtex;
 - wires in the weft having titre 530-630 dtex;

5 and having a multiple weave in which in weft the number of overlapping wefts is 2-4, and in the warp the number of overlapping threads is 10-50;

said wires consisting of 10-250 twisting or parallel filaments;

said optionally elasticized threads.
- 10 2. The protective fabric according to claim 1, in which in weft the number of overlapping wefts is 2 or 4, and in the warp the number of overlapping threads is 10-16
3. The protective fabric according to claim 1 or 2, in which:
 - the warp threads are made of polyester HT or polyamide HT, optionally elasticized;

15 the weft threads are made of polyester HT, preferably elasticized.
4. The protective fabric according to any one of claims 1-3 having 20 to 200 threads/cm in the weft, preferably 45-85, and 20-200 threads/cm in the warp, preferably 45-85;
5. The protective fabric according to any one of claims 1-4 having a weight less

20 than 1000 g/m² and a thickness of less than 1.5 mm.
6. A coupled protective fabric comprising at least 2 coupled fabrics:
 - an upper fabric is consisting of:
 - warp threads having titre 200-300 dtex;
 - weft threads having titre 530-630 dtex.

25 said wires consisting of 10-250 twisting or parallel filaments;

said optionally elasticated wires;

and having a multiple weave in which in weft the number of overlapping wefts is 2-20, preferably 2-6, and in the warp the number of overlapping threads is 10-50, preferably 10-16; and

30 a lower fabric;

wherein

the lower fabric is the same to the upper fabric

or the lower fabric is different to the upper fabric and then the threads constituting the weft of the lower fabric have the same or different diameter from that of the threads that constituting the warp;

the threads that constitute the weft of the lower fabric have a composition that
 5 is the same or different from that of the threads that constitute the warp;

the titre of said threads is from 100 to 700 dtex;

for the lower fabric the weave is such that the number of threads superimposed in the weft is 1-20 and the number of threads superimposed in the warp is 1-50;

10 the composition of said threads is selected from the group consisting of polyester or polyamide optionally with high tenacity (HT), high molecular weight polyethylene (UHMWPE), liquid crystal polymer fiber (LCP), para-aramid fiber (AR), fiber of polytetrafluoroethylene (PTFE) or mixtures thereof;

said threads composed of 10-250 twisted or parallel filaments;

15 said threads optionally elasticized.

7. The coupled protective fabric according to any one of the claims 6, consisting of 2 coupled fabrics wherein

the upper fabric is according to any one of claims 1-5.

8. The coupled protective fabric according to claim 6, consisting of 2 coupled
 20 fabrics wherein

the lower fabric has a simple plain weave in which the threads constituting the warp are the same as the threads constituting the weft.

9. The coupled protective fabric according to any one of claims 6-8, wherein in the lower fabric the threads forming the warp are alternated with drawing 1A
 25 - 1B and in which the titre of the threads constituting the weft and the warp is 100 -700 dtex, preferably, 350-650 dtex.

10. The coupled protective fabric according to claim 9, wherein;

the yarn in A is HT polyester having a titre of 500-600 dtex; and

the yarn in B is polyamide/UHMWPE in a mixture having a strength of 420-
 30 480 dtex,

both yarns in A and B are elasticized.

11. The coupled protective fabric according to any one of the claims 6-10, wherein
the lower fabric has 10-200 threads/cm in the weft, preferably 10-30; and 10-200 threads/cm in the warp, preferably 10-30.
- 5 12. The protective fabric according to any one of Claims 6-11 having a weight less than or equal of 1500 g/m^2 , preferably less than 1000 gr/m^2 and a thickness less than or equal to 2.0 mm, preferably less than 1.5 mm.
- 10 13. Use of a protective fabric according to any one of the claims 1-12 for the tailoring of protective clothing (PPE) resistant to abrasion, cutting and bursting, preferably protective clothing for motorcyclists (PPE).
14. Protective clothing (PPE) resistant to abrasion, cutting and bursting, said clothing comprising a protective fabric according to any one of the claims 1-12.

FIG. 1

Protective fabric weft profile of example 1

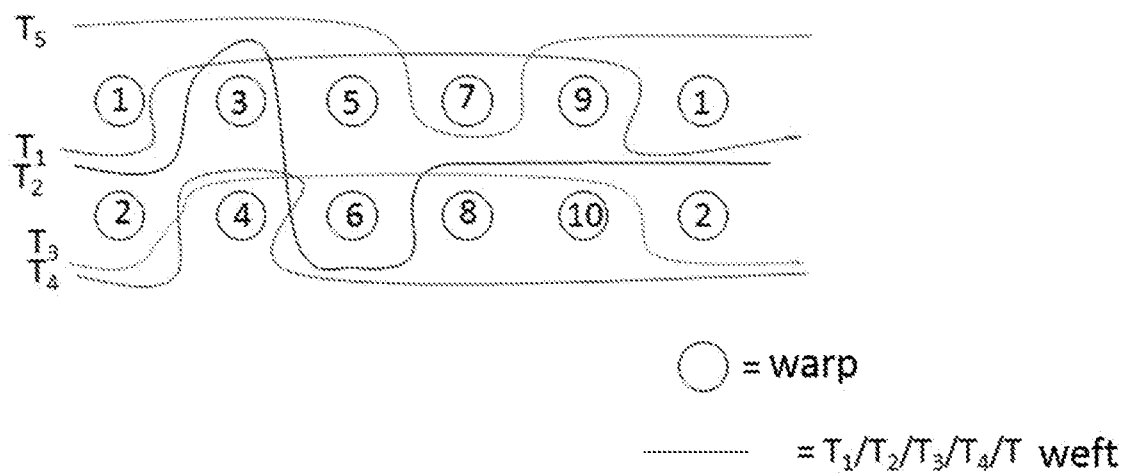


FIG. 2

Protective fabric weft profile of example 2

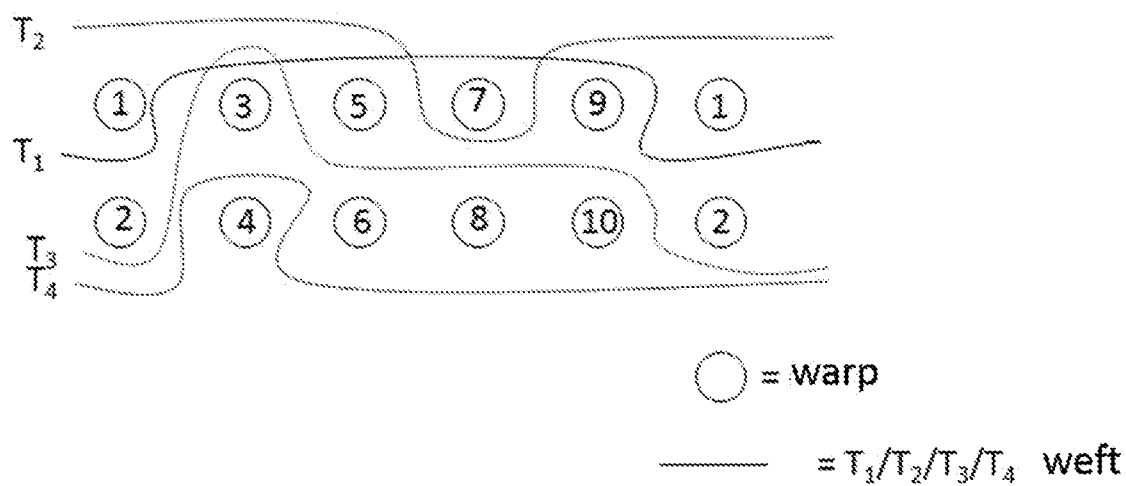


FIG. 3

Protective fabric weft profile of example 3

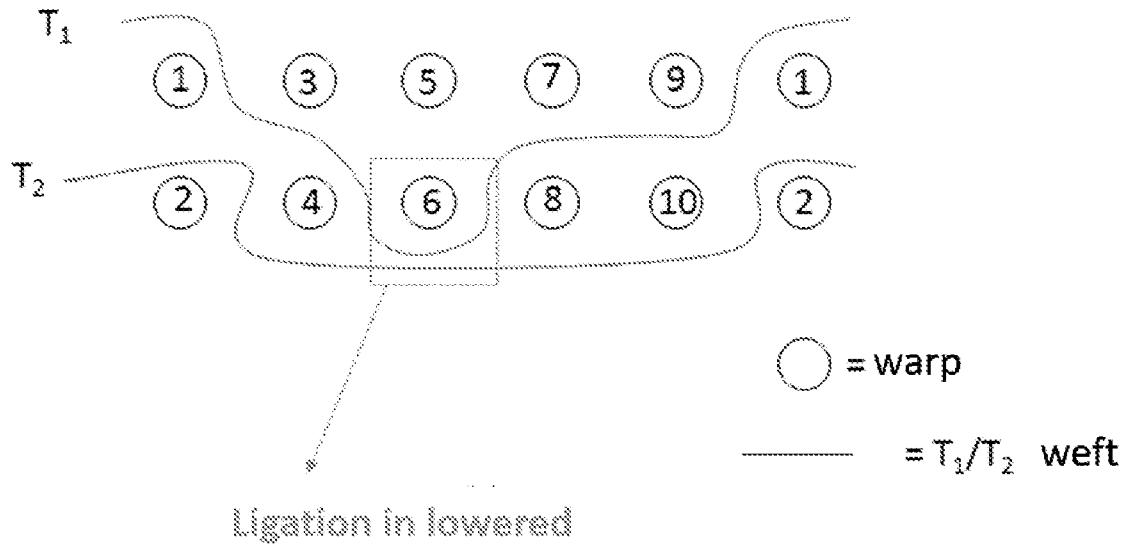


FIG. 4

Fabric warp profile of example 4

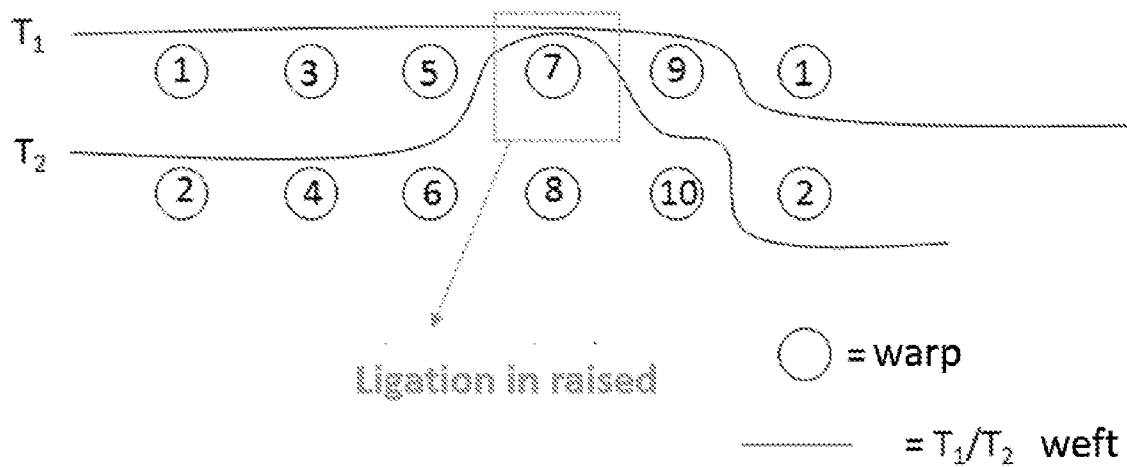
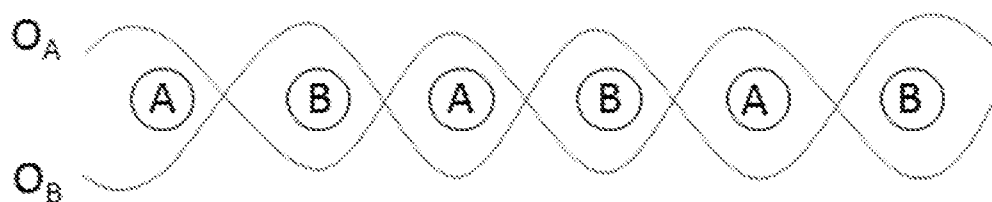


FIG. 5

Lower fabric warp profile

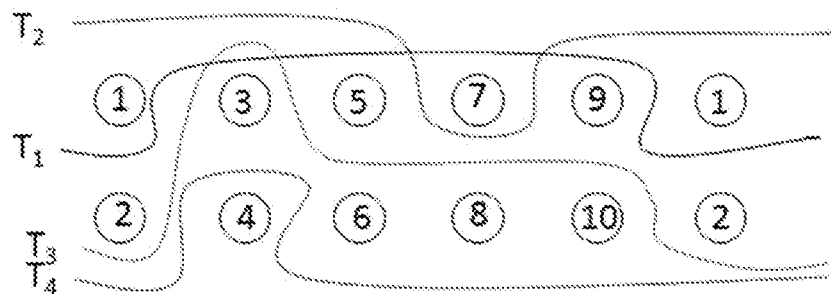


○ = Weft A/B

———— = Warp O_A/O_B

FIG. 2

Protective fabric weft profile of example 2



○ = warp

— = $T_1/T_2/T_3/T_4$ weft