(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
20 April 2006 (20.04.2006)

PCT

(10) International Publication Number
WO 2006/040679 A2

(51) International Patent Classification: Not classified

(21) International Application Number:
PCT/IB2005/003228

(22) International Filing Date: 11 October 2005 (11.10.2005)

(25) Filing Language: Italian

(26) Publication Language: English

(30) Priority Data:
PO2004A0005 14 October 2004 (14.10.2004) IT

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

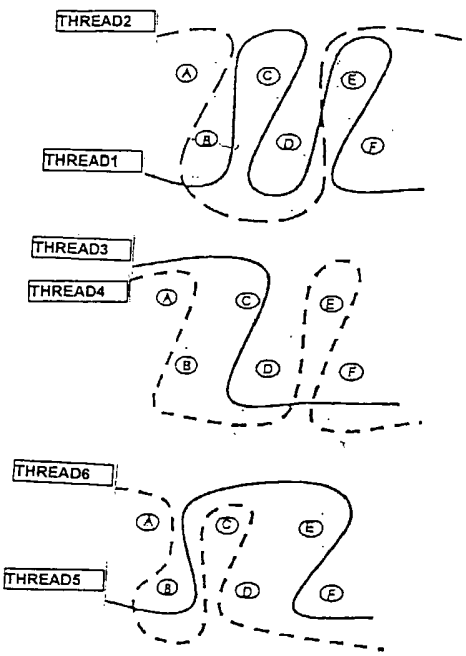
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) **Title:** ANTI-PERFORATION INSOLE FOR FOOTWEAR



(57) **Abstract:** An anti-perforation insole (1) includes a multi-layer (10) consisted of at least four layers of a fabric (12), with a double-faced weft, made of high toughness polyester fibers coupled together by a thermoplastic film or an adhesive resin; each of the layers of fabric shows a surface treated by a coating (14) of polyurethane and/or acrylic resin enriched with micronized, ceramic: materials in form of silicates, for example of aluminium.

WO 2006/040679 A2

ANTI-PERFORATION INSOLE FOR FOOTWEAR

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DESCRIPTION

The present invention relates to an anti-perforation insole for footwears and, in particular, an anti-perforation insole made of a textile material especially suitable for the use in the manufacturing of accident-prevention footwears with Strobel technique.

Anti-perforation insoles made of a textile material are shown, among others, in US 6368989 (relating to a multilayer in exclusively aramidic fibers) and WO 00/41583 (relating to a multilayer including at least a layer with high energy absorption ability in poly-nornbornene).

The same Applicant is the owner of the pending patent applications for invention No. PO2003A000005 and PCT/IT/2004/000208 relating to multilayered textile structures resistant to the perforation, wherein high toughness aramidic and non aramidic fibers are used and the single layers show a surface ceramic treatment.

Also ballistic protections are known, wherein multilayered textile structures are employed, which are however conceived in order to resist to the violent impact of a bullet and not to the penetration of nails

(the EN 12568 regulation foresees that an anti-perforation insole resists to a force of at least 1.100 N exerted by a nail advanced at the speed of 10 mm/min. ± 3 mm/min.).

The aim of the present invention is to provide an anti-perforation insole which is exclusively made in a non aramidic textile material and which, also being resistant to the penetration of a nail in accordance with the regulation in force, can be sewn to the upper of a footwear manufactured with Strobel technique.

Said aim is attained with an insole including at least four, and preferably five, layers of fabric with a double-face weft of high toughness polyester fibers, wherein each layer shows a ceramic surface treatment and the layers are coupled together through thermoplastic films or adhesive resins.

In particular, the fabric shows a face with a weave of the derived spine-type and a face with a weave of the derived satin-type.

The surface ceramic treatment is carried out through smearing with a polyurethane and/or acrylic resin enriched with powders of hard and abrasive materials, preferably micronized ceramic materials in form of silicates, for example of aluminium.

Among the advantages obtained with an insole according

to the invention, there is the fact that the double-faced fabric employed shows a high density of yarns (in particular of weft) and a very compact structure. In particular, in view of the superposition of the warp and weft yarns, the tip of a nail, not finding openings between the yarns among which it can penetrate, always meets the resistance of the yarn. The coating of silicates-based poliurethane further determines the blocking therebetween of the warp and weft yarns and the compacting of the structure, by also contributing to the obstruction of the interfibrous and intrafibrous interstices.

An insole according to the invention further shows the advantage of being able to be used in the manufacturing of accident-prevention footwears made with the Strobel technique.

These and further advantages of the invention will result apparent, together with the technical features, from the following detailed description of a non limiting example of embodiment.

In the drawings:

- Fig. 1 diagramatically shows a sectional view of an insole according to the invention;
- Fig. 2 shows the interlock ratio of the fabric used for the execution of the insole of Fig. 1;

- Fig. 3 diagramatically shows the warp profile of the fabric of Fig. 2;
- Fig. 4 diagramatically shows the insole of Fig. 1 sewn to the upper of an accident-prevention footwear manufactured with Strobel technique.

Referring to the Figures 1-3, an anti-perforation insole 1 according to the invention includes a multilayer 10 consisted of at least four layers of a fabric 12, with a double-face weft, made of high toughness polyester fibers, coupled together through a thermoplastic film or an adhesive resin. Each of the fabric layers shows a surface treated by means of a coating 14 (shown in Fig. 1 with enlarged thickness with respect to the reality) of polyurethane and/or acrylic resin enriched with micronized ceramic materials in form of silicates, for example of aluminium.

For a more effective protection, it is preferable to use five layers of fabric 12 having the coating 14.

The surface layer of the multilayer 10 constituting the insole 1 preferably shows the higher face (the one intended for being faced inwardly the footwear) which is not treated for a better comfort of the user.

Advantageously, as it can be seen from Fig. 1, the used fabric shows a face with a heavy opposed spine-type weave and a face with a weave of the derived

satin-type.

Surprisingly, it has been detected that by using the fabric and the coating above described, it is possible to carry out an exclusively textile effective structure, which resists to the perforating action of a nail, only using high toughness non-aramidic fibers, and therefore much more economic.

In particular, for an insole according to the invention, it is advantageous to use 1100 dtex polyester yarns, with a toughness of 67,5 - 80 cN/dtex, in a number of 22 ± 2% per cm. for the warp and 29 ± 2% per cm. for the weft.

The used weaves allow to carry out fabrics with yarns very close together, by making the structure of the same very bound for being able to already afford, per se, a quite good resistance to the penetration, still maintaining a high flexibility.

In particular, the composite weave used for the fabric in polyester fibers has proved particularly effective in the execution of the multilayer 10.

The coupling between the layers of fabric can occur by hot calendering and by means of thermoplastic films (or adhesive resins) interposed between the layers of the structure. The finished insole shows a limited thickness (about 3 mm.) and an adequate flexibility.

The tests carried out shown, in fact, the conformity of an insole (including 5 layers of fabric with a surface ceramic treatment) in conformity of the invention to the EN12568, ISO EN20344, ANSI Z41 and CSA regulations.

In Fig. 4 an insole 1 is shown, according to the invention, sewn according to the Strobel technique to the upper 20 of an accident-prevention footwear, equipped with a metal tip 22.

The invention thus conceived is susceptible of various modifications and variations, all lying within the ambit of the inventive concept. Furthermore, all the details can be replaced by technically equivalent elements.

CLAIMS

1. Anti-perforation insole for footwears, characterized in that it includes a multilayer consisted of at least four layers of fabric, with a double-face weft, made of high toughness polyester fibers coupled together through thermoplastic films or adhesive resins, each of the layers of fabric showing a surface treated by smearing of polyurethane and/or acrylic resin enriched with micronized ceramic materials in form of silicates.

2. Insole according to claim 1, characterized in that said layers of fabric are in a number of five.

3. Insole according to claim 1 or 2, characterized in that the surface layer of said multilayer preferably shows the higher face, intended for being faced inwardly the footwear, which is not treated.

4. Insole according to one of the preceding claims, characterized in that said fabric shows a heavy face with a heavy opposed spine type wave and a face with a weave of the derived satin-type.

5. Insole according to one of the preceding claims, characterized in that for said fabric, 1100 dtex polyester yarns, with a toughness of 67,5 - 80 cN/dtex, in a number of 22 ± 2% per cm for the warp and 29 ± 2% per cm for the weft are used.

6. Use of an anti-perforation insole, according to one of the preceding claims, as a protective insert within insoles of accident-prevention footwears.

7. Use of a perforation-resistant textile structure, according to one of the claims 1 to 5, in the manufacturing of footwears wherein the sole is directly executed on the upper by injection molding, as an insole previously sewn to the upper of the footwear.

8. Insole according to one of the preceding claims, substantially as above-mentioned and described, with reference to the enclosed drawings.

FIG. 1

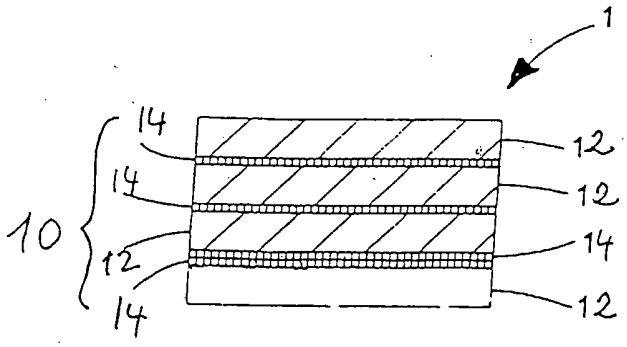
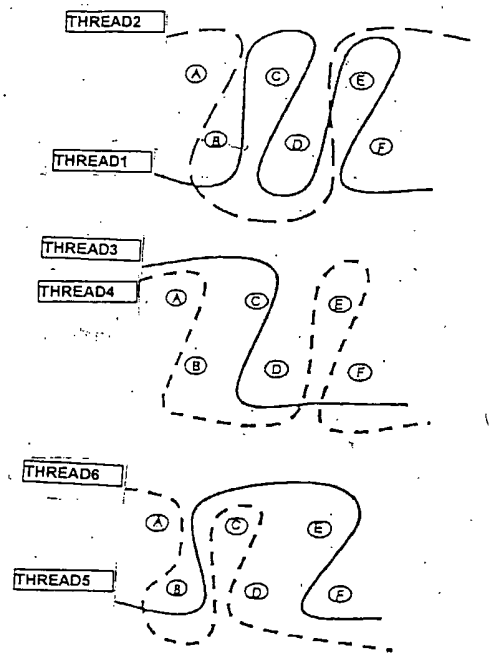


FIG. 3



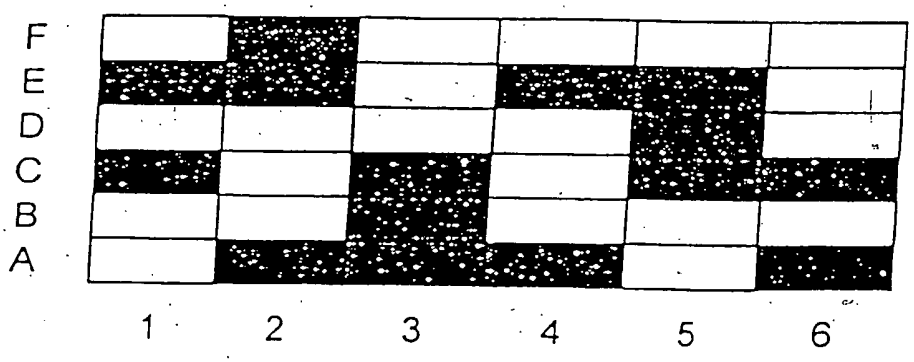


FIG. 2

FIG 4