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(56) Documents Cited:
WO 2011/050257 A1 WO 2008/075505 A1
JP 2005154974 A US 4927698 A
US 4868041 A US 20040152378 A1

(58) Field of Search:
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TXTKRT, TXTUS0-5, TXTWO1, TXTWOT

(54) Title of the Invention: Fire resistant textile material
Abstract Title: Fire resistant textile material

(57) A fire resistant textile material for garments comprises a woven twill comprising polyparaphenylene isophthalamide fibres and a blend of cellulose fibres and wool fibres. The polyparaphenylene isophthalamide fibres may be a meta aramid such as Nomex and is preferably 95% Nomex 3% Kevlar and 2% antistatic (P 140) fibres. The cellulose fibres may be manufactured from wood pulp treated with a fire retardant such as Lenzing. The wool fibres may be shrink resistant. The fabric may have a weight of 200-300g/m². The preferred weaving plan is shown in Figure 1.

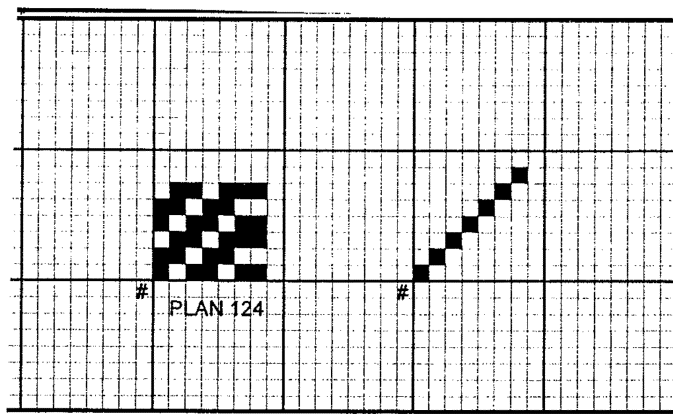


Figure 1

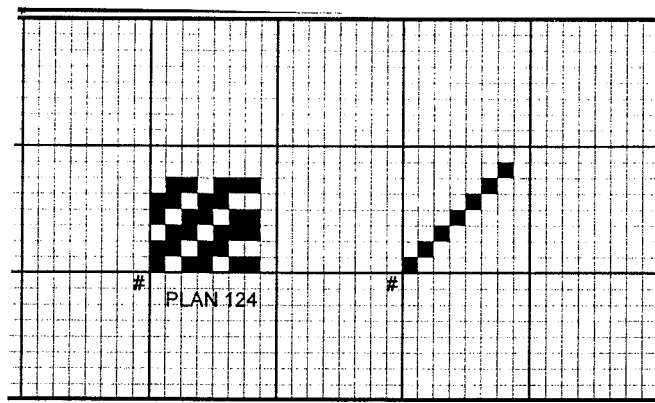


Figure 1

FIRE RESISTANT TEXTILE MATERIAL

This invention relates to fire resistant textile materials and garments made from these materials. The invention relates particularly but not exclusively to articles of clothing for use by fire fighters and for textiles for manufacture of such clothing.

European legislation requires employers to provide garments which protect their employees against hazards to which they may be exposed. Clothing for protection against heat and flame must pass minimum performance requirements for flame, radiant heat, heat resistance, tensile and tear strength, abrasion resistance and penetration by water and liquid chemicals. The assembled garments must achieve levels of resistance to heat transfer by both flame and radiant heat.

One of the most effective ways to reduce second and third degree burns is to make sure that the barrier of protective clothing between the heat source and the skin remains intact during exposure. This is referred to as the break open resistance or non-break open protection.

US 6699802 discloses a fire resistant textile material comprising a woven face fabric composed of meta-aramid fibres including a woven mesh of low thermal shrinkage fibres, for example para-aramid fibres.

An object of the present invention is to provide a fire resistant textile material with reduced weight, increased drape and improved comfort in use.

According to the present invention a fire resistant textile material is composed of a woven twill comprising:

polyparaphenylene isophthalamide fibres; and
a blend of cellulose fibres and wool fibres.

The cellulose/wool blend is predominantly located on the back surface or back area of the fabric.

A preferred polyparaphenylene isophthalamide (meta-aramid) is Nomex (Registered Trade Mark). A particularly preferred fibre comprises 95% Nomex, 3% Kevlar and 2% antistatic (P 140) fibres.

5 A preferred meta-aramid fibre may comprise polyparaphenylene isophthalamide eg Nomex (Registered Trade Mark). Alternative meta-aramid fibres may comprise polybenzimidazole (PBI), polybenzobisoxazole (PBO) or blends thereof.

10 A preferred cellulose fibre is a fire retardant cellulose fibre. These may be manufactured from wood pulp treated with a fire retardant, for example Lenzing FR. 2.2 Decitex fibres are preferred.

15 Preferred wool fibres are 20.8 μm shrink resistant wool fibres. The blend may comprise from 25% wool and 75% cellulose to 75% wool and 25% cellulose, preferably about 50% wool and 50% cellulose.

A fabric may comprise a 2 x 1 ripstop twill having a warp comprising meta-aramid eg Nomex eg Nomex 111 with a warp count of Nm 60/2.

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In a preferred fabric the weft may comprise a wool-cellulose blend with a weft count of Nm 60/2 and Nm 40/2/2 Nomex, with maximum weft mixing.

25 Use of a 2 x 1 twill allows an excess of Nomex warp to be provided on the fabric face. A ripstop is provided in the warp & weft combination.

30 Double twisted yarns may be employed. The warp may have a yarn count in the range of Nm 20/2 to 100/2, preferably Nm 30/2 to 80/2, more preferably Nm 40/2 to 60/2, especially Nm 60/2. When using Nm 60/2 the number of warp ends may be 4500 to 5600, typically 5168.

A preferred fabric weight may be 200 to 300, typically 240g/m².

A weaving plan is shown in Figure 1.

A fabric in accordance with the present invention confers several advantages. The water absorbing properties of wool combined with excellent working properties of the cellulose fibres ensures transfer of moisture away from a wearer's skin. The moisture is retained by the buffering effect of the wool before evaporation to maintain cool and dry wearing conditions of use of Lenzing (FR) and wool affords excellent thermal protection with break open protection provided by the meta-aramid fibres. Wool also provides inherent antimicrobial and antistatic properties to make the garment comfortable even after prolonged wearing.

Thermal regulation is improved in warm dry conditions due to the unique blend of wool / Lenzing and para-aramid fibres. The natural hydrophilic properties of wool facilitate vapour or moisture desorption in low relative humidity climates. The hydrophilic properties of Lenzing fibres serves to push moisture away. The fabric therefore acts as a heat exchanger and regulator.

The unique blend of the fibres and yarns gives the fabric a breathable buffer and a thermal barrier properties which assist in keeping the wearer comfortable and avoids a liability to suffer from heat fatigue.

The primary use of the fabric is a moisture management system coupled with a barrier to both radiant and convective heat extreme, for example during wildland fire fighting.

Tear Strength is increased due to the unique network of meta aramid fibres (which may be referred to as "tram lines") acting as strengthening support beams in the fabric structure and making it more durable.

When the face of the fabric is exposed to extreme heat and a consolidation occurs due to the nature of the aromatic fibres the heavier weft yarns (tram lines) act as a support to the fabric not only in providing dimensional stability but assists in the crimping effect of the structure thus getting volume into the structure. This property creates an increase in the thermal barrier protection by absorbing some of the energy on exposure and has less surface contact with the wearer.

During thermal decomposition of a surface layer water is released.

5 This may be dissolved by the underlying wool fibres. Evaporation of this moisture may enhance thermal protection of a user's skin.

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CLAIMS

1. A fire resistant textile material comprising a woven twill comprising:
polyparaphenylene isophthalamide fibres; and
5 a blend of cellulose fibres and wool fibres.
2. A fire resistant textile material as claimed in claim 1, wherein the cellulose/wool blend is predominantly located on a back surface of the fabric.
- 10 3. A fire resistant textile material as claimed in claim 1 or 2, wherein the polyparaphenylene isophthalamide fibres comprise meta aramid fibres selected from the group consisting of Nomex, polybenzimidazole (PBI) or polybenzobisoxazole (PBO) or blends thereof.
- 15 4. A fire resistant textile material as claimed in any preceding claim, wherein the cellulose fibre is a fire retardant cellulose fibre.
5. A fire resistant textile material as claimed in claim 4, wherein the cellulose fibre manufactured from wood pulp treated with a fire retardant.
- 20 6. A fire resistant textile material as claimed in any preceding claim, wherein the wool fibres are 20.8 μm shrink resistant wool fibres.
7. A fire resistant textile material as claimed in any preceding claim wherein the
25 blend of cellulose fibres and wool fibres comprises by weight, from 25% wool and 75% cellulose to 75% wool and 25% cellulose.
8. A fire resistant textile material as claimed in claim 7, wherein the blend comprises about 50% wool and about 50% cellulose.
- 30 9. A fire resistant textile material as claimed in any preceding claim comprising a 2 x 1 ripstop twill having a warp comprising meta aramid with a warp count of Nm 60/2.

10. A fire resistant textile material as claimed in any preceding claim wherein the weft comprises a wool-cellulose blend with a weft count of Nm 60/2 and Nm 40/2/2 meta aramid.
- 5 11. A fire resistant textile material as claimed in any preceding claim comprising double twisted yarns.
12. A fire resistant textile material as claimed in claim 11, wherein the warp has a yarn count in the range of Nm 20/2 to 100/2.
- 10 13. A fire resistant textile material as claimed in claim 12, wherein the warp has a yarn count in the range of Nm 30/2 to 80/2.
14. A fire resistant textile material as claimed in claim 13, wherein the warp has a yarn count in the range of Nm 40/2 to 60/2.
- 15 15. A fire resistant textile material as claimed in claim 14, wherein the warp has a yarn count is Nm 60/2.
- 20 16. A fire resistant textile material as claimed in claim 15, wherein the number of warp ends is 4500 to 5600.
17. A fire resistant textile material as claimed in any preceding claim, wherein the fabric weight is 200 to 300g/m².
- 25 18. A fire resistant textile material having a weaving plan as shown in Figure 1.
19. A fire resistant textile material substantially as hereinbefore described.



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Examiner: Tim James

Claims searched: 1-17 and 19

Date of search: 20 January 2014

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-4 at least	US2004/152378 A1 (SOUTHERN) see paragraphs 0021 and 0022, claims 1 and 2 and the figures
X	1 and 3 at least	US4927698 A (SPRINGS) see column 3 lines 14-55
X	1, 3, 4 and 17 at least	US4868041 A (TOYO) see the paragraph bridging columns 2 and 3, column 4 lines 30-34 and claim 1
X	1, 3, 4 and 17 at least	WO2011/050257 A1 (INVISTA) see paragraph 0034 and claim 1
X	1-3 at least	WO2008/075505 A1 (HAYASHI) see WPI abstract accession number 2008-N01196
X	1-3 at least	JP2005154974 A (ABBOTT) see paragraphs 0007 and 0008 and the figures and WPI abstract accession number 2005-461499

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X:

Worldwide search of patent documents classified in the following areas of the IPC

D03D

The following online and other databases have been used in the preparation of this search report

On-line: WPI, EPODOC, TXTAU1, TXTCA1, TXTCNT, TXTEP1, TXTGB1, TXTJPS, TXTJPT, TXTKRT, TXTUS0-5, TXTWO1, TXTWOT



International Classification:

Subclass	Subgroup	Valid From
D03D	0015/12	01/01/2006