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(54) Cloth structure

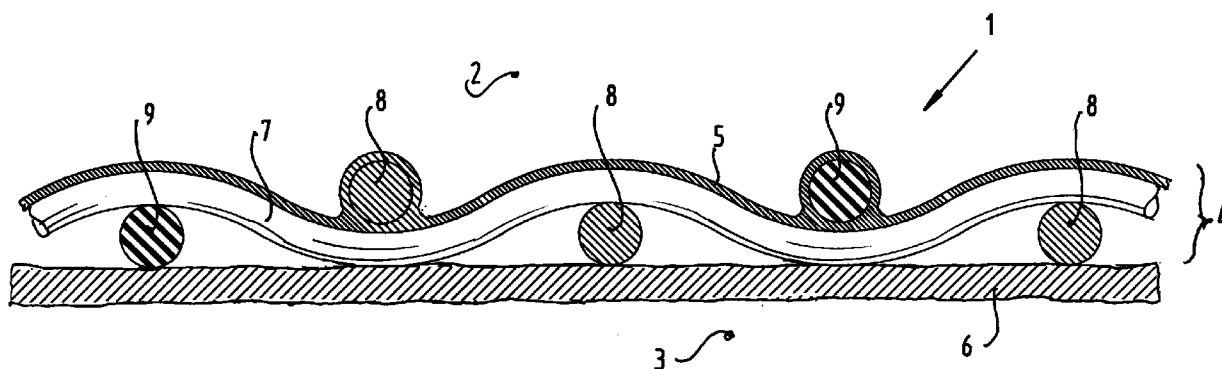
(57) The invention relates to a cloth structure and has for its object to provide a cloth structure which is watertight, windtight, flame-retardant, resistant to chemicals, antistatic and permeable for water vapour.

In respect of the above the invention generally provides a cloth structure, comprising:

a base cloth (4);

at least one fire-retardant and flame-extinguishing first cover layer (6); and

at least one second cover layer containing polyurethane (5), which cloth structure is watertight, resistant to chemicals, at least slightly porous and thus permeable for water vapour.



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Description

The invention relates to a cloth structure and has for its object to provide a cloth structure which is watertight, windtight, flame-retardant, resistant to chemicals, antistatic and permeable for water vapour.

In respect of the above the invention generally provides a cloth structure, comprising:

a base cloth;

at least one fire-retardant and flame-extinguishing first cover layer; and

at least one second cover layer containing polyurethane,

which cloth structure is watertight, resistant to chemicals, at least slightly porous and thus permeable for water vapour.

An embodiment is recommended in which the base cloth consists predominantly of polyester fibres and/or polyester filaments.

In respect of said properties it is of the greatest importance, particularly for safety clothing for instance for the petrochemical industry, that there is no danger of static charging of the cloth structure which could result in spark formation. In respect thereof a preferred embodiment has the special feature that the base cloth contains electrically conducting and thus antistatic fibres such that the base cloth is antistatic, which fibres consist for instance of carbon and are preferably ordered in a check structure.

An example of such a structure is that wherein in the base cloth a woven material is incorporated which is known as "Kanebo antistatic check".

As composition a base cloth can for instance be envisaged which in total constitutes 48% of the cloth and consists of polyester micro-fibre, together with 2% Kanebo antistatic check, while said cover layers consist respectively of a number of flame-extinguishing products totalling 10% and 40% polyurethane. The specific weight can be in the order of $(195 \pm 50)\text{g/m}^2$.

A water column of more than two 2 m. does not yet produce any seepage of water. This relates to the cloth structure both in new condition and after washing ten times at 60°C. The water vapour permeability is for instance greater than $600\text{ g/m}^2/24\text{h}$. The fire class corresponds with the French norm M1 and the European norm EN 533.

A specific embodiment has the special feature that the base cloth contains a woven material. Alternatively an embodiment can be envisaged in which the base cloth comprises a non-woven. The cloth structure according to the invention is preferably embodied such that the base cloth is impregnated with a flame-retardant agent, for instance a halogen-free or brominated hydrocarbon and/or a nitrogen and/or phosphorus-containing compound such that the base cloth is flame-retardant.

A specific embodiment has the special feature that the first cover layer consists at least predominantly of polyurethane.

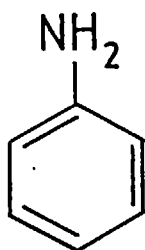
A variant can also be envisaged in which the two cover layers coincide. In particular, the two cover layers can together predominantly consist of polyurethane.

Alternatively, the second cover layer can be separate, wherein the cloth structure is embodied such that the second cover layer consists at least predominantly of polyurethane.

Yet another embodiment has the special feature that a flame-retardant agent is added to the polyurethane, for instance a halogen-free or brominated hydrocarbon and/or a nitrogen and/or phosphorus-containing compound such that the relevant cover layer is flame-retardant.

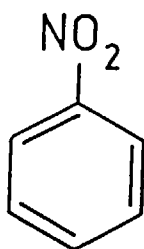
The base cloth as specified in claim 6 in particular can be made fireproof on the basis of a halogen-free, fire-retardant aqueous solution of inorganic or organic nitrogen and/or phosphorus compounds posing no hazards for human beings and environment. Below are given some examples of compounds for elucidation of the terminology used.

The compound (1) is an organic nitrogen compound, that is, aniline.



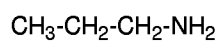
(1)

The compound (2) is likewise an organic nitrogen compound, that is, nitrobenzene.



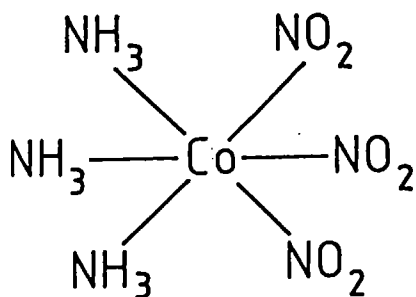
(2)

The compound (3) is likewise an organic nitrogen compound, that is, n-propylamine.



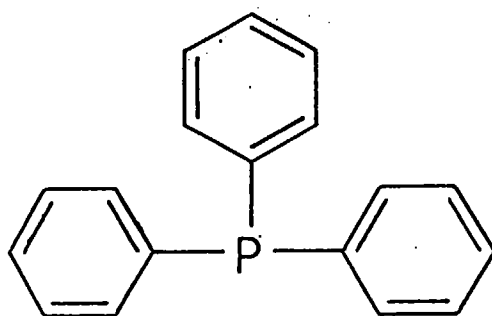
(3)

The compound (4) is a cobalt complex, an inorganic nitrogen compound.



(4)

The compound (5) is triphenylphosphine, an organic phosphorus compound.



(5)

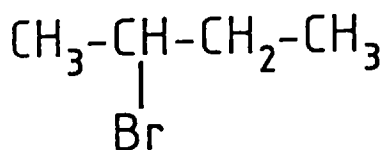
The compound (6) is aluminium phosphate, an inorganic phosphorus compound.



(6)

The compound (7), finally, is a brominated hydrocarbon, that is, 2-bromobutane.

(7)



It will be apparent that the cloth structure according to the invention can be embodied and varied in diverse ways. In addition, the structure can possess other than the stated properties. It can for instance be strongly wear-resistant, have great stretch resistance, be resistant to high and low temperatures, be provided with particular colours and so on.

The cloth structure according to the invention lends itself extremely well for application in CE approved safety clothing designed for single or combined, diverse and unrelated or interrelated hazards.

In a preferred embodiment the invention has for its object to provide a cloth structure which mutually combines a plurality of technical properties. The object of the invention in this aspect is to provide a cloth structure which combines at least a number of the following properties: watertight, permeable for water vapour, windtight, flame-retardant, resistant to chemicals, antistatic and increased visibility. This combination of properties is not known from the literature since, in contrast to the prior art, conflicting functions must be combined in one cloth structure.

According to a first aspect of this part according to the invention the cloth structure comprises:

the base cloth serving as middle layer;

a microporous and/or hydrophilic first cover layer arranged thereon on the inside; and

a second cover layer arranged thereon substantially on the outside and comprising a predominant proportion of fluorocarbon resin.

This cloth structure preferably displays the special feature that the base cloth consists substantially of polyester multifilament and/or microfilament and/or staple-fibres.

This cloth structure preferably has the special feature that the base cloth consists substantially of polyester fibres.

This latter variant can advantageously be applied for the use of fluorescent colours which for instance may greatly improve the safety of a user. In this respect the invention provides in this aspect a cloth structure in which the base cloth is coloured with colorants which provide increased visibility, in particular fluorescent colorants.

A polyester woven material is however not electrically conducting, whereby, when used as protective clothing in an explosion-hazardous environment, spark-over is possible as a result of static electrical charging of the clothing, which could cause an explosion and is therefore not acceptable. This can be obviated by applying conductive fibres, particularly in a check structure in the woven material, whereby the build-up of static electricity is effectively prevented. In practice this step is found to be effective, even if cover layers are arranged on both sides of the base cloth.

A specific embodiment has the special feature that the first cover layer consists substantially of a microporous and/or hydrophilic polyurethane and/or polytetrafluoroethylene.

A specific embodiment hereof displays the feature that the first cover layer is applied by a coating process or a laminating process on the basis of a film. The first cover layer preferably has a colour which depends on the colour of the base cloth. This is of particular importance in respect of the effect on a possible fluorescent colour of the base cloth. In the case the base cloth has such a fluorescent colour, the cover layer is preferably clear white. In other cases the cover layer can have the colour of the base cloth.

As already discussed above, the cover layer can take a flame-retardant form, for instance comprise flame-retardant agents. These can for instance be based on nitrogen and/or phosphorus compounds or organobromine compounds. The concentrations of these flame-retardant agents in the cover layer must be sufficient to impart flame-retardant properties to the total cloth structure, also in combination with an optionally untreated base cloth. On the other hand, it must be taken into account that the concentrations of the flame-retardant agents in the cover layer may not be so high that this results in an adverse effect on the achieved water vapour permeability, the strength and the wear-resistance of the cover layer.

The outer cover layer also functions as barrier against water or other liquids coming from outside, to which the protective clothing based on the cloth structure according to the invention may be exposed during operational conditions. Due to the hydrophilic and/or microporous character the cover layer is permeable for water vapour. By its nature the base cloth is likewise so, so that the total cloth structure is thereby permeable for water vapour.

In respect of the water vapour permeability it is noted that this is inversely proportional to the water vapour resistance, which will be further mentioned hereinbelow.

The cover layer can be deemed completely windtight.

Brief attention will now be given to the second cover layer. This second cover layer is predominantly arranged on the outside, for instance by means of a spray, dip or brush technique. It comprises a predominant proportion of fluorocarbon resin and can even substantially consist thereof.

The "inside" and "outside" are defined in terms of the inside and outside of the protective clothing manufactured on the basis of the cloth structure according to the invention.

The second cover layer ensures repulsion of for instance splashes of liquid chemicals of for instance the most frequently occurring types or specific types for which the cloth structure is designed. In combination with the first cover layer, these splashes are prevented from passing through the cloth structure. The second cover layer is very thin. Hereby is prevented that this cover layer will have an adverse effect on the water vapour permeability.

With the combination of the above described steps the following properties are obtained:

Property	Value
Watertightness	≥ 13 kPa ISO 811
Water vapour resistance	≈ 150 m ² Pa/W
Airtightness	≈ 20 l m ² /s
Fire resistance	index according to EN 532/533
Antistatic properties	complies with EN 1149-1
Increased visibility	complies with EN 471
Chemical resistance	penetration index = 0.0%
(kerosine)	Repulsion index $\geq 95\%$ according to EN 368

It is again noted that the literature provides no single indication relating to the combination of the above stated properties. JP-A-0 516 684 for instance mentions a cloth structure having a PVC-like character and intended as artificial leather. This cloth structure is essentially non-breathing.

A fire-retardant cloth structure is known per se from for instance DE-A-41 32 427.

The annexed figure shows in cross section a part of the cloth structure 1 according to the invention. The outside of the cloth is designated with the reference numeral 2, while the reference numeral 3 refers to the inside.

The base cloth 4 is some tenths of a millimetre thick. It consists of polyester multi-, microfilament or staple fibres which are treated with a colorant to provide the cloth structure with the desired colour. Arranged on the outside 2 is a second cover layer 5 which is a few micrometers thick and consists of a fluorocarbon resin.

Arranged on the inside 3 is a microporous and/or hydrophilic, flame-retardant first cover layer 6 with a thickness of some tenths of a millimetre. This cover layer 6 for instance consists wholly or partially of polyurethane, which is transparent by nature, or polytetrafluoroethylene, which is white by nature. The base cloth comprises a woven material of yarns or threads, respectively 7 in the warp direction and 8 in the weft direction. The threads are replaced locally in both directions by electrically conducting yarns or threads 9, consisting for instance of carbon fibres.

It is noted that the drawing is not necessarily drawn to scale.

Further attention is drawn to the fact that the drawing is highly schematic and that the first cover layer 6 can for instance follow the contours of base cloth 4 more closely.

It is further pointed out that the form of the second cover layer 5 is shown very schematically. It is the intention of the drawing to make clear that this layer, which can for instance be applied by spraying, will adapt naturally to the form of base cloth 4.

Said antistatic threads, filaments, fibres or yarns may also consist of materials other than carbon, for instance conductive metals or composite materials. They are co-woven with a suitable weaving technique and thereby form part of the woven material.

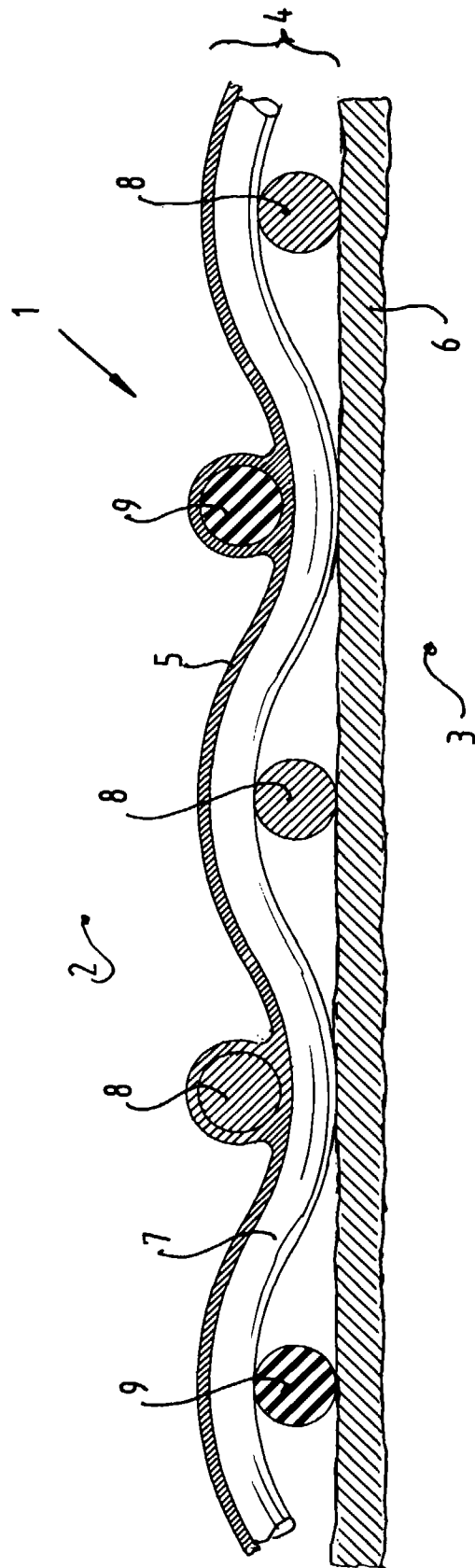
Claims

1. Cloth structure, comprising:

- a base cloth;
- at least one fire-retardant and flame-extinguishing first cover layer; and
- at least one second cover layer containing polyurethane,

which cloth structure is watertight, resistant to chemicals, at least slightly porous and thus permeable for water vapour.

- 5 2. Cloth structure as claimed in claim 1, wherein the base cloth consists predominantly of polyester fibres and/or polyester filaments.
- 10 3. Cloth structure as claimed in claim 1, wherein the base cloth contains electrically conducting and thus antistatic fibres such that the base cloth is antistatic, which fibres consist for instance of carbon and are preferably ordered in a check structure.
- 15 4. Cloth structure as claimed in claim 1, wherein the base cloth contains a woven material.
- 20 5. Cloth structure as claimed in claim 1, wherein the base cloth comprises a non-woven.
- 25 6. Cloth structure as claimed in claim 1, wherein the base cloth is impregnated with a flame-retardant agent, for instance a halogen-free or brominated hydrocarbon and/or a nitrogen and/or phosphorus-containing compound such that the base cloth is flame-retardant.
- 30 7. Cloth structure as claimed in claim 1, wherein the first cover layer consists at least predominantly of polyurethane.
- 35 8. Cloth structure as claimed in claim 1, wherein the two cover layers coincide.
- 40 9. Cloth structure as claimed in claim 1, wherein the second cover layer consists at least predominantly of polyurethane.
- 45 10. Cloth structure as claimed in claim 7 or 9, wherein a flame-retardant agent is added to the polyurethane, for instance a halogen-free or brominated hydrocarbon and/or a nitrogen and/or phosphorus-containing compound such that the relevant cover layer is flame-retardant.
- 50 11. Cloth structure as claimed in claim 1, comprising:
 the base cloth serving as middle layer;
 a microporous and/or hydrophilic first cover layer arranged thereon on the inside; and
 a second cover layer arranged thereon substantially on the outside and comprising a predominant proportion of fluorocarbon resin.
- 55 12. Cloth structure as claimed in claim 11, wherein the base cloth consists substantially of polyester multifilament and/or microfilament and/or staple-fibres.
- 60 13. Cloth structure as claimed in claim 12, wherein the base cloth is coloured with colorants which provide increased visibility, in particular fluorescent colorants.
- 65 14. Cloth structure as claimed in claim 11, wherein the first cover layer consists substantially of a microporous and/or hydrophilic polyurethane and/or polytetrafluoroethylene.
- 70 15. Cloth structure as claimed in claim 14, wherein the first cover layer is applied by a coating process or a laminating process on the basis of a film.





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EUROPEAN SEARCH REPORT

Application Number
EP 97 20 2155

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP 0 073 948 A (BLUECHER HASSO VON ;BLUECHER HUBERT (DE); RUITER ERNEST DE (DE)) * page 3, line 1 - page 4, line 28; claims 1,4,6,10-12 *	1,2,4,5, 7-10	D06N7/00 D06N3/14 D06N3/00 D06N3/04 B32B27/12
Y	* page 6, line 18 - line 30 *	3,6, 11-15	
Y	--- EP 0 151 963 A (UNITIKA LTD) * the whole document *	11-15	
Y	--- US 4 547 423 A (KOJIMA AKIRA ET AL) * column 2, line 34 - line 54; claims * * column 3, line 29 - line 42 *	3	
Y	--- DATABASE WPI Section Ch, Week 9513 Derwent Publications Ltd., London, GB; Class A25, AN 95-094347 XP002026987 & JP 07 018 584 A (DAIICHI LACE KK) , 20 January 1995 * abstract *	6	
A	--- EP 0 364 370 A (PICARDIE LAINIERE) * claims 1,2,6,7,12; figures *	1-10	
A	--- WO 88 01570 A (BURLINGTON INDUSTRIES INC) * abstract * * page 1, last paragraph - page 2, line 4 * * page 12, paragraph 2 * * page 19, paragraph 2 *	1,2,4,5, 7	
A	--- US 5 017 424 A (FARNWORTH BRIAN ET AL) * the whole document *	1-15	
	--- -/-		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 6 November 1997	Examiner Pamies Olle, S
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)



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EUROPEAN SEARCH REPORT

Application Number
EP 97 20 2155

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US 4 816 328 A (SAVILLE MARK K ET AL) * column 2, line 45 - column 3, line 23 * -----	1-10	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 6 November 1997	Examiner Pamies 011e, S
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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