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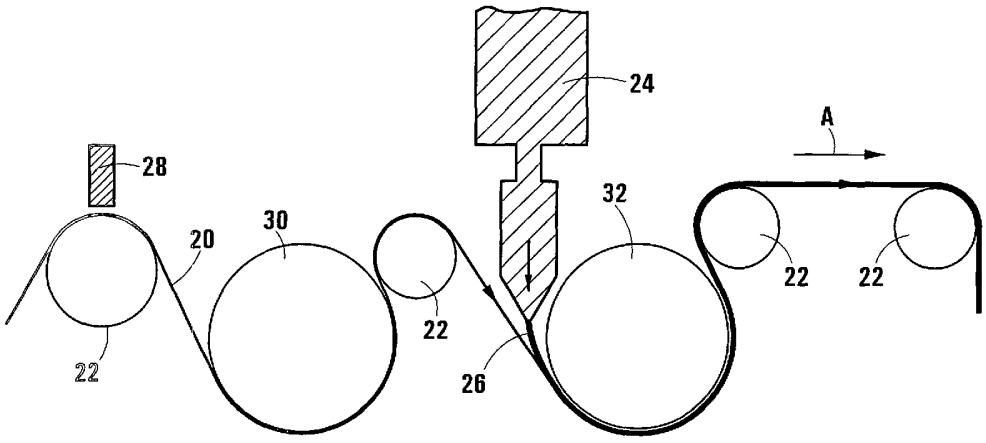
(54) Title: A WATER-RESISTANT SHEET MATERIAL



(57) Abstract: A water-resistant sheet material comprising a fabric base layer (20) which is made of knitted threads of high density polyethylene (HDPE) and which is coated on both sides thereof with a polymer coating compound of low density polyethylene (LDPE) which provides the sheet material with water-resistant properties. The fabric base layer comprises a single series of 400 Denier monofilament threads which are formed into pillar stitches, a second series of 350 Denier monotapes which are knitted in zig-zag fashion to form a Sammt stitch, and a third series of 350 Denier monotapes which are added as a filler. The fabric base layer is coated on one side thereof with the LDPE coating layer, is turned over and the other side is similarly coated with a further LDPE coating layer (26) thereby to coat both sides of the fabric base layer.

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A WATER-RESISTANT SHEET MATERIAL

FIELD OF INVENTION

THIS INVENTION relates to a water-resistant sheet material. It relates also to a method of manufacturing the sheet material.

BACKGROUND ART

International Patent Application PCT/IB01/02271 filed in the name of the applicant for the present invention, covers a knitted fabric produced on a warp knitting machine and comprising a series of monofilament threads and two series of monotape threads.

SUMMARY OF INVENTION

According to a first aspect of the invention there is provided a water-resistant sheet material including:

a fabric base layer which is made of knitted extruded polymer threads comprising

a first series of monofilament threads wherein each monofilament thread is formed into pillar stitches extending in a warp direction;

a second series of monotape threads which are knitted in a zig-zag fashion to form a Sammt stitch extending in a weft direction relative to the monofilament threads; and

a third series of monotape threads which are added to the monofilament threads and the second series of monotape threads as a filler; and

a coating layer in the form of a water-resistant polymer sheet element which is bonded to a side of the fabric base layer thereby providing the sheet material with water-resistant properties.

The monofilament threads may have 11½ pillar stitches per inch of fabric.

The monofilament threads may be approximately 400 Denier.

The fabric base layer may be produced on a warp knitting machine having at least three guide bars, with the second series of monotape threads extending across the equivalent of four needle gaps in a weft direction.

The monotape threads may be approximately 350 Denier.

The monotape threads may have a width of approximately 1.8mm and a thickness of approximately 0.035mm.

The third series of monotape threads may be added to the monofilament threads and the second series of monotape threads to traverse the equivalent of one needle gap in a weft direction to provide a filler.

The needle gaps may be 1/8 of an inch.

The threads of the fabric base layer may be of high-density polyethylene.

The coating layer may be in the form of an extruded low-density polyethylene film.

The coating layer may be approximately 1 micron thick.

The sheet material may comprise a coating layer bonded to each of two sides of the fabric base layer.

According to a second aspect of the invention there is provided a method of manufacturing a water-resistant sheet material, the method including:

providing a fabric base layer which is made of knitted threads of an extruded polymer compound;

feeding and guiding the fabric base layer in a particular direction and at a predetermined feed rate; and

extruding a predetermined amount of a preheated polymer coating compound in the form of a sheet element onto the surface of one side of the fabric base layer thereby to form a water-resistant coating layer on said one side of the fabric base layer.

The method may include pre-heating the polymer coating compound to approximately 250°C.

The method may include extruding the polymer coating compound in the form of a film having a thickness of approximately 1 micron, onto the fabric base layer.

A predetermined preheated amount of said polymer coating compound may be extruded onto the other side of the fabric base layer in the form of a film to form a water-resistant coating layer on said other side of the fabric base layer.

The method may include pre-heating the fabric base layer to approximately 30°C prior to extruding the coating layer onto the base layer.

The fabric base layer may be equivalent to the fabric base layer which forms part of the sheet material as defined hereinabove in accordance with the first aspect of the invention.

The coating layer may be equivalent to the coating layer forming part of the sheet material as defined hereinabove in accordance with the first aspect of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features of the invention are described hereinafter by way of a non-limiting example of the invention, with reference to and as illustrated in the accompanying diagrammatic drawings. In the drawings:

Figure 1 shows a vertical section of a warp knitting machine of the type used to make the fabric base layer of the water-resistant sheet material in accordance with the invention;

Figure 2 is a pattern diagram illustrating the configuration of the different stitches of the threads forming the fabric base layer;

Figure 3 is a pattern diagram which illustrates the knit configuration of the base layer; and

Figure 4 is a schematic block diagram illustrating a method of manufacturing the water-resistant sheet material in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The sheet material in accordance with the first aspect of the invention comprises a fabric base layer which is made of knitted threads of high-density polyethylene

(abbreviated "HDPE") and which is coated on both sides thereof with a polymer coating compound of low-density polyethylene (abbreviated "LDPE") which provides the sheet material with water-resistant properties. The Applicant has found that a good bond is achieved between a LDPE and a HDPE.

The fabric base layer is produced on a 16-gauge Raschel-type warp knitting machine. With reference Figure 1, a 16-gauge Raschel-type warp knitting machine comprises a series of latch needles 10, a trick plate 12 and three guide bars, the first guide bar carrying a series of guide needles 14.1, the second guide bar carrying a series of guide needles 14.2, and the third guide bar carrying a series of needles 14.3. The latch needles of the knitting machine are spaced 1/8 of an inch apart. Hence, the needle gaps are 1/8 of an inch. A knitting fabric 16 made on the knitting machine comprises a single series of monofilament threads M each of which passes through the eye of a corresponding one of the guide needles 14.1, a second series of threads in the form of monotapes T1 each of which passes through the eye of a corresponding one of the guide needles 14.2, and a third series of threads in the form of monotapes T2 each of which passes through the eye of a corresponding one of the guide needles 14.3.

The monofilament threads M are 400 Denier monofilament threads. The tapes T1 and T2 are each in the form of 350 Denier tape having a width of 1.8mm and a thickness of 0.035mm.

With reference to Figure 2 of the drawings, each of the monofilament threads M are knitted to form a pillar stitch which gives the fabric strength in the longitudinal or warp direction. The monofilament threads are knitted with 11½ pillar stitches per inch of fabric. The tapes T1 are knitted in a zig-zag fashion to form a binding between adjacent pillar stitches. The tapes T1 are knitted in a closed "Sammt" stitch and traverse the equivalent of four needle gaps in a weft direction per machine cycle. The monotapes T2 are added to the monofilament threads and the monotapes T1 and traverse the equivalent of one needle gap in a weft direction. As such, the configuration of the monotapes T1 and T2, in particular, provide the knitted fabric

with its "coverage" properties for shade protection.

Due to the knit configuration of the fabric base layer, the fabric base layer exhibits equal elongation and tensile strength properties in both warp and weft directions. The knit configuration thus provides a knitted fabric having uniform properties in both warp and weft directions. Due to the material properties and stitches used for the monotapes of the second and third series, the monotapes exhibit sufficient tensile strength in the weft direction, thereby obviating the need for monofilament threads in the weft direction.

The "throw" of the monotapes T1 in the knit fabric are relatively long thereby providing a more stable knit fabric. The monofilament threads and the monotapes do not slide over one another. By utilising the Sammt construction to anchor the weft monotapes T1 with the pillar stitches of the monofilament threads, the fabric is provided with stability in both weft and warp directions.

The relatively tight knit configuration of the fabric provides the fabric with a smoother surface texture which allows for coating of the fabric with more precision thereby providing the fabric with enhanced aesthetic appeal.

The following pattern chain is used to set up the knitting machine and defines the knit configuration.

Bar 1	Bar 2	Bar 3
2	6	0
0	8	0
---	---	---
0	2	4
2	0	4
=	=	=

With reference to Figure 4 of the drawings, a method of manufacturing the sheet material in accordance with the invention, is illustrated. The fabric base layer 20 is fed in the direction shown by arrow "A" at a feed rate of approximately 25m/min along

feed rollers 22 to a position below an extruder 24 which extrudes pre-heated LDPE film 26 having a thickness of 1 micron, onto the surface of an upper side of the fabric base layer. The coating compound is pre-heated to approximately 250°C. Prior to being coated with the LDPE film, the fabric base layer undergoes corona treatment and is preheated. A corona treatment unit 28 provides a corona discharge which etches the upper surface of the fabric base layer thereby to provide a chemically active surface which enhances bonding of the extruded LDPE film with the fabric base layer. An oil heated roller 30 heated to approximately 90°C, is provided for preheating the fabric base layer to a temperature of approximately 30°C, through contact with roller 30. A water-chilled roller 32 is provided downstream of the extruder for cooling the coating layer and the fabric base layer.

Thereafter, the fabric base layer coated on one side thereof with the LDPE coating layer, is turned over and the other side thereof is similarly coated with a further LDPE coating layer thereby to coat both sides of the fabric base layer with 1 micron thick LDPE coating layers. In coating the fabric base layer with the second coating layer, the process described above is repeated by extruding the second coating layer in the form of a sheet element onto the uncoated side of the fabric base layer which now faces upwardly, thereby to coat it with the coating layer.

The Applicant envisages that the sheet material can be used as a shade cloth having good water-resistant properties.

CLAIMS

1. A water-resistant sheet material including:

a fabric base layer which is made of knitted extruded polymer threads comprising

a) a first series of monofilament threads wherein each monofilament thread is formed into pillar stitches extending in a warp direction;

b) a second series of monotape threads which are knitted in a zig-zag fashion to form a Sammt stitch extending in a weft direction relative to the monofilament threads; and

c) a third series of monotape threads which are added to the monofilament threads and the second series of monotape threads as a filler; and

a coating layer in the form of a water-resistant polymer sheet element which is bonded to a side of the fabric base layer thereby providing the sheet material with water-resistant properties.

2. A sheet material as claimed in Claim 1, wherein the monofilament threads have 11½ pillar stitches per inch of fabric.

A sheet material as claimed in Claim 1 or Claim 2, wherein the monofilament threads are approximately 400 Denier.

A sheet material as claimed in any one of the preceding claims, wherein the fabric base layer is produced on a warp knitting machine having at least three guide bars and wherein the second series of monotape threads extend across the equivalent of four needle gaps in a weft direction.

A sheet material as claimed in any one of the preceding claims, wherein the monotape threads are approximately 350 Denier.

A sheet material as claimed in any one of the preceding claims, wherein the monotape threads have a width of approximately 1.8mm and a thickness of approximately 0.035mm.

A sheet material as claimed in Claim 4, wherein the third series of monotape threads are added to the monofilament threads and the second series of monotape threads to traverse the equivalent of one needle gap in a weft direction to provide a filler.

A sheet material as claimed in Claim 4, wherein the needle gaps are 1/8 of an inch.

A sheet material as claimed in any one of the preceding claims, wherein the threads of the fabric base layer are of high-density polyethylene.

A sheet material as claimed in any one of the preceding claims, wherein the coating layer is in the form of an extruded low-density polyethylene film.

A sheet material as claimed in Claim 10, wherein the coating layer is approximately 1 micron thick.

A sheet material as claimed in any one of the preceding claims, which comprises a coating layer bonded to each of two sides of the fabric base layer.

A method of manufacturing a water-resistant sheet material, the method including:

providing a fabric base layer which is made of knitted threads of an extruded polymer compound;

feeding and guiding the fabric base layer in a particular direction and at a predetermined feed rate; and

extruding a predetermined amount of a preheated polymer coating compound in the form of a sheet element onto the surface of one side of the fabric base layer

thereby to form a water-resistant coating layer on said one side of the fabric base layer.

A method as claimed in Claim 13, which includes pre-heating the polymer coating compound to approximately 250°C.

A method as claimed in Claim 13 or Claim 14, which includes extruding the polymer coating compound in the form of a film having a thickness of approximately 1 micron, onto the fabric base layer.

A method as claimed in Claim 15, wherein a predetermined preheated amount of said polymer coating compound is extruded onto the other side of the fabric base layer in the form of a film to form a water-resistant coating layer on said other side of the fabric base layer.

A method as claimed in any one of Claims 13 to 16, which includes pre-heating the fabric base layer to approximately 30°C prior to extruding the coating layer onto the base layer.

A method as claimed in any one of Claims 13 to 17, wherein the fabric base layer is equivalent to the fabric base layer which forms part of the sheet material as claimed in any one of Claims 1 to 12.

19. A method as claimed in any one of Claims 13 to 18, wherein the coating layer is equivalent to the coating layer forming part of the sheet material as claimed in any one of Claims 1 to 12.

20. A new sheet material substantially as described in the specification.

21. A sheet material substantially as described in the specification with reference to and as illustrated in the accompanying diagrammatic drawings.

22. A new method of manufacturing a water-resistant sheet material as described in the specification.

23. A method of manufacturing a water-resistant sheet material as described in the specification with reference to and as illustrated in the accompanying diagrammatic drawings.

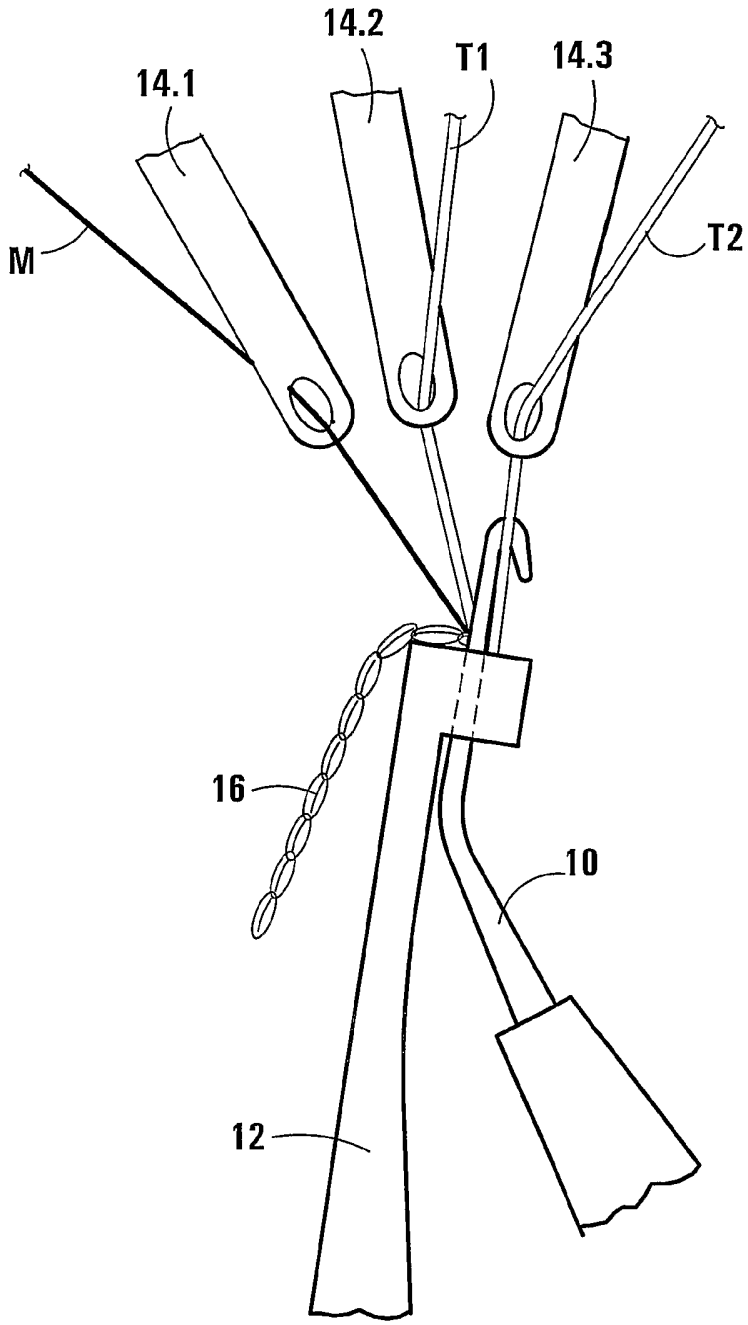

FIG 1

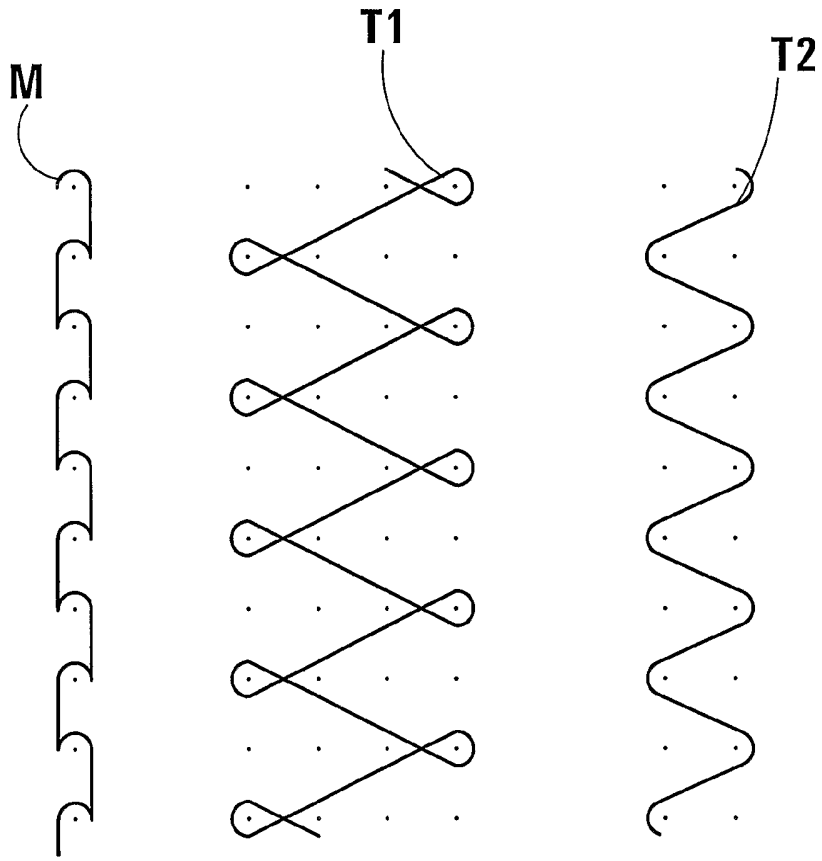

FIG 2

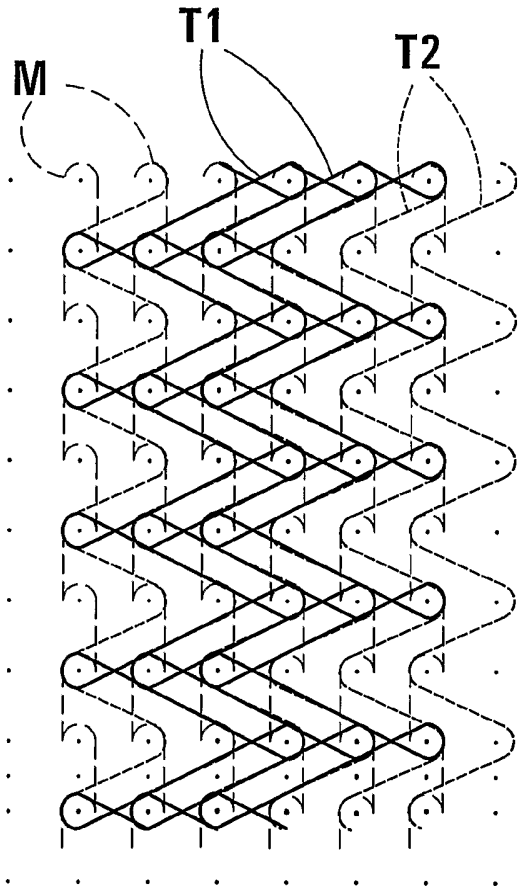

FIG 3

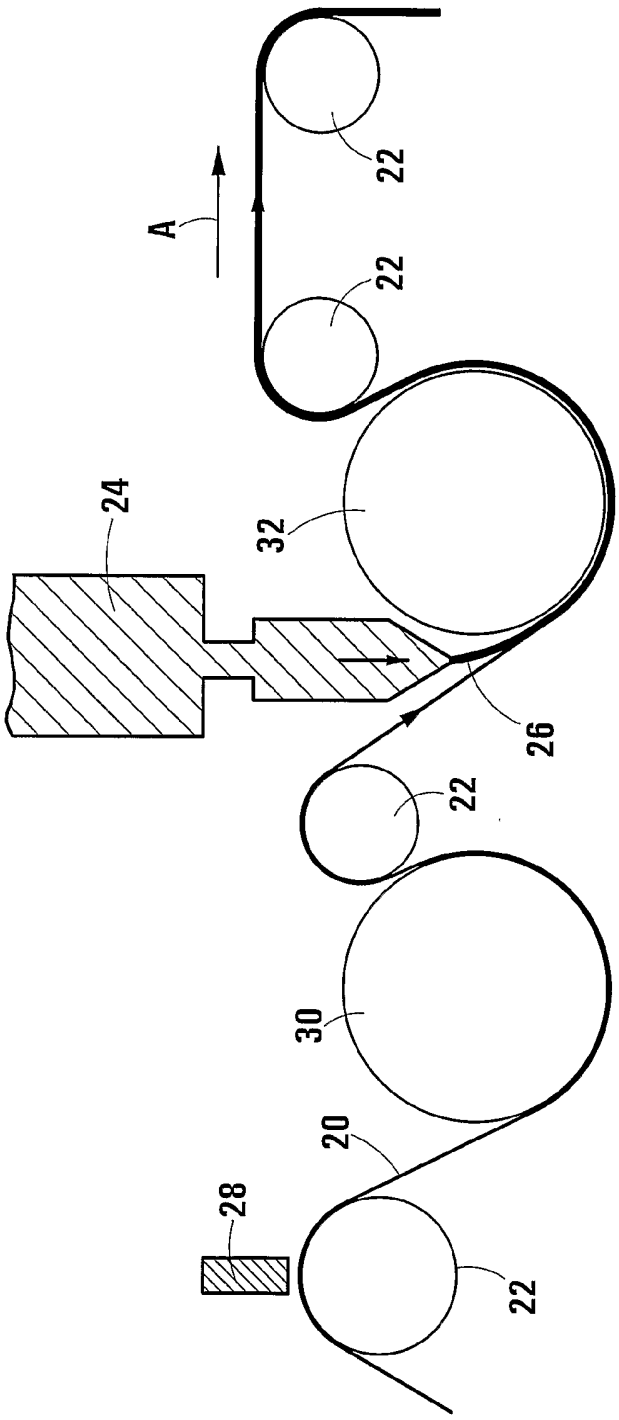

FIG 4

INTERNATIONAL SEARCH REPORT

PCT/IB 03/01316

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 D04B21/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 D04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 043 126 A (BECKER WILHELM AB;EISER AB) 1 October 1980 (1980-10-01) page 1, line 123 -page 2, line 33; figures 1-5	1,12,13, 18-23
A,P	WO 02 44452 A (VERMOOTEN JOACHIM ;BAILEY SHAMIEL (ZA)) 6 June 2002 (2002-06-06) cited in the application claims 1-12; figures 1-3	1,3-9
A	FR 2 143 612 A (CHOMARAT & CIE) 9 February 1973 (1973-02-09)	
A	US 6 159 877 A (TOCHACEK MIROSLAV ET AL) 12 December 2000 (2000-12-12)	

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
22 July 2003	31/07/2003

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

PCT/IB 03/01316

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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