

## PATENT ABSTRACTS OF JAPAN

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(21)Application number : **10-132738**

(71)Applicant : **MORIUCHI KYU KK**

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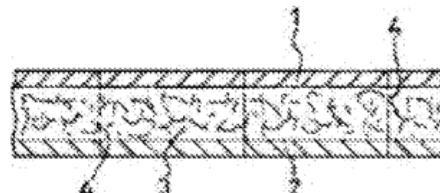
(72)Inventor : **MATSUMOTO TAKESHI**

### (54) **WATERPROOF SHEET**

(57)Abstract:

**PROBLEM TO BE SOLVED:** To make urine and sweat absorbed and to prevent bedding, clothes and surrounding from being stained by using a water-permeable and water-diffusive texture for a surface fabric, using a water-impermeable and air-permeable texture by water-repellent finishing for a back fabric, and arranging an intermediate fabric having a water absorbing property and preventing the backflow of moisture between both fabrics.

**SOLUTION:** A knit fabric or a woven fabric made of a water-permeable and water-diffusive texture, preferably polyester or other synthetic fibers, and having a proper expansion/shrinkage property is used for a surface fabric 1 to be kept in direct contact with the skin. A knit fabric or a woven fabric made of a water-impermeable and air-permeable texture by water-repellent finishing, preferably polyester or other synthetic fibers, is used for a back fabric 2 to be kept in contact with the mattress of bedding. A nonwoven fabric or a knit fabric having a water absorbing property and having the required thickness to prevent the backflow of absorbed moisture is used for an intermediate fabric 3, and preferably a nonwoven fabric of synthetic fibers such as polyester and a warp-knit fabric such as raschel or tricot are used singularly or in lamination.



(51)Int.Cl. <sup>6</sup>	識別記号	F I	
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B 3 2 B	5/26	B 3 2 B	5/26
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審査請求 有 請求項の数 3 F D (全 4 頁)

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 (22)出願日 平成10年(1998)4月27日

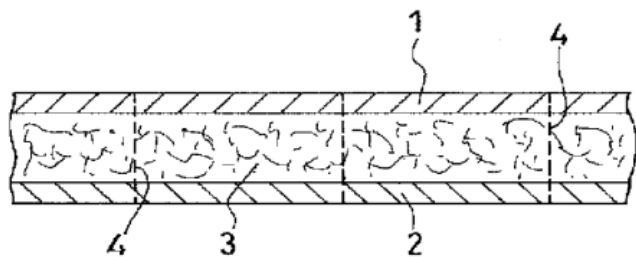
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(54)【発明の名称】 防水シート

(57)【要約】

【課題】 失禁や夜尿により漏れ出した尿や汗を吸収して、寝具、就寝中の人の着衣、周囲を汚すことなく、また、床ずれを起こしにくい防水シートを提供すること。

【解決手段】 表布1に透水性で、かつ水拡散性を有する布地を、裏布2に撥水加工を施すことにより不透水性で、かつ通気性を有する布地を、それぞれ用い、表布1と裏布2の間に、吸水性を有し、吸水した水分の逆流を防止する中布3を配する。



#### 【特許請求の範囲】

【請求項1】 表布に透水性で、かつ水拡散性を有する布地を、裏布に撥水加工を施すことにより不透水性で、かつ通気性を有する布地を、それぞれ用い、表布と裏布の間に、吸水性を有し、吸水した水分の逆流を防止する中布を配したことを特徴とする防水シート。

【請求項2】 中布に不織布を用いたことを特徴とする請求項1記載の防水シート。

【請求項3】 中布にラッセル、トリコット等の経編布を用いたことを特徴とする請求項1記載の防水シート。

#### 【発明の詳細な説明】

##### 【0001】

【発明の属する技術分野】本発明は、防水シートに関し、特に、失禁のおそれのある老人、病人等や夜尿症の幼児が用いる寝具の敷布団やマットレス上に敷く防水シートに関するものである。

##### 【0002】

【従来の技術】従来、失禁のおそれのある老人、病人等や夜尿症の幼児が用いる寝具の敷布団やマットレス上に、寝具を汚すことがないように、合成樹脂製シートや防水シートを敷くようにしている。このうち、防水シートは、布にゴム又は合成樹脂によるラミネート加工を施すことにより不透水性を備えるようにし、これによって、漏れ出した尿が、防水シートの下に敷いた寝具の敷布団やマットレスに染み込まないようにしている。

##### 【0003】

【発明が解決しようとする課題】このように、防水シートは、同じ目的で使用される合成樹脂製シートと同様、不透水性を備えることによって、失禁や夜尿により漏れ出した尿が、防水シートの下に敷いた寝具の敷布団やマットレスに染み込まないようにし、寝具の汚れを防止することができるものであるが、その一方で、漏れ出した尿が、吸収されずに防水シート上に溜まって就寝中の人の着衣を濡らしたり、防水シートを伝って流れ出ることににより周囲を汚すという問題があった。また、この種の合成樹脂製シートや防水シートは、不透水性を備えることだけを考えて製作させているため、通気性を備えておらず、このため、就寝中の人が汗をかいても吸収することができず、不快感を与えるだけでなく、健康上問題があり、特に、寝たきりの老人、病人等の場合には、床ずれを起こしやすくなるという問題があった。また、この種の合成樹脂製シートや防水シートは、通気性を備えていないため、床ずれを防止するために、近年広く用いられるようになってきている、加圧した空気を全面から噴出するようにした、いわゆる、エアーマットに使用した場合、本来のエアーマットの効果をなくしてしまうという問題があった。

【0004】本発明は、上記従来の失禁のおそれのある老人、病人等や夜尿症の幼児が用いる寝具の敷布団やマットレス上に敷く合成樹脂製シートや防水シートの有す

る問題点に鑑み、失禁や夜尿により漏れ出した尿や汗を吸収して、寝具、就寝中の人の着衣、周囲を汚すことがなく、また、床ずれを起こしにくい防水シートを提供することを目的とする。

##### 【0005】

【課題を解決するための手段】上記目的を達成するため、本発明の防水シートは、表布に透水性で、かつ水拡散性を有する布地を、裏布に撥水加工を施すことにより不透水性で、かつ通気性を有する布地を、それぞれ用い、表布と裏布の間に、吸水性を有し、吸水した水分の逆流を防止する中布を配したことを特徴とする。

【0006】この防水シートは、直接肌が接する表布に、透水性で、かつ水拡散性を有する布地を用いるようにしているため、失禁や夜尿により漏れ出した尿や汗を、速やかに吸収して、吸水性を有し、吸水した水分の逆流を防止する中布に送り込み、中布に保持させることができ、寝具、就寝中の人の着衣、周囲を汚すことがない。また、中布に保持されている尿や汗が、防水シートの下に敷いた寝具の敷布団やマットレスに染み込まないようにする裏布に、撥水加工を施すことにより不透水性で、かつ通気性を有する布地を用いるようにしているため、汗等がこもらず、湿度を適度に保持することができる。

【0007】この場合において、中布には、不織布やラッセル、トリコット等の経編布を用いることができる。

【0008】これにより、表布と裏布の間に、失禁や夜尿により漏れ出した尿や汗を保持するための大きな空間を形成することができ、尿や汗を確実に保持することができるとともに、保持防水シート自体に、適度のクッション性を持たせることができる。

##### 【0009】

【発明の実施の形態】以下、本発明の防水シートの実施の形態を図面に基づいて説明する。

【0010】図1～図2に、本発明の防水シートの一実施例を示す。この防水シートは、表布1に透水性で、かつ水拡散性を有する布地を、裏布2に撥水加工を施すことにより不透水性で、かつ通気性を有する布地を、それぞれ用い、表布1と裏布2の間に、吸水性を有し、吸水した水分の逆流を防止する中布3を配し、これらが分離しないように、縫着4して一体化するようにする。なお、この縫着方法は、本実施例に示すようなキルティング様のほか、三層の布1, 2, 3の外周縁を逢着する等、任意の逢着方法を採用することができる。

【0011】直接肌が接する表布1には、透水性で、かつ水拡散性を有する布地、好ましくは、ポリエステル、その他の合成繊維からなり、適度の伸縮性を有する編布又は織布を使用するようにする。ここでは、透水拡散加工、より具体的には、グラフト重合により親水基を導入したポリエステル改質加工したポリエステル繊維からなる編布を用いるようにしている。

【0012】防水シートの下に敷いた寝具の敷布団やマットレスに接する裏布2には、裏布に撥水加工を施すことにより不透水性で、かつ通気性を有する布地、好ましくは、ポリエステル、その他の合成繊維からなる編布又は織布を用いるようにしている。

【0013】表布1と裏布2の間に配する中布3には、吸水性を有し、吸水した水分の逆流を防止することができるように所要の厚みを有する不織布又は編布、好ましくは、ポリエステル等の合成繊維の不織布又はラッセル、トリコット等の経編布を単独で、あるいは、これらを積層して用いるようにしている。特に、ラッセル、トリコット等の経編布を用いた場合には、経編布のリブによって、表布1と中布3が密着することを防止することができ、これによって、中布3に吸水した水分が逆流することを確実に防止することができるものとなる。さらに、この中布3としてはスポンジの様な通気性、クッション性を有する合成樹脂製シート状のものを用いることもできる。

【0014】この防水シートは、従来の防水シートと同様、失禁のおそれのある老人、病人等や夜尿症の幼児が用いる寝具の敷布団やマットレス上に敷いて用いるものであるが、直接肌が接する表布1に、透水性で、かつ水拡散性を有する布地を用いるようにしているため、失禁や夜尿により漏れ出した尿や汗を、速やかに吸収して、その下に配した、吸水性を有し、吸水した水分に逆流を防止する中布2に送り込み、この中布2に保持させることができ、従来の防水シートのように漏れ出した尿が吸収されずに防水シート上に溜まるようなことがなく、これによって、寝具、就寝中の人の着衣、周囲を汚すことがなく、長時間に亘って、快適な状態を維持することができるものとなる。また、中布2に保持されている尿や汗が、防水シートの下に敷いた寝具の敷布団やマットレスに染み込まないようにする裏布2は、撥水加工を施すことにより不透水性で、かつ通気性を有する布地を用いるようにしているため、汗等がこもらず、湿度を適度に

保持することができ、床ずれを防止することができるものとなる。さらに、近年広く用いられるようになってきている、加圧した空気を全面から噴出するようにしたエアーマットを併用することができ、床ずれを有効に防止することができる。

【0015】

【発明の効果】本発明の防水シートによれば、直接肌が接する表布に、透水性で、かつ水拡散性を有する布地を用いるようにしているため、失禁や夜尿により漏れ出した尿や汗を、速やかに吸収して、吸水性を有し、吸水した水分に逆流を防止する中布に送り込み、中布に保持させることができ、寝具、就寝中の人の着衣、周囲を汚すことがなく、長時間に亘って、快適な状態を維持することができる。また、中布に保持されている尿や汗が、防水シートの下に敷いた寝具の敷布団やマットレスに染み込まないようにする裏布に、撥水加工を施すことにより不透水性で、かつ通気性を有する布地を用いるようにしているため、汗等がこもらず、湿度を適度に保持することができ、床ずれを防止することができ、さらに、床ずれを有効に防止することができるエアーマットを併用することも可能となる。

【0016】また、中布に、不織布やラッセル、トリコット等の経編布を用いることにより、表布と裏布の間に、失禁や夜尿により漏れ出した尿や汗を保持するための大きな空間を形成することができ、尿や汗を確実に保持することができるとともに、保持防水シート自体に、適度のクッション性を持たせることができる。

【図面の簡単な説明】

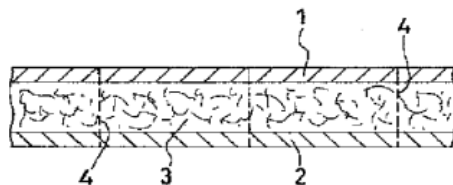
【図1】本発明の防水シートの平面図である。

【図2】同断面図である。

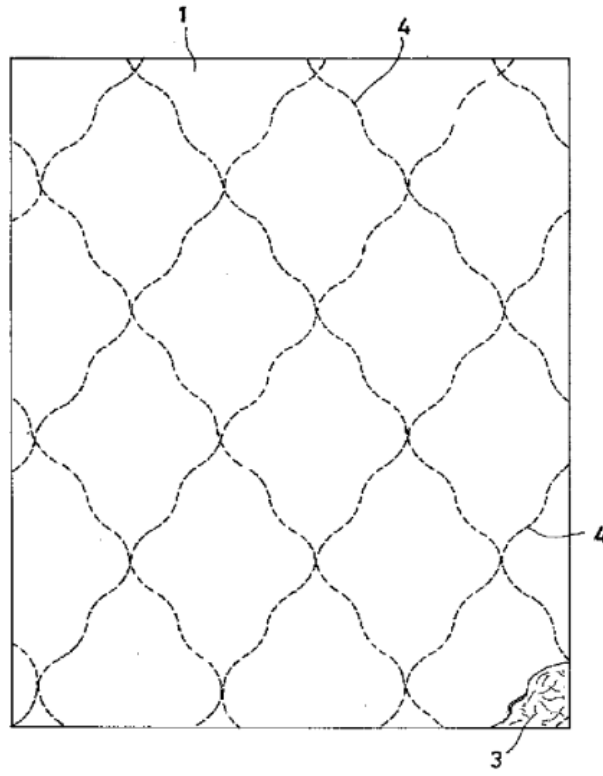
【符号の説明】

- 1 表布
- 2 裏布
- 3 中布

【図2】



【图1】



## PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

# PCT

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To: SCHNEIDER RYAN A.  TROUTMAN SANDERS LLP BANK OF AMERICA PLAZA 600 PEACHTREE STREET, N.E., SUITE 5200 ATLANTA GA 30308-2216 USA
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Date of mailing (day/month/year) <b>29 APRIL 2010 (29.04.2010)</b>
<b>FOR FURTHER ACTION</b> See paragraph 2 below

Applicant's or agent's file reference SHEEX1PCT	International application No. <b>PCT/US2009/058716</b>	International filing date (day/month/year) <b>29 SEPTEMBER 2009 (29.09.2009)</b>	Priority date(day/month/year) 29 SEPTEMBER 2008 (29.09.2008)
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International Patent Classification (IPC) or both national classification and IPC  <b>D04B 21/14(2006.01)i, D03D 11/00(2006.01)i</b>
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Applicant <b>SHEEX LLC et al</b>
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1. This opinion contains indications relating to the following items:
- Box No. I Basis of the opinion
  - Box No. II Priority
  - Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - Box No. IV Lack of unity of invention
  - Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - Box No. VI Certain documents cited
  - Box No. VII Certain defects in the international application
  - Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.  
For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

 Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu, Daejeon 302 -701, Republic of Korea Facsimile No. 82-42-472-7140	Date of completion of this opinion 28 APRIL 2010 (28.04.2010)	Authorized officer KIM, Jong Kyoo Telephone No.82-42-481-5593	
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**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

**PCT/US2009/058716**

**Box No. I Basis of this opinion**

1. With regard to the **language**, this opinion has been established on the basis of:
  - the international application in the language in which it was filed
  - a translation of the international application into \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
2.  This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:
  - a. a sequence listing filed or furnished
    - on paper
    - in electronic form
  - b. time of filing or furnishing
    - contained in the international application as filed.
    - filed together with the international application in electronic form.
    - furnished subsequently to this Authority for the purposes of search.
4.  In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

**PCT/US2009/058716**

**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-17	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-17	NO
Industrial applicability (IA)	Claims	1-17	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following document :

D1: JP 11-309183 A (MORIUCHI KYU KK) 09 November 1999

1. Novelty and Inventive Step

1-1. Regarding claims 1-4

Most of the features of claim 1 are disclosed in D1 except for making the finished fabric at least 90 inches wide. However, it is considered to be a minor difference over the disclosure of D1, that are merely matters of design option when the general knowledge in relevant field of the art is used. Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claim 1.

The additional feature of claim 2 is already disclosed in D1(see claim 3). The features added by claims 3 & 4 are considered to be a minor difference over the disclosure of D1(see paragraphs [0010]-[0013]), which fall under the general knowledge of a person skilled in the art. Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claims 2-4.

1-2. Regarding claims 5-8

Most of the features of claim 5 are disclosed in D1 except for making the finished fabric at least 90 inches wide, circular knitting the fabric and stitching the fabric portions together. However, making the finished fabric at least 90 inches wide is considered to be a minor difference over the disclosure of D1, that is merely matters of design option when the general knowledge in relevant field of the art is used. Circular knitting and stitching are considered to be a minor difference over the disclosure of D1(see paragraphs [0010]-[0013]), which fall under the general knowledge of a person skilled in the art. Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claim 5.

The additional feature of claim 6 is already disclosed in D1(see paragraph [0001]). The features added by claims 7 & 8 are a simple addition of conventional technique in this field as occasion demands. Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claims 6-8.

1-3. Regarding claims 9-12

Most of the features of claim 9 are disclosed in D1 except for making the bed sheet at least 90 inches wide, circular knitting the fabric, stitching the fabric portions together and heat setting finishing. However, making the bed sheet at least 90 inches wide is considered to be a minor difference over the disclosure of D1, that is merely matters of design option when the general knowledge in relevant field of the art is used. Circular knitting and stitching are considered to be a minor difference over the disclosure of D1(see paragraphs [0010]-[0013]), which fall under the general knowledge of a person skilled in the art. Heat setting finishing without limitation of kinds of the material of the fiber is a simple addition of conventional technique as occasion demands. Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claim 9.

Continued on Supplemental Box



**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

Continuation of :

Box V

The feature added by claim 10 is a simple addition of conventional technique in this field as occasion demands. The additional features of claims 11 & 12 are already disclosed in D1(see paragraph [0010]-[0013]). Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claims 10-12.

1-4. Regarding claims 13-17

Most of the features of claim 13 are disclosed in D1 except for the finished fabric at least 90 inches wide and the circular knitted fabric. However, the finished fabric at least 90 inches wide is considered to be a minor difference over the disclosure of D1, that is merely matters of design option when the general knowledge in relevant field of the art is used. Circular knitted fabric is considered to be a minor difference over the disclosure of D1(see paragraphs [0010]-[0013]), which fall under the general knowledge of a person skilled in the art. Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claim 13.

The feature added by claim 15 is a simple addition of conventional technique in this field as occasion demands. The additional features of claims 14, 16 & 17 are already disclosed in D1(see paragraph [0010]-[0013]). Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claims 14-17.

2. Industrial Applicability

The subject matter of claims 1-17 is industrially applicable meeting the requirements of Article 33(4) PCT.

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference SHEEX1PCT	<b>FOR FURTHER ACTION</b> see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. <b>PCT/US2009/058716</b>	International filing date ( <i>day/month/year</i> ) <b>29 SEPTEMBER 2009 (29.09.2009)</b>	(Earliest) Priority Date ( <i>day/month/year</i> ) 29 SEPTEMBER 2008 (29.09.2008)
Applicant <b>SHEEX LLC et al</b>		

This International search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

the international application in the language in which it was filed

a translation of the international application into \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b.  This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c.  With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2.  **Certain claims were found unsearchable** (See Box No. II)

3.  **Unity of invention is lacking** (See Box No. III)

4. With regard to the **title**,

the text is approved as submitted by the applicant.

the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

the text is approved as submitted by the applicant.

the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

a. the figure of the **drawings** to be published with the abstract is Figure No. 3

as suggested by the applicant.

as selected by this Authority, because the applicant failed to suggest a figure.

as selected by this Authority, because this figure better characterizes the invention.

b.  none of the figure is to be published with the abstract.

**A. CLASSIFICATION OF SUBJECT MATTER****D04B 21/14(2006.01)i, D03D 11/00(2006.01)i**

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)

D04B 21/14; A47G 9/00; A47G 9/02; A61G 7/05; B32B 5/26

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

Korean utility models and applications for utility models  
Japanese utility models and applications for utility models  
(Chinese Patents and application for patent)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 11-309183 A (MORIUCHI KYU KK) 09 November 1999 See paragraphs [0001] and [0010]-[0013]	1-17
X	US 6381779 B1 (THOMPSON; THOMAS L.) 07 May 2002 See claim 1 and figures 4-6	1
A	US 5817391 A1 (ROCK; MOSHE et al.) 06 October 1998 See column 1, line 66 - column 3, line 19	1-17
A	US 5765241 A1 (MACDONALD; ROBERT) 16 June 1998 See the whole document	1-17

 Further documents are listed in the continuation of Box C. See patent family annex.

\* Special categories of cited documents:

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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

28 APRIL 2010 (28.04.2010)

Date of mailing of the international search report

**29 APRIL 2010 (29.04.2010)**

Name and mailing address of the ISA/KR

Korean Intellectual Property Office  
Government Complex-Daejeon, 139 Seonsa-ro, Seo-  
gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

KIM, Jong Kyoo

Telephone No. 82-42-481-5593



**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2009/058716**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 11-309183 A	09.11.1999	None	
US 6381779 B1	07.05.2002	US 6678906 B1 WO 0309-2452A1	20.01.2004 13.11.2003
US 5817391 A1	06.10.1998	None	
US 5765241 A1	16.06.1998	AU 1997-12445 B2 EP 0787451 A2 EP 0787451 A3 EP 0787451 B1 GB 2309638 A	27.05.1999 06.08.1997 13.10.1999 04.06.2003 06.08.1997

## PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

# PCT

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To: SCHNEIDER RYAN A.  TROUTMAN SANDERS LLP BANK OF AMERICA PLAZA 600 PEACHTREE STREET, N.E., SUITE 5200 ATLANTA GA 30308-2216 USA
---

Date of mailing (day/month/year) <b>29 APRIL 2010 (29.04.2010)</b>
---



Applicant's or agent's file reference SHEEX1PCT	<b>FOR FURTHER ACTION</b> See paragraph 2 below
--	--

International application No. <b>PCT/US2009/058716</b>	International filing date (day/month/year) <b>29 SEPTEMBER 2009 (29.09.2009)</b>	Priority date(day/month/year) 29 SEPTEMBER 2008 (29.09.2008)
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International Patent Classification (IPC) or both national classification and IPC  <b>D04B 21/14(2006.01)i, D03D 11/00(2006.01)i</b>
--

Applicant <b>SHEEX LLC et al</b>
-------------------------------------

<p>1. This opinion contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p> <p>2. <b>FURTHER ACTION</b></p> <p>If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.</p> <p>If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later. For further options, see Form PCT/ISA/220.</p> <p>3. For further details, see notes to Form PCT/ISA/220.</p>
---

 <p>Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu, Daejeon 302 -701, Republic of Korea Facsimile No. 82-42-472-7140</p>	<p>Date of completion of this opinion 28 APRIL 2010 (28.04.2010)</p>	<p>Authorized officer KIM, Jong Kyoo Telephone No.82-42-481-5593</p> 
---	--	--

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US2009/058716

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
  - the international application in the language in which it was filed
  - a translation of the international application into \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
2.  This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:
  - a. a sequence listing filed or furnished
    - on paper
    - in electronic form
  - b. time of filing or furnishing
    - contained in the international application as filed.
    - filed together with the international application in electronic form.
    - furnished subsequently to this Authority for the purposes of search.
4.  In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

**PCT/US2009/058716**

**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	<u>1-17</u>	YES
	Claims	<u>NONE</u>	NO
Inventive step (IS)	Claims	<u>NONE</u>	YES
	Claims	<u>1-17</u>	NO
Industrial applicability (IA)	Claims	<u>1-17</u>	YES
	Claims	<u>NONE</u>	NO

2. Citations and explanations :

Reference is made to the following document :

D1: JP 11-309183 A (MORIUCHI KYU KK) 09 November 1999

1. Novelty and Inventive Step

1-1. Regarding claims 1-4

Most of the features of claim 1 are disclosed in D1 except for making the finished fabric at least 90 inches wide. However, it is considered to be a minor difference over the disclosure of D1, that are merely matters of design option when the general knowledge in relevant field of the art is used. Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claim 1.

The additional feature of claim 2 is already disclosed in D1(see claim 3). The features added by claims 3 & 4 are considered to be a minor difference over the disclosure of D1(see paragraphs [0010]-[0013]), which fall under the general knowledge of a person skilled in the art. Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claims 2-4.

1-2. Regarding claims 5-8

Most of the features of claim 5 are disclosed in D1 except for making the finished fabric at least 90 inches wide, circular knitting the fabric and stitching the fabric portions together. However, making the finished fabric at least 90 inches wide is considered to be a minor difference over the disclosure of D1, that is merely matters of design option when the general knowledge in relevant field of the art is used. Circular knitting and stitching are considered to be a minor difference over the disclosure of D1(see paragraphs [0010]-[0013]), which fall under the general knowledge of a person skilled in the art. Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claim 5.

The additional feature of claim 6 is already disclosed in D1(see paragraph [0001]). The features added by claims 7 & 8 are a simple addition of conventional technique in this field as occasion demands. Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claims 6-8.

1-3. Regarding claims 9-12

Most of the features of claim 9 are disclosed in D1 except for making the bed sheet at least 90 inches wide, circular knitting the fabric, stitching the fabric portions together and heat setting finishing. However, making the bed sheet at least 90 inches wide is considered to be a minor difference over the disclosure of D1, that is merely matters of design option when the general knowledge in relevant field of the art is used. Circular knitting and stitching are considered to be a minor difference over the disclosure of D1(see paragraphs [0010]-[0013]), which fall under the general knowledge of a person skilled in the art. Heat setting finishing without limitation of kinds of the material of the fiber is a simple addition of conventional technique as occasion demands. Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claim 9.

Continued on Supplemental Box

**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Box V

The feature added by claim 10 is a simple addition of conventional technique in this field as occasion demands. The additional features of claims 11 & 12 are already disclosed in D1(see paragraph [0010]-[0013]). Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claims 10-12.

1-4. Regarding claims 13-17

Most of the features of claim 13 are disclosed in D1 except for the finished fabric at least 90 inches wide and the circular knitted fabric. However, the finished fabric at least 90 inches wide is considered to be a minor difference over the disclosure of D1, that is merely matters of design option when the general knowledge in relevant field of the art is used. Circular knitted fabric is considered to be a minor difference over the disclosure of D1(see paragraphs [0010]-[0013]), which fall under the general knowledge of a person skilled in the art. Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claim 13.

The feature added by claim 15 is a simple addition of conventional technique in this field as occasion demands. The additional features of claims 14, 16 & 17 are already disclosed in D1(see paragraph [0010]-[0013]). Hence, no inventive step under PCT Article 33(3) is present in the subject matter of claims 14-17.

2. Industrial Applicability

The subject matter of claims 1-17 is industrially applicable meeting the requirements of Article 33(4) PCT.



## Electronic Patent Application Fee Transmittal

<b>Application Number:</b>	13271884			
<b>Filing Date:</b>	12-Oct-2011			
<b>Title of Invention:</b>	Fabric System			
<b>First Named Inventor/Applicant Name:</b>	Susan Walvius			
<b>Filer:</b>	Frank L. Gerratana/Jennifer franco			
<b>Attorney Docket Number:</b>	29712-0002002			
Filed as Large Entity				
<b>Utility under 35 USC 111(a) Filing Fees</b>				
<b>Description</b>	<b>Fee Code</b>	<b>Quantity</b>	<b>Amount</b>	<b>Sub-Total in USD(\$)</b>
<b>Basic Filing:</b>				
<b>Pages:</b>				
<b>Claims:</b>				
<b>Miscellaneous-Filing:</b>				
<b>Petition:</b>				
<b>Patent-Appeals-and-Interference:</b>				
<b>Post-Allowance-and-Post-Issuance:</b>				
<b>Extension-of-Time:</b>				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
<b>Miscellaneous:</b>				
Submission- Information Disclosure Stmt	1806	1	180	180
<b>Total in USD (\$)</b>				<b>180</b>

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	12094120
<b>Application Number:</b>	13271884
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	4645
<b>Title of Invention:</b>	Fabric System
<b>First Named Inventor/Applicant Name:</b>	Susan Walvius
<b>Customer Number:</b>	26161
<b>Filer:</b>	Frank L. Gerratana/Jennifer franco
<b>Filer Authorized By:</b>	Frank L. Gerratana
<b>Attorney Docket Number:</b>	29712-0002002
<b>Receipt Date:</b>	16-FEB-2012
<b>Filing Date:</b>	12-OCT-2011
<b>Time Stamp:</b>	15:14:29
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$180
RAM confirmation Number	1839
Deposit Account	061050
Authorized User	

### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
		000219			

1		2002IDS.pdf	142226	yes	4
			8072369ddd48a072c405d725d4a90b69576fe539		
<b>Multipart Description/PDF files in .zip description</b>					
<b>Document Description</b>			<b>Start</b>	<b>End</b>	
Transmittal Letter			1	2	
Information Disclosure Statement (IDS) Form (SB08)			3	4	
<b>Warnings:</b>					
<b>Information:</b>					
2	Foreign Reference	CN102245822.pdf	1436722	no	13
			67a5370f8b011bcc308110a1d6eda7df95c42903		
<b>Warnings:</b>					
<b>Information:</b>					
3	Foreign Reference	JP1999309183.pdf	328798	no	5
			6bc854ce17ad8923b19697b6935b82128c08ef54		
<b>Warnings:</b>					
<b>Information:</b>					
4	Non Patent Literature	2CA1_OA_1_16_12.pdf	400421	no	4
			1efb5f366c5b70630b29dc260f51ae0c7aea5ad2		
<b>Warnings:</b>					
<b>Information:</b>					
5	Non Patent Literature	2EP1_Comm_5_27_11.pdf	117168	no	2
			8df182cf227b87d1a5378cc75440755da164e699		
<b>Warnings:</b>					
<b>Information:</b>					
6	Non Patent Literature	2EP1_RCOMM_11_22_11.pdf	249260	no	12
			611bfd45983aab144b0e79f08473df5df64fc43fb		
<b>Warnings:</b>					
<b>Information:</b>					
7	Non Patent Literature	2001_pendingclaims_659.pdf	52210	no	6
			68300112732efe65db587e700158691751d800a		
<b>Warnings:</b>					
<b>Information:</b>					
8	Non Patent Literature	2003_pendingclaims_977.pdf	44740	no	4
		000220	bdc99a3fd57b2d6e87bc3782b121fec55a4d89b8		

<b>Warnings:</b>					
<b>Information:</b>					
9	Non Patent Literature	0002001TH_659.pdf	79770 b1ea73e5ca2dcf8e0e0dbe9cd619e3372c bd537	no	2
<b>Warnings:</b>					
<b>Information:</b>					
10	Non Patent Literature	2003TH_977.pdf	76286 d9c496ee942d87e5dc55baa57bb706ce3b 31bb75	no	1
<b>Warnings:</b>					
<b>Information:</b>					
11	Non Patent Literature	2WO1_IPRP.pdf	182518 bd6c05007e497bd2f7f0d0f8bcc3a983352a 2aeb	no	4
<b>Warnings:</b>					
<b>Information:</b>					
12	Non Patent Literature	2WO1_ISR.pdf	120408 2a775122b9388b2a4125a59215c27a977de eb83f	no	3
<b>Warnings:</b>					
<b>Information:</b>					
13	Non Patent Literature	2WO1_WO.pdf	176341 32575fc6901986de41663f446b4dccc016b2 722d2	no	4
<b>Warnings:</b>					
<b>Information:</b>					
14	Non Patent Literature	2EP1_COMM_2_16_12.pdf	97993 b664ad2d46de1eda456340c45d4d7be374 22d783	no	3
<b>Warnings:</b>					
<b>Information:</b>					
15	Fee Worksheet (SB06)	fee-info.pdf	29279 0d1724ab7e3f44e4c342239150ce6a87926f f154	no	2
<b>Warnings:</b>					
<b>Information:</b>					
<b>Total Files Size (in bytes):</b>				3534590	

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: Susan Walvius et al.	Art Unit	: 3673
Serial No.	: 13/271,884	Examiner	: Nicholas F. Polito
Filed	: October 12, 2011	Conf. No.	: 4645
Title	: FABRIC SYSTEM		

**MAIL STOP AMENDMENT**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Please consider the references listed on the attached PTO-1449 form.

Copies of United States patent documents will be provided upon request. Copies of all non-U.S. patent documents and other documents are enclosed.

The United States patent applications and/or patents listed below contain material related to material in this application. Copies of the applications and/or patents, their current claims (in the case of patents), and their transaction histories from the patent office public PAIR website are enclosed (or were provided previously with information disclosure statements identified in the table).

The applicant invites the examiner to consider the claims and claim amendments of these other applications and/or patents, and the positions of the examiners and the applicant that appear in their prosecution histories. The applicant understands that the examiner has direct access to these papers at the patent office, but will be happy to provide copies to the examiner upon request.

Applicant : Susan Walvius et al.  
Serial No. : 13/271,884  
Filed : October 12, 2011  
Page : 2 of 2

Attorney's Docket No.: 29712-0002002

US serial number and filing date/ status	Examiner and group art unit	Is patent or application attached and listed on form 1449 and/or what is the date of a prior information disclosure statement with which it was submitted	In the case of an application, are claims attached or what is the date of a prior information disclosure statement with which they were submitted	Is current PAIR transaction history attached and listed on form 1449
61/101,049 09/29/2008 Expired	N/A	No	No	No
12/569,659 09/29/2009 Pending	Nicholas F. Polito GAU 3673	Yes - publication 2011/0000020 submitted	Yes	Yes
13/272,977 10/13/2011 Pending	Nicholas F. Polito GAU 3673	Yes - publication 2012/0030874 submitted	Yes	Yes

This statement is being filed after a first Office action on the merits, but before receipt of a final Office action or a Notice of Allowance. The fees in the amount of \$180 in payment of the late submission fee of §1.17(p) are being paid concurrently herewith. In addition, please apply any other necessary charges or credits to deposit account 06-1050, referencing the above attorney docket number.

Respectfully submitted,

Date: February 16, 2012\_\_\_\_\_

/Frank L. Gerratana/  
Frank L. Gerratana  
Reg. No. 62,653

Customer Number 26161  
Fish & Richardson P.C.  
Telephone: (617) 542-5070  
Facsimile: (877) 769-7945

22792671.doc





UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

Table with 4 columns: APPLICATION NUMBER (13/271,884), FILING OR 371(C) DATE (10/12/2011), FIRST NAMED APPLICANT (Susan Walvius), ATTY. DOCKET NO./TITLE (29712-0002002)

CONFIRMATION NO. 4645

PUBLICATION NOTICE

26161
FISH & RICHARDSON P.C. (BO)
P.O. BOX 1022
MINNEAPOLIS, MN 55440-1022



Title: Fabric System

Publication No. US-2012-0024013-A1
Publication Date: 02/02/2012

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/271,884	10/12/2011	Susan Walvius	29712-0002002	4645
26161	7590	01/04/2012	EXAMINER	
FISH & RICHARDSON P.C. (BO)			POLITO, NICHOLAS F	
P.O. BOX 1022			ART UNIT	PAPER NUMBER
MINNEAPOLIS, MN 55440-1022			3673	
			NOTIFICATION DATE	DELIVERY MODE
			01/04/2012	ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATDOCTC@fr.com

**Office Action Summary**

<b>Application No.</b> 13/271,884	<b>Applicant(s)</b> WALVIUS ET AL.	
<b>Examiner</b> NICHOLAS POLITO	<b>Art Unit</b> 3673	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1)  Responsive to communication(s) filed on 11/30/2011.
- 2a)  This action is **FINAL**.
- 2b)  This action is non-final.
- 3)  An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_\_; the restriction requirement and election have been incorporated into this action.
- 4)  Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 5)  Claim(s) 14-43 is/are pending in the application.  
5a) Of the above claim(s) 14-24 is/are withdrawn from consideration.
- 6)  Claim(s) \_\_\_\_\_ is/are allowed.
- 7)  Claim(s) 25-42 is/are rejected.
- 8)  Claim(s) 43 is/are objected to.
- 9)  Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 10)  The specification is objected to by the Examiner.
- 11)  The drawing(s) filed on 12 October 2011 is/are: a)  accepted or b)  objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 12)  The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 13)  Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a)  All    b)  Some \*    c)  None of:  
1.  Certified copies of the priority documents have been received.  
2.  Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3.  Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1)  Notice of References Cited (PTO-892)
- 2)  Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3)  Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4)  Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 5)  Notice of Informal Patent Application
- 6)  Other: \_\_\_\_\_.

## DETAILED ACTION

### *Election/Restrictions*

1. Claims 14-24 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 11/30/2011

### *Double Patenting*

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to

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be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

3. Claims 25-43 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-4 and 28 of copending Application No. 12/569,659 and claims 15-25, 28-37 and 41. Although the conflicting claims are not identical, they are not patentably distinct from each other because they are drawn to the same subject matter but written separately as method and apparatus claims.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 25-29 and 31-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murphy et al. (U.S. Patent No. 6,823,548).

4. Regarding claim 25, Murphy et al. teach in Figures 1-3 a finished fabric comprising: a first circular knitted fabric portion (22); and a second circular knitted fabric

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portion (24), at least one of the circular knitted fabric portions comprising a circular knitted performance fabric portion (Table 1, Ex. No. 1.3); wherein the first and second fabric portions are discrete; and wherein the first and second fabric portions are joined (col. 6, lines 41-48) to form the finished fabric.

Murphy et al. do not teach wherein the finished fabric is at least 90 inches wide. Murphy et al. teach column 3, lines 42 to 45 wherein the finished fabric is for a mattress. The examiner takes official notice that it is commonly known in the art for a standard size mattress cover to be at least 90 inches wide. Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to make the finished fabric of Murphy et al. at least 90 inches wide to cover a standard mattress.

5. Regarding claim 26, Murphy et al. teach the finished fabric of claim 25. Murphy et al. do not teach piping. The examiner takes official notice that it is commonly known in the art to provide piping to a fabric. Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to provide piping to the bed fabric of Murphy et al. to provide a finished edge.

6. Regarding claim 27, Murphy et al. teach in column 5, lines 20 to 29 the finished fabric of claim 25, wherein the first and second fabrics have different fabric characteristics.

7. Regarding claim 28, Murphy et al. teach in column 5, lines 46 to 67 the finished fabric of claim 27, wherein at least one of the fabric characteristics comprises moisture management.

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8. Regarding claim 29, Murphy et al. teach in column 5, lines 46 to 67 the finished fabric of claim 27, wherein at least one of the fabric characteristics comprises UV protection.

9. Regarding claim 31, Murphy et al. teach in column 5, lines 46 to 67 the finished fabric of claim 27, wherein at least one of the fabric characteristics comprises thermo-regulation.

10. Regarding claim 32, Murphy et al. teach in column 5, lines 46 to 67 the finished fabric of claim 27, wherein at least one of the fabric characteristics comprises wind resistance.

11. Regarding claim 33, Murphy et al. teach in column 5, lines 46 to 67 the finished fabric of claim 27, wherein at least one of the fabric characteristics comprises water resistance.

12. Regarding claim 34, Murphy et al. teach in column 5, lines 46 to 67 the finished fabric of claim 25, wherein the performance fabric portion comprises a man-made fiber that has higher breathability than a cotton fabric.

13. Regarding claim 35, Murphy et al. teach in column 5, lines 46 to 67 the finished fabric of claim 25, wherein the performance fabric portion comprises a man-made fiber that has higher heat transfer than a cotton fabric.

14. Regarding claim 36, Murphy et al. teach in column 5, lines 46 to 67 the finished fabric of claim 25, wherein the performance fabric portion comprises a man-made fiber that has higher moisture wicking characteristics than a cotton fabric.

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15. Regarding claim 37, Murphy et al. teach the finished fabric of claim 25. Murphy does not teach wherein the finished fabric has a gauge of at least 17 gauges. The examiner takes official notice that it is commonly known in the art to use high gauge fabrics for bed coverings. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a gauge of at least 17, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

16. Regarding claim 38, Murphy et al. teach in column 3, lines 43 to 61 the finished fabric of claim 25, comprising a bed sheet.

17. Regarding claim 39, Murphy et al. teach in column 3, lines 43 to 61 the finished fabric of claim 25, comprising a bed covered by the bed sheet.

18. Regarding claim 40, Murphy et al. teach in column 3, lines 43 to 61, column 5, lines 46 to 64 and Table 1, Ex. No. 1.3 the finished fabric of claim 25, wherein the bed sheet is sufficiently stretchable to fit a standard rectangular bed and a smaller, non-rectangular marine bed.

19. Regarding claim 41, Murphy et al. teach in column 3, lines 43 to 61, column 5, lines 46 to 64 and Table 1, Ex. No. 1.3 the finished fabric of claim 25, wherein the bed sheet is sufficiently stretchable to fit either a crib or a standard adult bed.

20. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murphy et al. in view of Porter et al. (U.S. Patent No. 4,690,859).



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21. Regarding claim 30, Murphy et al. teach the finished fabric of claim 27. Murphy et al. do not teach wherein at least one of the fabric characteristics comprises anti-microbial properties. Porter et al. teach in column 4, lines 4 to 14 a finished fabric comprising anti-microbial properties. In view of Porter et al., it would have been obvious to a person having ordinary skill in the art at the time the invention was made to combine the anti-microbial properties of Porter et al. with the finished fabric of Murphy et al. to prevent the growth of microorganisms.

22. Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murphy et al. in view of Link et al. (U.S. Pub. No. 2007/0283493).

23. Regarding claim 42, Murphy et al. teach the finished fabric of claim 25. Murphy et al. do not teach a knit fabric that includes polyurethanepolyurea copolymer fiber. Link et al. teach in paragraph 28 a knit fabric that includes polyurethanepolyurea copolymer fiber. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use polyurethanepolyurea copolymer fiber, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. See also *Ballas Liquidating Co. v. Allied industries of Kansas, Inc.* (DC Kans) 205 USPQ 331.

***Allowable Subject Matter***

24. Claim 43 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

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25. The following is a statement of reasons for the indication of allowable subject matter: Murphy et al. and Link et al., taken either alone or in combination, do not teach "polyurethanepolyurea copolymer fiber is included in the knit fabric in a proportion that, if circularly knit at a high gauge, the knit fabric could be knit at no more than a 72.5 inch circumference without losing integrity of the polyurethanepolyurea copolymer fiber."

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NICHOLAS POLITO whose telephone number is (571)270-5923. The examiner can normally be reached on Monday-Friday 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pete Cuomo can be reached on (571) 272-6856. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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/Nicholas Polito/  
Examiner, Art Unit 3673

/ROBERT G. SANTOS/  
Primary Examiner, Art Unit 3673

12/21/2011

<b>Notice of References Cited</b>	Application/Control No. 13/271,884	Applicant(s)/Patent Under Reexamination WALVIUS ET AL.	
	Examiner NICHOLAS POLITO	Art Unit 3673	Page 1 of 1

**U.S. PATENT DOCUMENTS**

*	Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A US-6,823,548	11-2004	Murphy et al.	5/698
*	B US-4,690,859	09-1987	Porter et al.	442/68
*	C US-2007/0283493	12-2007	Link et al.	5/483
	D US-			
	E US-			
	F US-			
	G US-			
	H US-			
	I US-			
	J US-			
	K US-			
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	M US-			

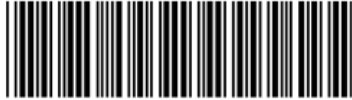
**FOREIGN PATENT DOCUMENTS**

*	Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N				
	O				
	P				
	Q				
	R				
	S				
	T				

**NON-PATENT DOCUMENTS**

*	Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)				
	U				
	V				
	W				
	X				

\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<b>Index of Claims</b>  	<b>Application/Control No.</b>  13271884	<b>Applicant(s)/Patent Under Reexamination</b>  WALVIUS ET AL.
	<b>Examiner</b>  NICHOLAS POLITO	<b>Art Unit</b>  3673

✓	<b>Rejected</b>
=	<b>Allowed</b>

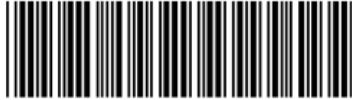
-	<b>Cancelled</b>
÷	<b>Restricted</b>

N	<b>Non-Elected</b>
I	<b>Interference</b>

A	<b>Appeal</b>
O	<b>Objected</b>

Claims renumbered in the same order as presented by applicant
  CPA
  T.D.
  R.1.47

CLAIM		DATE							
Final	Original	11/09/2011	12/21/2011						
	1	-	-						
	2	-	-						
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	15	÷	N						
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	17	÷	N						
	18	÷	N						
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	28	÷	✓						
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	32	÷	✓						
	33	÷	✓						
	34	÷	✓						
	35	÷	✓						
	36	÷	✓						

<b><i>Index of Claims</i></b>  	<b>Application/Control No.</b>  13271884	<b>Applicant(s)/Patent Under Reexamination</b>  WALVIUS ET AL.
	<b>Examiner</b>  NICHOLAS POLITO	<b>Art Unit</b>  3673

✓	<b>Rejected</b>
=	<b>Allowed</b>


-	<b>Cancelled</b>
÷	<b>Restricted</b>

N	<b>Non-Elected</b>
I	<b>Interference</b>

A	<b>Appeal</b>
O	<b>Objected</b>

Claims renumbered in the same order as presented by applicant
  CPA
  T.D.
  R.1.47

CLAIM		DATE							
Final	Original	11/09/2011	12/21/2011						
	37	÷	✓						
	38	÷	✓						
	39	÷	✓						
	40	÷	✓						
	41	÷	✓						
	42	÷	✓						
	43	÷	O						

<b>Search Notes</b>  	<b>Application/Control No.</b> 13271884	<b>Applicant(s)/Patent Under Reexamination</b> WALVIUS ET AL.
	<b>Examiner</b> NICHOLAS POLITO	<b>Art Unit</b> 3673

<b>SEARCHED</b>			
<b>Class</b>	<b>Subclass</b>	<b>Date</b>	<b>Examiner</b>
5	482 - 484, 486, 499 - 502	12/21/2011	NP

<b>SEARCH NOTES</b>		
<b>Search Notes</b>	<b>Date</b>	<b>Examiner</b>
EAST Search History Attached	12/21/2011	NP

<b>INTERFERENCE SEARCH</b>			
<b>Class</b>	<b>Subclass</b>	<b>Date</b>	<b>Examiner</b>

/NICHOLAS POLITO/  
Examiner.Art Unit 3673

Substitute Form PTO-1449 (Modified)  <b>Information Disclosure Statement by Applicant</b> (Use several sheets if necessary)  (37 CFR §1.98(b))	U.S. Department of Commerce Patent and Trademark Office		Attorney Docket No. 29712-0002002	Application No. 13/271,884
	Applicant Susan Walvius et al.			
	Filing Date October 12, 2011		Group Art Unit 3673	

**U.S. Patent Documents**

Examiner Initial	Desig. ID	Document Number	Publication Date	Patentee	Class	Subclass	Filing Date If Appropriate
	1	5,765,241	1998-06-16	Macdonald			
	2	5,817,391	1998-10-06	Rock et al.			
	3	6,381,779	2002-05-07	Thompson			

**Foreign Patent Documents or Published Foreign Patent Applications**

Examiner Initial	Desig. ID	Document Number	Publication Date	Country or Patent Office	Class	Subclass	Translation	
							Yes	No
	4	JP 11309183	1999-11-09	Japan				
	5	EP2344691	07/20/2011	Europe				
	6	WO2010/037082	04/01/10	WIPO				
	7	ES2368481	11/17/2011	Spain				

**Other Documents (include Author, Title, Date, and Place of Publication)**

Examiner Initial	Desig. ID	Document
	8	International Search Report and Written Opinion issued by the Korean Intellectual Property Office for related PCT Patent Application No. <i>PCT/US2009/058716</i> dated April 29, 2010
	9	International Preliminary Report on Patentability issued by the Korean Intellectual Property Office for related PCT Patent Application No. <i>PCT/US2009/058716</i> dated April 7, 2011 (6 pages).
	10	Voluntary Amendment from corresponding Australian patent application no. 2009296195, filed April 12, 2011 (11 pages).

Examiner Signature /Nicholas Polito/	Date Considered 12/21/2011
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EXAMINER: Initials citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.





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BIB DATA SHEET

CONFIRMATION NO. 4645

<b>SERIAL NUMBER</b> 13/271,884	<b>FILING or 371(c) DATE</b> 10/12/2011 <b>RULE</b>	<b>CLASS</b> 005	<b>GROUP ART UNIT</b> 3673	<b>ATTORNEY DOCKET NO.</b> 29712-0002002	
<b>APPLICANTS</b> Susan Walvius, Chapin, SC; Michelle Marciniak, Irmo, SC; <b>** CONTINUING DATA *****</b> This application is a CON of 12/569,659 09/29/2009 which claims benefit of 61/101,049 09/29/2008 <b>** FOREIGN APPLICATIONS *****</b> <b>** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **</b> 10/25/2011					
Foreign Priority claimed <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No 35 USC 119(a-d) conditions met <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Verified and /NICHOLAS F POLITO/ Acknowledged Examiner's Signature	<input type="checkbox"/> Met after Allowance Initials	<b>STATE OR COUNTRY</b> SC	<b>SHEETS DRAWINGS</b> 4	<b>TOTAL CLAIMS</b> 30	<b>INDEPENDENT CLAIMS</b> 4
<b>ADDRESS</b> FISH & RICHARDSON P.C. (BO) P.O. BOX 1022 MINNEAPOLIS, MN 55440-1022 UNITED STATES					
<b>TITLE</b> Fabric System					
<b>FILING FEE RECEIVED</b> 2400	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		<input type="checkbox"/> All Fees <input type="checkbox"/> 1.16 Fees (Filing) <input type="checkbox"/> 1.17 Fees (Processing Ext. of time) <input type="checkbox"/> 1.18 Fees (Issue) <input type="checkbox"/> Other _____ <input type="checkbox"/> Credit		

Substitute Form PTO-1449 (Modified)  <b>Information Disclosure Statement by Applicant</b> (Use several sheets if necessary)  (37 CFR §1.98(b))	U.S. Department of Commerce Patent and Trademark Office	Attorney Docket No. 29712-0002002	Application No. Unknown
	Applicant Susan Walvius et al.		
	Filing Date Unknown	Group Art Unit Unknown	

**U.S. Patent Documents**

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	2	5,817,391	10/06/98	Rock et al.			
	3	6,765,241	06/16/98	Macdonald			

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							Yes	No
	4	EP 2 344 691	07/20/11	EPO				
	5	JP 11309183	11/09/99	Japan				
	6	WO2010/037082	04/01/10	WIPO				

**Other Documents (include Author, Title, Date, and Place of Publication)**

Examiner Initial	Desig. ID	Document
	7	Voluntary Amendment from corresponding Australian patent application no. 2009296195, filed April 12, 2011 (11 pages).
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	9	International Search Report and Written Opinion issued by the Korean Intellectual Property Office for related PCT Patent Application No. PCT/US2009/058716 dated April 29, 2010

Examiner Signature /Nicholas Polito/	Date Considered 12/21/2011
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EXAMINER: Initials citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

## EAST Search History

## EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L11	0	(11/759586).APP.	USPAT; USOCR	OR	OFF	2011/12/21 20:35
L12	41	5/482-502.ccls. and (antimicrobial or anti-microbial)	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/21 20:40
S1	1	12/569659 or 13/271884 or 13/272977	US-PGPUB; USPAT; USOCR	OR	OFF	2011/12/19 16:46
S2	23	"5"/.clas. and ((circle or circular) adj knit)	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/19 16:49
S3	118	((circle or circular) adj knit) and stitch and (heat adj set)	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/19 16:52
S4	18	((circle or circular) adj knit) same stitch same (heat adj set)	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/19 16:52
S5	3	"5"/.clas. and (((circle or circular) adj knit) and stitch and (heat adj set))	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/19 16:57
S6	27828	bedding or (bed near sheet) or (mattress near cover\$3)	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/20 14:21
S7	1867	((circle or circular) adj knit)	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/20 14:21
S8	109	S6 and S7	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/20 14:21
S9	24359	(heat-set\$4) or (heat adj set\$4)	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/20 14:23
S10	11	S6 and S7 and S9	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/20 14:24
S11	23	flatlock near stitch\$3	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/20 14:27
S12	0	(12/162516).APP.	USPAT; USOCR	OR	OFF	2011/12/20 15:29
S13	0	("2009/0044338").URPN.	USPAT	OR	OFF	2011/12/20 15:29
S14	0	(10/710179).APP.	USPAT; USOCR	OR	OFF	2011/12/20 15:32
S15	1	("2005/0284189").URPN.	USPAT	OR	OFF	2011/12/20 15:33

000243

S16	20	("4504991"   "4801493"   "5279878"   "5645926"   "5935882"   "5972512").PN. OR ("6823548").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2011/12/20 15:44
S17	10	5/482-502.ccls. and ((circle or circular) adj knit)	US-PGPUB; USPAT; USOCR	OR	OFF	2011/12/20 15:45
S18	12	5/482-502.ccls. and ((circle or circular or round) near knit\$3)	US-PGPUB; USPAT; USOCR	OR	OFF	2011/12/20 15:46
S19	8356	((circle or circular or round) adj knit\$4)	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/20 15:59
S20	8586	((circle or circular or round) near knit\$4)	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/20 15:59
S21	165	S6 and S20	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/20 15:59
S22	9978	((circle or circular or round or jersey or fleece or terry or double) adj knit\$4)	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/20 16:12
S23	28	5/482-502.ccls. and ((circle or circular or round or jersey or fleece or terry or double) adj knit\$4)	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/20 16:12
S24	281	5/482-502.ccls. and knit\$4	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/20 16:22
S25	3	((("5765241") or ("5817391") or ("6381779")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2011/12/20 18:07
S26	2028	5/482-484,486,499-502.ccls.	US-PGPUB; USPAT; USOCR	OR	OFF	2011/12/20 18:09
S27	1	((susan near walvius) or (michelle near marciniak)).in.	US-PGPUB; USPAT; USOCR	OR	OFF	2011/12/20 18:27
S28	55	5/482-502.ccls. and spandex	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/21 17:24
S29	47	spandex with antimicrobial	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/21 17:34
S30	0	spandex with circumference with gauge	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/21 17:38
S31	4	spandex same circumference same gauge	US-PGPUB; USPAT; USOCR	OR	ON	2011/12/21 17:38

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U.S. Patent Documents							
Examiner Initial	Desig. ID	Document Number	Publication Date	Patentee	Class	Subclass	Filing Date If Appropriate
	1	5,765,241	1998-06-16	Macdonald			
	2	5,817,391	1998-10-06	Rock et al.			
	3	6,381,779	2002-05-07	Thompson			

Foreign Patent Documents or Published Foreign Patent Applications								
Examiner Initial	Desig. ID	Document Number	Publication Date	Country or Patent Office	Class	Subclass	Translation	
							Yes	No
	4	JP 11309183	1999-11-09	Japan				
	5	EP2344691	07/20/2011	Europe				
	6	WO2010/037082	04/01/10	WIPO				
	7	ES2368481	11/17/2011	Spain				

Other Documents (include Author, Title, Date, and Place of Publication)		
Examiner Initial	Desig. ID	Document
	8	International Search Report and Written Opinion issued by the Korean Intellectual Property Office for related PCT Patent Application No. <i>PCT/US2009/058716</i> dated April 29, 2010
	9	International Preliminary Report on Patentability issued by the Korean Intellectual Property Office for related PCT Patent Application No. <i>PCT/US2009/058716</i> dated April 7, 2011 (6 pages).
	10	Voluntary Amendment from corresponding Australian patent application no. 2009296195, filed April 12, 2011 (11 pages).

Examiner Signature	Date Considered
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(21) Application number: **10132738**(71) Applicant: **MORIUCHI KYU KK**(22) Date of filing: **27.04.98**(72) Inventor: **MATSUMOTO TAKESHI**(54) **WATERPROOF SHEET**

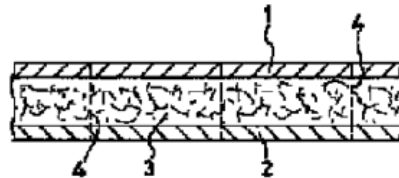
## (57) Abstract:

**PROBLEM TO BE SOLVED:** To make urine and sweat absorbed and to prevent bedding, clothes and surrounding from being stained by using a water-permeable and water-diffusive texture for a surface fabric, using a water-impermeable and air-permeable texture by water-repellent finishing for a back fabric, and arranging an intermediate fabric having a water absorbing property and preventing the backflow of moisture between both fabrics.

**SOLUTION:** A knit fabric or a woven fabric made of a water-permeable and water-diffusive texture, preferably polyester or other synthetic fibers, and having a proper expansion/shrinkage property is used for a surface fabric 1 to be kept in direct contact with the skin. A knit fabric or a woven fabric made of a water-impermeable and air-permeable texture by water-repellent finishing, preferably polyester or other synthetic fibers, is used for a back fabric 2 to be kept in contact with the mattress of bedding. A nonwoven fabric or a knit fabric having a water absorbing property and having the required thickness to prevent the backflow of absorbed moisture is used for an intermediate fabric 3, and preferably a nonwoven fabric

of synthetic fibers such as polyester and a warp-knit fabric such as raschel or tricot are used singularly or in lamination.

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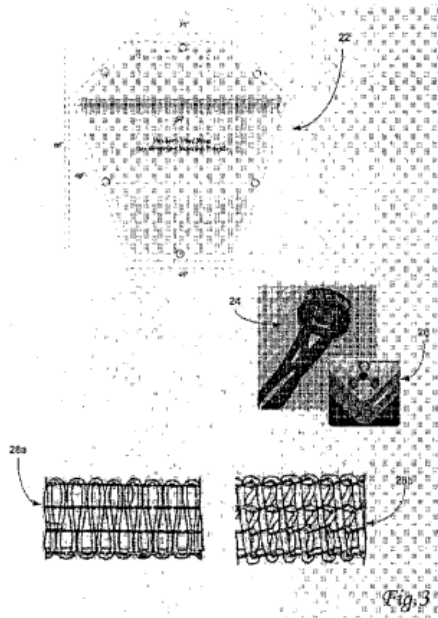
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(54) Title: FABRIC SYSTEM



(57) Abstract: Bedding material including a first fabric section manufactured from performance fabric and having a first and second side; and, a second fabric section attached to the first side of the first fabric section. Additionally, a third fabric section can be attached to the second side of the first fabric section. The first fabric section can be attached to the second fabric section through a flatlock stitch. The first fabric section can include a first zone and a second zone wherein the first zone contains different performance properties from the second zone and the first zone can have thermal or moisture wicking properties.

## FABRIC SYSTEM

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates generally to fabric systems, and more specifically to bed coverings constructed of high gauge circular knitted fabrics that accommodate and maintain optimum thermal conditions for sleep, which in turn can lead to faster sleep initiation and deeper, more restorative sleep.

#### 2. Description of Related Art

Sleep problems in the United States are remarkably widespread, affecting roughly three out of four American adults, according to research by the National Sleep Foundation (NSF). Consequently, a great deal of attention has been paid to the circumstances surrounding poor sleep, along with strategies for how to improve it.

The implications are not merely academic. Sleep – not only the right amount of it but also the right quality – impacts not just day-to-day performance, but also “the overall quality of our lives,” according to the NSF. Addressing the causes of poor quality sleep, therefore, has ramifications for millions.

Though many factors contribute to sleep quality, the sleep environment itself plays a critical role, and sleep researchers routinely highlight temperature as one of the most important components in creating an environment for optimal sleep. As advised by the University of Maryland Medical Center, “a cool (not cold) bedroom is often the most conducive to sleep.” The National Sleep Foundation further notes that “temperatures above 75 degrees Fahrenheit and below 54 degrees will disrupt sleep,” with 65 degrees being the ideal sleep temperature for most individuals, according to the NSF.

A lower environmental temperature is not the only thermal factor associated with improved sleep. Researchers have noted a nightly drop in body temperature among healthy, normal adults during sleep. This natural cycle, when inhibited or not functioning properly, can disrupt sleep and delay sleep onset, according to medical researchers at Cornell University. Conversely, the researchers noted, a rapid decline in body temperature not only accelerates sleep onset but also “may facilitate an entry into the deeper stages of sleep.”



Therefore, maintaining an appropriately cool sleep environment and accommodating the body's natural tendency to cool itself at night should be a top priority for individuals interested in optimizing their sleep quality. Performance fabrics crafted into bedding applications would be uniquely capable of promoting cool, comfortable – and therefore better – sleep, as these advanced fabrics maximize breathability and heat transfer. Performance fabrics are made for a variety of end-use applications, and can provide multiple functional qualities, such as moisture management, UV protection, anti-microbial, thermo-regulation, and wind/water resistance.

There has been a long felt need in several industries to provide improved bedding to help individuals get better sleep. Such improved bedding would include beneficial wicking among other properties. For example, in marine, boating and recreational vehicle applications, bedding should resist moisture, fit odd-shaped mattresses and beds, and reduce mildew. Particularly with watercraft, there is a need to protect bedding, and specifically sheets, from moisture and mildew accumulation.

An additional problem with bedding, not just with marine and recreational vehicles, is the sticky, wet feeling that can occur when the bedding sheets are wet due to body sweat, environmental moisture, or other bodily fluids. In particular, when bedding is used during hot weather, or is continuously used for a long time by a person suffering from an illness, problems can arise in that the conventional bed sheet of cotton fiber or the like cannot sufficiently absorb the moisture. All of these issues lead to poor sleep.

To date, performance fabric bedding products are not known. There are width limitations in the manufacturing of high gauge circular knit fabrics, because the finished width of bedding fabrics are dictated by the machine used in its construction. At present, performance fabrics are manufactured with a maximum width of under 90 inches wide, given present manufacturing and technical limitations, along with the inability of alternate manufacturing processes to produce a fabric with identical performance attributes. Yet, normal bed sheet panels can be 102 by 91 inches or larger. Thus, performance fabrics cannot yet be used for bed sheets.

Some conventional solutions for the above issues that hinder a good night's sleep include United States Patent 4,648,186, which discloses an absorbent wood pulp cellulose fiber that is provided in a variety of sizes and is placed under a mattress. The wood pulp is water absorbent and acts to capture moisture to prevent such moisture from being retained by the bedding or the

bedding sheets. However, this proposed solution does not interact with the bedding or the bedding sheets, but merely acts as a sponge for moisture that is in proximity to the target bedding.

United States Patent 5,092,088 discloses a sheet-like mat comprised of a mat cover, the inside of which is divided into a plurality of bag-like spaces, and a drying agent packed into a bag and contained in the bag-like spaces in such a manner that the drying agent cannot fall out of the bag-like spaces. A magnesium sulfate, a high polymer absorbent, a silica gel or the like can be used as the drying agent. As can be seen, this proposed solution to moisture in bedding is cumbersome and chemically-based.

In the athletic apparel industry, moisture wicking fabric has been used to construct athletic apparel. For example, United States Patent 5,636,380 discloses a base fabric of CoolmaxQ high moisture evaporation fabric having one or more insulating panels of ThermaxB or ThermastatQ hollow core fiber fabric having moisture wicking capability and applied to the inner side of the garment for skin contact at selected areas of the body where muscle protection is desired. However, this application cannot be applied to bedding sheets due to the limitations of the size of the performance fabrics manufactured. Further, performance fabric such as this type cannot be easily stitched together as the denier is so fine that stitching this fabric results in the stitching simply falling apart.

Circular knitting is typically used for athletic apparel. The process includes circularly knitting yarns into fabrics. Circular knitting is a form of weft knitting where the knitting needles are organized into a circular knitting bed. A cylinder rotates and interacts with a cam to move the needles reciprocally for knitting action. The yarns to be knitted are fed from packages to a carrier plate that directs the yarn strands to the needles. The circular fabric emerges from the knitting needles in a tubular form through the center of the cylinder. This process is described in United States Patent 7,117,695. However, the machinery presently available for this method of manufacture can only produce a fabric with a maximum width of approximately 90 inches. Therefore, this process has not been known to manufacture sheets, since sheets can have dimensions of 91 inches by 102 inches or greater.

Further, the machinery that is used for bedding is very different than for athletic wear. For example, bedding manufacturing equipment is not equipped to sew flatlock stitching or to provide circular knitting. Bed sheets typically are knit using a process known as warp knitting, a

process capable of producing finished fabrics in the widths required for bedding. This method, however, cannot be employed to produce high-quality performance fabrics. Warp knitting is not capable of reproducing these fabrics' fine tactile qualities nor their omni-direction stretch properties, for example.

Circular knitting must be employed to produce a performance fabric that retains these fabric's full range of benefits and advantages. However, in order to produce a fabric of the proper width for bedding applications, a circular knit machine of at least 48 inches in diameter would be necessary. Manufacturing limitations therefore preclude the construction of performance fabrics at proper widths for bedding. The industry is unsure if it could actually knit and then finish performance fabrics at these large sizes, even if the machinery were readily available.

Further, athletic sewing factories are typically not equipped to sew and handle large pieces of fabrics so that equipment limitations do not allow for the manufacture of bedding sheets.

What is needed, therefore, is a bedding system that utilizes performance fabrics and their beneficial properties, the design of which acknowledges and addresses limitations in the manufacture of these fabrics. It is to such a system that the present invention is primarily directed.

#### **BRIEF SUMMARY OF THE INVENTION**

Briefly described, in preferred form, the present invention is a high gauge circular knit fabric for use in bedding, and a method for manufacturing such bedding. The bedding fabric has superior performance properties, while allowing for manufacture by machinery presently available and in use. In order to achieve a finished width of the size needed to create sheet-sized performance fabric, a high gauge circular knit machine of at least 48 inches in diameter is necessary. And while warp knitting machines are available that can produce wider fabrics, this method will not provide a fabric with the tactile qualities required, nor provide a fabric with omni-directional stretch.

In an exemplary embodiment, the present invention is a method of making a finished fabric comprising at least two discrete performance fabric portions, and joining at least two

discrete performance fabric portions to form the finished fabric. Forming the at least two discrete performance fabric portions can comprise knitting at least two discrete performance fabric portions, and more preferably, circular knitting at least two discrete performance fabric portions. Joining the at least two discrete performance fabric portions to form the finished fabric can comprise stitching at least two discrete performance fabric portions together to form the finished fabric.

The at least two discrete performance fabric portions can have different fabric characteristics. Fabric characteristics as used herein include, among other things, moisture management, UV protection, anti-microbial, thermo-regulation, wind resistance and water resistance.

The finished fabric can be used in, among other applications, residential settings, or in marine, boating and recreational vehicle environments.

The present sheets offer enhanced drape and comfort compared to traditional cotton bedding, and are as fine as silk, yet provide the benefits of high elasticity and recovery along with superior breathability, body-heat transport, and moisture management as compared to traditional cotton bedding.

Conventional fitted sheets can bunch and slide on standard mattress sizes. Furthermore, if the fitted bed sheets do not fit properly, they do not provide a smooth surface to lie on. The present invention overcomes these issues.

The present high gauge circular knit fabrics stretch to fit and offer superior recovery on the mattress allowing the fabric to conform to fit the mattress without popping off the corners of the mattress or billowing. The performance fabric can include spandex, offers a better fit than conventional bedding products, can accommodate larger or smaller mattress sizes with a single size sheet, and can conform to mattresses with various odd dimensions.

Spandex - or elastane - is a synthetic fiber known for its exceptional elasticity. It is stronger and more durable than rubber, its major non-synthetic competitor. It is a polyurethane-polyurea copolymer that was invented by DuPont. "Spandex" is a generic name, and an anagram of the word "expands." "Spandex" is the preferred name in North America; elsewhere it is

referred to as “elastane.” The most famous brand name associated with spandex is Lycra, a trademark of Invista.

The present high gauge circular knit fabric offers durability in reduced pilling and pulling when compared to other knit technologies, and offer reduced wrinkles and enhanced color steadfastness

In a preferred embodiment, the present performance fabric can allow for a one-size fitted sheet that can actually fit two different size mattresses. For example, the full fitted sheet of the present invention can fit on both the full and queen size bed. The twin fitted sheet of the present invention will also fit an XL twin. In a boating application, the present invention can be produced to fit almost every custom boat mattress.

Testing of the present invention conducted at the North Carolina State University (NCSU) Center for Research on Textile Protection and Comfort confirms that the present performance fabrics provide a cooler sleeping environment than cotton. Performance bedding was tested side-by-side with commercially available cotton bed sheets in a series of procedures designed to measure each product’s heat- and moisture-transport properties, as well as warm/cool-to-touch thermal transport capabilities.

Across all tests, the present performance fabrics in bedding outperformed cotton, demonstrating the performance fabric’s superiority in establishing and maintaining thermal comfort during sleep. This advantage is evident to users from the very onset, as NCSU testing indicates that, on average, performance bedding of the present invention offers improved heat transfer upon initial contact with the skin, resulting in a cooler-to-the-touch feeling.

During sleep, high gauge circular knit performance bedding of the present invention helps to maintain thermal comfort by trapping less body heat and breathing better than cotton. Testing has demonstrated that performance bedding made out of performance fabrics transfers heat away from the body up to two times more effectively than cotton. This is critically important not only for sustained comfort during sleep, but also in terms of enabling the body to cool itself as rapidly as possible to facilitate sleep onset. In addition to trapping less heat, performance bedding breathes better than cotton – up to 50% better, giving performance bedding a strong advantage in terms of ventilation and heat and moisture transfer.

The performance advantage over cotton holds true for simulated dry and wet skin conditions, confirming that certain performance fabrics in bedding are better suited than cotton at managing moisture (e.g., sweat) to maintain thermal comfort. In addition to wicking moisture away from the skin through capillary action, the performance fabric's advanced breathability further enables heat and moisture transfer through evaporative cooling. As a result, the user is kept cooler, drier and more comfortable than with cotton.

The present performance bedding holds a distinct advantage over cotton in enabling, accommodating and maintaining optimum thermal conditions for sleep, which in turn can lead to faster sleep initiation and deeper, more restorative sleep.

These and other objects, features and advantages of the present invention will become more apparent upon reading the following specification in conjunction with the accompanying drawings.

#### **BRIEF DESCRIPTION OF THE FIGURES**

**Fig. 1** illustrates a preferred embodiment of the present invention.

**Fig. 2** illustrates another preferred embodiment of the present invention.

**Fig. 3** illustrates a further preferred embodiment of the present invention.

**Fig. 4** illustrates another preferred embodiment of the present invention.

#### **DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS**

Although preferred embodiments of the invention are explained in detail, it is to be understood that other embodiments are contemplated. Accordingly, it is not intended that the invention is limited in its scope to the details of construction and arrangement of components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or carried out in various ways. Also, in describing the preferred embodiments, specific terminology will be resorted to for the sake of clarity.

It must also be noted that, as used in the specification and the appended claims, the singular forms "a," "an" and "the" include plural referents unless the context clearly dictates otherwise. For example, reference to a sheet or portion is intended also to include the

manufacturing of a plurality of sheets or portions. References to a sheet containing “a” constituent is intended to include other constituents in addition to the one named.

Also, in describing the preferred embodiments, terminology will be resorted to for the sake of clarity. It is intended that each term contemplates its broadest meaning as understood by those skilled in the art and includes all technical equivalents which operate in a similar manner to accomplish a similar purpose.

Ranges may be expressed herein as from “about” or “approximately” one particular value and/or to “about” or “approximately” another particular value. When such a range is expressed, another embodiment includes from the one particular value and/or to the other particular value.

By “comprising” or “containing” or “including” is meant that at least the named compound, element, particle, or method step is present in the composition or article or method, but does not exclude the presence of other compounds, materials, particles, method steps, even if the other such compounds, material, particles, method steps have the same function as what is named.

It is also to be understood that the mention of one or more method steps does not preclude the presence of additional method steps or intervening method steps between those steps expressly identified. Similarly, it is also to be understood that the mention of one or more components in a fabric or system does not preclude the presence of additional components or intervening components between those components expressly identified.

Referring now in detail to the drawing figures, wherein like reference numerals represent like parts throughout the several views, the present invention of **Figs. 1 and 4** provides a sheet **10** shown having dimensions of 102 inches in length and 91 inches in width. The material is manufactured from performance fabric, which can include, for example, varying amounts of one or more of Lycra, Coolmax, Thermax and Thermastat. In a preferred embodiment, the fabric is treated so that the fabric has antimicrobial properties. By using circular-knit performance fabric, the fabric is able to provide elasticity in all four directions. This property allows for the sheet to fit extraordinary mattress, cushion and bedding shapes, as well as providing better fits for traditional rectangular sheets. By using performance fabrics, the sheet has elastic properties that allow stretching in the directions shown as **30**. In addition, by using circular-knit performance

fabric, the resulting bedding retains an exceptionally fine tactile quality critical for providing maximum levels of enhanced comfort.

An alternative to circular knitting is non-circular knitting – for example, warp knitting. This method can achieve widths greater than circular knitting. Industrial warp knit machines, for example, can produce tricote warp knit fabrics up to 130-140 inches in width. Circular knitting, however, is less expensive, as it requires less set-up time. Circular knitting also provides greater multidirectional stretch.

In order to provide a sheet that exceeds the maximum dimensions of fabric that can be produced by available circular knitting machines, flat lock stitching **12** is used to join a plurality of portions resulting in a sheet that is 91 inches wide (as shown). In an exemplary embodiment, piping **11** can be included in close proximity to the stitching. The stitching can be the same color as the fabric of the sheet portions, or different color(s). The piping can be 3/4 inch straight piping without a cord or other filler. In one preferred embodiment, the stitching is 16 stitches per inch. Piping **11** can be included at one end of the sheet and can be the same or a different color as the sheet fabric.

For a fitted sheet, the sheet can include an elastic portion surrounding the edge of the fitted sheet to better keep the fitted sheet in place when placed on a mattress or other sleeping surface. A cord can be sewn into the edge of the fitted sheet and cinched around the mattress or other sleeping surface to better hold the fitted sheet in place.

Referring to **Fig. 2**, a sheet is shown having dimensions of 91 inches wide and 102 inches in length. In this embodiment, stitching **14** is shown 34 inches from an interior edge **18** of a main portion **16** and another stitch **14** at edge **20** of the sewn-on portion. Flat lock stitching can be used for the stitching. Piping can be applied at or in proximity to the stitching.

Referring to **Fig. 3**, a non-rectangular shaped sheet is shown. In this exemplary embodiment, elastic can be included around the edge of the fitted sheet to better maintain the fitted sheet in position when placed on a sleeping surface. In one embodiment, pull ties **24** can be installed at various locations around the edge of the fitted sheet in order to assist in maintaining the fitted sheet secured to the sleeping surface. The pull tie can be cinched to increase tension around the edge of the fitted sheet as shown by **26**.



Stitching used for securing the portions of the sheet together can include that shown as **28a**. In another embodiment, the stitching used for securing the portion of fabric together is shown as **28b**.

Referring to **Fig. 4**, yet another preferred embodiment of the invention is shown. In this embodiment, the sheet can be assembled through stitching of differing fabrics for generating performance zones in the sheet. For example, zone **32** can have higher wicking properties than the other zones since this area is where the majority of the individual body rests. Areas **34a** through **34d** can have higher spandex or other elastic fabric properties so that the fit around a sleeping surface is improved. Area **36** may have thermal properties such as increased cooling since this area is generally where the individual's head lies. In an exemplary embodiment, the pillow covers of pillows used by the individual also have differing properties from the remainder of the sheet, e.g., thermal properties.

The present invention encompasses the construction of bedding materials that have superior performance properties while allowing for manufacture by machinery presently available and in use. More specifically, the invention is related to a new method for fabricating a covering and or sheets in bedding. When using the circular knitting machine, the high gauge performance fabrics can only be made to a maximum size of 72.5 inches without losing the integrity of the spandex in the fabric. Yet, normal sheet panels are 102 x 91 inches. This presents problems when manufacturing sheets from performance fabrics.

Additionally, special stitching techniques must be used given the thread density of the fabric. Using this special stitching, panels are sewn together to produce bedding or a sheet that is the proper size for standard bed sheets. Because discrete portions/panels are used in the manufacture of the present fabrics, panels can be selected that provide different properties for different areas of the bedding (**Fig. 4**). Stitching or seams on the sheet can also allow for the ease of making the bed. Because the bedding is made from performance fabric with spandex, it stretches to permit multiple and custom sizing for applications in cribs, recreational vehicles and boats.

Circular knitting machines used for high gauge performance bedding fabrics are called high-gauge circular knitting machines, because of dense knitting with thin yarn. High gauge generally denotes 17 gauges or more. Seventeen gauges indicate that 17 or more cylinder

needles are contained in one inch. Circular knitting machines of less than 17 gauges are referred to as low-gauge circular knitting machines. The low-gauge circular knitting machines are often used to knit outerwear.

“Yarn count” indicates the linear density (yarn diameter or fineness) to which that particular yarn has been spun. The choice of yarn count is restricted by the type of knitting machine employed and the knitting construction. The yarn count, in turn, influences the cost, weight, opacity, hand and drape of the resulting knitted structure. In general, staple spun yarns tend to be comparatively more expensive the finer their count, because finer fibers and a more exacting spinning process are necessary in order to prevent the yarn from showing an irregular appearance.

A top width in the 90-inch range is currently possible using a circular knit fabric formed on a 36-38-inch diameter machine, although higher levels of spandex in the performance fabric tend to pull the width in. In just one example, on a 30-inch diameter machine, the spandex can reduce an otherwise 94-inch circumference fabric tube to one with a 60-65 inch finished width.

A major limitation in finished width is not strictly a knitting concern but also concerns finishing. With performance fabric, it tends to sag in the middle – increasingly so with greater widths – making finishing difficult to impossible above a certain threshold. A possible 90-inch finished width is contingent upon having a good finishing set-up capable of handling the present performance fabric. This potential for difficulties would only become compounded at the larger widths required for bed sheets.

In a preferred process, the present fabric undergoes a heat setting finishing process. Applying a moisture-wicking finish to another fabric – like cotton – that can be produced at larger widths appears unlikely to match the moisture-control properties of the present fabric, as polyester itself is naturally moisture-resistant and there are physical actions (e.g. capillary action) at play. Further, the use of cotton comes at the expense of breathability and heat-transfer capabilities (as confirmed by laboratory testing) and stretchability.

Numerous characteristics and advantages have been set forth in the foregoing description, together with details of structure and function. While the invention has been disclosed in several forms, it will be apparent to those skilled in the art that many modifications, additions, and deletions, especially in matters of shape, size, and arrangement of parts, can be made therein

without departing from the spirit and scope of the invention and its equivalents as set forth in the following claims. Therefore, other modifications or embodiments as may be suggested by the teachings herein are particularly reserved as they fall within the breadth and scope of the claims here appended.

## CLAIMS

What is claimed is:

1. A method of making a finished fabric at least 90 inches wide comprising:  
forming at least two discrete performance fabric portions; and  
joining at least two discrete performance fabric portions to form the finished fabric.
2. The method according to Claim 1, wherein forming at least two discrete performance fabric portions comprises knitting at least two discrete performance fabric portions.
3. The method according to Claim 1, wherein forming at least two discrete performance fabric portions comprises circular knitting at least two discrete performance fabric portions.
4. The method according to Claim 1, wherein joining at least two discrete performance fabric portions to form the finished fabric comprises stitching at least two discrete performance fabric portions together to form the finished fabric.
5. A method of making a finished fabric at least 90 inches wide comprising:  
circular knitting at least two discrete performance fabric portions; and  
stitching at least two discrete performance fabric portions together to form the finished fabric.
6. The method according to Claim 5, wherein the finished fabric comprises a bed sheet.
7. The method according to Claim 5, further comprising heat setting finishing the finished fabric.
8. The method according to Claim 5, further comprising providing piping to the finished fabric.
9. A method of making a bed sheet at least 90 inches wide from performance fabric comprising:  
circular knitting at least two discrete performance fabric portions;  
stitching at least two discrete performance fabric portions together; and

heat setting finishing the stitched at least two discrete performance fabric portions to form the finished bed sheet.

10. The method according to Claim 9, further comprising providing piping to the finished bed sheet.

11. The method according to Claim 9, wherein the at least two discrete performance fabric portions have different fabric characteristics.

12. The method according to Claim 11, wherein fabric characteristics are selected from the group consisting of moisture management, UV protection, anti-microbial, thermo-regulation, wind resistance and water resistance.

13. A finished fabric at least 90 inches wide comprising:

a first circular knitted performance fabric; and

a second circular knitted performance fabric;

wherein the first and second performance fabrics are discrete; and

wherein the first and second performance fabrics are joined to form the finished fabric.

14. The finished fabric of Claim 13, wherein the finished fabric comprises a bed sheet.

15. The finished fabric of Claim 13, further comprising piping.

16. The finished fabric of Claim 13, wherein the first and second performance fabrics have different fabric characteristics.

17. The finished fabric of Claim 16, wherein fabric characteristics are selected from the group consisting of moisture management, UV protection, anti-microbial, thermo-regulation, wind resistance and water resistance.

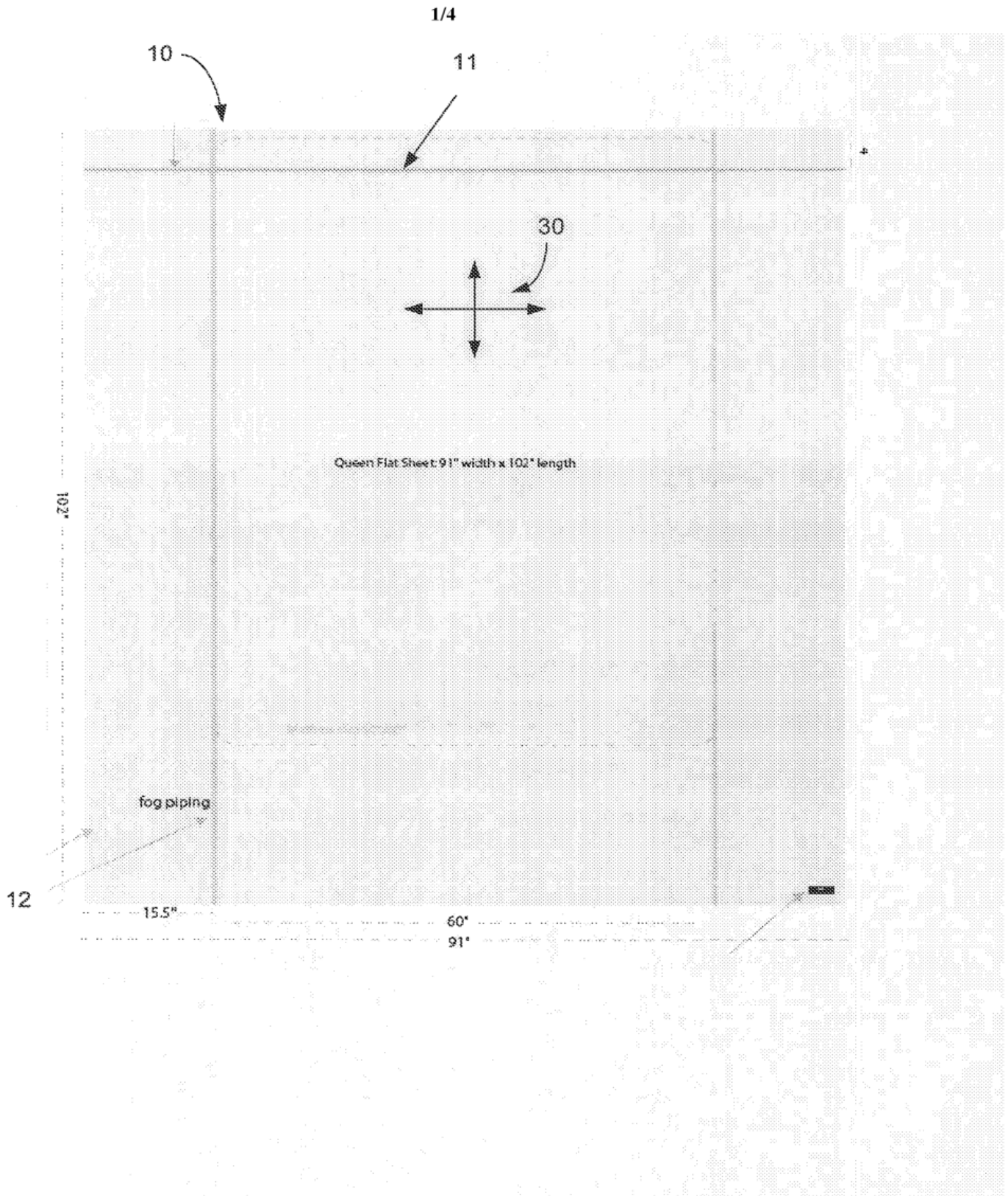
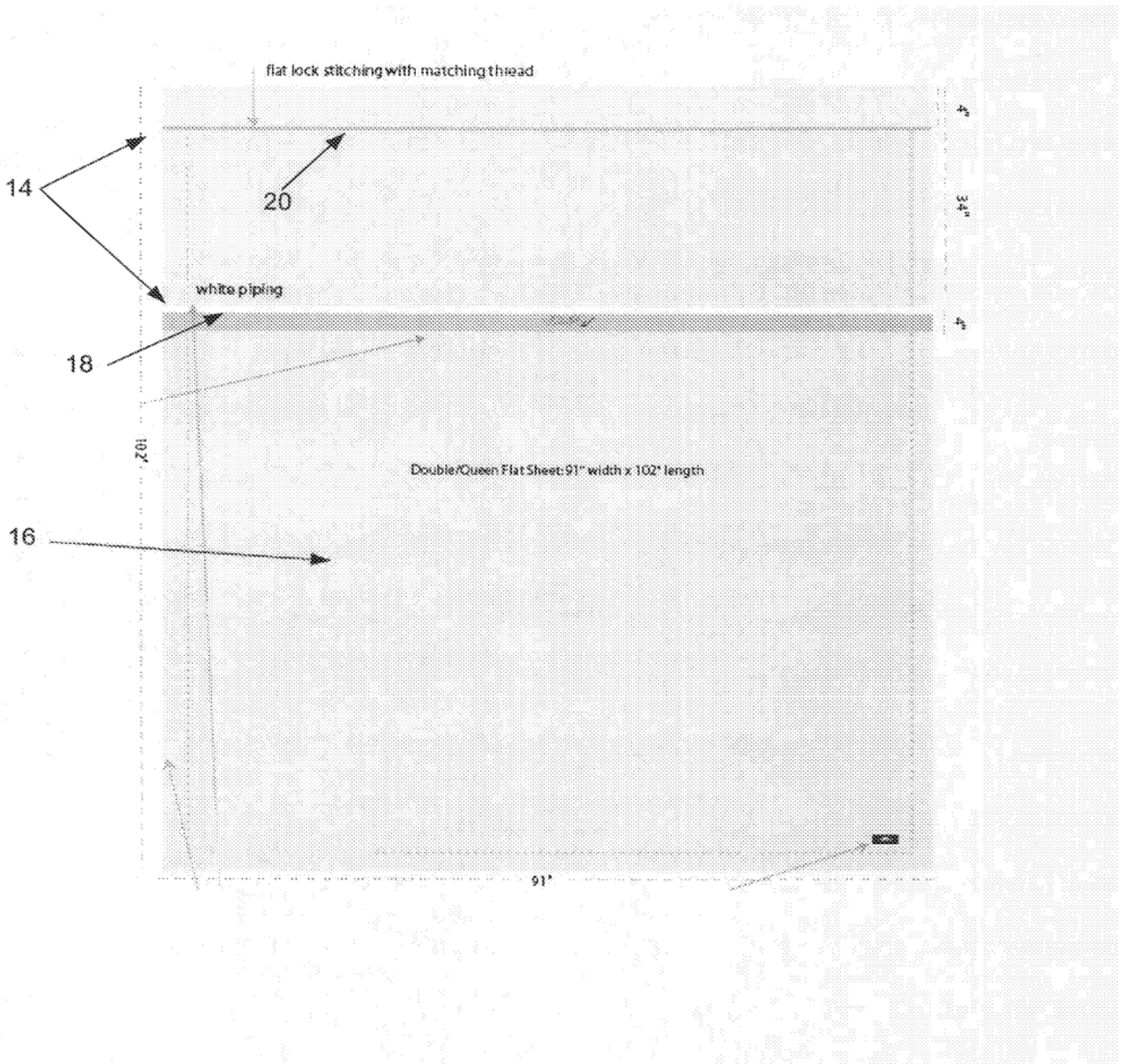


Fig. 1



*Fig. 2*

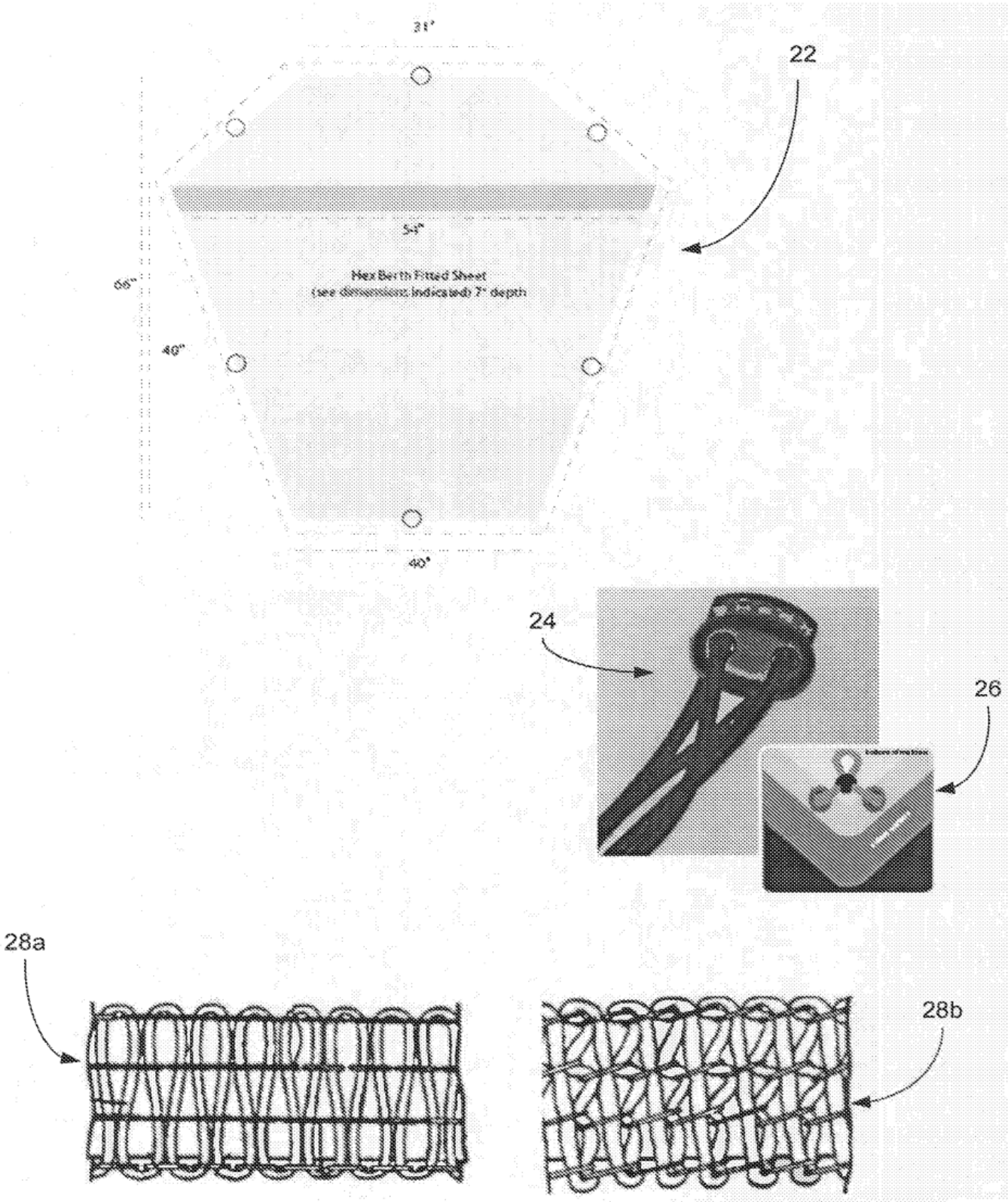
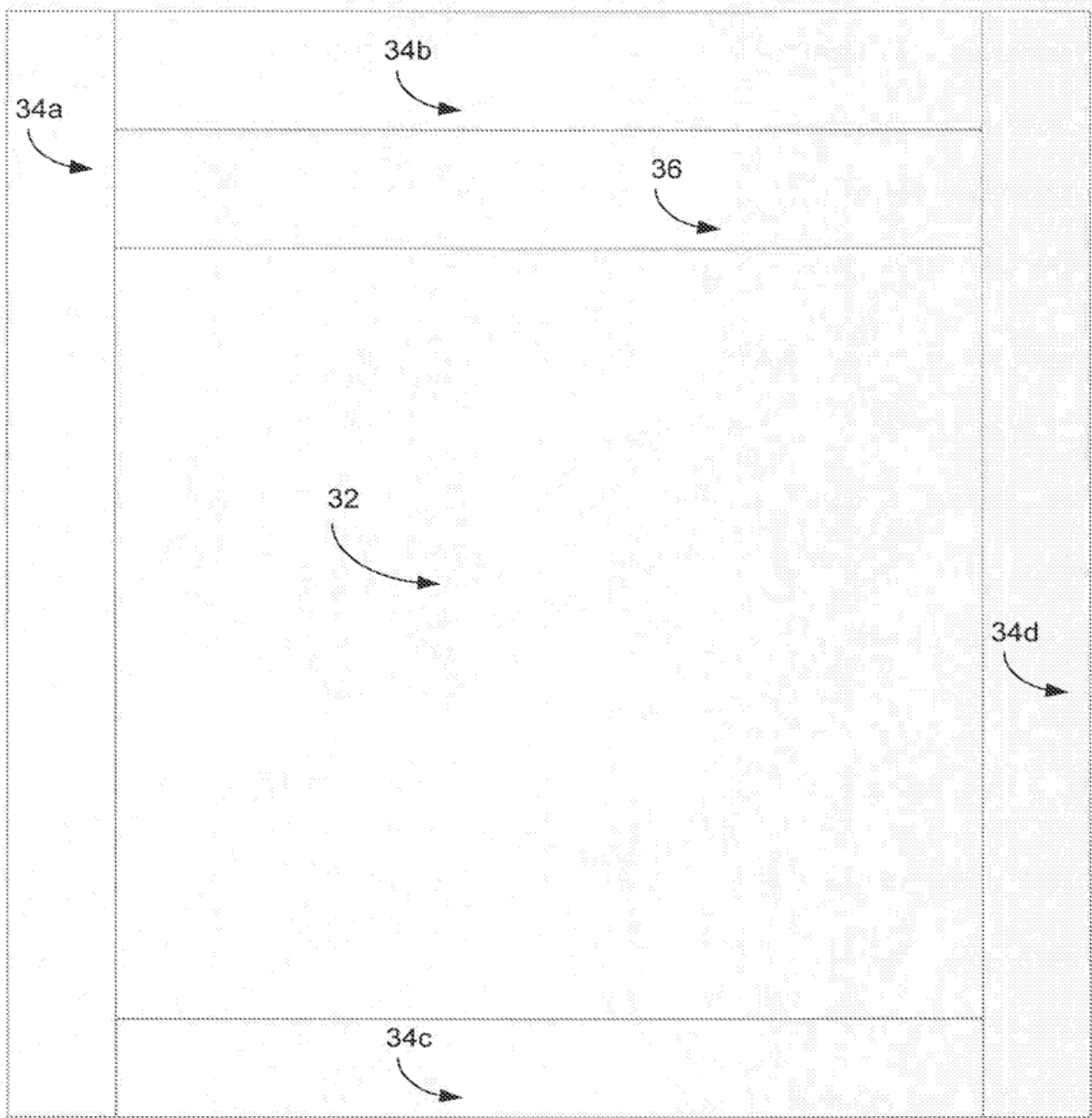


Fig. 3





*Fig. 4*

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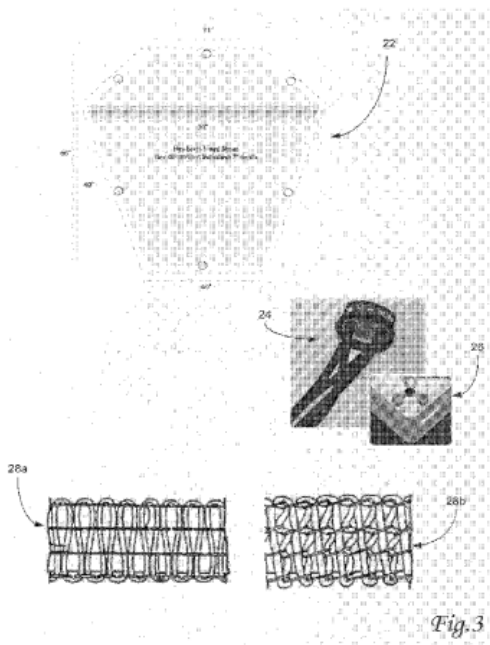
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- (74) Agent: **SCHNEIDER, Ryan, A.**; Troutman Sanders LLP, Bank of America Plaza, 600 Peachtree Street, N.E., Suite 5200, Atlanta, GA 30308-2216 (US).

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[Continued on next page]

(54) Title: FABRIC SYSTEM



(57) Abstract: Bedding material including a first fabric section manufactured from performance fabric and having a first and second side; and, a second fabric section attached to the first side of the first fabric section. Additionally, a third fabric section can be attached to the second side of the first fabric section. The first fabric section can be attached to the second fabric section through a flatlock stitch. The first fabric section can include a first zone and a second zone wherein the first zone contains different performance properties from the second zone and the first zone can have thermal or moisture wicking properties.



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**A. CLASSIFICATION OF SUBJECT MATTER****D04B 21/14(2006.01)i, D03D 11/00(2006.01)i**

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**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

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

Korean utility models and applications for utility models  
Japanese utility models and applications for utility models  
(Chinese Patents and application for patent)Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
eKOMPASS(KIPO internal)**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 11-309183 A (MORIUCHI KYU KK) 09 November 1999 See paragraphs [0001] and [0010]-[0013]	1-17
X	US 6381779 B1 (THOMPSON; THOMAS L.) 07 May 2002 See claim 1 and figures 4-6	1
A	US 5817391 A1 (ROCK; MOSHE et al.) 06 October 1998 See column 1, line 66 - column 3, line 19	1-17
A	US 5765241 A1 (MACDONALD; ROBERT) 16 June 1998 See the whole document	1-17

 Further documents are listed in the continuation of Box C. See patent family 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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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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**INTERNATIONAL SEARCH REPORT**

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 11-309183 A	09.11.1999	None	
US 6381779 B1	07.05.2002	US 6678906 B1 WO 0309-2452A1	20.01.2004 13.11.2003
US 5817391 A1	06.10.1998	None	
US 5765241 A1	16.06.1998	AU 1997-12445 B2 EP 0787451 A2 EP 0787451 A3 EP 0787451 B1 GB 2309638 A	27.05.1999 06.08.1997 13.10.1999 04.06.2003 06.08.1997

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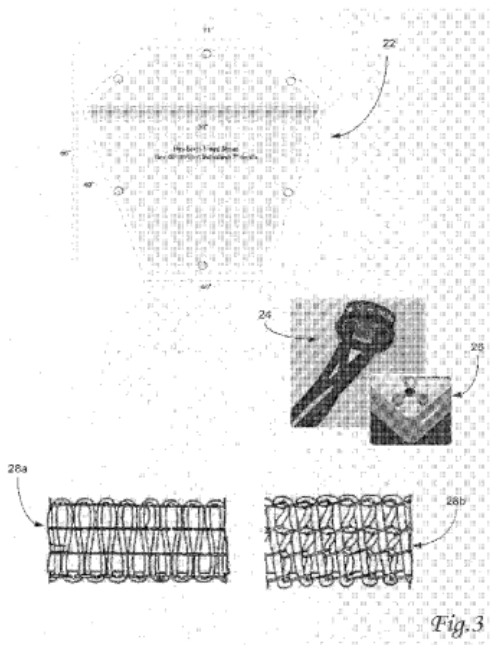
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- (71) Applicant (for all designated States except US): **SHEEX LLC** [US/US]; 169 Captain Lowman Road, Chapin, SC 29036 (US).
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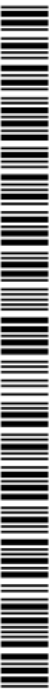
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(54) Title: FABRIC SYSTEM



(57) Abstract: Bedding material including a first fabric section manufactured from performance fabric and having a first and second side; and, a second fabric section attached to the first side of the first fabric section. Additionally, a third fabric section can be attached to the second side of the first fabric section. The first fabric section can be attached to the second fabric section through a flatlock stitch. The first fabric section can include a first zone and a second zone wherein the first zone contains different performance properties from the second zone and the first zone can have thermal or moisture wicking properties.



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## FABRIC SYSTEM

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates generally to fabric systems, and more specifically to bed coverings constructed of high gauge circular knitted fabrics that accommodate and maintain optimum thermal conditions for sleep, which in turn can lead to faster sleep initiation and deeper, more restorative sleep.

#### 2. Description of Related Art

Sleep problems in the United States are remarkably widespread, affecting roughly three out of four American adults, according to research by the National Sleep Foundation (NSF). Consequently, a great deal of attention has been paid to the circumstances surrounding poor sleep, along with strategies for how to improve it.

The implications are not merely academic. Sleep – not only the right amount of it but also the right quality – impacts not just day-to-day performance, but also “the overall quality of our lives,” according to the NSF. Addressing the causes of poor quality sleep, therefore, has ramifications for millions.

Though many factors contribute to sleep quality, the sleep environment itself plays a critical role, and sleep researchers routinely highlight temperature as one of the most important components in creating an environment for optimal sleep. As advised by the University of Maryland Medical Center, “a cool (not cold) bedroom is often the most conducive to sleep.” The National Sleep Foundation further notes that “temperatures above 75 degrees Fahrenheit and below 54 degrees will disrupt sleep,” with 65 degrees being the ideal sleep temperature for most individuals, according to the NSF.

A lower environmental temperature is not the only thermal factor associated with improved sleep. Researchers have noted a nightly drop in body temperature among healthy, normal adults during sleep. This natural cycle, when inhibited or not functioning properly, can disrupt sleep and delay sleep onset, according to medical researchers at Cornell University. Conversely, the researchers noted, a rapid decline in body temperature not only accelerates sleep onset but also “may facilitate an entry into the deeper stages of sleep.”

Therefore, maintaining an appropriately cool sleep environment and accommodating the body's natural tendency to cool itself at night should be a top priority for individuals interested in optimizing their sleep quality. Performance fabrics crafted into bedding applications would be uniquely capable of promoting cool, comfortable – and therefore better – sleep, as these advanced fabrics maximize breathability and heat transfer. Performance fabrics are made for a variety of end-use applications, and can provide multiple functional qualities, such as moisture management, UV protection, anti-microbial, thermo-regulation, and wind/water resistance.

There has been a long felt need in several industries to provide improved bedding to help individuals get better sleep. Such improved bedding would include beneficial wicking among other properties. For example, in marine, boating and recreational vehicle applications, bedding should resist moisture, fit odd-shaped mattresses and beds, and reduce mildew. Particularly with watercraft, there is a need to protect bedding, and specifically sheets, from moisture and mildew accumulation.

An additional problem with bedding, not just with marine and recreational vehicles, is the sticky, wet feeling that can occur when the bedding sheets are wet due to body sweat, environmental moisture, or other bodily fluids. In particular, when bedding is used during hot weather, or is continuously used for a long time by a person suffering from an illness, problems can arise in that the conventional bed sheet of cotton fiber or the like cannot sufficiently absorb the moisture. All of these issues lead to poor sleep.

To date, performance fabric bedding products are not known. There are width limitations in the manufacturing of high gauge circular knit fabrics, because the finished width of bedding fabrics are dictated by the machine used in its construction. At present, performance fabrics are manufactured with a maximum width of under 90 inches wide, given present manufacturing and technical limitations, along with the inability of alternate manufacturing processes to produce a fabric with identical performance attributes. Yet, normal bed sheet panels can be 102 by 91 inches or larger. Thus, performance fabrics cannot yet be used for bed sheets.

Some conventional solutions for the above issues that hinder a good night's sleep include United States Patent 4,648,186, which discloses an absorbent wood pulp cellulose fiber that is provided in a variety of sizes and is placed under a mattress. The wood pulp is water absorbent and acts to capture moisture to prevent such moisture from being retained by the bedding or the



bedding sheets. However, this proposed solution does not interact with the bedding or the bedding sheets, but merely acts as a sponge for moisture that is in proximity to the target bedding.

United States Patent 5,092,088 discloses a sheet-like mat comprised of a mat cover, the inside of which is divided into a plurality of bag-like spaces, and a drying agent packed into a bag and contained in the bag-like spaces in such a manner that the drying agent cannot fall out of the bag-like spaces. A magnesium sulfate, a high polymer absorbent, a silica gel or the like can be used as the drying agent. As can be seen, this proposed solution to moisture in bedding is cumbersome and chemically-based.

In the athletic apparel industry, moisture wicking fabric has been used to construct athletic apparel. For example, United States Patent 5,636,380 discloses a base fabric of CoolmaxQ high moisture evaporation fabric having one or more insulating panels of ThermaxB or ThermastatQ hollow core fiber fabric having moisture wicking capability and applied to the inner side of the garment for skin contact at selected areas of the body where muscle protection is desired. However, this application cannot be applied to bedding sheets due to the limitations of the size of the performance fabrics manufactured. Further, performance fabric such as this type cannot be easily stitched together as the denier is so fine that stitching this fabric results in the stitching simply falling apart.

Circular knitting is typically used for athletic apparel. The process includes circularly knitting yarns into fabrics. Circular knitting is a form of weft knitting where the knitting needles are organized into a circular knitting bed. A cylinder rotates and interacts with a cam to move the needles reciprocally for knitting action. The yarns to be knitted are fed from packages to a carrier plate that directs the yarn strands to the needles. The circular fabric emerges from the knitting needles in a tubular form through the center of the cylinder. This process is described in United States Patent 7,117,695. However, the machinery presently available for this method of manufacture can only produce a fabric with a maximum width of approximately 90 inches. Therefore, this process has not been known to manufacture sheets, since sheets can have dimensions of 91 inches by 102 inches or greater.

Further, the machinery that is used for bedding is very different than for athletic wear. For example, bedding manufacturing equipment is not equipped to sew flatlock stitching or to provide circular knitting. Bed sheets typically are knit using a process known as warp knitting, a

process capable of producing finished fabrics in the widths required for bedding. This method, however, cannot be employed to produce high-quality performance fabrics. Warp knitting is not capable of reproducing these fabrics' fine tactile qualities nor their omni-direction stretch properties, for example.

Circular knitting must be employed to produce a performance fabric that retains these fabric's full range of benefits and advantages. However, in order to produce a fabric of the proper width for bedding applications, a circular knit machine of at least 48 inches in diameter would be necessary. Manufacturing limitations therefore preclude the construction of performance fabrics at proper widths for bedding. The industry is unsure if it could actually knit and then finish performance fabrics at these large sizes, even if the machinery were readily available.

Further, athletic sewing factories are typically not equipped to sew and handle large pieces of fabrics so that equipment limitations do not allow for the manufacture of bedding sheets.

What is needed, therefore, is a bedding system that utilizes performance fabrics and their beneficial properties, the design of which acknowledges and addresses limitations in the manufacture of these fabrics. It is to such a system that the present invention is primarily directed.

#### **BRIEF SUMMARY OF THE INVENTION**

Briefly described, in preferred form, the present invention is a high gauge circular knit fabric for use in bedding, and a method for manufacturing such bedding. The bedding fabric has superior performance properties, while allowing for manufacture by machinery presently available and in use. In order to achieve a finished width of the size needed to create sheet-sized performance fabric, a high gauge circular knit machine of at least 48 inches in diameter is necessary. And while warp knitting machines are available that can produce wider fabrics, this method will not provide a fabric with the tactile qualities required, nor provide a fabric with omni-directional stretch.

In an exemplary embodiment, the present invention is a method of making a finished fabric comprising at least two discrete performance fabric portions, and joining at least two

discrete performance fabric portions to form the finished fabric. Forming the at least two discrete performance fabric portions can comprise knitting at least two discrete performance fabric portions, and more preferably, circular knitting at least two discrete performance fabric portions. Joining the at least two discrete performance fabric portions to form the finished fabric can comprise stitching at least two discrete performance fabric portions together to form the finished fabric.

The at least two discrete performance fabric portions can have different fabric characteristics. Fabric characteristics as used herein include, among other things, moisture management, UV protection, anti-microbial, thermo-regulation, wind resistance and water resistance.

The finished fabric can be used in, among other applications, residential settings, or in marine, boating and recreational vehicle environments.

The present sheets offer enhanced drape and comfort compared to traditional cotton bedding, and are as fine as silk, yet provide the benefits of high elasticity and recovery along with superior breathability, body-heat transport, and moisture management as compared to traditional cotton bedding.

Conventional fitted sheets can bunch and slide on standard mattress sizes. Furthermore, if the fitted bed sheets do not fit properly, they do not provide a smooth surface to lie on. The present invention overcomes these issues.

The present high gauge circular knit fabrics stretch to fit and offer superior recovery on the mattress allowing the fabric to conform to fit the mattress without popping off the corners of the mattress or billowing. The performance fabric can include spandex, offers a better fit than conventional bedding products, can accommodate larger or smaller mattress sizes with a single size sheet, and can conform to mattresses with various odd dimensions.

Spandex - or elastane - is a synthetic fiber known for its exceptional elasticity. It is stronger and more durable than rubber, its major non-synthetic competitor. It is a polyurethane-polyurea copolymer that was invented by DuPont. "Spandex" is a generic name, and an anagram of the word "expands." "Spandex" is the preferred name in North America; elsewhere it is

referred to as “elastane.” The most famous brand name associated with spandex is Lycra, a trademark of Invista.

The present high gauge circular knit fabric offers durability in reduced pilling and pulling when compared to other knit technologies, and offer reduced wrinkles and enhanced color steadfastness

In a preferred embodiment, the present performance fabric can allow for a one-size fitted sheet that can actually fit two different size mattresses. For example, the full fitted sheet of the present invention can fit on both the full and queen size bed. The twin fitted sheet of the present invention will also fit an XL twin. In a boating application, the present invention can be produced to fit almost every custom boat mattress.

Testing of the present invention conducted at the North Carolina State University (NCSU) Center for Research on Textile Protection and Comfort confirms that the present performance fabrics provide a cooler sleeping environment than cotton. Performance bedding was tested side-by-side with commercially available cotton bed sheets in a series of procedures designed to measure each product’s heat- and moisture-transport properties, as well as warm/cool-to-touch thermal transport capabilities.

Across all tests, the present performance fabrics in bedding outperformed cotton, demonstrating the performance fabric’s superiority in establishing and maintaining thermal comfort during sleep. This advantage is evident to users from the very onset, as NCSU testing indicates that, on average, performance bedding of the present invention offers improved heat transfer upon initial contact with the skin, resulting in a cooler-to-the-touch feeling.

During sleep, high gauge circular knit performance bedding of the present invention helps to maintain thermal comfort by trapping less body heat and breathing better than cotton. Testing has demonstrated that performance bedding made out of performance fabrics transfers heat away from the body up to two times more effectively than cotton. This is critically important not only for sustained comfort during sleep, but also in terms of enabling the body to cool itself as rapidly as possible to facilitate sleep onset. In addition to trapping less heat, performance bedding breathes better than cotton – up to 50% better, giving performance bedding a strong advantage in terms of ventilation and heat and moisture transfer.

The performance advantage over cotton holds true for simulated dry and wet skin conditions, confirming that certain performance fabrics in bedding are better suited than cotton at managing moisture (e.g., sweat) to maintain thermal comfort. In addition to wicking moisture away from the skin through capillary action, the performance fabric's advanced breathability further enables heat and moisture transfer through evaporative cooling. As a result, the user is kept cooler, drier and more comfortable than with cotton.

The present performance bedding holds a distinct advantage over cotton in enabling, accommodating and maintaining optimum thermal conditions for sleep, which in turn can lead to faster sleep initiation and deeper, more restorative sleep.

These and other objects, features and advantages of the present invention will become more apparent upon reading the following specification in conjunction with the accompanying drawings.

#### **BRIEF DESCRIPTION OF THE FIGURES**

**Fig. 1** illustrates a preferred embodiment of the present invention.

**Fig. 2** illustrates another preferred embodiment of the present invention.

**Fig. 3** illustrates a further preferred embodiment of the present invention.

**Fig. 4** illustrates another preferred embodiment of the present invention.

#### **DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS**

Although preferred embodiments of the invention are explained in detail, it is to be understood that other embodiments are contemplated. Accordingly, it is not intended that the invention is limited in its scope to the details of construction and arrangement of components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or carried out in various ways. Also, in describing the preferred embodiments, specific terminology will be resorted to for the sake of clarity.

It must also be noted that, as used in the specification and the appended claims, the singular forms "a," "an" and "the" include plural referents unless the context clearly dictates otherwise. For example, reference to a sheet or portion is intended also to include the

manufacturing of a plurality of sheets or portions. References to a sheet containing “a” constituent is intended to include other constituents in addition to the one named.

Also, in describing the preferred embodiments, terminology will be resorted to for the sake of clarity. It is intended that each term contemplates its broadest meaning as understood by those skilled in the art and includes all technical equivalents which operate in a similar manner to accomplish a similar purpose.

Ranges may be expressed herein as from “about” or “approximately” one particular value and/or to “about” or “approximately” another particular value. When such a range is expressed, another embodiment includes from the one particular value and/or to the other particular value.

By “comprising” or “containing” or “including” is meant that at least the named compound, element, particle, or method step is present in the composition or article or method, but does not exclude the presence of other compounds, materials, particles, method steps, even if the other such compounds, material, particles, method steps have the same function as what is named.

It is also to be understood that the mention of one or more method steps does not preclude the presence of additional method steps or intervening method steps between those steps expressly identified. Similarly, it is also to be understood that the mention of one or more components in a fabric or system does not preclude the presence of additional components or intervening components between those components expressly identified.

Referring now in detail to the drawing figures, wherein like reference numerals represent like parts throughout the several views, the present invention of **Figs. 1 and 4** provides a sheet **10** shown having dimensions of 102 inches in length and 91 inches in width. The material is manufactured from performance fabric, which can include, for example, varying amounts of one or more of Lycra, Coolmax, Thermax and Thermastat. In a preferred embodiment, the fabric is treated so that the fabric has antimicrobial properties. By using circular-knit performance fabric, the fabric is able to provide elasticity in all four directions. This property allows for the sheet to fit extraordinary mattress, cushion and bedding shapes, as well as providing better fits for traditional rectangular sheets. By using performance fabrics, the sheet has elastic properties that allow stretching in the directions shown as **30**. In addition, by using circular-knit performance

fabric, the resulting bedding retains an exceptionally fine tactile quality critical for providing maximum levels of enhanced comfort.

An alternative to circular knitting is non-circular knitting – for example, warp knitting. This method can achieve widths greater than circular knitting. Industrial warp knit machines, for example, can produce tricote warp knit fabrics up to 130-140 inches in width. Circular knitting, however, is less expensive, as it requires less set-up time. Circular knitting also provides greater multidirectional stretch.

In order to provide a sheet that exceeds the maximum dimensions of fabric that can be produced by available circular knitting machines, flat lock stitching **12** is used to join a plurality of portions resulting in a sheet that is 91 inches wide (as shown). In an exemplary embodiment, piping **11** can be included in close proximity to the stitching. The stitching can be the same color as the fabric of the sheet portions, or different color(s). The piping can be 3/4 inch straight piping without a cord or other filler. In one preferred embodiment, the stitching is 16 stitches per inch. Piping **11** can be included at one end of the sheet and can be the same or a different color as the sheet fabric.

For a fitted sheet, the sheet can include an elastic portion surrounding the edge of the fitted sheet to better keep the fitted sheet in place when placed on a mattress or other sleeping surface. A cord can be sewn into the edge of the fitted sheet and cinched around the mattress or other sleeping surface to better hold the fitted sheet in place.

Referring to **Fig. 2**, a sheet is shown having dimensions of 91 inches wide and 102 inches in length. In this embodiment, stitching **14** is shown 34 inches from an interior edge **18** of a main portion **16** and another stitch **14** at edge **20** of the sewn-on portion. Flat lock stitching can be used for the stitching. Piping can be applied at or in proximity to the stitching.

Referring to **Fig. 3**, a non-rectangular shaped sheet is shown. In this exemplary embodiment, elastic can be included around the edge of the fitted sheet to better maintain the fitted sheet in position when placed on a sleeping surface. In one embodiment, pull ties **24** can be installed at various locations around the edge of the fitted sheet in order to assist in maintaining the fitted sheet secured to the sleeping surface. The pull tie can be cinched to increase tension around the edge of the fitted sheet as shown by **26**.

Stitching used for securing the portions of the sheet together can include that shown as **28a**. In another embodiment, the stitching used for securing the portion of fabric together is shown as **28b**.

Referring to **Fig. 4**, yet another preferred embodiment of the invention is shown. In this embodiment, the sheet can be assembled through stitching of differing fabrics for generating performance zones in the sheet. For example, zone **32** can have higher wicking properties than the other zones since this area is where the majority of the individual body rests. Areas **34a** through **34d** can have higher spandex or other elastic fabric properties so that the fit around a sleeping surface is improved. Area **36** may have thermal properties such as increased cooling since this area is generally where the individual's head lies. In an exemplary embodiment, the pillow covers of pillows used by the individual also have differing properties from the remainder of the sheet, e.g., thermal properties.

The present invention encompasses the construction of bedding materials that have superior performance properties while allowing for manufacture by machinery presently available and in use. More specifically, the invention is related to a new method for fabricating a covering and or sheets in bedding. When using the circular knitting machine, the high gauge performance fabrics can only be made to a maximum size of 72.5 inches without losing the integrity of the spandex in the fabric. Yet, normal sheet panels are 102 x 91 inches. This presents problems when manufacturing sheets from performance fabrics.

Additionally, special stitching techniques must be used given the thread density of the fabric. Using this special stitching, panels are sewn together to produce bedding or a sheet that is the proper size for standard bed sheets. Because discrete portions/panels are used in the manufacture of the present fabrics, panels can be selected that provide different properties for different areas of the bedding (**Fig. 4**). Stitching or seams on the sheet can also allow for the ease of making the bed. Because the bedding is made from performance fabric with spandex, it stretches to permit multiple and custom sizing for applications in cribs, recreational vehicles and boats.

Circular knitting machines used for high gauge performance bedding fabrics are called high-gauge circular knitting machines, because of dense knitting with thin yarn. High gauge generally denotes 17 gauges or more. Seventeen gauges indicate that 17 or more cylinder



needles are contained in one inch. Circular knitting machines of less than 17 gauges are referred to as low-gauge circular knitting machines. The low-gauge circular knitting machines are often used to knit outerwear.

“Yarn count” indicates the linear density (yarn diameter or fineness) to which that particular yarn has been spun. The choice of yarn count is restricted by the type of knitting machine employed and the knitting construction. The yarn count, in turn, influences the cost, weight, opacity, hand and drape of the resulting knitted structure. In general, staple spun yarns tend to be comparatively more expensive the finer their count, because finer fibers and a more exacting spinning process are necessary in order to prevent the yarn from showing an irregular appearance.

A top width in the 90-inch range is currently possible using a circular knit fabric formed on a 36-38-inch diameter machine, although higher levels of spandex in the performance fabric tend to pull the width in. In just one example, on a 30-inch diameter machine, the spandex can reduce an otherwise 94-inch circumference fabric tube to one with a 60-65 inch finished width.

A major limitation in finished width is not strictly a knitting concern but also concerns finishing. With performance fabric, it tends to sag in the middle – increasingly so with greater widths – making finishing difficult to impossible above a certain threshold. A possible 90-inch finished width is contingent upon having a good finishing set-up capable of handling the present performance fabric. This potential for difficulties would only become compounded at the larger widths required for bed sheets.

In a preferred process, the present fabric undergoes a heat setting finishing process. Applying a moisture-wicking finish to another fabric – like cotton – that can be produced at larger widths appears unlikely to match the moisture-control properties of the present fabric, as polyester itself is naturally moisture-resistant and there are physical actions (e.g. capillary action) at play. Further, the use of cotton comes at the expense of breathability and heat-transfer capabilities (as confirmed by laboratory testing) and stretchability.

Numerous characteristics and advantages have been set forth in the foregoing description, together with details of structure and function. While the invention has been disclosed in several forms, it will be apparent to those skilled in the art that many modifications, additions, and deletions, especially in matters of shape, size, and arrangement of parts, can be made therein

without departing from the spirit and scope of the invention and its equivalents as set forth in the following claims. Therefore, other modifications or embodiments as may be suggested by the teachings herein are particularly reserved as they fall within the breadth and scope of the claims here appended.

## CLAIMS

What is claimed is:

1. A method of making a finished fabric at least 90 inches wide comprising:  
forming at least two discrete performance fabric portions; and  
joining at least two discrete performance fabric portions to form the finished fabric.
2. The method according to Claim 1, wherein forming at least two discrete performance fabric portions comprises knitting at least two discrete performance fabric portions.
3. The method according to Claim 1, wherein forming at least two discrete performance fabric portions comprises circular knitting at least two discrete performance fabric portions.
4. The method according to Claim 1, wherein joining at least two discrete performance fabric portions to form the finished fabric comprises stitching at least two discrete performance fabric portions together to form the finished fabric.
5. A method of making a finished fabric at least 90 inches wide comprising:  
circular knitting at least two discrete performance fabric portions; and  
stitching at least two discrete performance fabric portions together to form the finished fabric.
6. The method according to Claim 5, wherein the finished fabric comprises a bed sheet.
7. The method according to Claim 5, further comprising heat setting finishing the finished fabric.
8. The method according to Claim 5, further comprising providing piping to the finished fabric.
9. A method of making a bed sheet at least 90 inches wide from performance fabric comprising:  
circular knitting at least two discrete performance fabric portions;  
stitching at least two discrete performance fabric portions together; and

heat setting finishing the stitched at least two discrete performance fabric portions to form the finished bed sheet.

10. The method according to Claim 9, further comprising providing piping to the finished bed sheet.

11. The method according to Claim 9, wherein the at least two discrete performance fabric portions have different fabric characteristics.

12. The method according to Claim 11, wherein fabric characteristics are selected from the group consisting of moisture management, UV protection, anti-microbial, thermo-regulation, wind resistance and water resistance.

13. A finished fabric at least 90 inches wide comprising:

a first circular knitted performance fabric; and

a second circular knitted performance fabric;

wherein the first and second performance fabrics are discrete; and

wherein the first and second performance fabrics are joined to form the finished fabric.

14. The finished fabric of Claim 13, wherein the finished fabric comprises a bed sheet.

15. The finished fabric of Claim 13, further comprising piping.

16. The finished fabric of Claim 13, wherein the first and second performance fabrics have different fabric characteristics.

17. The finished fabric of Claim 16, wherein fabric characteristics are selected from the group consisting of moisture management, UV protection, anti-microbial, thermo-regulation, wind resistance and water resistance.

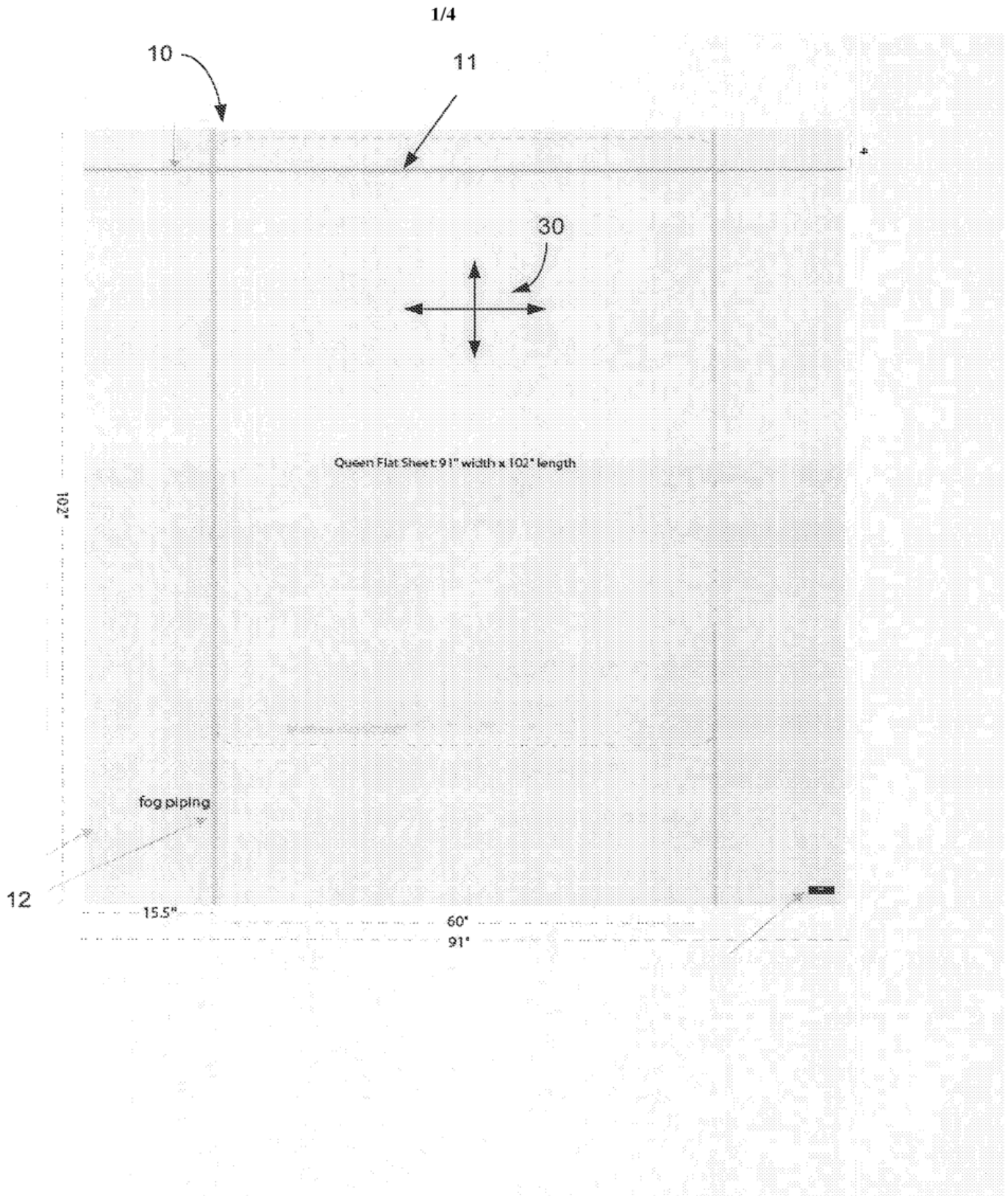
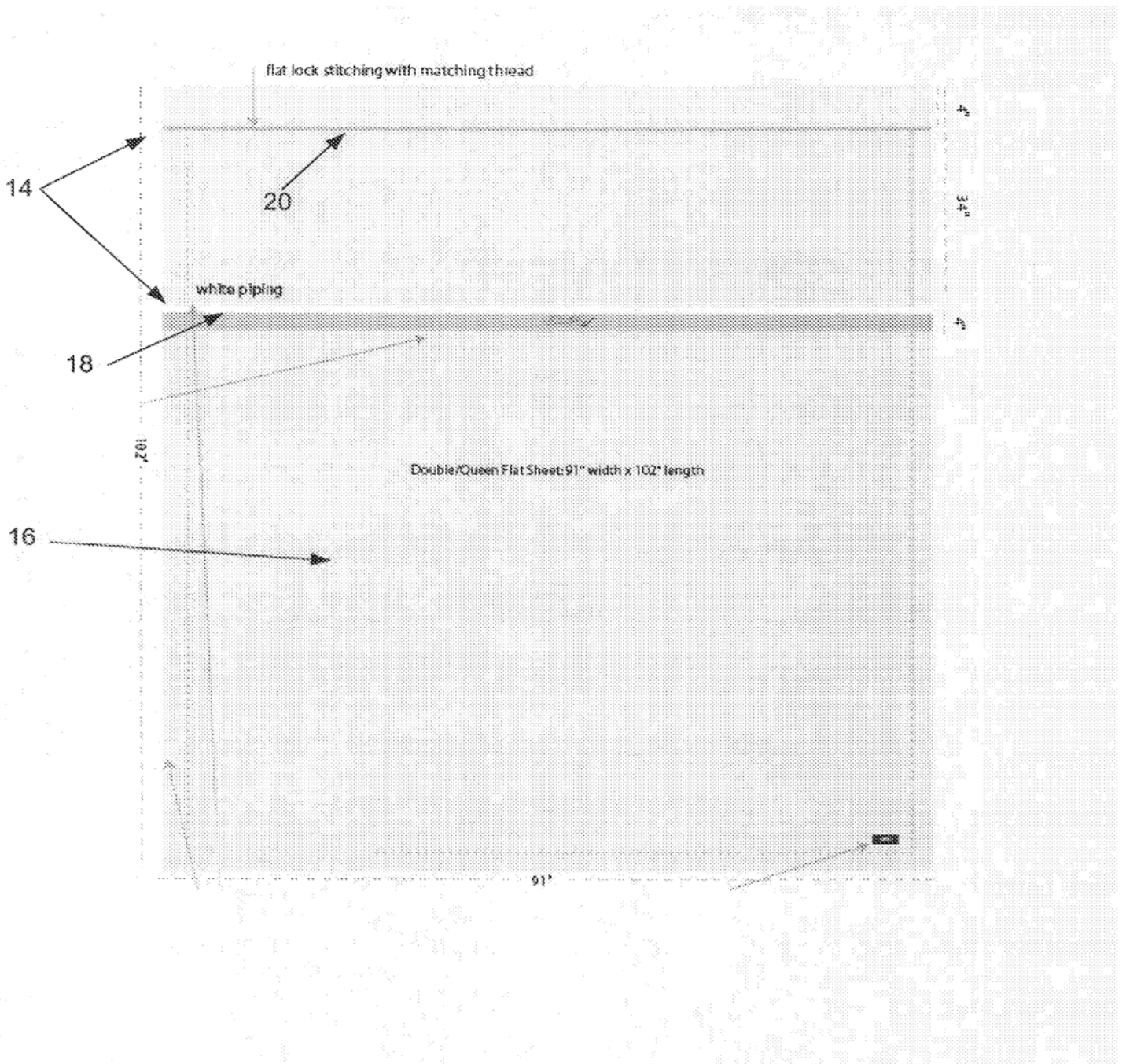
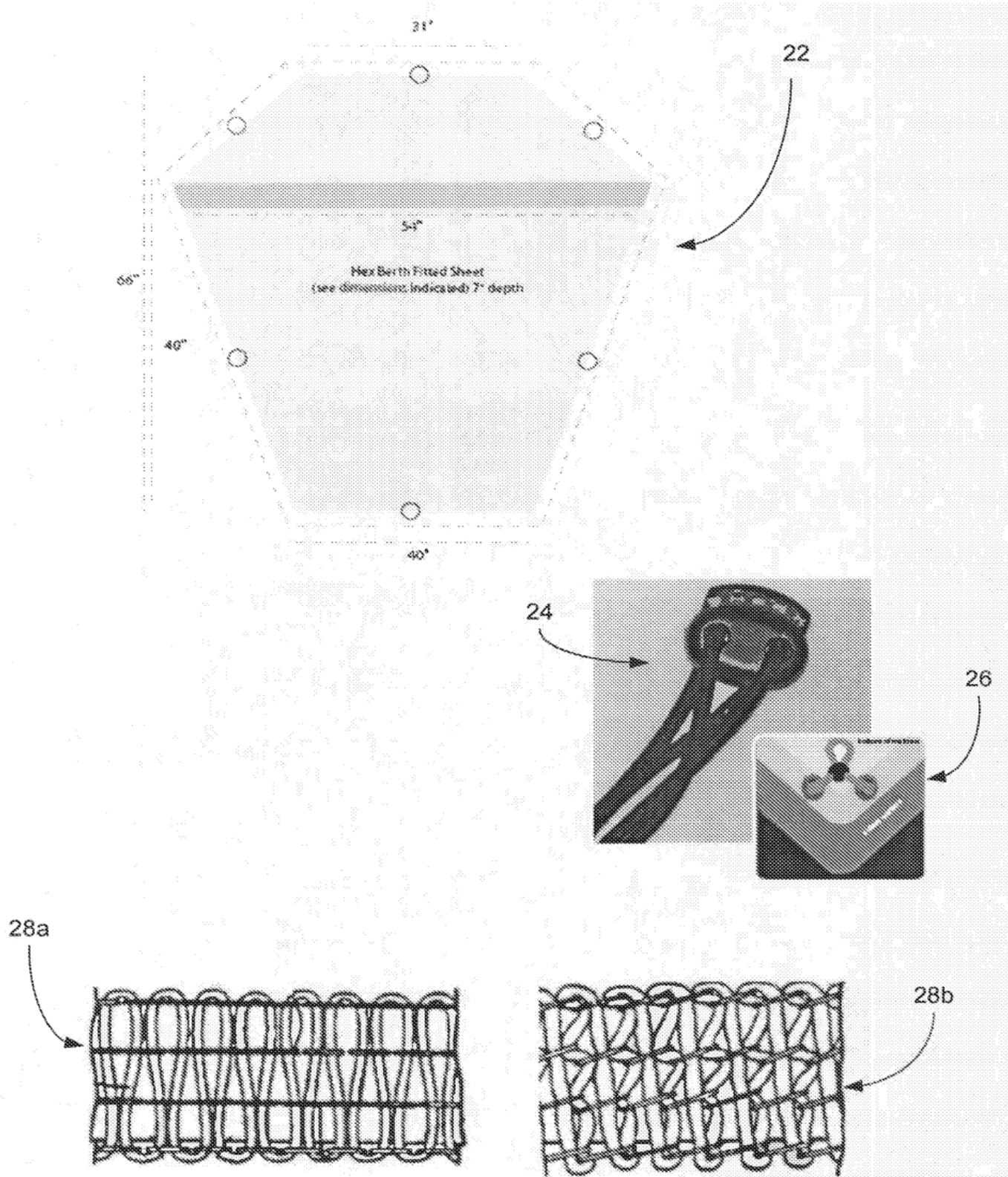


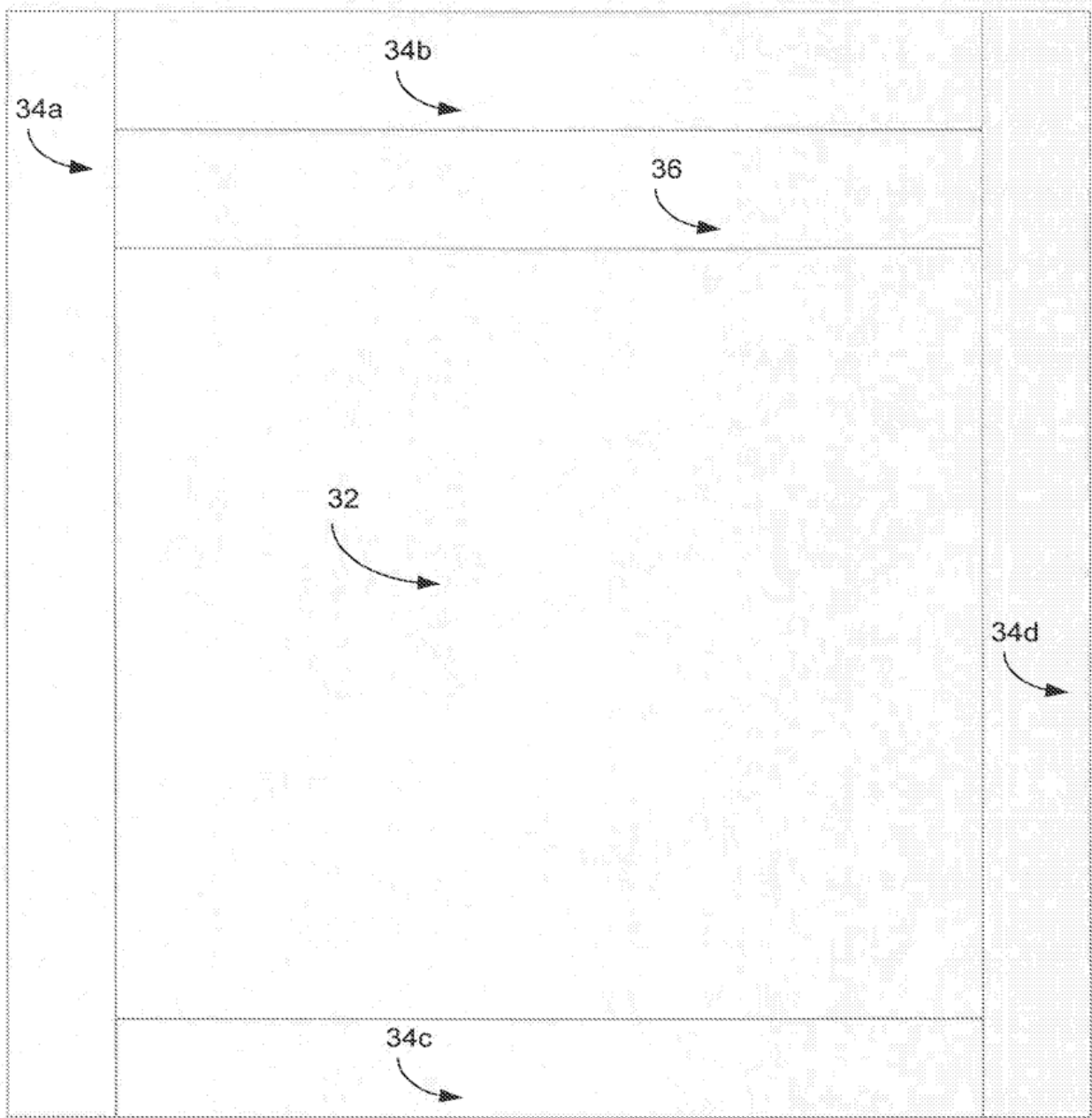
Fig. 1



*Fig. 2*



*Fig. 3*



*Fig. 4*



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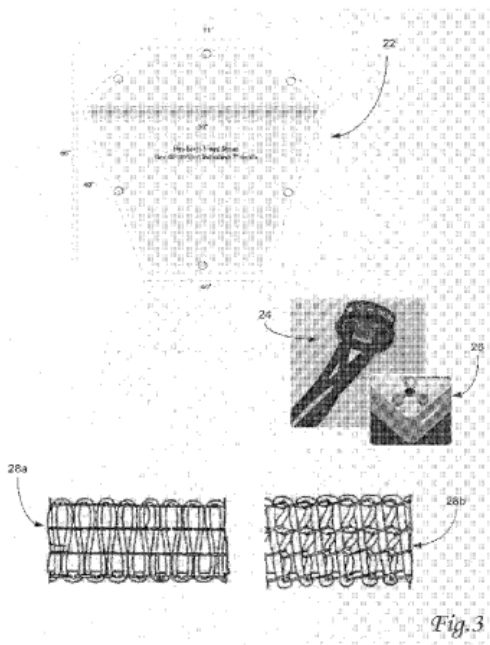
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(57) Abstract: Bedding material including a first fabric section manufactured from performance fabric and having a first and second side; and, a second fabric section attached to the first side of the first fabric section. Additionally, a third fabric section can be attached to the second side of the first fabric section. The first fabric section can be attached to the second fabric section through a flatlock stitch. The first fabric section can include a first zone and a second zone wherein the first zone contains different performance properties from the second zone and the first zone can have thermal or moisture wicking properties.



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Korean utility models and applications for utility models  
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eKOMPASS(KIPO internal)**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 11-309183 A (MORIUCHI KYU KK) 09 November 1999 See paragraphs [0001] and [0010]-[0013]	1-17
X	US 6381779 B1 (THOMPSON; THOMAS L.) 07 May 2002 See claim 1 and figures 4-6	1
A	US 5817391 A1 (ROCK; MOSHE et al.) 06 October 1998 See column 1, line 66 - column 3, line 19	1-17
A	US 5765241 A1 (MACDONALD; ROBERT) 16 June 1998 See the whole document	1-17

 Further documents are listed in the continuation of Box C. See patent family annex.

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JP 11-309183 A	09.11.1999	None	
US 6381779 B1	07.05.2002	US 6678906 B1 WO 0309-2452A1	20.01.2004 13.11.2003
US 5817391 A1	06.10.1998	None	
US 5765241 A1	16.06.1998	AU 1997-12445 B2 EP 0787451 A2 EP 0787451 A3 EP 0787451 B1 GB 2309638 A	27.05.1999 06.08.1997 13.10.1999 04.06.2003 06.08.1997

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**FABRIC SYSTEM**

**Page bookmark** [ES2368481 \(T1\) - FABRIC SYSTEM](#)

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**Applicant(s):** SHEEX INC [US] ±

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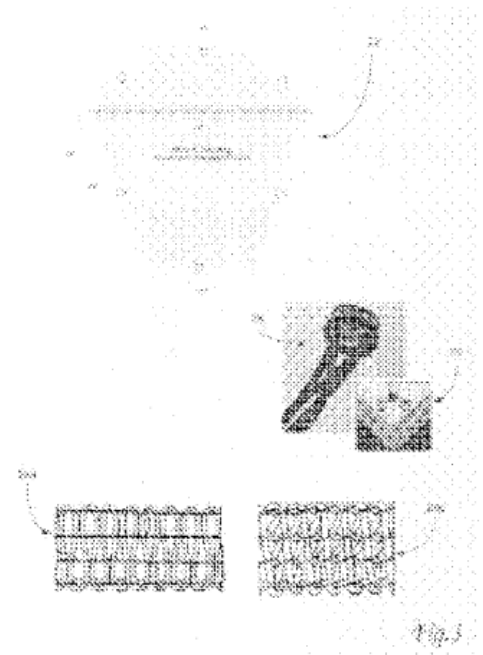
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[Translate this text](#)

Bedding material including a first fabric section manufactured from performance fabric and having a first and second side; and, a second fabric section attached to the first side of the first fabric section. Additionally, a third fabric section can be attached to the second side of the first fabric section. The first fabric section can be attached to the second fabric section through a flatlock stitch. The first fabric section can include a first zone and a second zone wherein the first zone contains different performance properties from the second zone and the first zone can have thermal or moisture wicking properties.





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ES 2 344 691 T3

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## DESCRIPCIÓN

Nuevas toxinas Vip3 y sus métodos de uso.

5 **Campo de la invención**

La presente invención se refiere a nuevas toxinas Vip3 de *Bacillus thuringiensis*, a secuencias de ácido nucleico cuya expresión origina dichas toxinas, y a métodos de preparación y métodos de uso de dichas toxinas y de las secuencias de ácido nucleico correspondientes para controlar insectos.

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**Antecedentes de la invención**

Las plagas vegetales son el principal factor de pérdida mundial de cultivos agrícolas importantes. Aproximadamente 8 mil millones de dólares se pierden cada año sólo en los EE.UU. debido a infecciones de plagas no mamíferas incluidos los insectos. Además de las pérdidas en las cosechas, las plagas de insectos son también una carga económica para los cultivadores de frutas y vegetales, para los productores de flores ornamentales y para los jardineros residenciales.

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Las plagas de insectos son controladas principalmente mediante aplicaciones intensivas de plaguicidas químicos, que actúan inhibiendo el crecimiento de los insectos, evitando que los insectos se alimenten o se reproduzcan o causándoles la muerte. Se puede lograr un buen control de los insectos, pero estos químicos pueden afectar a veces a otros insectos beneficiosos. Otro problema que resulta del amplio uso de plaguicidas químicos es la aparición de variedades de insectos resistentes. Esto ha sido parcialmente paliado mediante diversas prácticas de manejo de la resistencia, pero existe una necesidad creciente de agentes alternativos para el control de plagas. Los agentes biológicos para el control de plagas, como las cepas de *Bacillus thuringiensis* que expresan toxinas plaguicidas como  $\delta$ -endotoxinas, también han sido aplicados a plantas de cultivo con resultados satisfactorios, ofreciendo una alternativa o complemento a los plaguicidas químicos. Se han aislado los genes que codifican algunas de esas  $\delta$ -endotoxinas y su expresión en huéspedes heterólogos ha demostrado que proporcionan otra herramienta para el control de plagas de insectos importantes desde el punto de vista económico. En particular, la expresión de toxinas insecticidas en plantas transgénicas, como las  $\delta$ -endotoxinas de *Bacillus thuringiensis*, ha proporcionado una protección eficaz contra determinadas plagas de insectos, y las plantas transgénicas que expresan dichas toxinas se han comercializado permitiendo a los granjeros reducir las aplicaciones de agentes químicos para el control de insectos.

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En la actualidad, se han identificado otros genes que no son de endotoxinas y se identificaron las proteínas que ellos codifican. Las patentes 5,877,012, 6,107,279, 6,137,033 y 6,291,156 así como Estruch *et al.* (1996, Proc. Natl. Acad. Sci. 93:5389-5394) y Yu *et al.* (1997, Appl. Environ. Microbiol. 63:532-536), incorporados en este documento por referencia, describen una nueva clase de proteínas insecticidas denominadas Vip3. Los genes *vip3* codifican proteínas de aproximadamente 88 kDa que son producidas y secretadas por el *Bacillus* durante sus estadios vegetativos de crecimiento (proteínas insecticidas vegetativas, VIP, por sus siglas en inglés). La proteína Vip3 A posee actividad insecticida contra un amplio espectro de plagas lepidópteras, incluidas, pero no exclusivamente, gusano cortador grisiento (BCW, *Agrotis ipsilon*), gusano cogollero (FAW, *Spodoptera frugiperda*), gusano cogollero del tabaco (TBW, *Heliothis virescens*), y gusano elotero (CEW, *Helicoverpa zea*). Más recientemente, se encontró que plantas que expresan la proteína Vip3A son resistentes al daño por alimentación causado por plagas de insectos hemípteros. Por lo tanto, la proteína Vip3A exhibe un espectro de actividades insecticidas inigualable. Otras divulgaciones, WO 98/18932, WO 98/33991, WO 98/00546 y WO 99/57282, también identificaron actualmente homólogos de la clase de proteínas Vip3.

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El uso continuo de agentes químicos y biológicos para controlar plagas de insectos aumenta la probabilidad de que éstos desarrollen resistencia a dichas medidas de control. Asimismo, sólo unas pocas plagas específicas de insectos son controlables con cada agente de control.

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Por consiguiente, sigue siendo una necesidad descubrir agentes de control de plagas nuevos y eficaces que proporcionen un beneficio económico a los granjeros y que sean aceptables para el medio ambiente. Son particularmente necesarios agentes de control que estén dirigidos a un amplio espectro de plagas importantes desde el punto de vista económico, agentes de control que controlen eficazmente cepas de insectos que son o podrían tornarse resistentes a los agentes de control de insectos existentes, y aquellos con mayor potencia en comparación con los agentes de control actuales. Además, también son deseables agentes cuya aplicación reduzca al mínimo la carga sobre el ambiente.

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**Resumen**

La presente invención apunta a la necesidad de nuevos agentes de control de plagas proporcionando nuevos genes y toxinas que son diferentes de los divulgados en las patentes de los Estados Unidos 5,877,012, 6,107,279 y 6,137,033, y en Estruch *et al.* (1996), y Yu *et al.* (1997), así como en WO 98/18932, WO 99/33991, WO 99/5782 y WO 98/00546.

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En la presente invención, se proporcionan composiciones y métodos para controlar plagas vegetales. En particular, se proporcionan nuevas secuencias de ácido nucleico *vip3* aisladas de *Bacillus thuringiensis* y secuencias sustancialmente idénticas a éstas, cuya expresión origina toxinas plaguicidas con toxicidad para plagas de insectos importantes desde el punto de vista económico, particularmente plagas de insectos que infectan plantas. La invención apunta además a nuevas toxinas plaguicidas resultantes de la expresión de las secuencias de ácido nucleico, y a composiciones y

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formulaciones que contengan toxinas plaguicidas, que sean capaces de inhibir la capacidad de las plagas de insectos para sobrevivir, crecer y reproducirse, o de limitar el daño relacionado con los insectos o la pérdida de las plantas de cultivo.

5 La invención se dirige además a métodos de uso de las secuencias de ácido nucleico en plantas transgénicas para conferir protección contra el daño causado por insectos, y a un método de uso de las toxinas plaguicidas y composiciones y formulaciones que comprenden las toxinas plaguicidas, por ejemplo mediante la aplicación de las toxinas plaguicidas o las composiciones o formulaciones para tratar profilácticamente áreas o plantas sensibles a los insectos, a fin de conferirles protección contra las plagas de insectos.

10 Las secuencias de nucleótidos de la presente invención se pueden modificar genéticamente usando métodos conocidos en el área a fin de alterar dichas secuencias de nucleótidos para una diversidad de propósitos que incluyen, pero no exclusivamente, ampliar el espectro de la actividad plaguicida o aumentar la actividad específica contra una plaga específica. Se pueden usar barajado del ADN (transposición de secuencias de ADN por fragmentación aleatoria) y reagrupación por PCR de los fragmentos de genes y oligonucleótidos sintéticos para modificar genéticamente las secuencias de nucleótidos.

15 Las nuevas toxinas plaguicidas descritas en este documento son sumamente activas contra insectos. Por ejemplo, una cantidad de plagas de insectos económicamente importantes, como los lepidópteros *Ostrinia nubilalis* (barrenador del maíz europeo), *Plutella xylostella* (palomilla dorso de diamante), *Spodoptera frugiperda* (gusano cogollero), *Agrotis ipsilon* (gusano cortador grasiento), *Helicoverpa zea* (gusano elotero), *Heliothis virescens* (gusano cogollero del tabaco), *Spodoptera exigua* (gusano soldado de la remolacha), *Diatraea grandiosella* (barrenador del maíz del sudoeste), *Diatraea saccharalis* (barrenador de la caña de azúcar), *Helicoverpa punctigera* (gusano nativo) y *Helicoverpa armigera* (gusano de la cápsula del algodón) se pueden controlar con toxinas plaguicidas. Las toxinas plaguicidas se pueden usar solas o en combinación con otras estrategias de control de insectos para conferir máxima eficacia de control de plagas con mínimo impacto sobre el ambiente.

20 De acuerdo con un aspecto, la presente invención proporciona una molécula de ácido nucleico aislada que comprende una secuencia de nucleótidos que codifica una toxina que es activa contra insectos, donde la secuencia de nucleótidos: (a) tiene un complemento que se hibrida con los nucleótidos 1981-2367 de SEC. ID. N°: 1 en 7% de dodecilsulfato de sodio (SDS), NaPO<sub>4</sub> 0.5 M, EDTA 1 mM a 50°C con lavado en 0.1 X SSC, SDS al 0.1% a 65°C; o (b) es isocodificante con la secuencia de nucleótidos de (a); o (c) tiene al menos 95% de identidad con SEC. ID. N°: 1; o (d) codifica una secuencia de aminoácidos que tiene al menos 91% de identidad de secuencia con SEC. ID. N°: 2.

25 En una realización de este aspecto, la molécula de ácido nucleico aislada comprende una secuencia de nucleótidos que tiene un complemento que se hibrida con los nucleótidos 1981-2367 de SEC. ID. N°: 1 en 7% de dodecilsulfato de sodio (SDS), NaPO<sub>4</sub> 0.5 M, EDTA 1 mM a 50°C con lavado en 0.1 X SSC, SDS al 0.1% a 65°C.

30 En otra realización de este aspecto, la molécula de ácido nucleico aislada comprende una secuencia de nucleótidos que es isocodificante con una secuencia de nucleótidos que tiene un complemento que se hibrida con los nucleótidos 1981-2367 de SEC. ID. N°: 1 en 7% de dodecilsulfato de sodio (SDS), NaPO<sub>4</sub> 0.5 M, EDTA 1 mM a 50°C con lavado en 0.1 X SSC, SDS al 0.1% a 65°C.

35 En otra realización, la molécula de ácido nucleico aislada comprende una secuencia de nucleótidos que tiene al menos 75% de identidad de secuencia con los nucleótidos 1981-2367 de SEC. ID. N°: 1. Preferentemente, la molécula de ácido nucleico aislada comprende una secuencia de nucleótidos que tiene al menos 85% de identidad de secuencia con los nucleótidos 1981-2367 de SEC. ID. N°: 1. Más preferentemente, la molécula de ácido nucleico aislada comprende una secuencia de nucleótidos que tiene al menos 95% de identidad de secuencia con los nucleótidos 1981-2367 de SEC. ID. N°: 1. Aún más preferentemente, la molécula de ácido nucleico aislada comprende una secuencia de nucleótidos que tiene al menos 99% de identidad de secuencia con los nucleótidos 1981-2367 de SEC. ID. N°: 1. Muy preferentemente, la molécula de ácido nucleico aislada comprende los nucleótidos 1981-2367 de SEC. ID. N°: 1 o SEC. ID. N°: 3.

40 En otra realización, la molécula de ácido nucleico aislada comprende la secuencia de nucleótidos que se expone en SEC. ID. N°: 1, SEC. ID. N°: 3, SEC. ID. N°: 10, SEC. ID. N°: 31 o SEC. ID. N°: 33.

45 En una realización de la presente invención, la molécula de ácido nucleico aislada codifica la secuencia de aminoácidos que se expone en SEC. ID. N°: 2, SEC. ID. N°: 11 o SEC. ID. N°: 32. Muy preferentemente, la molécula de ácido nucleico aislada codifica una toxina que comprende los aminoácidos 661-788 de SEC. ID. N°: 2.

50 De acuerdo con una realización de la invención, la molécula de ácido nucleico aislada codifica una toxina que es activa contra insectos lepidópteros. Preferentemente, de acuerdo con esta realización, la toxina tiene actividad contra *Ostrinia nubilalis* (barrenador del maíz europeo), *Plutella xylostella* (palomilla dorso de diamante), *Spodoptera frugiperda* (gusano cogollero), *Agrotis ipsilon* (gusano cortador grasiento), *Helicoverpa zea* (gusano elotero), *Heliothis virescens* (gusano cogollero del tabaco), *Spodoptera exigua* (gusano soldado de la remolacha), *Pectinophora gossypiella* (lagarta rosada), *Trichoplusia ni* (gusano falso medidor de la col), *Cochylis hospes* (polilla de bandas del girasol), y *Homeosoma electellum* (polilla del girasol).



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La presente invención también proporciona un gen quimérico que comprende una secuencia promotora heteróloga unida operativamente a la molécula de ácido nucleico de la invención. Además, la presente invención proporciona un vector recombinante que comprende dicho gen quimérico. Aún además, la presente invención proporciona una célula huésped transgénica que comprende dicho gen quimérico. Una célula huésped transgénica de acuerdo con este aspecto de la invención puede ser una célula animal, un virus animal, un virus vegetal, una célula bacteriana, una célula de levadura o una célula vegetal, preferentemente, una célula vegetal. Incluso además, la presente invención proporciona una planta transgénica que comprende dicha célula vegetal. Una planta transgénica de acuerdo con este aspecto de la invención puede ser sorgo, trigo, girasol, tomate, hortalizas del grupo de las coles, algodón, arroz, soja, remolacha azucarera, caña de azúcar, tabaco, cebada, colza oleaginosa o maíz, preferentemente maíz y algodón. Aún además, la presente invención proporciona semillas del grupo de las plantas transgénicas que consisten en sorgo, trigo, girasol, tomate, hortalizas del grupo de las coles, algodón, arroz, soja, remolacha azucarera, caña de azúcar, tabaco, cebada, colza oleaginosa y maíz. En una realización particularmente preferida, la semilla es de una planta de maíz transgénico o de una planta de algodón transgénico.

La invención también proporciona plantas transgénicas de la invención que comprenden además una segunda secuencia de ácido nucleico o grupos de secuencias de ácido nucleico que codifican un segundo principio activo plaguicida. Las segundas secuencias de ácido nucleico particularmente preferidas son las que codifican una  $\delta$ -endotoxina, las que codifican otra toxina VIP (proteína insecticida vegetativa) o las que codifican una ruta para la producción de un principio activo plaguicida no proteico.

Aún en otro aspecto, la presente invención proporciona toxinas aisladas activas contra el barrenador del maíz europeo producidas por la expresión de las moléculas de ácido nucleico de la presente invención.

En otra realización, las toxinas de la invención son activas contra insectos lepidópteros, preferentemente contra *Plutella xylostella* (palomilla dorso de diamante), *Spodoptera frugiperda* (gusano cogollero), *Agrotis ipsilon* (gusano cortador grasiento), *Helicoverpa zea* (gusano elotero), *Heliothis virescens* (gusano cogollero del tabaco), *Spodoptera exigua* (gusano soldado de la remolacha), *Pectinophora gossypiella* (lagarta rosada), *Trichoplusia ni* (gusano falso medidor de la col), *Cochylis hospes* (polilla de bandas del girasol), y *Homeosoma electellum* (polilla del girasol).

En una realización, las toxinas de la presente invención son producidas por un aislado de *Bacillus thuringiensis* seleccionado el grupo que consiste en C1674, designado como el registro NRRL B-30556; y C536, designado como el registro NRRL B-30557.

En otra realización, las toxinas son producidas por un clon de *E. coli* seleccionado del grupo que consiste en pNOV3910, designado como el registro NRRL B-30553; pNOV3911, designado como el registro NRRL B-30552; pNOV3906, designado como el registro NRRL B-30555; pNOV3905, designado como el registro NRRL B-30554; y pNOV3912, designado como el registro NRRL B-30551.

En otra realización, una toxina aislada de la presente invención comprende una secuencia de aminoácidos que tiene al menos 91% de identidad con la secuencia de aminoácidos que se expone en SEC. ID. N°: 2. Preferentemente, la toxina aislada comprende una secuencia de aminoácidos que tiene al menos 95% de identidad con la secuencia de aminoácidos que se expone en SEC. ID. N°: 2. Más preferentemente, la toxina aislada comprende una secuencia de aminoácidos que tiene al menos 99% de identidad con la secuencia de aminoácidos que se expone en SEC. ID. N°: 2. Muy preferentemente, la toxina aislada comprende la secuencia de aminoácidos que se expone en SEC. ID. N°: 2, SEC. ID. N°: 11 o SEC. ID. N°: 32.

La presente invención también proporciona una composición que contiene una cantidad eficaz para el control de insectos de una toxina de acuerdo con la invención.

En otro aspecto, la presente invención proporciona un método para producir una toxina activa contra insectos, que comprende: (a) obtener una célula huésped transgénica que comprenda un gen quimérico, el cual a su vez comprenda una secuencia promotora heteróloga unida operativamente a la molécula de ácido nucleico de la invención; y (b) expresar la molécula de ácido nucleico en la célula transgénica, lo que resulta en al menos una toxina activa contra insectos.

En otro aspecto, la presente invención proporciona un método para producir una planta transgénica resistente a los insectos, que comprende introducir una molécula de ácido nucleico de la invención en la planta transgénica, donde la molécula de ácido nucleico se puede expresar en la planta transgénica en una cantidad eficaz para controlar insectos. De acuerdo con una realización, los insectos son insectos lepidópteros, preferentemente seleccionados del grupo que consiste en: *Ostrinia nubilalis* (barrenador del maíz europeo), *Plutella xylostella* (palomilla dorso de diamante), *Spodoptera frugiperda* (gusano cogollero), *Agrotis ipsilon* (gusano cortador grasiento), *Helicoverpa zea* (gusano elotero), *Heliothis virescens* (gusano cogollero del tabaco), *Spodoptera exigua* (gusano soldado de la remolacha), *Pectinophora gossypiella* (lagarta rosada), *Trichoplusia ni* (gusano falso medidor de la col), *Cochylis hospes* (polilla de bandas del girasol) y *Homeosoma electellum* (polilla del girasol).

Aún en otro aspecto, la presente invención proporciona un método para controlar insectos que comprende suministrar a los insectos una cantidad eficaz de una toxina de la presente invención. De acuerdo con una realización, los insectos son insectos lepidópteros, preferentemente seleccionados del grupo que consiste en: *Ostrinia nubilalis* (barrenador del maíz europeo), *Plutella xylostella* (palomilla dorso de diamante), *Spodoptera frugiperda* (gusano cogollero),

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*Agrotis ipsilon* (gusano cortador grasiento), *Helicoverpa zea* (gusano elotero), *Heliothis virescens* (gusano cogollero del tabaco), *Spodoptera exigua* (gusano soldado de la remolacha), *Pectinophora gossypiella* (lagarta rosada), *Trichoplusia ni* (gusano falso medidor de la col), *Cochylis hospes* (polilla de bandas del girasol) y *Homeosoma electellum* (polilla del girasol). Preferentemente, la toxina se suministra a los insectos oralmente. En una realización preferida, la toxina se suministra oralmente a través de una planta transgénica que comprende la secuencia de ácido nucleico que expresa una toxina de la presente invención.

La presente invención también proporciona toxinas híbridas activas contra insectos, donde las toxinas híbridas son codificadas por una molécula de ácido nucleico que comprende una secuencia de nucleótidos de acuerdo con la invención.

En una realización, las toxinas híbridas de la invención son activas contra insectos lepidópteros, preferentemente contra *Ostrinia nubilalis* (barrenador del maíz europeo), *Plutella xylostella* (palomilla dorso de diamante), *Spodoptera frugiperda* (gusano cogollero), *Agrotis ipsilon* (gusano cortador grasiento), *Helicoverpa zea* (gusano elotero), *Heliothis virescens* (gusano cogollero del tabaco), *Spodoptera exigua* (gusano soldado de la remolacha), *Pectinophora gossypiella* (lagarta rosada), *Trichoplusia ni* (gusano falso medidor de la col), *Cochylis hospes* (polilla de bandas del girasol) y *Homeosoma electellum* (polilla del girasol).

En otra realización, la toxina híbrida es codificada por el fragmento de ADN de aproximadamente 2.4 kb comprendido en el clon de *E. coli* pNOV3912, designado como el registro NRRL B-30551. En una realización preferida, la toxina híbrida es codificada por la secuencia de nucleótidos que se expone en SEC. ID. N°: 10.

La presente invención también proporciona una composición que comprende una cantidad insecticidamente eficaz de una toxina híbrida de acuerdo con la invención.

En otro aspecto, la presente invención proporciona un método para producir una toxina híbrida que es activa contra insectos, que comprende: (a) obtener una célula huésped transgénica que comprenda un gen quimérico, el cual a su vez comprenda una secuencia promotora heteróloga unida operativamente a la molécula de ácido nucleico de la invención; y (b) expresar la molécula de ácido nucleico en la célula transgénica, lo que resulta en al menos una toxina híbrida que activa contra insectos.

En otro aspecto, la presente invención proporciona un método para producir una planta transgénica resistente a los insectos, que comprende introducir una molécula de ácido nucleico de la invención en la planta, donde la molécula de ácido nucleico codifica una toxina híbrida y donde la toxina híbrida se puede expresar en la planta transgénica en una cantidad eficaz para controlar un insecto. De acuerdo con una realización, los insectos son insectos lepidópteros, preferentemente seleccionados del grupo que consiste en *Ostrinia nubilalis* (barrenador del maíz europeo), *Plutella xylostella* (palomilla dorso de diamante), *Spodoptera frugiperda* (gusano cogollero), *Agrotis ipsilon* (gusano cortador grasiento), *Helicoverpa zea* (gusano elotero), *Heliothis virescens* (gusano cogollero del tabaco), *Spodoptera exigua* (gusano soldado de la remolacha), *Pectinophora gossypiella* (lagarta rosada), *Trichoplusia ni* (gusano falso medidor de la col), *Cochylis hospes* (polilla de bandas del girasol) y *Homeosoma electellum* (polilla del girasol).

Aún en otro aspecto, la presente invención proporciona un método para controlar un insecto que comprende suministrar a los insectos una cantidad eficaz de una toxina híbrida de la presente invención. De acuerdo con una realización, los insectos son insectos lepidópteros, preferentemente seleccionados del grupo que consiste en *Ostrinia nubilalis* (barrenador del maíz europeo), *Plutella xylostella* (palomilla dorso de diamante), *Spodoptera frugiperda* (gusano cogollero), *Agrotis ipsilon* (gusano cortador grasiento), *Helicoverpa zea* (gusano elotero), *Heliothis virescens* (gusano cogollero del tabaco), *Spodoptera exigua* (gusano soldado de la remolacha), *Pectinophora gossypiella* (lagarta rosada), *Trichoplusia ni* (gusano falso medidor de la col), *Cochylis hospes* (polilla de bandas del girasol) y *Homeosoma electellum* (polilla del girasol). Preferentemente la toxina híbrida se suministra a los insectos oralmente. En una realización preferida, la toxina híbrida se suministra oralmente a través de una planta transgénica que comprende una secuencia de ácido nucleico que expresa una toxina híbrida de la presente invención.

La presente invención también proporciona una toxina híbrida activa contra el barrenador del maíz europeo que comprende una región carboxi-terminal de una toxina Vip3 unida en la dirección de amino a carboxi a una región amino-terminal de una toxina Vip3 diferente, donde la región carboxi-terminal comprende los aminoácidos 661-788 de la SEC. ID. N°: 2; y donde la región amino-terminal tiene al menos 85% de identidad, más preferentemente al menos 95% de identidad, muy preferentemente al menos 99% de identidad con los aminoácidos 1-660 de SEC. ID. N°: 7. En una realización preferida, la región carboxi-terminal comprende los aminoácidos 661-788 de SEC. ID. N°: 2, y la región amino-terminal comprende los aminoácidos 1-660 de SEC. ID. N°: 5. En una realización muy preferida, la toxina híbrida comprende los aminoácidos 1-788 de SEC. ID. N°: 11.

La toxina híbrida, de acuerdo con este aspecto de la invención, es preferentemente activa contra insectos lepidópteros, más preferentemente contra insectos lepidópteros seleccionados del grupo que consiste en *Ostrinia nubilalis* (barrenador del maíz europeo), *Plutella xylostella* (palomilla dorso de diamante), *Spodoptera frugiperda* (gusano cogollero), *Agrotis ipsilon* (gusano cortador grasiento), *Helicoverpa zea* (gusano elotero), *Heliothis virescens* (gusano cogollero del tabaco), *Spodoptera exigua* (gusano soldado de la remolacha), *Pectinophora gossypiella* (lagarta rosada), *Trichoplusia ni* (gusano falso medidor de la col), *Cochylis hospes* (polilla de bandas del girasol) y *Homeosoma electellum* (polilla del girasol).

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Este aspecto de la invención también abarca una molécula de ácido nucleico que comprende la secuencia de nucleótidos que codifica la toxina híbrida de este aspecto.

Otros aspectos y ventajas de la presente invención se tomarán evidentes para los expertos a partir del estudio de la descripción siguiente de la invención y de los ejemplos no limitantes.

### Breve descripción de las secuencias de la lista de secuencias

- SEC. ID. Nº: 1 es una secuencia de nucleótidos de *vip3C* nativa.
- SEC. ID. Nº: 2 es la secuencia de aminoácidos codificada por SEC. ID. Nº: 1.
- SEC. ID. Nº: 3 es una secuencia de nucleótidos de *vip3C* optimizada para maíz.
- SEC. ID. Nº: 4 es una secuencia de nucleótidos de *vip3A(a)* nativa.
- SEC. ID. Nº: 5 es la secuencia de aminoácidos codificada por SEC. ID. Nº: 4.
- SEC. ID. Nº: 6 es una secuencia de nucleótidos de *vip3B* nativa.
- SEC. ID. Nº: 7 es la secuencia de aminoácidos codificada por SEC. ID. Nº: 6.
- SEC. ID. Nº: 8 es una secuencia de nucleótidos de *vip3Z* nativa.
- SEC. ID. Nº: 9 es la secuencia de aminoácidos codificada por SEC. ID. Nº: 8.
- SEC. ID. Nº: 10 es una secuencia de nucleótidos de *vip3A(a)* híbrida.
- SEC. ID. Nº: 11 es la secuencia de aminoácidos codificada por SEC. ID. Nº: 10.
- SEC. ID. Nº: 12-29 son secuencias cebadoras (primers) útiles para practicar la invención.
- SEC. ID. Nº: 30 es la secuencia de nucleótidos del vector pNOV2149.
- SEC. ID. Nº: 31 es la secuencia de nucleótidos de *vip3C*-12168.
- SEC. ID. Nº: 32 es la secuencia de aminoácidos codificada por SEC. ID. Nº: 31.
- SEC. ID. Nº: 33 es la secuencia de nucleótidos de *vip3C*-12168 optimizada para maíz.

### Depósitos

El material siguiente se depositó en la colección de cultivos a los fines del procedimiento en materia de patentes, Agricultural Research Service, Patent Culture Collection (NRRL), 1815 North University Street, Peoria, Illinois 61604, bajo los términos del tratado de Budapest sobre el Reconocimiento Internacional del Depósito de Microorganismos a los fines del Procedimiento en Materia de Patentes. Todas las restricciones sobre la disponibilidad del material depositado serán irrevocablemente eliminadas una vez otorgada la patente.

Aislado/clon	Número de registro	de	Fecha del depósito
<i>B. t.</i> cepa C1674	NRRL B-30556		7 febrero de 2002
<i>B. t.</i> cepa C536	NRRL B-30557		7 febrero de 2002
<i>E. coli</i> BL21 (pNOV3906)	NRRL B-30555		7 febrero de 2002
<i>E. coli</i> BL21 (pNOV3905)	NRRL B-30554		7 febrero de 2002
<i>E. coli</i> DH5 $\alpha$ (pNOV3910)	NRRL B-30553		7 febrero de 2002
<i>E. coli</i> DH5 $\alpha$ (pNOV3911)	NRRL B-30552		7 febrero de 2002
<i>E. coli</i> DH5 $\alpha$ (pNOV3912)	NRRL B-30551		7 febrero de 2002

**Definiciones**

“Actividad” de las toxinas de la invención significa que las toxinas actúan como agentes de control de insectos activos por vía oral, tienen un efecto tóxico, o son capaces de interrumpir o impedir que los insectos se alimenten, lo que puede causar, o no, la muerte de los mismos. Cuando una toxina de la invención se suministra al insecto, el resultado es habitualmente la muerte del insecto, o que el insecto no se alimente de la fuente que hace que la toxina esté a su disposición.

“Asociada a/unida operativamente a” se refiere a dos secuencias de ácido nucleico que están relacionadas física o funcionalmente. Por ejemplo, se dice que una secuencia de ADN promotora o reguladora está “asociada a” una secuencia de ADN que codifica un ARN o una proteína, si las dos secuencias están unidas operativamente, o situadas de modo que la secuencia de ADN reguladora afectará el nivel de expresión de la secuencia de ADN codificante o estructural.

Un “gen quimérico” es una secuencia de ácido nucleico recombinante en la cual una secuencia de ácido nucleico promotora o reguladora está unida operativamente, o asociada a, una secuencia de ácido nucleico que codifica un ARNm o que se expresa como una proteína, de modo que la secuencia de ácido nucleico reguladora sea capaz de regular la transcripción o la expresión de la secuencia de ácido nucleico asociada. La secuencia de ácido nucleico reguladora del gen quimérico no está normalmente unida operativamente a la secuencia de ácido nucleico asociada como se encuentra en la naturaleza.

Una “secuencia codificante” es una secuencia de ácido nucleico que se transcribe en ARN como ARNm, ARN r, ARNt, ARNsn, ARN sentido o ARN antisentido. Preferentemente el ARN se traduce después en un organismo para producir una proteína.

“Controlar” insectos significa inhibir, a través de un efecto tóxico, la capacidad de las plagas de insectos para sobrevivir, crecer, alimentarse y/o reproducirse, o limitar el daño o las pérdidas, relacionados con los insectos, en las plantas de cultivo. “Controlar” insectos puede significar, o no, matar los insectos, aunque es preferible que signifique matar los insectos.

Correspondiente a: en el contexto de la presente invención, “correspondiente a” o “corresponde a” significa que cuando las secuencias codificantes de ácido nucleico o las secuencias de aminoácidos de genes o proteínas Vip3 están alineadas unas con otras, el ácido nucleico o los aminoácidos que “corresponden a” determinadas posiciones enumeradas son los que se alinean con esas posiciones pero que no están necesariamente en esas exactas posiciones numéricas en relación con la respectiva secuencia codificante de ácido nucleico o secuencia de aminoácidos de la Vip3 particular. Análogamente, cuando la secuencia codificante o secuencia de aminoácidos de una Vip3 particular (por ejemplo, Vip3Z) se alinea con la secuencia codificante o secuencia de aminoácidos de una Vip3 de referencia (por ejemplo, Vip3C), los ácidos nucleicos o aminoácidos en la secuencia Vip3Z que “corresponden a” determinadas posiciones enumeradas de la secuencia Vip3C son los que se alinean con esas posiciones de la secuencia Vip3C, pero no están necesariamente en esas exactas posiciones numéricas en la respectiva secuencia codificante de ácido nucleico o secuencia de aminoácidos de la proteína Vip3Z.

“Suministrar” una toxina significa que la toxina entra en contacto con un insecto, produciendo un efecto tóxico y el control del insecto. La toxina se puede suministrar de muchas maneras conocidas, p. ej., oralmente mediante ingestión por el insecto o mediante contacto con el insecto a través de: la expresión en una planta transgénica, composiciones de proteínas formuladas, composiciones de proteínas pulverizables, una matriz de cebo, o cualquier otro sistema de suministro de toxinas conocido en el área.

“Cantidad eficaz para controlar insectos” significa esa concentración de toxina que inhibe, a través de un efecto tóxico, la capacidad de los insectos para sobrevivir, crecer, alimentarse y/o reproducirse, o que limita el daño o la pérdida, relacionados con los insectos, en las plantas de cultivo. “Cantidad eficaz para controlar insectos” puede significar, o no, matar los insectos, aunque es preferible que signifique matar los insectos.

“Casete de expresión” como se usa en este documento significa una secuencia de ácido nucleico capaz de dirigir la expresión de una secuencia de nucleótidos particular en una célula huésped adecuada, que comprende un promotor unido operativamente a la secuencia de nucleótidos de interés la cual está unida operativamente a las señales de terminación. También comprende habitualmente las secuencias requeridas para la traducción adecuada de la secuencia de nucleótidos. El casete de expresión que comprende las secuencia de nucleótidos de interés puede ser quimérico, lo que significa que al menos uno de sus componentes es heterólogo con respecto a al menos uno de sus otros componentes. El casete de expresión puede también ser de origen natural pero que haya sido obtenido en forma recombinante útil para la expresión de heterólogos. Habitualmente, sin embargo, el casete de expresión es heterólogo con respecto al huésped, es decir, la secuencia de ácido nucleico particular del casete de expresión no se encuentra naturalmente en la célula huésped y debe ser introducida en la célula huésped o en un ancestro de la célula huésped mediante un fenómeno de transformación. La expresión de la secuencia de nucleótidos en el casete de expresión puede estar bajo el control de un promotor constitutivo o de un promotor inducible que inicie la transcripción sólo cuando la célula huésped es expuesta a algún estímulo externo particular. En el caso de un organismo multicelular, como una planta, el promotor también puede ser específico para un tejido, órgano o etapa del desarrollo particulares.