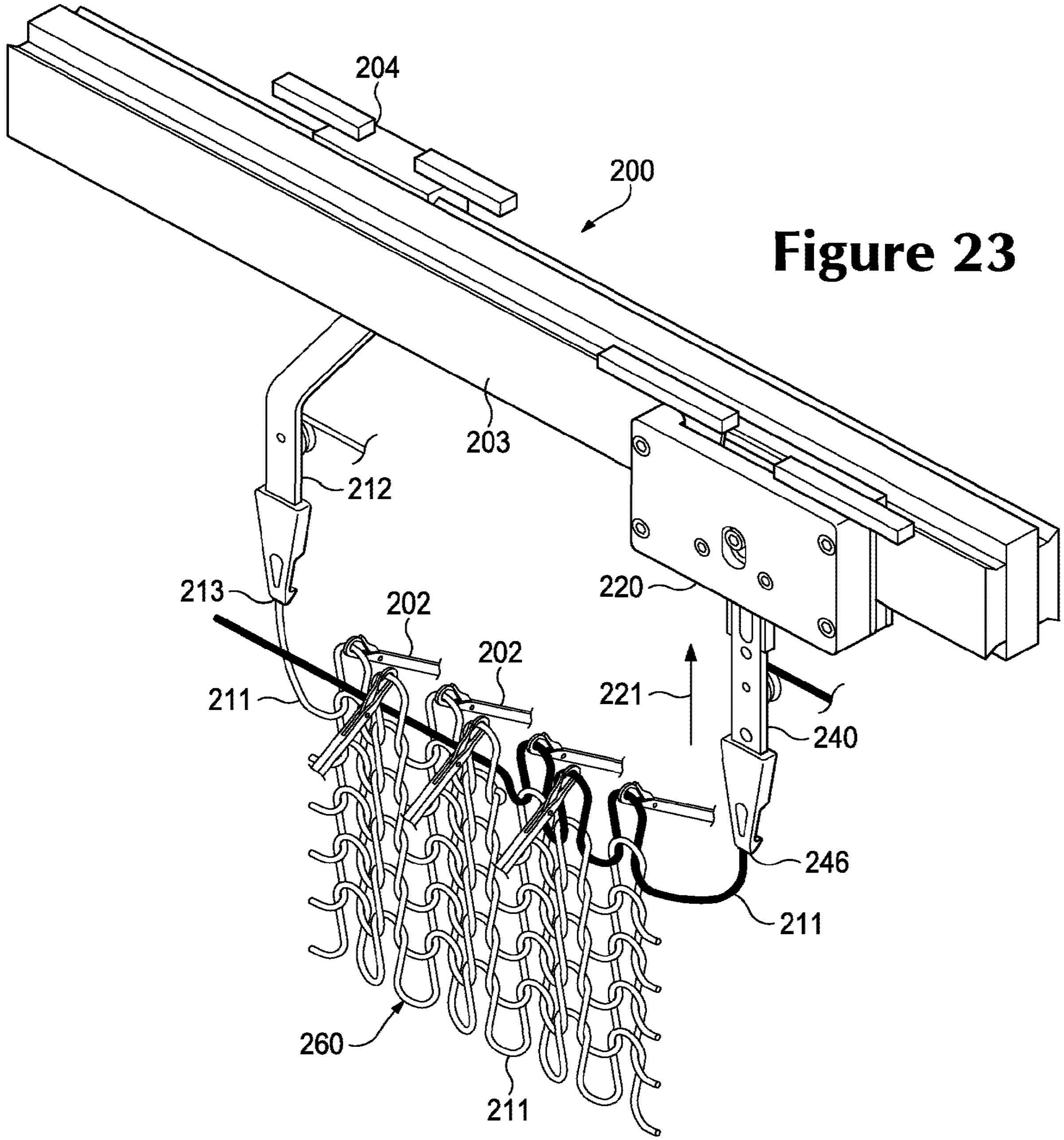

Figure 23

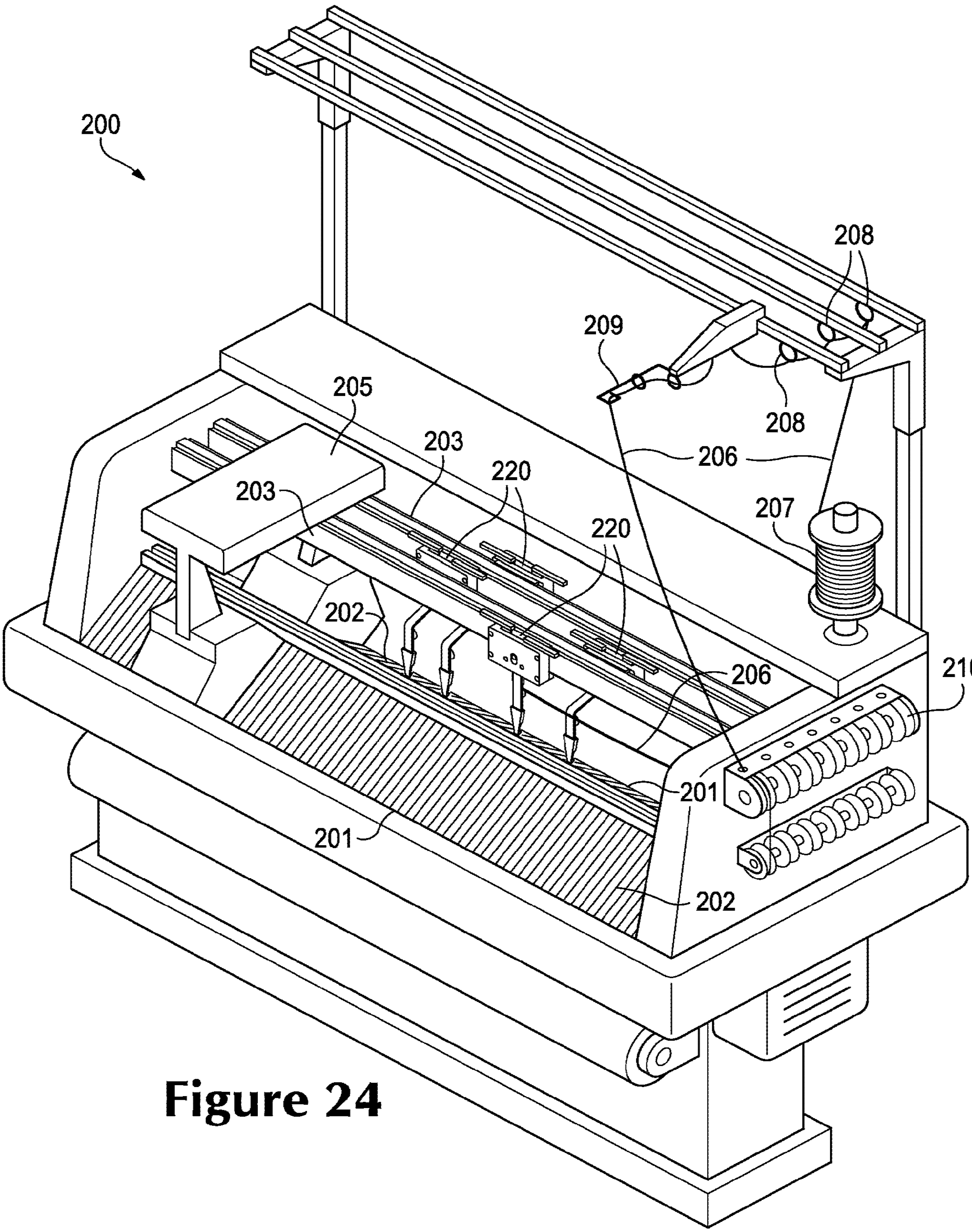
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Figure 24

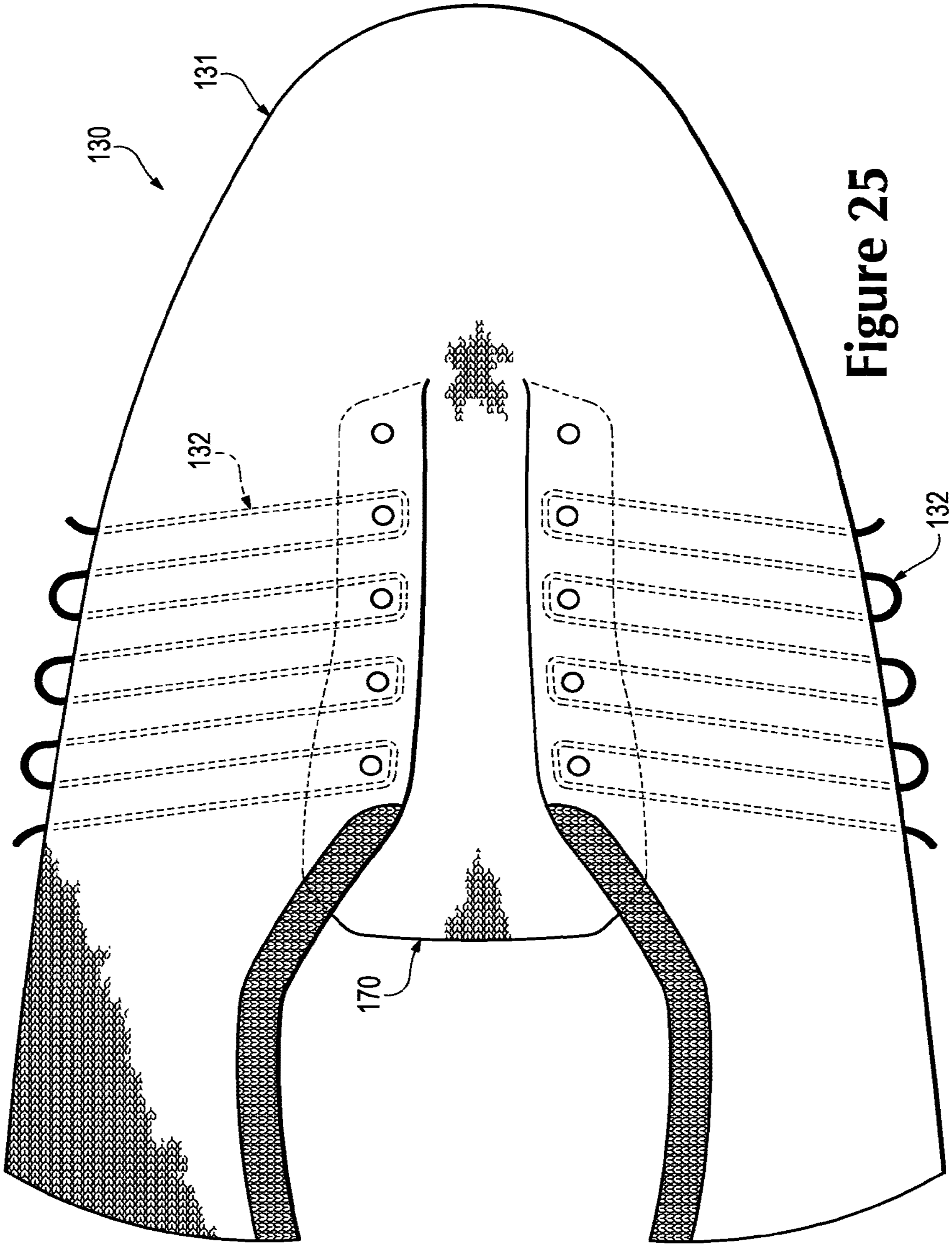


Figure 25

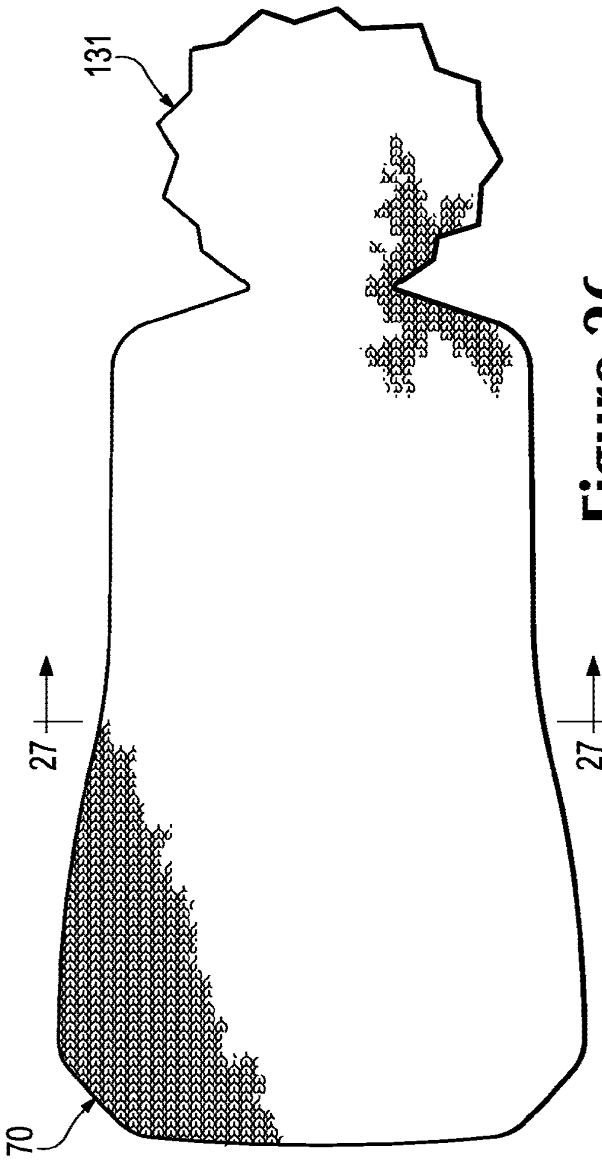


Figure 26

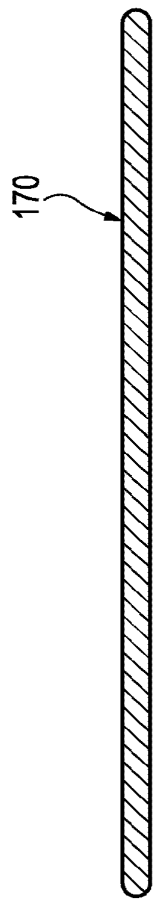


Figure 27

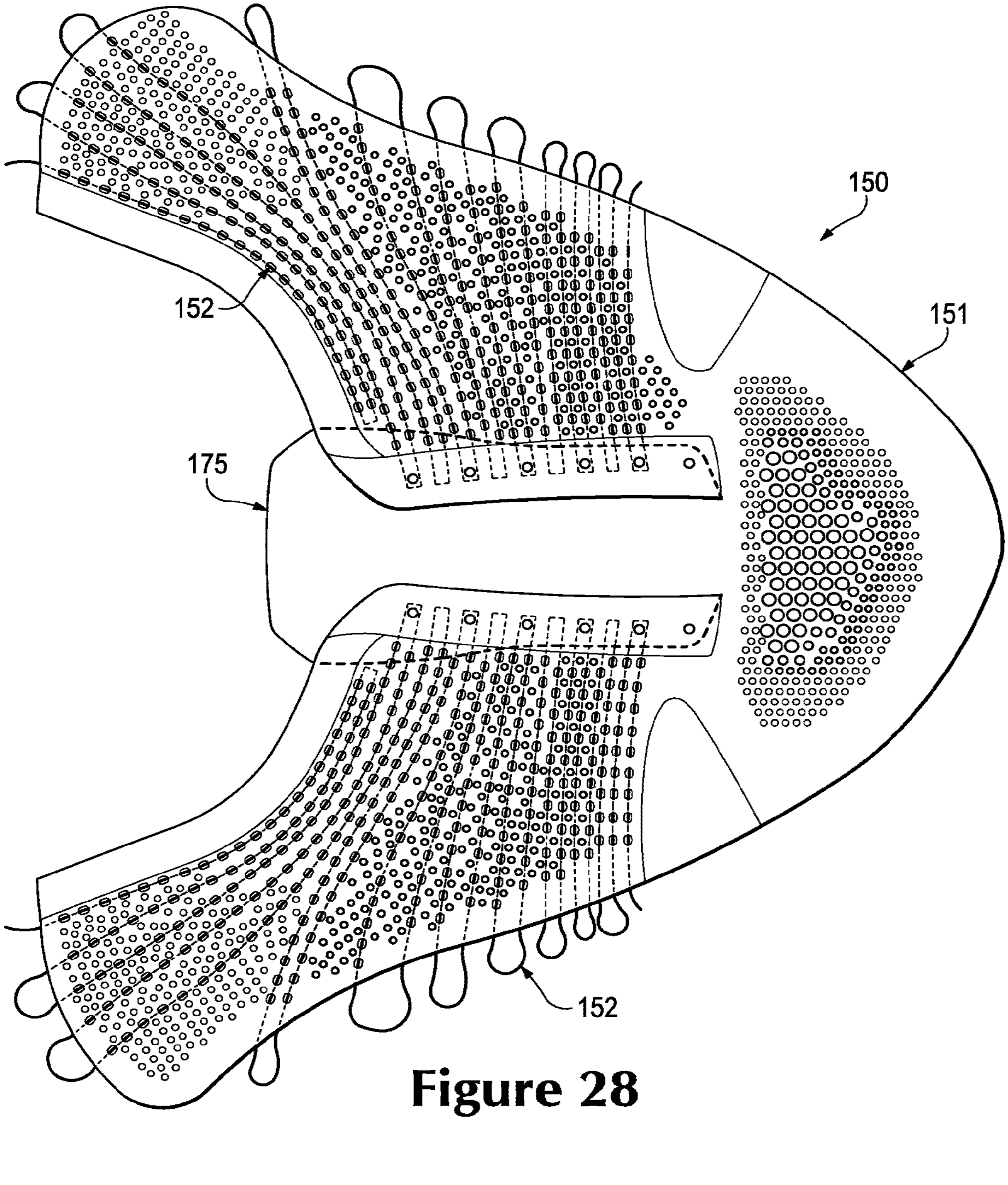


Figure 28

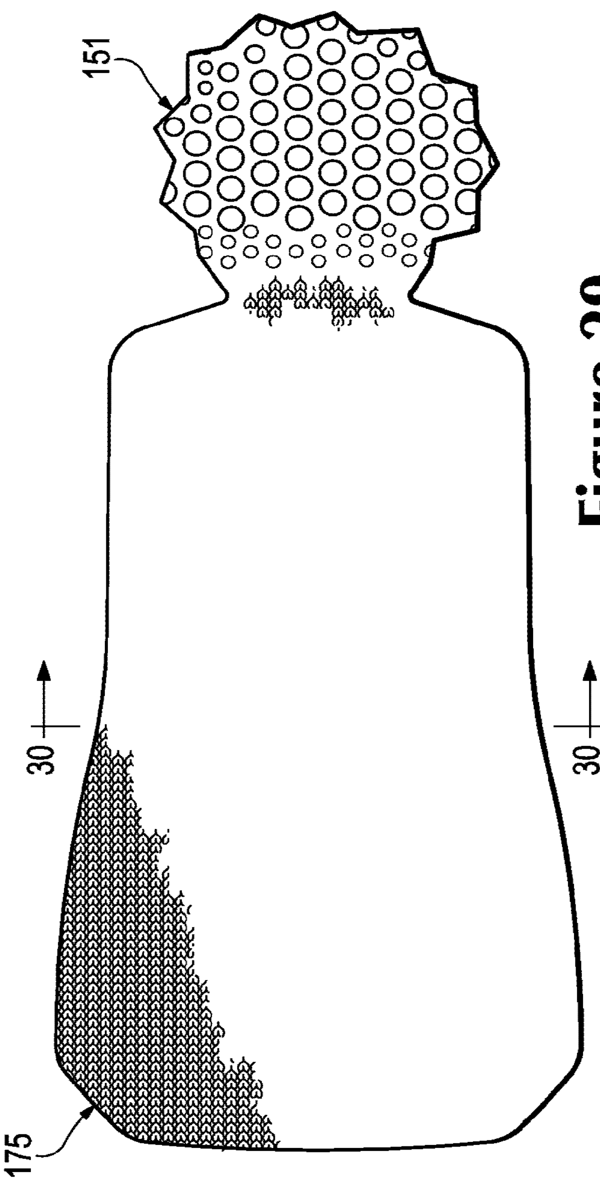


Figure 29

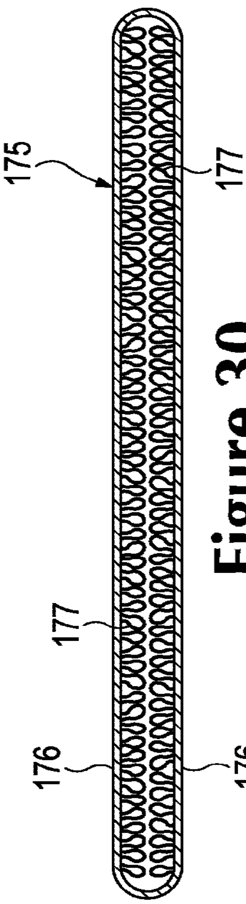


Figure 30

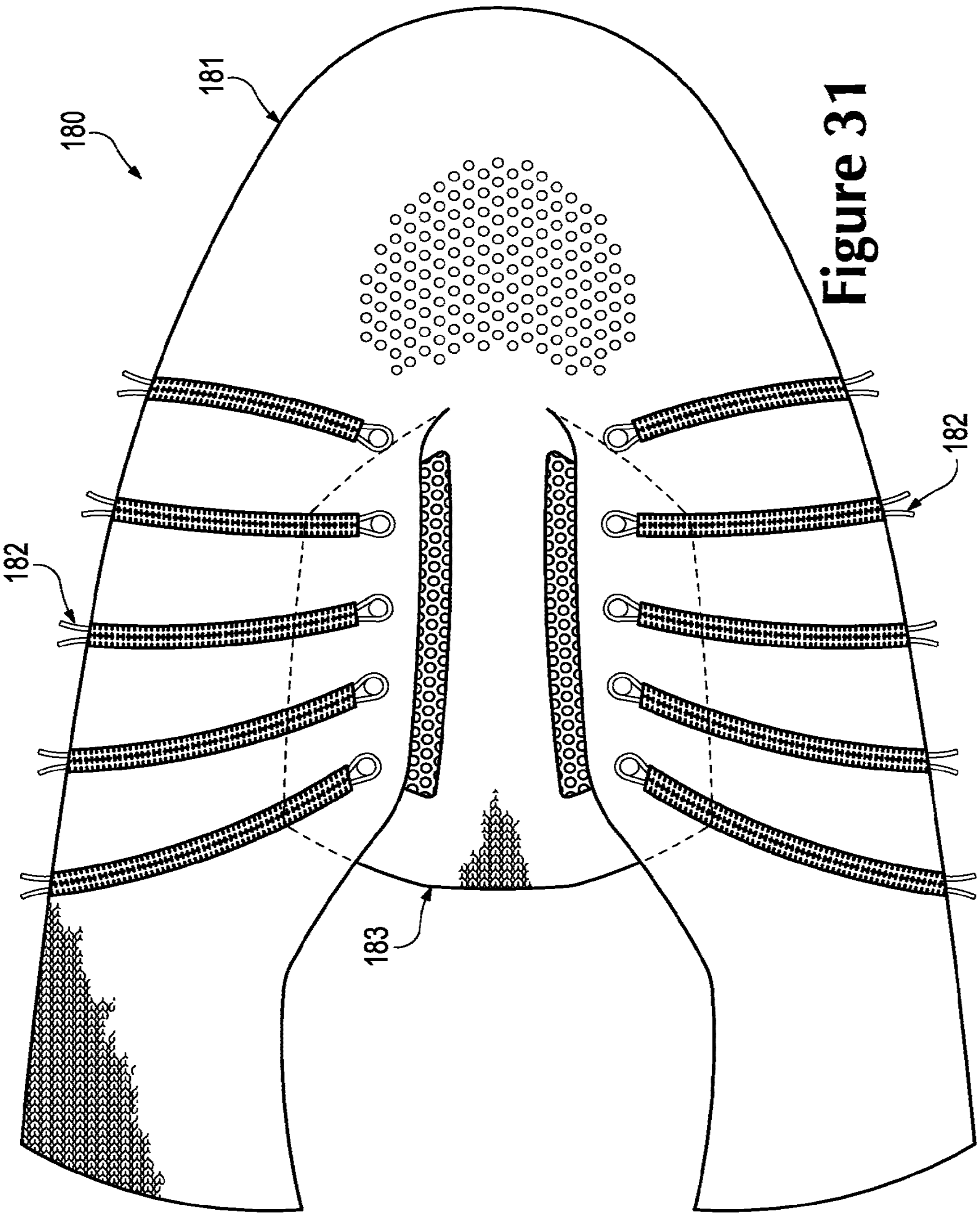


Figure 31

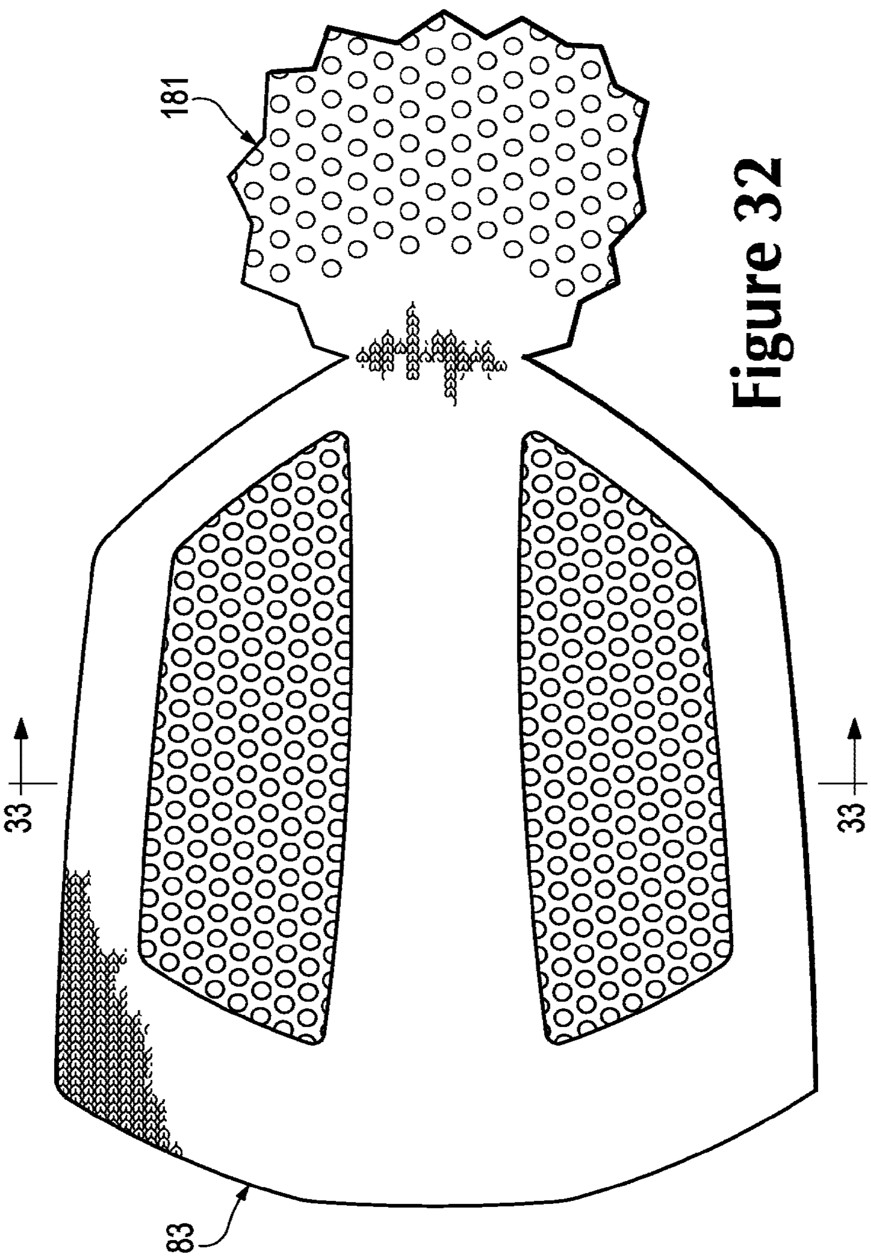


Figure 32

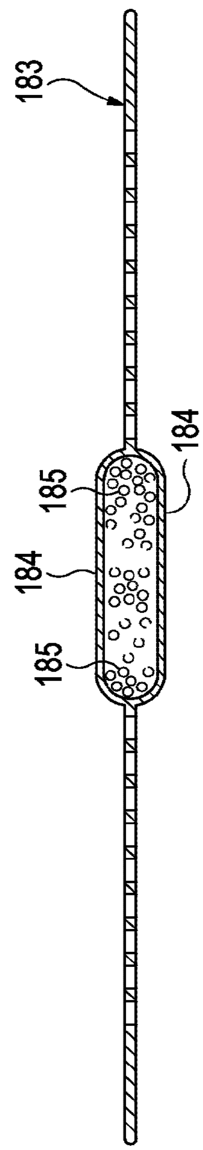


Figure 33

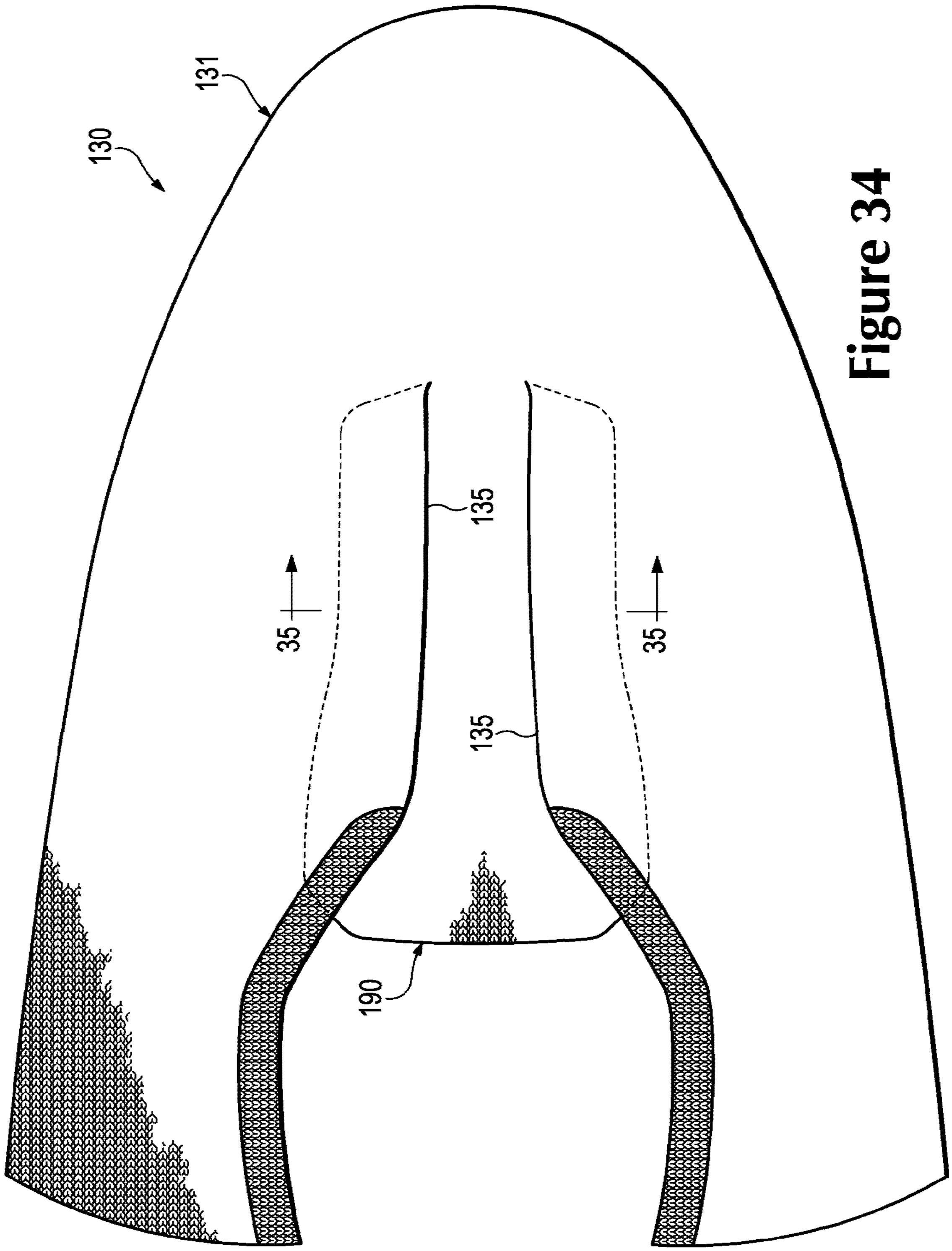


Figure 34

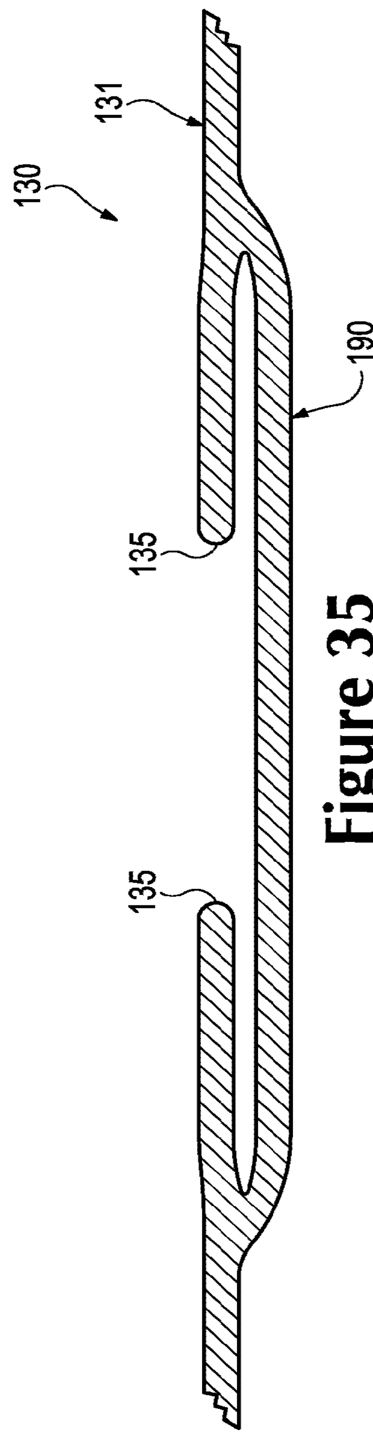


Figure 35

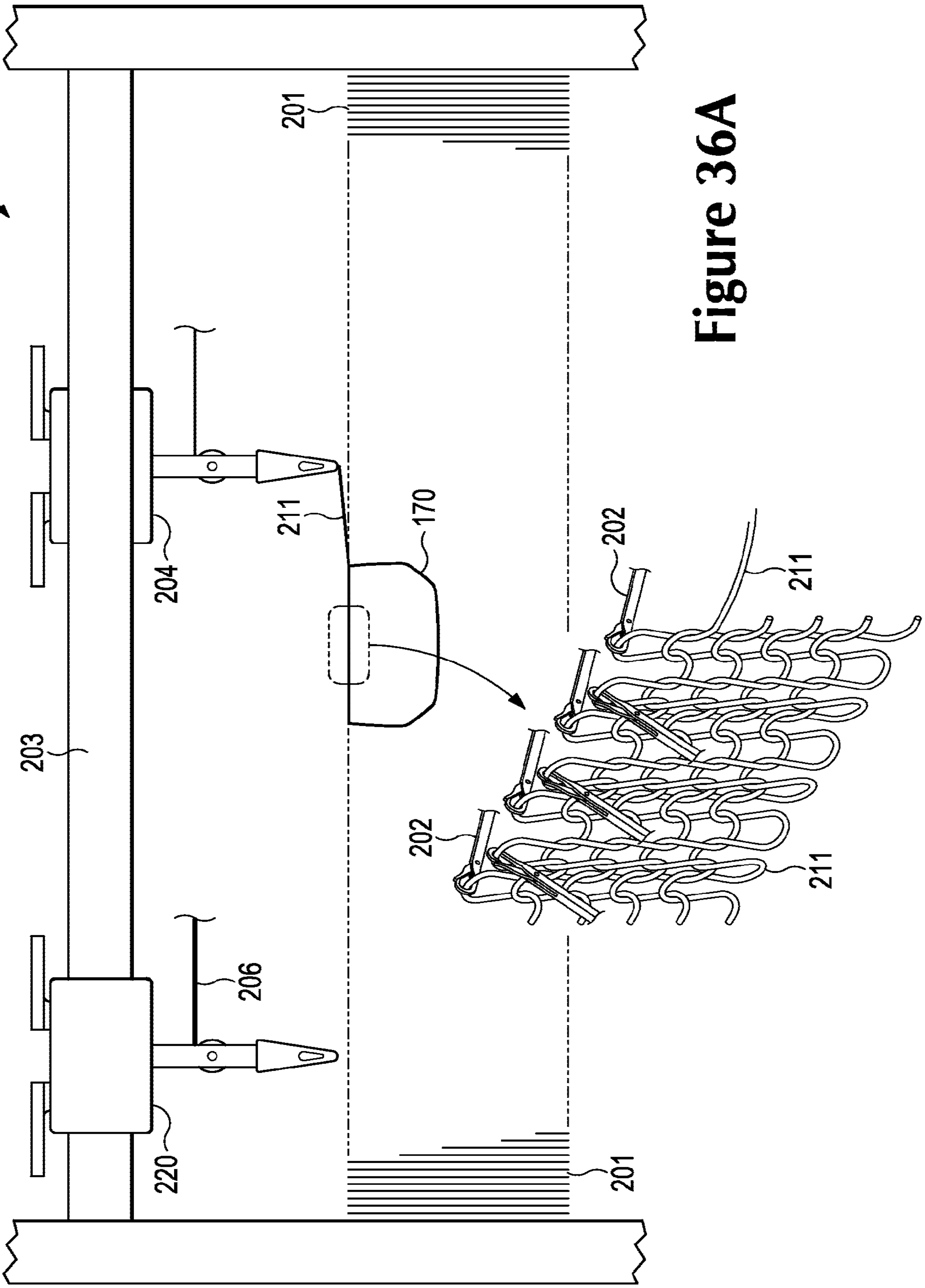


Figure 36A

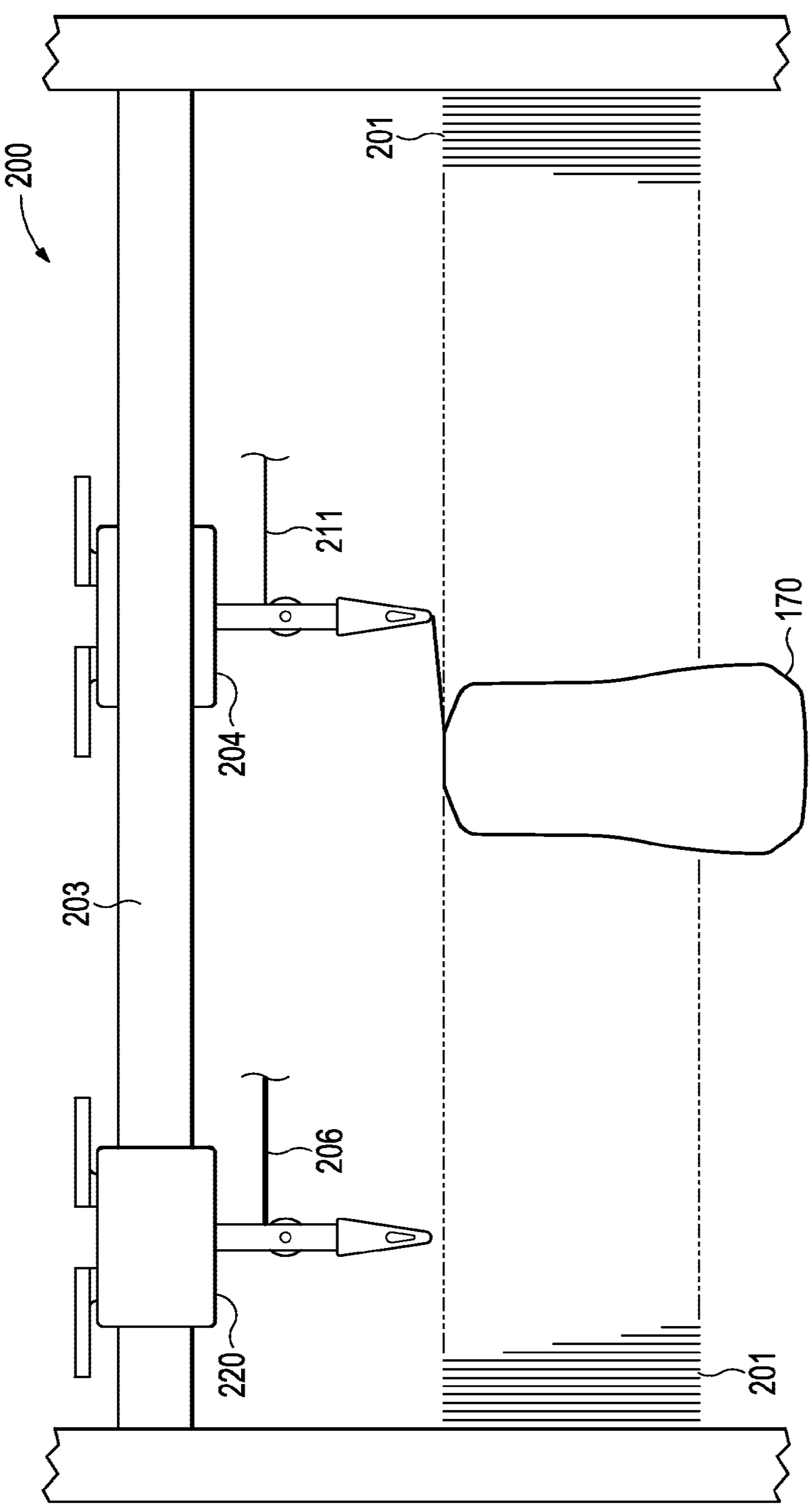


Figure 36B

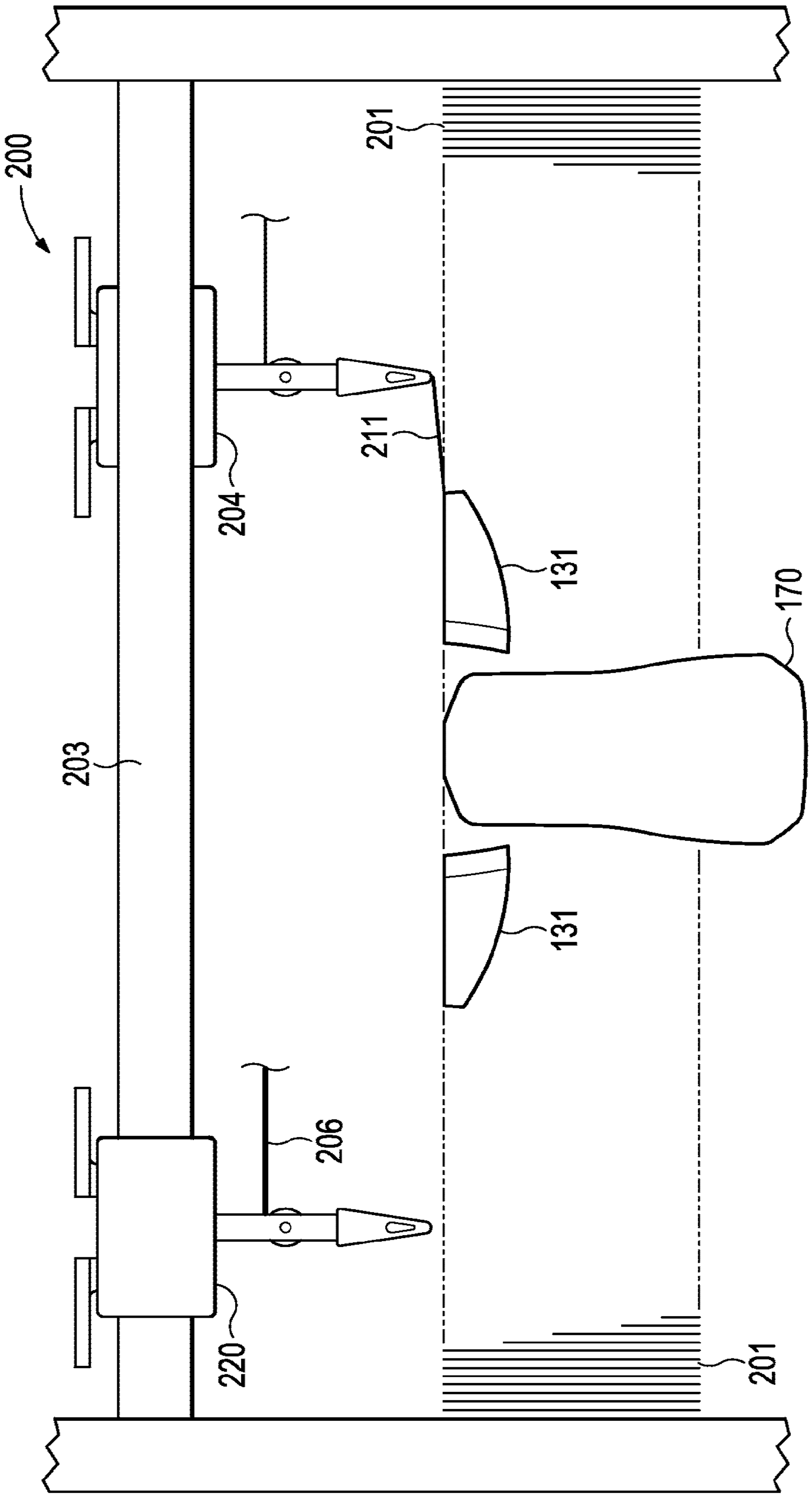


Figure 36C

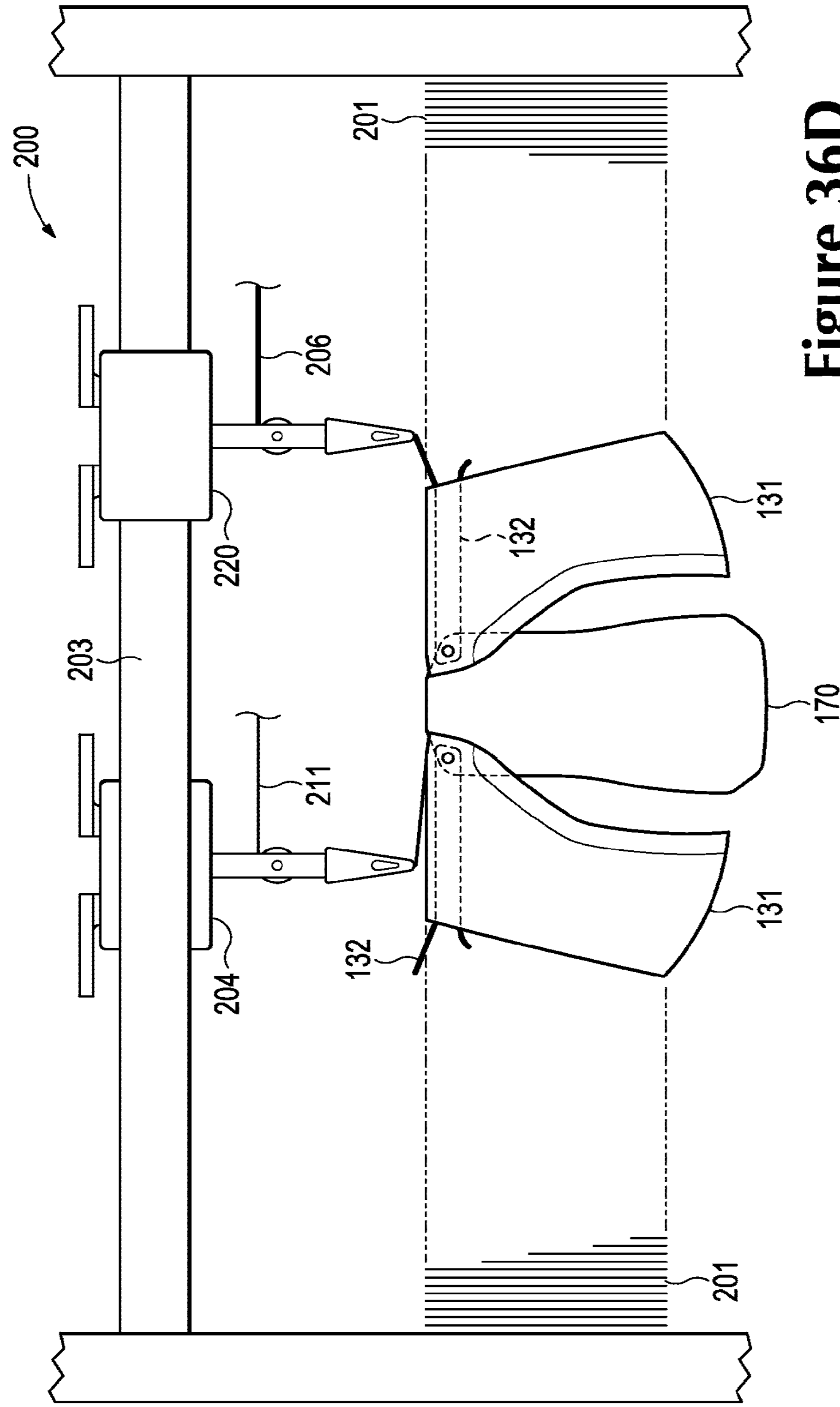


Figure 36D

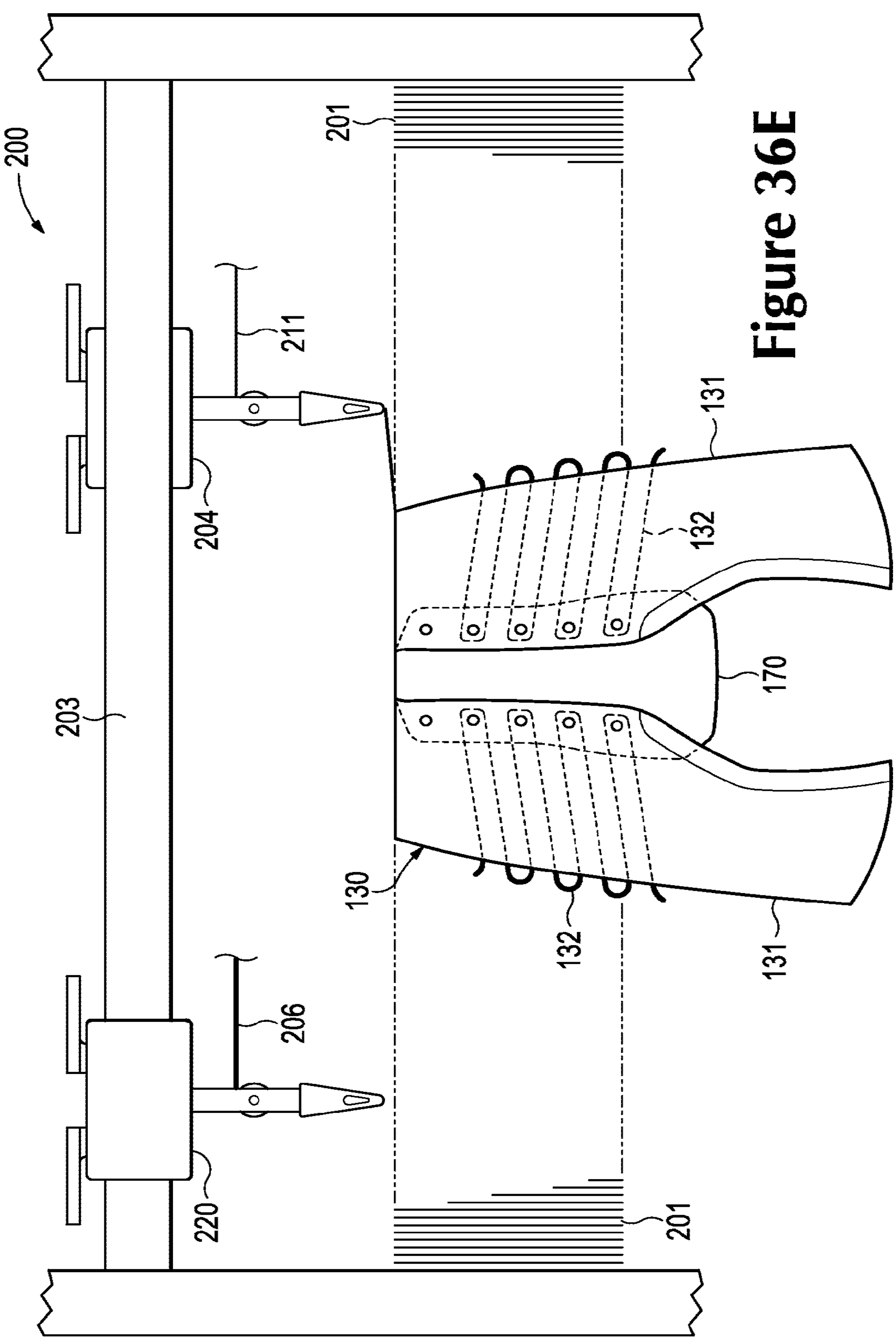


Figure 36E

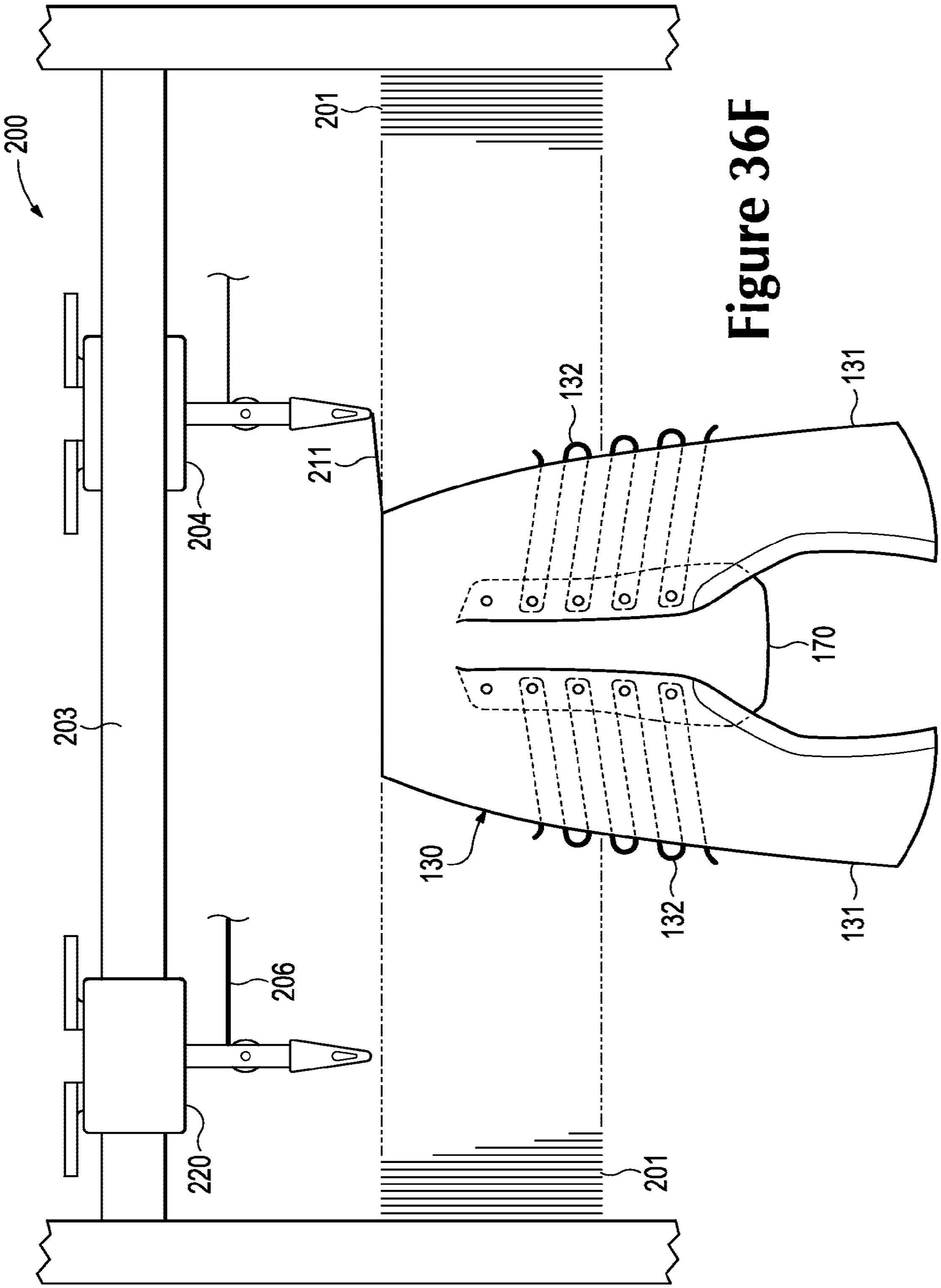


Figure 36F

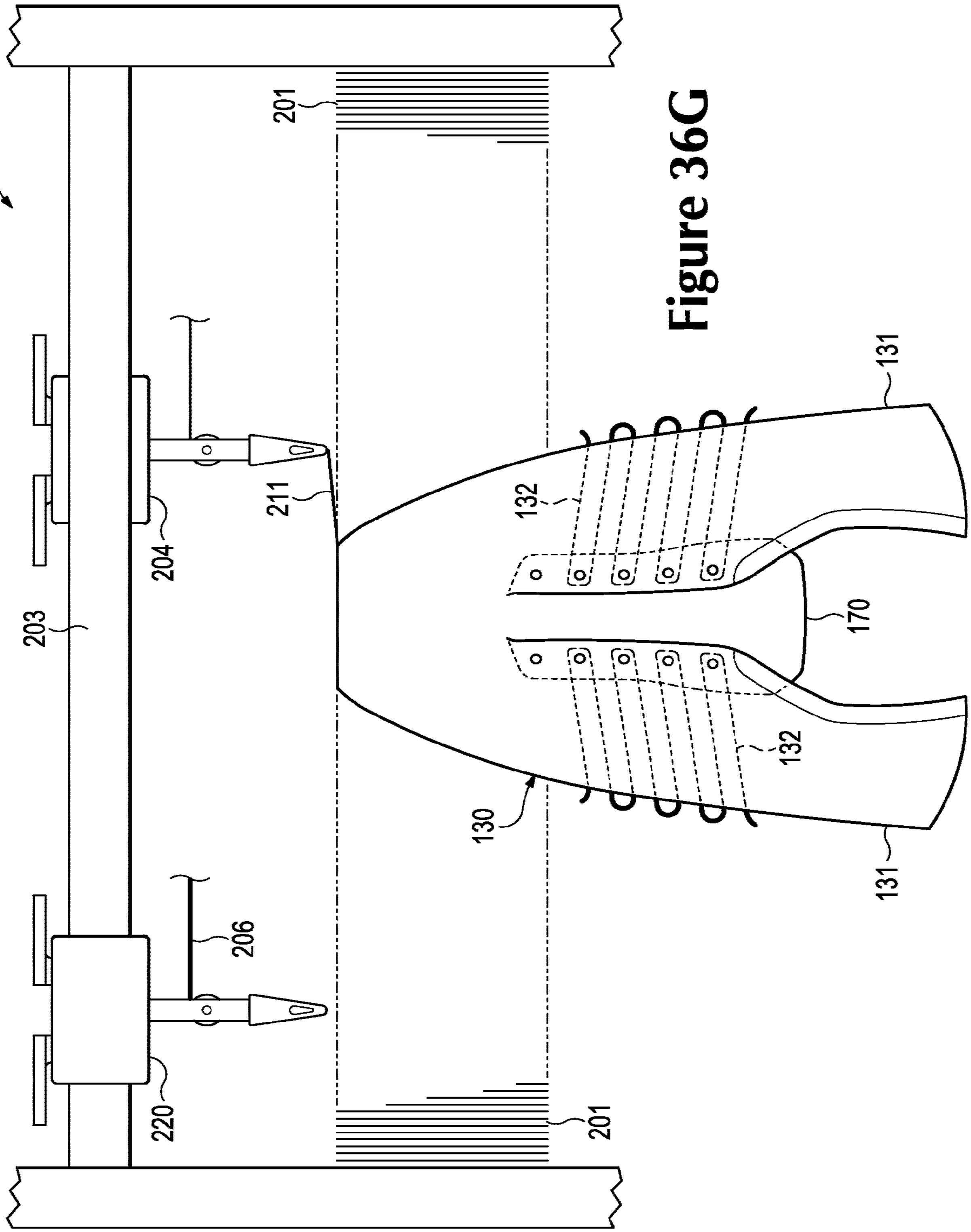


Figure 36G

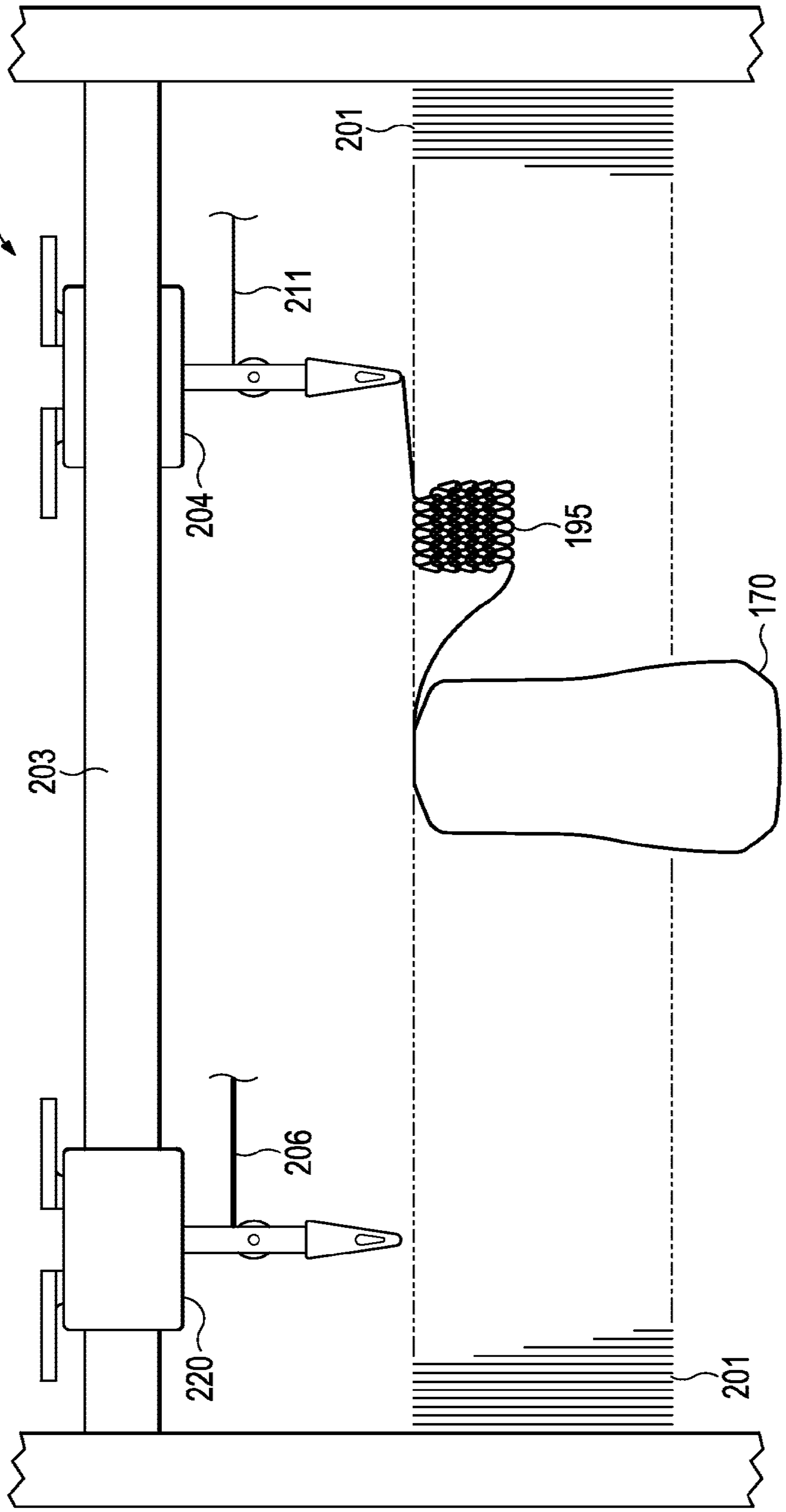
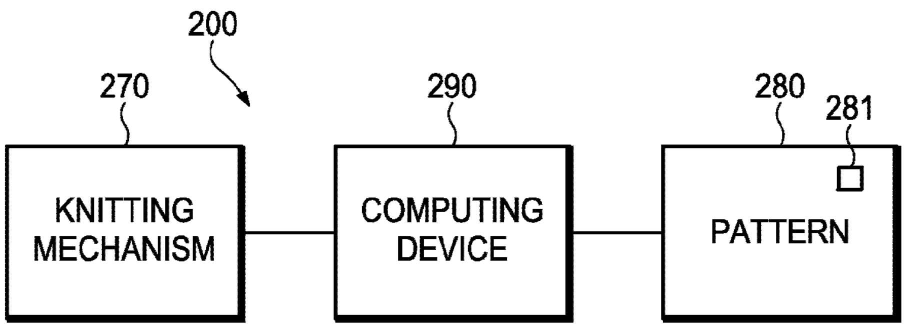


Figure 37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KNITTING MECHANISM
COMPUTING DEVICE
PATTERN

Figure 38

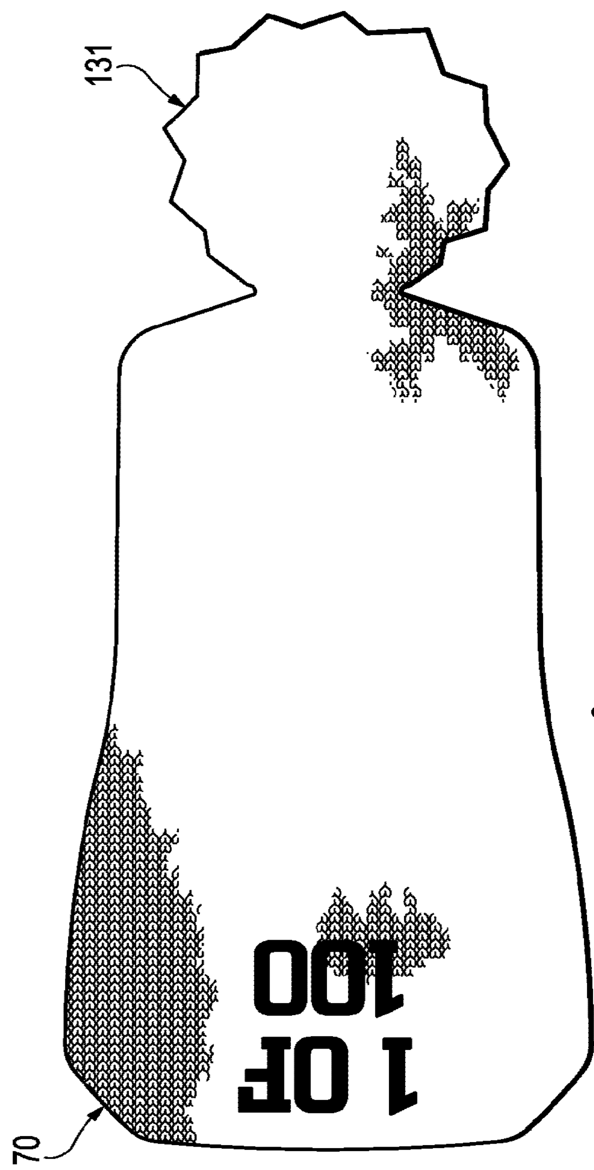

Figure 39A

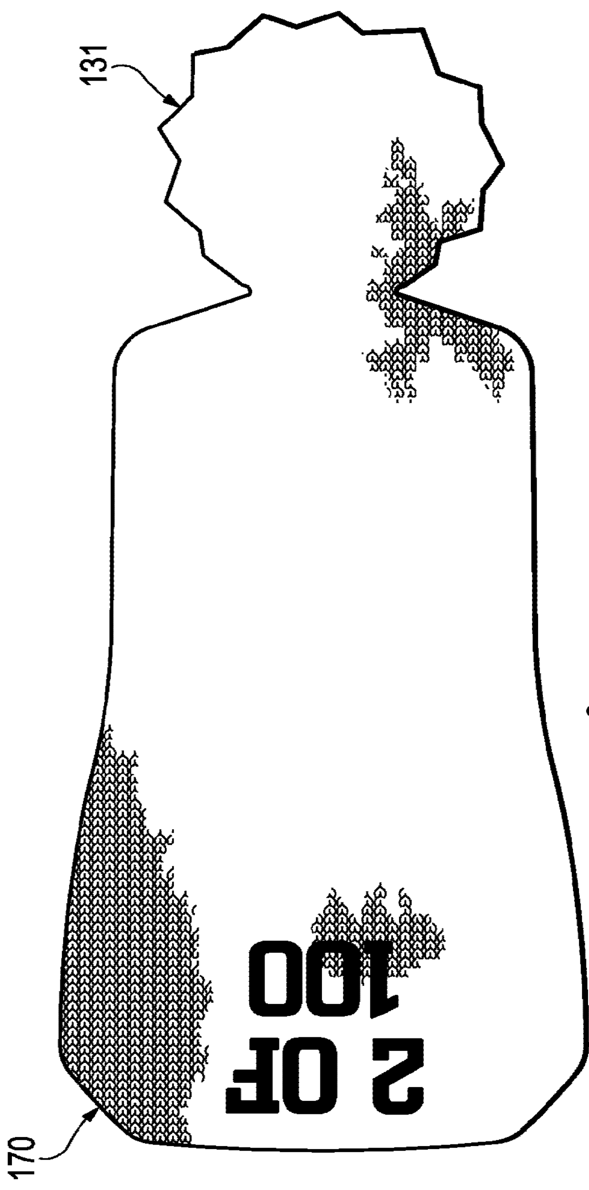

Figure 39B

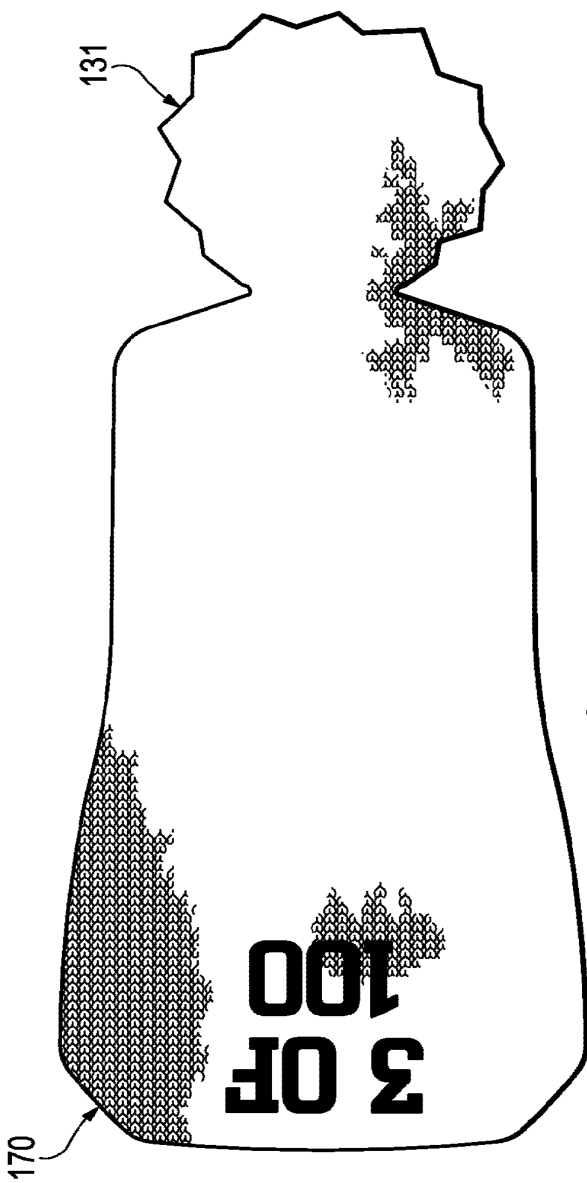

Figure 39C

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JUN 23 2014

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PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:
Gibson, Eric M.
PLUMSEA LAW GROUP, LLC
10411 Motor City Drive, Suite 320
Bethesda, MD 20817
ETATS-UNIS D'AMERIQUE

DOCKETED 6/24/2014
PDF MLA/YMT
ISR

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

	Date of mailing *(day/month/year)* 20 June 2014 (20-06-2014)
Applicant's or agent's file reference 51-3933	**FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/US2014/018852	International filing date *(day/month/year)* 27 February 2014 (27-02-2014)
Applicant NIKE INTERNATIONAL LTD.	

1. [X] The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the International Search Report.

   Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Fascimile No.: (41-22) 338.82.70

   For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 - 9.011.

2. [ ] The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. [ ] **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

   [ ] the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.

   [ ] no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. Following the expiration of 30 months from the priority date, these comments will also be made available to the public.

   Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months from** the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

   In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

   For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

Name and mailing address of the International Searching Authority	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040 Fax: (+31-70) 340-3016	NYSTRöM-HANNACK, Anette Tel: +49 (0)89 2399-6933

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
51-3933		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US2014/018852	27 February 2014 (27-02-2014)	28 February 2013 (28-02-2013)
Applicant		
NIKE INTERNATIONAL LTD.		

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 4 sheets.

[X] 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:
      [X] 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 43.6*bis*(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,**
   [X] 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,**
   [X] 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. 20
      [X] 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 figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/018852

A. CLASSIFICATION OF SUBJECT MATTER
INV. D04B1/24 A43B23/02
ADD.

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 A43B

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/193592 A1 (DUA BHUPESH [US] ET AL) 8 September 2005 (2005-09-08) paragraph [0055] - paragraph [0057]; figures 8, 11	1-4, 8-14, 16-23
X	US 2005/115284 A1 (DUA BHUPESH [US]) 2 June 2005 (2005-06-02) paragraph [0020] - paragraph [0031]; figure 1	1-4, 8-14, 16-23
A	US 2004/118018 A1 (DUA BHUPESH [US]) 24 June 2004 (2004-06-24) paragraph [0062] - paragraph [0063]; figures 6A, 6B	1-23

-/--

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

[X] 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 another 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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 June 2014	20/06/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Zirkler, Stefanie

1

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/018852

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	WO 2013/126313 A2 (NIKE INTERNATIONAL LTD; TATLER DAREN P [US]; PODHAJNY DANIEL A [US]) 29 August 2013 (2013-08-29) the whole document	1-23

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2014/018852

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005193592 A1	08-09-2005	CN 1925763 A	07-03-2007
		CN 101756428 A	30-06-2010
		TW I279198 B	21-04-2007
		US 2005193592 A1	08-09-2005
		US 2008196181 A1	21-08-2008
		US 2010325916 A1	30-12-2010
		US 2012005922 A1	12-01-2012
		US 2012159813 A1	28-06-2012
		US 2014150294 A1	05-06-2014
		WO 2005092134 A1	06-10-2005
US 2005115284 A1	02-06-2005	US 6931762 B1	23-08-2005
		US 2005115284 A1	02-06-2005
		US 2006130359 A1	22-06-2006
US 2004118018 A1	24-06-2004	AT 448703 T	15-12-2009
		AU 2003299627 A1	29-07-2004
		CA 2510558 A1	22-07-2004
		EP 1571938 A1	14-09-2005
		ES 2335988 T3	07-04-2010
		JP 4376792 B2	02-12-2009
		JP 2006511306 A	06-04-2006
		US 2004118018 A1	24-06-2004
		WO 2004060093 A1	22-07-2004
WO 2013126313 A2	29-08-2013	TW 201402030 A	16-01-2014
		US 8448474 B1	28-05-2013
		US 2013212907 A1	22-08-2013
		US 2014144190 A1	29-05-2014
		US 2014150296 A1	05-06-2014
		WO 2013126313 A2	29-08-2013

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2014/018852	27.02.2014	28.02.2013

International Patent Classification (IPC) or both national classification and IPC
INV. D04B1/24 A43B23/02

Applicant
NIKE INTERNATIONAL LTD.

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 43*bis*.1(a)(i) with regard to novelty, inventive step and 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 usually 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 notifed the International Bureau under Rule 66.1*bis*(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.

Name and mailing address of the ISA:	Date of completion of this opinion	Authorized Officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Fax: +49 89 2399 - 4465	see form PCT/ISA/210	Zirkler, Stefanie Telephone No. +49 89 2399-2056

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2014/018852

Box No. I Basis of the 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 sequence listing filed or furnished:

   a. (means)

   ☐ on paper

   ☐ in electronic form

   b. (time)

   ☐ in the international application as filed

   ☐ together with the international application in electronic form

   ☐ 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:

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

1. Statement

Novelty (N)	Yes:	Claims	5-23
	No:	Claims	1-4
Inventive step (IS)	Yes:	Claims	5-7, 15
	No:	Claims	1-4, 8-14, 16-23
Industrial applicability (IA)	Yes:	Claims	1-23
	No:	Claims	

2. Citations and explanations

see separate sheet

Box No. VI Certain documents cited

1. Certain published documents (Rules 43*bis*.1 and 70.10)

   and / or

2. Non-written disclosures (Rules 43*bis*.1 and 70.9)

   see form 210

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item VIII

Certain observations on the international application

1 **Claim 10** is not clear due to its back reference to claim 9 because claim 10 claims "*knitting the exterior surface of the first portion of the upper with the second feeder*" whereas claim 9 claims "*knitting the exterior surface of the first portion of the upper with the first feeder*".

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

D1 US 2005/193592 A1

D2 US 2005/115284 A1

2 The present application does not meet the criteria of **Article 33(1) PCT** for the following reasons:

2.1 Documents D1 and D2 both disclose *a method of manufacturing a knitted component for an article of footwear (D1: Fig. 11; D2: Fig. 1), the method comprising:*

knitting a portion of the knitted component defining an upper with a knitting machine, the upper including a portion of at least one of an exterior surface of the knitted component and an opposite interior surface of the knitted component [note: it is assumed that any knitted component comprises an exterior and an interior surface]*; and*

knitting an integral knit tongue [claim 1 does not define what features differentiate this region from an instep section of documents D1 and D2 (see for example D2: Fig. 1(33)), especially as the "*integral knit tongue*" of claim 1 loses the features characteristic for a tongue by fixing it to all sides of the throat area] *that is of unitary knit construction with the upper with the knitting machine, the integral knit tongue extending through a throat area of the knitted component; and* *wherein the integral knit tongue is joined by knitting with the knitting machine to a forward portion of the throat area and at least along a portion of a lateral side and a medial side of the throat area of the knitted component extending from the forward portion to an ankle opening of the upper (D1: Fig. 11; D2: Fig. 1 (33)).*

Hence, the subject-matter of claim 1 is not new (Articles 33(1) and 33(2) PCT).

2.2 The subject-matter of independent claim 8 differs from that of claim 1 in that it further defines that a first portion of an upper is knitted using a first feeder, a second portion of the upper is knitted using a second feeder and the integral knit tongue is knitted using at least one of these two feeders.

According to D2 ([0023]) "*upper 30 is formed primarily from multiple yarns that are mechanically manipulated through an interloping process to produce a unitary structure having various sections with different physical properties.*"

Although, this does not explicitly disclose the usage of a first feeder for a first section and a second feeder for a second section and one of those two for the instep section a person skilled in the art would without the exercise of inventive skill derive this configuration from the disclosure of D2.

Hence, the subject-matter of claim 8 does not involve an inventive step (Articles 33(1) and 33(3) PCT).

2.3 The subject-matter of independent claim 16 differs from that of claim 8 in that the integral knitted tongue is not knitted using one of the first and second feeder but an additional third feeder.

Hence, the subject-matter of claim 16 does not involve an inventive step for the reasons already given for claim 8 **(Articles 33(1) and 33(3) PCT).**

2.4 **Dependent claims 2 to 4, 9 to 14 and 17 to 23** do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/ or inventive step (**Articles 33(1), 33(2) and 33(3) PCT**), as the additional features of these claims are either already disclosed in D1 and D2 or are merely straightforward possibilities suggested by these documents so that the skilled person would select them, in accordance with the circumstances, without the exercise of inventive skill, in order to solve the respective problem posed.

3 The combination of the features of **dependent claims 5 to 7 and 15** is neither known from, nor rendered obvious by, the available prior art as none of these documents discloses or even suggests to add a "*free portion*" to the "*integral knit tongue*".

Re Item VI

Certain documents cited

Application No	Publication date *(dd/mm/yyyy)*	Filing date *(dd/mm/yyyy)*	Priority date *(dd/mm/yyyy)*
PCT/US2013/026618	29/08/2013	19/02/2013	20/02/2012

Re Item VII

Certain defects in the international application

1 The independent claims are not in the two-part form in accordance with **Rule 6.3(b) PCT**.

2 The features of the claims are not provided with reference signs placed in parentheses (**Rule 6.2(b) PCT**).

3 Contrary to the requirements of **Rule 5.1(a)(ii) PCT**, the relevant background art disclosed in documents D1 to D4 is not mentioned in the description, nor are these documents identified therein.

Electronic Acknowledgement Receipt

EFS ID:	19504565
Application Number:	13781551
International Application Number:	
Confirmation Number:	8567
Title of Invention:	Method Of Knitting A Knitted Component With An Integral Knit Tongue
First Named Inventor/Applicant Name:	Adrian Meir
Customer Number:	57618
Filer:	Eric M. Gibson/Jose Espejo
Filer Authorized By:	Eric M. Gibson
Attorney Docket Number:	51-3238
Receipt Date:	07-JUL-2014
Filing Date:	28-FEB-2013
Time Stamp:	14:56:25
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2014-07-07_51-3238_IDS.pdf	28927 dce7cc1156f76080ba1885bdc7001c2d6d3115e8	no	3

Warnings:

Information:

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2	Foreign Reference	2014-07-07_51-3238_IDS_WO2013126313A2.pdf	4331204 804156f6062c6ff537dd33bf0fc8e903758f6413	no	125
Warnings:					
Information:					
3	Non Patent Literature	2014-07-07_51-3238_IDS_ISR.pdf	666931 c4074a10a45c0baa500ea82d654acc3228bff737	no	11
Warnings:					
Information:					
			Total Files Size (in bytes):	5027062	

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.

<u>New Applications Under 35 U.S.C. 111</u>
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.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
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.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13781551
	Filing Date	2013-02-28
	First Named Inventor	Adrian Meir
	Art Unit	3765
	Examiner Name	Larry D. Worrell Jr.
	Attorney Docket Number	51-3238

U.S.PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	2343390		1944-03-07	Ushakoff	
	2	2608078		1952-08-26	Anderson	
	3	2569764		1951-10-02	Jonas	
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number		13781551
	Filing Date		2013-02-28
	First Named Inventor	Adrian Meir	
	Art Unit		3765
	Examiner Name	Larry D. Worrell Jr.	
	Attorney Docket Number		51-3238

	9	6333105		2001-12-25	Tanaka et al.	
	10	3583081		1974-06-08	Hayashi	
	11	4447967		1984-05-15	Mortara	
	12	4813158		1989-03-21	Brown	
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	15	4785558		1988-11-22	Shiomura	

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code1	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020148258		2002-10-17	Cole et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13781551
	Filing Date	2013-02-28
	First Named Inventor	Adrian Meir
	Art Unit	3765
	Examiner Name	Larry D. Worrell Jr.
	Attorney Docket Number	51-3238

Examiner Initial*	Cite No	Foreign Document Number3	Country Code2 i	Kind Code4	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T5
	1	19728848	DE		1999-01-07	Schuetzmeier		☐
	2	0448714	EP		1991-10-02	Nakajima et al.		☐
	3	1233091	EP		2002-08-21	Ractcliffe et al.		☐
	4	0231247	WO		2002-04-18	Greenhalgh		☐
	5	H11302943	JP		1999-11-02	Masahiko et al.		☐
	6	19738433	DE		1998-04-02	Schulte et al.		☐
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	8	7304678	NL		1974-10-08	Wildeman et al.		☐
	9	1084173	DE		1960-06-23	Geibler		☐
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number		13781551
	Filing Date		2013-02-28
	First Named Inventor	Adrian Meir	
	Art Unit		3765
	Examiner Name	Larry D. Worrell Jr.	
	Attorney Docket Number		51-3238

	11	538865	GB		1941-08-20	Brew		☐
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	17	9003744	WO		1990-04-19	Curley		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	Declaration of Dr. Edward C. Frederick from the US Patent and Trademark Office Inter Partes Review of US Patent No. 7,347,011 (178 pp).	☐
	2	David J. Spencer, Knitting Technology: A Comprehensive Handbook and Practical Guide (Third ed., Woodhead Publishing Ltd. 2001) (413 pp).	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	13781551
	Filing Date	2013-02-28
	First Named Inventor	Adrian Meir
	Art Unit	3765
	Examiner Name	Larry D. Worrell Jr.
	Attorney Docket Number	51-3238

	3	Excerpt of Hannelore Eberle et al., Clothing Technology (Third English ed., Beuth-Verlag GmnH 2002) (book cover and back; pp2-3, 83).	☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		13781551
	Filing Date		2013-02-28
	First Named Inventor	Adrian Meir	
	Art Unit		3765
	Examiner Name	Larry D. Worrell Jr.	
	Attorney Docket Number		51-3238

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Eric M. Gibson/	Date (YYYY-MM-DD)	2013-09-30
Name/Print	Eric M. Gibson	Registration Number	59,058

(19) BUNDESREPUBLIK DEUTSCHLAND

DEUTSCHES PATENT- UND MARKENAMT

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(72) Erfinder:
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(56) Entgegenhaltungen:
DE-PS 8 29 161

Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Prüfungsantrag gem. § 44 PatG ist gestellt

(54) Bekleidungsstück mit eingeprägtem Zeichen

(57) Ein vorzugsweise aus Maschenware ausgebildetes Bekleidungsstück besteht wenigstens teilweise aus einem elastomeren, thermisch deformierbaren Kunstfasergarn. Um das Bekleidungsstück mit gewünschten Zeichen, Kennzeichnungen u. dgl. zu versehen, sind diese in die Maschenware durch Temperatur- und/oder Druckeinwirkung eingeprägt. Es werden dabei Prägebereiche ausgebildet, in denen die Maschenware wesentlich dünner liegt als in der anschließenden Umgebung. Die Prägebereiche sind dabei im wesentlichen glatt, ohne daß hier die Fadenstruktur aufgelöst wäre. Obwohl die Maschen als solche erhalten sind, ergibt sich, beispielsweise durch partielles Anschmelzen der Oberfläche, ein glattes, im Vergleich zur Umgebung geändertes Aussehen, was eine plastische oder räumliche Wirkung des gewünschten Schriftzugs oder sonstigen Logos hervorbringt.

DE 197 28 848 A 1

Beschreibung

Die Erfindung betrifft ein Bekleidungsstück, insbesondere ein Beinbekleidungsstück, wie einen Strumpf oder eine Strumpfhose, mit den Merkmalen des Oberbegriffs des Patentanspruchs 1.

Sowohl bei Beinbekleidungsstücken, wie halterlosen Damenstrümpfen oder Feinstrumpfhosen, als auch bei anderen Kleidungsstücken, wie Freizeit- oder Sportbekleidung, ist häufig der Wunsch vorhanden, an dem betreffenden Kleidungsstück Markierungen, Zeichen, Beschriftungen, Logos, Schmuckelemente od. dgl. anzubringen. Dies erfolgt häufig durch aufgenähte Etiketten oder Farbaufdrucke. Jedoch sind in einigen Fällen sowohl Farbaufdrucke als auch Etiketten nicht praktikabel. Beide stören häufig den optischen Eindruck oder verschlechtern die Trageeigenschaften zumindest an der Anbringstelle.

Insbesondere elastische Gewebe oder Gestricke sind zum Anbringen von Farbmarkierungen oder Etiketten meist wenig geeignet. Während sich Farbmarkierungen in diesem Bereich beim Spannen des Grundmaterials lösen können, verändern aufgenähte Etiketten die Eigenschaften des textilen Flächengebildes, insbesondere die Elastizität nachhaltig. Außerdem stören beide den optischen Gesamteindruck. Dies gilt insbesondere für Abschnitte eines Bekleidungsstücks, die in getragenem Zustand gespannt, d. h. gedehnt sind. Dies ist beispielsweise an dem oberen Rand von halterlosen Damenstrümpfen oder Feinstrumpfhosen der Fall. Darüber hinaus gilt dies für entsprechende Abschnitte sonstiger Bekleidungsstücke.

Davon ausgehend ist es Aufgabe der Erfindung, eine Möglichkeit zu schaffen, Bekleidungsstücke mit einer Kennzeichnung zu versehen, die die Trageeigenschaften an der entsprechenden Stelle nicht fühlbar verändert.

Diese Aufgabe wird von einem Bekleidungsstück mit den Merkmalen des Patentanspruchs 1 gelöst.

Das erfindungsgemäße Bekleidungsstück weist wenigstens in dem zu kennzeichnenden Bereich ein textiles Flächengebilde auf, das durch ein oder mehrere Fäden gebildet ist, die dauerhaft verformbar sind. Vorzugsweise sind diese durch Temperatur und Druck verformbare Kunstfasern. Diese sind miteinander vermascht, so daß das textile Flächengebilde in entspanntem Zustand eine Dicke aufweist, die größer als die Fadendicke ist. Beispielsweise wird dieser Bereich des Flächengebildes durch Maschen gebildet, die eine gewisse Ausdehnung senkrecht zu der Fläche des Flächengebildes haben. Das Gestrick kann sowohl ein- als auch mehrfädig ausgebildet sein.

Dem zu erzeugenden Muster, dem Logo oder der sonstigen Markierung entsprechend sind Prägebereiche festgelegt, in denen das Flächengebilde durch Druck- und Temperatureinwirkung so umgeformt worden ist, daß es eine verminderte Dicke aufweist. Gegenüber diesen Prägebereichen wirken die übrigen Bereiche des textilen Flächengebildes erhaben, so daß eine räumliche Wirkung zustandekommt. Damit ist es möglich, ohne Veränderung der jeweiligen Farbe Schriftzüge, Logos oder sonstige Markierungen in den betreffenden Bereich des Bekleidungsstücks einzuprägen, die insbesondere dann plastisch hervortreten, wenn das Flächengebilde entspannt ist, d. h. keinem Zug ausgesetzt ist. Die Prägeparameter sind dabei vorzugsweise so festgelegt, daß die einzelnen Fäden oder Fasern des textilen Flächengebildes nicht aufgelöst werden, sondern bei dem Prägevorgang erhalten bleiben. Sie werden lediglich deformiert. Damit wird eine Schädigung des Gestricks insbesondere im Übergangsbereich von dem Prägebereich zu umgebenden ungeprägten Bereichen vermieden.

Auf die genannte Weise lassen sich insbesondere bei Feinstrumpfhosen, Strümpfen, Miederwaren oder Sportbekleidung Schriftzüge oder Logos einprägen, die relativ auf fällig sind, wenn die Ware lose ausgebreitet liegt und die die Trageeigenschaften nicht fühlbar verändern.

Das textile Flächengebilde besteht vorzugsweise aus Kunstfasern, die bei dem Prägevorgang dauerhaft verformt werden. Auch nach vielmaligem Tragen oder Waschen bleibt das eingeprägte Muster in dem lose liegenden Material deutlich sichtbar.

Ein besonders guter Effekt wird erreicht, wenn das textile Flächengebilde eine Maschenware, insbesondere ein Gewirk, ein Gestrick oder Raschelware ist. Dabei ist es besonders zweckmäßig, wenn der Prägebereich auf einem mehrlagigen Textilbereich ausgebildet ist. Hier tritt die räumliche Wirkung durch den Unterschied zwischen den Prägebereichen und den erhabenen Bereichen am deutlichsten hervor. Vorzugsweise sind die einzelnen Lagen des Flächengebildes auch in den Prägebereichen miteinander nicht verschmolzen, so daß der Tragekomfort nicht beeinträchtigt ist.

Die durch ein elastomeres Garn gebildeten einzelnen Fasern oder Fäden des textilen Flächengebildes sind vorzugsweise oberflächig so weit angeschmolzen, daß sich in dem Prägebereich im ungedehnten Zustand fast glatte Flächenbereiche ergeben, die die Strickstruktur kaum mehr erkennen lassen. Der Schmelzvorgang oder die Strukturänderung geht jedoch nicht so weit, daß die einzelnen Fäden ganz miteinander verschmelzen. Vielmehr bleiben sie in dem Gewebe wenigstens etwas beweglich, um keine steifen Bereiche zu erzeugen.

Die Prägebereiche können als Buchstabenzeichen od. dgl. ausgebildet werden. Sie können sowohl als Verzierungen als auch zur Kennzeichnung oder als Informationsträger verwendet werden.

In der Zeichnung ist ein Ausführungsbeispiel des Gegenstandes der Erfindung veranschaulicht. Es zeigen:

Fig. 1 einen mit einer eingeprägten Kennzeichnung versehenen Damenstrumpf, in schematisierter Darstellung,

Fig. 2 den Damenstrumpf nach **Fig.** 1, in einer ausschnittsweisen Darstellung seines oberen Randes,

Fig. 3 eine perspektivische Schnittdarstellung eines geprägten Bereichs und sich daran anschließender ungeprägter Bereiche des Randes des Strumpfs nach **Fig.** 2, in stark schematisierter Prinzipdarstellung und

Fig. 4 ein geprägtes textiles Flächengebilde, in aufs Äußerste schematisierter Schnittdarstellung und in einlagiger Ausführung.

Beschreibung

In **Fig.** 1 ist ein Damenstrumpf **1** dargestellt, dessen oberer Rand **2** mit einem Markenlogo **3** versehen ist. Der obere Rand **2** ist als Doppelrand oder Bündchen ausgebildet. Das hier doppelt vorhandene Strumpfmaterial ist durch den sogenannten Umhang **4** miteinander verbunden. In dem bei einer Trennlinie **5** beginnenden Rand- und Griffbereich **6** ist das Strumpfmaterial unter Verwendung texturierter Garne besonders elastisch ausgebildet. Der Damenstrumpf **1** ist insgesamt rundgestrickt aus synthetischem Garn gearbeitet. Dabei können auch mehrere Synthetikgarne unterschiedlicher Konstruktion verarbeitet sein. Beispielsweise kann in den Maschenreihen abwechselnd ein umwundenes elastomeres Garn und ein glattes Garn verstrickt sein ("Satin-Sheer"). Das synthetische elastomere Garn ist vorzugsweise aus Polyamidfasern gebildet, wobei unter Umständen auch andere Garne in Frage kommen.

Der in den Saum **2** eingeprägte Schriftzug **3** wird, wie **Fig.** 2 zeigt, durch Prägebereiche **8** gebildet, die von ungeprägten Bereichen **9** umgeben sind. Während die ungeprägten Bereiche **9** deutlich die Maschenstruktur des rundgestrickten Flächengebildes erkennen lassen, ist die Struktur der Maschenware in den Prägebereichen **8** so weit geändert, daß diese Flächenbereiche fast glatt sind. Dabei sind die einzelnen Fäden allenfalls oberflächlich angeschmolzen oder zumindest deformiert. Wie aus **Fig.** 3 ersichtlich ist, sind sowohl in dem ungeprägten Bereich **9** als auch in dem Prägebereich **8** einzelne Fäden **11**, **12** erkennbar, wobei die Maschen in dem Prägebereich **8** nicht zerstört sind.

Während in dem ungeprägten Bereich die Gesamtdicke des hier aus zwei Lagen **13**, **14** bestehenden Flächengebildes deutlich größer als der Durchmesser eines Fadens und auch größer als eine einzelne Masche ist, ist die Dicke in dem Prägebereich **8** geringer. Jedoch wird dies nur durch Verformung der einzelnen Fäden **11**, **12**, nicht aber durch Verschmelzen beider Lagen **13**, **14** miteinander erreicht. Während die Maschen der Lagen **13**, **14** in den ungeprägten Bereichen **9** mehr oder weniger räumlich angeordnet sein und aus den Fäden **11**, **12** Filamente herausragen können, die einen gewissen Flor schaffen, liegen die Maschen zumindest der oberen Lage **13**, in dem Prägebereich **8** flach, wobei die aus den Fäden **11**, **12** herausragenden Filamente hier angeschmolzen sind. Dadurch ist die Maschenstruktur kaum mehr zu erkennen und der Prägebereich **8** kann eine glatte, zum Teil auch glänzende Oberfläche erhalten, während die übrigen Bereiche matt und erhaben erscheinen. Die Maschenstruktur ist jedoch erhalten, so daß die Prägebereiche **8** sowohl dehnbar als auch dauerhaft mechanisch stabil sind.

Bei Dehnung des Saums **2**, insbesondere wenn der Strumpf **1** getragen wird, zeigen die Prägebereiche **8** im Vergleich zu den ungeprägten Bereichen kaum oder nicht verändertes Dehnverhalten. Die Fäden **11**, **12** sind in den Prägebereichen **8** im Wesentlichen genauso stabil wie in den ungeprägten Bereichen **9**, so daß der eingeprägte Schriftzug **3** keine nachteiligen Auswirkungen auf den Saum **2** hat.

Wie bei dem Strumpf **1** ist es gleichermaßen möglich, an einem entsprechenden Bund einer Feinstrumpfhose Schriftzüge **3** oder sonstige Markierungen, Logos od. dgl. anzubringen. Dies kann ebenfalls an entsprechenden Teilen von sonstigen, aus elastomeren Garnen hergestellter Kleidungsstücke geschehen. Dies können beispielsweise Bodies sein. Die eingeprägten Zeichen können an beliebigen zweilagig ausgebildeten Stellen, wie beispielsweise Ärmelbündchen, Kragen oder an sonstigen Stellen vorgesehen werden.

Darüber hinaus ist es möglich, textile Flächengebilde **15**, wie sie aus **Fig.** 4 ersichtlich sind, mit Prägebereichen **8'** zu versehen, wenn die betreffenden Flächengebilde **15** einen räumlichen Aufbau haben. Dieser kann sich, wie in **Fig.** 4 angedeutet, dadurch ergeben, daß das hier im Querschnitt veranschaulichte Flächengebilde in entspanntem Zustand nicht eben, sondern gerippt liegt. Das Flächengebilde **15** ist vorzugsweise eine Maschenware, die in diesem Fall sowohl ein- als auch mehrlagig ausgebildet sein kann. Der beim Prägen entstehende dauerhafte Dickenunterschied zwischen Prägebereichen **8'** und ungeprägten Bereichen **9'** ergibt sich durch plastische Verbiegung einzelner Rippen **17**, **18**, die gegenüber undeformierten Rippen **19**, **20** eine geringere Höhe aufweisen.

Ein vorzugsweise aus Maschenware ausgebildetes Bekleidungsstück **1** besteht wenigstens teilweise aus einem elastomeren, thermisch deformierbaren Kunstfasergarn. Um das Bekleidungsstück mit gewünschten Zeichen, Kennzeichnungen u. dgl. zu versehen, sind diese in die Maschware durch Temperatur- und/oder Druckeinwirkung eingeprägt. Es werden dabei Prägebereiche **8** ausgebildet, in denen die Maschenware wesentlich dünner liegt als in der anschließenden Umgebung **9**. Die Prägebereiche **8** sind dabei im Wesentlichen glatt ohne daß hier die Fadenstruktur aufgelöst wäre. Obwohl die Maschen als solche erhalten sind, ergibt sich, beispielsweise durch partielles Anschmelzen der Oberfläche, ein glattes, im Vergleich zur Umgebung geändertes Aussehen, was eine plastische oder räumliche Wirkung des gewünschten Schriftzugs oder sonstigen Logos hervorbringt.

Patentansprüche

1. Bekleidungsstück (**1**), insbesondere Beinbekleidungsstück,
mit wenigstens einem durch ein textiles Flächengebilde (**2**) gebildeten Abschnitt, der von einem oder mehreren dauerhaft verformbaren Fäden (**11**, **12**) gebildet ist und der eine Dicke aufweist, die deutlich größer ist, als die Dicke des Fadens, **dadurch gekennzeichnet**,
daß in das textile Flächengebilde (**2**) eine Struktur eingeprägt ist, die erhabene Bereiche (**9**) sowie Prägebereiche (**8**) enthält, die zwischen den erhabenen Bereichen (**9**) angeordnet sind und die eine Dicke aufweisen, die geringer ist als die Dicke der erhabenen Bereiche (**9**).
2. Bekleidungsstück nach Anspruch 1, dadurch gekennzeichnet, daß der oder die Fäden (**11**, **12**) Kunstfasern sind, die thermoplastische Eigenschaften aufweisen.
3. Bekleidungsstück nach Anspruch 1, dadurch gekennzeichnet, daß das textile Flächengebilde (**2**) eine Maschenware, insbesondere ein Gewirk, ein Gestrick oder Raschelware ist.
4. Bekleidungsstück nach Anspruch 1, dadurch gekennzeichnet, daß der oder die das Flächengebilde (**2**) bildenden Fäden (**11**, **12**) sowohl in den erhabenen Bereichen (**9**) als auch in den Prägebereichen (**8**) beweglich gelagert sind.
5. Bekleidungsstück nach Anspruch 1, dadurch gekennzeichnet, daß der oder die das Flächengebilde (**2**) bildenden Fäden (**11**, **12**) sowohl in den erhabenen Bereichen (**9**) als auch in den Prägebereichen (**8**) untereinander unverbunden sind.
6. Bekleidungsstück nach Anspruch 1, dadurch gekennzeichnet, daß die Fadenstruktur des oder der das Flächengebilde (**2**) bildenden Fäden (**11**, **12**) sowohl in den erhabenen Bereichen (9 als auch in den Prägebereichen (**8**) erhalten ist.
7. Bekleidungsstück nach Anspruch 1, dadurch gekennzeichnet, daß der oder die Fäden (**11**, **12**) aus einheitlichem Material bestehen.
8. Bekleidungsstück nach Anspruch 1, dadurch gekennzeichnet, daß der oder die Fäden (**11**, **12**) aus unterschiedlichen Materialien bestehen.
9. Bekleidungsstück nach Anspruch 1, dadurch gekennzeichnet, daß das Flächengebilde (**2**) elastisch ist.
10. Bekleidungsstück nach Anspruch 1, dadurch gekennzeichnet, daß das Flächengebilde (**2**) mehrlagig (**13**, **14**) ausgebildet ist.
11. Bekleidungsstück nach Anspruch 1, dadurch gekennzeichnet, daß das Flächengebilde (**2**) wenigstens abschnittsweise wenigsten zwei aufeinander liegende Lagen (**13**, **14**) aufweist.
12. Bekleidungsstück nach Anspruch 11, dadurch gekennzeichnet, daß die Lagen (**13**, **14**) untereinander nicht verbunden sind.
13. Bekleidungsstück nach Anspruch 1, dadurch gekennzeichnet, daß der oder die Fäden (**11**, **12**) des Flächengebildes (**2**) in den Prägebereichen (**8**) oberflächlich angeschmolzen sind.
14. Bekleidungsstück nach Anspruch 13, dadurch ge-

kennzeichnet, daß die oberflächlich angeschmolzenen Fäden (**11**, **12**) in dem Prägebereich (**8**) eine fast glatte Oberfläche definieren, die die Maschenstruktur des Flächengebildes (**2**) kaum mehr erkennen lassen.

15. Bekleidungsstück nach Anspruch 1, dadurch gekennzeichnet, daß die Prägebereiche (**8**) Informationsträger sind.

16. Bekleidungsstück nach Anspruch 1, dadurch gekennzeichnet, daß die Prägebereiche (**8**) als Logo ausgebildet sind.

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Nummer: **DE 197 28 848 A1**
Int. Cl.[6]: **A 41 B 11/00**
Offenlegungstag: 7. Januar 1999

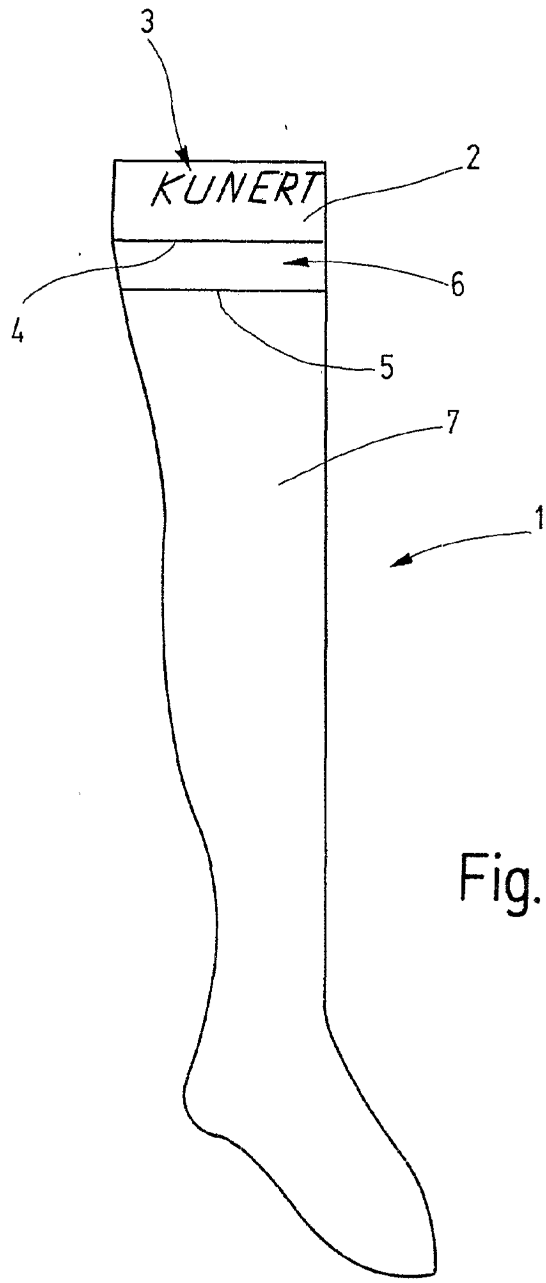

Fig. 1

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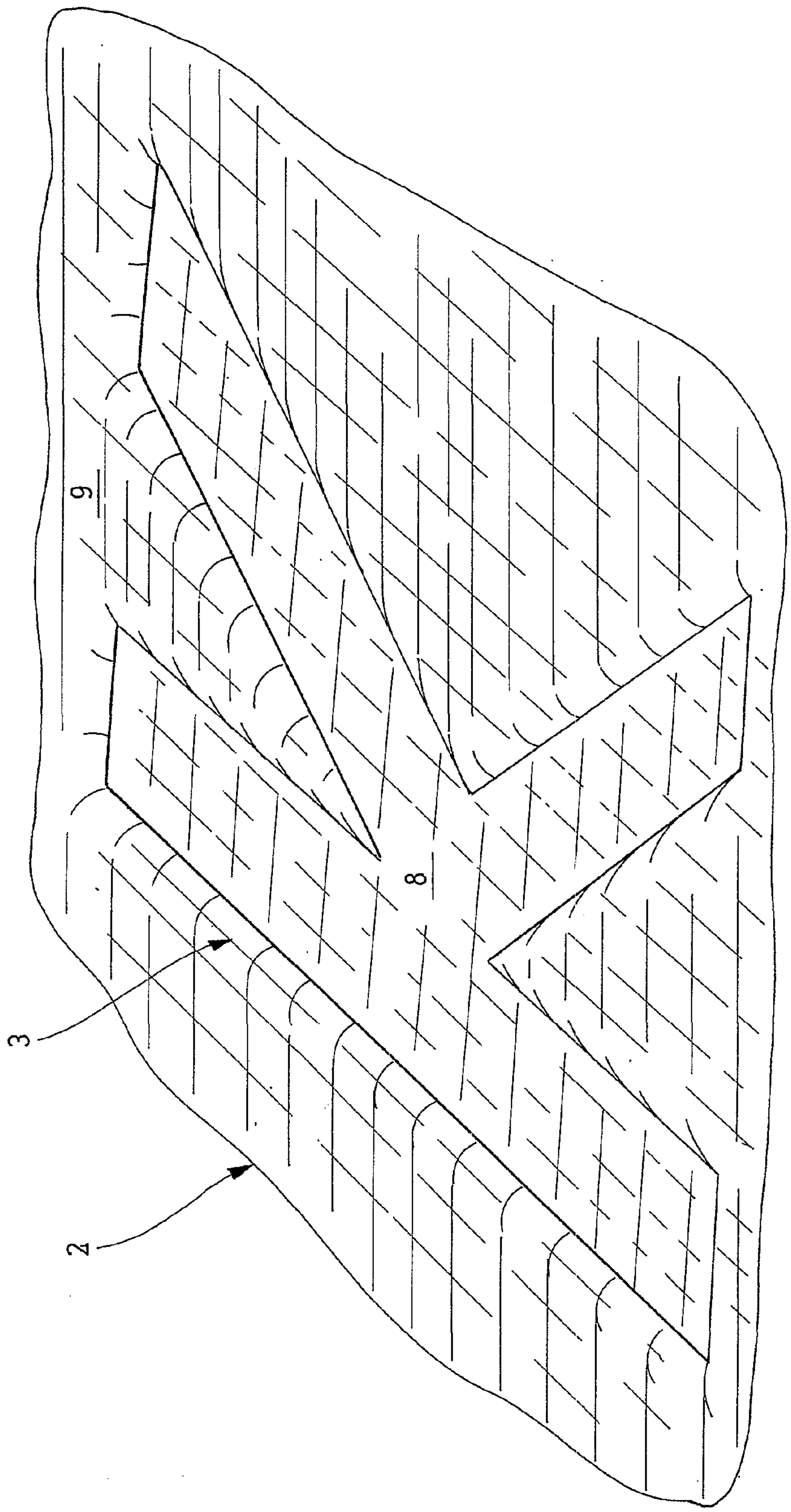

Fig. 2

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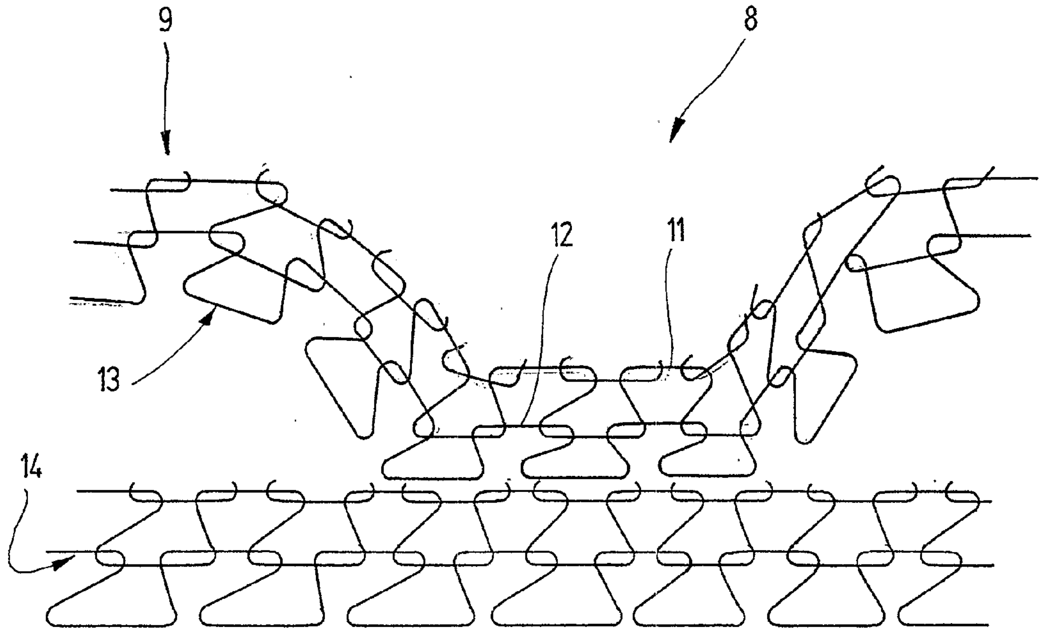

Fig. 3

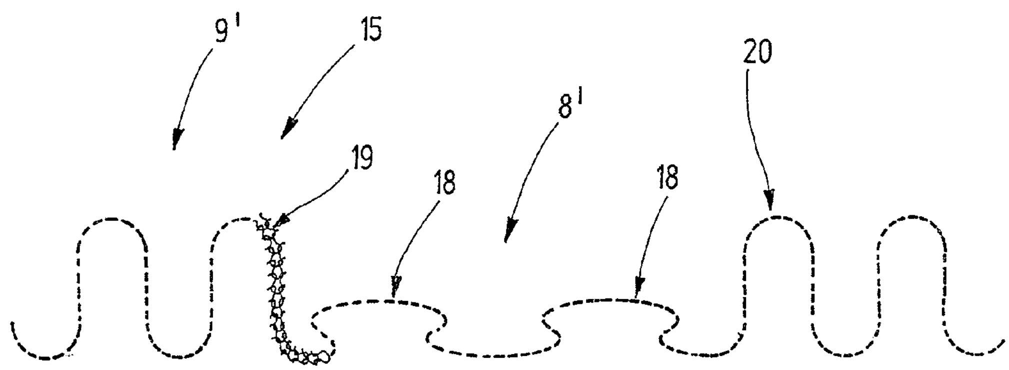

Fig. 4

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(54) PROCESS FOR PRODUCING A FABRIC HAVING OVERLAPPING STRIPS

VERFAHREN ZUR HERSTELLUNG VON STOFF MIT ÜBERLAPPENDEN LAMELLEN

PROCEDE DE PRODUCTION D'UN TISSU PRESENTANT DES BANDES LISSES RECOUVRANTES

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Description

The invention relates to a process for producing a special structure, in particular fabrics having overlapping strips providing openings between the strips.

Conventionally, when constructing fabrics, priority has often been given to fashion, including color and design, and brand names, and manufacturers have simply relied on the primary characteristics of fiber materials (such as the water absorbing ability of cotton) when producing articles having a permeability, waterproofness and other functional properties.

However, a fabric construction should have satisfactory functional properties allowing the products to act effectively in summer when the wearers, exposed to strong sunlight, tend to perspire profusely. Women, in particular, often wear clothes with long sleeves to avoid a suntan, and therefore, women's clothes are required to have particularly good properties including a high air permeability and comfort. Mesh-type fabrics are available to achieve a high air permeability, but are not widely used because the skin or underwear can be seen through them, or because the wearers may suffer from a mesh-like tan.

Recently, many types of closely-woven fabrics with a moisture permeability and water repellency have been made commercially available as materials for sportswear, rainwear and umbrellas, but these fabrics have a low air permeability (windbreak performance) and thus are regarded as completely different from the fabrics produced by the process of the invention, which have a high air permeability. Materials with a low air permeability cannot provide the comfort associated with air permeability, even though showing a good windbreak performance.

For certain applications fabrics having a special overlapping structure, in which a plurality of overlapping steps are interconnected so as to provide openings between the strips, have been used.

Fabrics having such an overlapping structure are disclosed in JP-A-57-46393. The fabrics, for rainwear, comprise many long strips of waterproof cloth cut in the direction of the weft, placed in overlapping relationship with one another and continuously stitched, intermittently adhered or intermittently fused in the direction of the warp.

GB-A-2025194 discloses a soil covering sheet, for use in growing crop plants, comprising a plurality of overlapping sheets connected together only by a plurality of tapes or strings secured to each strip and running transversely across each strip.

FR-A-867813 describes fabrics having an overlapping structure in which parallel strips of material overlap to a small extent with one another to provide a narrow elongate overlap portion between the fabrics within which the fabrics are glued together at longitudinally spaced apart regions along the overlap portion, thus leaving openings between the glued regions.

Each of the above fabrics is produced merely by laying strips of material in overlapping relationship and then permanently interconnecting them.

To the applicants' knowledge there are no fabrics available which are highly fashionable as well as having a high air permeability, together with a light screening ability and waterproofness, as these properties generally conflict with each other.

Fabrics having a high air permeability together with a light screening ability and waterproofness as described above, if made available, will be useful not only for clothing but for a wide variety of applications, in addition to clothing, in various industrial areas.

As a solution to the conventional technical problems described above, the invention provides a process for providing, in a practically useful manner, fabrics having an overlapping structure, which have a high air permeability together with a good light-screening ability and high waterproofness.

In the case of clothing, for example, the invention allows the production of fabrics suitable for producing fabrics having a special structure suitable for providing functional and fashionable clothing with characteristic features not available from conventional clothing, including the ability to prevent exposure of the skin of the wearer directly to sunlight or rain and to maintain a high air permeability preventing tanning of the skin, allowing the wearer to feel cool and comfortable in summer and yet still providing a garment having a unique and fashionable appearance.

Clothing having such an overlapping structure is suitable for outdoor wear, including sportswear such as golf wear, baseball uniforms, baseball undershirts, and tennis wear, casual articles such as T-shirts and polo shirts, and rainwear such as a raincoat.

In addition to these clothing articles, fabrics having such a structure can provide various other unique articles if good use is made of the functional characteristics obtained from their unique fabric structure.

Various unique materials made of such fabrics can provide different novel products not currently available in each relevant area, including various clothing articles other than those stated above, bedclothes, earth and sand fixing sheets, agricultural and horticultural greenhouses, footwear, perishables storage containers, beach umbrellas, tents, partitions, filtering materials, chair covers, and curtains.

Thus, the process of the invention allows the production of fabrics having the following features.

They have a special structure which consists of a large number of overlapping narrow strips which are connected to form a fabric in such a way that the overlapping portions provide openings in the direction of the width of the narrow strips.

In the process of the invention for producing fabrics with the special structure, narrow strips are placed one on top of another while displacing them so that they partially overlap each other to form an overlapping structure, and then adjacent narrow strips are connected while maintaining that structure, to thereby produce a fabric.

The articles which can be constructed from fabrics produced by a process in accordance with the invention include clothes, various clothing items other than clothes, bedclothes, earth and sand fixing sheets, agricultural and horticultural greenhouses, footwear, perishables packaging materials, beach umbrellas, tents, partitions, filtering materials, chair covers and curtains.

With such features as described above, fabrics having an overlapping structure consisting of narrow strips, as proposed herein, can provide the desirable actions and effects as described below.

(1) When used as material for clothes, they prevent the skin of the wearer from suffering from tanning or roughness, because they intercept direct sunlight.
(2) They serve to produce comfortable clothes which have a high air permeability but prevent the skin from being seen.
(3) They have a light-screening ability, waterproofness and moisture permeability together with a high air permeability.
(4) They have an uneven surface which provides a three-dimensional, dry appearance, and serve to produce clothes without a sticky touch to the skin of the wearer.
(5) When combined with other materials of different types or colors, they can have multiple functions with a very high fashionability not available from conventional fabrics.

With such a number of features as described above, fabrics produced by a process of the invention provide materials for a variety of clothing items including sportswear such as golf wear, tennis wear, baseball uniforms and baseball undershirts, rainwear such as raincoats, casual clothes such as summer sweaters, T-shirts and polo shirts, caps, hats and gloves.

In addition to these applications, they can effectively provide materials for bedclothes, earth and sand fixing sheets, agricultural and horticultural greenhouses, footwear, perishables packaging materials, beach umbrellas, tents, partitions, filtering materials, chair covers, and curtains, as described above.

Preferred embodiments of the invention will now be described in more detail with reference to the accompanying drawings in which

Fig. 1(A) shows a cross section of a fabric produced by a process of the present invention which consists of overlapping narrow strips connected to each other. The cross section schematically shows the fabric's special structure which is like a tiled roof. Fig. 1(B) illustrates a cross section of a non-connected portion of a fabric where overlapping narrow strips are separated from each other. This cross section schematically shows that many narrow strips overlap each other with appropriate gaps (openings) maintained between adjacent strips.

Fig. 2 schematically illustrates a top view of a special fabric with the overlap structure as depicted in Figs. 1(A) and (B). As seen from this top view, the narrow strips are machine sewn together in the width direction of the strips along parallel lines aligned at regular intervals.

Fig. 3 schematically shows the external appearance of a raincoat made of a fabric with a special structure which will be described later in Example 2.

Fig. 4(A) and (B) gives an oblique view of a structural example consisting of narrow strips of a few different materials and colors.

In Fig. 5 a cross section of a fabric structure which is not based on the present invention is illustrated schematically to show the difference thereof from a structure produced by a process of the invention.

Fig. 6(A), (B), (C), (D) and (E) gives cross sections of non-sewn portions of various types of fabrics with special structures consisting of narrow strips as proposed herein.

Fig. 7(A), (B) and (C) gives cross sections of non-sewn portions of other various types of fabrics with special structures consisting of narrow strips as proposed herein.

Fig. 8 illustrates an example of assembling a temporarily-fixed overlap structure as a step in a process of the invention for producing a fabric with an overlap structure.

Figs. 9-13 illustrate various articles made particularly of fabrics with a special structure produced by a process of the invention. Specifically, Figs. 9-13 show examples of bedclothes, earth and sand fixing sheet, agricultural or horticultural greenhouse, footwear, and perishables storage bag, respectively.

A fabric which may be produced by a process of this invention has a special structure which consists of a large number of narrow strips which overlap each other and are connected to form a fabric sheet in such a way that the overlapping portions provide openings in the direction of the width of the narrow strips.

Any kind of narrow strip in a sheet form with a smaller width than length can serve for the invention, and there are no specific limitations on their widths. In general, desirable materials include woven, knitted or non-woven fabric, film and plastics in the form of thin sheet with a width of 1-200 mm. Of these materials, woven, knitted and non-woven fabrics are most desirable because they can maximize the effect of the invention and can be handled easily when manufacturing products. Knitted, woven and non-woven fabrics are particularly desirable when used to produce such articles as clothes, other clothing items, bedclothes, perishables storage containers, beach umbrellas and tents.

However, the optimum width of narrow strips as described above should vary with the actual application of the fabrics produced by the process of the invention. For large-size articles such as large-type agricultural or horticultural greenhouses and large-type earth and sand fixing sheets, for example, the optimum width of the narrow strips used may be greater than the width range described above.

Also, desirable materials for narrow strips may vary with application. High-strength non-woven fabrics, film or thin plastic sheets may be desirable for such articles as agricultural or horticultural greenhouses, earth and sand fixing sheets and filter mediums.

Concerning production methods, narrow strips of woven fabric, for example, may be obtained by directly producing narrow strips with a desired width with a ribbon or tape weaving machine, or by producing a fabric with a wide fabric weaving machine followed by melt-cutting to a desired width on the weaving machine or with a melt-cutter, or by weaving soluble fiber into a fabric along parallel lines followed by treating the fabric with solution that dissolves the soluble fiber to provide narrow fabric strips with a desired width. Practically, an appropriate production method may be selected after considering the ease of the production operations and the specifications of the required narrow strips. For any type of material, including woven, knitted or non-woven fabrics, film and thin plastic sheets, proper narrow strips may be obtained either by producing large sheets and then cutting them into strips, or by directly producing narrow strips.

The desirable width range for these narrow strips is as described above. A more detailed explanation is given below concerning their application to clothes, other clothing items, bedclothes, and other small articles such as footwear and perishables storage containers. Widths smaller than 1 mm are generally undesirable because it is difficult to produce such narrow strips, and because it is usually difficult to form a fabric from such narrow strips. Widths greater than 200 mm are also generally undesirable because the resultant fabrics may not be significantly better than conventional fabrics with respect to functional and fashionable features as well as air permeability, which is the most important property of the fabrics produced by the process of the invention. Thus, widths of 2-100 mm, or 5-70 mm in particular, are desirable for these articles.

These narrow strips may have an irregular cross section with a moderately uneven or wavy surface. For example, the cross section may be either a flat rectangle or in the form-of "Λ", ">", or combinations of these shapes such as "W", or may have other bent forms such as "]", "}", "⌉", "]", "⌉", "┘", "[", "⌈" and "~". These narrow strips generally may be single-layer sheets, but also may be double-layer sheets such as tubes and double fabrics. Here, the width of a tube-like strip is defined as its diameter.

Where applied to articles used in contact with the skin, including clothes and other clothing items, narrow strips are preferably of a fiber material such as woven, knitted or non-woven fabric, because they are agreeable to the touch. Desirable fibers used as a base material for these narrow strips are synthetic fibers including polyethylene terephthalate and its copolymers (including, e.g., copolymers with isophthalic acid or 5-sodium sulfoisophthalate), polybutylene terephthalate and its copolymers, other various polyesters, polyamides such as nylon 6, 11, 12, 66 and 610 and their copolymers, acrylic polymers, polyurethane, polyethylene, ultra-high molecular weight polyethylene, polypropylene, their copolymers, and polyvinyl alcohol; regenerated cellulosic fibers including rayon and cuprammonia rayon, semi-synthetic fibers including acetate and triacetate, and natural fibers including cotton, hemp, silk and wool. These fibers may be used separately or in combination in the form of composite, combined filament yarn fabric, blended yarn fabric, twisted union yarn fabric or mixed-woven fabric.

Of these, narrow strips of composite yarn of polyester fiber and polyamide fiber, those of composite yarn of high shrinkage polyester-isophthalic acid copolymer fiber combined with other types of fibers such as low shrinkage fibers, and those of water-sensitive fibers made by spinning of low-saponification value polyvinyl alcohol are particularly desirable because they can shrink during processing to form a bulky fabric, leading to favorable bulky, dry-touch textures. As a result, the fabric will not cling to the skin and has a large porosity. Also, the fabric will have a higher air permeability and will be agreeable to the touch, making it possible to produce very comfortable clothes. Another way of obtaining bulky fabrics is to form narrow strips using bulky yarns such as woolen yarns produced from single multifilaments.

A fabric with an "overlap structure" of narrow strips as proposed herein consists of many narrow strips overlapping each other like a tiled roof. Its cross section is like that of a mino (straw raincoat).

Unique effects and functional features resulting from such a structure are explained below with reference to the drawings.

Figure 1(A) shows a cross section of sewn narrow strips that constitute a fabric with a special overlap structure which can be produced by a process of the invention, and schematically illustrates narrow strips S_1, S_2, S_3, S_4, S_5, S_6 and S_7 overlapping each other to form a structure like a tiled roof or a mino. Fig. 1(B) shows a cross section of a non-sewn portion of narrow strips that constitute a fabric with a special overlap structure, and further schematically illustrates narrow strips S_1, S_2, S_3, S_4, S_5, S_6 and S_7 overlapping each other with proper gaps therebetween.

As seen from these drawings, a fabric which can be produced by a process of the invention consists of many (more than one) narrow strips which overlap each other while maintaining an opening in the width direction of the narrow strips.

With this special structure, suchafabric, when exposed to rain for example, prevents an ingress of rain drops (arrow b) while allowing air to flow therein (arrow c), leading to a high water repellence and high air permeability. Arrow a in Fig. 1(A) and (B) shows the "downward" direction.

Compared to this, Fig. 5 schematically shows a cross section of a fabric structure which is not produced by a process of the present invention. The overlap structure given in Fig. 5, in which many narrow strips S_1, S_2, S_3, ... overlapping each other are bonded to base sheet B, has no openings in the width direction in the overlap portion of the narrow strips. Such a structure cannot increase the air permeability as indicated by arrow c in Fig. 1(B), even though it serves to repel raindrops as indicated by arrow b, and thus it cannot achieve a high air permeability together with a light-screening ability and waterproofness as intended in the present invention. In this example, a high air permeability could not be achieved even if an air permeable fabric is used as the base sheet B. In any case, a structure comprising a base sheet is obviously different from the fabrics of the invention with respect to expected effects.

Figure 2 schematically shows, as an example, a top view of a special fabric with an overlap structure as given in Fig. 1(A) and (B). The fabric in Fig. 2 consists of narrow strips sewn downward in the width direction thereof, and these strips are sewn with a machine along dashed lines 1, 2, 3 and 4. The cross section indicated by d-d along one of the sewing lines in Fig. 2 corresponds to that shown in Fig. 1(A), and the cross section e-e, which is spared from the sewing lines, corresponds to that given in Fig. 1 (B).

The narrow strips of a fabric having a special structure produced by a process of the invention may overlap each other either regularly or irregularly with varying overlapping widths, as long as a proper overlapped structure is maintained.

Figures 6 and 7 illustrate a cross section of a non-sewn portion of narrow strips contained in some variations of the basic fabric S produced by a process of the invention. Fig. 6(A), (B) and (C) shows an example in which narrow strips with a "Λ"-shaped cross section and the narrow strips in Fig. 6(D) and (E), although in a flat form, overlap each other irregularly, unlike the case shown in Fig. 1. Two adjacent strips form a repeating overlap pattern in Fig. 6(D), but a repeating pattern consists of three strips in Fig. 6(E). The examples in Fig. 7 (A), (B) and (C) show two layers (inside layer and outside layer), each of which has an overlap structure consisting of narrow strips.

Various process embodiments are available for producing fabrics with an overlap structure consisting of many narrow strips. The most practical way may be to put narrow strips one on top of another while slightly shifting their positions to form an overlap structure, followed by connecting them temporarily by adhesive while maintaining the overlap structure.

More specifically, narrow strips impregnated with a water-soluble adhesive (such as an adhesive based on polyvinyl alcohol or acrylic resin) may be put one on top of another on a tube or other appropriate supporting roll with a surface coated with, for instance, fluoroplastics such as polytetrafluoroethylene while rotating the tube so that the strips are put one on top of another with a slight misalignment therebetween, followed by drying and cutting along the axis of the tube to provide a sheet with an overlap structure consisting of temporarily bonded narrow strips. A fabric sheet consisting of temporarily bonded strips thus obtained is then sewn in the "downward" direction, in which the strips will not be turned up during the sewing operation, along lines at required intervals, in order to fix the narrow strips with regular shifts or irregular shift maintained therebetween. Then, the fabric sheet is immersed in heated water to dissolve and remove the water-soluble adhesive used for the temporary bonding, to form a fabric with an overlap structure produced by a process of the present invention.

This is explained in more detail below with reference to the drawings. Figure 8 illustrates a process that effectively produces a sheet consisting of temporarily bonded narrow strips. In the Fig. 8, a guide 12 moving at a constant speed and tension rolls 13 and 14 are provided near a cylinder 11, which rotates at a constant speed, and narrow strips 16 wound on a collared bobbin 15 are supplied through rolls 13 and 14 and guide 12, so that the narrow strips 16 are wound up on the constantly rotating cylinder 11 with a desired overlap therebetween.

In Fig. 8, a temporary bonding adhesive tank 18 and squeezing roll 17 are provided so that narrow strips impregnated with the temporary bonding adhesive form an overlap structure on the cylinder, followed by drying the temporary bonding adhesive in hot air supplied though hot water outlet 19 to ensure a temporary fixing. Thus, a temporary fixing is achieved during and/or after the winding of the narrow strips on the cylinder.

In view of the expected effects and workability, a water-soluble adhesive such as one based on polyvinyl alcohol or acrylic resin may be most desirable for the temporary fixing. An aqueous solution prepared by diluting the adhesive to an appropriate concentration may be applied to the narrow strips during and/or after the winding of the narrow strips on the cylinder, followed by drying. This may be performed while separating the strips from the cylinder. The application may be carried out by impregnation or an appropriate spreading process such as spraying, padding or brushing. A suitable process may be selected after considering its workability or other features. The narrow strips which are temporarily fixed by, for instance, exposure to normal temperature air or hot air after the application of the water-soluble adhesive are then cut or melt-cut in the transverse direction and removed from the roll to provide a fabric sheet with an overlap structure consisting of temporarily fixed narrow strips.

Next, the temporarily bonded narrow strips in the fabric with an overlap structure are connected together.

There are no specific requirements for the connecting method to be used. The use of a sewing machine is generally desirable because of its high availability. For instance, it is desirable to sew the narrow strips in their width direction along parallel lines aligned at appropriate intervals to combine the strips. In this case, the strips should preferably be sewn "downward", or in such a direction that the strips will not be turned up during sewing. There are no specific requirements for the intervals between sewing lines, and an appropriate interval may be selected depending on the use and purpose of the fabric. Also, there are no specific requirements for the sewing pattern, and appropriate pattern such as a linear, checked, checkered or cross-stitched pattern may be selected depending on the use and purpose of the fabric. Sewing may be carried out by a general-use sewing machine with one needle or by a multiple-needle sewing machine, suchasa kitting machine, that can sew along several lines simultaneously.

Another way of combining the narrow strips is the use of a high-frequency or supersonic sewing machine.

The use of a sewing machine is not the only way available for combining the narrow strips, but it may also be effective to use an adhesive for bonding them together. The use of a sewing machine, however, is desirable in most practical cases because it can combine them in the downward direction of the overlap structure, which serves to minimize the number of wrinkles and is easy to perform.

Also, they may be combined by continuous or discontinuous fusion bonding with thermoplastic fiber. A fusion bonding method using vibrational energy caused by supersonic wave may be useful in most cases.

Where narrow strips are combined by sewing into a fabric, a tape for reinforcement may be put on the sewing line, followed by sewing of the narrow strips together with the reinforcing tape. Furthermore, it may also be desirable to perform ironing and/or heat-pressing in the downward direction of the overlap structure after forming a fabric to further reinforce the overlap structure.

A fabric obtained by such processes as described above is then subjected to another process to remove the temporary bonding. When a water-soluble adhesive is used for temporary bonding, the water-soluble adhesive used for the temporary bonding is removed by immersing the fabric in hot water to dissolve the adhesive. In this case, appropriate agents such as desizing agents, antistatic agents and softening agents, may be used. After adequate desizing for complete removal of the temporary adhesive, the narrow strips are dried in air or hot air to form a fabric with such a structure as shown in Fig. 1(A) or (B).

The process for removing the temporary bonding of narrow strips overlapping each other may be performed after producing secondary products from the fabric sheet consisting of temporarily bonded narrow strips. For instance, secondary products such as clothes or other clothing items may be produced from fabric sheets consisting of narrow strips combined in a temporarily-bonded state, followed by treatment of the products in a process for dissolution and removal of the water-soluble adhesives. Such a procedure, in which temporary bonding is removed after the production of secondary products, may be more desirable in most practical cases because of the ease of operations for producing the secondary products.

It also may be desirable to subject a fabric produced by a process of the present invention to a water repellency treatment depending on the use of the fabric. Water repellency treatment can be easily carried out by applying an appropriate agent, such as silicone- or fluorine-based one, by means of spraying, padding, immersion or coating. In particular, padding is most desirable because it can apply a water repellency agent uniformly and also because its application in the downward direction of the overlap structure, as in the case of sewing as stated above, can be effective for preventing the formation of wrinkles. Thus, the padding process may be the best due to these advantages.

In producing such various secondary products as stated above from fabrics with an overlap structure consisting of narrow strips as proposed herein, such fabrics may be used solely or together with other fabric materials.

Such other fabric materials should preferably be appropriate general-use plain fabrics. In case of such secondary products as clothes and other clothing items, it may be desirable that an appropriate plain fabric be used at portions that are frequently subjected to strong bending motion while a fabric of the invention be used at flat portions that are free of strong bending motion. In rainwear, for instance, conventional waterproof material may be used at such portions as shoulders, knees and elbows, while using a fabric with an overlap structure the invention at other flat portions in order to maximize the effect of the fabric of the invention.

Figure 3, for example, schematically illustrates the appearance of a raincoat of a fabric with an overlap structure produced by sewing as described later in Example 2. Plain waterproof sheets made of high-density fabric 5 are used at flexible portions such as the collar, shoulders and elbows while fabric with an overlap structure 6 is used at other flat portions. This examples shows how both the characteristics of a fabric with an overlap structure and those of another material can be effectively exploited.

Where a raincoat is produced solely from a fabric with an overlap structure, combined-woven fiber with a low melting point may be used as material for narrow strips, and the fabric used at flexible portions such as collar, shoulders and elbows as stated above is heat-treated to melt and join the low melting point components so that the waterproofness is improved due to blinding, joining and increased density.

Where fabrics with an overlap structure are used for the production of such secondary products as clothes and other clothing items, it may be practical to use the fabric in such a way that the downward direction of the overlap structure is virtually consistent with the downward direction of the secondary products. Note, their use is not limited to such a direction, and they may be used in any other arrangement depending on such factors as fashion and appearance.

As described above, the fabrics produced by a process of the invention have an overlap structure consisting of narrow strips which can shade direct sunlight and ensure high air permeability. Furthermore, the process can impart to the fabrics other desired properties such as water repellency, oil repellency and moisture permeability by performing appropriate treatment steps. They also can have many other good features including dry, rough surface textures and unique appearance and may be fashionable and therefore can be useful for a variety of applications including sportswear such as golf wear, tennis wear, baseball uniforms and baseball undershirts; rainwear such as raincoats; casual clothes such as summer sweaters, T-shirts and polo shirts; and other articles such as caps, hats and gloves.

The fabric and secondary products, including clothes and other clothing items, with an overlap structure may be of reversible type. Thus, such fabrics can provide very unique material and products including clothes and- other clothing items having two useful sides.

Where narrow strips having two sides each of which are made of different materials, such as material 7 mainly for one side of the strips and material 8 mainly for the other side in Fig. 4(A), it will be easy to produce clothes having an outer surface and an inner surface each of which have a different characteristic from each other. Such narrow strips may be produced easily from, for instance, a double-woven fabric. In a typical case, such as fiber as cotton may be used as material for the inside surface thereof (in contact with the skin) and a water repellent material such as polyester may be used for the outside surface thereof. In another example, the fiber used in the outside surface of the narrow strips may be different from that used in their inside surface with respect to shrinkability and other properties. In such a case, the narrow strips may have a bent structure such that large openings may be formed between the strips so that the resultant fabric can have a high air permeability.

Where each narrow strip consists of two narrower strips made of different materials each arranged in a side by side structure in a widthwise direction, as shown in Fig. 4(B), material 9 used for the upper half thereof and forming the inside surface of the resultant fabric, may be cotton fiber while material 10 used for the lower half thereof may be water-repellent polyester fiber. In this case, a synergetic effect due to two different properties, i.e., sophisticated touch and water repellency, can be achieved very effectively. Where a narrow strip consists of two narrower strips of different materials as described above, the boundary between the two materials may not be consistent with the middle line, but the boundary line may be at any desirable position in the width direction.

To produce a fabric with an overlap structure particularly high in bulkiness and air permeability, narrow strips of polyurethane fiber may be temporarily combined under an appropriate tension followed by sewing of the strips and removal of the temporary bonding to form a fabric with an overlap structure. In such a fabric, the narrow strips will have a wavy form, resulting in large gaps between them. Another good way of obtaining large gaps is by placing narrow strips of polyurethane fiber and those of other fiber one on top of another alternatingly while applying a tension to the polyurethane fiber strips followed by the formation of a fabric and removal of the temporary bonding so that the two types of strips have different wavy shapes.

A fabric with large gaps may also be produced effectively by combining narrow strips of high shrinkable fiber and those of low-shrinkage fiber appropriately, followed by heat treatment. Large gaps may be formed due to the difference in the degree of shrinkage between the two types of strips.

Highly fashionable, colorful fabrics or secondary products, including clothes and other clothing items, may be obtained by using a fabric having an overlap structure consisting of narrow strips of different colors or having an overlap structure consisting of narrow strips which have two sides with different colors and or which have different colored portions formed in the widthwise direction as illustrated in Fig. 4(A) and (B).

Furthermore, a fabric with novel functional and colorful features that are not available in conventional fabrics may be produced by combining several types of narrow strips which are different in color, material and other properties.

Where a fabric with an overlap structure is used to form clothes or other clothing items, the number of narrow strips used in a piece of clothes or a clothing item is preferably in the range of 2 (incl.) to 1500 (incl.), more desirably in the range of 2 (incl.) to 1000 (incl.), and still more desirably in the range of 5 (incl.) to 700 (incl.). Several narrow strips, up to 30 or so, are preferably present in every 10 cm length of fabric.

The use of too many narrow strips is not desirable because it may lead to problems such as a lower fabric strength, lower number of effective gaps for ventilation due to an increased number of strips per unit length of the resultant fabric, and increased weight of the fabric.

There are no specific requirements for the size of each narrow strip, but those with a surface area of 1.1 mm^2 - 8×10^4 mm^2 are generally desirable for small articles including clothes and other clothing items. It is generally difficult to produce a desired overlap structure from narrow strips with a surface area of less than 1.1 mm^2, but a fabric consisting of narrow strips larger than 8×10^4 mm^2 will lose its good features and has fewer significant differences from conventional plain fabrics, though the desirable strip size varies with the application of the resultant fabric.

The fabrics with an overlap structure can be applied to a wide variety of articles, as described below.

Firstly, completely novel bedclothes with a high air permeation for good ventilation, together with a favorable heat insulation and which are fashionable, can be produced from a fabric with an overlap structure.

More specifically, novel bedclothes, including blanket and bed sheet fabric and side cloth for futon (Japanese quilt), pajamas, nightdresses, nightgowns, bathrobes, and pillowcases, particularly for summer use can be produced.

For such articles as bed sheets, pajamas and towel-cloth blankets, in particular, it is desirable to use narrow strips of cotton towel cloth because comfortable products with an agreeable touch can be produced. Where an article made solely of such towel cloth strips may have some problems, including a lack of effective gaps and excessive flexibility causing the fabric to cling to the skin, it may be desirable that appropriate narrow strips of, for instance, woven, knitted or non-woven fabric more firmly formed with a stronger nerve than the towel-cloth strips be used in combination with the towel-cloth strips in an alternating arrangement in a checked pattern or in other appropriate ways.

Furthermore, bedclothes with multiple functions can be produced by using several types of narrow strips of different materials in combination. For instance, bedclothes with an agreeable dry touch and good water absorbing ability can be produced by combining narrow strips made of polyester thread with those of cotton.

The bedclothes of the invention are produced by cutting and sewing a fabric with a special structure as described above. These bedclothes can be produced easily and in particular, those for summer use can ensure coolness and comfortability. Figure 9 schematically illustrates a towel-cloth blanket made of fabric S with an overlap structure.

Secondly, a novel soil and sand fixing sheet that has high water permeability and effectively hold soil and sand can be produced from a fabric with an overlap structure.

More specifically, it is possible to produce a soil and sand fixing sheet with a special structure that prevents soil and sand from flowing out therethrough, and serves to discharge soil water and rain water from the ground, while leaving an appropriate moisture in the ground.

Such soil and sand fixing sheets include drainage materials for building and engineering works for the construction of retaining walls, tunnels, roads, culverts, golf links, water supply/drain channels, slopes and weak ground treatment, other drainage materials such as for coal accumulation sites, and soil water removal sheets for flower pots.

Figure 10 schematically explains how a soil and sand fixing sheet of a fabric with an overlap structure can serve to hold soil and sand while retaining a high water permeability. Soil and sand layer 23 is supported by soil and sand fixing sheet 22, which comprises a fabric S with an overlap structure.

With such a unique structure, the soil and sand fixing sheet of such a fabric schematically shown in Fig. 10 maintains narrow gaps between the narrow strips, which provide channels for water drainage as indicated by arrows, while retaining particles in the ground layer, including soil and sand, which are greater than a certain size. In addition, with the multiple layer structure consisting of narrow strips, the sheet can work as a filter free of clogging. Thus, soil and sand fixing sheet 22 prevents soil and sand from flowing out while maintaining good performance for drainage and water permeation.

Based on this mechanism, fabrics with an overlap structure can serve as a filter for various applications.

Thirdly, fabrics with an overlap structure can be useful in producing novel agricultural or horticultural greenhouses which provide good ventilation and shade and are highly suitable for the cultivation of certain agricultural or horticultural plants.

No agricultural or horticultural greenhouses are available which are suitable for the cultivation of, for example, seedlings of such widely known foliage plants as benjamin tree, yucca, dracaena tree and concinna, which grow well in a well-ventilated, well-shaded environment free of direct sunlight. In general, conventional greenhouse materials with a good light screening ability have a low air permeability, and vice versa.

Unlike these, the fabrics with an overlap structure can serve to produce an agricultural or horticultural greenhouse which provide an effective shade while maintaining a good ventilation.

The agricultural and horticultural greenhouses of the invention are described in detail below.

The agricultural and horticultural greenhouses as proposed herein include covers, tents and greenhouses for protection and cultivation of seedlings of rice and vegetables for agricultural production; covers, tents and greenhouses for protection and cultivation of seedlings of other plants including foliage plants, flowers, garden trees and fruit trees; and other types and sizes of greenhouses.

Figure 11 schematically illustrates an example of greenhouse for seedlings of foliage plants and flowers as proposed herein. In Fig. 11, fabrics with a special structure of the invention are used as exterior materials including roofing for greenhouse 24.

For these agricultural and horticultural greenhouses in particular, the use of a combination of various narrow strips of different materials and colors will permit the construction of completely novel agricultural and horticultural greenhouses which have light-screening ability together with good ventilation and also has beautiful and fashionable appearance with various colors. By making use of such color features, it will also be easy to construct greenhouses which have different colors for identification of the plants cultivated in them.

If narrow strips of an appropriate size and of an appropriate color or appropriate different colors are used at appropriate portions, greenhouses useful under various conditions can be produced, including those which absorb light efficiently to maintain a high temperature while keeping good ventilation, or which reflect light considerably to prevent the inside temperature from rising excessively. Greenhouses that provide various basic inside environments can be constructed by using a combination of narrow strips of appropriate sizes and appropriate different colors, for instance black, white, gray or transparent, at appropriate portions.

Fourthly, fabrics with an overlap structure are useful to produce functional, fashionable and comfortable footwear which has novel, fashionable appearance together with good waterproofness and high air permeability to permit the wearer to feel cool and dry especially in summer.

The footwear as proposed herein includes sports shoes, boots, slippers, sandals and other indoor footwear as well as various shoes for daily use.

Figure 12 schematically illustrates a cross section of shoe 25 comprising fabric S of the invention. Narrow strips with a hook-like cross section are used in this example.

For footwear of a fabric with an overlap structure, it may be practical to use a fabric produced by a process of the invention in such a way that the downward direction of the overlap structure virtually coincides with that of the footwear. However, there are no specific requirements for the use direction of the structure. Narrow strips may be used in any desired direction depending on the desired fashionable features and appearance.

Footwear of novel design an high fashionability that was not available in the past can be produced by using a combination of a large number of narrow strips which are different in color, hue and shade.

Furthermore, footwear with multiple functions can be produced by using a combination of narrow strips of different materials. For instance, footwear with many good properties including waterproofness, water absorption and air permeability can be produced by using double-woven fabric strips in which the inside layer to come in contact with the body is made of cotton while the other layer to be exposed to rain is coated with synthetic polymer film containing fine pores.

Fifthly, fabrics with an overlap structure serve to produce novel perishables storage containers that provide an environment which is well screened from sunlight, well ventilated and therefore suitable for the transportation and storage of perishables.

Conventional flexible containers, for instance, have been generally used for the transportation of powder and particle materials including livestock feed, but not for perishables including grain, vegetables, fruits, fish, shellfish and flowers because no materials have been available which can provide an environment suitable for their transportation. Fabrics with a special structure of the invention, however, serve to produce novel perishables containers which can provide an environment suitable for the transportation and storage of these perishables.

The perishables storage containers as proposed herein include all boxes, bags and tubes designed to contain perishables including perishable plants as well as perishable foods such as grain, vegetables, fruits, fish, shellfish and flowers in order to transport them by land, sea or air or to preserve or store them.

Figure 13 schematically illustrates an example of a tube-like bag for transportation which is made of a perishables storage material with an overlap structure. The side wall of storage bag 26 is made of fabric with an overlap structure S.

Such perishables storage containers have good functions and effects as described below.

(1) The fabrics serve to produce perishables transporting containers which prevent the contents from being exposed to direct sunlight and maintain good ventilation. Thus, these containers are highly suitable for the storage and transportation of vegetables and other foods which require good ventilation and shade.

(2) They serve for easy production of containers which have high waterproofness, light-screening ability and moisture permeability as well as high air permeability and therefore, they are highly suitable for the transportation of perishables.

(3) The use of a combination of various narrow strips of different materials and colors permits the production of novel containers for the transportation, preservation or storage of perishables with colorful and fashionable appearance.

With such a colorful feature, these fabrics serve for easy production of containers of different colors for easy identification of the contents such as vegetables and fruits.

(4) If narrow strips of an appropriate size and of an appropriate color or appropriate different colors are used at appropriate portions, it is possible to produce containers which maintain good ventilation while absorbing light efficiently to keep a high temperature or which reflect light considerably to prevent the inside temperature from rising excessively.

If a proper combination of various narrow strips of an appropriate size and appropriate different colors, for instance black, white, gray and/or transparent, is used at appropriate portions, it is basically possible to produce containers which provide any desired inside environment.

In addition to these, fabrics with an overlap structure can be applied to a wide variety of products including curtains, partitions and chair covering materials as well as beach umbrellas and tents with high air permeability to ensure coolness and comfortability.

Some examples are given below to further illustrate processes embodying the present invention.

Example 1

Narrow fabric strips 36 mm wide were woven with a ribbon weaving machine using 30-denier (D), 12-filament polyester yarn as warp and weft. The yarn density of the strips was 80 warp threads and 26 weft threads per centimeter.

The narrow strips were immersed in a water-soluble polyvinyl alcohol adhesive and then wound up on a cylindrical roll coated with fluoropolymer while rotating the roll at 1 m/min and shifting each strip by a required distance so that the width of the overlap between them would be 18 mm. The sheet thus obtained was then dried and cut in the direction of the axis of the roll to provide fabric in which the narrow strips were temporarily fixed with the above-mentioned water-soluble adhesive.

Then, the fabric sheet was sewn with a plurality of sewing yarns utilizing a conventional sewing machine in the width direction of the narrow strips and in the downward direction of the fabric (so that the narrow strips would not be turned up) by a plurality of sewing lines parallel to each other with a regular space of 43 mm interposed therebetween, followed by immersion in hot water of 80°C to dissolve and remove the water-soluble adhesive.

Thus, a fabric sheet with an overlap structure of the invention which had a width of 36 mm, overlap width of 18 mm and sewing line interval of 43 mm was obtained.

A piece of golf wear was produced from the fabric by sewing. Though it was sultry and the sunlight was strong on the day of testing, it was revealed that the fabric screened the skin from the sunlight effectively and had a high air permeability, and further, had a suitable handling touch and was very comfortable, demonstrating that the fabric was very suitable as material for golf wear.

Example 2

Narrow fabric strips 10 mm wide were woven with a ribbon weaving machine using, as warp and weft, mixed-yarns produced by combining conventional type polyester filament yarns (30D, 12F, shrinkage rate in boiling water 7%) and isophthalate- copolymerized polyester filament yarns (30D, 12F, shrinkage rate in boiling water 15%) and interlaced with each other by utilizing a air jet nozzle. The yarn density thereof was 56 warp threads and 20 weft threads per centimeter.

The strips were connected to each other temporarily with a water-soluble adhesive and sewn with a sewing machine in the width direction of the strips to form a fabric sheet by the same method as in Example 1. They were sewn with a plurality of sewing lines arranged in parallel to each other with an interval of 5 mm interposed therebetween.

Then, a high-pressure paddle dyeing apparatus was used to immerse the sheet in boiling water to dissolve and remove the water-soluble adhesive while allowing a difference in shrinkage rate to develop, followed by dyeing the sheet deep brown with a disperse dye by a conventional dyeing process. The dyed and dried fabric sheet was then subjected to treatment for water and oil repellency. The water and oil repellent agent used was Asahi Guard AG-710 Emulsion (supplied by Asahi Glass Co., Ltd.) in the form of 6% aqueous solution. It was used with 0.1% Sumitex Accelerator Acx (supplied by Sumitomo Chemical Co., Ltd.) as catalyst. The solution for water and oil repellent treatment was applied to the fabric in the downward direction by light padding, followed by drying at 100°C and heat treatment at 180°C for 30 seconds to provide the final fabric product.

The fabric was then used to produce a raincoat as schematically illustrated in Fig. 3 and the raincoat was subjected to a test. High-density waterproof plain fabric coated with a water repellent agent was used as material for the collar, shoulders and elbows.

It was demonstrated that the raincoat had good features including high air permeability, waterproofness, moistureproofness and was fashionable with an attractive surface, which features are not available in conventional commercial rain coats.

Example 3

Narrow strips of polyester yarn as described in Example 1 and those of Nylon 6 yarns that had the same dimensions as the former were attached alternatingly to a plate made of fluorine-contained polymer with an overlap width of 15 mm using the same water-soluble adhesive as used in Example 1.

After drying, they were sewn together by the same procedure as in Example 1 with sewing line intervals of 20 mm. Then, a paddle dyeing apparatus was employed to performa hot water treatment at 80°C for dissolution and removal of the water-soluble adhesive and to dye the Nylon 6 strips yellow with an acid dye at 100°C, followed by drying.

A summer sweater was produced by sewing the fabric and worn for testing. Because of the overlap structure, the skin was not seen through the fabric, so it can be worn directly next to the skin. The fabric appeared moderately bulky and dry because of the difference in processing characteristics between the polyester and polyamide fiber. It had a suitable handling touch and high air permeability with a good tanning control ability. Furthermore, it had good properties and was fashionable, with a striped appearance with a combination of the yellow and natural color or off-white of the polyester.

Example 4

Narrow towel-cloth strips 7 mm wide were woven using cotton threads as warp and weft.

The strips were immersed in a water-soluble polyvinyl alcohol adhesive and then wound up on a fluoropolymer-coated cylindrical roll rotating at such a speed as to produce fabric with a required width and with an overlap width of 3 mm.

A sheet thus obtained was dried and cut in the direction of the axis of the roll to obtain fabric consisting of narrow strips temporarily fixed with the above-mentioned water-soluble adhesive.

The sheet was sewn with a conventional sewing machine along lines aligned at intervals of 20 mm in the "downward" direction so that the strips could not be turned up to provide multi-layer fabric with an overlap structure.

The fabric was the used to produce a towel-cloth blanket for summer use as illustrated in Fig. 9. The blanket is fringed with conventional polyester fabric, which serves also for reinforcement. It was then immersed in hot water at 80°C to dissolve and remove the water-soluble adhesive.

Thus, a towel-cloth blanket was obtained in which 7 mm-width strips forming an overlap structure with a overlap width of 3 mm as illustrated in Fig. 1 were sewn together along parallel lines aligned at intervals of 20 mm. Although it was very sultry on the night of the test and one would have been unable to sleep well under a conventional blanket, the towel-cloth blanket, with moderate heat insulation and dry surface texture together with a high air-permeability and moisture permeability, was found to be very comfortable and highly suitable for summer use.

Example 5

Narrow fabric strips 20 mm wide were produced with a tape weaving machine using 500-denier, 36-filament polyester yarn and 250-denier, 48-filament polyester yarn as warp and weft, respectively.

The strips were immersed in a water-soluble polyvinyl alcohol adhesive and then wound up on a cylindrical roll coated with fluorine contained polymer rotating at such a speed as to produce a sheet with a required width and with an overlap width of 7 mm. A sheet thus obtained was dried and cut in the direction of the axis of the roll to obtain fabric consisting of narrow strips temporarily fixed with the above-mentioned water-soluble adhesive.

The temporarily fixed sheet was double-sewn with an industrial sewing machine along parallel lines aligned at intervals of 20 mm in the "downward" direction so that the strips would not be turned up, in order to provide multi-layer fabric with an overlap structure as illustrated in Fig. 1(A) and (B). The fabric was then immersed in hot water at 80°C to dissolve and remove the above-mentioned adhesive.

Thus, a sheet was obtained in which 20 mm-width strips forming an overlap structure with a overlap width of 7 mm as illustrated in Fig. 10 were sewn together along parallel lines aligned at intervals of 20 mm.

The sheet was compared with coarse-pitch needle-punched non-woven fabric which had been used conventionally for retention of soil and sand.

These two fabric sheets were subjected to a test. Weak soil and sand containing much water was put on each sheet under the same conditions to determine their water discharge ability. It was shown that the soil and sand fixing sheet produced by the process of the present invention discharged water without allowing the soil and sand to flow away but leaving an appropriate moisture, while the conventional needle-punched non-woven sheet allowed large amounts of soil, sand an water to flow away with some holes clogged, indicating that the latter was failed to work well.

Example 6

Narrow fabric strips 25 mm wide were produced with a tape weaving machine using 50-denier, 24-filament nylon yarn and 100-denier, 48-filament nylon yarn as warp and weft, respectively.

The strips were immersed in a water-soluble polyvinyl alcohol adhesive and then wound up on a fluoropolymer-coated cylindrical roll rotating at such a speed as to produce a sheet with a required width and with an overlap width of 4 mm. A sheet thus obtained was dried and cut in the direction of the axis of the roll to obtain fabric consisting of narrow strips temporarily fixed with the above-mentioned water-soluble adhesive.

The sheet was sewn with a conventional sewing machine along parallel lines aligned at intervals of 20 mm in the "downward" direction so that the strips would not be turned up, in order to provide multi-layer fabric with an overlap structure.

The fabric was then immersed in hot water at 80°C and then washed in water to dissolve and remove the above-mentioned adhesive. The fabric thus obtained was dried to provide a sheet in which 25 mm-width strips forming an overlap structure with an overlap width of 4 mm as illustrated in Fig. 1(A) and (B) were sewn together along parallel lines aligned at intervals of 20 mm.

The sheet was then used to construct a horticultural greenhouse as schematically illustrated in Fig. 11, and foliage plants were cultivated in it. It was revealed that the greenhouse was able to provide a well-shaded, well-ventilated environment highly suitable for the cultivation of foliage plants. The plants grew rapidly without withering.

Example 7

Narrow fabric strips 12 mm wide were produced with a tape weaving machine using 50-denier, 24-filament nylon yarn and 100-denier, 48-filament nylon yarn as warp and weft, respectively.

The strips were immersed in a water-soluble polyvinyl alcohol adhesive and then wound up on a fluoropolymer-coated cylindrical roll rotating at such a speed as to produce a sheet with a required width and with an overlap width of 6 mm.

A sheet thus obtained was dried and cut in the direction of the axis of the roll to obtain fabric consisting of narrow strips temporarily fixed with the above-mentioned water-soluble adhesive.

The fabric sheet was sewn with a conventional sewing machine along parallel lines aligned at regular intervals of 20 mm in the "downward" direction so that the strips would not be turned up.

The fabric was then immersed in hot water at 80°C to dissolve the above-mentioned adhesive. The fabric thus obtained was dried and treated for water and oil repellency.

The water and oil repellent agent used was Asahi Guard AG-710 (Asahi Glass Co., Ltd.) in the form of 5% solution. The fabric was introduced into the solution in a downward direction of the multi-layer structure and wrung lightly in a mangle, followed by drying at 90°C for 5 minutes and curing at 150°C for 3 minutes to provide a fabric sheet with a special overlap structure produced by the process of the invention as shown in Fig. 1(A) and (B) which consists of 12 mm-width narrow strips forming overlaps with an overlap width of 6 mm and sewn together along parallel lines aligned at intervals of 15 mm.

The sheet was then used to produce low shoes for summer use as illustrated in Fig. 12. They were fringed with conventional synthetic leather, which served also for reinforcement.

The shoes were put on for testing. Though it was very sultry and conventional shoes would have been very stuffy on the day of test, it was demonstrated that the low shoes with an overlap structure very comfortable and suitable for summer use because of high air permeability, moisture permeability and waterproofness and also because the fabric with a slightly rough surface was agreeable to the touch.

Example 8

Narrow fabric strips 30 mm wide were produced with a tape weaving machine using 500-denier, 36-filament polyester yarn and 250-denier, 48-filament polyester yarn as warp and weft, respectively.

The strips were immersed in a water-soluble polyvinyl alcohol adhesive and then wound up on a fluoropolymer-coated cylindrical roll rotating at such a speed as to produce a sheet with a required width and with an overlap width of 5 mm. A sheet thus obtained was dried and cut in the direction of the axis of the roll to obtain fabric consisting of narrow strips temporarily fixed with the above-mentioned water-soluble adhesive.

The fabric sheet was sewn with a conventional sewing machine along parallel lines aligned at regular intervals of 20 mm in the "downward" direction so that the strips would not be turned up to provide fabric consisting of narrow strips temporarily fixed with the above-mentioned water-soluble adhesive.

The fabric was then immersed in hot water at 80°C and washed in water to dissolve and remove the above-mentioned adhesive, followed by drying. Thus, a fabric sheet with a special overlap structure as shown in Fig. 1(A) and (B) was obtained which consisted of 30 mm-width narrow strips forming overlaps with an overlap width of 5 mm and sewn together along parallel lines aligned at intervals of 20 mm.

The sheet was then used to produce a tube-like bag as schematically illustrated in Fig. 13, and the bag was subjected to a test for the transportation of vegetables. It was demonstrated that the bag was able to provide a well-shaded, well-ventilated environment highly suitable for the transportation and storage of vegetables. The vegetables under test were stored without withering for a long period of time.

POSSIBLE INDUSTRIAL APPLICATIONS

The fabrics with a special structure produced by the process of the present invention have high air permeability, light-screening ability and waterproofness, which are generally difficult to achieve simultaneously, and are also highly fashionable.

If used as material for clothing, it can form clothes with completely unique functions including the ability to prevent the skin of the wearer from being exposed directly to sunlight or rain water while maintaining very good ventilation and fashionable appearance.

For instance, the fabrics can be used as material for various clothes, especially for outdoor wear including sportswear such as golf wear, baseball uniform, baseball undershirts and tennis wear; casuals such as T-shirts and polo shirts; and rainwear such as raincoats.

As described previously, the fabrics produced by the process of the invention, with good features and functions, also serve as material for various clothing items other than clothes, namely bedclothes, soil and sand fixing sheets, agricultural and horticultural greenhouses, footwear, perishables storage containers, beach umbrellas, various tents, filters, chair coverings, partitions and curtains. Thus, they are useful for an extremely wide variety of products.

Claims

1. A process for producing a fabric (S) having a plurality of narrow strips (S_{1-7}) in overlapping relationship with one another, each strip having a longitudinal side portion overlapping with a longitudinal side portion of an adjacent strip, which strips are

interconnected with one another to provide a fabric, but which fabric is provided with openings between the respective overlapping longitudinal side portions of each pair of adjacent strips, in which process

(1) a plurality of narrow strips (S_{1-7}) are arranged in overlapping relationship with one another so that each strip has a longitudinal side portion overlapping with a longitudinal side portion of an adjacent strip,
(2) each strip is temporarily secured, one to the next, by adhesive between overlapping side portions of each pair of adjacent strips,
(3) the strips are permanently interconnected with one another to provide a fabric; and
(4) the adhesive between the overlapping longitudinal side portions of each pair of adjacent strips is removed to provide openings therebetween.

2. A process according to claim 1, wherein strips, each carrying adhesive are received, in overlapping relationship with one another, by a take-up roller and carried through a drying station so as to activate the adhesive and secure temporarily each strip, one to the next.

3. A process according to claim 2, wherein

(a) a plurality of strips are arranged in overlapping side by side relation with one another,
(b) the strips impregnated with an adhesive,
(c) the overlapping strips are introduced under tension to a take-up roller, and
(d) the strips are carried through the drying station.

4. A process according to claim 2 or claim 3, wherein at the drying station, hot air is directed at the overlapping strips.

5. A process according to claim 4, wherein the hot air is directed to overlapping strip material taken up on the take-up roller.

6. A process according to any preceding claim, in which the additional step of cutting the strips laterally to provide fabric pieces is carried out.

7. A process according to claim 6, wherein the strips are cut prior to removal of the adhesive.

8. A process according to claim 7, wherein the strips are cut while the material is taken up by the take-up roller and is cut in a direction along the axis of the take-up roller.

9. A process according to any one of claims 6 to 8, wherein the lateral cutting is carried out at regions of the strips spaced apart from one another such that a fabric piece is obtained which, after removal of the adhesive, has a large number of narrow strips forming an overlapping structure and connected together while maintaining openings in the width direction of the narrow strips.

10. A process according to any preceding claim, wherein the width of the narrow strips is selected in the range of 1-200 mm.

11. A process according to any preceding claim, wherein several types of narrow strip (9, 10), each type being of a different respective material, are used in large numbers to form an overlapping structure.

12. A process according to claim 11, wherein different respective materials having respective heat shrinkage rates different from one another are used.

13. A process according to any preceding claim, wherein narrow strips made of a fibrous structure comprising mixed yarns including fibers having a high shrinkage and/or composite yarns comprising high shrinkage yarns and low shrinkage yarns are used.

14. A process according to any preceding claim, wherein narrow fibrous strips are used in which fiber mainly providing one surface of each strip is different from fiber mainly providing the opposite surface thereof.

15. A process according to claim 14, wherein fibres providing respective opposite surfaces of the strips have different respective shrinkage rates are used.

16. A process according to any preceding claim, wherein several types of narrow strip, each type being of a different color, are used to form an overlapping structure.

17. A process according to any preceding claim, wherein a large number of narrow strips with a water- or oil-repellency are used to form an overlapping structure.

Patentansprüche

1. Verfahren zur Herstellung von Stoff (S) mit einer Anzahl schmaler Lamellen (S_{1-7}) in einander überlappendem Verhältnis, wobei jede Lamelle einen Längsseitenabschnitt aufweist, der den Längsseitenabschnitt der benachbarten Lamelle überlappt, die Lamellen miteinander zu Stoff verbunden sind, der Stoff jedoch mit Öffnungen zwischen den ent-

sprechenden überlappenden Längsseitenabschnitten jedes Paars benachbarter Lamellen versehen ist, wobei bei diesem Verfahren

(1) eine Anzahl schmaler Lamellen (S_{1-7}) in einander überlappendem Verhältnis angeordnet werden, so daß jede Lamelle einen Längsseitenabschnitt aufweist, der den Längsseitenabschnitt der benachbarten Lamelle überlappt,
(2) jede Lamelle, eine an die nächste, durch Klebstoff zwischen den überlappenden Seitenabschnitten jedes Paars benachbarter Lamellen zeitweilig befestigt wird,
(3) die Lamellen dauerhaft miteinander verbunden werden, wodurch Stoff bereitgestellt wird, und
(4) der Klebstoff zwischen den überlappenden Längsseitenabschnitten jedes Paars benachbarter Lamellen entfernt wird, wodurch dazwischen Öffnungen entstehen.

2. Verfahren nach Anspruch 1, wobei die Lamellen, die jeweils Klebstoff tragen, in einander überlappendem Verhältnis von einer Aufnahmerolle aufgenommen und durch eine Trocknungsstelle befördert werden, so daß der Klebstoff aktiviert wird und jede Lamelle, eine an die nächste, zeitweilig befestigt wird.

3. Verfahren nach Anspruch 2, wobei

(a) eine Anzahl von Lamellen in einander seitlich überlappendem Verhältnis angeordnet wird,
(b) die Lamellen mit Klebstoff imprägniert werden,
(c) die überlappenden Lamellen unter Spannung zu einer Aufnahmerolle geführt werden, und
(d) die Lamellen durch die Trocknungsstelle befördert werden.

4. Verfahren nach Anspruch 2 oder 3, wobei an der Trocknungsstelle Heißluft auf die überlappenden Lamellen gerichtet wird.

5. Verfahren nach Anspruch 4, wobei die Heißluft auf das überlappenden Lamellenmaterial gerichtet wird,das auf der Aufnahmerolle aufgenommen wird.

6. Verfahren nach einem der vorstehenden Ansprüche, wobei der zusätzliche Schritt des seitlichen Trennens der Lamellen erfolgt, wodurch Stoffstükke bereitgestellt werden.

7. Verfahren nach Anspruch 6, wobei die Lamellen vor der Entfernung des Klebstoffs geschnitten werden.

8. Verfahren nach Anspruch 7, wobei die Lamellen geschnitten werden, wenn das Material von der Aufnahmerolle aufgenommen wird und in einer Richtung entlang der Achse der Aufnahmerolle geschnitten wird.

9. Verfahren nach einem der Ansprüche 6 bis 8, wobei das seitliche Schneiden in Bereichen der voneinander getrennten Lamellen erfolgt, so daß ein Stoffstück erhalten wird, das nach der Entfernung des Klebstoffs eine große Anzahl schmaler Lamellen aufweist, die eine überlappende Struktur bilden und miteinander verbunden sind, wobei in Breitenrichtung der schmalen Lamellen Öffnungen erhalten bleiben.

10. Verfahren nach einem der vorstehenden Ansprüche, wobei die Breite der schmalen Lamellen im Bereich von 1 bis 200 mm ausgewählt wird.

11. Verfahren nach einem der vorstehenden Ansprüche, wobei verschiedene Arten schmaler Lamellen (9, 10), von denen jede Art aus einem entsprechenden anderen Material ist, in großer Zahl für die Bildung der überlappenden Struktur verwendet werden.

12. Verfahren nach Anspruch 11, wobei entsprechende unterschiedliche Materialien mit entsprechenden voneinander verschiedenen Wärmeschrumpfungsraten verwendet werden.

13. Verfahren nach einem der vorstehenden Ansprüche, wobei schmale Lamellen aus fasriger Struktur verwendet werden, die gemischte Garne umfassen, die Fasern mit starker Schrumpfung und/oder Verbundgarne einschließen, die stark schrumpfende Garne und wenig schrumpfende Garne umfassen.

14. Verfahren nach einem der vorstehenden Ansprüche, wobei schmale fasrige Lamellen verwendet werden, bei denen die Faser, die hauptsächlich eine Oberfläche jeder Lamelle bildet, von der Faser verschieden ist, die hauptsächlich die entgegengesetzte Oberfläche der Lamelle bildet.

15. Verfahren nach Anspruch 14, wobei Fasern, die die entsprechenden entgegengesetzten Oberflächen der Lamellen bilden, mit entsprechenden unterschiedlichen Schrumpfungsraten verwendet werden.

16. Verfahren nach einem der vorstehenden Ansprüche, wobei verschiedene Arten schmaler Lamellen für die Bildung der überlappenden Struktur verwendet werden, wobei jede Art eine andere Farbe hat.

17. Verfahren nach einem der vorstehenden Ansprü-

che, wobei für die Bildung der überlappenden Struktur eine große Zahl wasser- oder ölabweisender schmaler Lamellen verwendet wird

Revendications

1. Procédé de production d'un tissu (S) comportant plusieurs bandes étroites (S_{1-7}) à disposition relative de chevauchement entre elles, chaque bande comportant une partie latérale longitudinale chevauchant une partie latérale longitudinale d'une bande adjacente, lesquelles bandes sont reliées mutuellement entre elles de façon à fournir un tissu, mais ce tissu étant pourvu d'ouvertures séparant les parties latérales longitudinales respectives de chaque paire de bandes adjacentes qui se chevauchent, procédé selon lequel :

    (1) on dispose plusieurs bandes étroites (S_{1-7}) suivant une disposition relative de chevauchement entre elles, d'une façon telle que chaque bande comporte une partie latérale longitudinale chevauchant une partie latérale longitudinale d'une bande adjacente,
    (2) on fixe temporairement chaque bande à la suivante au moyen d'un adhésif disposé entre des parties latérales de chaque paire de bandes adjacentes qui se chevauchent,
    (3) on relie mutuellement les bandes d'une manière permanente entre elles de façon à fournir un tissu et
    (4) on élimine l'adhésif situé entre les parties latérales longitudinales de chaque paire de bandes adjacentes qui se chevauchent, de façon à ménager des ouvertures entre elles.

2. Procédé selon la revendication 1, selon lequel des bandes, portant chacune de l'adhésif, sont reçues par un rouleau récepteur suivant une disposition relative de chevauchement entre elles et sont transportées à travers un poste de séchage de façon à activer l'adhésif et fixer temporairement chaque bande sur la suivante.

3. Procédé selon la revendication 2, selon lequel :

    (a) on dispose plusieurs bandes suivant une disposition relative de chevauchement côte à côte entre elles,
    (b) on imprègne les bandes d'un adhésif,
    (c) on amène les bandes en chevauchement, sous tension, sur un rouleau récepteur et
    (d) on transporte les bandes à travers le poste de séchage.

4. Procédé selon la revendication 2 ou la revendication 3, selon lequel, au poste de séchage, de l'air chaud est dirigé sur les bandes en chevauchement.

5. Procédé selon la revendication 4, selon lequel l'air chaud est dirigé sur une matière formée de bandes en chevauchement reçue sur le rouleau récepteur.

6. Procédé selon l'une quelconque des revendications précédentes, selon lequel on exécute l'opération supplémentaire consistant à découper les bandes latéralement de façon à fournir des morceaux de tissu.

7. Procédé selon la revendication 6, selon lequel les bandes sont découpées préalablement à l'élimination de l'adhésif.

8. Procédé selon la revendication 7, selon lequel les bandes sont découpées alors que la matière est reçue par le rouleau récepteur et sont découpées suivant la direction de l'axe du rouleau récepteur.

9. Procédé selon l'une quelconque des revendications 6 à 8, selon lequel le découpage latéral est exécuté en des zones des bandes qui sont espacées entre elles, d'une façon telle qu'on obtient un morceau de tissu qui, après élimination de l'adhésif, comporte un grand nombre de bandes étroites formant une structure à chevauchement et reliées entre elles, tout en maintenant des ouvertures suivant la direction de la largeur des bandes étroites.

10. Procédé selon l'une quelconque des revendications précédentes, selon lequel la largeur des bandes étroites est choisie dans l'intervalle de valeurs de 1-200 mm.

11. Procédé selon l'une quelconque des revendications précédentes, selon lequel plusieurs types de bandes étroites (9, 10), chaque type étant en une matière respective différente, sont utilisés en des nombres élevés de façon à former une structure à chevauchement.

12. Procédé selon la revendication 11, selon lequel on utilise différentes matières respectives présentant des taux respectifs de retrait thermique qui sont différents entre eux.

13. Procédé selon l'une quelconque des revendications précédentes, selon lequel on utilise d'étroites bandes formées d'une structure fibreuse comprenant des fils mélangés comportant des fibres ayant un retrait élevé et/ou des fils composites comprenant des fils à retrait élevé et des fils à faible retrait.

14. Procédé selon l'une quelconque des revendications précédentes, selon lequel on utilise d'étroites bandes fibreuses dans lesquelles la fibre constituant

principalement une première surface de chaque bande est différente de la fibre constituant principalement la surface opposée de cette bande.

15. Procédé selon la revendication 14, selon lequel on utilise des fibres formant les surfaces opposées respectives des bandes qui ont des taux respectifs de retrait différents.

16. Procédé selon l'une quelconque des revendications précédentes, selon lequel on utilise plusieurs types de bandes étroites, chaque type étant d'une couleur différente, pour former une structure à chevauchement.

17. Procédé selon l'une quelconque des revendications précédentes, selon lequel un grand nombre de bandes étroites ayant des propriétés hydrophobe et oléorésistante sont utilisées pour former une structure à chevauchement.

Fig. 1

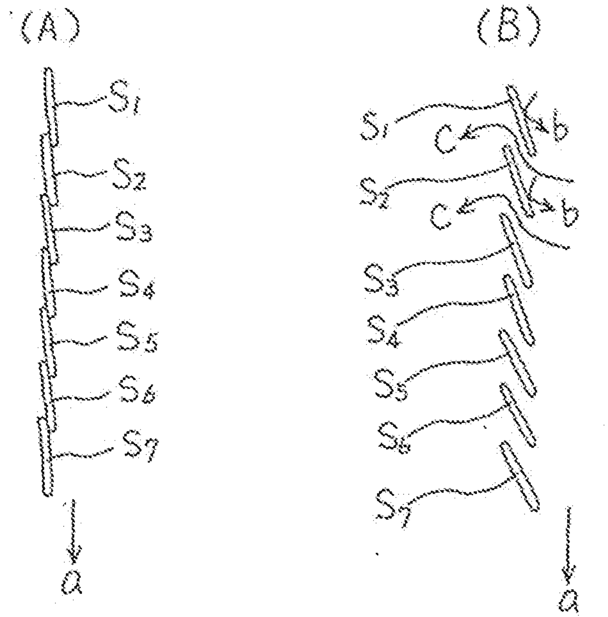


Fig. 2

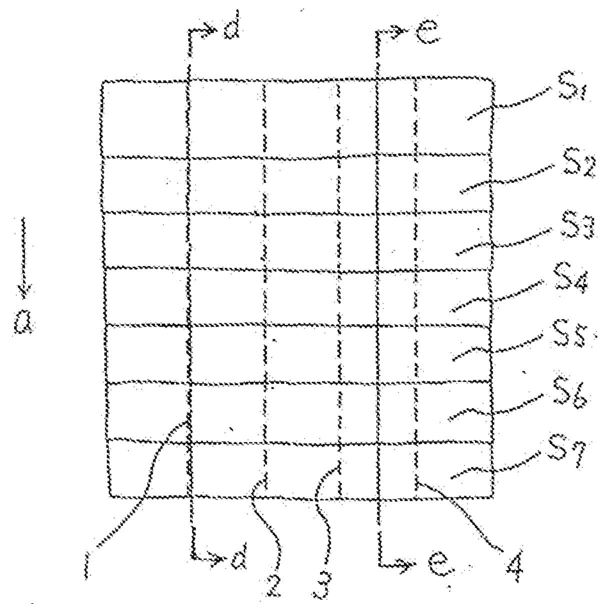


Fig. 3

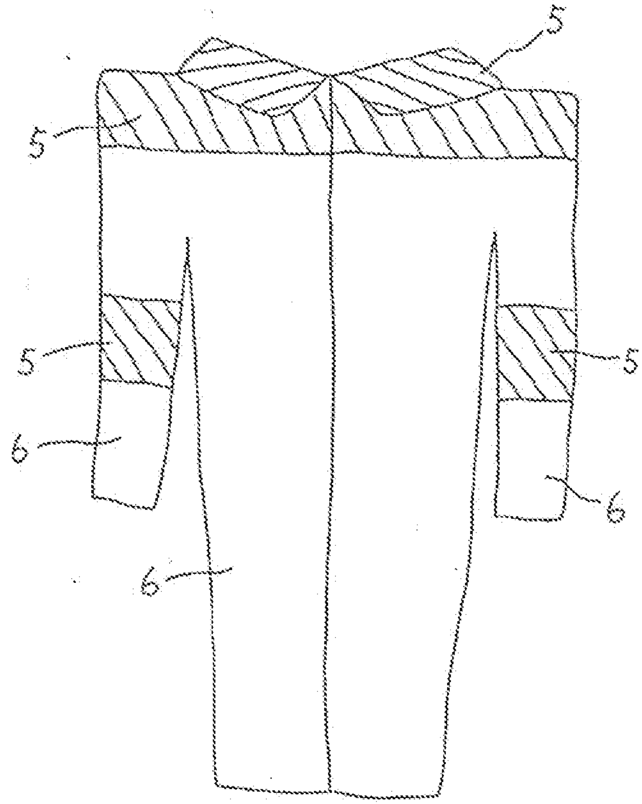


Fig. 4

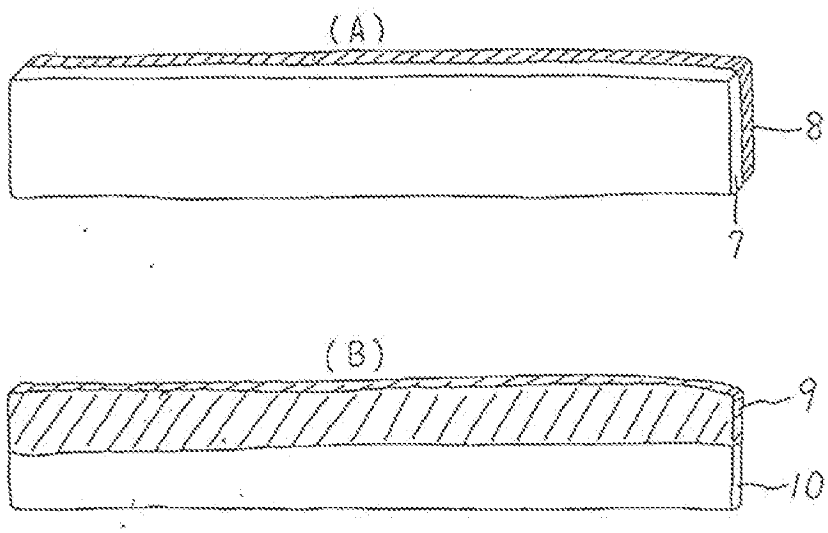


Fig. 5

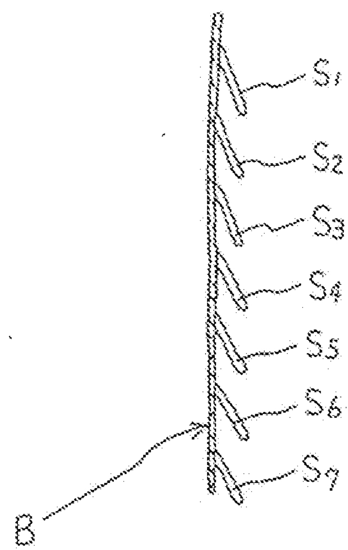


Fig. 6

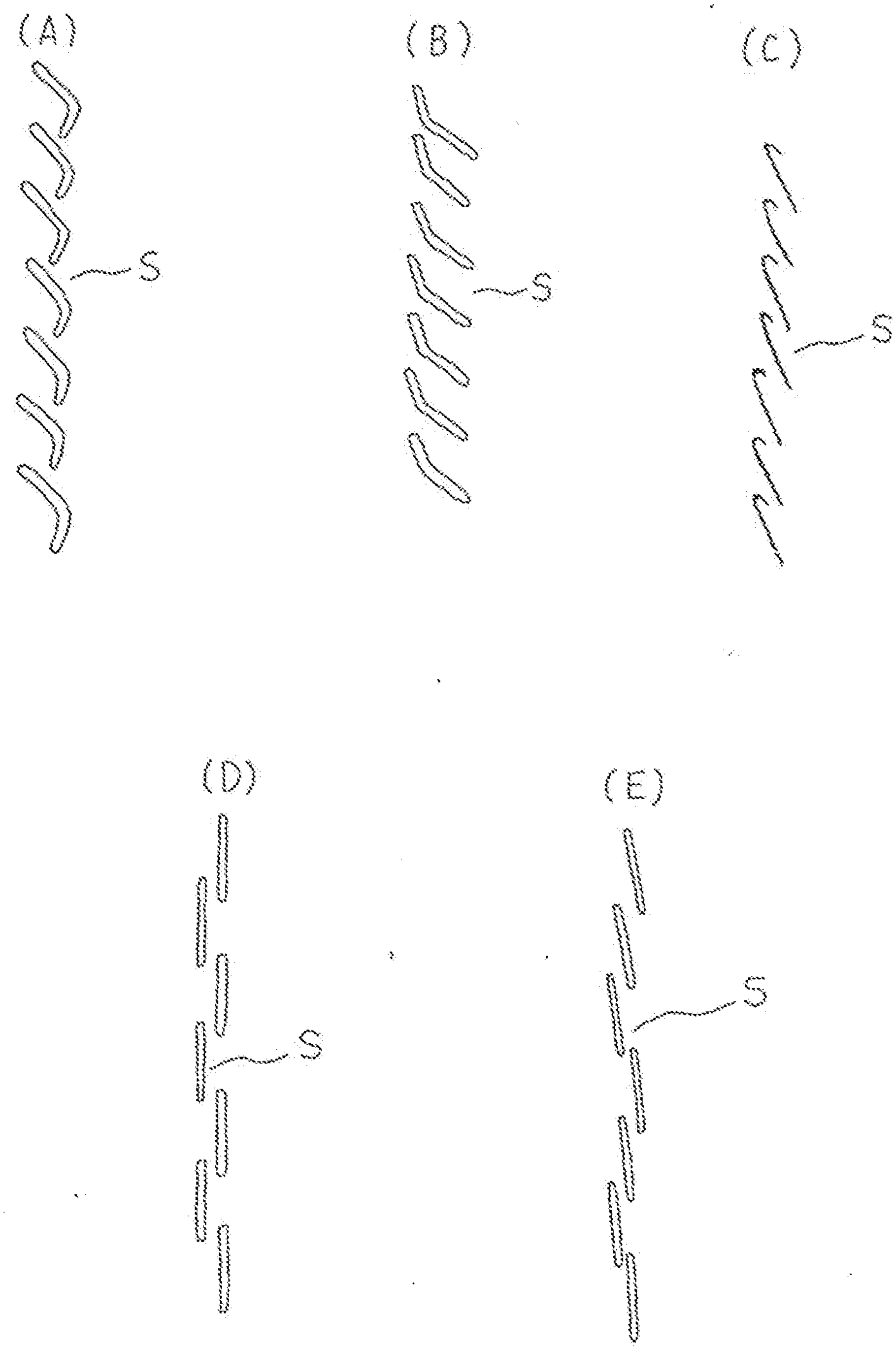


Fig. 7

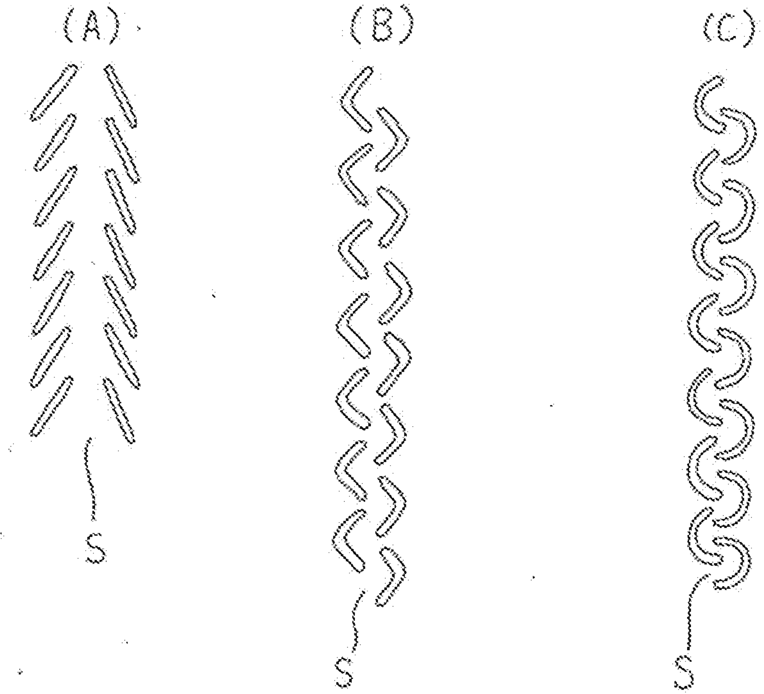


Fig. 8

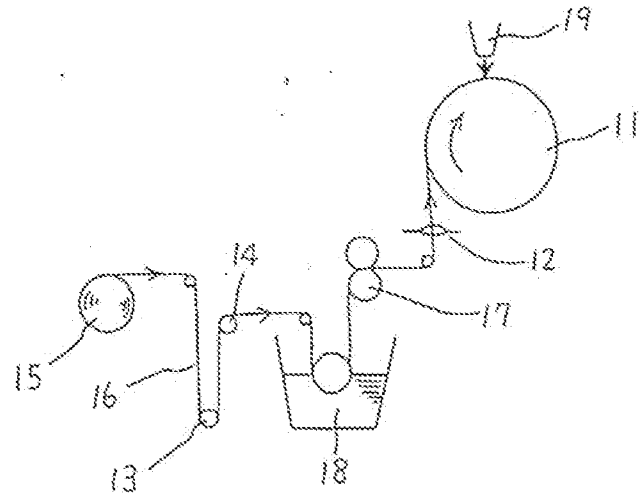


Fig. 9

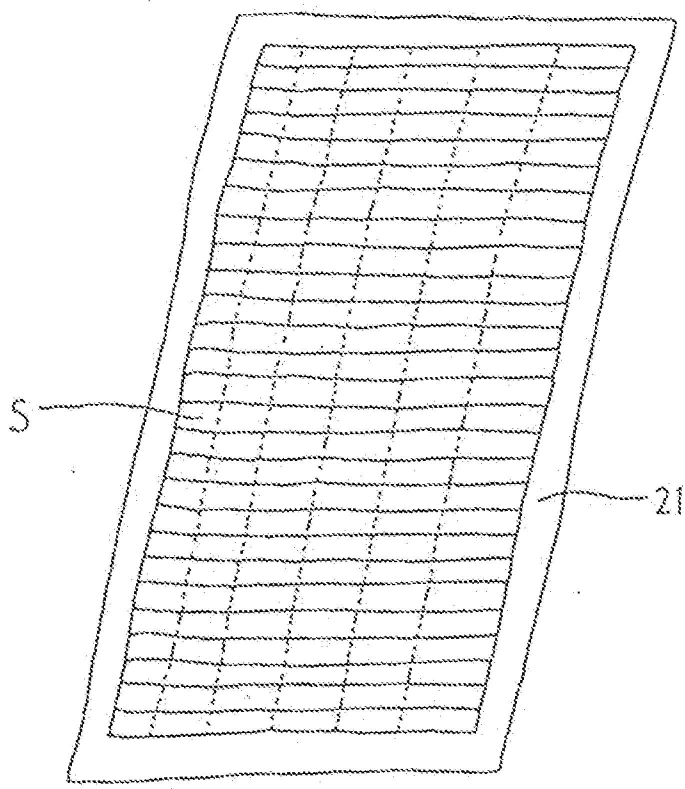


Fig. 10

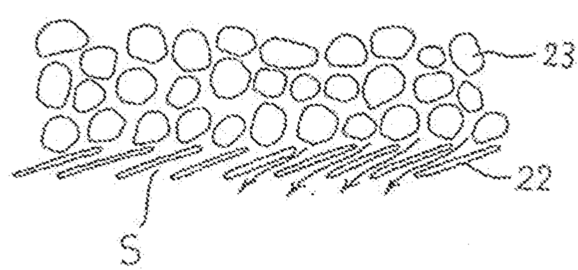


Fig. 11

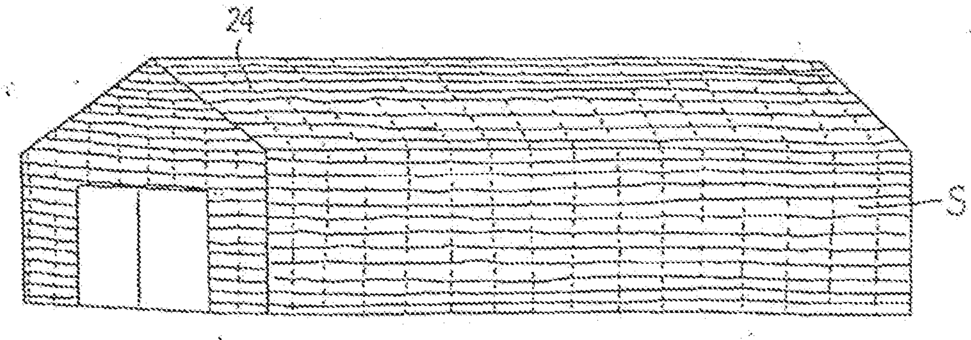


Fig. 12

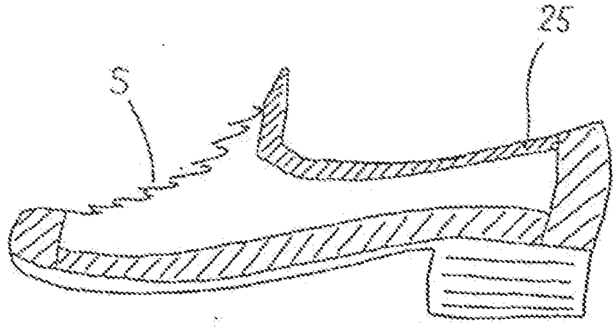
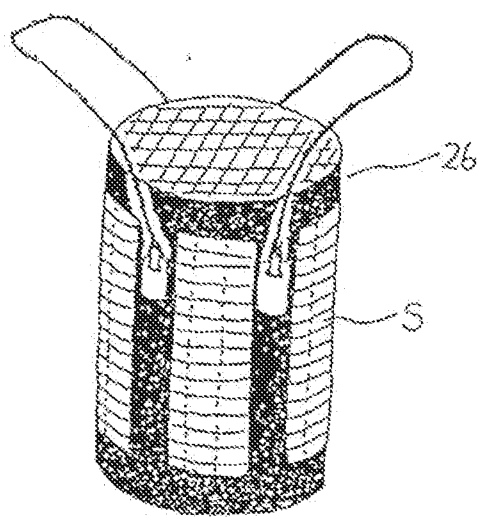


Fig. 13



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(54) **Knitted fabric**

(57) A knitted fabric comprising a plurality of knitted stitches which are interconnected to define a plurality of courses and wales, the knitted stitches being formed from a heat fusible yarn (14), with at least some of said stitches being formed from said heat fusible yarn plated with a ground yarn (12), the heat fusible yarn (14) being fused together at adjacent points of contact on stitches in order to give the fabric a desired dimensional stability and shape.

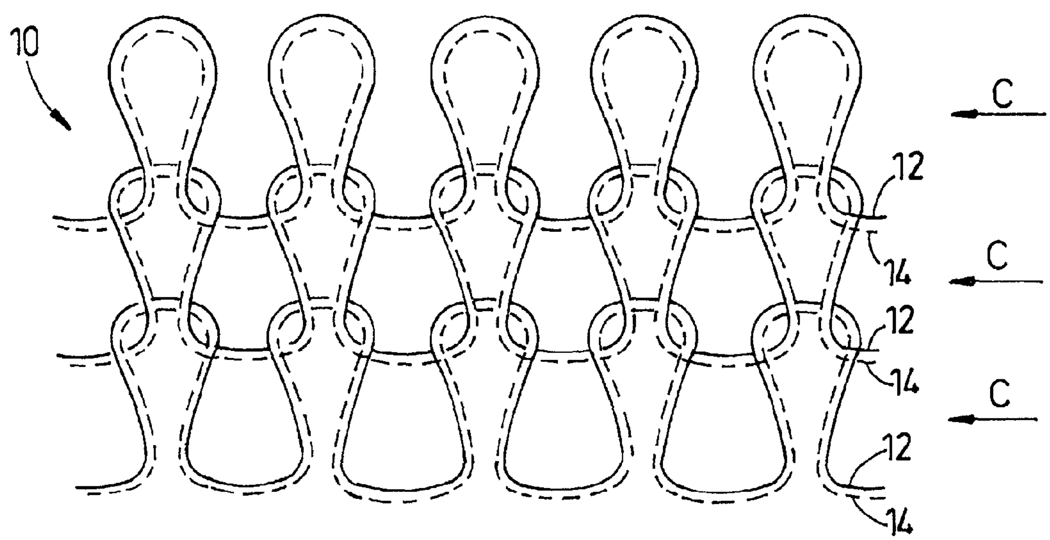

Fig. 1

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Description

[0001] The present invention relates to a warp or weft knitted fabric, in particular but not exclusively, a knitted fabric suitable for making garments.

[0002] Fabrics for garments are commonly knitted using thermoplastics yarns such as polyamide or polyesters. The fabric may be knitted using either warp knitting or weft knitting techniques.

[0003] Once knitted, it is common for the fabric to be heat set in order to give the fabric stable dimensions and/or shape. Heat setting is achieved by stretching the fabric to the required dimension/shape and raising the temperature of the fabric to the setting temperature of the yarn whereat a permanent change is induced, viz. a new memory position is introduced into the yarn and it loses some of its stretch recovery capabilities and usually becomes relatively stiff. The fabric therefore thereafter retains the dimension/shape to which it was stretched during the heat setting process.

[0004] Accordingly, once the fabric has been heat set, it tends to lose its soft feel and handle qualities.

[0005] A general aim of the present invention is to provide a knitted fabric which is knitted using thermoplastics yarns as ground yarns and which is dimensionally stable without fully heat setting of the ground yarns.

[0006] According to one aspect of the present invention there is provided a knitted fabric comprising a plurality of knitted stitches which are interconnected to define a plurality of courses and wales, the knitted stitches being formed from a heat fusible yarn, with at least some of said stitches being formed from said heat fusible yarn plated with a ground yarn, the heat fusible yarn being fused together at points of contact on adjacent stitches in order to give the fabric a desired dimensional stability and shape.

[0007] According to another aspect of the invention there is provided a process for setting the coursewise and walewise dimensions and/or three dimensional shape of a fabric, the process including the steps of knitting a fabric so as to comprise a plurality of knitted stitches which are interconnected to define a plurality of courses and wales, the knitted stitches being formed from a heat fusible yarn with at least some of said stitches being formed from heat fusible yarn plated with a ground yarn having a setting temperature greater than the fusing temperature at which the heat fusible yarn become fusible, stretching the fabric on a former to stretch the fabric to desired coursewise and walewise dimensions and/or three dimensional shape, heating the fabric whilst on said former to at least the fusing temperature and preferably below said heat setting temperature, in order to cause the fusible yarn to fuse together at points of contact between the fusible yarn and subsequently cooling and removing the fabric from the former.

[0008] Preferably the heat fusible yarn is an elastomeric yarn.

[0009] Preferably the ground yarn is a thermoplastics yarn such as a polyamide or polyester. The heat fusible yarn is fusible at a temperature below the heat setting temperature of the thermoplastics yarn; the difference in these temperatures being dependent on the fibre type and the method of heating to effect fusing.

[0010] Various aspects of the present invention are hereinafter described, with reference to the accompanying drawings, in which:-

Figure 1 is a schematic stitch diagram of part of a weft knitted fabric according to a first embodiment of the present invention shown in a stretched condition prior to a setting operation;

Figure 2 is a schematic stitch diagram of the weft knitted fabric of Figure 1 after a setting operation;

Figure 3 is a schematic stitch diagram similar to Figure 2 showing a weft knitted fabric according to a second embodiment of the present invention.

[0011] A weft knitted fabric 10 according to a first embodiment of the present invention is illustrated in Figures 1 and 2. The fabric 10 includes a plurality of courses C each of which is knit using at least two yarn ends, viz. a ground yarn 12 and a heat fusible yarn 14 which serves the function of providing the fabric with desired dimensions and/or shape after a heat treatment.

[0012] The ground yarn 12 provides the body to the fabric and is preferably a thermoplastic yarn such as a polyamide or a polyester. The weight of the ground yarn is preferably in the range of 10-200 dtex, more preferably in the range of 60 to 80 dtex.

[0013] The heat fusible yarn is formed from a thermoplastics material which at a predetermined fusible temperature will fuse with itself at points of contact of the heat fusible yarn.

[0014] The weight of the fusible yarn is preferably in the range of 10 to 160 dtex, more preferably in the range of 20 to 50 dtex.

[0015] In this specification, the term 'fusible' is used to denote the condition where the yarn is able to bond to itself by the application of heat whilst retaining its integrity as a yarn; in other words the fusible temperature of the yarn is the temperature at or above which it becomes sufficiently tactile for it to bond or weld to itself but is below the temperature at which the yarn fully melts. For example, the 'sticking point' of elastomeric yarns would be in the region of 150 to 170 degrees C, i.e. this is the temperature at which the fusing would become active. This is the temperature based on 'dry' heat. The temperatures in the presence of steam would be considerably lower. The normal setting temperature of the ground yarns would be in excess of 180 degrees C in dry heat.

[0016] Thus, the predetermined fusible temperature is lower than the temperature at which the fusible yarn 14 melts and is also lower than the temperature at which the thermoplastic ground yarn 12 fully sets.

[0017] Accordingly, as schematically illustrated in Figure 2, if the fabric 10 is stretched, for example is placed upon a former, and is then raised to the predetermined fusible temperature, the points of contact between the fusible yarn become tactile and fuse together to define fused connections 18. Since the fusible temperature is below the temperature at which the fusible yarn 14 fully melts, the stitches 20 formed by the fusible yarn remain intact. The fused connections 18 thereby lock the stitches 20 formed by the fusible yarn 14, i.e. stitch lengths inbetween each adjacent pair of connections 18 are fixed throughout the fabric.

[0018] Since the fusible yarn 14 is knitted on adjacent courses and wales throughout the fabric, the relative position/sizes of stitch loops created by both the fusible and ground yarns immediately prior to creation of the fused connections 18 are maintained thereby giving the fabric a desired dimension/shape.

[0019] Accordingly, the fusible yarn 14 acts to 'set' the fabric at a desired dimension/shape without requiring the thermoplastic ground yarn 12 to be fully set. It will therefore be appreciated that the ground yarn 12 is more flexible and has more stretch recovery than a fully set thermoplastic ground yarn and that, as a result, the fabric of the present invention has improved feel and handle qualities.

[0020] Desirably the fusible and ground yarns are chosen such that at the predetermined fusible temperature of the fusible yarn 14, the ground yarn 12 is partially set, i.e. the ground yarn 12 is given a degree of shape retention or memory. This assists in giving stability to the shape/dimension of the fabric whilst still providing the benefits of improved feel/handle qualities when compared with a fully set ground yarn.

[0021] The relative weights of the ground and fusible yarns are chosen to ensure that the fusible yarns 14 contact one another at adjacent stitches (i.e. the ground yarns are not sufficiently large to shield the fusible yarns 14 from one another).

[0022] Preferably the fusible yarn 14 is an elastomeric yarn such as a bare Lycra (RTM) or Roice (RTM).

[0023] The use of an elastomeric yarn as the fusible yarn gives the advantage of providing the fabric with stretch qualities which enhance close shape fitting of a garment on the body of a wearer.

[0024] Alternatively, the fusible yarn 14 may be a non-elastomeric yarn such as a thermoplastic monofilament yarn produced from polyamide, polypropylene or other polymer with a lower setting, softening or melting temperature than the ground yarn.

[0025] In the alternative embodiment 30 illustrated in Figure 3, a fabric is illustrated having single courses C_S of heat fusible yarn 14 only alternating with courses C of fusible yarn 14 plaited with ground yarn 12. Instead of a single course C_S located inbetween courses of plated yarns 12 and 14 it will be appreciated that a desired number of adjacent courses C_S may be provided.

[0026] The combination of the number of adjacent courses formed from plated ground and fusible yarns and the number of adjacent courses formed from fusible yarns only may be varied as required in order to provide the fabric with desired characteristics. An important consideration is that each stitch contains the fusible yarn 12 such that connections 18 may be formed at each stitch.

[0027] In the examples given in Figures 1 and 3, the fabric is shown as being formed from plain jersey stitches only.

[0028] It will be appreciated that the fabric may also include other conventional stitches such as tuck or miss-stitches.

[0029] The fabric of the present invention is particularly suited to the creation of seamless garments wherein a tubular blank of fabric is moulded to a three dimensional shape on a former.

[0030] For example, a former in the shape of a human body part, for example the torso, is provided for the shaping of garments such as brassieres or briefs.

[0031] A tube of fabric as described above is located upon the former and elevated in temperature to the heat fusible temperature of the fusible yarn which is a high enough temperature to cause the heat fusible yarn to bond or weld together at its points of contact; the fusible temperature however being lower than the temperature at which the ground yarns are fully set. Preferably the fabric is heated using live steam.

[0032] Once the fabric has been exposed to a temperature whereat the heat fusible yarn has welded to itself, the fabric structure is locked in its stretched condition and slightly contracts (due to the stretch recovery of the heat fusible yarn). Accordingly the size of the former is chosen to be slightly oversize in order to cater for the slight contraction of the garment when removed from the former.

[0033] It is envisaged that heat meltable yarns may be incorporated into the fabric so as to join regions of fabric together. These heat meltable yarns are chosen so as to completely melt when the fabric is exposed to the fusible temperature and thereby cause the regions of fabric joined thereby to separate leaving a welded edge formed by the melted heat meltable yarn and which is of a desired shape and which is run resistant. This enables the garment to be shaped by pattern control techniques during knitting and avoids the need for a separate cutting-out process to shape the garment from the tubular blank.

[0034] It is envisaged that the former may be made from a resin polymer and be provided with a heat sink to prevent the surface of the former retaining a surface temperature equal to or above the welding temperature after repeated fabric moulding operations.

Claims

1. A knitted fabric comprising a plurality of knitted stitches which are interconnected to define a plurality of courses and wales, the knitted stitches being

formed from a heat fusible yarn, with at least some of said stitches being formed from said heat fusible yarn plated with a ground yarn, the heat fusible yarn being fused together at adjacent points of contact on stitches in order to give the fabric a desired dimensional stability and shape.

2. A fabric according to claim 1 wherein said heat fusible yarn is a bare elastomeric yarn.

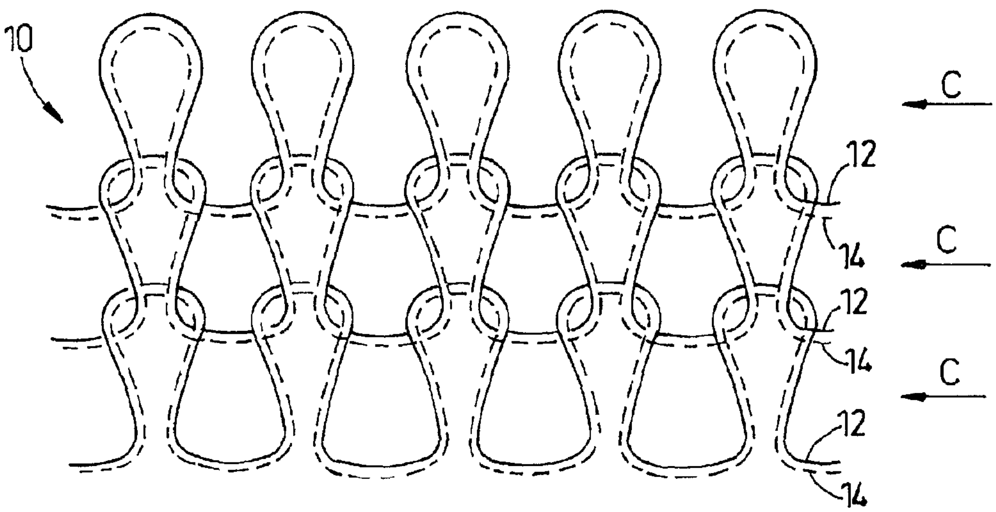
3. A fabric according to claims 1 or 2 wherein the ground yarn is a thermoplastics yarn capable of being fully set when elevated to a fully set temperature, said heat fusible yarn being fusible at a temperature below said fully set temperature.

4. A process for setting the coursewise and walewise dimensions and/or three dimensional shape of a fabric, the process including the steps of knitting a fabric so as to comprise a plurality of knitted stitches which are interconnected to define a plurality of course and wales, the knitted stitches being formed from a heat fusible yarn with at least some of said stitches being formed form heat fusible yarn plated with a ground yarn, stretching the fabric on a former to stretch the fabric to desired coursewise and walewise dimensions and/or three dimensional shape, heating the fabric whilst on said former to at least the fusing temperature in order to cause the fusible yarn to fuse together at points of contact between the fusible yarn and subsequently cooling and removing the fabric from the former.

5. A process according to claim 4 wherein said ground yarn is a thermoplastics yarn capable of being fully set when elevated to a fully set temperature, and wherein said heating of the fabric whilst on the former is preformed to elevate the fabric to a temperature greater than said fusing temperature but less than said fully set temperature.

6. A process according to claim 4 or 5 wherein the fabric is further knitted using heat meltable yarns in order to join regions of said fabric together, said heat meltable yarns being melted when raising the fabric to said heat fusible temperature so as to cause said regions of fabric to separate and define, where separated, a run resistant edge of a desired shape.

7. A garment formed at least in part from knitted fabric according to Claims 1, 2 or 3.


10
C
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14

Fig. 1

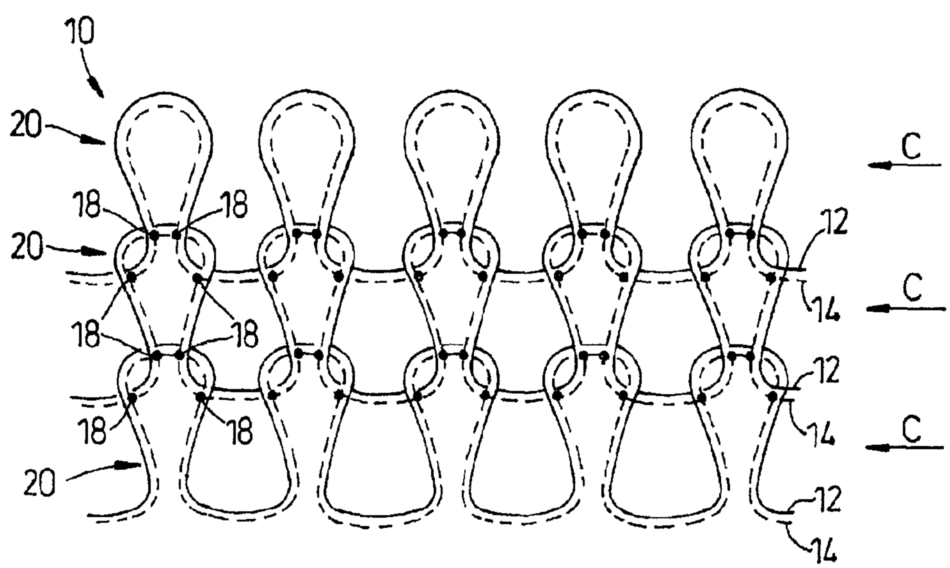
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Fig. 2

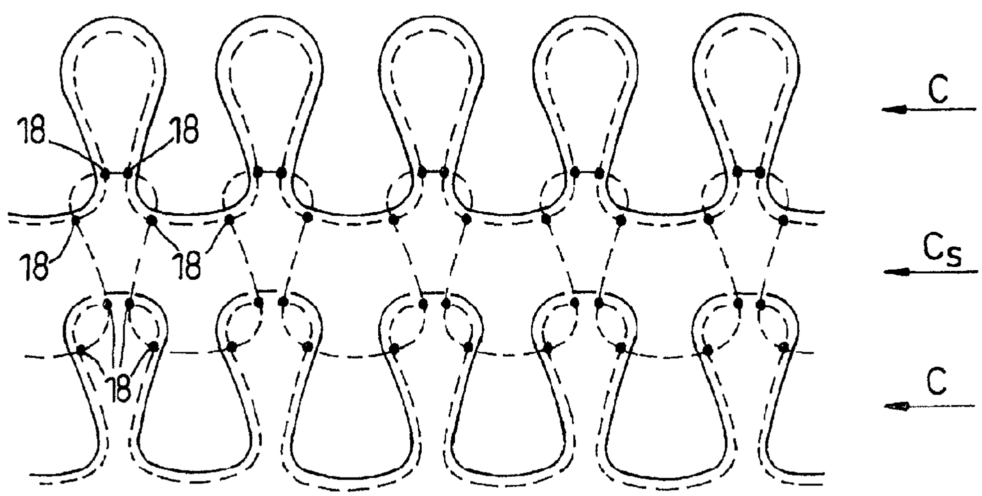

Fig. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 25 1103

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 May 2002	Van Gelder, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 25 1103

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The members are as contained in the European Patent Office EDP file on
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23-05-2002

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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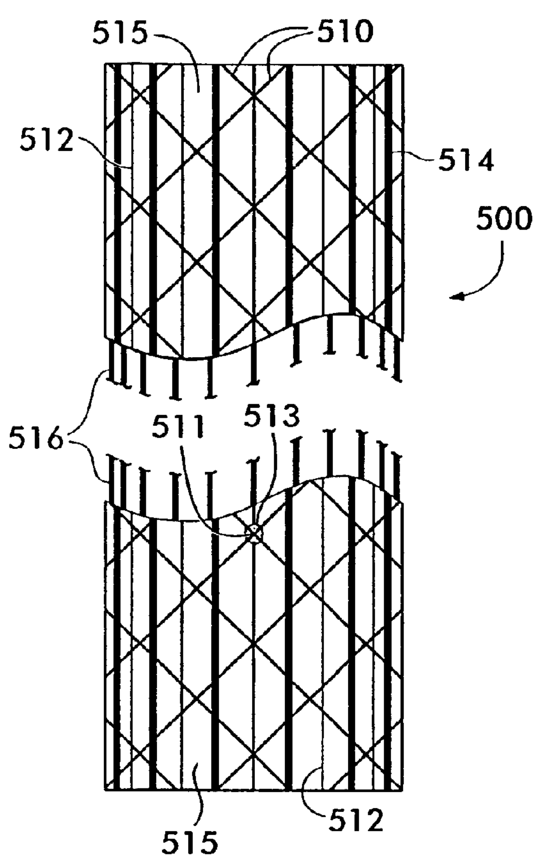
[Continued on next page]

(54) **Title:** STIFFENED FABRIC



(57) Abstract: A stiffened fabric (500) of interlaced filamentary members (510 & 514) is disclosed, stiffening of the fabric being caused by joining the filamentary members together at mutual points of contact (511) within the fabric to prevent relative motion of the filamentary members. Joining of the members occurs by heat fusing, chemical fusing, or adhesive (513) bonding at selected points to control the stiffness of the fabric. Bio-absorbable materials are used to form some of the filamentary members so that the stiffness and porosity of the fabric changes over time as the bio-absorbable material is absorbed when the fabric is implanted in living tissue.

WO 02/31247 A1

patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

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

STIFFENED FABRIC

Related Application

This application is based on and claims priority of U.S. Provisional Application No. 60/238,971, filed October 10, 2000.

Field of the Invention

This invention relates to fabrics preferably comprising a plurality of different materials, wherein filaments within the fabric are fused or otherwise joined together to control various physical properties of the fabric.

Background of the Invention

The physical characteristics of fabrics, such as stiffness (also known as "hand"), porosity, density, elasticity, resilience, tensile strength, resistance to abrasion, are largely controlled by the size and type of yarns or filaments which are interlaced together, the material from which the yarns or filaments are made and the manner in which they are interlaced, for example, by weaving, knitting or braiding.

There is generally a limit on the degree of stiffness which can be attained in a fabric. This is due, in part, to the inherent flexibility of the long, slender filamentary members comprising the fabric and the fact that they are generally free to move relatively to one another to some degree within the fabric.

It is sometimes desirable to have a fabric formed of relatively thin filamentary members of a relatively flexible material but having a stiffness which is relatively greater than would normally be achieved when the filamentary members are interlaced. Such fabrics are expected to find use as human implants to reinforce soft tissue for the treatment of conditions, such as sleep apnea and snoring. It would also be beneficial if the stiffness of the fabric could be designed to change over time to become less stiff in relation to the formation of scar tissue resulting from the implant, which tends to stiffen the tissue. If the fabric can be made to become less stiff over time, the total stiffness of the affected area will remain relatively constant over time for optimum treatment of the disorder.

It may also be desired to maintain or augment a particular porosity or interstice size in the fabric which is otherwise incompatible with the desired stiffness of the fabric. If relatively large interstices are desired in the fabric, for example, to allow flow of fluid therethrough or promote ingrowth of tissue into the fabric, this is achieved by interlacing relatively small diameter filamentary members in a relatively open mesh. This will yield a fabric of relatively low stiffness, especially if polymers such as polyester, nylon or polypropylene are used which are themselves relatively soft, pliant filaments.

If the stiffness of fabrics could be controlled and relatively high stiffness could be achieved in conjunction with other fabric properties which are presently considered incompatible or inconsistent with the higher stiffness, then woven, knitted and braided fabrics may find a wider spectrum of applications, especially, but not only, in the treatment of human diseases and disorders.

Summary of the Invention

The invention concerns a stiffened fabric comprising a plurality of filamentary members interlaced together, for example, by weaving, knitting or braiding. The filamentary members engage one another at mutual points of contact where, at selected ones of the mutual points of contact, they are substantially rigidly joined together to substantially inhibit relative motion between the filamentary members and thereby impart a predetermined stiffness to the fabric. The selected ones of the mutual points of contact joined together may comprise a portion of the total number of the mutual points of contact or substantially all of the mutual points of contact between the filamentary members as required to obtain a desired stiffness. The filamentary members are free to move relatively to one another between the selected ones of the mutual points of contact at which they are attached, thus providing for a degree of flexibility in the fabric.

In one embodiment, the plurality of filamentary members comprises a first group of filamentary members having a relatively low melting point interlaced with a second group of filamentary members having a relatively high melting point. The filamentary members of the first group are joined to filamentary members of the second group by heating the fabric to a temperature higher than the melting point of the first group of filamentary members and lower than the melting point of the second group of filamentary members thereby causing filamentary members of the first group to fuse with filamentary members of the second group at the mutual points of contact between the filamentary members of the first and the second groups. In another embodiment of the stiffened fabric according to the invention, an adhesive, positioned at the selected ones of the mutual points of contact, is used to join the filamentary members together, thereby stiffening the fabric.

The invention also contemplates a stiffened fabric wherein the plurality of filamentary members includes a first group of filamentary members comprising a material which is absorbable when implanted in living tissue. Filamentary members comprising such bio-absorbable material are interlaced with a second group of filamentary members, preferably comprising non bio-absorbable material. The bio-absorbable filamentary members of the first group are initially joined to filamentary members of the second group at the mutual points of contact to provide a relatively high stiffness to the fabric. The filamentary members of the first group are absorbed upon implantation of the fabric in living tissue and, over time, provide a relatively lower stiffness to the fabric as the filamentary members of the first group are absorbed. The purpose of this embodiment is to construct an implant formed by braiding the filamentary members into an elongated rod which is implanted in soft tissue to provide stiffness. Over time, as the bio-absorbable filaments are absorbed the rod becomes less stiff, thereby compensating for the increased stiffness of the surrounding tissue due to the formation of scar tissue to keep the overall stiffness of the tissue near the implant a constant.

In another embodiment of the stiffened fabric according to the invention, the filamentary members are interlaced by weaving to provide a plurality of interstices in the fabric having a predetermined size and resulting in the fabric having a first predetermined porosity. The fabric further comprises a plurality of absorbable filamentary members again formed of a material which is absorbable when implanted in living tissue. The absorbable filamentary members are interwoven in the fabric in overlying relation with the interstices thereby reducing the size of the interstices and resulting in the fabric having a second predetermined porosity smaller than the first predetermined porosity. The absorbable filamentary members are absorbed when the fabric is implanted in living tissue causing the porosity of the fabric to change from the second predetermined porosity to the first (larger) predetermined porosity.

It is an object of the invention to provide a fabric wherein the stiffness or "hand" may be controlled.

It is another object of the invention to provide a fabric wherein the stiffness may be varied.

It is another object of the invention to provide a fabric wherein the porosity of the fabric may be varied.

These and other objects and advantages of the invention may be discerned upon consideration of the following drawings and detailed description of the preferred embodiments.

Brief Description of the Drawings

Figure 1 shows a side view of a braided fabric rod according to the invention;

Figure 2 shows a perspective view of a knitted fabric tube according to the invention;

Figure 3 shows a perspective view of a woven fabric sleeve according to the invention; and

Figure 4 shows a perspective view of a wound rod according to the invention.

Detailed Description of the Preferred Embodiments

The invention comprises a fabric of interlaced filamentary members wherein the members, once interlaced, are joined together at points of contact with one another to prevent relative motion between them and thereby stiffen the fabric. The filamentary members are not otherwise constrained between the points of contact at which they are joined and may, thus, move relatively to one another between the joined contact points to provide some flexibility to the fabric. Joining together of the filamentary members is preferably accomplished by including throughout the fabric filamentary members having a relatively low melting point with filamentary members having a relatively higher melting point and subjecting the fabric to a temperature somewhere between the melting points of the two members. The lower melting point members fuse with the higher melting point members, locking all of the members in place and substantially increasing the stiffness of the fabric while maintaining other fabric characteristics such as porosity, interstice size, which would otherwise only be associated with a fabric having relatively less stiffness.

A stiffened fabric according to the invention may find use as a human implant in the area of the soft palate and air passageways of the body to stiffen the palate and passageways in the treatment of excessive snoring and obstructive sleep apnea (OSA). OSA, while not life threatening, is nevertheless a serious disorder which interrupts sleep and is recognized as a leading cause of excessive daytime sleepiness which increases the risk factors in automobile and industrial accidents.

OSA results from an occlusion of the upper airway at the level of the oropharynx. The occlusion occurs because the tissue defining the airway is insufficiently stiff and collapses when the airway is subjected to sub-atmospheric pressure during inspiration. The resulting apnea leads to progressive asphyxia until there is a brief arousal from sleep and the airway dilator and abductor muscles reopen the airway and airflow to the lungs resumes. The person then returns to sleep. The sequence repeats itself throughout sleep as many as 400 to 500 times per night. The compliant tissue is also naturally prone to vibrate at relatively low frequencies resulting in snoring. Currently, severe OSA is treated by a tracheotomy which bypasses the occluded passageways.

By way of example, a stiffened fabric rod 500, shown in Figure 1, having a of length 30mm, a diameter of 3mm, an elastic modulus of 80,000 psi and a porosity of 60% was made according to the invention to serve as an implant to stiffen the soft palate.

To achieve the above specified properties, 24 polyester yarns 510 of 150 denier were braided at a +/-45° braid angle with 12 axially oriented yarns 512 of 100 denier, also of polyester. A further 12 axial filamentary members 514 were also braided into rod 500, members 514 comprising monofilament polypropylene of 6 mil diameter. A further 22 polypropylene monofilaments 516 were braided axially into the rod to form a core.

The rod was then heated to a temperature of 163°C, the melting point of the polypropylene (the melting point of the polyester was 250°C) to fuse the polypropylene and polyester together and form a stiffened rod of braided fabric. The ratio of polyester and polypropylene was chosen to achieve the required elastic modulus of 80,000 psi. The axially oriented core monofilaments 516 help stabilize the rod when subjected to bending forces and prevent the rod from kinking when bent. When implanted in the soft palate, the rod stiffens the palate and increases its natural frequency to reduce snoring and any effects of sleep apnea caused by the compliance of the upper palate.

Rather than using heat to fuse the filamentary members to form the stiffened fabric rod 500, adhesive bonding of the filamentary members may be employed. Selected points of contact such as 511 between filamentary members 510 are bonded together with an adhesive 513. Adhesive 513 is preferably substantially inelastic and effectively prevents relative sliding motion as well as relative rotation of the filamentary members 510 to provide increased stiffness to the stiffened fabric rod 500. The stiffness of the rod is proportional to the number of mutual points of contact which are adhered to one another. The adhesive may be a permanent adhesive, activated by heat, chemicals or water, as well as a solvent which chemically fuses the filamentary members together at the cross-over points. The adhesive may also be water soluble, yielding a rod with one stiffness when dry, and a second, lower stiffness when wetted to dissolve the adhesive bonds thereby allowing the filamentary members to move relatively to one another.

An aspect of the invention is the creation of a structure whose stiffness and/or porosity changes over time. For example, filamentary members 514 may be bio-absorbable filaments made from materials such as polylactic acid or polyglycolic acid instead of polypropylene. The bio-absorbable filaments are interbraided with the polyester yarns 510 forming the stiffened rod and joined with them at the mutual points of contact. Once implanted, the bio-absorbable filaments 514 degrade over time and are absorbed into and eliminated from the tissue, leaving only the polyester yarns and/or polypropylene filaments in the implant. Stiffness of the rod is reduced over time as a result of the elimination of some of the filaments which would normally contribute some stiffness to the rod. This is useful, for example, to maintain the stiffness of the tissue constant as scar tissue, which is stiffer than regular tissue, forms as the tissue heals after the operation. The degrading components compensate for the development of the stiffer scar tissue by reducing the stiffness provided by the rod.

Porosity of the fabric may also be increased by interlacing the bio-absorbable filaments to coincide with interstices 515 formed by the non-biodegradable filamentary members 510 of the stiffened fabric rod as shown in Figure 1. As the bio-absorbable filaments degrade, they no longer block the interstices 515 between the other filamentary members 510, resulting in increased porosity over time. This is of interest to promote the ingrowth of living cells into the implant to secure it in position and prevent migration.

The composite stiffened fabric according to the invention is not limited to the above described application, and several examples of additional applications are provided below.

In the construction of a Bowden cable, used for the remote mechanical actuation of a device, a flexible yet relatively stiff outer sleeve houses a coaxial wire core which is movable longitudinally through the sleeve to place a tension or compression force on a mechanism connected to one end of the wire core, such as the trunk release of an automobile, to actuate it and allow the trunk to be opened remotely, for example, from within the passenger compartment. Such a Bowden cable 518, a portion of which is shown in Figure 2, may have an outer sleeve formed from a warp knitted tube 520 comprising polyester yarns 522 having a relatively low melting point and PTFE yarns or filaments 524, which has a relatively higher melting point. Tube 520 is knitted by techniques well known in the art so that the polyester yarns comprise the outer surface 526 of the tube, and the PTFE filaments comprise the inner surface 528 of the tube. When the tube is heated, the polyester yarns fuse to each other and the PTFE filaments provide the required stiffness to the tube. The PTFE provides for a non-stick inner surface 528 allowing the wire core 530 to slide within the tube substantially without friction, thus, providing an excellent bearing surface on the inside of the tube.

By way of a further example, in the construction of a flexible sheath 532 (see Figure 3) for covering electrical wiring harnesses to protect the wires 534 against abrasion, a woven tube 536 may be manufactured from a combination of two different filamentary materials 538 and 540 having different melting points, such as polypropylene and polyester respectively. If the two materials are interwoven to form a substantially homogeneous fabric, then when the heat is applied to fuse the lower melting point material (the polypropylene 538) a continuously stiffened tube will be formed. However, if the polypropylene 538 is interwoven with the polyester 540 at selected points intermittently along the length of the tube, for example, at regular intervals, this will form an intermittently stiffened tube having stiffened segments 542 alternating with unstiffened segments 544. The length of tube having the alternating section will be more flexible than the continuously stiffened tube and will bend more easily to follow a curved path.

In another example, shown in Figure 4, a filament wound rod 546 may be formed by the stiffened composite fabric according to the invention. Starting with a core 548 of polyester filaments, polypropylene filaments 550 may be wrapped, either alone or in combination with other filaments or yarns 552, around the polyester core 548. Upon fusing of the lower melting polypropylene filaments 550, a stiffened rod is produced. If bio-absorbable filaments such as polyglycolic or polylactic are used for filaments 552, then the rod will be capable of changing stiffness as the bio-absorbable filaments are absorbed over time. The filament-wound embodiment may also be used to stiffen living tissue similar to the braided embodiment.

The composite stiffened fabric according to the invention may also be used to create flat fabric and stiffen the flat fabric into a desired three dimensional shape. Materials having different melting points, such as polyester and polypropylene, are woven, knitted or braided together. The fabric may be shaped in a mold or on a mandrel having the desired shape, and when heated to the melting temperature of the lower melting point material and then cooled, the fabric will be fixed into the desired shape by the fusing of the yarns or filaments together.

In all the examples provided above, the relative stiffness of the end product may be tailored to a desired value by the choice of materials and the ratio of lower melting to higher melting temperature materials used, with greater stiffness being achieved if more lower melting temperature material is used. In addition to joining the various yarns and/or filaments together by heat fusing, adhesives may also be used. Selected ones or all of the filamentary members comprising the fabric may be coated with adhesive which causes the filamentary members to bond together at points of contact.

CLAIMS

What is claimed is:

1. A stiffened fabric, comprising a plurality of filamentary members interlaced together and engaging one another at mutual points of contact, said filamentary members being substantially rigidly joined together at selected ones of said mutual points of contact to substantially inhibit relative motion between said filamentary members and thereby impart a predetermined stiffness to said fabric, said filamentary members being free to move relatively to one another between said selected ones of said mutual points of contact.

2. A stiffened fabric according to Claim 1, wherein said selected ones of said mutual points of contact comprise substantially all of said mutual points of contact between said filamentary members.

3. A stiffened fabric according to Claim 1, wherein said plurality of filamentary members comprise a first group of filamentary members having a relatively low melting point interlaced with a second group of filamentary members having a relatively high melting point, said filamentary members of said first group being joined to filamentary members of said second group by heating said fabric to a temperature higher than said melting point of said first group of filamentary members and lower than said melting point of said second group of filamentary members thereby causing filamentary members of said first group to fuse with filamentary members of said second group at said mutual points of contact between said filamentary members of said first and said second groups.

4. A stiffened fabric according to Claim 3, wherein said filamentary members of said first group comprise polypropylene and said filamentary members of said second group comprise polyester, said polypropylene having a relatively lower melting point than said polyester.

5. A stiffened fabric according to Claim 3, wherein said filamentary members are interlaced by braiding into an elongated rod.

6. A stiffened fabric according to Claim 5, wherein said elongated rod comprises:

filamentary members of said second group braided together at a predetermined braid angle; and

filamentary members of said first group braided with said first group axially with respect to said rod.

7. A stiffened fabric according to Claim 3, wherein said fabric has a relatively greater number of filamentary members of said first group than the number of filamentary members of said second group.

8. A stiffened fabric according to Claim 1, further comprising an adhesive positioned at said selected ones of said mutual points of contact to join said filamentary members together, thereby stiffening said fabric.

9. A stiffened fabric according to Claim 8, wherein said adhesive comprises a water activated adhesive which joins said filamentary members together when in contact with water, thereby increasing the stiffness of said fabric.

10. A stiffened fabric according to Claim 8, wherein said adhesive comprises a water soluble adhesive which releases said filamentary members from one another when in contact with water, thereby reducing the stiffness of said fabric.

11. A stiffened fabric according to Claim 1, wherein said plurality of filamentary members includes a first group of filamentary members comprising a material which is absorbable when implanted in living tissue, filamentary members comprising said first group being interlaced with a second group of filamentary members, said filamentary members of said first group being initially joined to filamentary members of said second group at said mutual points of contact to provide a relatively

high stiffness to said fabric, said filamentary members of said first group being absorbed upon implantation of said fabric in living tissue and thereby providing a relatively lower stiffness to said fabric as said filamentary members of said first group are absorbed.

12. A stiffened fabric according to Claim 11, wherein said filamentary members are interlaced by braiding to form said fabric into an elongated rod shape.

13. A stiffened fabric according to Claim 11, wherein said filamentary members are interlaced to form a tube.

14. A stiffened fabric according to Claim 13, wherein said filamentary members are interlaced by braiding.

15. A stiffened fabric according to Claim 11, wherein said absorbable material comprises polylactic acid.

16. A stiffened fabric according to Claim 11, wherein said absorbable material comprises polyglycolic acid.

17. A stiffened fabric according to Claim 1, wherein said filamentary members are interlaced by weaving to provide a plurality of interstices in said fabric having a predetermined size and resulting in said fabric having a first predetermined porosity, said fabric further comprising a plurality of absorbable filamentary members comprising a material which is absorbable when implanted in living tissue, said absorbable filamentary members being interwoven in said fabric in overlying relation with said interstices thereby reducing the size of said interstices and resulting in said fabric having a second predetermined porosity smaller than said first predetermined porosity, said absorbable filamentary members being absorbed when said fabric is implanted in living tissue causing said porosity of said fabric to change from said second predetermined porosity to said first predetermined porosity.

18. A stiffened fabric according to Claim 17 wherein said absorbable filamentary members comprise polylactic acid.

19. A stiffened fabric according to Claim 17 wherein said absorbable filamentary members comprise polyglycolic acid.

20. A stiffened fabric according to Claim 1, further comprising an elongated core around which said filamentary members are interlaced to form a stiffened sheath surrounding said core.

21. A stiffened fabric according to Claim 20, wherein said filamentary members are interlaced by wrapping around said core.

22. A stiffened fabric according to Claim 21, wherein a portion of said filamentary members comprise a material which is absorbable in living tissue.

23. A stiffened fabric, comprising:

a plurality of filamentary members interlaced together and engaging one another at mutual points of contact; and

means for substantially rigidly attaching said filamentary members to one another at selected ones of said mutual points of contact, said attaching means being inelastic and substantially preventing relative motion between said filamentary members at said selected ones of said mutual points of contact and thereby imparting a predetermined stiffness to said fabric, said filamentary members being free to move relatively to one another between said selected ones of said mutual points of contact.

24. A stiffened fabric according to Claim 23, wherein said attaching means comprises fusing said filaments together at said selected ones of said mutual points of contact.

25. A stiffened fabric according to Claim 23, wherein said attaching means comprises adhesively bonding said filaments together at said selected ones of said mutual points of contact.

26. A method of making a fabric having a predetermined stiffness, said method comprising the steps of:

interlacing a plurality of filamentary members together, said filamentary members engaging one another at mutual points of contact;

rigidly joining together said filamentary members at selected ones of said mutual points of contact to substantially prevent relative motion at said selected ones of said mutual points of contact; and

allowing said filamentary members to move relatively to one another between said selected ones of said mutual points of contact.

27. A method of making a fabric implantable in human tissue and having a stiffness which changes over time, said method comprising the steps of:

interlacing a plurality of filamentary members together, said filamentary members engaging one another at mutual points of contact, at least some of said filamentary members comprising a material which is absorbable in living tissue;

rigidly joining together said filamentary members at selected ones of said mutual points of contact to substantially prevent relative motion at said selected ones of said mutual points of contact; and

allowing said filamentary members to move relatively to one another between said selected ones of said mutual points of contact, when said fabric is implanted in living tissue, said filamentary members comprising said absorbable material being absorbed, thereby reducing the stiffness of said fabric.

28. A method of making a fabric implantable in human tissue and having a porosity which changes over time, said method comprising the steps of:

interlacing a plurality of first filamentary members together thereby creating interstices between said filamentary members, said filamentary members engaging one another at mutual points of contact;

interlacing a plurality of second filamentary members comprising a material which is absorbable in living tissue with said first plurality of filamentary members, said second filamentary members being positioned to substantially coincide with said interstices;

rigidly joining together at least said first filamentary members at selected ones of said mutual points of contact to substantially prevent relative motion at said selected ones of said mutual points of contact; and

allowing said filamentary members to move relatively to one another between said selected ones of said mutual points of contact, when said fabric is implanted in living tissue, said second filamentary members comprising said absorbable material being absorbed thereby increasing the porosity of said fabric.

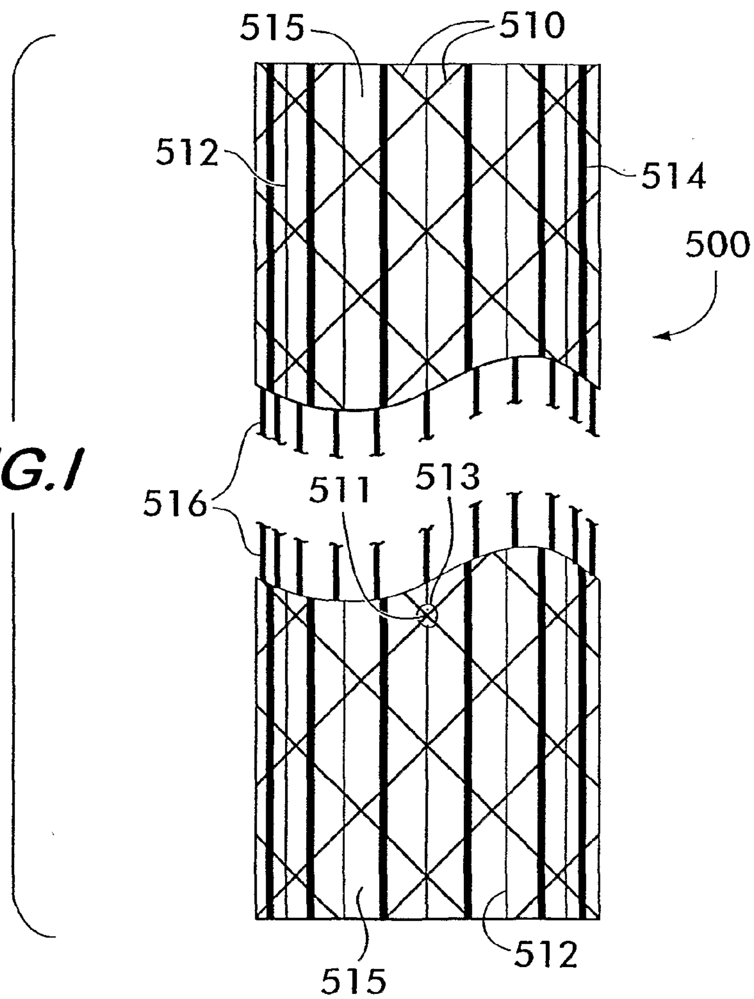

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FIG.1

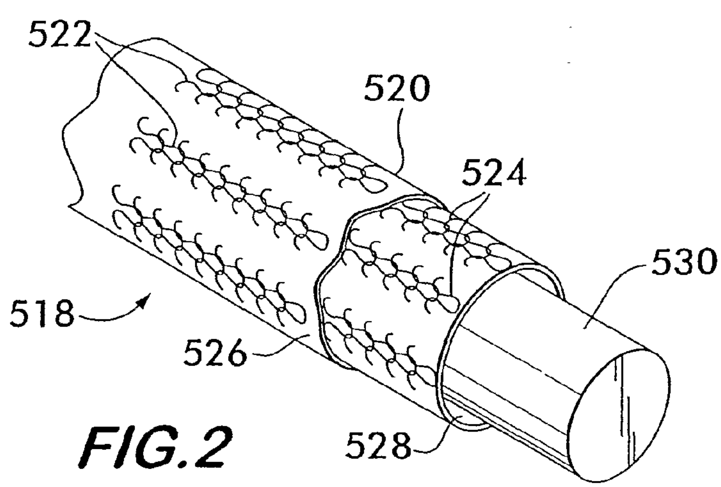
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FIG.2

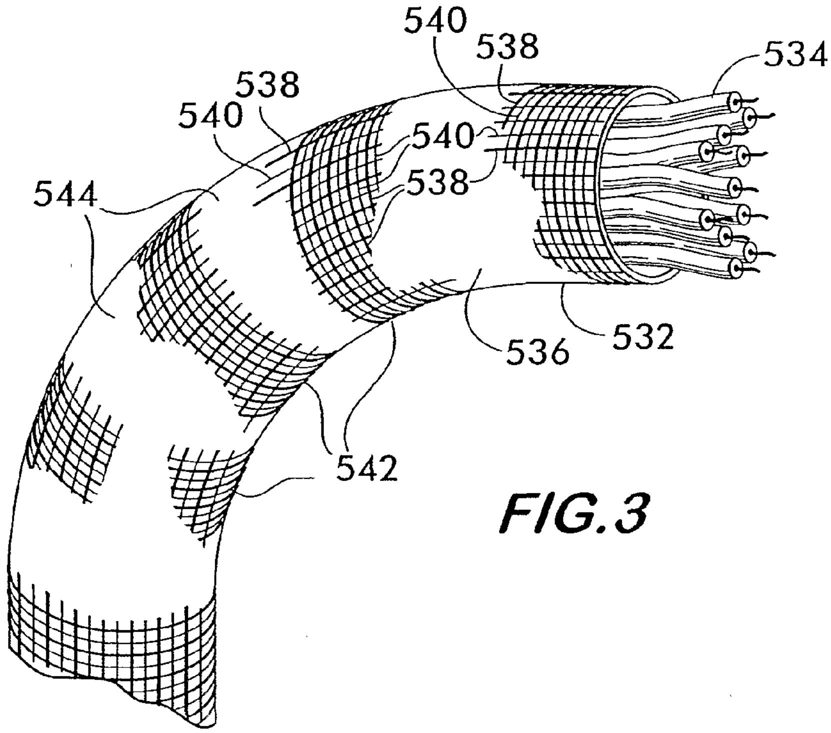

FIG.3

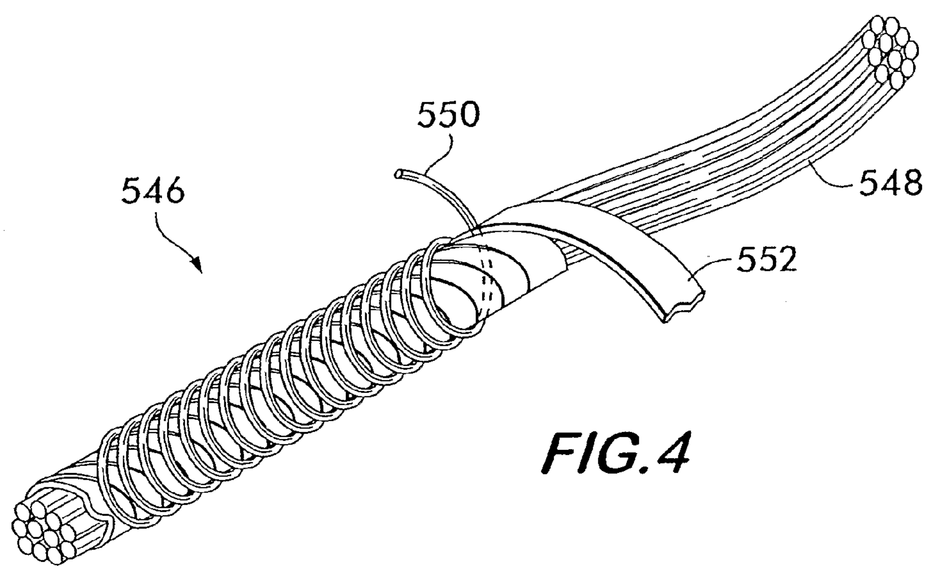

FIG.4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/31604

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :D04H 1/00, 3/14; B32B 27/04, 27/12
US CL :442/103,361,364,409,411,415; 604/265,288; 623/1.38,1.39,1.40
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)

U.S. : 442/103,361,364,409,411,415; 604/265,288; 623/1.38,1.39,1.40

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

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

Please See Extra Sheet.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,015,429 A (LAU et al) 18 January 2000, see entire document.	1-28
X,P	US 6,162,537 A (MARTIN et al) 19 December 2000, see entire document.	1-28

☐ 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 document 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 another 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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 NOVEMBER 2001	04 JAN 2002

Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	ULA C. RUDDOCK
Facsimile No. (703) 305-3230	Telephone No. (703) 308-0661

Form PCT/ISA/210 (second sheet) (July 1998)★

B. FIELDS SEARCHED
Electronic data bases consulted (Name of data base and where practicable terms used):

WEST
search terms: fiber, polyester, polypropylene, polylactic acid, polyglycolic acid, stiffened, fabric, textile, cloth, sheat, core, braiding, braided

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報**（Ａ）　(11)特許出願公開番号

特開平11－302943

(43)公開日　平成11年(1999)11月２日

(51)Int.Cl.^{6}	識別記号	ＦＩ	
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Ａ４２Ｂ　1/00		Ａ４２Ｂ　1/00	Ｋ
Ｄ０４Ｂ　1/16		Ｄ０４Ｂ　1/16	
Ｄ０４Ｃ　1/02		Ｄ０４Ｃ　1/02	

審査請求　未請求　請求項の数７　ＯＬ　（全 ５ 頁）

(21)出願番号　特願平10－109367

(22)出願日　平成10年(1998)４月20日

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最終頁に続く

(54)【発明の名称】　アパレル用生地及びブレード、それを用いた形態安定化繊維製品の製造方法

(57)【要約】
【課題】　アパレル用生地やブレードを素材として作られる繊維製品の形態安定性を簡単かつ安価な方法で高めることである。
【解決手段】　繊維製品の素材となるアパレル用生地やブレードの構成糸の中に熱可塑性樹脂の低融点糸を含ませ、素材を縫合するなどしてできる製品を低融点糸の融点を越える温度で熱成形して仕上げるようにしたのである。

【特許請求の範囲】

【請求項１】　よこ糸又は１本置きのたて糸と１本置きのよこ糸に低融点糸を用い、この低融点糸と他の糸を織成して成るアパレル用生地。

【請求項２】　ニットの地編組織の中に低融点糸を編込んで成るアパレル用生地。

【請求項３】　構成繊維の中に低融点糸を含ませた原糸を平打ちに組んで成るブレード。

【請求項４】　原糸の中に低融点糸を含ませ、その低融点糸の原糸と非低融点糸の原糸を平打ちに組んで成るブレード。

【請求項５】　請求項１又は２記載のアパレル用生地を裁断、縫合し、しかる後、低融点糸の融点を越える温度で熱成形することから成る形態安定化繊維製品の製造方法。

【請求項６】　請求項２記載のアパレル用生地を所要形状に成型編みし、しかる後、低融点糸の融点を越える温度で熱成形することから成る形態安定化繊維製品の製造方法。

【請求項７】　請求項３又は４記載のブレードを縫合又は織成してブレード製シートを形成し、そのシートを低融点糸の融点を越える温度で熱成形することから成る形態安定化繊維製品の製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、形態安定化繊維製品の製造方法と、その製品の専用素材として利用するアパレル用生地並びにブレードに関する。

【０００２】

【従来の技術】形態安定化が要求される繊維製品は、服、帽子、手提袋、手提バッグなど種々ある。

【０００３】この繊維製品の素材としては、織布、ニット（編物）が利用され、また、帽子等の素材としてブレード（平打ちの組紐）もよく利用されている。ところで、服、帽子などの素材生地のうち、綿、麻、或いはそれ等の繊維の混紡率を高めた糸を織成して作られる生地は特にしわがつき易い。このため、織成後の生地を樹脂加工（防しわ加工）してしわをつき難くすることがなされている。比較的しわになり難い合繊の高率混紡物に対しても、より完全な防しわ性をもたせるためにその樹脂加工がなされており、また、最近では、カッターシャツなどに対して高度な形態安定加工（ウォッシュアンドウエア加工やパーマネント加工など）も施されている。

【０００４】

【発明が解決しようとする課題】樹脂加工等で防しわ性を向上させる方法は、生地の製造工程が複雑になり、生産性やコスト面で問題がある。また、樹脂加工や特殊加工による形態安定機能は、クリーニング等によって徐々に消失するなど長続きしないことが多い。

【０００５】また、ニットは、織布に比べてしわになり難い反面、形崩れし易い欠点をもつが、防しわのための樹脂加工でニットに形状保持機能をもたせるのは難しい。

【０００６】さらに、帽子用真田と称される帽子用ブレードの場合、材料として天然繊維の中で最も腰の強い麻がよく用いられているが、麻のブレードで作った帽子は小さく折り畳むと折り目が残って体裁が悪くなる。また、麻は水に濡れると腰が弱くなって（しなやかになって）製品が形崩れし易くなる。

【０００７】そこで、この発明は、形崩れし難く、かつしわになり難い形態安定化繊維製品を簡単に作るための製造方法と、その方法用の専用素材を提供することを課題としている。

【０００８】

【課題を解決するための手段】上記の課題を解決するため、この発明においては、下記(1) 、(2) のこの発明のアパレル用生地を裁断、縫合し、しかる後、低融点糸の融点を越える温度で熱成形する方法を採る。

(1) よこ糸又は１本置きのたて糸と１本置きのよこ糸に低融点糸を用い、この低融点糸と他の糸を織成して成るアパレル用生地。

(2) ニットの地編組織の中に低融点糸を編込んで成るアパレル用生地。

【０００９】また、上記(2) のアパレル用生地を所要形状に成型編みし、しかる後、低融点糸の融点を越える温度で熱成形する方法を採る。

【００１０】さらに、下記(3) 、(4) のこの発明のブレードを縫合又は織成してブレード製シートを形成し、そのシートを低融点糸の融点を越える温度で熱成形する方法を採る。

(3) 構成繊維の中に低融点糸を含ませた原糸を平打ちに組んで成るブレード。

(4) 原糸の中に低融点糸を含ませ、その低融点糸の原糸と非低融点糸の原糸を平打ちに組んで成るブレード。

【００１１】

【作用】この発明のアパレル用生地及びブレードに含まれる低融点糸がこの発明の製造方法による熱成形時に塑性変形し、その後、冷え固まって成形後の形状を保とうとする。また、熱成形時に低融点糸が他の糸に付着して糸同志の熱固定もなされ、これによっても保形性が高まる。そのため、製品にしわがつき難く、製品の形崩れも起こり難くなる。

【００１２】さらに、この発明の製造方法では、低融点糸を含む素材を用いるので、仕上げ成形を熱成形とするだけでよく、工程の複雑化やコストアップを招かない。

【００１３】

【発明の実施の形態】図１～図３に、この発明のアパレル用生地の実施形態を示す。図１、図２はいずれも織布である。これ等の織布１、２は、実際は密に織られるが、図は判り易くするために糸の配列ピッチを粗くして

表わした。

【００１４】図１の織布１は、たて糸（経糸）３と、低融点糸のよこ糸（緯糸）４を平織りしたものである。

【００１５】また、図２の織布２は、通常のたて糸３と低融点糸のたて糸５を交互に配し、さらに、通常のよこ糸６と低融点糸のよこ糸４を交互に配し、これ等を平織したものである。

【００１６】たて糸３、よこ糸６には天然繊維（綿、麻など）、合成繊維（ポリエステル、ナイロンなど）再生繊維（レーヨン、ポリノジック、キュプラ）それ等の繊維の混紡糸などを用いる。

【００１７】また、よこ糸４、たて糸５には、一緒に織込む他の糸よりも融点の低い熱可塑性樹脂、例えば、ポリ塩化ビニル、ビニロン、アクリル、ポリプロピレン、アセテート、ポリウレタンなどで形成された糸を用いる。この低融点糸のよこ糸４とたて糸５はモノフィラメントであってもよいが、糸３、６が熱可塑性樹脂で形成されている場合には、それよりも融点の低い材料樹脂を選ぶ必要がある。

【００１８】なお、図２の織布２は、２本のよこ糸、即ち、通常のよこ糸６と低融点糸のよこ糸４を交互に織込む必要があるので、図１の織布に比べて織が面倒になるが、熱成形後に得られる形態安定化の機能はこの糸配置が最も優れる。

【００１９】織布の織り方は、平織りを例示したが、この平織りに限定されるものではない。

【００２０】図３は、第３実施形態のニットを示している。このニット７は、通常の編糸８と、低融点糸の編糸９（これは編糸８よりも融点が低い）を用いて両面編したものであって、２つのゴム編組織が腹合わせになっている。ニットは、織物に比べて元々しわがつき難いが、織物よりも形崩れし易い。しかし、例示のニット７は、熱成形すると低融点糸９による保形性が生じて形崩れが起こり難くなり、しわもつき難くなる。

【００２１】平編、或いはゴム編される通常の編糸に低融点糸を添えて編成した添え編糸のニットや編組織の中に低融点糸を編込んだレース地なども形態安定機能が高まり、形崩れが起こり難くなる。

【００２２】図４は、この発明の生地を素材にして作った帽子の一例である。この帽子１０に採用した生地は、天然繊維のたて糸と低融点糸であるポリ塩化ビニルのよこ糸を杉織した後、表面を起毛処理した織布１であり、その生地を所要形状に裁断、縫合し、さらに、成形型を用い、ポリ塩化ビニルの融点よりも高い温度で熱生成して帽子１０に仕立ててある。この帽子１０は小さく折り畳んでバッグや服のポケットなどに収納しても、取り出して元の状態に広げると折り目が自然に消え、体裁が悪くならない。

【００２３】なお、この発明の生地は、服、カーテン、手提袋など、他の繊維製品の素材としても利用できる。

【００２４】図５は、ブレードの実施形態である。このブレード１１は、数本（図は２本）のたて糸１２を中に通して数本（通常６～１２本）の原糸１３を平打ちに組んだものである。

【００２５】原糸１３は、図６（ａ）に示すように、麻の繊維１４の中に低融点糸（ここではポリ塩化ビニルの単繊維を用いた）１５を数本加えてこれを軽く撚り合わせたものや、図６（ｂ）に示すように、麻の繊維１４の束の外周に低融点糸１５を巻き沿わせたもの、或いは図６（ｃ）に示すように、低融点糸１５を芯にしてその外周に麻の繊維１４を軽く撚り合わせたものなどを用いた。

【００２６】低融点糸１５は、平打ちに組む原糸１３の何本かを低融点糸に置き代える形で加えてもよい。

【００２７】なお、原糸１３を構成する繊維１４は、低融点糸１５よりも融点の高い繊維であればよく、麻に限定されない。

【００２８】図７は、図５のブレード１１を部分的にオーバラップさせて渦状に巻き、隣り合うブレードの重ね部を縫合して（１６が縫い目）して作られた円形シート１７を示している。この円形シート１７を成形型（図示せず）を用いて低融点糸の融点以上の温度（他の糸は溶けたりちぢれたりしない温度）で熱成形し、図８に示すような帽子１８に仕上げる。

【００２９】このブレードは、籠、手提袋、手提バッグなど、他の製品の素材としても利用できる。そのブレードを縫合して継ぎ合わせる方法や、図９に示すように平織する方法で材料シートを作り、そのシートを加工すれば様々な形態安定化繊維製品を作ることができる。

【００３０】

【発明の効果】以上述べたように、この発明では素材と成すアパレル用生地やブレードに低融点糸を含ませ、その生地やブレードで作られた製品を熱成形することにより低融点糸を変形させ、さらに、他の糸に付着させるので製品の形態安定性を簡単に、しかも、コストをかけずに高めることができる。

【００３１】なお、この発明の方法で得られる製品はしわがつき難く、形態の回復性に優れるため、ブレード製帽子等も小さく折り畳んでバッグ等に収納することができる。

【００３２】また、熱成形後の低融点糸は水に濡れても成形後の形を保つので、水を吸うセルロース系の繊維（綿、麻など）を用いた生地やブレードで作られる繊維製品にこの発明を適用すると、水濡れ、洗濯等による形態悪化を防止できる。

【図面の簡単な説明】

【図１】この発明の生地（織布）の実施形態の組織図

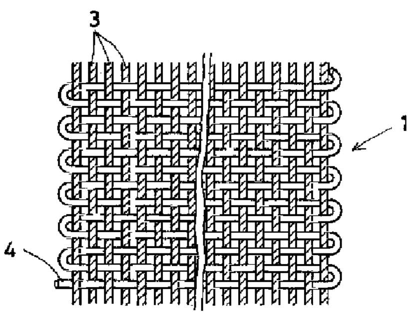
【図２】他の実施形態（織布）の組織図

【図３】更に他の実施形態（ニット）の組織図

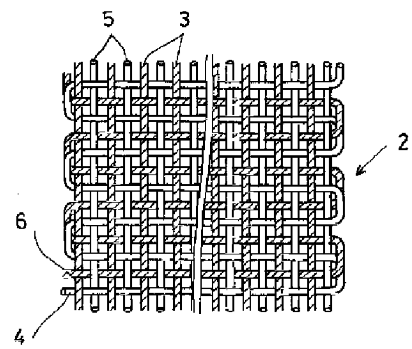
【図４】図１の生地で作った繊維製品の一例（帽子）を

示す斜視図
【図５】この発明のブレードの概要を示す平面図
【図６】低融点糸を含む原糸の具体例を示す図
【図７】ブレードを渦状に縫合して得られる円形シートの平面図
【図８】図７の円形シートを熱成形して得られるブレード製帽子の一例を示す斜視図
【図９】ブレードを平織りしてできるシートの平面図
【符号の説明】
１、２　織布
３　通常のたて糸
４　低融点糸のよこ糸
５　低融点糸のたて糸
６　通常のよこ糸
７　ニット
８　編糸
９　低融点糸の編糸
１０　帽子
１１　ブレード
１２　たて糸
１３　原糸
１４　麻の繊維
１５　低融点糸
１６　縫い目
１７　円形シート
１８　ブレード製帽子

【図１】



【図２】



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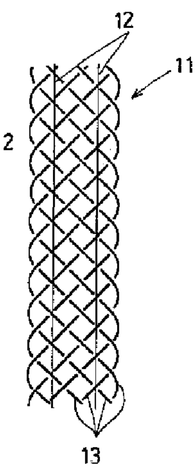

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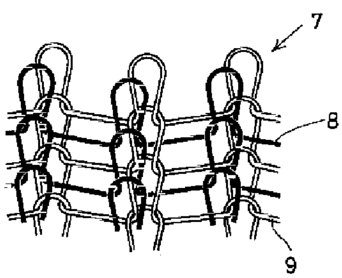

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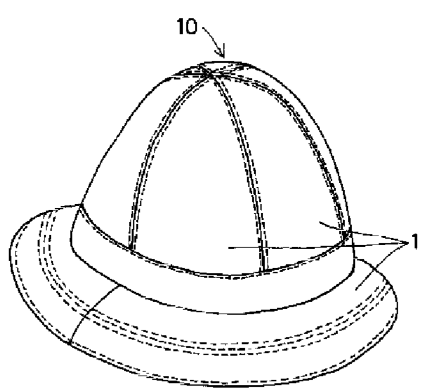

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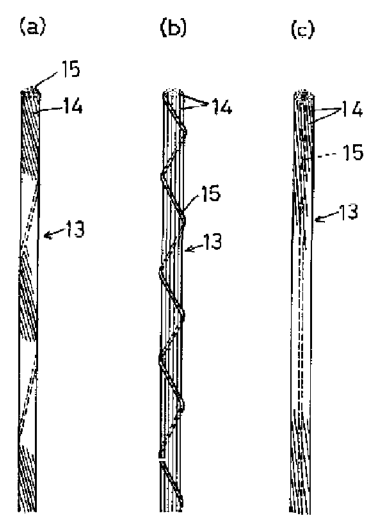

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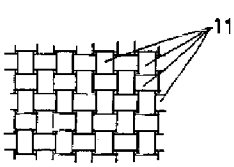

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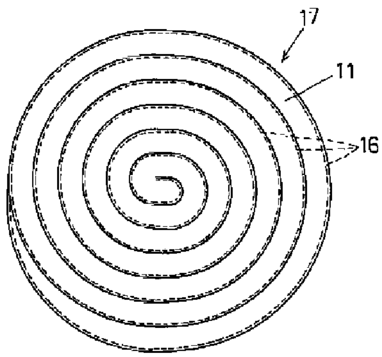

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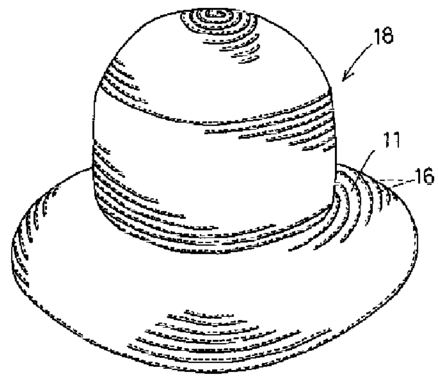

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(54) Textiles Flächengebilde

(57) Die Erfindung betrifft ein textiles Flächengebilde, in das Garn mit Anteilen von größenordnungsmäßig zehn bis zwanzig Gewichtsprozenten niedrigschmelzender Bindefaser und neunzig bis achtzig Gewichtsprozenten von bei einer höheren Temperatur als die Bindefasern schmelzenden Fasern oder nichtschmelzenden Fasern eingearbeitet ist. Im Vergleich zu Laminaten wird durch Wegfall des für die Erstellung von Laminaten erforderlichen Kaschiervorganges ein Arbeitsschritt eingespart. Eine Delaminierung der Einzelkomponenten ist ausgeschlossen, da diese bindungstechnisch miteinander verbunden sind.

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Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Beschreibung

Die Erfindung betrifft ein textiles Flächengebilde.

Aus DE-GM 94 09 763 ist ein Laminat mit einer auf einer voluminösen Warenbahn aufkaschierten textilen Oberware bekannt, bei dem die voluminöse Warenbahn als thermofusioniertes Vlies ausgebildet ist. Die Herstellung eines Laminates erfordert bei der Herstellung den Arbeitsschritt eines Kaschiervorganges. Weiterhin besteht das Problem, eine Delaminierung der Einzelkomponenten sicher auszuschließen.

Der Erfindung liegt die Aufgabe zugrunde, ein textiles Flächengebilde zu schaffen, welches die Vorteile des bekannten Laminates, nicht aber dessen Nachteile aufweist.

Zur Lösung dieser Aufgabe ist erfindungsgemäß vorgesehen, daß in das textile Flächengebilde Garn mit Anteilen von größenordnungsmäßig zehn bis zwanzig Gewichtsprozenten niedrigschmelzender Bindefaser und neunzig bis achtzig Gewichtsprozenten von bei einer höheren Temperatur als die Bindefasern schmelzenden Fasern oder nicht schmelzenden Fasern eingearbeitet ist.

Sofern es sich bei dem textilen Flächengebilde beispielsweise um eine Webware handelt, kann diese bindungstechnisch so ausgelegt werden, daß bei der Erstellung ein sogenannter "Unterschuß" miteingetragen und eingebunden wird. Dieser Unterschuß ist von der Dekoroberseite her nicht sichtbar. Der Unterschuß kann sowohl in der Garnstärke (somit im Gewicht pro Quadratmeter) und der Garnzusammensetzung variiert werden. Es können beispielsweise niedrigschmelzende Bindefasern mit in das Garn eingearbeitet sein (zehn bis fünfzig Gewichtsprozente), die bei einer niedrigeren Temperatur schmelzen als die Restfasern.

Zweckmäßige Ausgestaltungen der Erfindung ergeben sich aus den Unteransprüchen.

Ähnlich einem "Unterschuß" bei einer Webware können andere textile Konstruktionen, wie Wirk-, Raschel- und Strickware, mit den in den Schutzansprüchen beschriebenen Garnen kombiniert werden.

Bei der Erfindung ist vorteilhaft, daß im Vergleich zu Laminaten durch Wegfall des für die Erstellung von Laminaten erforderlichen Kaschiervorganges ein Arbeitsschritt eingespart wird. Eine Delaminierung der Einzelkomponenten ist ausgeschlossen, da diese bindungstechnisch miteinander verbunden sind.

Weiterhin ist eine deutlich verbesserte Drapierbarkeit der Stoffe vorteilhaft, da einerseits keine Verhärtung durch ein Klebemedium entsteht und andererseits der "innige" Verbund von Ober- und Unterware selbst bei kritischen Radien zu keiner Knickbildung führt.

Zudem ist vorteilhaft, daß der Unteraufbau des textilen Flächengebildes durch entsprechende Verfahren aufgerauht werden kann, wodurch die Einzelfasern eine Orientierung in die "dritte Dimension" erhalten. Durch Aktivierung der niedrigschmelzenden Fasern kann diese "Volumigkeit" fixiert werden, wodurch eine Polsterwirkung erzielt wird.

Patentansprüche

1. Textiles Flächengebilde, **dadurch gekennzeichnet,** daß in das Flächengebilde Garn mit Anteilen von größenordnungsmäßig zehn bis zwanzig Gewichtsprozenten niedrigschmelzender Bindefaser und neunzig bis achtzig Gewichtsprozenten von bei einer höheren Temperatur als die Bindefasern schmelzenden Fasern oder nichtschmelzenden Fasern eingearbeitet ist.

2. Textiles Flächengebilde nach Anspruch 1, dadurch gekennzeichnet, daß das Garn eine Bikomponenten-Polyesterfaser aufweist, und daß die bei einer höheren Temperatur als Bindefasern schmelzenden Fasern oder nichtschmelzenden Fasern solche auf der Basis von Polyester oder Polyestermischgeweben sind.

3. Textiles Flächengebilde nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die bei einer höheren Temperatur als Bindefasern schmelzenden oder nichtschmelzenden Fasern recyclierte Fasern sind.

4. Textiles Flächengebilde nach Anspruch 3, dadurch gekennzeichnet, daß die recyclierten Fasern Reißspinnfasern sind.

5. Textiles Flächengebilde nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß der Anteil an niedrigschmelzender Bindefaser bei fünfzehn Gewichtsprozenten liegt.

6. Textiles Flächengebilde nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß der Anteil an niedrigschmelzenden Bindefasern bei dreißig Gewichtsprozenten liegt.

7. Textiles Flächengebilde nach Anspruch 6, dadurch gekennzeichnet, daß eine thermoplastische Faser mit einem ähnlichen Hochfrequenz-Schweißverhalten wie Polyvenylchlorid Verwendung findet.

8. Textiles Flächengebilde nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß das textile Flächengebilde eine Webware ist.

9. Textiles Flächengebilde nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß das textile Flächengebilde eine Wirkware ist.

10. Textiles Flächengebilde nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß das textile Flächengebilde eine Raschelware ist.

11. Textiles Flächengebilde nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß das textile Flächengebilde eine Strickware ist.

12. Textiles Flächengebilde nach Anspruch 8, dadurch gekennzeichnet, daß das Garn als Unterschuß in die Webware eingetragen ist.

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(54) **Halbzeug für Verbundwerkstoff**

(57) Ein Fertigprodukt oder ein insbesondere zur Herstellung von Formteilen geeignetes Halbzeug (20,30) besteht aus einer Maschenware, in der wenigstens ein Faden (4) aus einem ersten Material und wenigstens ein anderer Faden (5) aus einem zweiten Material verarbeitet sind. Zumindest das zweite Material ist thermoplastisch und hat eine Erweichungstemperatur (Glasumwandlungspunkt), die niedriger liegt als die Erweichungstemperatur des ersten Materials. Das zweite Material ist ein Material, das sich bei Erwärmung über eine vorbestimmte Temperatur stoffschlüssig mit dem ersten Material und mit sich selbst verbindet.

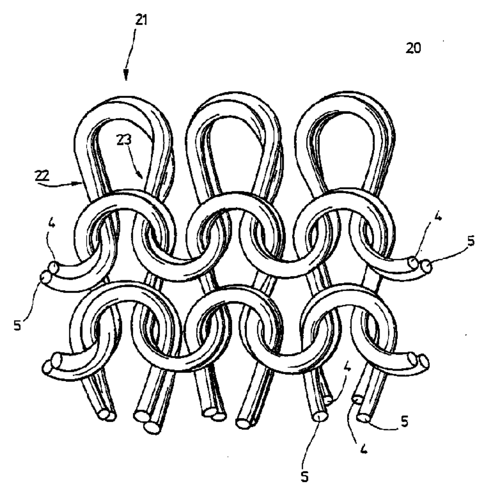

Fig. 1

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Beschreibung

Grundsätzlich eignen sich thermoplastische Kunststoffe sehr gut dazu, komplizierte Formteile herzustellen. Hierzu sind unterschiedliche Vorgehensweisen bekannt.

Der thermoplastische Kunststorf kann in Gestalt von Pellets vorliegen und wird in entsprechenden Spritzgußmaschinen aufgeschmolzen und in die Spritzgußform unter Druck eingefüllt. Derartige Formteile haben nur eine begrenzte Festigkeit, die sich ausschließlich aufgrund der Eigenschaften des thermoplastischen Kunststoffes ergibt. Allerdings sind mit dem Spritzgußverfahren bislang im wesentlichen nur Teile hergestellbar, die kein allzu ungünstiges Verhältnis zwischen der Wandstärke und der Fläche der betreffenden Wand aufweisen.

Bei ungünstigeren Verhältnissen, also Teilen, die, bezogen auf ihre flächige Ausdehnung, verhältnismäßig dünn sind, wird eine andere Vorgehensweise bevorzugt, die darin besteht, den thermoplastischen Kunststoff zunächst als große Folie zu extrudieren, die sodann im Tiefziehverfahren in die endgültige Gestalt gebracht wird. Auch diese Teile haben eine geringe Festigkeit. Zum Erhöhen der Festigkeit bleibt nichts anderes übrig, als Fasern einzubetten. In diesem Falle wird eine andere Technik angewendet, die darin besteht, daß lange Glasfasern in ein noch nicht vollständig ausgehärtetes thermoplastisches Harz eingebettet werden und diese zähe Masse in eine Form gegeben wird, in der die Masse in die entsprechende Gestalt umgeformt und ausgehärtet wird. Nachteilig bei diesem Verfahren ist die begrenzte Haltbarkeit des Halbzeugs, das dazu neigt, im Laufe der Zeit vollständig auszuhärten, so daß es nicht mehr die gewünschte, etwa kaugummiartige Konsistenz hat. Im ausgehärteten Zustand kann es in der Regel in komplizierte Formen nicht mehr eingebracht werden.

Es wurde deswegen bereits versucht, in die Form die Fasern einzulegen und anschließend die Form mit dem thermoplastischen Material zu füllen. Auch hierbei sind Probleme aufgetreten, die durch das Fasermaterial hervorgerufen werden, das einerseits von dem thermoplastischen Kunststoff zur Seite gedrückt wird und andererseits eine gleichmäßige Durchdringung verhindert, da das Fasermaterial für den thermoplastischen Kunststoff wie eine Art Filter wirkt.

Die für großflächige Teile bislang praktikabelste Technik besteht darin, auf einen Formkörper ein Glasgewebe oder Glasrovings Schicht für Schicht aufzulaminieren. Diese Laminiertechnik ist außerordentlich aufwendig und deswegen nur bei von Haus aus teuren Gegenständen einigermaßen rentabel.

Darüber hinaus ist es aus der DE-A-41 37 406 bekannt, ein Hybridgarn herzustellen, das aus ca. 64% Kohlenstoffasern und 38% Polyamidfasern besteht. Dieses Garn wird zu einem textilen Flächengebilde verarbeitet, beispielsweise ein Gestrick. Durch Wärmeeinwirkung bei gleichzeitigem Pressen des Gestricks kann daraus ein faserverstärkter Formkörper erzeugt werden. Allerdings hat die Praxis gezeigt, daß dieses Hybridgarn eine extreme statische Aufladung beim Stricken zeigt. Die starke elektrostatische Aufladung behindert den Strickvorgang, so daß ein Stricken oder Wirken parktisch nicht möglich ist. Das Hybridgarn kann nur zu anderen textilen Flächengebilden, wie Geweben, Gelegen und Wickelkörpern verarbeitet werden, also in Verfahren, bei denen die elektrostatische Aufladung nicht auftritt oder nicht stört.

Ferner kann bei dem Hybridgarn der verarbeitende Betrieb das Mischungsverhältnis zwischen den beiden Materialien nicht variieren. Das Mischungsverhältnis ist durch den Aufbau des Hybridgarns fest vorgegeben.

Ausgehend hiervon ist es Aufgabe der Erfindung, ein Halbzeug zur Herstellung großflächiger Formteile zu schaffen, das mit geringem Aufwand herstellbar ist.

Diese Aufgabe wird erfindungsgemäß durch ein Halbzeug mit den Merkmalen des Anspruches 1 bzw. des Anspruches 2 gelöst.

Die Verwendung der Maschenware, die aus Fäden zweierlei Materials besteht, sorgt dafür, daß in jedem genügend großen Volumenelement des textilen Flächengebildes vergleichbare Mengen des ersten und des zweiten Materials vorhanden sind. Das so hergestellte Halbzeug kann in beliebige Formen eingelegt werden, die lediglich erwärmt werden müssen, um das thermoplastische zweite Material aufzuschmelzen, d.h. auf eine Temperatur oberhalb des Glasumwandlungspunktes zu bringen, so daß es sich stoffschlüssig, d.h. dauerhaft und fest mit den Fäden aus dem ersten Material verbinden kann. Wegen der gleichmäßigen oder gleichförmigen Verteilung der Fäden des zweiten Materials in dem Halbzeug befindet sich der als Bindemittel dienende thermoplastische Kunststoff bereits von Haus aus an derjenigen Stelle, an der er die Fäden des ersten Materials miteinander verkleben soll. Er braucht keine weiten Strecken zu fließen, da unmittelbar das Bindemittel in Gestalt der Fäden aus dem zweiten Material bereitsteht. Deformationen des textilen Flächengebildes durch Fließen des thermoplastischen Materials sind dadurch ebenso ausgeschlossen wie Fehlstellen, hervorgerufen durch einen Mangel an thermoplastischem Kunststoff zum Verbinden der Fäden aus dem ersten Material.

Ferner hat das Halbzeug den Vorteil, daß das Mischungsverhältnis zwischen den beiden Materialien im verarbeitenden Betrieb praktisch beliebig frei wählbar ist.

Eventuell sonst auftretende elektrostatische Aufladung kann dadurch verhindert werden, daß das sich elektrostatisch aufladende Material vor dem Verarbeitungsvorgang entsprechend vorbehandelt wird. Aufgrund der Tatsache, daß beide Materialien getrennt vorbearbeitet werden können, lassen sich Probleme beim Verstricken weitgehend verhindern.

Da der thermoplastische Kunststoff über die gesamte Fläche des Halbzeugs gleichmäßig verteilt zur Verfügung steht, ist die Größe des herzustellenden Fertigfabrikats praktisch unbegrenzt. Durch Übereinanderlegen mehrerer Lagen des erfindungsgemäßen Halbzeugs können beliebig starke und in der Fläche beliebig große Werkstücke ohne weiteres hergestellt werden.

Ein weiterer wesentlicher Vorteil des erfindungsgemäßen Halbzeugs besteht darin, daß fertig ausgehärteter und somit dauerhafter thermoplastischer Kunststoff verwendet wird. Das Halbzeug unterliegt vor der Verarbeitung keiner besonderen Alterung, die eine nachträgliche Verarbeitung erschweren würde. Es ist auch weder klebrig, noch sind besondere Vorsichtsmaßnahmen bei der Handhabung notwendig, wie dies bei manchen, nicht vollständig ausgehärteten Thermoplasten der Fall ist.

Da das Halbzeug aus im wesentlichen nicht miteinander verbundenen einzelnen Fäden besteht, kann es auch leicht in nahezu jede beliebige Form gebracht werden. Einem Umformen beim Einlegen in das betreffende Formgebungswerkzeug setzt es keine besonderen Kräfte entgegen.

Falls aus bestimmten anderen Gesichtspunkten heraus für das erste Material ein Stoff in Frage kommt, der sich nicht unmittelbar mit dem zweiten Material stoffschlüssig verbindet, besteht die Möglichkeit, die Fäden des ersten Materials mit einem als Haftvermittler dienenden dritten Material vor der Verarbeitung zu beschichten.

Zweckmäßigerweise hat das zweite Material ein Formgedächtnis, derart, daß es bei Erwärmung über eine vorbestimmte Temperatur und anschließende Abkühlung den Verlauf beibehält, den es während der Erwärmung inne hatte. Dadurch kann erreicht werden, daß bei der Herstellung des Halbzeugs die Struktur in bestimmter Weise vorher festgelegt wird, wodurch beispielsweise die von den Fäden des ersten Materials gebildete Struktur unter einer vorbestimmten Vorspannung gehalten werden.

Das erste Material ist vorzugsweise kein organisches Material und kann aus Stoffen wie Metall, Keramik oder anderen anorganischen Verbindungen ausgewählt sein.

Der mechanische Aufbau der Fäden des ersten Materials und der Fäden des zweiten Materials kann entsprechend den mechanischen Anforderungen bei der Herstellung, Verarbeitung oder den Anforderungen an das Fertigprodukt ausgewählt werden. So ist es beispielsweise besonders einfach, wenn die Fäden aus dem zweiten Material Endlosgarne oder Monofile sind, da sich der thermoplastische Kunststoff ohne weiteres in diese Form bringen läßt. Bei Karbonfasern oder ähnlichen Fasern sind Endlosfasern unter Umständen nur bedingt herstellbar, weshalb Garne aus Stapelfasern dort zweckmäßig sein können.

Für die Gestricke oder Gewirke kommen grundsätzlich alle Bindungsarten in Frage, wobei einfache Bindungsarten bevorzugt werden, weil sie die geringste Anzahl von Kreuzungspunkten im Bereich der Maschen aufweisen. Wegen der einfacheren Verarbeitung wird einfaches rechts/links Gestrick bevorzugt, weil bei diesem Gestrick ohne weiteres lange Maschenschenkel erzeugt werden können.

Die langen Maschenschenkel wiederum ergeben eine gute Festigkeit des aus dem erfindungsgemäßen Halbzeug hergestellten Fertigproduktes.

Bei der Maschenware können die Fäden aus dem ersten und dem zweiten Material entweder zufällig verteilt an der Vorder- und der Rückseite liegen, wodurch eine leichte gleichmäßige Durchdringung des aus den ersten Fäden gebildeten Gestricks mit dem thermoplastischen Material erzielt wird. Andererseits kann auch eine sogenannte platierte Ware verwendet werden, bei der sich der thermoplastische Faden ausschließlich auf einer und der nichtthermoplastische Faden auf der anderen Seite befindet. Wird ein solches Halbzeug zum Fertigprodukt verarbeitet, kann durch entsprechende kurze Einwirkung von Wärme eine vollständige Durchdringung des Gestricks aus den Fäden des ersten Materials durch den thermoplastischen Kunststoff verhindert werden, wodurch auf einer Seite der Gestrickcharakter erhalten bleibt.

Die Verarbeitung des Halbzeugs läßt sich vereinfachen, wenn es als eben liegendes Flächengebilde mit einer gewissen inneren Spannung vorfixiert ist. Diese Vorfixierung läßt sich entweder erreichen, indem das Halbzeug auf eine Temperatur erwärmt wird, bei der das zweite Material sich noch nicht stoffschlüssig mit anderen Teilen des Halbzeugs verbindet, aber bereits Formgedächtnis auf den Zustand umprogrammiert wird, den es während der Erwärmung einnimmt. Durch anschließendes Abkühlenlassen auf Umgebungstemperatur behalten dann die Fäden des zweiten Materials im wesentlichen ihre Gestalt, in die sie während des Erwärmens auf die Fixiertemperatur gebracht wurden. Ein solches Halbzeug ist nach wie vor sehr elastisch.

Es besteht auch die Möglichkeit, die Temperatur beim Fixieren weiter zu erhöhen, so weit, bis bereits Teile der Fäden des zweiten Materials beginnen, sich stoffschlüssig mit anderen Teilen des Halbzeugs zu verbinden. Hierdurch entsteht eine punktuelle Verbindung der Fäden des zweiten Materials mit sich selbst oder mit Fäden des ersten Materials. Nach dem Abkühlen auf die Umgebungstemperatur wird wegen der punktuellen Verbindung ein vergleichsweise recht steifes Halbzeug erhalten,das aber dennoch eine begrenzte Beweglichkeit hat und ohne Schaden auch in komplizierte Formen eingelegt werden kann, insbesondere dann, wenn während des Einlegens gleichzeitig durch Heizen die Fixierpunkte wiederum gelöst werden.

Der Anteil an Fäden gleichen Materials richtet sich nach der Festigkeit des Fertigproduktes bzw. dem im Fertigprodukt enthaltenen Bindemittelanteil.

In der Zeichnung sind Ausführungsbeispiele des Gegenstandes der Erfindung dargestellt. Es zeigen:

Fig. 1 ein Halbzeug in Gestalt eines rechts/links Gestricks mit zufälligem Verlauf der Fäden des zweiten Materials und

Fig. 2 ein Halbzeug in Gestalt eines rechts/links Gestricks.

Fig. 1 zeigt ein Halbzeug 20 in Gestalt eines textilen Flächengebildes, das von einem rechts/links Gestrick gebildet ist. Das rechts/links Gestrick besteht aus zwei Fäden 4 und 5 aus einem ersten und einem zweiten Material. Diese beiden Fäden 4 und 5 sind gemeinsam verstrickt, und zwar werden sie beim Verstricken so in die Nadeln der jeweiligen Strickmaschine eingelegt, daß willkürlich und zufällig verteilt der Faden 4 oder der Faden 5 an der Vorder- oder rechten Seite des Gestrikkes 20 erscheint. So ist beispielsweise bei einer Masche 21 der Faden 4 im linken Maschenschenkel 22 vorne, während er im rechten Maschenschenkel 23 an der vom Betrachter abgewandten Rückseite verläuft.

Das erste Material, aus dem der Faden 4 besteht, ist bevorzugt kein organisches Material, sondern ein Material, das aus den Stoffen Metall, Keramik oder sonstige anorganische Verbindungen wie Mineralfasern ausgewählt ist. Der Faden 5 dagegen besteht aus einem thermoplastischen Kunststoff. Als thermoplastisches Material kommt jeder Kunststoff in Frage, der geeignet ist, sich durch Erwärmen stoffschlüssig mit sich selbst oder dem Material für den ersten Faden 4 zu verbinden. Falls die Haftung unzureichend ist, besteht auch die Möglichkeit, den ersten Faden 4 mit einem dritten Material zu beschichten, das als Haftvermittler oder Haftbrücke zwischen dem zweiten Material und dem ersten Material dient.

Die Fäden 4 können Garne, Spinnfasergarne, Endlosgarne, Monifile, gefachte Garne oder Zwirne sein, ebenso wie die Fäden 5 Garne, Spinnfasergarne, Endlosgarne, Monofile, gefachte Garne oder Zwirne sein können, wobei die Art des Fadens 4 von der Art des Fadens 5 abweichen kann. Zweckmäßigerweise sind die Fäden 5 aus dem zweiten Material, dem thermoplastischen Kunststoff, Endlosgarne oder Monofile oder daraus hergestellte Zwirne, da es ohne weiteres möglich ist, entsprechende Endlosfilamente herzustellen.

Das Gestrick 20 kann als Flachgestrick auf einer Flachstrickmaschine oder als Schlauch auf einer Rundstrickmaschine erzeugt werden. Zweckmäßigerweise wird es unmittelbar nach dem Stricken durch Erwärmen fixiert, wobei zwei Fälle unterschieden werden können. Im einen Fall wird beim Fixieren die Temperatur des Gestricks 20 nur so weit erhöht, daß der aus dem thermoplastischen Kunststoff bestehende Faden 5 noch nicht aufschmilzt, sondern gerade eben kräftefrei den Verlauf annimmt, den das Gestrick 20 während des Fixierens aufgrund außen angreifender Kräfte annimmt. Sodann läßt man das Gestrick 20,ohne die von außen angreifenden Kräfte zu verändern, sich wieder auf Raumtemperatur abkühlen, womit die Fäden 5 aus dem thermoplastischen Kunststoff dauerhaft in die gewünschte Maschenstruktur umgeformt sind. Selbst beim Wegnehmen der äußeren Vorspannkräfte springt das Gestrick 20 nicht mehr in seine ursprüngliche Gestalt zurück. Ein solcher maßen vorfixiertes Gestrick 20 hat praktisch die ursprüngliche Schmiegsamkeit und läßt sich ohne Kraftaufwand in nahezu jede beliebige Form bringen,und das praktisch faltenfrei.

Eine andere Möglichkeit der Vorfixierung besteht darin, die Temperatur des Gestricks 20 so weit zu erhöhen, bis lokal der Faden 5 aus dem thermoplastischen Kunststoff an der Oberfläche klebrig wird und sich an den Kreuzungsstellen mit den darüber oder darunter verlaufenden anderen Fäden 4, 5 stoffschlüssig verbindet. Nach dem Abkühlen auf Umgebungstemperatur ist ein punktuell bereits verfestigtes Gewebe erhalten, das wesentlich steifer ist als das, das erhalten wird, wenn die Erwärmungstemperatur gerade nur so weit getrieben wird, bis das Formgedächtnis des thermoplastischen Kunststoffes auf den anderen Verlauf des Fadens 4 umprogrammiert wird.

Das so erhaltene Gestrick 20 kann beim Verwender in eine beheizbare Form eingelegt werden, die das Halbzeug 1 auf eine Temperatur bringt, bei der die Fäden 5 aus dem zweiten Material aufschmelzen, so daß sich deren Material gleichmäßig über die gesamte Fläche verteilt und dadurch die in dem aufgeschmolzenen Material eingebetteten Fäden 4 aus dem ersten Material stoffschlüssig miteinander durch Verkleben verbindet. Nach dem Erkalten wird ein in sich steifes und verfestigtes Formteil, das auch eben sein kann, erhalten.

Das in Fig. 1 dargestellte Gestrick 20 kann entweder das Fertigprodukt sein, wenn es beispielsweise eine Tapete bilden soll oder es ist ein Halbzeug, aus dem, wie vorher beschrieben, Formteile gepreßt werden können. Beim Pressen stellen aie aus dem thermoplastischen Kunststoff bestehenden Fäden den gleichmäßiger verteilten Bindemittelvorrat dar, mit dessen Hilfe die im fertigen Formteil eingebettete Verstärkung aus den verstrickten Fäden 4 eingehüllt ist.

Es hat sich gezeigt, daß besonders feste Formteile erhalten werden können, wenn das Stricken so erfolgt, daß die Maschenschenkel 22, 23 eine Länge von größer 2 mm aufweisen. Vorzugsweise beträgt die Länge der Maschenschenkel 22, 23 zwischen 2 mm und 12 mm, besser zwischen 4 mm und 8 mm. Unter bestimmten Umständen können besonders gute Verhältnisse mit 6 mm Schenkellänge erzielt werden.

Wie vorerwähnt, kann das Verhältnis zwischen der Menge an Bindemittel zu der Menge an Verstärkungseinlage durch das Volumenverhältnis zwischen den Fäden 4 und den Fäden 5 gesteuert bzw. eingestellt werden.

Weil der Faden 4 aus dem thermoplastischen Kunststoff zufällig verteilt an der Vorder- und an der Rückseite des Gestricks 20 liegt, entsteht beim Pressen des Halbzeugs in den entsprechenden Formkörper ein Formkörper, bei dem die Einlage weitgehend in der Mitte verläuft, d.h. an beiden Seiten der Einlage ist thermoplastisches Bindemittel vorhanden.

Wenn es gewünscht ist, daß das Bindemittel sich vorzugsweise auf einer Seite des Formteils befindet, während die andere Seite von dem Bindemittel weitgehend frei ist, kann das Gestrick als platierte Ware hergestellt werden, wie dies in Fig. 3 dargestellt ist. Bei diesem Gestrick 30 liegt der Faden 5 beispielsweise immer nur an der vom Betrachter abliegenden rechten Seite des Gestricks, während der Faden 4 an der dem Betrachter zugekehrten linken Seite verläuft.

In den beiden Fig. 1 und 2 ist jeweils ein einfaches rechts/links Gestrick gezeigt. Dieses Gestrick ist auch mit großer Länge der Maschenschenkel verhältnismäßig einfach herzustellen. Allerdings ist das gezeigte rechts/links Gestrick keineswegs die einzige geeignete Bindungsart. Vielmehr kommen auch rechts/rechts/ oder links/links Gestricke sowie gegebenenfalls Interlockware in Betracht. Schließlich versteht sich, daß Halbzeug mit vergleichbaren Eigenschaften auch als Wirkware bzw. Kettenwirkware hergestellt werden kann. Der Vorteil einer Wirkware liegt vor allen Dingen darin, daß das Halbzeug in Richtung parallel zu zwei unter einem spitzen Winkel zueinander verlaufenden Achsen eine recht hohe Zugfestigkeit aufweist.

In jedem Fall ist die Weiterverarbeitung,wie oben beschrieben, wobei ein wesentlicher Vorteil darin besteht, daß der mit verarbeitete Faden 5 oder gegebenenfalls mehrere Fäden 5 aus thermoplastischem Material praktisch keine Alterung aufweisen, womit das Halbzeug 20 oder 30 beliebig lange bis zur Verarbeitung in das Formteil lagerfähig ist. Außerdem ist der Faden 5 aus thermoplastischem Kunststoff bei Umgebungstemperatur nicht klebrig, was bei der Weiterverarbeitung ebenfalls einen erheblichen Vorteil darstellt.

Wegen des überall gleichen Mischungsverhältnisses zwischen dem Fadenanteil aus dem ersten Material und dem Fadenanteil aus dem zweiten Material, nämlich dem thermoplastischen Kunststoff, besteht in jedem Volumenelement des Halbzeugs 20 oder 30 der gleiche Vorrat an Bindemittel, gebildet durch den Faden 5 aus thermoplastischem Kunststoff. Beim Verpressen braucht das Bindemittel nur Strecken entsprechend der Größe der Maschenweite zurückzulegen. Dadurch können großtechnisch rationell flächige Formteile hergestellt werden, die sonst nur mit Hilfe einer Laminiertechnik produzierbar wären.

Patentansprüche

1. Fertigprodukt oder insbesondere zur Herstellung von Formteilen geeignetes Halbzeug (20,30), bestehend aus einer Maschenware, in der wenigstens ein Faden (4) aus einem ersten Material und wenigstens ein Faden (5) aus einem zweiten Material verarbeitet sind,

   wobei zumindest das zweite Material thermoplastisch ist,

   das zweite Material eine Erweichungstemperatur (Glasumwandlungspunkt) aufweist, die niedriger liegt als die Erweichungstemperatur des ersten Materials,

   das zweite Material ein Material ist, das sich bei Erwärmung über eine vorbestimmte Temperatur stoffschlüssig mit dem ersten Material und mit sich selbst verbindet, und

   die Fäden (4) aus dem ersten Material und die Fäden (5) aus dem zweiten Material über die Fläche des Flächengebildes gleichmäßig verteilt sind.

2. Fertigprodukt oder insbesondere zur Herstellung von Formteilen geeignetes Halbzeug (20,30), bestehend aus einer Maschenware, in der wenigstens ein Faden (4) aus einem ersten Material und wenigstens ein Faden (5) aus einem zweiten Material verarbeitet sind,

   wobei die Fäden (4) aus dem ersten Masterial mit einem dritten Material beschichtet sind,

   zumindest das zweite Material thermoplastisch ist,

   das zweite Material eine Erweichungstemperatur (Glasumwandlungspunkt) aufweist, die niedriger liegt als die Erweichungstemperatur des ersten Materials,

   das zweite Material ein Material ist, das sich bei Erwärmung über eine vorbestimmte Temperatur stoffschlüssig mit dem dritten Material und mit sich selbst verbindet, und

   die Fäden (4) aus dem ersten Material und die Fäden (5) aus dem zweiten Material über die Fläche des Flächengebildes gleichmäßig verteilt sind.

3. Fertigprodukt oder Halbzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß das zweite Material ein Formgedächtniss aufweist, derart, daß es bei Erwärmung über eine vorbestimmte Temperatur und anschließender Abkühlung den Verlauf beibehält, den es während der Erwärmung inne hatte.

4. Fertigprodukt oder Halbzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß das erste Material kein organisches Material ist.

5. Fertigprodukt oder Halbzeug nach Anspruch 4, dadurch gekennzeichnet, daß das erste Material aus den Stoffen Metall, Keramik und sonstige anorganische Verbindungen ausgewählt ist.

6. Fertigprodukt oder Halbzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Fäden (4) aus dem ersten Material Garne, Spinnfasergarne, Endlosgarne, Monofile, gefachte Garne oder Zwirne sind oder aufweisen.

7. Fertigprodukt oder Halbzeug nach Anspruch 6, dadurch gekennzeichnet, daß zumindest die Fäden (4) aus dem ersten Material Einzelfasern oder Stapelfasern aufweisen.

8. Fertigprodukt oder Halbzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß zumindest die

Fäden (4) aus dem ersten Material gedrehte Garne sind.

9. Fertigprodukt oder Halbzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Fäden (5) aus dem zweiten Material Garne, Spinnfasergarne, Endlosgarne, Monofile, gefachte Garne oder Zwirne sind oder aufweisen.

10. Fertigprodukt oder Halbzeug nach Anspruch 9, dadurch gekennzeichnet, daß zumindest die Fäden (5) aus dem zweiten Material Einzelfasern oder Stapelfasern aufweisen.

11. Fertigprodukt oder Halbzeug nach Anspruch 9, dadurch gekennzeichnet, daß zumindest die Fäden (5) aus dem zweiten Material gedrehte Garne sind.

12. Fertigprodukt oder Halbzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Maschenware eine Wirkware ist.

13. Fertigprodukt oder Halbzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Maschenware ein Gestrick (20,30) ist.

14. Fertigprddukt oder Halbzeug nach Anspruch 12 oder 13, dadurch gekennzeichnet, daß das Gestrick (20,30) oder Gewirk ein rechts/links, ein rechts/rechts oder ein links/links Gestrick oder Gewirk ist.

15. Fertigprodukt oder Halbzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß in der Maschenware (20,30) jede Masche von Fäden (4) aus dem ersten Material und von Fäden (5) aus dem zweiten Material gebildet ist.

16. Fertigprodukt oder Halbzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß in der Maschenware die Fäden (4) aus dem ersten Material und die Fäden (5) aus dem zweiten Material zufällig verteilt an der Vorderseite oder an der Rückseite liegen.

17. Fertigprodukt oder Halbzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Maschenware eine plattierte Ware ist, bei der die Fäden (4) aus dem ersten Material auf der eine Seite und die Fäden (5) aus dem zweiten Material auf der anderen Seite der Ware liegen.

18. Fertigprodukt oder Halbzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Maschenware (20,30) in zumindest einer Richtung vorgedehnt und in der gedehnten Stellung fixiert ist.

19. Fertigprodukt oder Halbzeug nach den Ansprüchen 1 und 18, dadurch gekennzeichnet, daß die Richtung parallel zu den Maschenstäbchen liegt.

20. Fertigprodukt oder Halbzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Maschen (21) der Maschenware Maschenschenkel (22,23) mit einer Länge zwischen 2 mm und 12 mm vorzugsweise zwischen 4 mm und 8 mm bevorzugt um 6 mm aufweisen.

21. Fertigprodukt oder Halbzeug nach Anspruch 18, dadurch gekennzeichnet, daß zum Fixieren das textile Flächengebilde (20,30) auf eine Temperatur erwärmt wird, bei der es eine der Vordehnung entsprechende Gestalt annimmt, die es nach dem Abkühlen auf die Umgebungtemperatur beibehält.

22. Fertigprodukt oder Halbzeug nach Anspruch 18, dadurch gekennzeichnet, daß zum Fixieren das textile Flächengebilde (20,30) auf eine Temperatur erwärmt wird, bei der sich zumindest einige Fäden (5) aus dem zweiten Material stoffschlüssig mit den Fäden (5) aus dem zweiten Material oder dessen Beschichtung verbinden.

23. Fertigprodukt oder Halbzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Volumenanteil an dem zweiten Material bezogen auf den Volumenanteil des ersten Materials zwischen 10% und 60% vorzugsweise zwischen 10% und 40% beträgt.

24. Tapete bestehend aus einem Fertigprodukt oder Halbzeug nach einem oder mehreren der vorhergehenden Ansprüche.

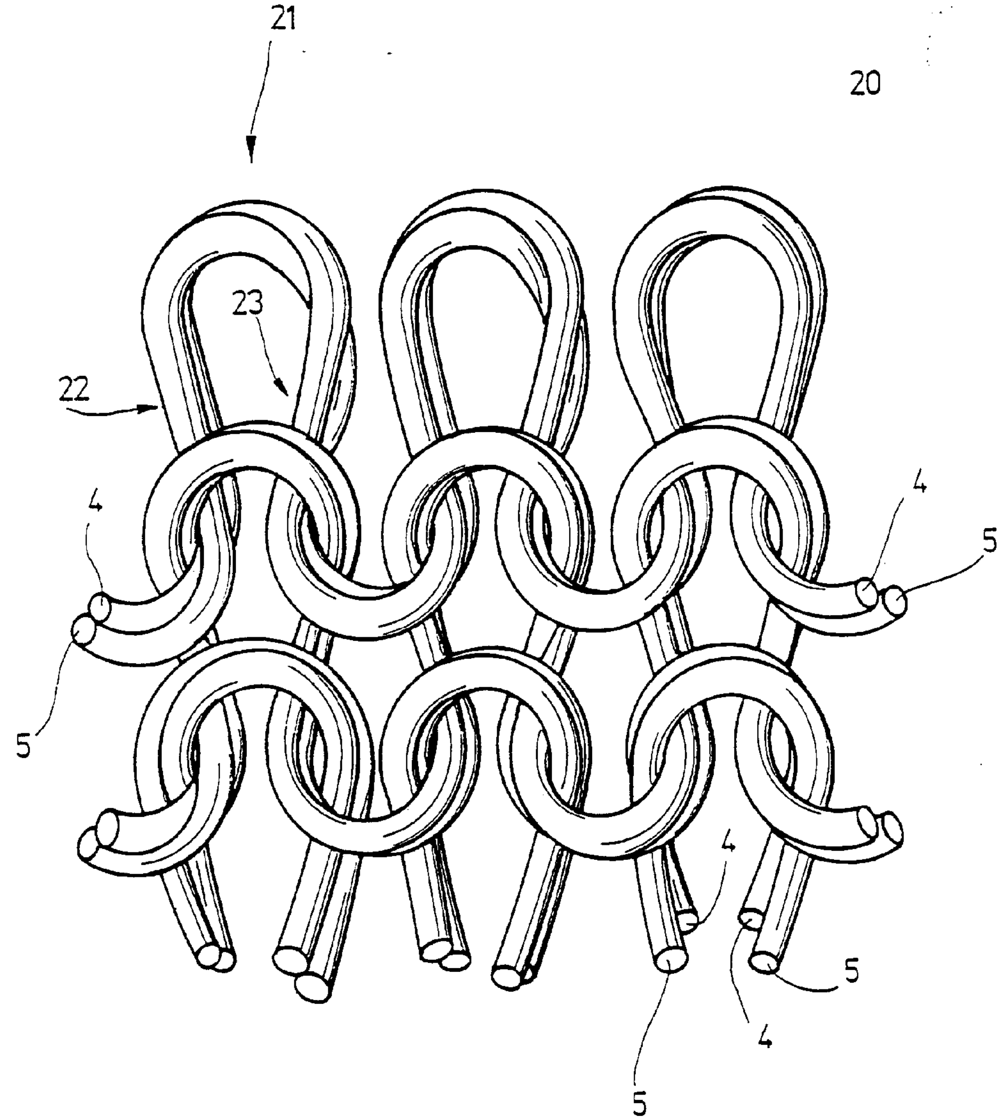

Fig. 1

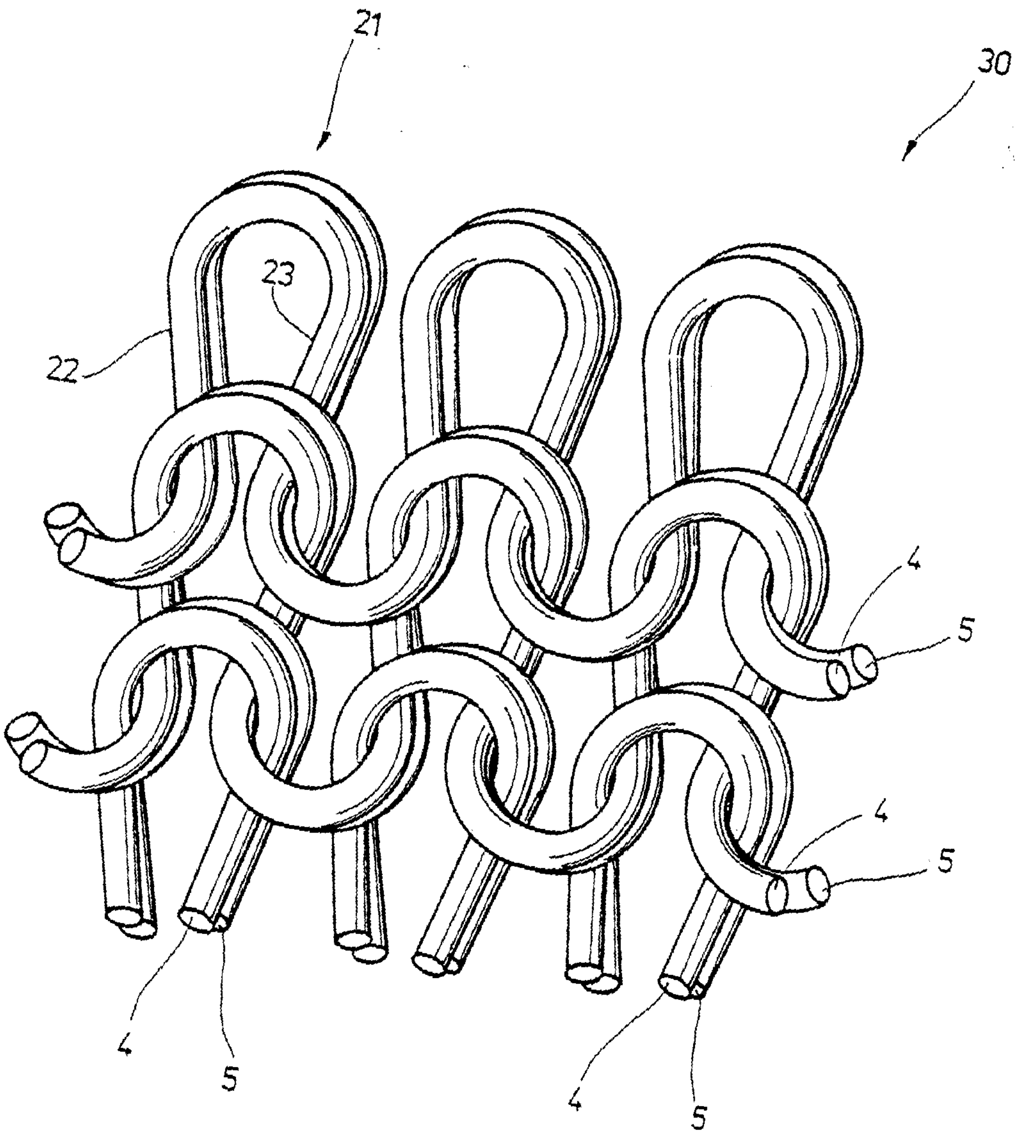

Fig. 2

Europäisches Patentamt

EUROPÄISCHER RECHERCHENBERICHT

Nummer der Anmeldung
EP 95 11 2661

EINSCHLÄGIGE DOKUMENTE

Kategorie	Kennzeichnung des Dokuments mit Angabe, soweit erforderlich, der maßgeblichen Teile	Betrifft Anspruch	KLASSIFIKATION DER ANMELDUNG (Int.Cl.6)
X	WO-A-93 21367 (PROTECMA) * Seite 10, Zeile 1 - Zeile 17; Ansprüche 4-6 *	1,4,5,9, 13-15, 17,22	D04B1/14
X	EP-A-0 310 200 (STAMICARBON B.V.) * Ansprüche 1,2,4 *	1,6,9, 22,23	
E	DE-A-44 12 376 (BUCK) * Ansprüche 1-29 *	1-24	
D,A	DE-A-41 37 406 (BASF AG)		
A	FR-A-2 568 275 (ÉTABLISSEMENTS LES FILS D'AUGUSTE CHOMARAT ET CIE)		
A	US-A-2 608 078 (ANDERSON)		

RECHERCHIERTE SACHGEBIETE (Int.Cl.6)
D04B
D02G

Der vorliegende Recherchenbericht wurde für alle Patentansprüche erstellt

Recherchenort	Abschlußdatum der Recherche	Prüfer
DEN HAAG	16.Januar 1996	Van Gelder, P

KATEGORIE DER GENANNTEN DOKUMENTE

X : von besonderer Bedeutung allein betrachtet
Y : von besonderer Bedeutung in Verbindung mit einer anderen Veröffentlichung derselben Kategorie
A : technologischer Hintergrund
O : nichtschriftliche Offenbarung
P : Zwischenliteratur

T : der Erfindung zugrunde liegende Theorien oder Grundsätze
E : älteres Patentdokument, das jedoch erst am oder nach dem Anmeldedatum veröffentlicht worden ist
D : in der Anmeldung angeführtes Dokument
L : aus andern Gründen angeführtes Dokument

& : Mitglied der gleichen Patentfamilie, übereinstimmendes Dokument

EPO FORM 1503 03.82 (P04C03)

Prijs f 3,—

OCTROOIRAAD

NEDERLAND

Ter inzage gelegde
Octrooiaanvrage Nr. 7304678

Int. Cl. D 04 h 3/08.

Indieningsdatum: 4 april 1973, 24 uur.

Datum van terinzagelegging: 8 oktober 1974.

De hierna volgende tekst is een afdruk van de beschrijving met conclusie(s), zoals deze op bovengenoemde datum werd ingediend.

Aanvrager: Arno Edgar Wildeman
Bowdon, Altrincham, Graafschap Chester, Groot-Brittannië.

Gemachtigde: Nederlandsch Octrooibureau (Dr. J. G. Frielink c.s.), Johan de Wittlaan 15, 's-Gravenhage.

Ingeroepen recht van voorrang: geen.

Korte aanduiding: Textielproduct en werkwijze voor het vervaardigen ervan.

De uitvinding heeft betrekking op een textielproduct en werkwijze voor het vervaardigen ervan.

Niet geweven textielproducten van het steek gebreide type ("stitch knitted type") vervaardigd zonder gebruikmaking van steekgarens, zijn vervaardigd en wel uit een basis-vezelvlies, door het vlies samen te drukken en samen te breien met vezelbundels, opgenomen door samengestelde naalden vanaf een zijde van het vlies naar de andere zijde, waar zij worden samengenaaid in een kettingsteekformatie met vezelbundels genomen uit opeenvolgende doordringingen om de naalden door het vlies, als beschreven in de Britse octrooischriften 1.058.483 of 1.143.827.

Het gebruik van dergelijke textielmaterialen is beperkt als gevolg van het feit, dat zelfs bij machines met een fijne naaldzetting met 28 naalden per 25 mm, de afzonderlijke naalden slechts in staat zijn tot onderling breien van minder dan de helft van de vezels in het vlies. Er is daarom onvoldoende verankering voor meer dan de helft van de vezels in het samengestelde textielmateriaal. Verschillende pogingen zijn gedaan om dit te vermijden, bijv. (a) door naaldprikken na het hechten met steken, maar dit geeft grote veranderingen in het uiterlijk van het textielmateriaal zonder de nadelen volledig te vermijden; (b) het bekleden of impregneren van het textielmateriaal met hechtmiddelen, maar hierdoor wordt ook de greep belangrijk gewijzigd, waardoor het textielmateriaal voor vele toepassingen ongeschikt is.

Onderhavige uitvinding heeft betrekking op een vervaardiging van een niet-geweven thermo-gehecht textielmateriaal in twee trappen. Eerst wordt een basis vezelvlies onderworpen aan een werkwijze van vezelbreien om het vlies te consolideren tot een gebreid vliesmateriaal en in de tweede plaats wordt dit aldus gefabriceerde materiaal onderworpen aan een werkwijze van thermo-hechten voor het verschaffen van een betere verankering van de vezels en een grotere stabiliteit van het uiteindelijke materiaal.

Bij het uitvoeren van de uitvinding kan het vlies worden vervaardigd op de een of andere bekende wijze op een vliesvormmachine, bijv. door de banen genomen van de doffercilinder van een gebruikelijke katoen- of wolkaarde of op een pneumatische vliesvormmachine over de gehele breedte samengevouwen. De aldus verkregen vezelvliesbanen worden dan geconsolideerd tot een textielmateriaal door vezelbreien, bijv. op de een of andere steekhechtmachine, of door gebruikmaking van een vezelbreiwerkwijze.

Volgens de uitvinding is het textielmateriaal volgens de uitvinding gekenmerkt door het differentieel hechten van het textielmateriaal door het erin brengen van thermoplastisch gehechte vezels of elementairdraden.

De samenstelling van het vlies of de baan kan als volgt zijn:

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1. 100% smeltvezels van een enkel type synthetische vezels, bijv. nylon 6, nylon 66, polypropeen, polyester, enz.

2. Een mengsel van smeltvezels van twee of meer typen waarvan de smeltpunten variëren, bijv. 50% nylon 6 en 50% nylon 66, of 40% bicomponent vezel met een nylon 6 mantel en een nylon 66 kern en 60% nylon 66 vezel.

3. Een mengsel van niet-smelt vezels, bijv. viscose met tenminste 10% smeltvezels, bijv. nylon 6 of polypropeen.

Het textielmateriaal vervaardigd uit een van de drie vliessamenstellingen als boven aangegeven wordt vervolgens onderworpen aan een werkwijze van thermo-hechten door het materiaal te leiden door de kneep gevormd door twee rollen op de thermo-hechtmachine. Het thermo-hechten kan worden uitgevoerd onder gebruikmaking van een verwarmde en een niet-verwarmde kalanderrol, waarbij de verwarmde rol is gegraveerd of glad en de niet-verwarmde rol is hard of zacht.

De oppervlaktetemperatuur van de verwarmde rol of rollen is van belang en wordt zo gekozen dat hij hoger is dan het smeltpunt van de smeltvezels in het vezel-gebreide materiaal, waarna het materiaal van de rollen wordt genomen. De mate van smelten en de doordringingsdiepte door het vezel-gebreide textielmateriaal, waarop smelten wordt uitgevoerd, wordt geregeld door:

(a) de temperatuur van de hechtrol of -rollen;
(b) de druk uitgeoefend op het textielmateriaal in de kneep;
(c) de snelheid waarmede het vezel-gebreide textielmateriaal door de kneep passeert;
(d) de kenmerken van de roloppervlakken.

Aan de hand van de volgende voorbeelden wordt de uitvinding hierna nader beschreven.

VOORBEELD I

Een mengsel van nylon 6 en nylon 66 vezels worden gekaard op een kaarde van het woltype, dwars gevouwen en toegevoerd aan een Malivlies steek-hechtmachine onder de volgende omstandigheden:

Gegevens van het vlies: nylon 6, 4 denier, 2½% 65%
nylon 66, 3 denier, 4" 35%

Malivlies
Brei-gegevens: 18 naalden per 25 mm
steeklengte 1,6 mm
materiaalgewicht 204 g/m2
snelheid 1000 steken/min.

Dit materiaal bezat goede textiel-eigenschappen, maar de oppervlakken waren zo zacht dat "pilling" optrad bij lichte wrijving.

Het vezel-gebreide materiaal werd daarna thermo-gehecht door het leiden ervan door de kneep van een kalander met een verwarmde gegraveerde rol in aanraking met de zijde zonder lussen van het materiaal en een "cotton bowl" aanraking met de luszijde, in overeenstemming met de volgende omstandigheden:

Oppervlakte-temperatuur verwarmde rol 230°C
Meetdruk 1000 kg/10 cm lengte
Loopsnelheid 5 m/min.
Gepatroneerde rol met geheven vierkanten
Punten van vierkanten - 0,68 mm x 0,68 mm
Afstand tussen de punten 0,52 mm
Oppervlak van de punten 32,1% van het totale oppervlak.
Na thermo-hechting onder gebruikmaking van de "pillbox tester" van Imperial Chemical Industries Ltd. gedurende 5 uur bleek het "pilling" op de thermo-gehechte zijde van het materiaal nul te zijn en aan de luszijde te verwaarlozen.

VOORBEELD II

Een mengsel van nylon 6 en vincel wordt gekaard op een kaarde van het wol-type, dwars gevouden en toegevoerd aan een Malivlies stik-hechtmachine, onder de volgende omstandigheden:

Gegevens van het vlies: nylon 6, 3 denier 2½% 65%
"vincel 64" denier 6" 35%

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Malivlies
Brei-gegevens: 14 naalden per 25 mm
steeklengte 1,6 mm
gewicht textielmateriaal 1,80 g/m2
snelheid 1200 steken/min.

Als bij Voorbeeld I bezat het materiaal goede textiel-eigenschappen, maar was niet bevredigend als gevolg van "pilling".

Het vezel-gebreide textielmateriaal was thermo-gehecht door het leiden ervan door de kneep van een calander met een verwarmde gegraveerde rol in aanraking met een zijde van het materiaal zonder lussen en een gladde stalen onverwarmde rol in aanraking met de luszijde, in overeenstemming met de volgende omstandigheden:

Oppervlakte-temperatuur verwarmde rol 225°C
Kneepdruk 1500 kg/10 cm lengte
Loopsnelheid 5 m/min.
Gepatroneerde rol geheven vierkanten
Toppen van de vierkanten 0,68 mm x 0,68 mm
Afstand tussen de toppen 0,52 mm
Oppervlak van de toppen 32,1% van het totale oppervlak
Het thermo-gehechte materiaal bezat na 5 uur in een "pillbox tester" van Imperial Chemical Industries Ltd. een "pilling" gelijk aan nul aan de thermo-gehechte zijde van het materiaal en te verwaarlozen "pilling" aan de luszijde.

Als gevolg van het gebruik van een hechttemperatuur boven de smeltpunten van de nylon 6 vezel in bovengenoemde voorbeelden werd een volledig hechten van de anders losse vezels op de zijde zonder lussen van het materiaal bereikt, de verankering van de vezels veroorzaakt een te verwaarlozen "pilling" op de niet-thermo-gehechte luszijde van het materiaal.

Het plaatsen van de verwarmde rol op de zijde van het materiaal zonder lussen met een onverwarmde rol op de zijde

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van het materiaal met de lussen maakt differentieel hechten van het vlies op de baan met meer hechting op de achterzijde of de zijde zonder lussen en progressief minder hechting naar de lus- of voorzijde mogelijk.

Textielmaterialen vervaardigd volgens de uitvinding bezitten een zeer goede greep en drapeervermogen en zijn geschikt voor bekleding, huishoudelijke en industriële doeleinden.

C O N C L U S I E S

1. De vezel-gebreide textielmateriaal, g e k e n m e r k t door het differentieel hechten van het materiaal door de aanwezigheid van thermo-plastisch gehechte vezels of elementairdraden.

2. Materiaal volgens conclusie 1, m e t h e t k e n m e r k, dat de vezels 100% thermo-plastische of smeltvezels kunnen zijn, een mengsel van thermo-plastische opsmeltvezels van twee of meer typen, of een mengsel van thermoplastische of smeltvezels en niet-smeltvezels.

3. Werkwijze voor het vervaardigen van een vezel-gebreid textielmateriaal, g e k e n m e r k t door het onderwerpen van een vlies of baan bevattende thermo-hardende of smeltvezels, aan een vezelbrei-handeling en het leiden van het verkregen vlies, of de verkregen baan door de kneep van een verwarmde en een koude rol om de thermo-hardende of smeltvezels differentieel te smelten om het vlies op e baan tot een vezel-gebreid thermo-gehard materiaal te vormen.

4. Werkwijze volgens conclusie 2, m e t h e t k e n m e r k, dat het vlies op de baan wordt geleid door de kneep van een koude rol en een verwarmde rol met een gegrafeerd patroon daarop bij een temperatuur liggende boven X het smeltpunt van tenminste een van de thermo-plastische of smeltcomponentvezels.

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BUNDESREPUBLIK DEUTSCHLAND

DEUTSCHES PATENTAMT

KL. 71a 23/02

INTERNAT. KL. A 43 b

AUSLEGESCHRIFT 1 084 173

G 15395 VII/71a

ANMELDETAG: 18. SEPTEMBER 1954

BEKANNTMACHUNG DER ANMELDUNG UND AUSGABE DER AUSLEGESCHRIFT: 23. JUNI 1960

Schuhoberteil

Anmelder:

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Unterföhring bei München, Bahnhofstr. 16

Walter Geißler, Unterföhring bei München,
ist als Erfinder genannt worden

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Die Erfindung bezieht sich auf ein Schuhoberteil, welches aus einem Mischgewebe mit Textil- und Polyvinylchloridanteilen hergestellt und einer Warmbehandlung unterzogen ist.

Es ist bekannt, Mischgewebe, die aus Textil- und PVC-Fasern bestehen, zu verwenden, wobei man ein derartiges Mischgewebe durch eine Warmbehandlung und eventuell durch Beflocken und Schleifen so ausbilden kann, daß es eine samt- oder wildlederartige Beschaffenheit erhält.

Es ist auch bekannt, Schußfäden und Kettenfäden thermoplastisch miteinander zu verschmelzen, wobei es möglich ist, daß sowohl der Schuß- als auch der Kettenfaden oder nur einer der beiden Fäden thermoplastisch ist und durch Verschmelzung und anschließende Härtung mit dem anderen Faden ein Gewebe entsteht, welches hart ist.

Der Nachteil dieser bekannten Gewebe oder von Gewirken dieser Art besteht darin, daß bei der Herstellung des Gewebes oder Gewirkes der Anteil der PVC-haltigen Fäden an genau bestimmten Stellen, die anschließend gehärtet werden sollen, berücksichtigt werden muß und dadurch bei der Herstellung eine Verteuerung entsteht.

Aufgabe der Erfindung ist es, es zu gestatten, daß das Material für das Schuhoberteil in der Web- oder Wirkwarenfabrik hergestellt wird, ohne daß dabei auf die spätere Weiterverarbeitung dieses Materials zu Schuhschäften Rücksicht genommen zu werden braucht, z. B. darauf, welche Stellen des Gewebes oder Gewirkes besonders mit PVC-Fäden angereichert werden müssen.

Die Lösung der Aufgabe nach der Erfindung besteht darin, daß das Mischgewebe oder Mischgewirk aus an sich bekannten Mischfäden aus Textil- und Polyvinylchloridfasern hergestellt und an wählbaren Stellen in bekannter Weise durch Warmbehandlung versteift ist.

Nach diesem Merkmal findet die Mischung mit dem thermoplastischen Werkstoff nicht im Gewebe oder Gewirk z. B. durch Verwendung unterschiedlicher Schuß- oder Kettenfäden statt, sondern im Faden selbst. Wenn man direkt in der Faser mischt, dann braucht man nicht mehr Schuß- und Kettenfäden aus verschiedenen Werkstoffen zu wählen, man kann also einheitlich denselben Faden für Schuß- und Kette verwenden, so daß das ganze Gewebe oder Gewirk aus einem einheitlichen Werkstoff hergestellt wird, ohne daß dabei Rücksicht auf den Zuschnitt genommen werden muß. Erst wenn die Teile zugeschnitten sind und wenn feststeht, welche Teile z. B. für die Fersen- oder Zehenkappe verwendet werden, wird an örtlich begrenzten Stellen eine an sich bekannte Warmbehandlung durchgeführt, womit die entsprechende Härtung erreicht wird.

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In weiterer Ausgestaltung der Erfindung ist an der dem Fuß zugekehrten Innenseite des Fersenteils ein aufgerauhtes Baumwollgewebe angeordnet, welches sich während der Warmbehandlung des Schuhoberteils mit diesem verbindet.

Nach diesem Merkmal wird also innen am Schuh ein aufgerauhtes, aus anderen Fasern bestehendes Gewebe oder Gewirk thermoplastisch befestigt. Statt des Baumwollgewebes oder -gewirkes kann auch ein Wollgewebe oder -gewirk verwandt werden, so daß der Schuh außen ein wildlederartiges Aussehen hat, wasserabweisend ist und eine gewisse Härte mit noch genügend großer Dehnbarkeit aufweist, während sich innen eine flauschartige, wärmende und an dem Fuß sich anschmiegende Baumwoll- oder Wollauskleidung befindet. Die thermoplastische Verformung wird zweckmäßig so weit getrieben, daß die Maschenbildung vom Weben oder Wirken verschmolzen ist.

Eine weitere mögliche Ausgestaltung besteht darin, daß der Anteil an Polyvinylchlorid in den Mischfäden des Gewebes oder Gewirkes so hoch ist, daß die der Abnutzung unterliegenden Ränder des gewebten oder gewirkten Schuhoberteils nach der Warmbehandlung eine genügende Härte besitzen und daß Ösen und bzw. oder Verzierungen aus Metall od. dgl. durch Erhitzen der betreffenden Stellen und Einschmelzen befestigt werden können.

Hinsichtlich der dekorativen Ausgestaltung ist es noch wichtig, daß in den Mischfäden des Gewebes bzw. Gewirkes ein so hoher Gehalt an Polyvinylchlorid vorhanden ist, daß vorzugsweise Ornamente durch erhitzte Prägestempel herstellbar sind.

Als Anwendungsgebiet der vorliegenden Erfindung sind alle Möglichkeiten zu bezeichnen, bei denen man Schuhoberteilen aus dekorativen Gründen das Aussehen von Wildleder geben will, den Preis aber erheblich senken möchte. Insbesondere ist das Schuh-

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oberteil auch für medizinische Zwecke geeignet, um bei anormal ausgebildeten Füßen die Möglichkeit zu haben, das elastisch nachgebende Schuhoberteil der Fußform anzupassen.

PATENTANSPRÜCHE:

1. Schuhoberteil, bestehend aus einem Mischgewebe mit Textil- und Polyvinylchloridanteilen, welches einer Warmbehandlung unterzogen ist, **dadurch gekennzeichnet,** daß das Mischgewebe aus an sich bekannten Mischfäden aus Textil- und Polyvinylchloridfasern hergestellt und an wählbaren Stellen in bekannter Weise durch Warmbehandlung versteift ist.

2. Schuhoberteil nach Anspruch 1, dadurch gekennzeichnet, daß an Stelle des Mischgewebes ein Mischgewirk verwendet ist.

3. Schuhoberteil nach den Ansprüchen 1 und 2, dadurch gekennzeichnet, daß seine Fersen- und Zehenteile durch Warmbehandlung versteift sind und daß an der dem Fuß zugekehrten Innenseite des Fersenteiles ein aufgerauhtes Woll- oder Baumwollgewebe oder ein Woll- oder Baumwollgewirk angeordnet ist, welches sich während der Warmbehandlung des Schuhoberteiles mit diesem verbunden hat.

4. Schuhoberteil nach den Ansprüchen 1 bis 3, dadurch gekennzeichnet, daß der Anteil an Polyvinylchlorid in den Mischfäden des Gewebes oder Gewirkes so hoch ist, daß die der Abnutzung unterliegenden Ränder des gewebten oder gewirkten Schuhoberteiles nach der Warmbehandlung eine genügende Härte besitzen und daß Ösen und bzw. oder Verzierungen aus Metall od. dgl. durch Erhitzen der betreffenden Stellen und Einschmelzen befestigt sind.

5. Schuhoberteil nach den Ansprüchen 1 bis 3, dadurch gekennzeichnet, daß in den Mischfäden des Gewebes oder Gewirkes ein so hoher Gehalt an Polyvinylchlorid vorhanden ist, daß vorzugsweise Ornamente durch erhitzte Prägestempel herstellbar sind.

In Betracht gezogene Druckschriften:
Deutsche Patentschriften Nr. 822 240, 475 648;
deutsches Gebrauchsmuster Nr. 1 676 274;
USA.-Patentschriften Nr. 2 639 250, 2 343 390.

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Vor Ablauf der für Änderungen der Ansprüche zugelassenen Frist; Veröffentlichung wird wiederholt falls Änderungen eintreffen.

(54) Title: STABILIZATION OF A KNITTED ARTICLE USING A THERMAL MATERIAL

(54) Bezeichnung: STABILISIERUNG EINES GESTRICKS DURCH THERMOMATERIAL

(57) Abstract

The invention relates to a method for stabilizing a knitted article comprising mechanically sensitive weaves, such as, for example, terry cloth or loop pile weaves. To this end, either a melt fiber is knitted in or the knitted article is coated with a melt material and is subsequently subjected to a thermal treatment.

(57) Zusammenfassung

Die Erfindung betrifft ein Verfahren zur Stabilisierung eines Gestricks mit mechanisch empfindlichen Bindungen, wie z.B. Frottee– oder Polfadenbindungen. Hierbei wird entweder in das Gestrick ein Schmelzfaden eingestrickt oder das Gestrick mit einem Schmelzmaterial beschichtet und anschließend thermisch behandelt.

LEDIGLICH ZUR INFORMATION

Codes zur Identifizierung von PCT-Vertragsstaaten auf den Kopfbögen der Schriften, die internationale Anmeldungen gemäss dem PCT veröffentlichen.

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STABILISIERUNG EINES GESTRICKS DURCH THERMOMATERIAL

Die vorliegende Erfindung betrifft ein Verfahren zur Stabilisierung von Gestricken.

Es sind Gestrickstrukturen bekannt, die über oder weniger lockere Bindungen verfügen, die im Falle einer mechanischen Beanspruchung leicht aufgeweitet oder gar zerstört werden können. Derartige Bindungen sind z.B. Frottéebindungen oder Polfadenstrukturen.

Der vorliegenden Erfindung liegt die Aufgabe zugrunde, ein Verfahren zu schaffen, das eine Fixierung von lockeren Bindungsstrukturen in einem Gestrick ermöglicht. Diese Aufgabe wird durch ein Verfahren gemäß Anspruch 1 oder 2 gelöst. Vorteilhafte Weiterbildungen der Erfindung sind Gegenstand der Unteransprüche. Die Erfindung betrifft ebenfalls ein Gestrick, das unter Anwendung des Verfahrens nach Anspruch 1 oder 2 hergestellt ist.

Erfindungsgemäß erfolgt die Festlegung oder Fixierung der lockeren Bindungsstrukturen im Gestrick durch ein thermoplastisches Material, das unter Einwirkung von Hitze weich wird und/oder verklebt und/oder seine Struktur verändert.

Bei der thermischen Behandlung eines Schmelzmaterials verbindet sich bzw. verklebt das thermoplastische Material mit dem Gestrick in einem definierten Bereich, wodurch die lockeren Bindungsstrukturen sicher an dem Gestrick festgelegt werden.
Ein derartiges Material, das in Garnform erhältlich ist, ist z.B. Grilon® von EMS-Chemie AG. Diese Schmelzfäden sind mit einem Schmelzpunkt in einem weiten Temperaturbereich von 85 bis 160°C erhältlich.

Statt eines Schmelzfadens, der durch die Thermobehandlung zumindest partiell, in der Regel völlig aufschmilzt, kann auch ein Thermofaden verwendet werden, der unter Temperatureinwirkung seine Eigenschaften seine Struktur, wie z.B. Form, Länge etc. verändert. Bei der thermischen Behandlung des Thermomaterials, z.B. eines Thermoschrumpffadens verändert dieser seine Struktur, z.B. Länge. Eine Stabilisierung des Gestricks erfolgt hier durch die Längenabnahme des Fadens, die zu einer Verdichtung des Gestricks führt. Vorzugsweise sollte dabei der Durchmesser des Fadens beibehalten werden.

Es gibt drei Alternativen, das thermoplastische Material in das Gestrick einzubringen.

Eine erste Möglichkeit zur Einbringung des thermoplastischen Materials in das Gestrick besteht im Beschichten des fertigen Gestricks mit dem Material. Das thermoplastische Material wird vorzugsweise auf der Rückseite, d.h. nicht Sichtseite des Gestrickes aufgeklebt, aufgedampft oder anderweitig beschichtet. Nach der thermischen Behandlung verschmilzt bzw. verklebt das Material dann auf der Rückseite des Gestricks und fixiert dadurch eventuell in dem Gestrick vorhandene lockere Bindungsstrukturen.

In einer zweiten Alternative wird das thermoplastische Material als Faden in einer rückwärtigen Lage oder in eine Verbindungslage eines mehrlagigen Gestricks eingestrickt. Nachdem das Gestrick fertig gestrickt ist oder bereits im Laufe der Herstellung wird das Gestrick thermisch behandelt, wodurch der Faden aufschmilzt bzw. verklebt und auf diese Weise lockere Bindungsstrukturen in dem Gestrick festigt. Der thermoplastische Faden kann hierbei als Vermaschungsfaden fungieren. Da jedoch der Faden bei der thermischen Behandlung eventuell reißen kann, wird er vorzugsweise als Faden eingestrickt, der nicht an der

Maschenbildung des Gestricks beteiligt ist. Eine geeignete Einbringung wäre hier ein Kett- oder Schußfadeneintrag.

Eine dritte Möglichkeit der Einbringung des Thermo- oder Schmelzfadens ist das Aufplattieren des Fadens. Hier wird der Faden über einen speziellen Fadenführer neben dem Vermaschungsfaden derart eingebracht, daß er in Abständen an dem Gestrick festgelegt, z.B. partiell vermascht wird.

Als thermoplastischer Faden bzw. Thermofaden wird vorzugsweise aus Faden Typ Grilon® Multifil, K oder KE der EMS-Chemie AG verwendet.

Allgemein sollte der Schmelzpunkt des Fadens bzw. Aufweichpunkt des Fadens sollte vorzugsweise wenigstens 30° über Raumtemperatur liegen, um bei höheren Stricktemperaturen keine Ausfälle zu verursachen, andererseits sollte die Schmelztemperatur nicht zu hoch liegen, um durch die Thermobehandlung nicht die Qualität der anderen Fäden des Gestricks zu beeinträchtigen.

Durch die erfindungsgemäße Technologie lassen sich mechanisch sehr strapazierte Gestricke, wie z.B. Sitzbezüge in ihren Abriebeigenschaften beträchtlich verbessern.

Der Schmelzfaden kann auch dazu verwendet werden, nachträglich Funktions- oder Zierelemente mit dem Gestrick zu verbinden. Die Verbindung wird dann durch die thermische Aktivierung des definiert ein- bzw. aufgebrachten Schmelzfadens bewirkt.

Der Schmelzfaden kann auch als Polfaden zwischen zwei Lagen eingebracht und anschließend thermisch aktiviert werden, wodurch die beiden Lagen stabil miteinander verbunden werden.

In einer sehr vorteilhaften Weiterbildung der Erfindung wird der Schmelzfaden dazu verwendet, Anfangs- oder Endreihen, Löcher Kanten oder andere hervortretende oder konturierte Gestrickelemente zu verkleben oder diese Stellen zu stabilisieren.

Durch die Verwendung von Thermofäden lassen sich auf einfache Weise Mehrlagen-Abstandsstrukturen herstellen.

Der Schmelz- oder Thermofaden kann auch von anderen Fadenmaterialien umsponnen oder umwunden sein, wodurch es möglich ist, auch schlecht strickbare Fadenmaterialien in das Gestrick einzubringen.

Zum Fixieren des Gestricks auf einem Träger kann auf der Rückseite des Gestricks ein Schmelz- oder Thermofaden aufgebracht, vorzugsweise definiert aufplattiert oder partiell vermascht werden. Durch Dampf- bzw. Hitzebehandlung kann dann das Gestrick, z.B. ein Sitzbezug einfach auf einen Träger wie z.B. Formschaum aufgebracht und fixiert werden.

PATENTANSPRÜCHE:

1. Verfahren zur Stabilisierung eines Gestricks mit mechanisch empfindlichen Bindungen, wie z.B. Frottee- oder Polfadenbindungen, bei dem in das Gestrick ein Schmelz- oder Thermofaden eingestrickt bzw. aufplattiert und das Gestrick anschließend thermisch behandelt wird.

2. Verfahren zur Stabilisierung eines Gestricks mit mechanisch empfindlichen Bindungen, wie z.B. Frottee- oder Polfadenbindungen, bei dem das Gestrick mit einem Schmelz- oder Thermomaterial beschichtet und anschließend thermisch behandelt wird.

3. Verfahren nach Anspruch 1,
dadurch gekennzeichnet,
daß der Schmelzfaden in dem Gestrick vermascht wird.

4. Verfahren nach Anspruch 1 oder 3,
dadurch gekennzeichnet,
daß der Schmelzfaden in das Gestrick als Kett- oder Schußfaden eingebracht wird.

5. Verfahren nach Anspruch 1, 3 oder 4,
dadurch gekennzeichnet,
daß der Schmelzfaden auf der Rückseite des Gestricks eingebunden wird.

6. Verfahren nach Anspruch 2,
dadurch gekennzeichnet,
daß dir Rückseite des Gestricks mit dem Schmelzmaterial beschichtet wird.

7. Verfahren gemäß Anspruch 1 und 2.

8. Verfahren nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß ein Schmelz- oder Thermofaden verwendet wird, der von anderen Fadenmaterialien umsponnen oder umwunden ist.

9. Verfahren nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß durch die thermische Aktivierung des definiert ein- bzw. aufgebrachten Schmelzfadens nachträglich Funktions- oder Zierelemente mit dem Gestrick verbunden werden.

10. Verfahren nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Schmelzfaden als Polfaden zwischen zwei Lagen eingebracht und anschließend thermisch aktiviert wird.

11. Verfahren nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß durch thermische Aktivierung des Schmelzfadens Anfangs- oder Endreihen, Löcher Kanten oder andere hervortretende oder konturierte Gestrickelemente verklebt oder stabilisiert werden.

12. Gestrick, hergestellt gemäß einem Verfahren nach einem der vorhergehenden Ansprüche.

13. Sitzbezug, hergestellt mit einem Gestrick nach Anspruch 12.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/DE 99/03852

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 D04B1/16

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

B. FIELDS SEARCHED

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

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 728 860 A (HOECHST TREVIRA GMBH & CO KG) 28 August 1996 (1996-08-28) claims 1,4,41	1,3,5, 12,13
X	EP 0 208 627 A (TEXTILES ET PLASTIQUES CHOMARAT) 14 January 1987 (1987-01-14) example 1	2,6,12, 13
X	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 8, 30 August 1996 (1996-08-30) & JP 08 109553 A (TOHO SENI K.K.), 30 April 1996 (1996-04-30) abstract	1,4,12, 13
X	EP 0 305 094 A (LOMBARDI) 1 March 1989 (1989-03-01) claim 4; figures 3,4	1,3,5,12

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

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 196 36 208 A (RECARO GMBH & CO) 15 July 1971 (1971-07-15) column 6, line 16 - line 62; figures 3-5	1,9, 11-13
A	GB 1 465 361 A (DE WITTE) 23 February 1977 (1977-02-23)	
A	GB 538 865 A (BREW)	
A	PATENT ABSTRACTS OF JAPAN vol. 18, no. 201, 8 April 1994 (1994-04-08) & JP 06 002240 A (KAWASHIMA TEXTILE MFG LTD) abstract	

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Internatior pplication No
PCT/DE 99/03852

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
EP 0728860	A	28-08-1996	DE	19506037	A	29-08-1996
			BR	9600792	A	23-12-1997
			CA	2170013	A	23-08-1996
			CZ	9600518	A	15-01-1997
			HU	9600381	A	28-04-1997
			JP	8260303	A	08-10-1996
			PL	312882	A	02-09-1996
			TR	960840	A	21-10-1996
			US	5618624	A	08-04-1997
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			AT	39857	T	15-01-1989
			DE	3661687	D	16-02-1989
JP 08109553	A	30-04-1996	NONE			
EP 0305094	A	01-03-1989	US	4794767	A	03-01-1989
			CA	1286514	A	23-07-1991
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			EP	0932715	A	04-08-1999
GB 1465361	A	23-02-1977	NONE			
GB 538865	A		NONE			
JP 06002240	A	11-01-1994	NONE			

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/DE 99/03852

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 7 D04B1/16

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
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Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

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C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	EP 0 728 860 A (HOECHST TREVIRA GMBH & CO KG) 28. August 1996 (1996-08-28) Ansprüche 1,4,41	1,3,5, 12,13
X	EP 0 208 627 A (TEXTILES ET PLASTIQUES CHOMARAT) 14. Januar 1987 (1987-01-14) Beispiel 1	2,6,12, 13
X	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 8, 30. August 1996 (1996-08-30) & JP 08 109553 A (TOHO SENI K.K.), 30. April 1996 (1996-04-30) Zusammenfassung	1,4,12, 13
X	EP 0 305 094 A (LOMBARDI) 1. März 1989 (1989-03-01) Anspruch 4; Abbildungen 3,4	1,3,5,12

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[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

[X] Siehe Anhang Patentfamilie

° Besondere Kategorien von angegebenen Veröffentlichungen :

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Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
10. Mai 2000	18/05/2000

Name und Postanschrift der Internationalen Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Van Gelder, P

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INTERNATIONALER RECHERCHENBERICHT

Internatio ; Aktenzeichen
PCT/DE 99/03852

C.(Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	DE 196 36 208 A (RECARO GMBH & CO) 15. Juli 1971 (1971-07-15) Spalte 6, Zeile 16 - Zeile 62; Abbildungen 3-5	1,9, 11-13
A	GB 1 465 361 A (DE WITTE) 23. Februar 1977 (1977-02-23)	
A	GB 538 865 A (BREW)	
A	PATENT ABSTRACTS OF JAPAN vol. 18, no. 201, 8. April 1994 (1994-04-08) & JP 06 002240 A (KAWASHIMA TEXTILE MFG LTD) Zusammenfassung	

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INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internationa ıktenzeichen
PCT/DE 99/03852

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
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		PL 312882 A	02-09-1996
		TR 960840 A	21-10-1996
		US 5618624 A	08-04-1997
EP 208627 A	14-01-1987	FR 2583339 A	19-12-1986
		AT 39857 T	15-01-1989
		DE 3661687 D	16-02-1989
JP 08109553 A	30-04-1996	KEINE	
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		CA 1286514 A	23-07-1991
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DE 19636208 A	12-03-1998	WO 9810127 A	12-03-1998
		EP 0932715 A	04-08-1999
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GB 538865 A		KEINE	
JP 06002240 A	11-01-1994	KEINE	

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PATENT SPECIFICATION.

Application Date: Nov. 18, 1939. No. 30312/39. **538,865**

" " April 26, 1940. No. 7497/40.

One Complete Specification Left: Dec. 12, 1940.

(Under Section 16 of the Patents and Designs Acts, 1907 to 1939.)

Specification Accepted: Aug. 20, 1941.

PROVISIONAL SPECIFICATION

No. 30312 A.D. 1939.

Improvements relating to Knitted Fabrics and Manufactured Knitted Articles.

I, HAROLD EDMUND BREW, B.Sc., A.T.I., Assoc. M.C.T., a British subject, of Hawthorn Cottage, Glazebrook Lane, Glazebrook, Manchester, do hereby declare the nature of this invention to be as follows:—

This invention relates to knitted fabrics, and to manufactured articles made by knitting, such for example as ladies stockings.

One of the disadvantages of certain types of knitted wear at present known, is the susceptibility to "laddering", that is, to a broken stitch in one course releasing the engaged stitch in the next course and allowing the dropping of the successively-engaged stitches in successive courses. In the case of a stocking for instance, a stitch broken at the knee may cause a "ladder" along the length of the stocking as far as the instep.

Again, knitted fabrics are usually very susceptible to lateral distortion, for which reason they are not suitable for the manufacture of processed goods since they would be distorted in the processing machinery; and, in addition, many knitted fabrics if cut into narrow-width strips or into other small-dimensioned pieces are apt to curl and/or fray.

The object of the present invention is to provide knitted goods of an improved character in which, (a) if the stitching is of a ladderable type, laddering is prevented, or at the least if it occurs is confined to short lengths; (b) the fabrics may be reinforced against lateral distortion, and (c) the fabrics may be prevented from fraying and/or curling.

According to the invention, the knitted goods are made from yarns some of which or some parts of which are capable of being rendered temporarily adhesive, and such state of adhesion is brought about after knitting has been accomplished. The result aimed at is that where, in the finished article, a portion rendered adhesive is in contact with another part union will take place, thus uniting contiguous stitches at random. According to the particular goods being made, that is according to whether non-laddering or reinforcement is the principal aim, the number and spacing of the unions will be varied. For instance, in the case of a stocking the unions must be such as not unduly to interfere with the elasticity and tension of the article.

The invention contemplates the use of a double yarn, of which one strand only is capable of being rendered adhesive, and whether the two yarns are knitted simultaneously from separate supplies, or whether they are twisted together or otherwise combined, as a composite yarn. Further, the invention includes the use of thermo-plastic yarn components, to be rendered adhesive by the application of heat as well as the use of substances which, if treated with solvents or liquid reagents, become adhesive. As further alternatives gaseous or vapour reagents may be employed, and either with or without super-atmospheric pressure.

As applied to double or composite yarns, the invention may be characterised by the use of "primary" or foundation yarns of silk or viscose rayon, or other natural or synthetic fibre, and "binding" yarns comprising filaments of acetate or ether rayon, or of hydrolised acetate, or of acetylated yarn, or of other filaments of a yarn having different chemical properties from the primary yarn. The difference of chemical properties is to be such that a treatment of the selected binding yarn, to effect the desired union, will be of a kind not calculated to affect the primary yarn.

In other cases the binding yarn of a composite yarn may be treated at intermittent places to modify its chemical and/or physical properties in such a way as to render the yarn adhesive when treated say by heat, or with a solvent, or the like.

In examples of the invention when a viscose-acetate combination yarn, or a

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real-silk-acetate combination yarn is employed, the state of adhesion may be introduced by the application of such solvents as either glacial acetic acid or acetone, these two examples being named as representative of a wide range of alternatives. The proportions of solvent and the periods of immersion to give optimum results can be found by simple trial and error. In other examples, instead of a solvent being employed the yarn could be hydrolised by the application of caustic soda to the acetate constituents, that is, for example, in the case of a viscose-acetate combination. Again, in other examples, instead of solvents or hydrolising agents being used, the acetate constituents may be fused by the application of heat with or without pressure.

In the use of solvents or other re-agents, in particular liquid re-agents, a too-rapid treatment of the binding yarn may result, and this would cause excessive binding of the primary yarn, or even dispersion of the binding yarn. This can be prevented by the treatment of the binding yarn with a resist at short intervals, which intervals may be regularly or irregularly spaced.

In other embodiments of the invention when a composite yarn is used in which the two constituents are of similar material, the material will be such as to allow of the adhesion being produced, but one or both the yarns will be treated with a resist, in parts, so that the adhesion will be brought about only in those places not treated with the resist.

In the manufacture of such articles as stockings, the binding yarn may, if desired, be employed for a certain proportion only of the courses, and in such case it may be necessary to vary the effective denier or count of the primary yarn in the intervening courses, so that there will be no noticeable " ringing " or other marking of the finished article.

The invention is capable of a number of modifications, but in all cases the aim is to use yarns which, when the knitted article is subsequently treated, will be rendered adhesive in certain points, with the result that a union will accrue where those points are points of contact in the stitching.

Dated this 17th day of November, 1939.

For the Applicant,
WILSON, GUNN & ELLIS,
Chartered Patent Agents,
54/56, Market Street, Manchester, 1.

PROVISIONAL SPECIFICATION.

No. 7497 A.D. 1940.

Improvements relating to Knitted Fabrics and Manufactured Knitted Articles.

I, HAROLD EDMUND BREW, B.Sc., A.T.I., Assoc. M.C.T., a British subject, of Hawthorn Cottage, Glazebrook Lane, Glazebrook, Manchester, do hereby declare the nature of this invention to be as follows :—

This invention relates to knitted fabrics and to manufactured articles made by knitting, such for example as ladies stockings, and consists of improvements in or modifications of the invention forming the subject of my earlier Application for Patent No. 30312/39 filed on the 18th November, 1939 (Serial No. 538,865).

According to that invention, knitted goods were made from yarns, some of which, or some parts of which, were capable of being rendered temporarily adhesive, such state of adhesion being brought about after the knitting had been accomplished, and with a view to preventing or resisting laddering of the fabric. Alternative modes of operation are described in my said earlier Application, and the present invention consists of improved means for bringing about the adhesion between the yarns.

The present invention consists mainly in the use of improved or alternative solvents or swelling agents, which will act on the auxiliary yarn of say cellulose derivative (in particular cellulose acetate) to affect the adhesion, but which will have no adverse affect on the basic yarn (for example a viscose yarn). Other derivatives than cellulose acetate are cellulose nitrate, and cellulose ethers, e.g., benzyl cellulose and ethyl cellulose, and also mixed cellulose esters, cellulose aceto propionate. Further, synthetic threads of other materials may be employed as the auxiliary yarn (and even as the main yarn), for example, the polyamide and vinyl resins, the solvents or swelling agents being suitably chosen.

According to the invention, solvents or swelling agents are selected from (a) the alkyl and aryl esters, (for example, ethyl acetate, ethyl lactate, benzyl benzoate); from (b) the halogen derivatives of the lower members of the aliphatic and aromatic hydrocarbons (for example, chloroform, methylene chloride, benzylidene chloride); or from (c) the alkyl ketones, (for example, acetone); from (d) the group comprising ethyl aceto-acetate, diethyl carbonate, benzyl alcohol, diacetone alcohol, the polyglycol and glycol acetates and ethers (for example, ethylene glycol di-acetate, ethylene glycol mono-ethyl ether), cyclo-hexanone and methyl cyclohexanone, cyclohexanol acetate, methyl cyclohexanol acetate, the chlorohydrins (for example, mono- di- or epi-chlorohydrin) di-chlor ethyl ether, tetralin, eugenol, nitrobenzene, and nitromethane; or (e) from suitable mixtures of any of these.

According to another feature of the invention for use in cases where the pure solvent would be too strong and disperse or unduly weaken the yarn, a diluent is used, for example, one or more selected from the group comprising the aliphatic alcohols, ethers and hydrocarbons (for example, ethyl alcohol, ethyl ether, pentane or petroleum) amylene, petroleum ether, and the aromatic hydrocarbons (for example benzene or toluene), these diluents being selected so as not to destroy the required adhesion in the yarn.

The diluent is preferably one having a boiling point appreciably lower, and a rate of evaporation higher than the solvent or swelling agent used for treatment of the acetate.

Some of the solvents or swelling agents referred to above are not solvent at normal temperatures, but may be rendered solvent by raising the temperature. For example, ethylene-glycol mono-ethyl ether produces no adhesion in the cellulose acetate at normal temperatures, but when raised say to 60° C. will produce an adhesion.

According to a further feature of the invention, in cases where the cellulose derivative yarn is likely to shrink or become brittle under the influence of the solvent, suitable plasticisers are used to counteract this tendency. These plasticisers should have a high boiling point, should be stable against normal conditions, should be insoluble in water, and unaffected by hot detergents. Preferably also, the plasticisers should be such as to have a solvent action on the auxiliary yarn, and for most uses should be colourless and odourless. Examples, suitable principally with cellulose acetate yarns, are the alkyl phthalates (for example di-ethyl phthalate), alkyl tartrates (for example, dibutyl tartrate), alkyl citrates (for example tri-amyl citrate) and alkyl salicylates (for example ethyl salicylate), benzyl alcohol, benzyl benzoate, butylene glycol diacetate, cresyl glyceryl diacetate, glyceryl tri-crotonate, and tri-cresyl phosphate. In some instances, mixtures of certain of these substances may be employed.

After the treatment of the fabric, the plasticisers may be removed from the main yarn (but not from the auxiliary yarn) by utilising the preferential absorption of the cellulose derivative for the plasticiser and by using a relatively poor solvent for the plasticiser. For example, with an alkyl phthalate as a plasticiser, petroleum ether or benzene has been found useful as a solvent.

For the best results, and to maintain the elasticity of the fabric, it is important that the auxiliary yarn should be twisted with the main yarn, otherwise there may be no points of contact between the auxiliary yarn and itself, and excessive swelling would therefore have to be engendered to obtain local adhesion. Further, the number of contacts between the auxiliary yarn and itself, may be controlled by varying the degree of twist in the composite yarn.

The aim of the solvent treatment is to produce adhesion of the cellulose derivative or other auxiliary yarn where it meets itself only and not with the principal yarn.

In an example of the invention, a composite twisted yarn comprises a main yarn of viscose or real silk of 50 denier, and an auxiliary yarn of cellulose acetate of 10 denier, or finer. These components are twisted so as to have from two to six turns per inch. The knitted fabric is immersed in a bath containing :

ethyl acetate 20 gms. to 25 gms.,
ethyl ether 77.5 gms. to 72.5 gms. (Sp.Gr. .720),
di-ethyl phthalate 2.5 gms.,

for 12 hours, at room temperature, and is then removed and the solvents allowed to evaporate.

It is to be understood that the time periods, the temperatures, and the rate and conditions of evaporation are variable.

In another example, the following bath is made up :—

ethyl acetate 25 gms. to 30 gms.,
pentane 74 gms. to 69 gms.,
di-ethyl phthalate 1 gm.

and the fabric treated as before.

In some cases the immersion of the fabric may be carried out under super-atmospheric pressure.

The conditions of evaporation of the solvent and diluent are likely to have considerable effect on the nature of the auxiliary yarn. The evaporation should preferably take place at a temperature above normal room temperature, and in an atmosphere containing the solvent in vapour form.

The twisting together of the two components of the yarn may be effected in various ways, and either in the knitting machine, or as a preliminary operation. The two components may each have a twist, or one may be twisted around the other.

Dated this 25th day of April, 1940.
For the Applicant,
WILSON, GUNN & ELLIS,
Chartered Patent Agents,
54/56, Market Street, Manchester, 1.

COMPLETE SPECIFICATION.

Improvements relating to Knitted Fabrics and Manufactured Knitted Articles.

I, HAROLD EDMUND BREW, B.Sc., A.T.I., Assoc. M.C.T., a British subject, of Hawthorn Cottage, Glazebrook Lane, Glazebrook, Manchester, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

This invention refers to machine-made knitted goods, including both knitted piece goods and shaped knitted articles such as articles for wear and parts thereof, for example ladies' stockings, under-wear and the like. The invention is concerned only with goods of the type (hereinafter referred to as " the said type " or " the type refered to ") in which the knitting is done entirely from continuous filaments, whether natural (e.g. silk) or artificial (e.g. acetate rayon or viscose rayon).

The terms " filament " and " filamentary " are used herein to denote an elongated knittable element of continuous longitudinal structure, as distinct from an element which is of a longitudinally-built-up structure, such as a spun yarn. The invention is not concerned with spun yarns made by associating short fibres together. The continuous filamentary elements with which the invention is concerned are characterised by substantial uniformity of cross-section, and by smoothness of surface. In the art " filament " denotes a single element the product of only one extrusion orifice. As these filaments are too fine for use alone, it is usual to twist a number of them together as a unit. In this specification, the term filament includes and usually denotes such a unitary twisted assembly.

One of the disadvantages of these filamentary knitted goods, which are fine-gauge goods, is that, with certain types of stitch there is, owing to the smooth surfaces of the filaments, a marked susceptibility to " laddering "; that is a susceptibility to a broken stitch in one course, releasing the engaged stitch of the next course, which in turn releases the engaged stitch of the third course, and so on for successively-engaged stitches in successive courses. In the case of a lady's stocking, for instance, a loop stitch broken at the knee may cause a " ladder " along the length of the stocking, as far as the instep. When stockings are being worn they are subject to a certain amount of lateral tension tending to straighten out the loop stitches, which tension helps in the disengagement of the successive stitches once a broken stitch occurs.

The use of the fine-gauge knitted goods to which this invention relates, involves two main desiderata, one being the presence of a high degree of resistance to laddering (when the stitch is of a laddering type) to prevent easy damage to the goods; and the other being the presence of a sufficient degree of elasticity in the goods to ensure (say in the case of a garment) a good fit without permanent distortion. Broadly, the means for satisfying these desiderata are, to some extent, opposed to each other, in that any attempt to anchor the stitches of a knitted fabric together to resist laddering, tends, by preventing relative movement at the points of anchorage, to lessen the elasticity of the fabric. The commercial failure of many of the proposals previously put forward for preventing laddering has been due to their undue interference with the elasticity of the goods.

The object of the present invention is to provide knitted goods of the type referred to which are of an improved character in that, if the stitching is of a ladderable type, laddering is prevented, or at the most is confined to a very small number of courses, without the goods having been rendered too inelastic for their normal purposes.

According to the invention, knitted goods of the type referred to are made from a composite yarn composed of at least one inert foundation filament and at least one potentially-adhesive binding filament, the filaments being twisted together with a low degree of twist, and, after knitting, the goods are subjected to treatment which will render the binding filament or filaments tacky or adhesive and will cause mutually-contacting adhesive parts to unite. The degree of twist in the composite yarn is such that there are sufficient contacts of adhesive parts with each other to prevent laddering, and such that there is sufficient relative freedom between the component filaments of the yarn to maintain the desired elasticity, and the nature of the treatment is such that, whilst two mutually-contacting adhesive parts will unite, one adhesive part will not as a rule unite with an inert filament. The invention embraces both the method of manufacture and the manufactured goods, and also the special yarns hereinafter described.

By the term "binding filament" is meant a filament composed of, or carrying on its surface (continuously or intermittently) a substance which may be rendered tacky or adhesive by means such as heat and/or gelatinising agents, or by such chemical treatment as may be applied without damaging or seriously weakening the filament; and, by the term "inert foundation filament" is meant a filament which will not be rendered tacky or adhesive by the treatment which renders the binding filament tacky or adhesive. The expression "potentially-adhesive" as applied to the binding filament means "capable of being rendered adhesive."

The binding filament or filaments with which the inert foundation filament is twisted may be potentially adhesive throughout its or their whole length, or may be potentially adhesive at some parts only. Filaments made from cellulose esters or ethers are potentially adhesive throughout their whole length, in that the whole surface may be rendered adhesive by the action of solvents or gelatinising agents. Similarly, the whole surface of filaments coated with some natural or synthetic resins, or resin-forming substances, may be rendered adhesive by heat. A filament potentially adhesive at some parts only of its surface may be obtained by covering an inert filament at some parts only of its surface with a substance capable of being rendered adhesive, or by covering with a resist at some parts only the surface of a filament potentially adhesive throughout its length.

The present invention seeks as far as possible to avoid adhesion between different parts of any one stitch loop, and between adjacent stitches in the same course. By the process of the invention adhesion normally takes place only between the binding filament of a stitch in one course and the binding filament of an inter-engaging stitch of the next course, and since the points of contact between any two such stitches in different courses are always at the base of a loop, the adhesions between the binding filament and itself will be at the base of the loop. Moreover, as the adhesions occur between the binding filament and itself, the stitches are, despite their connection, capable of some relative movement or deformation because the foundation filaments may pull away from the binding filaments to a slight extent when under stress.

The control of the position of the unions throughout the stitches, and of the relative freedom of the component filaments, is determined by regulating the degree of twist between the components of the composite yarn, and also, if the binding filament has interrupted potentially-adhesive surface parts, by regulating the spacing of those parts from each other. These factors will be variable according to the size of the stitches to be made and to the degree of elasticity required in the ultimate article. In any one stitch, the chances of that stitch being united by adhesion to another will depend on the position of the potentially-adhesive part along the yarn (determining whether or not it is at the base of the loop), on the position of such part around the yarn (determining whether or not it contacts with the inter-engaging stitch even if at the base of a loop), and on the corresponding positions in the inter-engaging stitch (determining whether or not two potentially-adhesive parts come into contact). The number of potential unions between the crossing yarns in the knitted fabric will increase as the number of twists per unit length of yarn is increased, such number of unions being related to the square of the number of turns. The number of potential unions is also dependent upon the size of the knitted stitch, which is determined by the gauge or fineness of the fabric. Given the standard of elasticity required in the goods to be made, and the size of stitch required, the determination of the correct amount of twist between the components of the yarn may be made by trial and error, but it will be found usually to be between two and ten turns per inch.

Theoretically, if the potentially-adhesive parts are regularly spaced in the yarn, because of the twist being perfectly regular, and the stitches are of uniform size, the unions will occur in a regular series. In practice, however, it is very difficult, if not impossible, to ensure perfect regularity in the treatment or preparation of the yarn, so that the resulting unions will be somewhat irregularly spaced in the fabric, although of the desired frequency. In most cases the yarn will be so prepared with respect to the size of the stitches to be made, that on the average not more than one contact of adhesive-forming parts will occur in any one loop.

The means selected to bring about the tacky or adhesive condition will depend to some extent on the nature of the potentially-adhesive substance in the yarn. In some cases, when that substance is one which on ageing will pass through an adhesive phase, a mere ageing will suffice, either at atmospheric or superatmospheric pressure. In other cases, when that substance is a thermo-plastic one, the application of heat will be required, sometimes accompanied by pressure, either a mechanical pressure (e.g. ironing) or a gaseous pressure. Again, it may be necessary to apply to the knitted goods fluids which produce an adhesive state in the binding filament by acting as gelatinising agents for the adhesive-forming substances such fluids being either in gaseous or liquid form, or themselves carried in an inert medium, any surplus being removed before final drying; or combinations of these several steps may be found advantageous. In cases where the potentially-adhesive binding filament consists of or carries on its surface partly-condensed resin-forming materials as the adhesive-forming substance the adhesion between the stitches may be effected in and by a final condensation reaction carried out in the knitted goods, for example in a closed chamber under heat and pressure. Given the substances of which the various components of the yarn are made, the selection of the best means, and the choice of fluid agents (if used) will be made by trial and error until the adhesion can be restricted almost entirely to the binding filament and itself. The examples given below will be a guide to the right selection.

The heat treatment of the goods to bring about adhesion, when that form of treatment is selected, may be carried out in hot water when the reagents or some of them previously applied to the yarns are not readily water-soluble, or in other suitable liquid media, the temperature being maintained at a sufficiently high degree to produce the required tacky or adhesive state. In this connection, instead of the goods being subjected to a separate treatment for producing the adhesion, the adhesion may be effected during the usual dyeing and finishing processes either by the mere heat treatment in those processes effecting gelatinisation, or by one of the reagents for gelatinisation being carried in one of the finishing baths. The usual care will be taken to see that the temperatures are not raised to a degree which would be injurious to any of the substances under treatment.

In the application of the invention to the finer gauges of silk stockings, composed of 2, 3, or 4 thread thrown silk yarns, it may not be desirable to use a fine cellulose acetate or other thermoplastic filament as a binding filament and in such cases the necessary adhesive-forming substance would be deposited intermittently or continuously on one or more of the silk threads e.g. by printing, spraying or other means.

In a convenient method of carrying out the invention, the composite yarn comprises as the inert foundation filament, viscose rayon; and as the potentially-adhesive binding filament, acetate rayon; the foundation filament being of larger diameter than the binding filament. The two components are twisted together slightly, so as to give, for example, from two to ten turns per inch. The twisting together of the components of the composite yarn will preferably be done before the yarn is brought to the knitting machine, although it is not inconceivable that knitting machines may be adapted to twist the filaments together immediately prior to knitting. In any case, it is necessary to insert only sufficient twist in the composite yarn to provide enough binding places to give the desired degree of anti-laddering effect and to maintain a desirable elasticity. More twist than this, by introducing too many bindings, and by associating the binding filament too tightly with the foundation filament, will be liable to reduce the elasticity of the fabric unduly.

It is probable that with some methods of treatment a slight shrinkage will occur in the length of the binding filament, and in order to counter-act this and thus preserve the elasticity of the fabric, it may be desirable to have a greater length of the binding filament than of the inert foundation filament per unit length of composite yarn. This may be accomplished by having different tensions for the different components during folding and twisting together, and/or by twisting (or untwisting) the components themselves (or one of them) prior to or during twisting together, the separate twisting or untwisting of the components being to the same or to different degrees, and in the same or in different directions. It would be possible, for instance, so to prepare the components that in twisting them together the inert foundation filament would be still further twisted, whilst the binding filament would be untwisted, thus providing a greater length of the shrinkable component than of the other component, in any given length of the composite yarn, but not sufficiently to interfere with the knitting properties of the yarn.

The knitted articles of the invention may be regarded as formed of two fabrics, the respective threads of which are intertwined, and one only of which is keyed to itself at points of crossing. If the degree of twist, the separate tensions during the folding of the inert and binding filaments, and the tension of the composite yarn during knitting are adjusted to the optimum, a certain amount of relative movement is possible between the two fabrics, and if the finishing treatment is appropriately selected such relative movement is maintained, thus preserving to a large extent the elasticity of the material as a whole. This effect may be enhanced by giving to the compound fabric a finishing treatment with a suitable lubricant. The binding filament being mainly for the introduction of binding places, may be as fine as conveniently possible consistent with its having sufficient strength for its purpose.

In a fabric made according to this invention, the unions at the crossed adhesive parts are within the thickness of the fabric, between the crossed yarns.

When the adhesive or tacky state is brought about by the application of a gelatinising agent or solvent, it is necessary to control the action so as to avoid any adverse effect on the physical properties of the yarn, and for this purpose a diluent may be used. Such diluent may be one that is appreciably more volatile than the gelatinising agent. Where the degree of gelatinisation is controlled by the application of the gelatinising agent and diluent for a short period of time and by the rapid removal (say by evaporation, or washing off, or further dilution) of the diluent, the volatility of this latter need not be so high. When a more volatile diluent is used the gelatinisation and adhesion occur during evaporation of the agent and diluent.

In cases where the binding filament is likely to shrink and become brittle under the influence of a volatile gelatinising agent, and where this tendency cannot be conveniently or sufficiently counteracted by regulating tensions and twists as above mentioned, a less volatile solvent may be used as the gelatinising agent or as an addition to the volatile gelatinising agent, which less volatile solvent will, when it remains in the binding filament, also serve as a plasticiser to counteract such tendency to brittleness. This less volatile solvent or plasticiser if not subsequently removed, should be stable under normal conditions, insoluble in water, and unaffected by hot detergents, and should be non-toxic and non-irritant.

Preferably also, the plasticiser should be colourless and odourless. The terms " volatile " and " less volatile " as used herein refer to volatility at normal room temperatures in open atmosphere, the latter denoting " substantially non-volatile under normal conditions ".

The binding filament may be formed from cellulose esters, such as cellulose acetate or cellulose nitrate; the mixed cellulose esters (such as cellulose aceto propionate); or from cellulose ethers (such as benzyl cellulose or ethyl cellulose). Further, synthetic filaments of other materials may be employed as the binding filament, for example, the polyamide and vinyl resins; or a filament with a smooth sheath or coating or impregnation of cellulose acetate or other cellulose derivatives, or other potentially-adhesive substance on a core of non-reactable substance such as viscose. Natural and synthetic rubber substances may also be used as the adhesive-forming substance if in filamentary form or carried by a non-adhesive filament. In all these cases, the selected gelatinising agent will be suitable to the substance used in or for the auxiliary or binding filament.

Examples of agents for effecting gelatinisation and comprising solvents of high and low volatility, selection from which will be determined by the nature of the adhesive-forming substance to be gelatinised, are :—

(a) Some of the aliphatic and aromatic esters, including some of those derived from the simple esters by the inclusion of substituent groups in the molecule (such as ethyl acetate, ethyl aceto-acetate, di-ethyl carbonate, benzyl benzoate, glyceryl tri-acetate, and di-methyl glycol phthalates). Dimethyl phthalate has been found particularly useful for cellulose acetate;

(b) Some of the glycols and their substituted derivatives (such as ethylene glycol mono ethyl ether and butylene glycol di-acetate);

(c) Some of the halogen derivatives of the aliphatic and aromatic hydrocarbons (such as methylene chloride and chloroform);

(d) Some of the alkyl and aryl ketones (such as methyl ethyl ketone and diacetone alcohol);

(e) Some of the fatty acids (such as acetic acid and propionic acid);

(f) The aryl sulphonamides (such as *p*-

toluene sulphonamide); and

(g) Any suitable mixture of any of the above.

Agents which have a strong solvent or dispersing action on the material of the binding filament are not suitable for use alone as gelatinisers. The aim of the treatment is to produce in the binding filament an adhesive state of such degree that union occurs only between parts of the binding filament in contact with each other, and not between the binding filament and the inert foundation filament. Thus, acetone and acetic acid are not suitable alone as gelatinisers for cellulose esters. Where cellulose acetate forms the potentially-adhesive substance, dimethyl phthalate gives the range of adhesiveness required to achieve the object of the invention.

Some of the gelatinising agents mentioned are not effective when used alone, but have a gelatinising effect when mixed with another non-solvent. Such mixtures have advantages in that the solvent or gelatinising action is more gentle and is more easily controlled. An example of such a mixture is ethyl alcohol with diethyl carbonate or butyl formate. Again, some of the agents specified are nonsolvent at ordinary temperatures but become effective on the temperature being raised. For example:—ethylene glycol monoethyl ether produces no adhesion in cellulose acetate at normal temperatures but will do so at say 60° C. Other similar examples are *n*-propyl and iso-propyl alcohols and acetates and methyl amyl ketone.

When the adhesive-forming substance is a cellulose acetate, the gelatinising agent selected will depend to some extent on the acetyl content of the acetate used, as some of the solvents above-named are more effective with some types of acetate than with others.

Examples of diluents suitable for use with gelatinising agents which otherwise would be too strong and injure the yarn are, the aliphatic alcohols and ethers (such as ethyl alcohol and ethyl ether), and the aliphatic and aromatic hydrocarbons and certain of their chlorinated derivatives (such as pentane, benzene and carbon-tetra-chloride).

If the gelatinising agent consists of or includes a substance not readily volatilised at moderate temperatures, such substance may be removed from the inert foundation filament, but not completely from the binding filament, by washing off. In this case, selective action is obtained as a result of preferential absorption by the binding filament. The selective action may be increased by using in the washing process a relatively poor solvent for the less volatile substance and a short period of treatment. For example, when an alkyl phthalate has been used with cellulose acetate, petroleum ether and benzene are useful as solvents to remove the alkyl phthalate from the inert foundation filament whilst not removing it altogether from the binding filament.

It may here be stated that a process has been described in and claimed by Specification No. 501,436 for the manufacture of textiles, to increase the tensile strength and the resistance to wear and laundering and to prevent untwisting of the yarns thereof without substantially altering the original appearance and porosity of the textile, comprising mixing together, before spinning, non-adhesive textile fibres or filaments and a minor proportion of at least one type of potentially-adhesive fibres or filaments, spinning the mixture of fibres or filaments into a single yarn, activating the potentially-adhesive fibres or filaments sufficiently to render them adhesive but not sufficiently to render the yarn formed therefrom non-porous, and squeezing the fibres or filaments of the yarn together while the fibres or filaments are in an adhesive condition to cause the fibres or filaments to adhere to each other at their points of contact.

In the accompanying drawing:—

Fig. 1 is an enlarged face view of a piece of knitted fabric according to this invention, made with a composite yarn having an inert foundation filament and a potentially-adhesive binding filament twisted together, in which the pitch of the twist is greater than the total length of one complete stitch;

Fig. 2 is a like view, in which the pitch of twist is equal to the total length of one complete stitch;

Fig. 3 is a like view, of a fabric in which the components of the composite yarn are not twisted together, and in which therefore there is a possibility of the number of unions being nil, or at the most being very small; and

Figs. 4 and 5 are diagrams to illustrate how the number of possible unions in a fabric according to Fig. 1 increases as the square of the number of twists per unit length of composite yarn.

Referring to Fig. 1 the yarn comprises a filamentary base or foundation element 1, for example of thrown silk or of viscose rayon, or of other filamentary natural or artificial material not potentially-adhesive in relation to the mode of treatment to be selected, and a filamentary binding element 2 twisted with the inert foundation filament 1, the element 2 being of cellulose acetate, or of ether rayon, or of locally hydrolised acetate, or being an acetylated filament or other filamentary adhesive-forming substance, the selection being such that the subsequent treatment to bring about an adhesive condition will not affect the inert foundation element 1. The type of fabric shown is a simple, single-ply knit having loop stitches A and sinker stitches B, such as might be produced on an ordinary circular stocking-knitting machine. It will be observed that at the point 3, the binding element 2 crosses itself in contact, such point 3, being at the base of a loop A, and that these contacts occur at more or less random points but relatively frequent. As shown in Fig. 2 the points of contact are more numerous, and occur consistently at the same parts of the stitches. This regularity is difficult to achieve, and moreover the greater number of unions, whilst increasing the reinforcement of the fabric, may render the fabric too rigid for some purposes, e.g. for stockings.

In both cases shown, the main fabric which is formed from the inert foundation filament 1 has no unions in it, and therefore is elastically free. Should a stitch break at any point, whether in one element only or in both, laddering will occur only so far as the nearest points of adhesion of the binding filament 2.

In a preferred mode of carrying out the invention, for the manufacture of anti-laddering stockings, the stockings are knitted with a composite yarn such as is shown in Fig. 1, in which the binding filament is cellulose acetate, and the inert foundation filament 1 is viscose. After knitting, the stockings are first immersed in a bath containing a non-volatile gelatinising agent such as di-methyl phthalate in benzene, are then drained, dried, and finally subjected to a hot-pressing or ironing treatment which causes union of contacting adhesive parts. A suitable temperature for pressing is usually between 110° C. and 150° C., and a suitable time is ½ minute or thereabouts; a suitable range of pressure is that adopted in normal hosiery finishing. All the optima for these factors may be found readily by trial. In order to prevent one side of the stocking sticking to the other side during the pressing operation it is necessary to insert a shielding material in the stocking, for example a wooden form, as in the known finishing art.

In this mode of treatment, instead of a mechanical pressure being employed, the goods may be subjected to a gaseous pressure in a closed chamber and at an elevated temperature.

In a modification of this mode of treatment, instead of a non-volatile solvent being applied to the yarn by immersing the goods in a bath containing the solvent, the non-volatile solvent is incorporated in the binding filament itself during its manufacture. In such case, after knitting, the goods are merely subjected to a heat and pressure treatment in either of the ways referred to above.

In another mode of operation, after the application of the non-volatile solvent to the knitted goods, the goods are passed to the dye bath, the heat of which effects gelatinisation. Alternatively, the gelatinising bath is also the dye bath, and the usual drying processes which follow will give the required heat treatment to bring about the adhesion.

In another convenient mode of carrying out the invention, also for the manufacture of anti-laddering stockings, the stockings are knitted with a composite yarn such as is shown in Fig. 1 and are then immersed in a sufficiently-strong bath of a volatile gelatinising agent, such as ethyl acetate, and a diluent such as pentane, and with or without a non-volatile solvent to act as a plasticiser, and are then dried at room temperature and pressure, or thereabouts, gelatinisation occurring in the bath or during evaporation according to the nature of the agent employed.

In another modification, the goods, instead of being dipped in a volatile gelatinising reagent, are exposed to a vapour, for example, chloroform vapour, preferably at superatmospheric pressure.

In cases where two layers of a stocking or of other tubular or folded articles would otherwise be in contact whilst adhesion is being brought about, and would become united, a shielding element will be inserted to prevent to adjacent layers of fabric adhering to each other, as described above.

This protection of the tubular goods from self-contact may not always be necessary; for example it may not be necessary when the adhesion is brought about whilst the goods are in an aqueous bath. It is believed that during and after the immersion of the goods in an aqueous gelatinising bath, absorption of water causes some swelling action as a preliminary to and distinct from gelatinisation, and that where such swelling occurs in two contacting binding filaments, within the fabric, the contact pressure is sufficient to guarantee at those points a union which does not take place elsewhere.

It may be found that, after some modes of treatment, the fabric has acquired a slight stiffness which is due to mere matting or incipient cohesion, between the yarns at points other than the main binding places where more or less complete union has occurred. This stiffness may be removed, and at the same time the yarn may be somewhat softened, by subjecting the fabric to an after-treatment which will break down such incipient connections without impairing the main unions. The after-treatment may comprise the application of a warm weak soap solution, or even of warm water alone, or of other media, and in some cases may comprise or include a light mechanical working.

Referring now to Fig. 3, it will be observed that in the fabric shown there are no unions. The elements 1 and 2 in this case are not twisted together and there is a probability that one of the elements will be thrown consistently to the outside of the fabric in the knitting process. If and where this occurs the anti-laddering effect is absent, for which reason it is necessary to twist the element together, if only slightly.

In Fig. 4, unit lengths of two portions of compound yarn are shown each having two twists. It will be obvious that, potentially, each of the parts X in one unit may unite with either of the parts X in the other unit, making four possibilities in all. In Fig. 5 equal units of compound yarn are shown, each having four twists. Here also, each of the parts X in one unit may unite with any one of the parts X in the other unit, making sixteen possibilities in all. The number of actual unions taking place will be roughly proportional to the number of possibilities offered, and the number of actual unions will vary substantially as the square of the number of twists per unit length of the compound yarn.

The following are examples of the carrying out of the invention, the fabric in all cases being brought to a clean scoured condition before the treatment begins :—

EXAMPLE 1.

The fabric was made from a composite yarn having a basic or foundation filamentary component of viscose of 75 denier with 2 turns Z twist per inch, and an auxiliary or binding filamentary component of cellulose acetate of 15 denier with 2 turns Z twist per 1″, the two components being twisted together so as to have 4 turns S twist per 1″. The fabric was knitted with 48 wales per 1″ and with 48 courses per 1″. The fabric was immersed for 30 seconds in a bath made up of :

4—6 parts by volume di-methyl phthalate
96—94 parts by volume benzene

at a normal temperature and pressure, and then dried by evaporating, but so that the air-dry fabric contained about 15% by weight of the di-methyl phthalate. The fabric was then subjected to a hot pressing treatment for ¼ minute or thereabouts at 135° C. during which gelatinisation and adhesion took place, and to an after-treatment of 10 minutes duration at 70—80° C. in a ½% to 1% soap solution, and finally dried.

EXAMPLE 2.

In this case, the fabric was of the same construction as that used for Example 1, but the binding filament had from 10% to 15% (by weight) of di-methyl phthalate incorporated in it during its manufacture. No wet treatment was required for producing an adhesion. Instead the fabric was subjected to a heat and pressure treatment by being heated in a closed chamber for a short period at 140° C. under a gaseous pressure of 80 lbs. per square inch. The fabric was then subjected to the after-treatment in soap solution as in the preceding example.

EXAMPLE 3.

Fabric exactly as used for Example 2, but in which the binding filament contained from 10% to 15% (by weight) of di-methyl phthalate, or a fabric exactly as used for Example 1 but to the binding filament of which that amount of di-methyl phthalate had been applied by dipping and drying the goods, was then dyed in a bath at a temperature of from 70—80° C. and finished in the usual manner, gelatinisation and adhesion occurring during dyeing and/or finishing. No after-treatment in soap solution or the like was required in this case.

EXAMPLE 4.

A fabric as used for Example 1 was immersed for 30 seconds in a bath made up of

30—35 parts by volume ethyl acetate
62—68½ parts by volume pentane
1½—3 parts by volume di-ethyl phthalate

at normal temperature and pressure, and the surplus liquor then removed as by centrifuging, the remaining volatile solvent (ethylacetate) then being allowed to evaporate slowly. Adhesion took place during evaporation. The major proportion of the non-volatile solvent (di-ethyl phthalate) was then removed from the main filament by a short washing-off treatment with petroleum ether, some of it being retained in the binding filament by preferential absorption. An after-treatment in soap solution was then carried out as in Example 1, and the fabric finally dried.

EXAMPLE 5.

A fabric as used in Example 1 was immersed in the following bath, and the treatment continued as in Example 4:—

12.5 parts of volumė di-ethyl carbonate
35—40 parts of volume ethyl alcohol
40—45 parts of volume benzene
1—1.5 parts of volume di-methyl phthalate.

EXAMPLE 6.

A fabric as used in Example 1 was immersed in the following bath and the treatment continued as in Example 4:—

50 parts by volume butyl formate
50 parts by volume alcohol.

EXAMPLE 7.

A fabric as used for Example 1 was exposed to an atmosphere of chloroform vapour for an hour at normal temperature and pressure, during which exposure the adhesion took place, and the fabric was then subjected to the after-treatment as in Example 1. This example may be modified by the dilution of the chloroform vapour with air or an inert gas, and/or by the presence of a plasticiser (such as di-methyl phthalate) in or on the binding yarn. In all cases the treatment could be accelerated by raising the temperature and/or by raising the pressure of the gaseous reagent.

EXAMPLE 8.

A fabric as used for Example 1 was immersed for 30 seconds in a bath made up of

80 parts by volume methylene chloride
20 parts by volume benzene

at normal temperature and pressure, during which immersion the adhesion took place, the surplus liquor was then removed, and the remainder allowed to evaporate, after which an after-treatment was carried out as in Example 1.

EXAMPLE 9.

Knitted goods were made from thrown silk yarn composed of three silk threads, one of which, before twisting, had been printed at intervals of about ½″ with a mixture containing cellulose acetate and di-methyl phthalate, carried in a volatile medium. Such a mixture may also contain softeners and/or a lubricant to assist knitting as in known practice. After knitting the goods were heat treated according to Example 2, to produce the desired adhesion.

In any of the foregoing examples where an immersion teatment is used, the immersion may be carried out under super-atmospheric pressure.

The conditions of evaporation of the solvent and diluent from the fabric may have considerable effect on the binding filament. The evaporation of the volatile solvents should preferably take place at a temperature above normal room temperature, and in an atmosphere containing the solvent in vapour form, and if necessary with the material undergoing a slow uniform movement.

As an alternative to the after-treatment with soap solution, when the adhesive-forming substance is cellulose acetate, an after-treatment with an aqueous solution of a swelling agent for cellulose acetate (such as acetone or di-acetone alcohol) may be used.

In the manufacture of such articles as stockings, the composite yarn may if desired be employed for a certain proportion only of the courses, and some other yarn be employed for the other courses. In such a case it may be necessary to use an equivalent count for that other yarn, so that there will be no noticeable "ringing" or like marking of the finished article.

The gelatinising process may, in the case of dyed goods, be carried out before or after or during dyeing. It is possible, by using this process, and particularly with the soaping as an after-treatment to give to rayon material some of the handle and appearance of real silk.

Whilst the invention has been described as related to the prevention or reduction of laddering, it is found also that the resulting knitted goods have an increased resistance to distortion, making them more amenable to mechanical processing, and have an increased resistance to curling and fraying.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is :—

1. Method of manufacture of knitted goods of the type referred to, wherein the goods are knitted from a composite yarn which is composed of at least one inert foundation filament and at least one potentially-adhesive binding filament the filaments being twisted together with a low degree of twist; and wherein after knitting the goods are subjected to treatment which will render the binding filament or filaments tacky or adhesive and will cause mutually-contacting adhesive parts to unite; the degree of twist in the composite yarn being such that there are sufficient contacts of adhesive parts with each other to prevent laddering and such that there is sufficient relative freedom between the component filaments of the yarn to maintain the desired elasticity; and the nature of the treatment being such that, whilst two mutually-contacting adhesive parts will unite, one adhesive part will not, in general, unite with an inert filament.

2. Method according to claim 1, wherein the potentially-adhesive parts are rendered adhesive by heating, and pressure

is applied during the heating to bring about union.

3. Method according to claim 1, wherein the potentially-adhesive parts are rendered adhesive by the application of a gelatinising agent.

4. Method according to claim 3, wherein the gelatinising agent is contained within the binding filament itself, and is rendered active by heating.

5. Method according to Claim 3, in which a diluent is employed with the gelatinising agent.

6. Method according to claim 1, in which the surface of the binding filament or filaments is potentially-adhesive throughout.

7. Method according to claim 1, in which the surface of the binding filament or filaments is potentially-adhesive only in some parts.

8. Method according to claim 1, in which the composite yarn has only one binding filament.

9. Method according to claim 1, in which the composite yarn is formed from one larger inert foundation filament and one or more than one smaller binding filament.

10. Method according to claim 9, in which the inert foundation filament is formed of silk or viscose and is twisted with one binding filament formed of cellulose acetate.

11. Method according to claim 10, in which di-methyl phthalate is applied to the goods after knitting, and the goods are then heated.

12. Method according to claim 3, wherein the gelatinising agents are volatile solvents, and have mixed with them one or more less volatile solvents to serve as plasticisers.

13. In the method according to any of the preceding claims, the use of a composite yarn having one inert foundation filament and one gelatinisable binding filament wherein prior to being twisted together the components were each twisted separately, the direction of twist being such that when the components are being twisted together the inert component is still further twisted whilst the gelatinisable component is untwisted.

14. The method of manufacture of knitted goods of the type referred to, and having anti-laddering properties, when carried out according to any one of the Examples herein set forth.

15. The method according to claim 1, wherein the adhesive-forming substances, of which the binding filaments are made, or with which they are coated, are synthetic-resin-forming substances, the adhesive state being producible during a condensation of the resin; and wherein the knitted goods are subjected to heat and pressure to condense the resin and thereby produce union at points where condensation occurs in the meeting surfaces of two binding filaments crossing in contact.

16. The method according to any of the preceding claims, wherein the knitted goods are subjected to an after-treatment in a warm aqueous bath, to break down incipient cohesion and mere matting without impairing the main unions.

17. In the method according to claim 12, the step of removing the less volatile solvents from the foundation filament but not completely from the binding filament or filaments by the use of a weak solvent for the less volatile solvent through a short period, and by relying on the preferential absorption of the binding filament or filaments for the less volatile solvent.

18. In a method according to any of the preceding claims in which adhesion is to be brought about by heating without pressure, the step of heating the knitted goods whilst immersed in an aqueous medium.

19. Method according to claim 1, wherein the goods are knitted from multi-thread thrown silk yarn, one of the threads of which has been coated throughout or at intervals with an adhesive-forming compound to constitute it a binding filament.

20. Knitted goods of the type referred to prepared or produced according to the method or process herein particularly described and ascertained.

21. For use in the manufacture of knitted goods of the type referred to, a composite knitting yarn consisting of at least one inert foundation filament and at least one potentially-adhesive binding filament, the components having been twisted together, and the degree of twist being such that in the knitted goods there will be a sufficient number of contacts between the auxiliary component or components and itself or themselves after treatment as herein set forth to prevent laddering whilst there will be sufficient relative freedom between the component filaments to maintain the desired elasticity.

22. A composite yarn according to claim 21, having an inert foundation filament, wherein the several components had each been twisted before they were brought and twisted together, the directions of twist being such that in twisting the components together, the foundation component became further twisted whilst the auxiliary component or components became slightly untwisted sufficiently to

allow for relative shrinkage in the subsequent manufacturing process.

23. A composite yarn as claimed in claim 21 or 22, wherein the auxiliary component or each of them contains a substance which may be caused to gelatinise to produce an adhesive state.

24. For use in the manufacture of knitted goods of the type referred to, a knitting yarn according to claim 21 wherein the binding filament is potentially adhesive at some parts only of its length.

Dated this 14th day of November, 1940.
For the Applicant,
WILSON, GUNN & ELLIS,
54/56, Market Street, Manchester, 1.

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3rd Edition

[This Drawing is a reproduction of the Original on a reduced scale.]

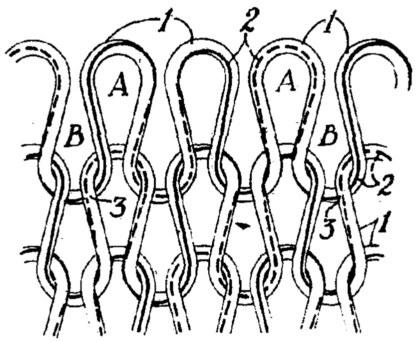

FIG. 1.

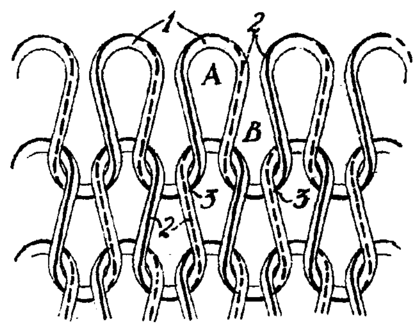

FIG. 2.

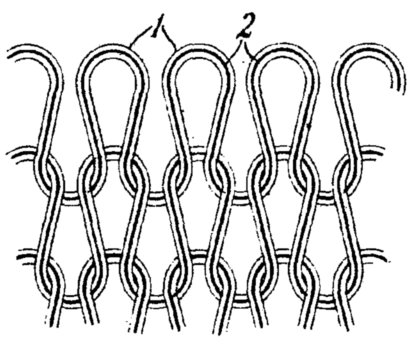

FIG. 3.

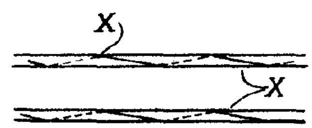

FIG. 4.

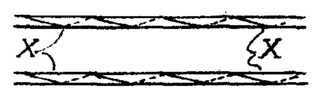

FIG. 5.

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(54) Verformbare, hitzestabilisierbare textile Polware

(57) Die vorliegende Erfindung betrifft eine Polware aus einem textilen Rücken aus Maschenware oder Gewebe und darin eingebundenen henkelbildenden Polgarnen, deren textiler Rücken aus einem Multifilament-Hybridgarn aus einer Mischung aus niedriger schmelzenden und gekräuselten höher schmelzenden Filamenten besteht, die dreidimensional verformbar ist und deren Rücken durch eine Wärmebehandlung verfestigt werden kann. Die erfindungsgemäße Polware hat einen angenehm weichen, textilen Griff und kann z.B. als Bezugsstoff für Sitzmöbel oder zur textilen Oberflächengestaltung von kompliziert gestylten Flächen, wie z.B. der Innenseite von Autotüren, eingesetzt werden.

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Beschreibung

Die vorliegende Erfindung betrifft eine Polware aus einem textilen Rücken aus Maschenware oder Gewebe und darin eingebundenen henkelbildenden Polgarnen, deren textiler Rücken aus einem Multifilament-Hybridgarn aus einer Mischung aus niedriger schmelzenden und gekräuselten höher schmelzenden Filamenten besteht, die dreidimensional verformbar ist und deren Rücken durch eine Wärmebehandlung verfestigt werden kann. Die erfindungsgemäße Polware hat einen angenehm weichen, textilen Griff und kann z.B. als Bezugsstoff für Sitzmöbel oder zur textilen Oberflächengestaltung von kompliziert gestylten Flächen, wie z.B. der Innenseite von Autotüren, eingesetzt werden.

Flächengebilde aus Hybridgarnen, die aus niedriger schmelzenden und höher schmelzenden Fasermaterialien zusammengesetzt sind, und die durch eine Wärmebehandlung verfestigt werden können, sind bereits bekannt.
So sind beispielsweise aus dem EP-B-0359436 Lamellenvorhänge bekannt, deren Lamellen aus einem Gewebe aus niedriger schmelzenden und höher schmelzenden Garnen bestehen, das nach seiner Herstellung einer Wärmebehandlung unterzogen wird, bei der die niedriger schmelzenden Garnanteile schmelzen und das Gewebe versteifen.

Es ist auch bekannt, aus Hybridgarnen, die einen hochschmelzenden oder unschmelzbaren Filamentanteil und einen thermoplastischen niedriger schmelzenden Filamentanteil aufweisen, Flächengebilde herzustellen, die durch Erwärmen über den Schmelzpunkt der thermoplastischen, niedriger schmelzenden Garnkomponente in faserverstärkte, steife Thermoplast-Platten, sog. "organische Bleche" überführt werden können.

Verschiedene Wege der Herstellung faserverstärkter Thermoplasthalbzeuge sind beschrieben worden in Chemiefasern/Textiltechnik 39./91. Jahrgang (1989) Seiten T185 bis T187, T224 bis T228 und T236 bis T240. Die Herstellung ausgehend von flächenförmigen Textilmaterialien aus Hybridgarnen wird dort als ein eleganter Weg beschrieben, der den Vorteil bietet, daß das Mischungsverhältnis von Verstärkungs- und Matrixfasern sich sehr exakt einstellen läßt und daß die Textilmaterialien sich aufgrund ihrer Drapierfähigkeit gut in Preßformen einlegen lassen (Chemiefasern/Textiltechnik 39./91. Jahrgang (1989), Seite T186).
Wie aus Seite T238/T239 dieser Publikation hervorgeht, ergeben sich Probleme allerdings bei der zweidimensionalen Verformung der Textilmaterialien. Da die Dehnungsfähigkeit der Verstärkungsfäden in der Regel vernachlässigbar klein ist, können Textilflächen aus herkömmlichen Hybridgarnen, nur noch aufgrund ihrer Bindung verformt werden.
Dieser Verformbarkeit sind jedoch in der Regel enge Grenzen gesetzt, wenn Faltenbildung vermieden werden soll (T239), eine Erfahrung die durch Computersimulationen bestätigt wurde.
Der Ausweg, die Textilien aus Verstärkungs- und Matrixfäden in Formen zu pressen ist mit dem Nachteil behaftet, daß dann eine partielle Stauchung eintritt, was zu einer Verlagerung und/oder Kräuselung der Verstärkungsfäden, verbunden mit einem Abfall der Verstärkungswirkung, führt.
Eine weitere in Seite T239/T240 angesprochene Möglichkeit, dreidimensional verformte Formteile mit unverlagerten Verstärkungsfäden herzustellen, bestünde in der Herstellung dreidimensional gewebter Vorformlinge, was aber erheblichen maschinellen Aufwand, sowohl bei der Herstellung der Vorformlinge als auch bei der Thermoplast-Imprägnierung oder -Beschichtung, bedingt.

Zur Verbesserung der Verformbarkeit von Verstärkungseinlagen dient ein aus der DE-A-40 42 063 bekanntes Verfahren. Bei diesem werden in das als Textilbewehrung vorgesehene Flächengebilde längenverformbare, nämlich hitzeschrumpfende, Hilfsfäden eingearbeitet. Durch Erwärmen wird der Schrumpf ausgelöst und das Textilmaterial etwas zusammengezogen, sodaß die Verstärkungsfäden gewellt oder in loser Umschlingung gehalten werden.

Aus der DE-A-34 08 769 ist eine Verfahren bekannt zur Herstellung von faserverstärkten Formkörpern aus thermoplastischem Material, bei dem flexible textile Gebilde eingesetzt werden, die aus weitgehend unidirektional ausgerichteten Verstärkungsfasern und aus einer aus thermoplastischen Garnen oder Fasern aufgebauten Matrix bestehen. Diese Halbzeuge werden bei Ihrer endgültigen Formgebung durch heizbare Profildüsen verformt, wobei praktisch alle thermoplastischen Fasern aufgeschmolzen werden.

Aus der Europäischen Patentanmeldung EP-A-0 260 872 ist ein getuftetes Textilmaterial bekannt bei dem Polgarne in einen Primärrücken aus Vliesstoff getufted sind, der relativ niedrig schmelzende Garne enthält. Durch eine Wärmebehandlung der getufteten Ware werden die niedriger schmelzenden Faserbestandteile des Vliesrückens geschmolzen, wobei der Rücken verfestigt wird und die Polgarne darin eingebunden werden.

Aus der Europäischen Patentanmeldung EP-A-0 568 916 ist ein getuftetes Textilmaterial bekannt bei dem Polgarne, die niedrig schmelzende Fasern enthalten, in einen mehrschichtigen Primärrücken getufted sind. Durch eine gezielte Wärmebehandlung, die nur den Rücken der getufteten Ware beeinflußt, werden die niedriger schmelzenden Garnbestandteile der Polgarne geschmolzen und in den Rücken eingebunden. Dabei sorgt eine auf der Polseite vorhandene besondere Schicht des mehrschichtigen Rückens für eine Wärmeisolierung, um eine Verhärtung der Polgarne zu verhindern.

Aus der Japanischen Patent-Offenlegungsschrift 30 937/1984 ist eine Polware bekannt aus einem Grundgewebe, in das Polgarne eingebunden sind. Das Grundgewebe besteht aus einem Garn aus niedriger schmelzenden und höher schmelzenden Fasern. Nach der Herstellung des Gewebes und Einbinden des Pols wird das Material auf eine Temperatur erwärmt, bei der die niedriger schmelzenden Fasern schmelzen, wobei eine Verfestigung des Geweberückens erfolgt. Aus dem Beispiel dieser Druckschrift ist zu ersehen, daß das zu Herstellung des gewebten Rückens eingesetzte Garn ein Stapelfasergarn ist, das aus einer Mischung niedriger schmelzender und höher schmelzender Stapelfasern durch Sekundärspinnen erhalten wird.

Diese Druckschriften geben allerdings keine Hinweise zur Herstellung einer Polware, die verformbar ist, d.h. sich zum Überziehen kompliziert dreidimensional gestalteter Flächen eignet.

In der deutschen Patentanmeldung P 42 09 970.6 ist bereits vorgeschlagen worden, einen Strukturplüsch aus einem gestrickten Rücken und darin mustermäßig eingebundene Polgarne herzustellen, wobei vorzugsweise Garne aus Polyestern eingesetz werden. Allerdings können die dort beschriebenen Materialien nicht thermoverfestigt werden und ihre Verformbarkeit ist auf das aus der Gestrickstruktur des Rückens sich ergebende Ausmaß begrenzt.

Hybridgarne aus unschmelzbaren (z.B. Glas- oder Kohlenstoffaser) und schmelzbaren Fasern (z.B. Polyesterfaser) sind bekannt. So betreffen beispielsweise die Patentanmeldungen EP-A-156 599, 156 600, 351 201 und 378 381 und die Japanische Druckschrift JP-A-04 353 525 Hybridgarne aus nichtschmelzbaren Fasern, z.B. Glasfasern, und thermoplastischen, z.B. Polyester-Fasern.
Auch die EP-A-551 832 und die DE-A-29 20 513 betreffen Mischgarne, die allerdings gebondet werden, vorher aber als Hybridgarn vorliegen.
Aus dem Europäischen Patent EP-B-0 325 153 ist ein textiles Flächengebilde aus Polyestergarnen mit einem Craquelé-Effekt bekannt, das zum Teil aus kaltverstreckten, höher schrumpfenden und zum Teil aus warmverstreckten normalschrumpfenden Polyesterfasern besteht. Bei diesem Material wird der Craquelé-Effekt durch Auslösen des Schrumpfs der höherschrumpfenden Fasern herbeigeführt.
Aus der EP-B- 0 336 507 ist ein Verfahren zum Verdichten eines textilen Flächengebildes aus Polyestergarnen bekannt, das zum Teil aus kaltverstreckten, höher schrumpfenden und zum Teil aus warmverstreckten, normalschrumpfenden Polyesterfasern besteht. Bei diesem Material wird die Verdichtung durch Auslösen des Schrumpfs der höherschrumpfenden Fasern herbeigeführt.

Aus der EP-A-0 444 637 ist ein Verfahren bekannt zur Herstellung eines gekräuselten Hybridgarns aus niedriger schmelzenden und höher schmelzenden Filamentgarnen. Bei diesem Verfahren wird zuerst das höher schmelzende Garn in einer Texturierdüse (bulking jet gemäß US-A-3 525 134) gekräuselt, dann wird es mit der niedriger schmelzende Garnkomponente vereinigt und beide Garne in einer zweiten Texturierdüse gemeinsam gekräuselt.

Eine Aufgabe der vorliegenden Erfindung ist es, eine Polware bereitzustellen, die einen angenehm weichen, "textilen" Griff hat, in vielen ansprechenden Dekors herstellbar ist, eine gute Drapierfähigkeit hat, sich dreidimensional verformen und damit auch kompliziert dreidimensional gestalteten Oberflächen, wie z.B. Sitz- und Rückenlehnenflächen von Sitzmöbeln oder der Innenseite von Autotüren, faltenlos anpassen läßt, und deren Rücken durch einfaches Erwärmen in einem den Erfordernissen der Weiterverarbeitung angepaßten Umfang verfestigt und versteift werden kann.

Die im Folgenden beschriebene erfindungsgemäße Polware löst diese Aufgabe.

Ein Gegenstand der vorliegenden Erfindung ist eine Polware aus einem textilen Rücken aus Maschenware oder Gewebe und darin eingebundenen henkelbildenden Polgarnen, deren textiler Rücken aus einem Multifilament-Hybridgarn aus mindestens 2 Sorten A und B von Filamenten und ggf. Begleitfilamenten C besteht, die dadurch gekennzeichnet ist, daß

die Filamente A	texturiert sind und einen Schmelzpunkt über 180°C, vorzugsweise über 220°C insbesondere über 250°C haben,
die Filamente B	einen Schmelzpunkt unter 220°C, vorzugsweise unter 200°C, insbesondere unter 180°C haben,

der Schmelzpunkt der Filamente B mindestens 20°C, vorzugsweise mindestens 40°C, insbesondere mindestens 80°C unter dem Schmelzpunkt der Filamente A liegt, und
das Gewichtsverhältnis der Filamente A:B im Bereich von 20:80 bis 80:20, vorzugsweise von 40:60 bis 60:40 liegt und das Multifilament-Hybridgarn noch bis zu 40 Gew.-% Begleitfilamente C enthält.

Ein wesentlicher Vorteil dieser Polware besteht darin, daß sie dreidimensional verformbar ist.
Diese wertvolle Eigenschaft wird besonders begünstigt und auch dann erzielt, wenn der Rücken aus einem Gewebe besteht, wenn die höherschmelzenden texturierten Filamente A eine Einkräuselung von 3 bis 50 %, vorzugsweise von 8 bis 30 %, insbesondere von 10 bis 22 % aufweisen.

Die Einkräuselung der höherschmelzenden Filamente kann im Prinzip nach allen bekannten Methoden erfolgen, bei denen in die Filamente bei erhöhter Temperatur eine zwei- oder dreidimensionale Kräuselung einfixiert wird. Geeignete bekannte Verfahren sind z.B. die Stauchkammerkräuselung, die Zahnradkräuselung, das "knit-deknit"-Verfahren, bei dem ein Garn zunächst zu einem Strickschlauch gestrickt wird, dieser thermofixiert und anschließend wieder aufgezogen wird. Das bevorzugte Verfahren zur Texturierung der Filamente A ist jedoch das in zahlreichen Veröffentlichungen beschriebene Falschdrahtverfahren.

Zweckmäßigerweise sind die höherschmelzenden texturierten Filamente A luftdüsentexturiert oder vorzugsweise falschdrahttexturiert.

Eine weitere besonders wertvolle Eigenschaft der erfindungsgemäßen Polware besteht darin, daß ihr Rücken durch eine Wärmebehandlung verfestigt werden kann. Hierbei bilden die niedriger schmelzenden Filamente B des Mul-

tifilament-Hybridgarns des textilen Rückens zumindest partiell eine Matrix, die die höherschmelzenden texturierten Filamente des Multifilament-Hybridgarns untereinander und mit dem Polgarn im Bereich der Rückenebene miteinander verbindet.
Unter Matrix im Sinne dieser Erfindung ist eine zusammenhängende Polyestermasse zu verstehen, die durch das vollständige oder partielle Schmelzen der Filamente B, oder durch ein Miteinanderverkleben der bis zur Klebrigkeit erweichten Filamente B gebildet wird.

Um diese Verfestigungsmöglichkeit zu erzielen, ohne dabei unerwünschte Einbußen bezüglich Festigkeit, Formhaltigkeit der Ware unter erschwerten Anwendungsbedingungen oder an textilem Griff und Aspekt des Flors hinnehmen zu müssen, ist es zweckmäßig und vorteilhaft, wenn die Filamente A einen Schmelzpunkt von über 220°C, vorzugsweise von 220 bis 300°C, insbesondere von 240-280°C haben.
Ferner ist es zweckmäßig und vorteilhaft, wenn die Filamente B einen Schmelzpunkt von unter 220°C, vorzugsweise von 110 bis 220°C, insbesondere von 150 bis 200°C haben.

Erfindungswesentlich ist somit der Einsatz von Filamentsorten A,B für die bestimmte Schmelzpunktsvorgaben bestehen.
Der Schmelzpunkt der Filamente wird an dem zu Ihrer Herstellung verwendeten Polymer-Rohstoff bestimmt. Eine Besonderheit vieler Polymermaterialien, wie z.B. auch von Polyestermaterialien, besteht darin, daß sie in der Regel vor dem Schmelzen erweichen und der Schmelzvorgang sich über einen relativ großen Temperaturbereich erstreckt. Dennoch ist es möglich, gut reproduzierbare, für diese Polymermaterialien, z.B. für Polyestermaterialien, charakteristische Temperaturpunkte zu ermitteln, bei denen die untersuchte Probe ihre geometrische Form verliert, d.h. in einen flüssigen (wenngleich oft hochviskosen) Zustand übergeht. Die Bestimmung dieser charakteristischen Temperaturpunkte erfolgt mit sogenannten Penetrometern (analog DIN 51579 bzw. 51580), bei denen auf ein Chip oder Pellet der zu untersuchenden Polymerprobe eine Meßspitze definierter Dimension unter definiertem Druck aufgesetzt wird, die Probe dann mit definierten Aufheizgeschwindigkeit erwärmt und das Eindringen der Meßspitze in das Polymermaterial messend verfolgt wird.
Sobald die Probe, z.B. die Polyesterprobe erweicht, beginnt ein sehr langsames Eindringen der Meßspitze in das Material.
Das Eindringen der Meßspitze kann sich bei steigender Temperatur wieder verlangsamen und auch ganz zum Stillstand kommen, wenn die erweichte, zunächst amorphe Polyestermasse kristallisiert.
In diesem Fall zeigt sich bei weiterer Erhöhung der temoeratur ein zweiter Erweichungsbereich der dann im folgenden beschriebenen "Schmelzbereich" übergeht.

Der genannte "Schmelzbereich" ist ein bestimmter recht enger, für das Material charakteristischen Temperaturbereich, in dem eine auffällige Beschleunigung des Eindringens der Meßspitze in das Polyestermaterial erfolgt. Als gut reproduzierbarer Schmelzpunkt kann dann ein Temperaturpunkt definiert werden, bei dem die Meßspitze eine bestimmte Eindringtiefe erreicht hat.
Als Schmelzpunkt im Sinne dieser Erfindung wird der Temperaturpunkt (Mittelwert aus 5 Messungen) definiert, bei dem eine Meßspitze mit einer kreisförmigen Auflagefläche von 1 mm^2 unter einem Auflagegewicht von 0,5 g in eine mit 5°C/min aufgeheizte Polymerprobe, z.B. Polyesterprobe, 1000 µm tief eingedrungen ist.

Sowohl aus Gründen der Herstellung der erfindungsgemäßen Polware als auch aus Gründen einer besonders vorteilhaften Verteilung des Matrixmaterials bei der Verfestigung des Rückens (kurze Fließwege) ist es bevorzugt, daß zwischen den Filamente A und B und ggf. C Fadenschluß besteht.
Der Fadenschluß zwischen den Filamenten ist erforderlich um einen Fadenkörper zu bilden, der nach Art eines Garns verarbeitet werden kann, d.h. der z.B. verwebt oder verwirkt werden kann, ohne daß sich Einzelfilamente des Verbundes aus diesem lösen oder größere Schlaufen bilden und somit zu Störungen der Verarbeitungsschritte führen.
Der erforderliche Fadenschluß kann z.B. dadurch herbeigeführt werden, daß dem Garn ein sogenannter Schutzdrall von z.B 10 bis 100 Drehungen/m vermittelt wird, oder daß die Filamente punktuell miteinander verschweißt werden. Vorzugsweise wird der erforderliche Fadenschluß durch Verwirbelung in einer Jet-Düse herbeigeführt wobei die zu einem Garn zu verbindenden Filamente in einem engen Faden Kanal seitlich mit einem scharfen Gasstrahl angeblasen werden. Der Grad der Verwirbelung und damit die Güte des Fadenschlusses kann dabei durch die Stärke der Anblasung variiert werden.

Vorzugsweise sind die Filamente A,B und ggf. C des Multifilament-Hybridgarns miteinander verwirbelt, wobei der Verwirbelungsgrad des Multifilament-Hybridgarns zweckmäßigerweise einer Öffnungslänge von 10 bis 100 mm entspricht.

Der Verwirbelungsgrad wird charakterisiert durch die Angabe der Öffnungslänge, die gemäß der in US-A-2 985 995 beschriebenen Nadeltest-Methode mit einem ITEMAT Nadeltest-Gerät gemessen wird.

Weitere bevorzugte Merkmale des Multifilament-Hybridgarns, die je nach Anwendungserfordernissen oder Zweckmäßigkeit einzeln oder in wechselnden Kombinationen vorliegen können, sind, daß die Filamente B glatt sind, das Multifilament-Hybridgarn keine Begleitfilamente C enthält, es einen Gesamttiter von 80 bis 500 dtex, vorzugsweise 100 bis 400 dtex, insbesondere 160 bis 320 dtex, hat, die höherschmelzenden texturierten Filamente A einen Einzelfilament-

Titer von 0,5 bis 15 dtex, vorzugsweise von 2 bis 10 dtex, haben, und die niedrigerschmelzenden Filamente B einen Einzelfilament-Titer von 1 bis 20 dtex, vorzugsweise von 3 bis 15 dtex, haben.

Im Interesse einer guten textilen Qualität der erfindungsgemäßen Polware ist es zweckmäßig ein Multifilament-Hybridgarn einzusetzen dessen höherschmelzende texturierte Filamente A einen Anfangsmodul von 15 bis 28 N/tex, vorzugsweise von 20 bis 25 N/tex, und eine feinheitsbezogene Höchstzugkraft von über 25 cN/tex, vorzugsweise von über 30 cN/tex, insbesondere von 30 bis 40 cN/tex haben.

Es hat sich als vorteilhaft erwiesen, insbesondere bei der Herstellung von erfindungsgemäßen Polwaren mit dunkleren Farbtönen einen Rücken zu benutzen der ebenfalls in dunkleren Tönen gefärbt ist. Ist der Rücken wesentlich heller als der Pol so kann es passieren, daß beim Streichen über den Pol oder beim Legen der Polware über Strukturen mit geringem Krümmungsradius der hellere Rücken durch den Pol hindurchscheint ("durchgrinsen").
Es ist daher bevorzugt, daß die höherschmelzenden texturierten Filamente A gefärbt, vorzugsweise spinngefärbt sind. Die niedrigerschmelzenden Filamente B können spinngefärbt, oder vorzugsweise rohweiß sein, da es sich gezeigt hat, daß beim thermischen Verfestigen des Rückens das Material des Filamente B weitestgehend von den Strängen der Filamente A aufgenommen wird und sich insgesamt die dunkle Farbe der Filamente A ergibt.

Es hat sich gezeigt, daß bei der Herstellung des Rückens neben den erfindungsgemäß einzusetzenden Multifilament-Hybridgarn auch andere Garne mitverarbeitet werden können. Zweckmäßigerweise soll jedoch der Anteil des Multifilament-Hybridgarns im Rücken mindestens 30 %, vorzugsweise mindestens 75 %, insbesondere 100% betragen.

Für die meisten Applikationen ist es zweckmäßig daß das Flächengewicht der erfindungsgemäßen Polware 100 bis 1000 g/m^2, vorzugsweise 200 bis 500 g/m^2 beträgt und daß das Gewichtsverhältnis von textilem Rücken zu Polgarn in der Rohware im Bereich von 20:80 bis 40:60 liegt.

Ferner ist es zweckmäßig, daß die Henkel eine Länge von 1,0 bis 6,0 mm, im Falle von Scherplüsch vorzugsweise von 2,8 bis 3,5 mm, im Falle von Kurzhenkelplüsch vorzugsweise von 1,0 bis 2,5 mm, haben.

In der Regel genügt die erfindungsgemäße Polware den Anforderungen an Innendekorationsmaterial wenn der Gesamttiter des Polgarns 50 bis 800 dtex, vorzugsweise 100 bis 400 dtex beträgt.
Dabei beträgt der Einzelfilament-Titer des Polgarns normalerweise 0,5 bis 10 dtex, vorzugsweise 0,7 bis 6 dtex, insbesondere 3 bis 6 dtex.
Mit Rücksicht auf den textilen Charakter der erfindungsgemäßen Polware ist es bevorzugt, daß die Polgarne texturiert, vorzugsweise blas-oder falschdrahttexturiert, sind.

Der Pol selbst kann aus ungeschnittenen Polgarn-Schlingen oder aus geschnittenen Polgarn-Enden bestehen.

Wie oben bereits angegeben ist eine Ausführungsform der erfindungsgemäßen Polware dadurch gekennzeichnet, daß der textile Rücken aus Maschenware besteht.
In dieser Ausführungsform kann der Rücken der erfindungsgemäßen Polware gewirkt oder gestrickt sein.
Die gewirkten textilen Flächen können kettengewirkt oder kuliergewirkt sein.

Ein gestrickter oder gewirkter Rücken kann Rechts/Rechts, Links/Links oder eine Rechts/Links-Maschenstruktur und deren bekannte Varianten sowie Jacquard-Musterungen aufweisen.
Die Rechts/Rechts-Maschenstruktur beinhaltet beispielsweise auch deren Varianten plattiert, durchbrochen, gerippt, versetzt, Welle, Fang oder Noppe sowie die Interlock-Bindung Rechts/Rechts/Gekreuzt.
Die Links/Links-Maschenstruktur beinhaltet beispielsweise auch deren Varianten plattiert, durchbrochen, unterbrochen, versetzt, übersetzt, Fang oder Noppe. Die Rechts/Links-Maschenstruktur beinhaltet beispielsweise auch deren Varianten plattiert, hinterlegt, durchbrochen, Plüsch, Futter, Fang oder Noppe.

Wie oben ebenfalls bereits angegeben, ist eine weitere Ausführungsform der erfindungsgemäßen Polware dadurch gekennzeichnet, daß der textile Rücken gewebt ist.
Im Prinzip kann ein gewebter Rücken alle bekannten Gewebekonstruktionen aufweisen wie die Leinwandbindung und deren Ableitungen, wie z.B. Ripse-, Panama-, Gerstenkorn- oder Scheindreherbindung, oder die Köperbindung und deren vielfache Ableitungen, von denen nur beispielsweise Fischgratköper, Flachköper, Flechtköper, Gitterköper, Kreuzköper, Spitzköper, Zickzackköper, Schattenköper oder Schatten-Kreuzköper genannt seien. (Wegen der Bindungsbezeichnungen vergl. DIN 61101)

Die Gewebe- oder Maschenbindungen werden nach dem beabsichtigten Einsatzzweck des erfindungsgemäßen Textilmaterials ausgewählt, wobei rein technische Zweckmäßigkeit ausschlaggebend sind, gelegentlich aber auch zusätzlich dekorative Gesichtspunkte berücksichtigt werden können. Bevorzugte Maschenstruktur ist die Grundbindungen Rechts/Rechts, Links/Links oder eine Rechts/Links, bevorzugte Gewebebindung ist die Leinwandbindung ggf. mit einfachen Ableitungen ohne größere Flottierungen.
Bevorzugt sind jeweils die Grundstrukturen der Maschenware oder Gewebe.

Die Dichte der Rückenfläche liegt je nach der Anwendung für die das Material vorgesehen ist und je nach dem Titer der bei der Herstellung eingesetzten Garne bei Geweben im Bereich von 10 bis 25 Fäden/cm, vorzugsweise von 14 bis 20 Fäden/cm in Kette und Schuß, bei Maschenware bei einer entsprechenden Maschendichte von ca. 12 bis 30 Nadeln/inch, vorzugsweise 16 bis 24 Nadeln/inch. Innerhalb dieses Bereichs können die Dichten natürlich dem beabsichtigten Anwendungsfall angepaßt werden.

Je nach den Anforderungen des Anwendungsfalls und insbesondere des angestrebten Struktordekors des Pols weisen bei einem Rücken aus Maschenware mindestens 30 %, vorzugsweise 60 bis 100 % der Maschen Polgarne auf. Aus dem gleichen Grund kann es zweckmäßig sein, daß bei einem Rückengewebe nicht jeder Kett-und/oder Schußfaden Polnoppen einbindet. In der Regel binden bei einem Rückengewebe 30 %, vorzugsweise 60 bis 100 % der Kett- und/oder Schußfäden Polnoppen ein.

Durch eine gezielt gesteuerte Einbindung von Polnoppen in die Rückenfläche können sehr dekorative Plüsche mit interessanten Oberflächenstrukturen und Dekors erzeugt werden. Derartige Erzeugnisse sind unter der Bezeichnung "Strukturplüsch" bekannt.
Die Struktur und Herstellung dieser dekorativen Strukturplüsche, mit gewebtem Rücken oder einem Rücken aus Maschenware soll im Folgenden anhand eines gestrickten Rückens erläutert werden. Die beschriebene Struktur kann sinngemäß und analog auch auf Polwaren mit gewebtem Rücken übertragen werden.
Wegen des erfindungsgemäßen Einsatzes des Multifilament-Hybridgarns ergibt sich auch bei gewebtem Rücken eine dreidimensional verformbare, durch Hitze zu verfestigende Polware.

Eine solche, besonders bevorzugte, dekorative Plüschkonstruktion besteht aus einem gestrickten Strukturplüsch mit hoher Verformbarkeit, aus Grund- und Henkelgarnen, der als Henkelgarne Filamentgarne aufweist, die, bezogen auf eine Maschinenteilung von 18 oder 20 Nadeln pro inch, einen Gesamttiter von 300 - 400 dtex, vorzugsweise 345 - 360 dtex, haben, dessen Grundgarn, bezogen auf eine Maschinenteilung von 18 oder 20 Nadeln pro inch einen Gesamttiter von 300 bis 370 dtex, vorzugsweise 320 - 350 dtex, hat, wobei die Einzeltiter der Filamente größer als 1,5 dtex, vorzugsweise größer als 2,5 dtex sind, und dessen Flächengewicht etwa 350 bis 550 g/m^2 beträgt, und dessen Grundmaschen in Strukturzonen kein Henkelgarn enthalten.

Strukturzonen im Sinne dieser Erfindung sind Bereiche, in denen der erfindungsgemäße Strickplüsch keine Henkel aufweist.

Auch die zur Herstellung des Strukturplüsches geeignete Grundgarne bestehen zweckmäßigerweise ebenfalls aus synthetischen Filamenten. Geeignete Filamentmaterialien für Grund- und Henkelgarne sind beispielsweise Polyester-, Polyamid- oder Polyacrylnitril-Filamente; bevorzugt sind Polyesterfilamente. Sprechen keine besonderen anwendungstechnische Forderungen für die Verwendung unterschiedlicher Materialien in Henkel- und Grundgarn, so ist es bevorzugt, für beide Polyester-Filamentgarne einzusetzen.
Zweckmäßigerweise haben alle im Polgarn enthaltenen Filamente einen Schmelzpunkt der mindestens 20°C, vorzugsweise mindestens 40°C insbesondere mindestens 80°C über dem Schmelzpunkt der Filamente B des Multifilament-Hybridgarns liegt. Ist dies aus besonderen Gründen nicht der Fall so ist bei der Verfestigung des Rückens der erfindungsgemäßen Polware darauf zu achten, daß die Wärmebehandlung auf den Rücken des Materials beschränkt wird, z.B. durch Kontakterwärmung an einer Heizfläche, um eine Verhärtung des Polgarns zu vermeiden.

Bevorzugt, insbesondere für Garn- und Einzeltiter im unteren Teil des angegebenen Titerbereichs, werden texturierte Garne. Dabei ist es besonders vorteilhaft, wenn Grundgarne falschdrahttexturiert, Henkelgarne falschdraht- oder luftdüsentexturiert sind.
Die erfindungsgemäßen Stukturplüsche können auch aus Mischgarnen aus glatten und texturierten Filamenten bestehen oder solche Garne enthalten.

Geeignete Garne im oben angegebenen Titerbereich sind beispielsweise unter den Handelsnamen ®TREVIRA texturiert, in verschiedenen Typen, bekannt.

Wie oben ausgeführt, beziehen sich die oben angegebenen Gesamttiter der in den erfindungsgemäßen Strukturplüsch enthaltenen Grund- und Henkelgarne auf eine Maschendichte entsprechend einer Maschinenteilung von 18 oder 20 Nadeln pro inch. Bei feinerer Maschinenteilung werden die Titer von Grund - und Henkelgarnen entsprechend herabgesetzt.

Die Einzeltiter der Grund- und Henkelgarne liegen oberhalb 1,5 dtex und sollten zweckmäßigerweise 5 dtex nur bei besonderen Anforderungen an den Plüsch übersteigen. Die Titerauswahl innerhalb dieses Bereichs richtet sich einerseits nach den gewünschten Eigenschaften der erfindungsgemäßen Strukturplüsche. Strukturplüsche aus Garnen, insbesondere aus Henkelgarnen mit Einzeltitern unterhalb 3 dtex, sind weicher, dichter und seidiger als solche aus Garnen mit höheren Einzeltitern. Andererseits sind neben den Qualitäts- und Echtheitsanforderungen auch wirtschaftliche Gesichtspunkte bei der Titerauswahl zu berücksichtigen. So ist es zweckmäßig, wenn keine anderen Anforderungen dagegen sprechen, Garne mit Einzeltitern von 2,5 dtex bis 5 dtex, insbesondere handelsübliche Standardtypen, einzusetzen.

Für besonders hohe Qualitäten und insbesondere wenn eine sehr ansprechende Optik und angenehmer Griff gewünscht werden ist es bevorzugt, Profilfilamente wie z.B. solche mit ovalem, hantelförmigem oder bändchenförmigem Querschnitt, der auch noch eine oder mehrere Einschnürungen aufweisen kann, oder Dreikant-, Dreilapp (trilobal)- und besonders Achtlapp (oktolobal)- Profile einzusetzen.

Der Henkelanteil liegt beim erfindungsgemäßen Strukturplüsch in Abhängigkeit vom Dessign bei 40 - 75 %, vorzugsweise bei 45 - 60 %, insbesondere bei etwa 50 %. Der hier in Rede stehende "Henkelanteil" ist der Anteil in % der im Rapport vorhandenen Henkel zur Anzahl der auf der gleichen Fläche des Grundmaterials bei Vollplüsch maximal möglichen Henkel.

$$\text{Henkelanteil [\%]} = \frac{\text{Anzahl der im Rapport vorhandenen Henkel x 100}}{\text{Anzahl der bei Vollplüsch maximal möglichen Henkel}}$$

Während bei herkömmlichen Strickplüschen der Gewichtsanteil des Grundmaterials etwa 25-28 Gew.% des Gesamtgewichts beträgt, beläuft sich der Gewichtsanteil des Grundmaterials beim erfindungsgemäßen Strukturplüsch aufgrund der hohen Titer sowohl im Henkel- als auch im Grundgarn und wegen seines oben beschriebenen, sehr kompakten Aufbaus auf 40-45 Gew% und kann je nach dem Dessign (d.h. bei geringerem Henkelanteil) auch noch darüber liegen.

Zur Gestaltung des Oberflächendessigns können die Maschen der Grundware mustermäßig mit Henkeln kombiniert sein, was durch entsprechende jacquardmäßige Nadelauswahl der Strickmaschine erreicht wird oder es können Henkel-Leerreihen, d.h. komplette Grundreihen ohne Henkel vorliegen.

Beispielsweise können auf 1 bis 5 Henkelreihen eine oder zwei Reihen ohne Henkel folgen (Querripp-Effekt). Auch Muster mit gewebeähnlichem Charakter lassen sich auf diese Weise herstellen. Auf diese Weise hergestellte Dessigns, die längslaufende und/oder querlaufende und/oder diagonallaufende Gassen aufweisen, die als eine Art von Lüftungskanälen wirken, tragen bei der Verwendung dieser Stukturplüsche als Sitzbezüge wesentlich zum Sitzkomfort bei.

Die erfindungsgemäßen Strukturplüsche haben aufgrund der oben genannten Merkmale, insbesondere der hohen Dichte des Grundgewebes, der hohen Garnstärke in Grund- und Henkelgarn und der damit erzielten hohen Poldichte, aber auch durch eine ggf. angewandte den Pol zusätzlich stabilisierende Ausrüstung, und dem daraus resultierenden sehr guten Polstand auch bei kritischen Dessigns eine sehr gute Stabilität.

Von besonderer anwendungstechnischer Bedeutung ist es, daß trotz der sehr kompakten, dichten Warenkonstruktion die Dehnbarkeit und die reversible und irreversible Verformbarkeit des erfindungsgemäßen Strukturplüsches noch in weiten Grenzen den anwendungstechnischen Forderungen angepaßt werden kann durch die Einstellung der Strickmaschine (Warenfestigkeit), die Wahl der Elastizität und/oder Einkräuselung des Grundgarns und/oder eine Nachbehandlung des Strukturplüsches z.B. durch eine der gewünschten Verformbarkeit angepaßte Schrumpfbehandlung.
Die Einstellung der Dehnung erfolgt entsprechend dem Ausmaß der bei der Weiterverarbeitung zu dreidimensional geformten Gegenständen, wie z.B. Sitzbezügen oder speziellen tiefgezogenen Verkleidungselementen, beispielsweise in einem Autoinnenraum, notwendigen Verformung.
Durch die freie Einstellbarkeit der Dehnung ergibt sich für die erfindungsgemäßen Strukturplüsche neben der einfacheren Herstellung auch ein zusätzlicher Qualitätsvorteil gegenüber den nahezu oder völlig unelastischen Geweben aus Flockgarnen. Bei letzteren ist eine gewisse Verformbarkeit nur durch aufwendige Konstruktionen unter Einsatz von speziellen Garnen mit hoher Dehnbarkeit erreichbar.

Der Pol der erfindungsgemäßen Strukturplüsche wird bevorzugt auf etwa 1 bis 3 mm geschoren. Hierbei ergibt sich der weitere wirtschaftliche Vorteil, daß der durch die hohe Stärke von Grund- und Henkelgarnen bewirkte hervorragende Polstand ein sparsames Abscheren ermöglicht und somit zu der wirtschaftlich sehr erwünschten Reduzierung des Scherverlusts, der nach dem Stand der Technik bei etwa 20 bis 30 Gew.-% liegt, beim erfindungsgemäßen Strukturplüsch aber nur 10 bis 15 Gew.-% beträgt, beiträgt.
Durch Einstellung einer niedrigen Polhöhe kann mit dem erfindungsgemäßen Strukturplüsch auch eine Flockgewebe-Optik erzeugt werden.

Die hohe Dichte des Grundmaterials des erfindungsgemäßen Strukturplüsches bringt den weiteren Vorteil, daß es eine erheblich verringerte Durchdringbarkeit für Formmassen hat und daher mit besonderem Vorteil bei Formgebungsverfahren, die mit einem direkten Hinterspritzen oder Hinterschäumen arbeiten, in vielen Fällen ohne die sonst erforderliche durchdringungssperrende Unterkaschierung eingesetzt werden kann.

Wie oben ausgeführt, wird der Rücken der erfindungsgemäßen Polware aus einem Multifilament-Hybridgarn hergestellt, das höherschmelzende (A) und niedrigerschmelzende Filamente (B) aufweist, wobei die Schmelzpunkte einen bestimmten, verfahrenstechnisch bedingten Mindestabstand haben müssen, und die Filamente A texturiert sind. Diese Merkmale sind notwendig aber auch ausreichend, um der erfindungsgemäßen Polware und dem sie tragenden Rücken die Verformbarkeit und die Fähigkeit zur Thermoverfestigung zu vermitteln.

Für die Filamente A des Multifilament-Hybridgarns gilt, daß sie oberhalb 180C, vorzugsweise über 220°C, insbesondere über 250°C schmelzen sollen. Sie können im Prinzip aus allen spinnfähigen Materialien bestehen, die diese Voraussetzungen erfüllen. Geeignet sind daher sowohl halbsynthetische Materialien, wie z.B. Filamente aus regenerierter Zellulose oder Zelluloseacetat, als auch synthetische Filamente, die wegen der Möglichkeit, ihre mechanischen und chemischen Eigenschaften in weitem Bereich zu variieren, besonders bevorzugt sind.
So können prinzipiell Filamente A aus Hochleistungspolymeren bestehen, wie z.B. aus Polymeren, die ohne oder mit nur geringer Verstreckung, ggf. nach einer dem Spinnvorgang nachgeschalteten Wärmebehandlung, Filamente mit sehr hohem Anfangsmodul und sehr hoher Reißfestigkeit (= feinheitsbezogener Höchstzugkraft) liefern. Solche Filamente sind eingehend beschrieben in Ullmann's Encyclopedia of Industrial Chemistry, 5.Auflage (1989), Band A13, Seiten 1 bis 21 sowie Band 21, Seiten 449 bis 456. Sie bestehen beispielsweise aus flüssigkristallinen Polyestern (LPC), Polybenzimidazol (PBI), Polyetherketon (PEK), Polyetheretherketon (PEEK), Polyetherimiden (PEI), Polyethersulfon (PESU), Aramiden wie Poly-(m-phenylenisophthalamid)(PMIA), Poly-(m-phenylen-terephthalamid)(PMTA), oder

Poly(phenylensulfid)(PPS).
In der Regel ist jedoch der Einsatz derartiger Hochleistungsfasern nicht erforderlich und im Hinblick auf die Anforderungen an die Festigkeit des Rückenmaterials der erfindungsgemäßen Polware auch nicht zweckmäßig.
Zweckmäßigerweise bestehen daher die Filamente A aus regenerierter oder modifizierter Zellulose, höherschmelzenden Polyamiden (PA), wie z.B. 6-PA oder 6,6-PA, Polyvinylalkohol, Polyacrylnitril, Modacrylpolymeren, Polycarbonat, insbesondere aber aus Polyestern. Polyester eignen sich insbesondere deshalb als Rohstoff für die Filamente A weil es möglich ist, auf relativ einfache Weise durch Modifikation der Polyesterkette die chemischen, mechanischen und sonstigen physikalischen anwendungsrelevanten Eigenschaften, insbesondere z.B. den Schmelzpunkt zu variieren.

Als Polymermaterial, aus denen die niedriger schmelzenden Filamente (B) bestehen, kommen ebenfalls zweckmäßigerweise spinnfähige Polymere in Betracht wie z.B. Vinylpolymere wie Polyolefine, wie Polyethylen oder Polypropylen, Polybuten, niedriger schmelzende Polyamide, wie z.B. 11-PA oder alicyclische Polyamide (z.B. das durch Kondensation von 4,4'-Diaminodicyclohexylmethan und Decancarbonsäre erhältliche Produkt), insbesondere aber auch hier modifizierte Polyester mit erniedrigtem Schmelzpunkt

Die Polgarne bestimmen weitgehend den textilen Charakter der erfindungsgemäßen Polware. Sie können aus allen üblicherweise zur Herstellung des Pols von Polwaren, z.B. von Plüschen, eingesetzten Faser- und Filamentmaterialien bestehen. So können die Polgarne aus Spinnfasern aus natürlichen Fasermaterialien, wie z.B. Baumwolle oder Wolle, bestehen oder aus halbsynthetischen Fasermaterialien, oder auch aus Synthesefasern und -filamenten. Auch Mischungen von natürlichen und synthetischen Fasern können im Polgarn vorliegen, wenn dies den Anforderungen des Endverbrauchers gerecht wird.
Die Polgarne sind in der Regel gefärbt, z.B. spinngefärbt, und es werden häufig Garne verschiedener Färbungen verarbeitet um bestimmte Dekorative Effekte zu erzielen.
Vorzugsweise sind die Polgarne texturiert.
Wie oben bereits dargelegt, ist es besonders zweckmäßig, daß die höherschmelzenden texturierten Filamente A Polyesterfilamente sind, und daß es dann besonders vorteilhaft ist, wenn auch die niedrigerschmelzenden Filamente B aus modifiziertem Polyester mit erniedrigtem Schmelzpunkt bestehen.

In einer bevorzugten Ausführungsform der vorliegenden Erfindung besteht das Polgarn aus der gleichen Polymerklasse wie die Rückengarne. Es ist besonders bevorzugt, daß das Polgarn ein Polyestergarn ist.

Bevorzugt ist es, daß alle im Polgarn enthaltenen Filamente einen Schmelzpunkt haben, der mindestens 20°C, vorzugsweise mindestens 40°C insbesondere mindestens 80°C über dem Schmelzpunkt der Filamente B des Multifilament-Hybridgarns liegt. Wird diese Bedingung nicht erfüllt, so kann sich der Pol bei der thermischen Verfestigung des Rückens mitverfestigen und versteifen und damit seinen textilen Charakter einbüßen, es sei denn, daß die Thermofixierung des Rückens so ausgeführt wird, daß nur der Rücken die zur Verfestigung nötige Temperatur annimmt, z.B. durch eine Kontaktheizung des Rückens.

Wenn die Rückengarne und das Polgarn im wesentlichen aus der gleichen Polymerklasse besteht, ergeben sich erhebliche Vorteile bei der Entsorgung des gebrauchten Materials. Ein derartiges sortenreines Produkt kann nämlich auf besonders einfache Weise recyclisiert werden, z.B. durch einfaches Aufschmelzen und Regranulieren.

Sofern das Polymermaterial von Rücken und Pol Polyester ist, besteht darüberhinaus die Möglichkeit aus den gebrauchten Produkten z.B. durch Alkoholyse wertvolle Rohmaterialien zur erneuten Herstellung von Polyestern zu gewinnen. Polyester im Sinne dieser Erfindung sind auch Copolyester, die aus mehr als einer Sorte von Dicarbonsäureresten und/oder mehr als einer Sorte Diolresten aufgebaut sind.

Ein Polyester, aus dem die Fasermaterialien der erfindungsgemäßen Polware hergestellt sind, besteht zu mindestens 70 Mol.-%, bezogen auf die Gesamtheit aller Polyesterbaugruppen, aus Baugruppen, die sich von aromatischen Dicarbonsäuren und von aliphatischen Diolen ableiten, und
zu maximal 30 Mol%, bezogen auf die Gesamtheit aller Polyesterbaugruppen, aus Dicarbonsäure-Baugruppen, die von den aromatischen Dicarbonsäure-Baugruppen, die den überwiegenden Teil der Dicarbonsäure-Baugruppen bilden, verschieden sind oder sich von araliphatischen Dicarbonsäuren mit einem oder mehreren, vorzugsweise einem oder zwei kondensierten oder nicht kondensierten aromatischen Kernen, oder von aliphatischen Dicarbonsäuren mit insgesamt 4 bis 12 C-Atomen, vorzugsweise 6 bis 10 C-Atomen ableiten
und Diol-Baugruppen, die sich von verzweigten und/oder längerkettigen Diolen mit 3 bis 10, vorzugsweise 3 bis 6, C-Atomen, oder von cyclischen Diolen, oder von Ethergruppen enthaltenden Diolen, oder, sofern in geringer Menge vorhanden, von Polyglycol mit einem Molgewicht von ca. 500 - 2000 ableiten.

Im Einzelnen ist der Polyester des Kerns, bezogen auf die Gesamtheit aller Polyesterbaugruppen, aus

35 bis 50 Mol-% Baugruppen der Formel $-CO-A^1-CO-$ (I)
0 bis 15 Mol-% Baugruppen der Formel $-CO-A^2-CO-$ (II)
35 bis 50 Mol-% Baugruppen der Formel $-O-D^1-O-$ (III)
0 bis 15 Mol-% Baugruppen der Formel $-O-D^2-O-$ (IV)
und 0 bis 25 Mol.-% Baugruppen der Formel $-O-A^3-CO-$ (V)

aufgebaut, worin

A^1 aromatische Reste mit 5 bis 12, vorzugsweise 6 bis 10 C-Atomen

A^2 von A^1 verschiedene aromatische Reste oder araliphatische Reste mit 5 bis 16, vorzugsweise 6 bis 12 C-Atomen oder aliphatische Reste mit 2 bis 10 Kohlenstoffatomen, vorzugsweise 4 bis 8 Kohlenstoffatomen,

A^3 aromatische Reste mit 5 bis 12, vorzugsweise 6 bis 10 C-Atomen

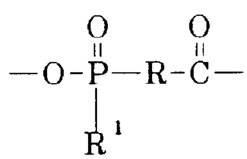
D^1 Alkylen- oder Polymethylengruppen mit 2 bis 4 Kohlenstoffatomen oder Cycloalkan- oder Dimethylen-cycloalkangruppen mit 6 bis 10 C-Atomen,

D^2 von D^1 verschiedene Alkylen- oder Polymethylengruppen mit 3 bis 4 Kohlenstoffatomen oder Cycloalkan- oder Dimethylencycloalkangruppen mit 6 bis 10 C-Atomen oder geradkettige oder verzweigte Alkandiyl-Gruppen mit 4 bis 16, vorzugsweise 4 bis 8, C-Atomen oder Reste der Formel $-(C_2H_4-O)_m-C_2H_4-$, worin m eine ganze Zahl von 1 bis 40 bedeutet, wobei m = 1 oder 2 für Anteile bis zu 20 Mol.-% bevorzugt sind und Gruppen mit m = 10 bis 40 vorzugsweise nur in Anteilen von unter 5 Mol.-% vorhanden sind, bedeuten,

wobei die Anteile der Grundbausteine I und III und der Modifizierungsbausteine II, IV und V im Rahmen der oben angegebenen Bereiche so gewählt werden, daß sich der gewünschte Schmelzpunkt des Polyesters ergibt.

Die erfindungsgemäße Polware, deren Fasermaterialien aus derartigen Polyestern, insbesondere aus Polyethylenterephthalat, bestehen, sind nicht leicht zu entflammen.

Die Schwerentflammbarkeit kann noch verstärkt werden durch den Einsatz von flammhemmend modifizierten Polyestern. Derartige flammhemmend modifizierten Polyester sind bekannt. Sie enthalten Zusätze von Halogenverbindungen, insbesondere Bromverbindungen, oder, was besonders vorteilhaft ist, sie enthalten Phosphorverbindungen, die in die Polyesterkette einkondensiert sind. Besonders bevorzugte, flammhemmende erfindungsgemäße Polwaren enthalten in Rücken und/oder Pol Garne aus Polyestern, die in der Kette Baugruppen der Formel



(VI)

worin R Alkylen oder Polymethylen mit 2 bis 6 C-Atomen oder Phenyl und R^1 Alkyl mit 1 bis 6 C-Atomen, Aryl oder Aralkyl bedeutet, einkondensiert enthalten. Vorzugsweise bedeuten in der Formel VI R Ethylen und R^1 Methyl, Ethyl, Phenyl, oder o-, m- oder p-Methyl-phenyl, insbesondere Methyl.

Die Baugruppen der Formel VI sind zweckmäßigerweise in der Polyesterkette zu bis zu 15 Mol%, vorzugsweise zu 1 bis 10 Mol%, enthalten.

Es ist von besonderem Vorteil wenn die eingesetzten Polyester nicht mehr als 60 mVal/kg, vorzugsweise weniger als 30 mVal/kg, verkappte Carboxylendgruppen und weniger als 5 mVal/kg, vorzugsweise weniger als 2 mVal/kg, insbesondere weniger als 1,5 mVal/kg, freie Carboxylendgruppen aufweist.

Vorzugsweise weist daher der Polyester z. B. durch Umsetzung mit Mono-, Bis- und/oder Polycarbodiimiden verkappte Carboxylendgruppen auf.

In einer weiteren, im Hinblick auf eine auch über längere Zeiträume anhaltende Hydrolysestabilität weist der Polyester des Kerns und der Polyester der Polyestermischung des Mantels maximal 200 ppm, vorzugsweise maximal 50 ppm, insbesondere 0 bis 20 ppm, Mono- und/oder Biscarbodiimide und 0,02 bis 0,6 Gew.-%, vorzugsweise 0,05 bis 0,5 Gew.-% freies Polycarbodiimid mit einem mittleren Molekulargewicht von 2000 bis 15000, vorzugsweise von 5000 bis 10000 auf. Die Polyester der in der erfindungsgemäßen Polware enthaltenen Garne können außer den Polymer-Materialien bis zu 10 Gew% von nicht-polymeren Stoffen, wie Modifizierungszusätzen, Füllmitteln, Mattierungsmitteln, Farbpigmenten, Farbstoffen, Stabilisatoren, wie UV-Absorbern, Antioxydantien, Hydrolyse-, Licht- und Temperatur-Stabilisatoren und/oder Verarbeitungshilfsmitteln enthalten.

Ein Gegenstand der Erfindung sind auch die verfestigten oben beschriebenen Polwaren, d.h. solche, bei denen die niedriger schmelzenden Filamente B des Multifilament-Hybridgarns des textilen Rückens zumindest partiell eine Matrix bilden, die die höherschmelzenden texturierten Filamente des Multifilament-Hybridgarns untereinander und mit dem Polgarn im Bereich der Rückenebene miteinander verbindet.

Ein besonderes Charakteristikum dieses Materials ist, daß nicht nur der Rücken durch zumindest partielle Matrixbildung der Filamente B des Multifilament-Hybridgarns des Rückens verfestigt ist sondern daß überraschenderweise die Festigkeit der Einbindung des Polgarns in den Rücken höher ist als dessen Höchstzugkraft.

Ein weiterer Gegenstand der vorliegenden Erfindung ist ein Multifilament-Hybridgarn bestehend aus mindestens 2 Sorten A und B von Filamenten und ggf. Begleitfilamenten C, dadurch gekennzeichnet, daß die Filamente A texturiert sind und einen Schmelzpunkt über 180°C, vorzugsweise über 220°C insbesondere über 250°C haben,

die Filamente B glatt sind und einen Schmelzpunkt unter 220°C, vorzugsweise unter 200°C, insbesondere unter 180°C haben,

der Schmelzpunkt der Filamente B mindestens 20°C, vorzugsweise mindestens 40°C, insbesondere mindestens 80°C unter dem Schmelzpunkt der Filamente A liegt, und

das Gewichtsverhältnis der Filamente A:B im Bereich von 20:80 bis 80:20, vorzugsweise von 40:60 bis 60:40 liegt und das Multifilament-Hybridgarn noch bis zu 40 Gew.-% Begleitfilamente C enthält.

Ein weiterer Gegenstand der vorliegenden Erfindung ist ein Verfahren zur Herstellung einer thermisch zu verfestigenden Polware aus einem textilen Rücken aus Maschenware oder Gewebe und darin eingebundenen henkelbildenden Polgarnen, durch Weben, Wirken oder Stricken eines Gewebes, eines Gewirkes oder eines Gestricks mit eingebundenen Henkeln oder durch Weben, Wirken oder Stricken eines Doppelgewebes, Doppelgewirkes oder Doppelgestricks wobei die beiden textilen Flächen durch Henkelgarne miteinander verbunden sind, und anschließendes Trennen der beiden textilen Flächen derart, daß zwei einbahnige Polgewebe, -gewirke oder gestricke gebildet werden, das dadurch gekennzeichnet ist, daß

das dem Webstuhl, der Wirk- oder der Strickmaschine zur Bildung der textilen Rückenflächen der Polware zugeführte Garn zu mindestens 30 %, vorzugsweise mindestens 75 % ein Multifilament-Hybridgarn ist, bestehend aus mindestens 2 Sorten A und B von Filamenten und ggf. Begleitfilamenten C besteht, wobei

die Filamente A texturiert sind und einen Schmelzpunkt über 180°C, vorzugsweise über 220°C insbesondere über 250°C haben,

die Filamente B einen Schmelzpunkt unter 220°C, vorzugsweise unter 200°C, insbesondere unter 180°C haben,

der Schmelzpunkt der Filamente B mindestens 20°C, vorzugsweise mindestens 40°C, insbesondere mindestens 80°C unter dem Schmelzpunkt der Filamente A liegt, und

das Gewichtsverhältnis der Filamente A:B im Bereich von 20:80 bis 80:20, vorzugsweise von 40:60 bis 60:40 liegt und das Multifilament-Hybridgarn noch bis zu 40 Gew.-% Begleitfilamente C enthält.

Anschließend kann das erhaltene Polgewebe, -gewirke oder gestrick einer verfestigenden Wärmebehandlung, die ebenfalls ein, ggf. integraler, Teil des erfindungsgemäßen Verfahrens ist, unterzogen werden bei einer Temperatur, bei der die niediger schmelzenden Filamente B des Multifilament-Hybridgarns erweichen. Auch die so hergestellte verfestigte Polware ist Gegenstand der vorliegenden Erfindung.

Die Temperatur der abschließenden Wärmebehandlung und die Behandlungsdauer richten sich nach dem gewünschten Grad der Verfestigung und dem Schmelzpunkt der Filamente B des Multifilament-Hybridgarns. In der Regel wird die Wärmebehandlung bei 100 bis 200°C, vorzugsweise bei 120 bis 180°C ausgeführt.

In der Praxis hat es sich als sehr vorteilhaft erwiesen, die Rohware des hergestellten Polgewebes, -gewirkes oder -gestricks durch eine Wärmebehandlung bei relativ niedriger Temperatur, z.B. durch Dämpfen, auf dem Spannrahmen vorzufixieren.

Der Rohware wird dadurch die Aufrollneigung genommen, sie wird gängiger für die weiteren Verarbeitungsschritte, der Pol wird besser eingebunden (Henkelstabilisierung) und widersteht damit besser mechanischen Zugbelastungen. Ein besonderer Vorteil, der mit der Vorfixierung verbunden ist, besteht darin, daß keine Kaschierung zur Erzwingung der Planlage erforderlich ist und kein oder nur sehr geringer Kantenverschnitt entsteht.

Es ist daher bevorzugt, daß die Rohware des hergestellten Polgewebes, -gewirkes oder -gestricks auf dem Spannrahmen vorfixiert wird. Vorzugsweise werden zur Bildung des RückensMultifilament-Hybridgarne eingesetzt deren Filamente B glatt sind.

Weiterhin wird entsprechend den Anforderungen der Anwendungspraxis das Verfahren so gesteuert, daß das Flächengewicht der Polware 100 bis 1000 g/m^2, vorzugsweise 200 bis 500 g/m^2 beträgt und das Einlaufverhältnis von Rückengarn zu Polgarn im Bereich von 20:80 bis 40:60 liegt.

Die Steuerung erfolgt je nach gemünschter Poldichte und -musterung so, daß bei einem Rücken aus Maschenware mindestens 30 %, vorzugsweise 60 bis 100 % der Maschen Polgarne aufweisen, bei einem Rückengewebe 30 %, vorzugsweise 60 bis 100 % der Kett-und/oder Schußfäden Polnoppen einbinden.

Die Herstellung des bevorzugten erfindungsgemäßen, gestrickten Strukturplüsches erfolgt durch Verstricken eines Grund- und eines Henkelgarns, Ausrüsten des Gestricks und Scheren des Pols, und ist dadurch gekennzeichnet, daß für die Bildung des Rückens ein oben beschriebenes Multifilament-Hybridgarn eingesetzt wird und das Stricken auf Strickmaschinen mit systemweise getrennter Einarbeitung von Grund- und Henkelgarnen und jacquardmäßiger Nadelauswahl und einer Maschinenteilung von 18, 20 oder 24 Nadeln pro inch, vorzugsweise 18 oder 20 Nadeln/inch, ausgeführt wird, wobei als Henkelgarne Polyester-Filamentgarne eingesetzt werden, die, bezogen auf eine Maschinenteilung von 18 oder 20, einen Gesamttiter von 300 - 400 dtex, vorzugsweise 345 - 360 dtex, haben, daß Grundgarne eingesetzt werden, die, bezogen auf eine Maschinenteilung von 18 oder 20 Nadeln/inch einen Gesamttiter

von 300 bis 370 dtex, vorzugsweise 320 - 350 dtex, haben, daß die Einzeltiter der Filamente größer als 1,5 dtex, vorzugsweise größer als 2,5 dtex sind, und daß auf ein Flächengewicht von etwa 350 bis 550 g/m^2 gestrickt wird.
Die so erhaltene erfindungsgemäße, durch eine Wärmebehandlung zu verfestigende Polware, kann durch die oben beschriebene Wärmebehandlung in eine erfindungsgemäße verfestigte Polware überführt werden.

Die Garnauswahl und die Auswahl der Einzeltiter der Grund- und Henkelgarne erfolgt nach den oben angegebenen Kriterien.

Der Henkelanteil wird beim erfindungsgemäßen Strukturplüsch in Abhängigkeit vom Dessign auf 40-70 % eingestellt und liegt damit deutlich unter dem Henkelanteil bekannter Plüsche.

Sowohl über jacquardmäßige Auswahl als auch durch Henkel-Leerreihen können gezielt spezielle Dessigns erzeugt werden. Beispielsweise können auf 1 bis 5 Henkelreihen eine oder zwei Reihen ohne Henkel folgen.

Auch Muster mit gewebeähnlichem Charakter und Dessigns, die längslaufende, querlaufende und/oder diagonallaufende Gassen aufweisen, lassen sich auf diese Weise herstellen.

Die Musterauswahl erfolgt überwiegend nach ästhetischen Gesichtspunkten. Wie weiter oben bereits dargelegt, lassen sich auch typische gewebevelourähnliche Oberflächen einstellen.
Der optische Eindruck der Strukturplüsche wird durch geeignete Farbwahl in Grund und Henkelgarn stark beeinflußt; Farbkontraste betonen den Strukturcharakter, insbesondere wenn Grund- und Henkelgarn Kontrastfarben aufweisen.

Die Ausrüstung dieses Strukturplüsches gemäß Erfindung erfolgt in an sich bekannter Weise so, daß ein sauberer Pol und eine kontrastreiche Optik entsteht.

Die vorliegende Erfindung betrifft auch ein Verfahren zur Herstellung eines Multifilament-Hybridgarns durch Mischen von mindestens zwei Garnen A und B und ggf. weiteren Begleitgarnen C und anschließende Durchführung einer Fadenschluß-Operation dadurch gekennzeichnet, daß

die Filamente A	texturiert sind und einen Schmelzpunkt über 180°C, vorzugsweise über 220°C insbesondere über 250°C haben,
die Filamente B	einen Schmelzpunkt unter 220°C, vorzugsweise unter 200°C, insbesondere unter 180°C haben,

der Schmelzpunkt der Filamente B mindestens 20°C, vorzugsweise mindestens 40°C, insbesondere mindestens 80°C unter dem Schmelzpunkt der Filamente A liegt, und
das Gewichtsverhältnis der Filamente A:B im Bereich von 20:80 bis 80:20, vorzugsweise von 40:60 bis 60:40 liegt und das Multifilament-Hybridgarn noch bis zu 40 Gew.-% Begleitfilamente C enthält.

Vorzugsweise erfolgt die Fadenschlußoperation durch Luftdüsenverwirbelung. Weiterhin ist es bevorzugt, daß bei der Herstellung des Multifilament-Hybridgarns keine Begleitfilamente C eingesetzt werden.

Die erfindungsgemäße Polware ist in der bevorzugten Ausführungsform sortenrein und weist daher die oben bereits beschriebenen Vorteile bei der Entsorgung bzw. Recyclisierung auf. Darüberhinaus ergeben sich durch die vorliegende Erfindung weitere Vorteile, nämlich die Einsparung einer Kaschierung vor der Weiterverarbeitung, die Möglichkeit den Rücken soweit zu versteifen und dabei zu verdichten, daß ein direktes Hinterspritzen z.B. mit Formschäumen möglich ist, ohne daß ein Durchschlagen des Schaums auf die Polseite erfolgt. Besonders vorteilhaft ist es, daß die Polware, selbst dann wenn ihr Rücken gewebt ist, eine sehr gute dreidimensionale Verformbarkeit aufweist, die sich aus der Verwendung des beschriebenen Multifilament-Hybridgarns bei der Herstellung des Rückens ergibt.

Die folgenden Ausführungsbeispiele veranschaulichen die Herstellung des erfindungsgemäßen Multifilament-Hybridgarns und dessen Einsatz bei der Herstellung von erfindungsgemäßen unstrukturierten und strukturierten (Strukturplüsch) Polwaren.

Beispiel 1

Herstellung des für den Rücken eingesetzten Grundgarns:

Ein Hybridgarn wird hergestellt durch dubeln eines Garns 110 dtex f 32, spinngefärbt, texturiert, aus unmodifiziertem Polyethylenterephthalat (Rohstoff-Schmelzpunkt 265°C) (®TREVIRA Type 536) mit einem Garn 140 dtex f 24 aus isophthalsäuremodifiziertem Polyethylenterephthalat (Rohstoff-Schmelzpunkt 110 bis 120°C) und gemeinsames Verwirbeln in einer mit einem Luftdruck von 2 bar betriebenen Verwirbelungsdüse, wobei das tiefer schmelzende Garn im wesentlichen glatt bleibt.

Beispiel 2

Auf einer Rundstrickmaschine Type MCPE mit Jacquard-Einrichtung mit 20 Nadeln/inch und 26" Zylinderdurchmesser, und 3,5 mm - Platinen wird ein Gestrick hergestellt. Es wird ein Henkelanteil von 100% eingestellt bei einem Einlaufverhältnis von Henkelgarn/Grundgarn von 75% : 25%.

Bindung: Zweifarbig Jacquard, 14 Vollreihen mit Grundgarn, 28 Henkelreihen. Als Grundgarn wird ein gemäß Beschreibung im Beispiel 1 erhaltenes Multifilament-Hybridgarn, als Henkelgarn ein Polyester-Buntgarn ®TREVIRA texturiert, vom Titer 84 f 24 X 2 mit oktalobalem Querschnitt eingesetzt.

Der so erhaltene Strickschlauch wird wie üblich geschnitten zu einer Strickware mit 172 cm Breite und einem Flächengewicht von 380 g/m^2. Die Rohware wird auf einem Spannrahmen bei max. 120°C gedämpft, wobei eine Vorstabilisierung erfolgt. Anschließend wird die Ware geschoren (2 Passagen), gewaschen (Breitwäsche 50°C), bei 150°C auf Rahmen getrocknet und fixiert und fertiggestellt.
Die Fertigware hat eine Warenbreite von 165 cm und ein Flächengewicht von 330g/m^2.
Durch den Einsatz des Multifilament-Hybridgarns ist das sonst übliche Kantenschneiden und -leimen nicht erforderlich, da die Ware einwandfrei flach liegt.

Beispiel 3

Auf einer Rundstrickmaschine mit Jacquard-Einrichtung mit 20 Nadeln/inch und 26" Zylinderdurchmesser, und 3,5 mm - Platinen wird ein Gestrick hergestellt. Es wird ein Henkelanteil von 50% eingestellt bei einem Einlaufverhältnis von Henkelgarn/Grundgarn von 55% : 45%, wobei die Henkel in einem Karomuster von 3 X 6 Maschen gestrickt werden.
Als Grundgarn wird ein analog Beschreibung im Beispiel 1 erhaltenes (Ausgangsgarne sind: Höherschmelzende Type: Multifilamentgarn dtex 220 f 40 aus Polyethylenterephalat, Schmelzpunkt 265°C; Niedrigerschmelzende Type: Multifilamentgarn dtex 140 f 24 aus isophthalsäuremodifiziertem Polyethylenterephthalat, Schmelzpunkt 110°C) Multifilament-Hybridgarn, als Henkelgarn ein Polyestergarn ®TREVIRA texturiert vom Titer 167 f 48 X 2 (oktal) eingesetzt.

Der so erhaltene Strickschlauch wird wie üblich geschnitten zu einer Strickware mit 182 cm Breite und einem Flächengewicht von 489 g/m^2. Die Rohware wird auf einem Spannrahmen bei max. 120°C gedämpft, wobei eine Vorstabilisierung erfolgt. Anschließend wird die Ware geschoren (2 Passagen), gewaschen (Breitwäsche 50°C), bei 150°C auf Rahmen getrocknet und fixiert und fertiggestellt.
Die Fertigware hat eine Warenbreite von 170 cm und ein Flächengewicht von 446g/m^2. Der Scherverlust beträgt 10,4%.

Beispiel 4

Auf einer Rundstrickmaschine mit Jacquard-Einrichtung mit 20 Nadeln/inch und 26" Zylinderdurchmesser, und 3,5 mm - Platinen wird ein Gestrick hergestellt. Es wird ein Henkelanteil von 72% eingestellt bei einem Einlaufverhältnis von Henkelgarn/Grundgarn von 61,5% : 38,5%, wobei für den Henkelanteil ein schräglaufendes Jacquardmuster eingestellt wird.
Als Grundgarn wird ein analog Beschreibung im Beispiel 1 erhaltenes (Ausgangsgarne sind: Höherschmelzende Type: Multifilamentgarn dtex 220 f 40 aus Polyethylenterephalat, Schmelzpunkt 265°C; Niedrigerschmelzende Type: Multifilamentgarn dtex 140 f 24 aus isophthalsäuremodifiziertem Polyethylenterephthalat, Schmelzpunkt 110°C) Multifilament-Hybridgarn, als Henkelgarn ein Polyestergarn ®TREVIRA Velours, PMC vom Titer 110 f 32 X 3 eingesetzt.

Die Rohware wird auf einem Spannrahmen bei max. 120°C gedämpft, wobei eine Vorstabilisierung erfolgt. Anschließend wird die Ware geschoren (2 Passagen), gewaschen (Breitwäsche 50°C), bei 150°C auf Rahmen getrocknet und fixiert und fertiggestellt.
Die Fertigware hat ein Flächengewicht von 435g/m^2. Der Scherverlust beträgt 13,3%.

Beispiel 5

Auf einer Rundstrickmaschine mit Jacquard-Einrichtung mit 20 Nadeln/inch und 26" Zylinderdurchmesser, und 3,5 mm - Platinen wird ein Gestrick hergestellt. Es wird ein Henkelanteil von 50% eingestellt bei einem Einlaufverhältnis von Henkelgarn/Grundgarn von 58% : 42%, wobei die Henkel in einem Karomuster von 3 X 6 Maschen gestrickt werden.
Als Grundgarn wird ein analog Beschreibung im Beispiel 1 erhaltenes (Ausgangsgarne sind: Höherschmelzende Type: Multifilamentgarn dtex 220 f 40 aus Polyethylenterephalat, Schmelzpunkt 265°C; Niedrigerschmelzende Type: Multifilamentgarn dtex 140 f 24 aus isophthalsäuremodifiziertem Polyethylenterephthalat, Schmelzpunkt 110°C) Multifilament-Hybridgarn, als Henkelgarn ein Polyestergarn ®TREVIRA Jet-Tex vom Titer 365 f 128 eingesetzt.
Der so erhaltene Strickschlauch wird wie üblich geschnitten zu einer Strickware mit 180 cm Breite und einem Flächengewicht von 518 g/m^2. Die Rohware wird auf einem Spannrahmen bei max. 120°C gedämpft, wobei eine Vorstabilisierung erfolgt. Anschließend wird die Ware geschoren (2 Passagen), gewaschen (Breitwäsche 50°C), bei 150°C auf Rahmen getrocknet und fixiert und fertiggestellt.
Die Fertigware hat eine Warenbreite von 170 cm und ein Flächengewicht von 506g/m^2. Der Scherverlust beträgt 11,4%.

Patentansprüche

1. Polware aus einem textilen Rücken aus Maschenware oder Gewebe und darin eingebundenen henkelbildenden Polgarnen, dessen textiler Rücken aus einem Multifilament-Hybridgarn aus mindestens 2 Sorten A und B von Filamenten und ggf. Begleitfilamenten C besteht, dadurch gekennzeichnet, daß
die Filamente A
texturiert sind und einen Schmelzpunkt über 180°C haben,
die Filamente B
einen Schmelzpunkt unter 220°C haben,
der Schmelzpunkt der Filamente B mindestens 20°C unter dem Schmelzpunkt der Filamente A liegt, und
das Gewichtsverhältnis der Filamente A:B im Bereich von 20:80 bis 80:20 liegt und das Multifilament-Hybridgarn noch bis zu 40 Gew.-% Begleitfilamente C enthält.

2. Polware gemäß Anspruch 1, dadurch gekennzeichnet, daß sie dreidimensional verformbar ist.

3. Polware gemäß mindestens einem der Ansprüche 1 und 2, dadurch gekennzeichnet, daß die höher schmelzenden texturierten Filamente A des Multifilament-Hybridgarns eine Einkräuselung von 3 bis 50 %, vorzugsweise von 8 bis 30 % aufweisen.

4. Polware gemäß mindestens einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß ihr Rücken durch eine Wärmebehandlung verfestigt werden kann.

5. Polware gemäß mindestens einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß die Filamente A des Multifilament-Hybridgarns einen Schmelzpunkt von 220 bis 300°C, vorzugsweise von 240-280°C haben.

6. Polware gemäß mindestens einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die Filamente B des Multifilament-Hybridgarns einen Schmelzpunkt von 110 bis 220°C, vorzugsweise von 150 bis 200°C haben.

7. Polware gemäß mindestens einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß zwischen den Filamente A und B des Multifilament-Hybridgarns und ggf. C Fadenschluß besteht.

8. Polware gemäß mindestens einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß das Multifilament-Hybridgarn keine Begleitfilamente C aufweist.

9. Polware gemäß mindestens einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß das Multifilament-Hybridgarn einen Gesamttiter von 80 bis 500 dtex, vorzugsweise 100 bis 400 dtex, insbesondere 160 bis 320 dtex, hat, und die höher schmelzenden texturierten Filamente A des Multifilament-Hybridgarns einen Einzelfilament-Titer von 0,5 bis 15 dtex, vorzugsweise von 2 bis 10 dtex, und die niedriger schmelzenden Filamente B des Multifilament-Hybridgarns einen Einzelfilament-Titer von 1 bis 20 dtex, vorzugsweise von 3 bis 15 dtex, haben.

10. Polware gemäß mindestens einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß die höherschmelzenden texturierten Filamente A des Multifilament-Hybridgarns gefärbt sind.

11. Polware gemäß mindestens einem der Ansprüche 1 bis 10, dadurch gekennzeichnet, daß ihr Flächengewicht 100 bis 1000 g/m2, vorzugsweise 200 bis 500 g/m2 beträgt.

12. Polware gemäß mindestens einem der Ansprüche 1 bis 11, dadurch gekennzeichnet, daß das Gewichtsverhältnis von textilem Rücken zu Polgarn in der Rohware im Bereich von 20:80 bis 40:60 liegt.

13. Polware gemäß mindestens einem der Ansprüche 1 bis 12, dadurch gekennzeichnet, daß der Gesamttiter des Polgarns 50 bis 800 dtex, vorzugsweise 100 bis 400 dtex beträgt.

14. Polware gemäß mindestens einem der Ansprüche 1 bis 13, dadurch gekennzeichnet, daß der Einzelfilament-Titer des Polgarns 0,5 bis 10 dtex, vorzugsweise 0,7 bis 6 dtex, beträgt.

15. Polware gemäß mindestens einem der Ansprüche 1 bis 14, dadurch gekennzeichnet, daß Rückengarne und Polgarn aus der gleichen Polymerklasse, vorzugsweise aus Polyestern, bestehen.

16. Polware gemäß mindestens einem der Ansprüche 1 bis 15, dadurch gekennzeichnet, daß alle im Polgarn enthaltenen Filamente einen Schmelzpunkt haben, der mindestens 20°C, vorzugsweise mindestens 40°C insbesondere mindestens 80°C über dem Schmelzpunkt der Filamente B des Multifilament-Hybridgarns liegt.

17. Polware gemäß mindestens einem der Ansprüche 1 bis 16, dadurch gekennzeichnet, daß der Pol aus geschnittenen Polgarn-Enden besteht.

18. Polware gemäß mindestens einem der Ansprüche 1 bis 17, dadurch gekennzeichnet, daß mindestens 30 %, vorzugsweise 60 bis 100 % der Maschen bzw der Kett-und/oder Schußfäden Polgarne einbinden.

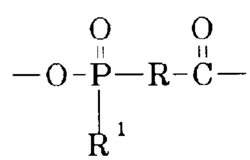
19. Polware gemäß mindestens einem der Ansprüche 1 bis 18, dadurch gekennzeichnet, daß sie einen gestrickten Rücken und Strukturdekor aufweist und daß sie als Henkelgarne Filamentgarne aufweist, die, bezogen auf eine Maschinenteilung von 18 oder 20 Nadeln pro inch, einen Gesamttiter von 300 - 400 dtex haben, dessen Grundgarn, bezogen auf eine Maschinenteilung von 18 oder 20 Nadeln pro inch einen Gesamttiter von 300 bis 370 dtex hat, wobei die Einzeltiter der Filamente größer als 1,5 dtex sind, dessen Flächengewicht etwa 350 bis 550 g/m^2 beträgt, und dessen Grundmaschen in Strukturzonen kein Henkelgarn enthalten.

20. Polware gemäß mindestens einem der Ansprüche 1 bis 19, dadurch gekennzeichnet, daß Garne aus Profilfilamenten mit ovalem, hantelförmigem oder bändchenförmigem Querschnitt, der auch noch eine oder mehrere Einschnürungen aufweisen kann, oder Dreikant-, Dreilapp (trilobal)- und besonders Achtlapp (oktolobal)- Profile eingesetzt werden.

21. Polware gemäß mindestens einem der Ansprüche 1 bis 20, dadurch gekennzeichnet, daß der Henkelanteil bei etwa 40 bis 73 Prozent liegt.

22. Polware gemäß mindestens einem der Ansprüche 15 bis 21, dadurch gekennzeichnet, daß der Polyester zu mindestens 70 Mol.-%, bezogen auf die Gesamtheit aller Polyesterbaugruppen, aus Baugruppen, die sich von aromatischen Dicarbonsäuren und von aliphatischen Diolen ableiten, und zu maximal 30 Mol%, bezogen auf die Gesamtheit aller Polyesterbaugruppen, aus Dicarbonsäure-Baugruppen, die von den aromatischen Dicarbonsäure-Baugruppen, die den überwiegenden Teil der Dicarbonsäure-Baugruppen bilden, verschieden sind oder sich von araliphatischen Dicarbonsäuren mit einem oder mehreren, vorzugsweise einem oder zwei kondensierten oder nicht kondensierten aromatischen Kernen, oder von cyclischen oder acyclischen aliphatischen Dicarbonsäuren mit insgesamt 4 bis 12 C-Atomen, vorzugsweise 6 bis 10 C-Atomen ableiten und Diol-Baugruppen, die sich von verzweigten und/oder längerkettigen Diolen mit 3 bis 10, vorzugsweise 3 bis 6, C-Atomen, oder von cyclischen Diolen, oder von Ethergruppen enthaltenden Diolen, oder, sofern in geringer Menge vorhanden, von Polyglycol mit einem Molgewicht von ca. 500 - 2000 ableiten, besteht.

23. Polware gemäß mindestens einem der Ansprüche 1 bis 22, dadurch gekennzeichnet, daß der Polyester Baugruppen der Formel VI enthält,



(VI)

worin R Alkylen oder Polymethylen mit 2 bis 6 C-Atomen oder Phenyl, vorzugsweise Ethylen, und R^1 Alkyl mit 1 bis 6 C-Atomen, Aryl oder Aralkyl, vorzugsweise Methyl, bedeutet, einkondensiert enthalten.

24. Polware gemäß mindestens einem der Ansprüche 1 bis 23, dadurch gekennzeichnet, daß der Rücken durch zumindest partielle Matrixbildung der Filamente B des Multifilament-Hybridgarn des Rückens verfestigt ist.

25. Polware gemäß mindestens einem der Ansprüche 1 bis 24, dadurch gekennzeichnet, daß die Festigkeit der Einbindung des Polgarns in den Rücken höher ist als dessen Höchstzugkraft.

26. Multifilament-Hybridgarn bestehend aus mindestens 2 Sorten A und B von Filamenten und ggf. Begleitfilamenten C, dadurch gekennzeichnet, daß

die Filamente A
texturiert sind und einen Schmelzpunkt über 180°C haben,
die Filamente B
glatt sind und einen Schmelzpunkt unter 220°C haben,
der Schmelzpunkt der Filamente B mindestens 20°C unter dem Schmelzpunkt der Filamente A liegt, und
das Gewichtsverhältnis der Filamente A:B im Bereich von 20:80 bis 80:20 liegt und das Multifilament-Hybridgarn noch bis zu 40 Gew.-% Begleitfilamente C enthält.

27. Multifilament-Hybridgarn gemäß Anspruch 26, dadurch gekennzeichnet, daß die höherschmelzenden texturierten Filamente A eine Einkräuselung von 3 bis 50 %, vorzugsweise von 8 bis 30 %, insbesondere von 10 bis 22 % aufweisen.

28. Multifilament-Hybridgarn gemäß mindestens einem der Ansprüche 26 und 27, dadurch gekennzeichnet, daß die Filamente A einen Schmelzpunkt von 220 bis 300°C, vorzugsweise von 240-280°C haben.

29. Multifilament-Hybridgarn gemäß mindestens einem der Ansprüche 26 bis 28, dadurch gekennzeichnet, daß die Filamente B einen Schmelzpunkt von 110 bis 220°C, vorzugsweise von 150 bis 200°C haben.

30. Multifilament-Hybridgarn gemäß mindestens einem der Ansprüche 26 bis 29, dadurch gekennzeichnet, daß zwischen den Filamente A und B und ggf. C Fadenschluß besteht.

31. Multifilament-Hybridgarn gemäß mindestens einem der Ansprüche 26 bis 30, dadurch gekennzeichnet, daß das Multifilament-Hybridgarn keine Begleitfilamente C enthält.

32. Verfahren zur Herstellung einer Polware aus einem textilen Rücken aus Maschenware oder Gewebe und darin eingebundenen henkelbildenden Polgarnen, durch Weben, Wirken oder Stricken eines Gewebes, eines Gewirkes oder eines Gestricks mit eingebundenen Henkeln oder durch Weben, Wirken oder Stricken eines Doppelgewebes, Doppelgewirkes oder Doppelgestricks wobei die beiden textilen Flächen durch Henkelgarne miteinander verbunden sind, und anschließendes Trennen der beiden textilen Flächen derart, daß zwei einbahnige Polgewebe, -gewirke oder gestricke gebildet werden, dadurch gekennzeichnet, daß
das dem Webstuhl, der Wirk- oder der Strickmaschine zur Bildung der textilen Rückenflächen der Polware zugeführte Garn zu mindestens 30 %, vorzugsweise mindestens 75 % ein Multifilament-Hybridgarn ist, bestehend aus mindestens 2 Sorten A und B von Filamenten und ggf. Begleitfilamenten C besteht, wobei
die Filamente A
texturiert sind und einen Schmelzpunkt über 180°C, vorzugsweise über 220°C insbesondere über 250°C haben,
die Filamente B
einen Schmelzpunkt unter 220°C, vorzugsweise unter 200°C, insbesondere unter 180°C haben,
der Schmelzpunkt der Filamente B mindestens 20°C, vorzugsweise mindestens 40°C, insbesondere mindestens 80°C unter dem Schmelzpunkt der Filamente A liegt, und
das Gewichtsverhältnis der Filamente A:B im Bereich von 20:80 bis 80:20, vorzugsweise von 40:60 bis 60:40, liegt und das Multifilament-Hybridgarn noch bis zu 40 Gew.-% Begleitfilamente C enthält.

33. Verfahren gemäß Anspruch 32, dadurch gekennzeichnet, daß das erhaltene Polgewebe, -gewirke oder gestrick einer verfestigenden Wärmebehandlung unterzogen wird bei einer Temperatur, bei der die niediger schmelzenden Filamente B des Multifilament-Hybridgarns erweichen.

34. Verfahren gemäß mindestens einem der Ansprüche 32 und 33, dadurch gekennzeichnet, daß die Wärmebehandlung bei 100 bis 200°C ausgeführt wird.

35. Verfahren gemäß mindestens einem der Ansprüche 32 bis 34, dadurch gekennzeichnet, daß die Rohware des hergestellten Polgewebes, -gewirkes oder -gestricks auf dem Spannrahmen vorfixiert wird.

36. Verfahren gemäß mindestens einem der Ansprüche 32 bis 35, dadurch gekennzeichnet, daß der Rücken gestrickt ist und das Stricken auf Strickmaschinen mit systemweise getrennter Einarbeitung von Grund- und Henkelgarnen und jacquardmäßiger Nadelauswahl und einer Maschinenteilung von 18, 20 oder 24 Nadeln pro inch ausgeführt wird, wobei als Henkelgarne Polyester-Filamentgarne eingesetzt werden, die, bezogen auf eine Maschinenteilung von 18 oder 20, einen Gesamttiter von 300 - 400 dtex haben, daß Grundgarne eingesetzt werden, die, bezogen auf eine Maschinenteilung von 18 oder 20 Nadeln/inch einen Gesamttiter von 300 bis 370 dtex haben, daß die Einzeltiter der Filamente größer als 1,5 dtex sind, und daß auf ein Flächengewicht von etwa 350 bis 550 g/m^2 gestrickt wird.

37. Verfahren zur Herstellung eines Multifilament-Hybridgarns durch Vereinigen und Mischen eines höherschmelzenden (A) und eines niedriger schmelzenden (B) Filamentgarns dadurch gekennzeichnet, daß die Garne A und B einer Verwirbelungsdüse zugeführt werden, wobei ein Garn A eingesetzt wird dessen Filamente texturiert sind und einen Schmelzpunkt über 180°C haben,
ein Garn B eingesetzt wird dessen Filamente glatt sind und einen Schmelzpunkt unter 220°C haben, wobei
der Schmelzpunkt der Filamente B mindestens 20°C unter dem Schmelzpunkt der Filamente A liegt, und
die Filamente A und B im Gewichtsverhältnis A:B im Bereich von 20:80 bis 80:20 zugeführt werden und noch bis zu 40 Gew.-% Begleitfilamente C zugeführt werden.

38. Verfahren gemäß Anspruch 37, dadurch gekennzeichnet, daß die Fadenschlußoperation in einer Luftdüsenverwirbelung besteht.

39. Verfahren gemäß mindestens einem der Ansprüche 37 und 38, dadurch gekennzeichnet, daß keine Begleitfilamente C eingesetzt werden.

40. Verwendung der Polware des Anspruchs 1 zur textilen Innenraumgestaltung

41. Verwendung gemäß Anspruch 40 zur Herstellung von Sitzbezügen und Sitzen.

42. Verwendung gemäß mindestens einem der Ansprüche 40 und 41 zur Herstellung von Innenauskleidungen und zur Innenauskleidung.

43. Verwendung gemäß mindestens einem der Ansprüche 40 bis 42 im Fahrzeugbau.

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EUROPÄISCHER RECHERCHENBERICHT

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EP 96 10 1888

EINSCHLÄGIGE DOKUMENTE			
Kategorie	Kennzeichnung des Dokuments mit Angabe, soweit erforderlich, der maßgeblichen Teile	Betrifft Anspruch	KLASSIFIKATION DER ANMELDUNG (Int.Cl.6)
A	PATENT ABSTRACTS OF JAPAN vol. 14, no. 74 (C-0687), 13.Februar 1990 & JP-A-01 292139 (KURARAY CO LTD), 24.November 1989, * Zusammenfassung *	1,4,6, 32,33	D04B1/04 D03D27/00
A	WO-A-94 20657 (E.I. DU PONT DE NEMOURS & CO) * Seite 5, Zeile 5 - Seite 6, Zeile 22 *	1,26, 28-32	
D,A	DE-A-40 42 063 (SCHWARZ)		
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			D04B D03D D02G

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Recherchenort	Abschlußdatum der Recherche	Prüfer
DEN HAAG	4.Juni 1996	Van Gelder, P

KATEGORIE DER GENANNTEN DOKUMENTE

X : von besonderer Bedeutung allein betrachtet
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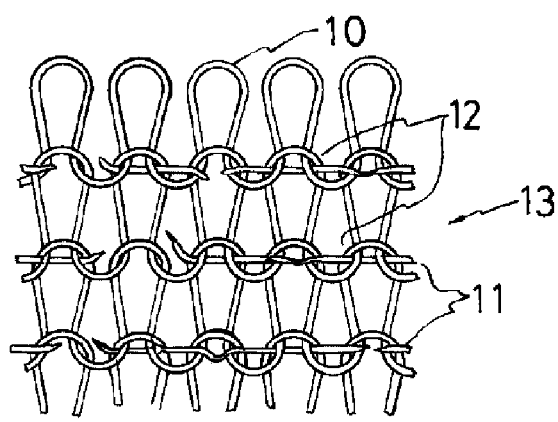
(54)【発明の名称】　三層シート用基布及びその製造方法並びに、この三層基布を用いた自動車座席、靴、鞄、袋物など用の三層シート

(57)【要約】

【目的】　三層用のシートの基布がメリヤス編み布であり、しかも一部の編み糸が断線したとしても、編み糸が伝線せず、かつメリヤス生地としての伸縮性と風合いを保つようにしたもので、この基布を及びその製造方法、並びにその基布を用いた自動車座席、靴、鞄袋など用の三層シートを市場に提供する。

【構成】平メリヤス編み布の少なくとも３コース毎に熱可塑性の挿入糸１１が挿入してあって、編み布１３が構成してある。この編み布１３が縦方向に牽引されて、熱セットしてある。このときの熱で相隣るコースの掛合部分であって、前記挿入糸１１を挟持している部分はバインダーとして結合して、前記編み糸が伝線せず、かつメリヤス生地としての伸縮性と風合いを保つようにした。



【特許請求の範囲】
【請求項１】合成樹脂製のフィラメントよりなる編み糸により平編みのメリヤスとしてあり、これに少なくとも３コース毎に前記編み糸よりも低融点の熱可塑性合成樹脂のフィラメント挿入糸が挿入してあって、この挿入糸は前記上下のコースの編み糸の掛合位置において挟持されて、全体としてクロスインレイの平編みメリヤス布としてあり、これを縦方向に牽引して熱セットしてあって、前記上下のコースの編み糸は挿入糸をバインダーとして前記掛合位置において、それぞれ融着して形成してあることを特徴とする三層シート用基布。
【請求項２】前記挿入糸による前記編み糸の融着は熔融固化した挿入糸の一部が前記編み糸繊維の一部乃至全部を抱持して結合したものであることを特徴とする請求項１記載の三層シート用基布。
【請求項３】前記編み糸は１５デニール乃至１２０デニールであり、フィラメントカウント１乃至３６のポリエステルフィラメントであり、前記挿入糸はナイロン、ポリエチレン、ポリエステル、ポリプロピレンのうちの一種であり、１５デニール乃至３６デニールの範囲あることを特徴とする請求項１または請求項１又は請求項２記載の三層シート用基布。
【請求項４】合成樹脂製のフィラメント編み糸により平編みのメリヤスを編成する際に、これに少なくとも３コース毎に前記編み糸よりも低融点の熱可塑性合成樹脂のモノフィラメント樹脂よりなる挿入糸を相隣するコースの編み糸が掛合する間に挿入して、コース方向に挿入糸が挿入してあるクロスインレイの平編みメリヤス布を編成する第１工程。前記第１工程で編成された編み布を幅寸法を維持したまま、縦方向に順次牽引しながら、前記挿入糸が塑性変形可能な軟化温度であって、編み糸が塑性変形しない温度まで加熱し、前記相隣するコースの編み糸が掛合する間に挟持されている軟化した挿入糸の一部によってを相圧接する部分前記編み糸の全部乃至前記編み糸繊維の一部を抱持する第２工程。その後編み布を牽引状態のまゝ冷却して、前記挿入糸をその状態で固化させる第３工程。以上の３工程よりなる三層シート用の基布の製造方法。
【請求項５】請求項４の発明の第１工程の編み糸は前記編み糸は１５デニール乃至１２０デニール、フィラメントカウントは１乃至３６のポリエステルフィラメント、挿入糸はナイロン、ポリエチレン、ポリエステル、ポリプロピレンのうちの一種であり、１５デニール乃至３０デニールの範囲のものを用いる方法であることを特徴とする三層シート用の基布の製造方法。
【請求項６】織布、不織布、編み布、合成樹脂フィルムの一種よりなる表層と、この裏面にウレタン発泡層及び基布が順次積層して一体化してある表皮材に於いて、
前記基布は合成樹脂製のフィラメントよりなる編み糸により平編みのメリヤスとしてあり、これに少なくとも３コース毎に前記編み糸よりも低融点の熱可塑性合成樹脂のフィラメント挿入糸が挿入してあって、この挿入糸は前記上下のコースの編み糸の掛合位置において挟持されて、全体としてクロスインレイの平編みメリヤス布としてあり、これを縦方向に牽引して熱セットしてあって、前記上下のコースの編み糸は挿入糸をバインダーとして前記掛合位置において、それぞれ融着して形成してあることを特徴とする自動車座席、靴、鞄、袋物など用三層シート。
【請求項７】前記編み糸は前記編み糸は１５デニール乃至１２０デニール、フィラメントカウントは１乃至３６のポリエステルを用いる方法であり、挿入糸はナイロン、ポリエチレン、ポリエステル、ポリプロピレンのうちの一種であり、１５デニール乃至３６デニールの範囲であことを特徴とする請求項６記載の自動車座席、靴、袋物など用三層シート。
【請求項８】前記挿入糸による編み糸の融着は熔融固化した挿入糸の一部が編み糸繊維の一部乃至全部を抱持して結合したものであることを特徴とする請求項６、又は請求項７記載の自動車座席、靴、鞄、袋物など用三層シート。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】この発明は、主として家具又は自動車の椅子、靴、鞄、その他の袋物、衣服用の表皮材に係るものであり、殊に、その表皮材が表層と基布の中間に合成樹脂発泡層（通常ポリウレタンフォーム）を有する三層シートに係るものであり、また前記三層シートに用いる基布に関する。
【０００２】
【従来の技術】従来のこの種の表皮材は一般に密な化粧シートであり、一般に中間が合成樹脂発泡層であり、裏面に基布が裏打ちしてある三層シートとなっている。この三層シートの基布としては、捲縮糸を用いたメリヤス、トリコット編布、不織布などを用いているが糸の使用量が多くコストを押し上げている。またモノフィラメントを用いて平編メリヤス編布を用いることも考えられるが、一部の編み糸が破断したとき、簡単に伝線が起こり、使用に耐えない。また全体に糊付け、若しくは合成樹脂エマルジョンを塗布してゲル化した基布も市場には見受けられるが、メリヤスとしての伸縮性乃至風合いが減殺されている。
【０００３】
【発明が解決しようとする課題】そこでこの請求項１乃至４記載の発明は従来のトリコット編布などより遥かに糸乃至繊維の使用量が少なく、しかも一部の繊維が断線したとしても、みだりに伝線せず、メリヤスとしての伸縮性と風合いのある三層シート用の基布を市場に提供することである。請求項２記載の発明の課題とするところは、前記の課題の他、相隣るコースとの掛合位置の編み

糸の結合を強固した前記基布を得るためである。請求項３記載の発明の課題とするところは、前記の課題の他、丈夫で軽量な前記基布を得るためである。

【０００４】請求項４及び５記載の発明の課題とするところは、請求項１、請求項３、又は請求項４記載の発明の物を製造する方法を市場に提供することを目的とする。

【０００５】請求項６、７及び１１記載の発明の課題とするところは、請求項１記載の発明の基布を用いた自動車座席、靴、鞄、袋物など用三層シートを市場に提供することである。

【０００６】請求項８記載の発明の課題とするところは、請求項２又は請求項３記載の発明の基布を用いた自動車座席、靴、鞄、袋物など用三層シートを市場に提供することである。

【０００７】

【課題を解決するための手段】前記の課題を解決するために、この物の発明は合成樹脂製のフィラメントよりなる編み糸により平編みのメリヤスとしてあり、これに少なくとも３コース毎に前記編み糸よりも低融点の熱可塑性合成樹脂のフィラメント挿入糸が挿入してあって、この挿入糸は前記上下のコースの前記編み糸の掛合位置において挟持されて、全体としてクロスインレイの平編みメリヤス布としてあり、これを縦方向に牽引して熱セットしてあって、前記上下のコースの前記編み糸は挿入糸をバインダーとして前記掛合位置において、それぞれ融着して形成してあることを特徴とする三層シート用基布とする。

【０００８】また前記の課題を解決するために、前記三層シート用基布の前記挿入糸による編み糸の融着は熔融固化した挿入糸の一部が編み糸繊維の一部乃至全部を抱持して結合したものであることを特徴とすることが好ましい。

【０００９】また前記の課題を解決するために、前記三層シート用基布の前記編み糸は１５デニール乃至１２０デニールでフィラメントカウントは１乃至３６のポリエステルフイラメントであり、挿入糸はナイロン、ポリエチレン、ポリエステル、ポリプロピレンのうちの一種であり、１５デニール乃至３６デニールの範囲ものが好ましい。

【００１０】前記の課題を解決するために、この方法の発明は合成樹脂製のフィラメント編み糸により平編みのメリヤスを編成する際に、これに少なくとも３コース毎に前記編み糸よりも低融点の熱可塑性合成樹脂のモノフィラメント樹脂よりなる挿入糸を相隣するコースの編み糸が掛合する間に挿入して、コース方向に挿入糸が挿入してあるクロスインレイの平編みメリヤス布を編成する第１工程。前記第１工程で編成された編み布を幅寸法を維持したまま、縦方向に順次牽引しながら、前記挿入糸が塑性変形可能な軟化温度であって、編み糸が塑性変形しない温度まで加熱し、前記相隣するコースの編み糸が掛合する間に挟持されている軟化した挿入糸の一部に押し込み、前記軟化した挿入糸の一部によって、前記編み糸の前記掛合部分の全部乃至前記編み糸繊維の一部を抱持する第２工程。その後編み布を牽引状態のまゝ冷却して、前記挿入糸をその状態で固化させる第３工程。以上の３工程よりなる三層シート用の基布の製造方法とする。

【００１１】また前記の課題を解決するために、前述の方法発明において、第１工程の編み糸は前記編み糸は１５デニール乃至１２０デニール、フィラメントカウントは１乃至３６のポリエステルフィラメントを用いる方法であり、挿入糸はナイロン、ポリエチレン、ポリエステル、ポリプロピレンのうちの一種であり、１５デニール乃至３０デニールの範囲を用いる方法であることが好ましい、

【００１２】また前記の課題を解決するために、他の物の関連発明は織布、不織布、編み布、合成樹脂フィルムの一種よりなる表層と、この裏面にウレタン発泡層及び基布が順次積層して一体化してある表皮材に於いて、前記基布は合成樹脂製のフィラメントよりなる編み糸により平編みのメリヤスとしてあり、これに少なくとも３コース毎に前記編み糸よりも低融点の熱可塑性合成樹脂のフィラメント挿入糸が挿入してあって、この挿入糸は前記上下のコースの編み糸の掛合位置において挟持されて、全体としてクロスインレイの平編みメリヤス布としてあり、これを縦方向に牽引して熱セットしてあって、前記上下のコースの編み糸は挿入糸をバインダーとして前記掛合位置において、それぞれ融着して形成してあることを特徴とする自動車座席、靴、鞄、袋物など用三層シートとする。

【００１３】また前記の課題を解決するために、前記自動車座席、靴、鞄、袋物など用三層シートの前記編み糸は１５デニール乃至１２０デニール、フィラメントカウントは１乃至３６のポリエステルをフィラメント用いる方法であり、挿入糸はナイロン、ポリエチレン、ポリエステル、ポリプロピレンのうちの一種であり、１５デニール乃至３６デニールの範囲であることが好ましい。

【００１４】また前記の課題を解決するために、前記基布の前記編み糸が非熔融性の繊維よりなる自動車座席、靴、鞄、袋物など三層シートの前記挿入糸による編み糸の融着は熔融固化した挿入糸の一部が編み糸繊維の一部乃至全部を抱持して結合したものであることが好ましい。

【００１５】

【作用】請求項１記載の三層シート用の基布は前述の通り構成しているから、相隣するコースの掛合位置に於いて、挿入糸を介して編み糸が結合しているから、編み糸の一部が断線したとしても、その断線部分の直ぐ近傍の両側に相隣する編み糸がその掛合位置で編み糸同士が結

合している部分があるから、編み糸に張力が作用しても、掛合位置における結合部分において、バインダーとなっている前記挿入糸が熔融し固化した部分によって、前記ニードルループ乃至シンカループが延ばされるのが制限され、余程強い引っ張り力が部分的に作用しない限り、前記ニードルループ乃至シンカループ部分が抜けて、縦方向に伝線が起こらない作用をなす。

【００１６】また仮に部分的に受ける引張力によって、一部コースの挿入糸が断線したとしても、或いは成形時の熱によって、挿入糸が断線していたとしても、その近傍のニードルループ乃至シンカループが外れるだけで、他のコースは平常状態を維持する作用をなす。従って、この三層シート用の基布を中間に合成樹脂発泡層（通常ポリウレタンフォーム）のある三層シートの裏面の裏打材として使用する場合においても、縫製部分の縫糸を充分に支持する作用をなす。また全体として、従来のトリコット編みに対し糸の使用量は３０％乃至５０％減である。

【００１７】また基布全体としては平編みメリヤスとしての左右及び縦方向への伸縮性は保持された状態となる。請求項２記載の発明に於いては、請求項１記載の作用の外、前記挿入糸による編み糸の融着は熔融した挿入糸の一部が編み糸の全部若しくは編み糸の繊維間に押し込まれて、一部の繊維を抱持して主として機械的に結合しており、編み糸自体の強度をそのまま維持しているから平編みメリヤスの風合いを保持した状態を維持する作用を為す。

【００１８】請求項３記載の発明に於いては、請求項１記載の作用の外、編み糸がポリエステルであり、挿入糸はナイロンであり、ポリエチレン、ポリプロピレン、又はポエステルそれぞれのデニール数も前記の通りであるから、軽量であり、この三層シート用の基布を中間に合成樹脂発泡層（通常ポリウレタンフォーム）のある三層シートの裏面の裏打材として使用した場合において、三層シートの裏面の滑りがよいものとなり、また全体として軽量となる作用をなす。

【００１９】請求項４記載の方法発明に於いては、前述の第１工程に於いて製造されたクロスインレイの平編みメリヤス編み布は、第２工程で縦方向に牽引されるときに、編み糸が軟化しない範囲で、挿入糸のみが軟化熔融されるから、相隣のコースとの掛合部分において、軟化した挿入糸を前記掛合部分で挟持し、挿入糸を押し潰し、熔融した挿入糸の一部は、その部分の編み糸の一部若しくは全部を抱持するように変形する。而して、その状態で冷却し、熔融した挿入糸は前述の変形状態のまま固化し、相隣する編み糸のニードルループとシンカループが結合され平編みメリヤスとなる作用をなす。この請求項４記載の方法により請求項１記載の発明の基布が製造される。

【００２０】請求項５記載の方法発明に於いては、請求項５記載の発明の作用の外、発明の第１工程の編み糸は前記編み糸は１５デニール乃至１２０デニールであり、フィラメントカウントは１乃至３６のポリエステルを用いる方法であり、挿入糸はナイロン、ポリエチレン、ポリエステル、ポリプロピレンのうちの一種であって、１５デニール乃至３０デニールの範囲のものを用いる方法であるから、前記バインダーとなる挿入糸は加熱により容易に軟化し、その一部が編み糸の全部を抱持し、若しくは編み糸の繊維間に塑性変形して押し込まれ、一部の編み糸繊維を抱持し、相隣るコースの掛合点を塑性流動した挿入糸の一部によって結合する。またこの方法に於いては挿入糸はナイロン、ポリエチレン、ポリプロピレン、ポリエステルのうちの一種であり、前述のデニール数も編み糸より細く、かつ軽量でメリヤス編み布全体としての繊維使用量も、挿入糸を使用しない平編みメリヤスと比較してもせいぜい２０％増の編み布となる作用をなす。

【００２１】請求項６乃至８記載の自動車用座席、靴、鞄、袋物用三層シートの発明においては、これらの目的物として使用中に前記編み糸の一部が破断したとしても、この編み糸はそれぞれ結合点で前述の様に、前記挿入糸をバインダーとして結合されているから、相隣るコースのニードルループまたはシンカループが抜け、順次外れる伝線現象は極めて起こりがたく、この自動車用座席三層シートを裁断して、自動車用座席、靴、袋物などの表面形状に縫製した場合に縫い糸が基布から抜けて、直接発泡層に食い込み、発泡層を破壊して、結局縫製部分を破壊するようなこともなく、長期間縫い糸の保持がされる作用をなす。

【００２２】また前記の縫製した自動車用座席の表面形状の縫製品としたとき、内部に自動車座席のクッション材等を詰め込み、或いは自動車の座席の下地部分にこの縫製品を被せる場合に、前記基布が用いられているから、従来のトリコット同様に前記下地部分との滑りがよい。殊に前記基布の表面を外面に向けて積層したものは、前記作用は更に顕著である。殊に請求項６及び７記載の発明のものにおいては、前記基布の裏面を外面に向けて積層したものは、多少内部の下地部分がウレタンホーム場合は、これとの滑り具合は前記基布の表面を外面に向けて積層したものより滑り難く、完全にウレタンホームよりなる前記下地部分に被せた後においては、みだりに滑らず安定性がよい作用をなす。

【００２３】また自動車座席、靴、鞄、袋物など用三層シートの基布の前記挿入糸による融着部分が塑性変形して、編み糸の全部又は一部を抱持して結合している状態であるから、編み糸の引張力は何ら減殺されておらず、縫い糸に対して充分なアンカー作用をなす。また平編みメリヤスとしての伸縮性と風合いを保っている。

【００２４】

【実施例】

実施例1
図1及び図2に図示するものであり、請求項1、及び請求項3記載の発明を含む実施例である。編み糸10として、ポリエステルよりなるマルチフィラメントを用い、そのデニール数は15乃至120であり、フィラメントカウントは32乃至42のものを用いた。また挿入糸11としてはナイロン6のモノフィラメントを用い、デニール数は15ないし36のものを用いた。而して編み組織としては、編み糸10によって平編メリヤス編み布を編む際に、前記挿入糸11を各コース毎に挿入したクロスインレイの平編みメリヤス編み布として（図1参照）、三層シート用基布13を形成している。前述の挿入糸11は各コース毎に挿入することが好ましいが、2又は3コース毎であっても、これらの請求項1、請求項3及び請求項4記載の発明の実施例に含まれる。

【0025】前記挿入糸11は図示の例では1ウエルおきに相隣するコースの編み糸10間に挿入され、その隣のウエルに於いては、その表面側に浮かしてそれぞれ形成してあり、相隣する挿入糸11の編み糸11によって挟持される位置はウエル位置が異にしてある。即ち相隣するコースのニードルループとシンカーループとの掛合部14のうち、コース方向に1ウエルおきに挿入糸11を挟持している。

【0026】更に前記挿入糸11を挟持した編み糸10の結合点12はそれぞれ編み糸10の一部をバインダーとして、相互に溶着されている（図2参照）。その結合状態は、前記編み糸10の一部が軟化して塑性変形し、編み糸10の繊維間に食い込み、一部の繊維を抱持して、その状態で冷却した挿入糸11によって、主として機械的に結合されている。

【0027】前述の実施例に用いた編み糸10としてポリエステルのマルチフィラメント糸の材質は単なる例示であって、その他の合成樹脂製のモノフィラメントであってもこの実施例に含まれる。合成樹脂製の繊維としては例えば、ビニロン、ビニリデン、ポリ塩化ビニル、アクリル、ポリエチレン、ポリプロピレン、ポリウレタンなどであってもよく、デニール数15乃至120、ヒラメントカウント1乃至36の範囲であり、挿入糸11より融点が相対的に高い編み糸と適宜組み替えても、前述の請求項1、請求項3及び請求項4記載の発明の実施例に含まれる。

【0028】また挿入糸11としては丈夫で融点が前記編み糸10よりも相対的に15℃以上低い熱可塑性合成樹脂性のフィラメントであれば、ナイロン6に限定するわけではない。

【0029】実施例1の作用は請求項1、請求項3及び請求項4記載の発明の作用を合わせて奏するため、重ねての説明を省略する。挿入糸11が各コース毎になく3コースまでの範囲で1コースおきまたは2コースおきに挿入したものは、編み糸10が断線したときは、伝線が起こったとしても、次の挿入糸11のあるコースで伝線が止まる作用を成す。

【0030】実施例2
請求項4及び請求項5記載の方法発明の実施例であり、実施例1の基布を製造する方法である。図4のブロック線図に基づいて説明する。

【0031】先ず実施例1記載の編み糸10及び挿入糸11を用い、丸編み機または平編み機を用いて、各コース毎に挿入糸11をクロスインレイして、クロスインレイの平編みメリヤス編み布を順次編成する。次に、この編成された編み布を順次縦方向に牽引しながら、例えば加熱トンネルを通す。この場合編み糸10は緊張状態となるが、挿入糸11には全く引張力は作用しない。

【0032】加熱トンネル内の温度は前記挿入糸11の塑性変形可能な軟化温度（ナイロン6の場合は130℃乃至140℃）に加熱すると、編み糸10は軟化せず殆どそのままの状態であり、各挿入糸11は軟化され、これを挟持している相隣のコースの編み糸10の掛合部分において、その牽引力によって軟化状態の挿入糸11に食い込み、挿入糸11の一部は編み糸10の繊維間に細かく分散して押し込まれる（図2参照）。つまり熔融した挿入糸11の一部が編み糸10の一部即ち、繊維を抱持した状態となる。挿入糸11の太さを編み糸10よりも相対的に細いものを使用する場合も、この実施例に含まれる。前述の加熱手段は加熱トンネルに限定されず加熱ロールによっても同様の結果が得られ、この発明の方法の実施例に含まれる。

【0033】次に加熱トンネルより搬出された編み布は冷却区間において、縦方向に牽引された状態のまま、空冷または水槽中に入れて冷却する。その後必要に応じて、幅方向に挿入糸11がほぼ直線になるまで拡げて、仕上げて成品たる基布13とする。

【0034】実施例2の方法の実施例の作用は請求項4及び請求項5記載の発明の効果を合わせて奏するため重ねての説明を省略する。具体的には、クロスインレイされている挿入糸11のうち、編み糸10よりなるメリヤス面から浮き上がった部分は、加熱時の熱により、一部が溶断する部分もあり、或いは熔融して細くなる部分もある（図2参照）。その他、挿入糸11が編み糸10より細いものを用いる実施例の方法においては、挿入糸11の軟化が容易であり、挿入糸11と編み糸10との熔融温度差の少ない場合あっても、過加熱により編み糸10を熱損傷するおそれがなく、挿入糸11の選択幅が拡大する作用をなす。

【0035】実施例3
請求項6記載及び7記載の発明を含むの実施例であり、実施例1記載の基布を用いたのであり、この基布14たるメリヤス地の裏面側ウレタンホーム層15及び表層16を順次重なって密着して一体となっている自動車座席、靴、鞄、袋物など用の三層シートAとしたものであ

る（図５参照）。

【００３６】前記の表層１６は織布、不織布、編み布、合成樹脂フイルムなどよりなり、縫い糸１７が表層１６を破壊して、発泡ポリウレタン層１５にもぐり込まないものであれば、この発明においては特に限定はない。

【００３７】このようにして形成されている実施例３の自動車座席、靴、袋物など用三層シートＡの作用は例えば、自動車座席として、この自動車座席用三層シートＡを使用するとき、適宜形状に裁断とて縫製して使用されるが、前記基布１３の編み糸１０は縫い糸１７のアンカーとして、充分これを支持し、永年自動車座席として使用された結果、縫い糸１７部分に応力が集中して、その裏面の基布１４のうちの一部の編み糸が切断されたとしても、その直ぐ近傍おいて、相隣するコースの編み糸との掛合点乃至結合点で結合されているから、相隣するコース同士の編み糸１０のニードルループ乃至シンカループの掛合が外れ難く、従って、前記断線部分よりウエル方向に伝線現象が極めて起こり難い。従って縫い糸１７は充分に前記編み糸１０に支持され続ける作用をなす。

【００３８】また自動車座席用三層シートＡの裏面は前記の基布１４のメリヤス面の表面側である場合は凹凸が少なく摩擦係数が小さい。従って自動車用座席の形状に仕立てた後、内部にクッション材を充填したり、或いはクッション材の上に覆い被せるときにも、滑りやすく作業性がよい。

【００３９】この発明において、前記自動車座席用三層シートＡと同一の構造の三層シートとし、自動車の座席以外の目的として、靴、他鞄、ハンドバッグなどの袋物用の三層シートとすることもでき、また衣服用の三層シートとしても使用できる。これらの場合も自動車座席用三層シートＡの場合と同等の作用をなす。　また衣服用の三層シートとするときは、裏面のメリヤス編みの表を外面にして張り合わせたものは、裏生地又は下着との滑りがよく気心地がよいものとなる。

【００４０】

【発明の効果】請求項１の物の特定発明においては、相隣するコースの掛合位置に於いて、挿入糸を介して編み糸が結合しているから、編み糸の一部が断線したとしても、その断線部分の直ぐ近傍の両側に前記編み糸が結合している部分があるから、編み糸に張力が作用しても、前記挿入糸によって、前記ループ乃至シンカが延ばされるのが制限され、余程強い引っ張り力が部分的に作用しない限り、前記ループ乃至シンカ部分が抜けて、縦方向に伝線現象が起こらない効果を奏する。

【００４１】また挿入糸の融点は編み糸の融点より低いものを用いているから、編み糸自体の強度は充分に保持されており、仮に部分的に受ける引張力によって、一部コースの編み糸が断線したとしても、その部分のニードルループ乃至シンカループが外れるだけで、との隣の他ウエルの相隣るコース若しくは次のコースの掛合部に於いては、相隣のコースが相互に結合しているから、それ以上伝線は広がらず平常状態を維持する効果を有する。

【００４２】また相隣するコースの結合点は前記の挿入糸をバイダーとして相隣するコースの編み糸が結合されている部分のみで、他は全く結合されていないから、クロスインレイ乃至平メリヤス編み布としての風合いと縦横の伸縮性を維持している。

【００４３】合成樹脂発泡層を中間に表層とこの基布でサンドイッチ状に挟んで成形した時に、前記編み糸は伝線し難く、縫製糸の支持力が高く、三層シートの内面が滑りやすいものが得られ、自動車座席用は勿論のこと、その他の靴、鞄、などの袋物、或いは衣服用の三層シートの基布として最適である。また全体として、従来のトリコット編みに対し糸の使用量は３０％乃至５０％減で軽量である。

【００４４】また全体として平メリヤスであるから、表面側は凹凸が少なく、滑らかであり、裏面はこれに比較して、凹凸があるから、三層シートの基布として使用するとき、表裏の何れを外側にして、積層するかによって、完成した三層シートの裏面の滑り度合いが異なるものが、２種成形することが出来る。従って、目的に応じこの基布の表裏何れかを外面にして、三層シートを成形することができる。

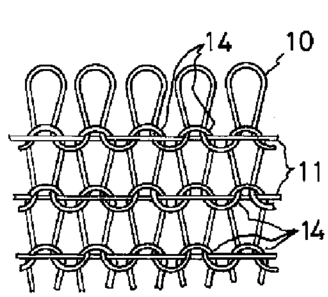
【００４５】請求項２記載の発明は請求項１記載の効果のほか相隣するコースの挿入糸による編み糸の結合は、編み糸繊維の一部乃至全部を抱持して結合したものであるから、結合は強固で編み糸の風合い及びメリヤス生地としての伸縮性は損なわておらず、かつ強度も編み糸の強度を維持している効果を有する。

【００４６】請求項３記載の発明は請求項１記載または請求項２の効果の他、編み糸は１５デニール乃至１２０デニールであり、フィラメントカウント１乃至３６のポエステルであり、挿入糸はナイロン、ポリエチレン、ポリプロピレン、ポリエステルのうちの一種であり、１５乃至３６デニールのものを用いたものであるから、基布自体が極めて軽量で、摩擦計数が小さく、引っ張り強度が大きく、縫い糸の支持力が大きい。従って、自動車座席用は勿論のこと、靴、鞄その他の袋物、或いは衣服用の三層シートの基布として使用したとき、基布が滑りやすく、自動車座席用として使用するときは、縫製作業後内部にクッション材などを挿入する時の作業性がよいし、靴、鞄、衣服用として使用する時は、基布の肌触りがよく、また裏生地若しくは下着との滑りもよい。

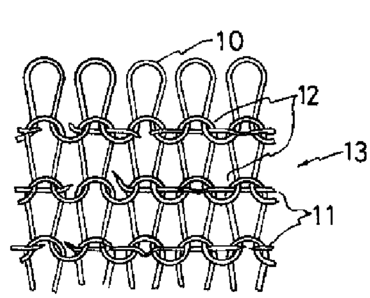
【００４７】請求項４及５記載の方法発明は、従前の平編み機や丸編み機を用いて簡単にかつ、従来のトリコット編みの方法より数倍の編み速度で編み布が製造でき、かつ加熱牽引及び冷却も連続加工が出来るから、すこぶる能率的に請求項１、２及び３記載の発明の基布が製造できる。さらに単に第１工程で編み上げた編み布を、第２工程で単に牽引しながな前記の温度範囲で加熱し冷却

するだけで相隣するコースの掛合部分のみをそれぞれ結合ができる。
【００４８】請求項６、７及び８記載の関連発明の物の発明に於いては、前述の請求項４及５記載の方法発明により成形された請求項１記載の基布を自動車の座席、靴、鞄、袋物など用の三層シートの基布として、形成したものであるから、この三層シートによって、自動車座席の表面を形成するように、或い靴、鞄、袋物など適宜目的に応じた形状に裁断し、ミシンなどを用いて縫製すると、この時前述の編み糸及び挿入糸は縫い糸と掛合して、充分な支持力を発揮し、縫糸が必要以上に中間の発泡層に食い込ませない効果を奏する。
【００４９】而して、例えば自動車座席の表層材として縫製し、内部にクッションなどを詰め込み、或いは自動車の座席の骨組み及びクッション材が取り付けてある自動車の座席の下地部分に被せて、自動車の座席を完成させる。この時、前記基布が発泡層の裏面に一体に積層されているから、従来のトリコットなどの基布と同様に座席の下地との滑りがよくすこぶる組立て作業の作業性がよい。
【００５０】また自動車用座席その他、目的物に縫製後、これらの使用中に編み糸の一部が破断したとしても、編み糸はそれぞれ結合点で、前述の様に挿入糸をバインダーとして結合されているから、相隣るコースのニードルループまたはシンカループが抜け、順次外れる伝線減少は極めて起こり難たく、縫糸が基布から抜けて、直接発泡層に食い込み、発泡層を破壊して、結局縫製部分を破壊するようなこともなく、長期間縫製糸の保持がされる効果を有する。
【００５１】請求項８記載の物の発明に於いては、自動車座席用三層シートの基布の前記挿入糸による融着部分が挿入糸が塑性変形して、編み糸の纖維間に食い込んで、主として機械的に結合しているから、編み糸の引張力は何ら減殺されておらず、縫い糸に対して充分なアンカー作用をなす。また編み糸の他の部分に対しては、通常のメイヤスの風合いを保持している。
【００５２】実施例固有の効果
実施例１の物の効果は請求項１、請求項３及び請求項４記載の発明の効果を合わせて奏する。挿入糸１１がコース毎になく一つおき又は二つおきにある物においては、挿入糸１１が少ないだけ、三層シート用の基布として、糸使用量が少なく軽量であり、また仮に編み糸の一部であって、挿入糸１１のないコースの編み糸が断線しても、２コース以内には必ず相隣するコースの編み糸が結合した結合点１２があるから、その部分のニードルループ乃至シンカループはそれほど延ばされず、伝線減少は余り起こらず、仮に起こったとしても、前記挿入糸１１が挿入されて、結合点１２があるコースで伝線が止まり、実質的に伝線が伝播するコースは２コースまででであり、実質的に毎コース毎に挿入糸１１のあるものと伝線阻止効果において、遜色はない。
【００５３】実施例２の方法は請求項４及び請求項５記載の方法発明の効果を合わせて奏する。その他、挿入糸１１が編み糸１０より細いものを用いる実施例の方法においては。挿入糸１１の軟化が容易であり、挿入糸１１と編み糸１０との熔融温度差の少ない場合あっても、過加熱により編み糸１０を熱損傷するおそれがなく、挿入糸１１の選択幅が拡大する効果を奏する。実施例３の物は請求項６及び８記載の発明の効果を合わせて奏する。
【図面の簡単な説明】
【図１】クロスレイイン編み布の一部拡大表面図である。
【図２】加熱成形後の基布の一部拡大表面図である。
【図３】編み糸と挿入糸との結合状態を示す拡大断面図である。
【図４】実施例２の方法のフローチャートである。
【図５】実施例３の三層シートの縫い合わせ部分の拡大断面図である。
【符号の説明】
１０　　編み糸
１１　　挿入糸
１２　　結合点
１３　　基布
１５　　表層
１６　　合成樹脂発泡層
１７　　縫い糸

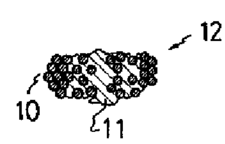
【図１】



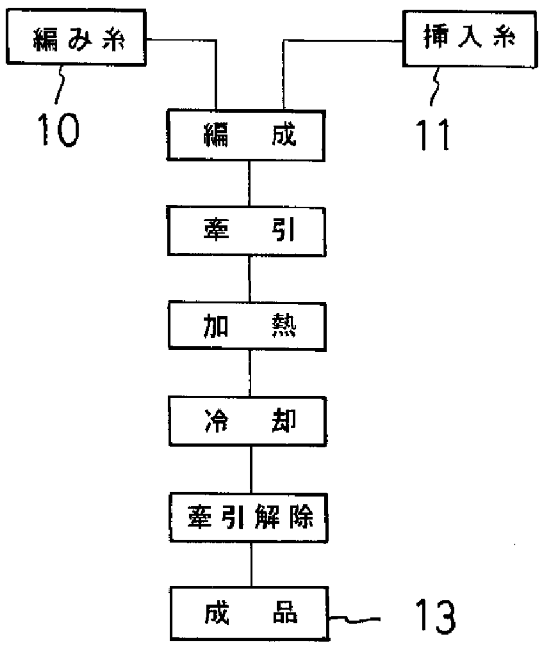
【図２】



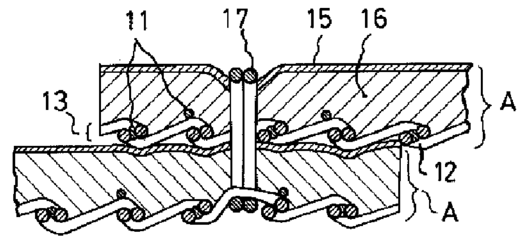
【図３】



【図４】



【図５】



【手続補正書】
【提出日】平成６年１１月１７日
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】特許請求の範囲
【補正方法】変更
【補正内容】
【特許請求の範囲】
【請求項１】合成樹脂製のフィラメントよりなる編み糸により平編みのメリヤスとしてあり、これに少なくとも３コース毎に前記編み糸よりも低融点の熱可塑性合成樹脂のフィラメント挿入糸が挿入してあって、この挿入糸は前記上下のコースの編み糸の掛合位置において挟持されて、全体としてクロスインレイの平編みメリヤス布としてあり、これを縦方向に牽引して熱セットしてあって、前記上下のコースの編み糸は挿入糸をバインダーとして前記掛合位置において、それぞれ融着して形成してあることを特徴とする三層シート用基布。
【請求項２】前記挿入糸による前記編み糸の融着は溶融固化した挿入糸の一部が前記編み糸繊維の一部乃至全部を抱持して結合したものであることを特徴とする請求項１記載の三層シート用基布。
【請求項３】前記編み糸は１５デニール乃至１２０デニールであり、フィラメントカウント１乃至３６のポリエステルフィラメントであり、前記挿入糸はナイロン、ポリエチレン、ポリエステル、ポリプロピレンのうちの一種であり、１５デニール乃至３６デニールの範囲あることを特徴とする請求項１または請求項１又は請求項２記載の三層シート用基布。
【請求項４】合成樹脂製のフィラメント編み糸により平編みのメリヤスを編成する際に、これに少なくとも３コース毎に前記編み糸よりも低融点の熱可塑性合成樹脂のモノフィラメント樹脂よりなる挿入糸を相隣するコースの編み糸が掛合する間に挿入して、コース方向に挿入糸が挿入してあるクロスインレイの平編みメリヤス布を編成する第１工程。前記第１工程で編成された編み布を幅寸法を維持したまま、縦方向に順次牽引しながら、前記挿入糸が塑性変形可能な軟化温度であって、編み糸が塑性変形しない温度まで加熱し、前記相隣するコースの編み糸が掛合する間に挟持されている軟化した挿入糸の一部によってを相圧接する部分前記編み糸の全部乃至前記編み糸繊維の一部を抱持する第２工程。その後編み布を牽引状態のまゝ冷却して、前記挿入糸をその状態で固化させる第３工程。以上の３工程よりなる三層シート用の基布の製造方法。
【請求項５】請求項４の発明の第１工程の編み糸は前記編み糸は１５デニール乃至１２０デニール、フィラメントカウントは１乃至３６のポリエステルフィラメント、挿入糸はナイロン、ポリエチレン、ポリエステル、ポリプロピレンのうちの一種であり、１５デニール乃至３０デニールの範囲のものを用いる方法であることを特徴と

する三層シート用の基布の製造方法。
【請求項６】織布、不織布、編み布、合成樹脂フィルムの一種よりなる素層と、この裏面にウレタン発泡層及び基布が順次積層して一体化してある表皮材に於いて、前記基布は合成樹脂製のフィラメントよりなる編み糸により平編みのメリヤスとしてあり、これに少なくとも３コース毎に前記編み糸よりも低融点の熱可塑性合成樹脂のフィラメント挿入糸が挿入してあって、この挿入糸は前記上下のコースの編み糸の掛合位置において挟持されて、全体としてクロスインレイの平編みメリヤス布としてあり、これを縦方向に牽引して熱セットしてあって、前記上下のコースの編み糸は挿入糸をバインダーとして前記掛合位置において、それぞれ融着して形成してあることを特徴とする自動車座席、靴、鞄、袋物など用三層シート。
【請求項７】前記編み糸は前記編み糸は１５デニール乃至１２０デニール、フィラメントカウントは1乃至３６のポリエステルを用いる方法であり、挿入糸はナイロン、ポリエチレン、ポリエステル、ポリプロピレンのうちの一種であり、１５デニール乃至３６デニールの範囲であことを特徴とする請求項６記載の自動車座席、靴、袋物など用三層シート。
【請求項８】前記挿入糸による編み糸の融着は溶融固化した挿入糸の一部が編み糸繊維の一部乃至全部を抱持して結合したものであることを特徴とする請求項６、又は請求項７記載の自動車座席、靴、鞄、袋物など用三層シート。
【手続補正２】
【補正対象書類名】明細書
【補正対象項目名】０００８
【補正方法】変更
【補正内容】
【０００８】また前記の課題を解決するために、前記三層シート用基布の前記挿入糸による編み糸の融着は溶融固化した挿入糸の一部が編み糸繊維の一部乃至全部を抱持した結合したものであることを特徴とすることが好ましい。
【手続補正３】
【補正対象書類名】明細書
【補正対象項目名】００１４
【補正方法】変更
【補正内容】
【００１４】また前記の課題を解決するために、前記基布の前記編み糸が非溶融性の繊維よりなる自動車座席、靴、鞄、袋物など三層シートの前記挿入糸による編み糸の融着は溶融固化した挿入糸の一部が編み糸繊維の一部乃至全部を抱持して結合したものであることが好ましい。
【手続補正４】
【補正対象書類名】明細書
【補正対象項目名】００１５
【補正方法】変更
【補正内容】
【００１５】
【作用】請求項１記載の三層シート用の基布は前述の通り構成しているから、相隣するコースの掛合位置に於いて、挿入糸を介して編み糸が結合しているから、編み糸の一部が断線したとしても、その断線部分の直ぐ近傍の両側に相隣する編み糸がその掛合位置で編み糸同士が結合している部分があるから、編み糸に張力が作用しても、掛合位置における結合部分において、バインダーとなっている前記挿入糸が溶融し固化した部分によって、前記ニードルループ乃至シンカループが延ばされるのが制限され、余程強い引っ張り力が部分的に作用しない限り、前記ニードルループ乃至シンカループ部分が抜けて、縦方向に伝線が起こらない作用をなす。
【手続補正５】
【補正対象書類名】明細書
【補正対象項目名】００１７
【補正方法】変更
【補正内容】
【００１７】また基布全体としては平編みメリヤスとしての左右及び縦方向への伸縮性は保持された状態となる。請求項２記載の発明に於いては、請求項１記載の作用の外、前記挿入糸による編み糸の融着は溶融した挿入糸の一部が編み糸の全部若しくは編み糸の繊維間に押し込まれて、一部の繊維を抱持して主として機械的に結合しており、編み糸自体の強度をそのまま維持しているから平編みメリヤスの風合いを保持した状態を維持する作用を為す。
【手続補正６】
【補正対象書類名】明細書
【補正対象項目名】００１９
【補正方法】変更
【補正内容】
【００１９】請求項４記載の方法発明に於いては、前述の第１工程に於いて製造されたクロスインレイの平編みメリヤス編み布は、第２工程で縦方向に牽引されるときに、編み糸が軟化しない範囲で、挿入糸のみが軟化熔融されるから、相隣のコースとの掛合部分において、軟化した挿入糸を前記掛合部分で挟持し、挿入糸を押し潰し、溶融した挿入糸の一部は、その部分の編み糸の一部若しくは全部を抱持するように変形する。而して、その状態で冷却し、溶融した挿入糸は前述の変形状態のまま固化し、相隣する編み糸のニードルループとシンカループが結合され平編みメリヤスとなる作用をなす。この請求項４記載の方法により請求項１記載の発明の基布が製造される。
【手続補正７】
【補正対象書類名】明細書

【補正対象項目名】００２２
【補正方法】変更
【補正内容】
【００２２】また前記の縫製した自動車用座席の表面形状の縫製品としたとき、内部に自動車座席のクッション材等を詰め込み、或いは自動車の座席の下地部分にこの縫製品を被せる場合に、前記基布が用いられているから、従来のトリコット同様に前記下地部分との滑りがよい。殊に前記基布の表面を外面に向けて積層したものは、前記作用は更に顕著である。殊に請求項６及び７記載の発明のものにおいては、前記基布の裏面を外面に向けて積層したものは、多少内部の下地部分がウレタンホームの場合、これとの滑り具合は前記基布の表面を外面に向けて積層したものより滑り難く、完全にウレタンホームよりなる前記下地部分に被せた後においては、みだりに滑らず安定性がよい作用をなす。
【手続補正８】
【補正対象書類名】明細書
【補正対象項目名】００３４
【補正方法】変更
【補正内容】
【００３４】実施例２の方法の実施例の作用は請求項４及び請求項５記載の発明の効果を合わせて奏するため重ねての説明を省略する。具体的には、クロスインレイされている挿入糸１１のうち、編み糸１０よりなるメリヤス面から浮き上がった部分は、加熱時の熱により、一部が溶断する部分もあり、或いは溶融して細くなる部分もある（図２参照）。その他、挿入糸１１が編み糸１０より細いものを用いる実施例の方法においては、挿入糸１１の軟化が容易であり、挿入糸１１と編み糸１０との溶融温度差の少ない場合あっても、過加熱により編み糸１０を熱損傷するおそれがなく、挿入糸１１の選択幅が拡大する作用をなす。
【手続補正９】
【補正対象書類名】明細書
【補正対象項目名】００４１
【補正方法】変更
【補正内容】
【００４１】また挿入糸の融点は編み糸の融点より低いものを用いているから、編み糸自体の強度は充分に保持されており、仮に部分的に受ける引張力によって、一部コースの編み糸が断線したとしても、その部分のニードルループ乃至シンカループが外れるだけで、この隣の他ウエルの相隣るコース若しくは次のコースの掛合部に於いては、相隣のコースが相互に結合しているから、それ以上伝線は広がらず平常状態を維持する効果を有する。
【手続補正１０】
【補正対象書類名】明細書
【補正対象項目名】００５２
【補正方法】変更
【補正内容】
【００５２】実施例固有の効果
実施例１の物の効果は請求項１、請求項３及び請求項４記載の発明の効果を合わせて奏する。挿入糸１１がコース毎になく一つおき又は二つおきにある物においては、挿入糸１１が少ないだけ、三層シート用の基布として、糸使用量が少なく軽量であり、また仮に編み糸の一部であって、挿入糸１１のないコースの編み糸が断線しても、２コース以内には必ず相隣するコースの編み糸が結合した結合点１２があるから、その部分のニードルループ乃至シンカループはそれほど延ばされず、伝線現象は余り起こらず、仮に起こったとしても、前記挿入糸１１が挿入されて、結合点１２があるコースで伝線が止まり、実質的に伝線が伝播するコースは２コースまでであり、実質的に毎コース毎に挿入糸１１のあるものと伝線阻止効果において、遜色はない。

フロントページの続き

(51)Int.Cl.^{6}	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｄ０６Ｃ　7/00		Ａ		

(19) RÉPUBLIQUE FRANÇAISE

INSTITUT NATIONAL
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(54) **Etoffes non tissées.**

(72) Invention de :

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Vente des fascicules à l'IMPRIMERIE NATIONALE, 27, rue de la Convention - PARIS (15e)

La présente invention concerne des étoffes non tissées améliorées qui sont renforcées et stabilisées par des liaisons formées entre les fibres ou filaments contigus, la matière constituant les liaisons provenant de certains au moins des filaments ou fibres dont se compose l'étoffe non tissée.

Il a été proposé de réaliser des étoffes non tissées à partir d'un mélange de fibres homogènes de deux types dont celles de l'un d'eux (les fibres liables) peuvent être rendues adhésives dans des conditions qui laissent les fibres de l'autre type (les fibres non liables) inchangées. Ainsi, des étoffes non tissées ont été produites à partir de mélanges de fibres naturelles, par exemple de laine ou de coton, avec des fibres synthétiques, par exemple des fibres de poly(ε-caprolactame) ou à partir de mélanges de deux fibres synthétiques différentes, par exemple des fibres de poly(hexaméthylène-adipamide) avec des fibres de poly(ε-caprolactame). Dans les deux cas, les fibres de poly(ε-caprolactame) sont rendues adhésives à une température d'environ 210°C qui n'affecte pas sensiblement les autres types de fibres, de sorte qu'elles adhèrent les unes aux autres et aux autres fibres non liables et forment des liaisons après refroidissement.

Plus récemment, le brevet britannique N° 1 073 182 a proposé de fabriquer un type d'étoffes non tissées liées connues sous la désignation d'étoffes liées par fusion. Ces étoffes sont renforcées et stabilisées par des liaisons formées entre les fibres ou filaments contigus, dont une proportion au moins est conjuguée et présente au moins un composant formant une partie de sa surface qui peut être rendu collant dans des conditions qui n'affectent pas sensiblement les autres composants, c'est-à-dire que le composant est potentiellement adhésif.

Ces fibres conjuguées (qui sont les fibres liables) peuvent être utilisées soit seules, soit en mélange avec d'autres fibres non liables qui ne sont pas affectées par le traitement de liaison. Selon l'une de ses caractéristiques, la présente invention concerne les étoffes ou structures liées par fusion comprenant un mélange de fibres conjuguées et de fibres non liables.

Pour plus de commodité et pour faciliter la compréhension, on va se référer dans le présent mémoire à des fibres à deux composants (en ce qui concerne les étoffes liées par fusion). Toutefois, il est bien entendu que les fibres hétérogènes et les fibres conjuguées contenant plus de deux composants ne sont pas exclues du cadre de l'invention.

Dans le contexte du présent mémoire, le mot "fibre" doit être considéré comme englobant les filaments continus aussi bien que les fibres discontinues.

Les propriétés physiques des étoffes non tissées liées dépendent dans une certaine mesure du nombre des liaisons entre les filaments et par suite de la proportion des fibres liables dans le mélange. Pour certaines applications nécessitant une propriété physique spécifique minimale, par exemple une grande résistance à la déchirure, les propriétés de l'étoffe telle que la résistance à l'abrasion de la surface et l'aspect peuvent être inappropriées, étant donné que la proportion des fibres liables donnant cette propriété spécifique peut être trop faible pour fixer et lier efficacement toutes les fibres de la surface à la masse principale de l'étoffe.

En conséquence, la présente invention concerne une étoffe non tissée obtenue à partir d'un mélange de fibres liables et non liables et comprenant un corps principal et des couches superficielles de part et d'autre de ce dernier, une couche superficielle au moins contenant une plus forte proportion de fibres liables que le corps principal.

D'une manière surprenante, les propriétés physiques ne sont tout au plus que légèrement affectées par ces surfaces riches en fibres liables, et la résistance à l'abrasion et l'aspect sont très améliorés.

La présente invention s'applique à tout type d'étoffes ou structures non tissées liées, que ce soit par fusion ou d'une autre manière, comprenant des étoffes fabriquées à partir de fibres discontinues, de filaments continus, des étoffes aiguilletées et tuftées, des étoffes à couches multiples et des étoffes piquées.

Les produits de l'invention peuvent être réalisés par un certain nombre de procédés dont la nature dépend du type de fibres et de la nature du produit que l'on désire obtenir. Par exemple, un produit se composant de fibres discontinues peut être réalisé en produisant une première bande présentant un mélange contenant une forte proportion de fibres liables et une seconde bande comprenant une plus faible proportion de fibres liables que la première bande et en stratifiant les première et seconde bandes. Les bandes peuvent être produites par n'importe quel procédé classique, par exemple par traitement sur la machine Garnett, par introduction des nappes en travers de la carde ou par dépôt à l'air des fibres.

Des bandes à filaments continus peuvent être préparées d'une façon classique en utilisant plusieurs dispositifs pour déposer les filaments sur une surface collectrice, les dispositifs déposant les filaments formant une surface recevant une plus forte proportion de fibres liables que les autres dispositifs de dépôt.

Des bandes à fibres discontinues peuvent être également réalisées en posant en travers une seule nappe non tissée dans laquelle une forte proportion des fibres liables sont concentrées vers les bords de la nappe. Lorsque cette nappe est posée en travers, les surfaces de la bande non tissée résultante sont riches en fibres liables.

La proportion des fibres liables des couches superficielles du produit dépend dans une large mesure de l'équilibre entre des facteurs économiques et la nécessité d'obtenir une surface ayant une grande résistance à l'abrasion et un bon aspect.

Il est préférable que la proportion des fibres liables de la couche superficielle soit d'au moins 20 % supérieure à la proportion des fibres liables du corps principal. Le corps principal doit contenir au moins 5 % et de préférence 25 % de fibres liables (voir brevet britannique N° 1 073 182 précité).

Les exemples suivants sont donnés à titre illustratif, mais non limitatif de l'invention.

Exemple 1

On fait fondre un polypropylène ayant un indice d'écoulement à l'état fondu de 6, lorsqu'on le détermine suivant la méthode ASTM - D1238 à 190°C sous une charge de 2,14 kg, et un copolyamide 6.6/6 (75:25 poids/poids), la viscosité relative d'une solution à 8,4 % dans l'acide formique à 90 % étant de 40, dans une extrudeuse à vis d'un diamètre de 7,5 cm et un appareil à vis classique de fusion du "Nylon" sous pression, respectivement. Les polymères fondus sont introduits dans chacun des huit ensembles de filtres dans les proportions de 75 parties de polypropylène et de 25 parties de copolyamide en poids. Le débit total des polymères de chaque ensemble de filtres est de 118 g/minute. Six des huit ensembles produisent chacun 40 filaments homogènes de polypropylène et 42 filaments à deux composants, à savoir une âme de polypropylène et une gaine de copolyamide 6.6/6 (75:25) à un rapport volumique de l'âme à la gaine de 60:40. Chacun des deux autres ensembles de filtres produit 80 filaments à deux composants, à savoir une âme de polypropylène et une gaine de copolyamide 6.6/6 à un rapport volumique de l'âme à la gaine de 80:20. Tous les trous de la filière sont de même dimension. Les filaments extrudés de chaque ensemble de filtres sont refroidis à l'air et étirés à un rapport de 2,67, la surface des rouleaux d'étirage étant moletée. Les 8 faisceaux de filaments sont chargés électrostatiquement et ont fait passer chaque faisceau immédiatement dans un pistolet de pulvérisation qui est animé continuellement d'un mouvement alternatif au-dessus d'une courroie mobile constituée par une toile de fils d'acier inoxydable. Les deux ensembles de filtres ne produisant que des filaments à deux composants alimentent les deux derniers des huit pistolets de pulvérisation. A la sortie du pistolet, les filaments se séparent. La vitesse de déplacement des pistolets est de 1,38 m/seconde.

La largeur de la bande est de 4,3 m et elle pèse 70 g/m^2. On traite la bande par la vapeur à la pression atmosphérique pour favoriser sa séparation du transporteur et on la lie ensuite en la faisant passer dans une chambre à vapeur d'une longueur de 0,3 m pendant qu'elle est intercalée entre deux courroies transporteuses en tissu. La chambre à vapeur comporte à l'entrée et à la sortie des éléments étanches à la vapeur constitués par des sacs à air gonflables, comme décrit dans le brevet britannique N° 1 001 508, qui ont pour effet de comprimer la bande. Une pression d'air de 3,30 kg/cm^2 est maintenue dans les éléments d'étanchéité et la vapeur d'eau saturée est maintenue à une pression de 1,54 kg/cm^2 dans la chambre, ces conditions ayant pour effet de ramollir les gaines de copolyamide des filaments à deux composants de l'étoffe et de former des liaisons entre lesdits filaments contigus. Finalement, on enroule le produit.

La bande présente des résistances à la déchirure de 25 kg à la fois dans le sens machine et dans le sens transversal.

On recouvre le côté de la bande présentant la plus faible proportion des filaments à deux composants avec une solution visqueuse d'un caoutchouc naturel non vulcanisé qu'on étale régulièrement sur la bande à l'aide d'une raclette. Le caoutchouc est ultérieurement vulcanisé.

Le produit constitue une assise élastique de tapis et est caractérisé par une bonne stabilité dimensionnelle et une bonne résistance à la déchirure, grâce à la bande non tissée liée. Lorsqu'on pose le produit en plaçant la bande au-dessus, la surface supérieure présente une grande résistance à l'abrasion.

A titre de comparaison, on a préparé une assise de tapis analogue renforcée par une bande liée par fusion ayant les mêmes proportions des filaments à deux composants que la bande décrite ci-dessus, mais sans présenter de couche superficielle riche en de tels filaments. Cette assise présente une bonne stabilité dimensionnelle et une bonne résistance à la déchirure, mais la surface supérieure est rapidement usée par abrasion, les filaments se détachant du corps principal.

Une troisième assise, renforcée par une matière liée par fusion se composant entièrement de filaments à deux composants, présente une bonne stabilité dimensionnelle et une bonne résistance à l'abrasion, mais une très faible résistance à la déchirure.

Exemple 2

On prépare une bonne cardée en travers pesant 68 g/m^2 à partir d'un mélange de fibres discontinues comprenant 40 % de fibres de "Nylon 66" de 6 deniers d'une longueur de 63,5 mm et 60 % de fibres hétérogènes à âme et gaîne de 6 deniers d'une longueur de 63,5 mm, l'âme étant en "Nylon 66" et la gaine en "Nylon 6" en proportions égales, et on l'aiguillette légèrement pour former une structure cohérente.

On prépare également une seconde bande cardée en travers pesant 136 g/m^2 à partir d'un mélange de fibres comprenant 70 % de fibres de "Nylon 66" de 3 deniers d'une longueur de 50 mm et 30 % de fibres hétérogènes de 3 deniers d'une longueur de 50 mm, les composants et leur disposition étant identiques à ceux du premier mélange. On aiguillette aussi légèrement cette bande pour former une structure cohérente.

On dépose la seconde bande sur un transporteur mobile et on dépose la première bande sur la surface supérieure de la seconde. On fait passer tout d'abord la bande combinée sur un métier à aiguilles dans lequel elle est consolidée (stratifiée) en utilisant des aiguilles minces (36,norme britannique.), puis on la lie dans une étuve à vapeur d'eau et à air chaud. Dans cette étuve, la bande est exposée à une température de 225°C dans une atmosphère comprenant 20 % d'air et 80 % de vapeur d'eau pendant 20 secondes.

Après le passage dans l'étuve de liaison, la bande est refroidie à la température ambiante et est bobinée. Le produit présente une surface lisse résistant à l'abrasion, son autre surface étant relativement molle. La matière est considérée comme étant appropriée pour réaliser des tiges de pantoufles.

Exemple 3

On prépare l'étoffe à double bande de l'exemple 2, mais en interposant entre les première et seconde bandes une toile de fibres discontinues de "Nylon 66" filé, à 7,2 brins par cm à la fois dans le sens de la chaîne et de la trame. On lie la structure comme dans l'exemple 2. Le produit est analogue à celui de l'exemple 2, mais présente une plus grande stabilité dimensionnelle.

Exemple 4

On prépare une bande liée comme dans l'cxemple 2, mais, immédiatement à sa sortie de l'étuve de liaison, on la fait passer dans une presse de calandrage non traitée, dont un rouleau présente une configuration de gaufrage sur sa surface. La bande est ainsi comprimée sous forme d'une configuration correspondant à celle du rouleau.

Il va de soi que de nombreuses modifications peuvent être apportées à l'étoffe décrite sans sortir du cadre de l'invention.

REVENDICATIONS

1. Etoffe non tissée produite à partir d'un mélange de fibres liables et non liables et comprenant un corps principal et des couches superficielles de part et d'autre de ce dernier, étoffe caractérisée en ce qu'une couche superficielle au moins contient une plus forte proportion de fibres liables que le corps principal.

2. Etoffe selon la revendication 1, caractérisée en ce que les couches superficielles contenant la plus forte proportion des fibres liables constituent au total jusqu'à 50 % en poids de l'étoffe non liée.

3. Etoffe selon la revendication 1 ou 2, caractérisée en ce que la proportion des fibres liables de la couche superficielle présente une proportion de fibres liables d'au moins 20 % supérieure à celle du corps principal.

4. Etoffe selon l'une quelconque des revendications 1 à 3, caractérisée en ce que les fibres liables sont des fibres conjuguées comportant un composant potentiellement adhésif qui constitue au moins une partie de leur surface.

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1603487

(54) LEATHER LIKE MATERIALS

(71) We, INMONT CORPORATION, a Corporation organised under the laws of the State of Delaware, United States of America, of 1133 Avenue of the Americas, New York, New York 10036, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the production of leather-like materials.

The leathers used for shoe uppers (and other leather products) come in a great variety of types, grades, and finishes, to meet customer demand. They may vary in colour (and in shadings) gloss, softness, grain, or thickness. Demand for any particular grade or finish may vary, unpredictably, with changes in the public taste or other circumstances.

Economical manufacture of synthetic leatherlike materials often requires relatively large scale continuous runs of any particular grade or finish. If even a small portion of the demand for variety is to be met promptly, large inventories of a great many different finished materials are needed.

The present application describes an overall system, and various aspects thereof, by which synthetic leatherlike materials of high quality (such as desirable softness, tear-resistance, grain, leatherlike "break", good behavior on lasting of shoes, stitch-retention, pleasing and abrasion-resisting surface, freedom from "orange peel", and good moisture vapor transmission,) can be produced as needed. The system even makes it possible for the shoe manufacturer to make his shoe upper materials as required with a minimum of investment in inventory of raw materials and with simple, relatively inexpensive equipment, without the need to use polluting solvents and without the attendant fire and toxicity hazards.

The synthetic leatherlike materials described herein are made up of two or three basic components. One is a thin microporous elastomeric layer. Another is a fibrous backing layer. And a third is a very thin preformed skin. Webs of these materials are laminated together in continuous fashion, preferably entirely by heat, as needed. The microporous elastomeric material and the fibrous backing may be stocked in only one or more or three basic colors (e.g. white, black or grey and brown) and may be produced by large scale continuous manufacture. A wide variety of different colors and patterns of the thin skins may be prepared at low cost, as by gravure printing on suitable thin, economical carrier layers. The grain is produced by continuous heat-embossing of the laminate and may be accomplished on the very same rolls that are used for the laminating.

One way to vary the properties of the shoe upper materials is to vary the fibrous layer. Thus for shoes which are to be made by the known string-lasting or slip-lasting technique, in which the property of stretchability of the shoe upper material (e.g. stretchability such that the upper conforms smoothly to the last at zones of relatively high curvature such as the toe zone) is unimportant or undesirable, the fibrous layer may include a woven structure, such as an open woven scrim, which has (owing to its openness) little yarn crimp and thus resists elongation; the resulting structure is strong but may have a relatively low elongation at break (e.g. an elongation of about 20% or less). Similarly athletic shoes (designed to have high dimensional stability, so as to support the foot well) may be made with such a scrim-containing fibrous layer. For conventional men's dress shoes, particularly of the currently popular softer type, a fibrous layer having considerably greater stretchability may be used (e.g. to produce a structure having an elongation at break of well above 15% such as 25, 30 or 50%). Also, a different fibrous layer may be preferred in order to obtain the thickness desired for a particular use, e.g., different thicknesses may be employed for men's dress and casual shoes, and thinner material may be used for women's shoes. The system described herein permits a change in the type of fibrous layer to be made simply and easily; there is no need to provide an inventory of laminates of any given fibrous backing.

According to the present invention a process for making artificial leather comprises:

(a) providing a supply of a continuous web of fibrous material, for example comprising needle-punched staple fibres, and a separate supply of a continuous sheet of microporous elastomeric polyurethane and a separate supply of a macro-apertured web of a fusible elastomeric polymer the said microporous elastomeric polyurethane having a higher melting point than the fusible polymer of the macro-apertured web such as to remain in a microporous condition at the fusion temperature of the said macro-apertured web;

(b) continuously pulling the said webs and sheet lengthwise under tension from the said supplies to an assembling zone;

(c) continuously pre-heating the said fibrous web during its passage to the said assembling zone;

(d) continuously bringing the said macro-apertured web into contact with the said pre-heated fibrous web and transferring heat from and through the said fibrous web to the said macro-apertured web to raise the said macro-apertured web to its fusion temperature;

(e) bringing the said microporous sheet into contact with the said macro-apertured web before the said macro-apertued web attains its fusion temperature and before the said macro-apertured web attains its network breakdown temperature whereby the said macro-apertured web adheres to the said microporous sheet without substantial network breakdown;

(f) passing the resulting assemblage of webs and sheet lengthwise through a nip between two rotating rolls, for example comprising a metal roll having a hot surface and an elastomer surfaced back up roll, the said rolls exerting high pressure to compress the said microporous sheet and cause the said fusible elastomeric polymer to flow around fibres of the said fibrous web to encase and bond the said fibres while leaving unbonded breathable areas corresponding to the macro-apertures of the said web; and

(g) cooling the resulting assemblage to set the said fusible polymer in solid condition.

The term "macro-apertured web" means a web having apertures visible to the unaided human eye, but having substantially no apertures which are more than 10 mms across.

The said macro-apertured web preferably is a stretchable web having a thickness of about 3 to 5 mils, and weighs about 0.5 to 0.08 oz/yd².

Preferably the said tension on the said macro-apertured web is maintained sufficiently low that the said web stretches less than 10% in passing from its supply to the said nip.

The said fibrous web may comprise an elastomeric binder in amount of about 2 to 40%, based on the total weight of the said fibrous web.

Preferably prior to cooling the assemblage resulting from the process, the said assembly is passed continuously lengthwise onto a rotating roll having a hot surface, the said hot surface preferably having a temperature which is within about 15°C of the melting-sticking temperature of the said microporous material, for providing a finish on the said microporous sheet, and is continuously removed lengthwise from the said hot roll.

The said assemblange is then preferably maintained in a relaxation step under substantial absence of tension and in lengthwise arcuate form with its hot-finished surface convex at an elevated temperature such as to cause lengthwise relaxation of the microporous material thereby causing the said fibrous web laminated thereto to undergo lengthwise contraction.

The said assemblage preferably travels in contact with the said hot surface of the said rotating roll for a residence time of more than 1/2 second while the said assemblage is in arcuate form with its fibrous surface convex, and the said assemblage then, directly after its removal from the said hot surface of the said rotating roll, travels continuously in an arcuate form with its hot-finished surface convex at an elevated temperature such as to cause lengthwise relaxation of the microporous material thereby causing the said fibrous web laminated thereto to undergo lengthwise contraction.

The said hot surface is preferably an embossing surface having ridges penetrating into the said microporous material. The said microporous material is preferably directly in contact with the said hot surface.

The said microporous sheet may be about 10 to 50 mils thick and the said fibrous web may have a thickness of about 20 to 50 mils during the said relaxation step, the overall thickness of the laminate during the said relaxation step being about 35 to 80 mils.

The fibre to elastomer weight ratio in the said assemblage may be about 0.8:1 to 1.2.:1

A grain pattern is preferably imparted to the microporous polyurethane sheet by passing the said sheet material continuously to the nip between a roll having a hot grain-embossing surface having hot grain-embossing projections, (which hot surface may be afforded by the surface of the one of the two rotating rolls to which the microporous sheet is juxtaposed), and another roll, compressing the said sheet in the said nip and thereby forcing the said projections into the said sheet, passing the said sheet material out of the said nip and maintaining the said sheet material on the said grain embossing surface to transfer heat from the said projections into the said sheet while the said sheet is substantially uncompressed, and then continuously removing the said sheet material from the said hot roll.

In another form of the invention when the said assemblage is on the said hot roll there may be a thin elastomeric skin between the said microporous material and the said hot surface of the said roll. The said thin elastomeric skin may have a thickness of less than about 15 mils.

The residence time of the said sheet material in the said nip is preferably less than about 0.1 second and its residence time on the said hot surface while substantially uncompressed is preferably at least about 1/2 second.

Preferably the said residence time in the said hot nip is so short that the said microporous sheet recovers to substantially its original thickness in the said process.

The said microporous polyurethane preferably has a melting-sticking temperature of at least about 130°C, e.g. about 155—185°C.

In another form of the invention a surface showing a depth of surface colour is imparted to the microporous sheet by a process which comprises continuously supplying a transparent coloured skin having an elastomeric layer onto a hot roll, continuously supplying a web having a coloured microporous elastomeric surface layer into contract with the said coloured skin, and, while the said skin is on the said roll, fusing the said elastomeric layer to the said microporous elastomeric sheet to form a product in which the colour of the said microporous zone is visible through the said coloured skin.

The said skin is preferably supported on a carrier sheet in its passage to and on the said hot roll and the heat to effect the said fusion is supplied from the said roll through the said carrier sheet.

The said skin may be made by gravure coating a plurality of different shades of material successively onto the said carrier sheet, the said different shades of material being differently distributed on the same overall area of the said carrier sheet to form a mottled pattern.

The fibrous web supplied before the process commences preferably is a ligated web, for example comprising needle-punched staple fibres and comprising about 0.05 to 0.1 gram of staple fibres per cubic centimetre, and has a specific gravity below about 0.15 and the continuous sheet of microporous elastomeric polyurethane supplied before the process commences preferably has a specific gravity above 0.2, and the process preferably is such as to compact the said web to raise its specific gravity to above about 0.2.

The said fibrous web preferably comprises heat-settable fibres, and at least one of the said rolls has a hot surface maintained at temperature at which heat-setting of the said heat-settable fibres occurs.

The said fibrous web may be passed through a web-preheating zone under tension before passing through the said nip.

The said heat-settable fibres preferably comprise polyethylene terephthalate staple fibres and the said hot surface preferably is maintained at a temperature of at least about 170°C but below the fusing temperature of the said heat-settable fibres.

According to another form of the invention the process includes:

(a) placing a thin preformed skin on the outer surface of the said microporous polyurethane, the said skin having a surface, in contact with the said microporous outer surface, which is heat fusible to the said outer surface, the said fusible surface of the said skin preferably being of elastomeric polyurethane having a lower melting point than the polyurethane of the said outer microporous surface;

(b) passing the said assemblage continuously lengthwise onto a rotating embossing roll having a hot grain-embossing surface, (which may be afforded by the surface of the one of the two rotating rolls to which the microporous sheet is juxtaposed), and which preferably is at a temperature within about 15°C of the melting-sticking temperature of the said microporous material, in contact with the said skin at a temperature above the temperature at which the said skin fuses to the said outer surface; and

(c) continuously removing the said assemblage lengthwise from the said embossing roll.

The said skin preferably is heat-adhered to the said outer surface of the said microporous polyurethane sheet prior to the said embossing step (b).

The process thus preferably includes the steps of providing a supply of a continuous supporting film, e.g. of polyethylene terephthalate, carrying the said skin, continuously drawing off the said skin-carrying film from the said supply onto the surface of a rotating roll having a hot surface in contact with the said supporting film at a temperature above the said skin-outer surface fusion temperature and maintaining the said outer surface of the said microporous polyurethane in contact with the said skin on the said film-contacted roll so as to adhere the said skin to the said outer microporous surface, and thereafter stripping the said film from the said assemblage prior to the said embossing step (b).

The face of the said skin which is in contact with the said embossing surface preferably carries a release agent.

In the said embossing step (b) the said assemblage passes through the nip between the said embossing roll and an elastomer surface roll biased toward the said embossing roll, and the conditions are preferably such that at the said nip the said microporous polyurethane is compressed and the said elastomer roll surface deformed, and the said microporous polyurethane then expands to substantially its original thickness on leaving the said nip and the said assemblage, with the said skin, then remains in contact with the said embossing roll for a period of at least about 1/2 second, the residence time in the said nip being less than about 0.1 second.

The weight ratio of fibrous material to elastomer in the said assemblage preferably is about 0.8:1 to 1.2:1 and the thickness of the said assemblage is about 20 to 80 mils.

The said skin may comprise a plurality of layers including a layer adjacent to the said film and carrying a release agent to reduce adhesion to the said embossing surface and another layer, further from the said film than the said first mentioned layer, of elastomeric polyurethane.

The invention also extend to a highly air-permeable grain-embossed artificial leather having a dull grained surface comprising a fibrous non-woven material and a microporous elastomeric layer laminated thereto by fused elastomeric material bonded by the process according to the invention to the said microporous layer in a discontinuous or open pattern and embedding adjacent surface portion of fibres of the said non-woven layer, the said microporous layer being produced by coagulation of a solution of elastomer followed by mechanical removal of coagulated surface material to expose the inner structure of the coagulated microporous material and thereby provide an open surface having exposed microscopic open cells, the said microporous material being embossed by contact with a hot grain-embossing surface at a temperature within 15°C of the melting-sticking temperature of the said microporous material, the said embossing being effected to an extent sufficient to impart a visible grain pattern but insufficient to close the said exposed open cells.

Such an artificial leather showing a depth of surface colour may comprise a base sheet having a coloured microporous surface zone heat-laminated to a preformed coloured transparent substantially continuous skin, the colour of the said microporous zone being visible through the said skin. The said microporous zone may be coloured brown or black, and the said skin may be less than 20 mils thick. The microporous zone may be of pigmented elastomeric polyurethane and the said skin may comprise a layer of pigmented elastomer fused to the said microporous zone. The polyurethane of the said microporous zone preferably is thermoplastic and has a fusing temperature above that of the polyurethane of the said skin.

The said skin may comprise at least two layers including an outer layer which is harder than the said elastomer layer.

The fibrous non-woven material may comprise a batt of non-woven fibrous material needle punched to a microporous elastomeric polyurethane sheet having a thickness of about 10 to 40 mils and a specific gravity of about 0.2 to 0.6 so that fibres of the said batt extend transversely from one face of the sheet into the said microporous sheet.

The said needle punched fibres may extend through the said microporous sheet onto the opposite face thereof, the amount of fibres being above about 2 ounces per square yard on the said one face and less than about 1 ounce per square yard on the said opposite face.

Various aspects of the system are described more fully in the following Examples and discussion and accompanying drawings, in which:—

Figures 1—3, 7—9, 12—16B, 18—23A, 33 and 34 are photomicrographs taken with a scanning electron microscope, and Figures 4, 16 and 25—32 are photomicrographs taken with a light microscope. The scale for each photomicrograph is given in the drawings.

Figures 1 and 2 shows the microporous material,

Figure 3 shows a cross-section of a portion of the laminate, illustrating the bonding between fibres and the microporous material,

Figure 4 shows a macro-apertured web used as a bonding material,

Figure 5 shows, schematically, a laminating apparatus,

Figure 6 shows, schematically, another laminating apparatus,

Figures 7 and 8 show a pattern of projections on the microporous material, Figure 7 being a cross-section.

Figure 9 is a cross-section showing the bond between fibers and the microporous material, formed in Example 2,

Figure 10 shows, schematically, an embossing arrangement,

Figures 11 and 11A show, schematically, a portion of the embossing apparatus and the path of the embossed material,

Figures 12 and 12A show the embossed material and Figures 13 and 13A show the material before embossing.

Figure 14 is a cross-section taken at and near the embossed top surface shown in Figures 12 and 12A,

Figures 15, 15A and 15B show the pattern of a first skin-forming coat on a carrier film,

Figures 16, 16A and 16B show material

having two skin-forming coats on a carrier film,

Figure 17 shows, schematically, apparatus for applying the skin to the laminate,

Figures 18, 18A and 18B are cross-sections of the product of Example 4,

Figures 19 and 19A are schematic views of machines for use in applying a film surface to the assemblage in the system described herein,

Figures 20 to 20C and 21 to 21C are cross-sections of products of Example 7 and Figures 22—23A are views of the top surfaces of those products,

Figure 24 is a schematic view of the embossing procedure,

Figures 25 and 25A are cross-sectional views of a needle-punched fibrous material,

Figures 26, 26A, 27 and 27A are cross-sectional views of a laminate made from these needle-punched materials while Figures 28 and 28A are specially prepared views of the same material illustrating the bonding,

Figures 29 to 32 relate to needle-punched microporous material (the darker portions shown in Figures 30 and 32 having been inked for contrast),

Figures 33 (a cross-section) and 34 (a top view of the embossed surface) illustrate less desirable embossed structures, and

Figure 35 is a schematic view of another laminating arrangement.

In the following Examples all proportions are by weight unless otherwise indicated.

The melting-sticking temperatures mentioned herein may be measured on a standard Fischer-Johns melting point block and indicate the temperatures at which the materials stick noticeably to the thin glass cover slip of the block. The measurements with microporous materials (particularly those which have a very open surface structure as shown in Figure 1 and thus have very little material directly in contact with the hot glass) are carried out under conditions providing (a) light pressure on the material, (b) insulation to reduce cooling of the subsurface portions owing to loss of heat by convection (or otherwise) through the microporous open-cell material and (c) sufficient time for subsurface portions to be affected by the temperature of the hot glass. For example the pressure may be provided by a one pound weight exerting its force (through the light insulating layers) on a round piece of the material (about 18 mm in diameter, so that the pressure is about 45 g/cm^2) resting on the hot glass. The insulation may be provided by placing several layers of the microporous sheet material above the sample (so that the total thickness of the layers of microporous material is about 0.1 inch) while underneath the one pound weight there is a thin layer of silicons rubber resting on a thin glass cover slip which in turn rests on the top of those layers of microporous material. In tests in which the assembly is kept for 5 minutes each at melting point block temperatures of 160, 165, 170 and 175°, it is found that slight sticking (requiring one to lightly peel off the material to separate it from the hot glass) occurs at about 160 to 170°C. and strong sticking occurs at about 170°C.

EXAMPLE 1

In this Example a fibrous backing is laminated to a microporous polyurethane sheet about 30 mils (3/4 mm) thick having a specific gravity of about 0.33 and having the microporous structure shown in Figs. 1 and 2. These SEM photomicrographs (taken at an edge of a cross-section cut with a razor) show the internal texture (cross section) of the microporous sheet and, at a long angle, the similar external texture of its top surface. The microporous sheet is made by mechanically slitting a thicker microporous polyurethane sheet made by coagulating, leaching and drying a cast layer containing dissolved polyurethane and dispersed salt particles (salt:polyurethane ratio about 3:1) as described for instance in British patent 1,122,804, and U.S. patents 3,860,680, 4,028,451 and patents referred to therein. The dissolved polyurethane used in that process also contains about 2 to 5% (based on the weight of polyurethane) of carbon black and the coagulated dried material therefore has a dull black or brownish-black appearance. The dried sheet, 1.6 mm thick, is slit mechanically to form two thinner sheets of about 3/4 mm thickness.

The fibrous backing is a 30 mil (about 0.7—0.8 mm) thick fibrous, fabric weighing about 7.6 ounces per square yard, made by needle punching polyester (polyethylene terephthalate) staple fibers through a woven scrim and then impregnating with a latex to add about 20% of butadiene-acrylonitrile copolymer rubber as a binder for the fibrous structure. The woven scrim is made of polyester yarns square woven to have about 20 ends per inch in both warp and weft in a very open weave (the spaces between adjacent yarns being about 5 times the yarn diameter) weighing about 1.6 oz/sq.yd. The fibrous sheet may be made by a needling method as described in U.S. patents 3,206,351, 3,090,100 or 3,090,099. The needled staple fibers constitute about 80% of the total fiber weight. The calculated specific gravity of the fibrous sheet is in the neighborhood of 0.25.

The structure of the resulting laminate, at the interface between fabric and microporous material, is as shown in Figure 3. The materials are bonded together by thermal fusion, under controlled conditions, of an intervening web of macroapertured elastomeric polyurethane whose structure is illustrated in Figure 4; it will be seen that it has a lace-like random-patterned fibrous appearance. It is produced by a process of melt-extruding, in tubular form, the polyurethane saturated with inert gas; the extruded material, containing spaced bubbles (formed by release of gas on extrusion), is then stretched to burst the bubbles and opposing walls of the tube are pressed together (while hot and self-adhesive) to form the tubular structure into a flat sheet. Similar materials produced in the same general way (but not having the same melting point and fiber spacing and thickness) are sold under the name "Sharnet", as heat-sealable adhesives for thermally bonding fibrous fabrics together. See U.S. 4062915.

The heat-lamination is effected with the apparatus illustrated in Figure 5, using an 8 1/2 inch diameter steel idler roll 11 internally heated with hot oil and a 10 inch diameter driven rubber backup roll 12 (whose rubber surface has a Shore A hardness of about 80). The hot roll 11 is mounted for free rotation on an adjustable support 13 which can be raised or lowered to open or close the nip between the hot roll 11 and the backup roll 12 to the desired degree.

The macro-apertured web W wound on a supply roll 14 is drawn off that roll and over an idler roll 16 and onto the microporous sheet M carried by a roll 17 while the microporous sheet M is drawn off from its supply roll 18, onto a five inch diameter slotted expander idler roll 19 (which functions to avoid creasing or wrinkling), then over an idler roll 21 and the 4 1/2 inch diameter idler roll 17 and then onto the fibrous fabric FF which is supported on the heated roll 11. At the same time the fibrous fabric is unwound from its supply roll 22, passed over idler roll 23 and onto the hot roll 11 which has a surface speed of about 2.3 feet per minute; it is in contact with the hot roll for about 1/2 turn of that roll to preheat the fabric, before it is contacted by web W and microporous material M. The resulting assembly of microporous material and fabric is thereafter on the hot roll for about 2/5 turn of that roll. It then travels over cooling rolls 24, 26 to a windup roll 27.

The hot roll has a surface temperature of 340—350°F (170—177°C). The pressure at the nip is of the order of about 30 to 40 pounds per lineal inch (about 5 to 7 kg/cm) and is such that the effective width of the nip (owing to yielding of the rubber of backup roll 12) is about 3/4 inch (about 2 cm). The tension (exerted by the pulling effect of the backup roll) is such that the macro-apertured web W stretches up to about 10% (measured by marking a fixed length of the supplies of web W and sheet M and then measuring the distances between these marks in the laminate).

The melting-sticking point of the macro-apertured web is less than the melting-sticking point of the microporous structure (e.g. ~120 vs. ~160°C. It is also well below the melting temperature of the polyester (polyethylene terephthalate) fibers of the fabric (>250 °C).

In the process the macro-apertured web W is heated, on hot roll 11 by heat transferred from and through the pre-heated fabric F, while the web W is held in place on the fabric and maintained in its substantially continuous lace-like configuration by the microporous sheet. If the web W (which, as previously noted is made by a stretching process) is laid onto the preheated fabric as described, while unrestrained by the microporous sheet and while under the tension resulting from the pulling of the structure by the action of the nip (and the frictional contact with the fabric F) its fibrous structure or network tends to break up into individual spaced lumps even when its temperature is still well below its melting temperature and well below the temperature at which it forms a substantial bond to the fabric. But when it is in contact with the microporous sheet at this stage, the network does not break up but instead adheres to, and forms a bond with, the microporous sheet. Then on further heating and passage through the nip between rolls 11 and 12 under high pressure the heat-tackified network material is deformed around fibers of the fabric (as can be seen in Figure 3: see also Figures 9 and 18B). The resulting hot laminate is cooled while avoiding small-radius changes in direction (which could exert delaminating forces before the bond between the fibers and the polymer has been set by cooling).

In this Example the web W comes into contact with the microporous material when the web temperature is still below the above-mentioned network-breakup temperature of the web. At some stage in the process the web temperature is sufficiently high to cause the polyurethane of the macro-apertured web to form a physico-chemical bond with the polyurethane of the microporous structure. Thus, at that stage the microporous sheet carries, in effect, integral projections of lower-melting polyurethane in a web, or network pattern on its surface. When the temperature is then raised above the melting point of this lower-melting polyurethane, the network does not break up into lumps but flows plastically to embed therein fibers of the fabric. The maximum temperature attained at the surface (of the microporous material) being laminated (which temperature may be measured by inserting a piece of temperature-indicating paper on said surface so that the paper is carried through the laminating process) is above the melting point of the polyurethane of the macro-apertured web but well below the melting point of the microporous polyurethane at said surface. It is also below the temperature at which the microporous structure collapses, even under the high pressure in the nip (i.e. below the "collapse temperature" measured at the nip pressure).

The macro-apertured web used in this Example has a thickness of over 3 mils (i.e., over about 0.08 mm) and less than 5 mils (about 0.13 mm), such as about 3.5—4 mils and has a unit weight of over 0.5 oz/yd^2 (17 g/m^2) and less than 0.8 oz/yd^2 (27 g/m^2) such as about 0.55 to 0.65 oz/yd^2 (about 18 to 22 g/m^2). This provides sufficient material, in sufficient local concentration, to effect strong embedment of the fibers. The web has substantially no apertures which are more than 10 mm across (preferably substantially none are above 7 mm across) in any direction. This helps to give a laminate that is not subject to local internal separation or gapping (between bond lines or zones). While there is noticeable anisotropy in the macro-apertured web (in which, it having been formed by stretching, most of the apertures are longer in the "machine" direction, lengthwise of the web, than in the cross direction, as can be seen in Figure 4), it is nevertheless found that the resulting bond has substantially equal strength in the machine direction and the cross direction. However, undue further stretching in the machine direction (e.g. by more than 10%) does cause some significant anisotropy, which is undesirable for many purposes. Tension control may be effected by various techniques as by control of let-off brakes acting on the supply roll for the web W.

EXAMPLE 2

In this Example the apparatus of Figure 6 is employed. The materials used are the same as in Example 1, except as noted. The fabric F passes from its supply roll around one or more idler rolls 31 and then around a series of pre-heating rolls 32 which are internally heated, with hot oil, at a temperature of 325°F; as will be seen from the drawing, they apply heat alternately to the two faces of the fabric. At the last hot roll 32A of this series the pre-heated fabric is brought into contact with an assembly of the macro-apertured web W and the micro-porous sheet M, then the three-layer assemblage passes around a roll 33 and then a heater roll 34 which contacts the fabric F of the assemblage and is at a temperature higher than that of the pre-heating rolls, and then over an idler roll and onto a final heating roll 36 internally heated with steam at a temperature of 350°F and then through the nip between that roll 36 and a rubber-covered back up roll 37 (the force at the nip being 60 pounds per lineal inch) then around cooling cans 38 and idler rolls 39 to a windup roll.

The webs W and M are passed from their respective supply rolls 41, 42 to an idler roll and then (if required by the available equipment) over other idler rolls 43, 44 to the pre-heating roll 32A.

In one run the temperature of heater roll 34 is about 360°F (182°C) and the speed is such that the time of contact with that roll is about 0.1 minute, the temperature of the heater roll 36 is about 325—350°F and the time of contact therewith is about 0.2 minute.

All the webs are pulled over the various rolls by the force exerted, at the nip, by the driven backup roll 37, which also causes the hot roll 36 to rotate. The rolls 32, 32A, 33, 34 may be independently driven at surface speeds slightly less (e.g. 1% less) than that of backup roll 37 to insure that the fabric F makes a tight wrap around those rolls thus facilitating heat transfer to the fabric. The tensions in the fabric F and webs W and M are controlled by appropriate adjustment of brakes on the supply rolls. The web W is under tension which tends to stretch it lengthwise and cause it to decrease in width; preferably this tension is so controlled (as by the braking) that the resulting lengthwise stretch is less than 10% and the consequent decrease in the width of web W is well below 15% (e.g. from a starting width of 44 inches, the web necks down to a width of no less than 39 or 40 inches). The microporous sheet M is also maintained under tension, preferably at a level such that it stretches less than 5% (e.g. 2 1/2—3%) in its passage to the nip.

The particular sheet of microporous material used in this Example 2 has small spaced projections on the face which comes into contact with the web W and fabric F. It is a 30 mil (3/4 mm) thick sheet made by mechanically splitting (in half) a 1.6 mm thick white-pigmented coagulated, leached and dried microporous polyurethane sheet made by a casting process (described in U.S. patent 3,860,686) in which such spaced projections are, incidentally, formed on the lower face of the sheet. (Figures 6 to 8 of U.S. patent 3,860,680 illustrate the pattern of projections formed on one type of casting belt.) Figures 7 and 8 of the present application show a pattern of projections which is essentially like that of the material used in this Example (those Figures 7 and 8 are actually views of another microporous layer which differs from the layer used in this Example, in density and melting point). In Figure 7 the spaces 51 are formed by the parallel warp wires of a square woven wire casting belt on which the product is formed, while the arc 52 is a depression formed by a weft wire, which runs transverse to the warp wires of the belt and is interlaced with these warp wires, in a plain ("one up and one down") weave. The diameters of the wires are about17 mils (warp), 8 mils weft and there are about 36 warp wires per inch and about 68 weft wires per inch). Thus, behind the plane of Figure 7 there is another arcuate depression (53 shown in Figure 8) of the same shape as the depression 52 but in staggered relation thereto.

Figure 9 indicates that the bond between the microporous material and the fibrous fabric is largely localized at the outer portions of the previously mentioned small spaced projections. Nevertheless it is a very strong bond.

EXAMPLE 3

The laminate of Example 2 is passed around an idler roll 54 (Figure 10) and then around a driven roll 56 and around a driven heating roll 57, then over a roll 58, to the nip between a heated embossing idler roll 59 and a rubber-surfaced backup roll 61 which is pressed against the embossing roll, and then, over cooling rolls 62 to a driven takeup roll 63. The surfaces of rolls 57 and 59 are at about the melting-sticking temperature (discussed below) of the microporous polyurethane. The exact temperatures of the roll surfaces are not known and the temperatures given here are rough approximations. Roll 57 is internally heated with oil (at about 350°F); roll 59 is internally heated with steam (at about 345°F). The backup roll 61 is driven at a surface speed about 1% higher than that of the rolls 56, 57 so that the material is pulled and therefore pressed closely to the surface of the latter rolls. On the heating roll 57 the residence time (of contact between the surface of the microporous polyurethane material of the laminate and the hot roll surface) is about 6 seconds; the laminate is under lengthwise tension but this does not cause significant thinning or compression (in thickness) of the microporous material. At the nip, the laminate is compressed considerably against the hot surface of the embossing roll which is also at a temperature close to the sticking temperature. This embossing roll has a pattern of surface ridges conforming to the surface grooves or veins in grain leather, and the localized pressure exerted on the microporous material by these ridges is sufficient at this temperature to cause the microporous material to tend to adhere to the surface of the embossing roll after it leaves the nip; thus when the speed of the takeup roll 63 is adjusted so that there is practically no tension on the laminate leaving the nip, the laminate (see also Figure 11) stays on the surface of the rotating embossing roll 59 for a short distance. The microporous surface becomes embossed, in that it has a distinct grain pattern of grooves or lines like that of grain leather but no continuous skin is formed on the microporous surface. In fact, even after the embossed material has been given a colour coating (i.e. two white pigmented coatings of elastomeric polyurethane each applied, by gravure printing from a gravure roll whose surface has conventional tiny coating-containing cups or hollows uniformly distributed thereover, the amount of each coating applied being 2.5 grams of polyurethane per square meter), the surface of the embossed material is still devoid of any continuous skin. See Figures 12 and 12A which are top views of the embossed and coated material and compare them with Figs. 13 and 13A which are similar views of the untreated surface. It will be noted in Fig. 12 that there are some areas in which localized compaction appears to have occurred to a larger degree but without significant destruction of the essential open pore structure.

During the treatment described in this Example the entire microporous layer is exposed to heat. At its outer surface the temperature is at about its melting-sticking temperature. At the fabric-bonded face the temperature is below the softening temperature of the lower-melting, polyurethane of the web W. After leaving the nip the microporous polyurethane is not subjected to any significant tension while hot, but is permitted to relax. It is believed that this effects an annealing of any stresses and strains such as those imposed by pulling of the material lengthwise during manufacture or processing (e.g. during the laminating step), and that such annealing helps to impart to the material a softer, leather-like hand, rather than a "plastic" feel. It is noted that at times the laminate will have a tendency to curl, with the microporous polyurethane being on the concave side (particularly when the microporous polyurethane web M has been pulled more than desired during the laminating step) and that such curl is significantly reduced or eliminated by the effects of the embossing.

The product of Example 3 has outstanding utility for uppers of sport shoes (such as tennis shoes) made by a process involving conventional injection molding of the sole of the shoe to the insole and the upper. In that process the sole is formed in a cavity whose upper wall includes the lower portions of the upper; the sole-forming material (which, in reaction injection molding, may be a reactive polyurethane) is injected into the cavity, displacing the air in the cavity. To expedite the process the upper material must be highly permeable to the displaced air, especially when low injection pressures are employed. The highly open surface shown in Figures 12, 12A and 14 permits rapid air transmission at a pressure difference of say 1000 mm of water (such as a permeability of 50,000 liters of air per square meter per hour at 20°C); in contrast, the same material subjected to more drastic embossing (Figures 30 and 31) has much lower air permeability.

Typical products of Example 3 (having a unit weight of 14.7 oz/sq yd, thickness of 0.062 inch, specific gravity 0.32, ultimate elongation of over 100% in all directions) have high tear strength, high water vapor permeability, outstanding abrasion resistance and resistance to flexing and excllent washability.

As mentioned above, the material may be color coated, as by gravure printing, after embossing. One such coating is an off-white (or grey) made up of 215 parts of Verona Impranil D392 (described below), 480 parts of Permuthane U—23—336 (also described below) 61 parts of a white color concentrate (Verona White PP901) and very small amounts of red, black and blue color concentrates, plus 223 parts of a 1/1 toluene/isopropanol blend.

EXAMPLE 4

A sheet of Mylar (Registered Trade Mark) (polyethylene terephthalate) film about 1 mil (25 microns) in thickness and having a shiny surface is drawn off from a roll thereof and printed, by direct gravure printing in a "spray" ground pattern, with a black-pigmented solution of thermoplastic elastomeric polyurethane of relatively high modulus in a volatile solvent. The printed sheet is heated to remove the solvent, leaving a dry non-tacky mottled gray deposit having a thickness of less than 0.2 mil (less than 5 microns). This deposit is transparent; thus when the coated sheet is laid onto a newspaper it is easy to read the printed words of the newspaper through the printed sheet, as illustrated in the enlarged photograph Figure 15. Figure 15 also shows the "spray" pattern which gives the same overall mottled effect as a light non-uniform spray. Figures 15A and 15B are views of this first coating at different, much higher, magnifications.

The sheet is then given a second gravure coating on top of the first one, this time with a burgundy pigmented solution of thermoplastic elastomeric polyurethane which is softer (of lower modulus) and has a lower melting point than the previously applied polyurethane; the coated sheet is then heated to remove the solvent. The amount of this second coat is such that the total coating thickness (both coats) is less than 0.3 mil (less than 8 microns). The twice-coated sheet is still transparent and non-uniform by transmitted light (see Figure 16), but less so than the once-coated sheet. (The dot patterns seen in Figures 15 and 16 correspond to the pattern of the tiny coating-carrying "cells" of the gravure roll.) When viewed against a white background it appears pink with darker pink mottling. Figures 16A and 16B are views of the resulting coating at different, much higher, magnifications. The coated sheet is rolled up for storage.

Both coatings are found to be tightly bonded to the Mylar film; they are not visibly affected by scraping with one's finger nail.

The coated sheet is then used for applying a thin skin to the top (microporous) surface of the laminate of Example 1.

In the skin-applying step the apparatus shown in Figure 17 is employed. In this apparatus the coated side of the Mylar film is brought into contact with the surface of the microporous layer and heat is transferred through the film to the coating and microporous surface while pressure is exerted on the assemblage. The lower-melting second coating fuses sufficiently to bond the coatings to the microporous surface. More particularly the apparatus includes an 8 1/2 inch diameter steel idler roll 11, internally heated with hot oil, and the coated film S and microporous-surfaced fibrous laminate L are pulled onto this hot roll by the force exerted (on the assemblage of S and L by a 10 inch diameter driven rubber backup roll 12 (whose rubber surface has a Shore A hardness of about 80) which is in contact with the fibrous bottom surface of L. The hot roll 11 is mounted for free rotation on a conventional adjustable support 13 (which can be raised or lowered to open or close the nip between hot roll 11 and backup roll 12 to the desired degree) the support 13 being adjustably forced under pressure in a direction to urge the hot roll 11 against the backup roll. More particularly, the coated film (wound on roll 71) is drawn off over idler rolls 72, 73, then over a five inch diameter slotted expander idler roll 74 (which functions to avoid creasing or wrinkling), and then onto laminate L which is supported on the backup roll 12. At the same time the laminate L is unwound from its supply roll 76, passed over idler roll 77 and onto the backup roll 12. The resulting assembly of S and L is on the hot roll for about 3 to 5 seconds. It then travels over idler (cooling) rolls 78, 79 to a windup roll 81.

Roll 11 has a surface temperature which is believed to be of the order of about 345°F. The pressure at the nip is on the order of about 10 pounds per lineal inch and is such that the effective width of the nip (owing to yielding of the rubber of backup roll 12) is about 1/2 inch. Thereafter the Mylar film is stripped off (this requires substantially no force). Even though the hot roll 11 is an embossing roll, having a leather-grained dull outer surface, the product has a shiny surface (with a very light grain embossed therein) and the Mylar film still is very smooth to the touch and has a clear appearance (although it shows a faint grain pattern of fine creases). The material is given a marked leather grain appearance and feel by passing it through the nip between the rolls 11 and 12 and then over roll 11 in the manner shown in Figure 17 while the hot embossing roll 11 is maintained at a surface temperature believed to be on the order of about 345—360°C.

The product has a relatively dull, or "flat", leather-grained surface with a subdued aniline appearance. Its color is rich reddish brown and is much deeper and darker than that of the skin, because, it is believed, the dark surface of the original microporous surface shows through the skin, changing the pink color of the skin to a deep reddish brown color.

The structure of the skin and underlying microporous material is shown in Figures 18 and 18A.

The first coating on the Mylar sheet has the following composition:

"Impranil D 392" 277.3 parts; "Permuthane U—23—336" 641 parts, "Impranil PP—922 Jet Black" 81.7 parts. The Impranil D 392 is a solution of a light-stable elastomeric polyurethane sold by Verona Dyestuff Division of Mobay Chemical Corp.; it contains 30% polymer and 70% solvent (dimethylformamide/toluene/isopropyl alcohol 1/2/1.5 ratio); this solution is then diluted with a sufficient amount of a 1/1 toluene/isopropanol blend to reduce its viscosity to a suitable level (e.g. to a viscosity of 15 poise) for gravure printing. The Permuthane U—23—336 is a 14% solution of an aliphatic elastomeric polyurethane in a mixture of methyl cellosolve, toluene and isopropyl alcohol. The Impranil PP—922 Jet Black (also sold by Verona) is a pigment concentrate containing 7% pigment and 22.0% total solids, the 14% difference being dissolved cellulose acetate butyrate ("C.A.B."). The Impranil D392 comprises a very hard clear polyurethane and, if used alone, gives a very glossy coating, while the Permuthane U—23—336 contains a conventional flatting or dulling agent and also has a lower viscosity. By using a mixture of these, as described, the final product has a medium gloss, good face-to-face slip, good hand and good flexing, good blocking resistance and good release from the hot embossing roll. As can be seen from Figure 15 the deposit of the first coating is not uniform; the average amount of solids deposited is in the range of about 2 to 3 (e.g. 2.5) g/m². The solvent removal after printing is effected in an oven at about 70°C for 2 minutes.

The second coating on the Mylar sheet has the following composition: "Witco Y 343" 504.3 parts, red-blue pigment concentrate 214.3 parts, 1/1 toluene/isopropanol mixture 281.4 parts. The Witco Y 343 is a 35% solution of a non-discoloring thermoplastic elastomeric polyester polyurethane in a 15/35/25/25 blend of toluene/isopropanol/DMF/methyl cellosolve. The pigment concentrate contains 9.3% pigment and 10.86% of a mixture of C.A.B. and the elastomer of Witco Y343; The average amount of solids deposited in the second coating is in the range of about 2 to 3 (e.g. 2.5) g/m². The solvent removal after printing is effected in an oven at about 70°C for about 2 minutes.

In the coatings the polymers are most preferably of the well known nondiscoloring type, resistent to discoloration by ultraviolet light. Such materials are well known in the art and are commercially available.

EXAMPLE 5

Example 4 is repeated except that the Mylar film has a thickness of about 0.4 mil (about 10 microns) and the skin applying and final embossing are effected in a single step, using the same dull grained surface embossing roll as described in Example 4 operating under similar embossing conditions but with the embossing roll in contact with the Mylar film. The product is similar to that of Example 1 but has a much more lustrous surface and a shallower grain.

EXAMPLE 6

Example 5 is repeated, except that the Mylar film is a commercial film having a dull surface to produce a grained-surface product having a subdued luster.

EXAMPLE 7

In this Example a film of Mylar about 0.5 mil thick is coated with two thin polymeric layers: (a) the layer first deposited on the Mylar film (which is to form the outer skin surface of the artificial leather) is of a hard relatively inflexible polymer, such as polymeric methyl methacrylate, (b) the second layer (which is to serve as the thermoplastic adhesive which bonds the first layer to the microporous surface), is of a flexible polymer, preferably an elastomeric polyurethane such as a polyester polyurethane made from ethylene glycol (or other glycol), adipate polyester and hexamethylenediisocyanate. To promote release of the Mylar on heating the Mylar may first be coated with a very thin layer of a release agent such as a hydrocarbon wax (e.g. a paraffin wax or microcrystalline wax). The two skin-forming layers may each be applied to the Mylar film as solutions in solvents, which are then evaporated off as in Example 4. The total thickness of the two layers is about 3 1/2 mil or about 13 microns as will be seen in Figures 20A and 21A, while the thickness of the harder layer (*a*, above) is less than 5 microns such as about 1 to 2 microns.

The coatings on the Mylar film are transferred to the microporous surface of a laminate like that described in Example 2 in a manner such as that described in Example 4; in this case the nip pressure is very low so as to avoid permanent compaction of the microporous layer while the roll temperatures and roll contact time, are sufficiently high to effectively activate the adhesive qualities of the skin and thus bond the skin to the microporous layer. The Mylar film can be stripped off while the material is still hot, or stripped off later. Preferably it is stripped off hot, as shown in Figure 19; the still-hot skin and upper zone of the microporous layer may then be embossed with a minimum of reheating.

In the embossing step employed in this particular Example the laminate carrying the skin is passed into the nip between the previously described hot grain-surface embossing roll 11 and backup roll 12 (with its skin in contact with the hot roll 11) and remains stuck to roll 11 (whose surface temperature is probably in the neighborhood of 360°F for a period of some 5 seconds before it is drawn off. Two different draw-off systems are employed:

(A) In one, as shown schematically in Figure 11 the material being drawn off forms a loop with the hot microporous layer on the convex side, and the material is drawn off from that loop at a rate carefully controlled to maintain the running material in that loop form (just as it leaves the hot roll) under substantially no tension.

(B) In the second system, shown schematically in Figure 11A the material is drawn off under tension and the loop is maintained by the presence of a guide bar 91.

In both cases the resulting material had a well-formed leather grain appearance. Figure 22 is view taken at 45° of the material made by process A. Figures 23 and 23A (at a higher magnification) are similar views of the material made by process B.

In both cases there is substantially no compaction of the microporous layer. The thickness of the product in each case is about 62 mils before embossing and about 62 mils after embossing and cooling. The structure of the materials made by processes A and B are shown in the cross-sectional views in Figures 20 to 20C, (for A) and 21 to 21C (for B).

In both cases it will be seen that the harder outer layer of the skin tends to break into plates, especially on flexing in use, (see Figure 20B and 21A for instance); these are held firmly by the elastomeric lower layer.

The material made by process A has a much more pleasant, softer leatherlike hand. Its fibrous layer is not taut but so free of tension that it shows (in this case) slight puckering.

A sample of the material made by process B is retained in curved configuration (in the machine direction as in the loops in Figs. 11 and 11A) without tension in an oven at 150 °C for 10 min. then taken out hot and allowed to cool under a weight which keeps it flat. The material is found to have a feel and appearance like that of the material made by process A.

It is believed that the embossing effects shown in Figures 20 to 20C and 21 to 21C can be explained as follows: The microporous layer has a large void volume, well over 50% (e.g. about 70—75% for a layer having a specific gravity about 0.3), and is composed of thin walls of elastomeric material around its cells or voids (see Figure 1). It is thus relatively easily compressible; its cellular structure collapses, at least partially, resiliently under pressure. When (as shown schematically in Figure 24) the laminate having the skin thereon is brought into the nip between the metallic embossing roll 11 (which has embossing ridges 101) and the rubber-surface backup drive roll 12, the microporous layer 102 is squeezed at the nip and the rubber surface 103 of the backup roll is deformed. The pressure at the nip is sufficient under these conditions to force the embossing ridges 101 into the material and to cause the skin to conform closely to the very hot surface of the embossing roll. The temperature of that surface is such that if the material remained compressed in the nip for some time the microporous layer would become permanently compacted. However the rate of travel of the material, and its effective path length in the nip, are such that the time in the nip is very short (e.g. less than 0.1 second, such as 0.03 second) and, despite the fact that the solid skin provides relatively fast heat transfer (as compared to heat transfer at a wholly porous surface), it is found that such permanent compaction can be substantially avoided.

After the material leaves the nip its microporous layer expands to substantially its original thickness; the skin surface remains on the hot surface of the embossing roll for a period of time such that the skin and the immediately underlying portion of the expanded microporous material are molded to the configuration of the very hot surface of the embossing roll. See for instance Figures 20—20C. The hot embossing surface may be at a temperature well above the fusion temperature of the skin, and the contact between the hot embossing surface and the skin may be such that the laminate adheres to the embossing surface against the force of gravity as shown in Figure 29. (The penetration of the hot embossing ridges into the microporous layer and the resulting local plastic deformation of the latter may aid in supporting the laminate on the roll at this stage). For instance, the material may remain in contact with the surface of the hot embossing roll for about 1/3 or 1/2 of a revolution (120 or 180°) of that roll, for a period of time well over 1/2 second (e.g. about 1 or 2 to 6 or 10 seconds).

The temperature of the embossing surface is generally within about 15°C (more preferably within about 10° or 5°) of the melting-sticking temperature of the microporous material. In one embodiment, the temperature of the embossing surface is at or above the melting temperature of the material of the skin (especially the material at the underside of the skin which is in contact with the microporous surface); it is best to have a release agent (such as the hydrocarbon mentioned earlier) at the outer surface of the skin to prevent undue sticking to the embossing surface. When such undue sticking occurs, all or part of the skin may remain on the embossing surface when the laminate is removed therefrom.

In one typical run the surface temperature of the steel embossing roll is about 165°C, the melting-sticking point of the microporous material is about 160—165°C, the melting-sticking point of the skin material adjacent to the microporous layer is about 160—170°C and the melting temperature of the macro-apertured material is about 120°C. With a steel embossing roll having embossing ridges which project out about 10 mils from the base level of the roll surface, a backup roll whose rubber surface layer is about 3/4 inch thick and has a hardness of 62 (Shore A durometer), and a laminate which is about 60 mils thick and is compressible to a thickness of about 20 mils, the rolls are adjusted so that the rubber surface of the backup roll is just in contact with the outer edges of the embossing ridges and a stop is positioned to prevent the rolls from approaching any closer than that during operation (and, during operation, a force of about 7 lbs. per lineal inch of nip is applied across the axes of the rolls to bias them toward each other); the use of the stop in this manner effectively avoids undue local rises in pressure.

The conditions of embossing are such that there is a sharp temperature gradient between the embossing surface and the interface between the microporous layer and the fibrous layer, so that the lower-melting material derived from the macroapertured web is kept at a temperature below that at which it becomes mobile; the bond, at that interface, between the fibrous and microporous layers is substantially undisturbed. The use of relatively low pressures at the nip helps to preserve this thermal gradient; at high pressures (with consequent higher compression of the microporous layer), the transfer of heat to that interface is much more rapid.

For any particular set of matrials and any particular piece of equipment the temperature, pressures and times will need to be adjusted, by trial-and-error, to arrive at the optimum operating conditions within the guidelines set forth herein. For instance, the thermal responses of different batches of similar polyurethanes may differ and the temperature level needed for sharp embossing may be some 5° or 10°C higher for one batch than for another even though they have similar melting-sticking temperatures. Even with the same batch, one may vary the embossing conditions. Thus for a material which embosses best at one temperature level one may, less desirably, use a lower embossing temperature (some 10 or 15°C lower) with a somewhat higher nip pressure, and consequent greater deformation of the rubber roll at the nip; such use of lower temperature and higher pressure usually gives a product whose grain pattern is not as sharp, and whose "break", hand, and moisture vapor transmission are not as good.

In Examples 4—7 above, the thin elastomeric skin is deposited onto a smooth strong plastic (Mylar) film of high dimensional stability and modulus and high softening temperature. The skin is applied to the microporous layer and the stable plastic film is stripped off. The step of applying the skin to the microporous layer may be effected under the very same conditions (e.g. pressure, temperature and time) as the subsequent embossing step, previously discussed. The hot roll may have the very same embossing surface, but (owing to the presence of the stable plastic carrier film) even then very little embossing of the material occurs at this stage (and the stripped polyethylene terephthalate carrier film remains shiny, flat and smooth to the touch, but may have a faintly visible embossed pattern of fine shallow creases). The support may also be a relatively weak, stretchy film of low softening temperature such as low density polyethylene film, especially if the skin-film compositie is handled carefully (as under controlled relatively low feeding tensions to avoid undue stretching) and the hot roll in contact with such film 30 has a non-adherent (e.g. Teflon) surface. Another suitable support is a film of stereoregular polyolefin such as polypropylene, e.g. biaxially stretched or extruded (cast) polypropylene film.

The skin in Examples 4—7, above, is quite thin (well below 20 microns) being below 15 microns in Example 7 and below 10 microns in Example 4.

The skin may also be stripped from its carrier film (or other carrier structure, e.g. paper) before the skin is applied to the surface of the microporous material and the desired steps of applying the skin and embossing may then be combined, using a single pass around the hot roll under the same conditions as described above. Since the unsupported skin is elastomeric, tender and stretchy, greater care is required for such an operation, such as finer control of feeding tensions. In such embodiments the carrier film may be stripped away and the unsupported skin may be rolled up for storage and then unrolled when it is to be applied; alternatively the apparatus may have provision for stripping off the carrier film during the travel of the carrier skin composite from a supply roll to the hot embossing roll, e.g. the carrier film may be stripped off just before the skin comes into contact with that hot roll.

The same kind of process may occur in the absence of a skin, as in the process of Example 3. Comparison of Figures 1, 2, 13 and 13A with Figures 12, 12A and 14 indicates that fusion and spreading of the individual outer edges of thin polyurethane walls of the cellular structure occurs on contact with the hot embossing surface. Less desirably, substantially complete fusion of the outer surface may occur (as shown in Figures 33 and 34) when the contact time in the nip is unduly prolonged at a given temperature.

A typical leather grain pattern has relatively deep, broad and widely spaced intersecting "veins" whose depth is on the order of about 5 to 10 or 15 mils, and shallower "hair cells" which are small depressions having a depth on the order of about 1/2 to 1 mil, or more. The embossing roll has a corresponding pattern of vein-forming ridges and their cell-forming knobs of corresponding heights. In Figure 22 reference numeral 91 indicates a vein and numeral 92 indicates hair cells.

In the foregoing Example 7 the microporous material is dull black and the skin is pigmented a deep opaque black. It will be understood that other colour combinations may be used (e.g. a white skin on a white microporous layer). Also either or both layers of the skin may be transparent; they may be either clear or transparently or translucently pigmented (or dyed) in a colour, or colors, selected to augment or modify the colour of the microporous surface as in Example 4.

The surface of the microporous layer may be preheated, before it passes through the nip; e.g. that surface may be preheated to substantially its melting-sticking temperature and then passed through the nip between the embossing roll and the backup roll and then travel along the hot embossing roll. With such a procedure embossing may be effected at quite a rapid rate. A procedure of this type is described in Example 3 (and Figure 10) wherein a preheat roll 57 is employed. It has also been found that the carrier web (e.g. the Mylar film employed in Examples 4 to 7 may be stripped off just after the material leaves the hot skin-applying roll, while the material is still hot; the thus preheated skin-carrying laminate may be fed directly to the nip of the embossing roll, as illustrated schematcally in Figure 19.

In Figure 19, a supply of a laminate (of microporous layer and fibrous layer) is let off from a braked roll 105, passes over tensioning rolls 106 and an adjustable idler roll 107 while a supply of plastic film (e.g. Mylar) carrying the skin is let off from a braked roll 108 and fed to the hot surface of an oil-heated Teflon-coated roll 109. The laminate passes onto the skin on the hot roll 109, the assemblage passes through the nip between the backup roll 111 and the hot roll 109, then between idler rolls 112, 113 at which point the film is stripped off and wound up (on the roll 114) for re-use while the hot skin-carrying laminate passes on to the surface of the hot embossing roll 116, then through the nip between that roll 118 and a backup roll 117, then over adjustably located idler roll 118, idler roll 119 and roll 121 to the windup roll 122 which is driven by the roll 123. The arrangement of the rolls 121 and 124 serves to isolate the winding tension from the material passing over the roll 121.

The same apparatus may be used, with modifications, for the laminating, as illustrated schematically in Figure 19A, in which the rolled up supply of macro-apertured web is mounted on a roll 131 having a ball-bearing shaft and is fed over a short path (with substantially no tension) directly into contact at the idler rolls 132, 133 with the microporous sheet M which is being pulled, under tension from its supply (not shown) over tension rollers 106 and the idler roll 107 and the macroapertured web (carried by the microporous material) passes into contact with the heated surface of the fibrous web F which has been drawn under tension over tension rolls (not shown) and idler rolls (not shown) around a hot roll 116 and onto the surface of hot roll 102. The whole assemblage, with the fibrous layer in contact with the hot roll 109 passes around that hot roll and through the nip between the backup roll 111 and that roll 109.

EXAMPLE 8

This Example illustrates that hot-laminating and transfer of a skin to the microporous surface may be effected in a single pass over a hot roll and that the heat for the lamination may be transferred through the microporous layer to the fusible adhesive without collapse of the microporous material by suitable control. Referring to Figure 35 a film of Mylar, carrying skin-forming layers (as described in Example 7 above), is fed from its supply roll 141 over guide rolls 142, 143 to the hot surface of the 8 1/2 inch diameter steel idler embossing roll 11 internally heated with hot oil (e.g. at a temperature in the neighborhood of 345°F). At the same time the microporous sheet material M (wound on the supply roll 144 and fed around the idler guide roll 146), the macro-apertured web W (wound on the supply roll 147) and the fibrous backing F (wound on the supply roll 148 and fed around the idler guide roll 149) are all drawn off their supply rolls to an idler guide roll 151 at whose surface they are assembled together. (The supply roll for the macro-apertured web is placed as close as possible to the assembly point to reduce necking down of that web as it passes from the roll 147 to the roll 151). The assemblage is fed onto the heated skin on the embossing roll so that the microporous surface adheres to the skin as the whole assemblage passes around the embossing roll and through the nip between that roll and the 10 inch diameter driven rubber-surfaced backup roll 12, after which the material is drawn off as in Example 1. At a driven roll speed of about 3 feet per minute there is a good grain pattern but the microporous structure is drastically collapsed; when the roll speed is increased to about 5 fpm the microporous layer of the resulting product is not as collapsed but shows little, if any, leatherlike "break". But when the roll speed is increased to about 9 fpm a good leatherlike "break" is obtained (with little grain embossing) while retaining good adhesion between the fibrous and microporous layers. The surface is then embossed (e.g. in the manner described in Example 7) to provide the grain pattern.

While the illustrations show the backup roll below the embossing roll, it will be understood that these rolls may be side-to-side or the backup roll may be above the embossing roll.

For best results the surface temperature of the hot rolls (particularly the embossing roll) should be carefully controlled. To this end, the internally heated roll should have a relatively thin outer wall (e.g. 3/4 inch thick steel) and the heating fluid, such as oil, should be circulated at a relatively rapid rate to maintain a relatively uniform temperature over the entire roll surface; typically the fluid circulates through a cylindrical annular space whose outer boundary is the annular cylindrical outer wall of the roll, and there is a vane (or vanes) to cause the fluid to flow in a spiral path along that wall. The equipment also preferably has suitable devices for maintaining the webs or sheet materials in alignment as they are fed to the zone where they are brought into contact with each other, and devices for trimming off edges (where owing to misalignment, the desired lamination or bonding has not occurred). The hot roll used for laminating may have a non-stick surface (e.g. a surface coated with polytetrafluoroethylene) so that it will not be marred by contact with mis-aligned macro-apertured adhesive web material.

As previously mentioned, the embossed material is preferably taken off the embossing roll in a reversely curved path to effect the relaxation previously described. Apparently the contact with the hot roll causes sufficient transfer of heat into the main body of the microporous layer so that its temperature while in the zone Z (Figure 24) is sufficiently high to effect that relaxation under the circumstances. Very good results have been obtained when the arc formed in zone Z has a relatively small radius (e.g. well below 2 inches such as about 1/4 inch or 1/2 inch) and the time of travel around that arc is relatively short (e.g. as low as 0.3 seconds or less, although of course longer times may be used). The position of the arc may be pre-set, as by positioning a guide bar (e.g. a 1/2 inch diameter rod) as shown in dotted lines in Figure 11. The guide bar may be freely rotatable to make sure that the material is not drawn around it under a significant tension.

The preferred microporous materials are produced by coagulating at least one layer of a solution of elastomeric polyurethane in a liquid solvent (e.g. by contacting the layer of solution with a non-solvent or coagulant which is miscible with said solvent); methods of this type are well known in the art. As indicated in Example 2, a temporary support used in this process may have a surface so patterned as to form the projections during this process. The temporary support need not be a fabric; it may, for instance, be a coagulant-permeable plastic having apertures, or valleys, for forming the projections. The microporous structure generally has a specific gravity in the range of about 0.3 to 0.5; preferably at its upper portion (to which the skin is to be adhered) its specific gravity is in the range of about 0.3 to 0.4. As indicated previously, the microporous layer, whose thickness is preferably within the range of about 10 to 50 mils, such as about 20, 30 or 40 mils, (about 0.5 to 0.1 mm) may be made by slitting a thicker coagulated sheet (which may, for instance, be 1, 2 or 3 mm thick), thereby exposing, at the slit surfaces, the interior structure of the coagulated material. That interior structure is often more open and more uniform than the structure at the original outer surfaces of the thicker coagulated sheet. It is preferred to arrange the microporous layer in the laminate so that a slit microporous surface is at the outside (to receive the skin and/or embossing) and the original surface (if any) of the sheet is at the inside, adhered to the fibrous layer. One may also use a sheet made by coagulation of a layer (of polyurethane solution) which is sufficiently thin to provide the desired 10 to 50 mil sheet thickness directly, without slitting; in that case the outside surface of the microporous layer of the laminate may have, of course, a coagulated surface structure. The structure of a surface of that type is seen in Figures 3 and 4 of Civardi et al U.S. patent 3,764,363, which are plan views of the surface and in Figure 2 of that patent, where the cross-section at the surface is shown. Comparison of those views with Figures 1 and 2 of this application shows that the coagulated surface structure is less open and the cavities just below the surface are partially covered by a micro-apertured skin. Experiments thus far indicte that in the embossing of a laminate having a microporous layer whose outside surface has the less open coagulated structure it is preferable to maintain the embossing roll at a lower temperature (e.g. at about 155—160°C) and the pressure at the nip at a higher value (e.g. some 100—200% higher such as at about 15 pounds per lineal inch) than is the case for the slit-surfaced material; in one run the post-nip residence time on the hot roll is about 10 seconds.

The preferred polyurethanes for the microporous material are those described in U.S. patent 3,709,864, particularly those having nitrogen contents above about 4%, more preferably containing about 4 1/2% N. Usually the melting-sticking temperature of the microporous polyurethane is well above 120° or 130°C and below 200°C such as about 155 to 175°C.

In the foregoing Examples the fibrous sheet is a needle-punched non-woven fabric containing a binder. The binder (e.g. in amount of 2 to 40%) aids in bonding the fibers of the fabric together (e.g. one may use a non-woven fabric whose fibers have been treated with a latex of an elastomer, such as butadiene-acrylonitrile copolymer, as is well known in the art). The fibers of the non-woven fabric may be interlaced in other ways, e.g. by entangling fibers with water jets, the fabric being held together solely by the fiber to fiber friction; also the fibers may be interlaced into a woven or knitted fabric (e.g. two layers of a nonwoven fibrous structure may be needle punched through a central reinforcing open weave, scrim, fabric). The fibrous fabric may be woven or knitted (e.g. of multifiber yarns) and in that case it is desirable that the fabric face being laminated have exposed individual fibers or small groups of fibers which can become embedded in the fused projections of the microporous material; thus a surface of a woven fabric may be sanded, or otherwise treated, to raise a light nap of spaced individual fibers thereon. A fabric of the type described in U.S. 3,988,488 having a bonded nap (on the side opposite that facing the microporous layer) may be employed; here again it may be desirable to nap, at least lightly, the un-napped face (Figure 5 of 3,988,488) before laminating, so as to facilitate embedment of fibers into the fused projections. The fabric is preferably such as to impart additional strength to the microporous material, or in some cases to provide the principal tensile strength of the laminate. Preferably also its presence imparts to the laminate a higher tangent modulus at 15 or 20% elongation, a property which appears to be significant in the consistent lasting of shoe uppers.

One type of preferred fabric is a nonwoven structure of entangled or ligated individual fibers (e.g. of about 1 to 5 denier) having a high degree of "vertical" entanglement and interlocking (which is produced by needling a batt of staple fibers, either by the use of solid needles, usually having fiber-moving barbs, as in U.S. patents 3,090,099, 3,090,100 and 3,206,351, or by the use of fluid needling jets as in U.S. patents 3,214,819; 3,485,706, 3,508,308 and 3,620,903); preferably the fabric has little or no binder which would tend to stiffen the fabric and make it less pliable (less than 30% binder and more preferably below 20%, e.g. 0, 5 or 10% elastomeric binder). Certain fabrics of this type, such as those sold under the names Nexus and Sontara, usually are anisotropic, having considerably higher strengths and moduli in the "machine direction" than in the cross direction; these may be reshaped to make them more isotropic in use or they may be used without reshaping. In the latter case the laminated product will be cut anisotropically (as is done with the leather customarily used for shoe uppers), by the shoe manufacturer, into shoe upper blanks in which the lasting-pulling direction corresponds to the machine direction of the fabric. In either case, the laminate will have a tangent modulus at 15 or 20% elongation in the lasting-pulling direction which is significantly higher (e.g. 50% or 100% higher) than that of the microporous layer alone, whether measured at room temperature (e.g. 23°C) or at elevated temperature (e.g. dry at 80°C or in steam at 100°C). The fibers are generally close together; thus as can be seen in Figure 3 a plurality of individual fibers may become embedded within a small portion of fused material, on laminating. The Nexus and Sontara fabrics usually have high elongations at break (e.g. about 50% or more even in the machine directions).

Another fibrous fabric which may be employed is the material described as a "melded fabric" in the article on "Cambrelle Melded Fabrics" by Sudnik which appears at pages 34—39 of Textiles (pub. by Shirley Institute) June 1976 or described in British patent 1,245,088.

The fibrous web employed in Examples 1 and 2 has a high degree of fiber entanglement resulting, in part, from the use of a high density of needle punches, and also has a substantial degree of fiber bonding, due to the presence of the binder; its woven scrim is situated between two layers of fibers. It has been found, surprisingly, that one may obtain very good results by the use of a fibrous web in which the degree of fiber entanglement is very appreciably lower, in which there is substantially no binder and in which the scrim may be omitted, or situated as before, or situated at or just below the surface of the web. As shown in Example 9 below, the fibrous web may have a very low specific gravity prior to laminating, and the heat and pressure of the laminating process may itself be employed to densify the fibrous layer. This makes it possible to employ very economically produced loose fibrous webs (such as needle-punched webs having specific gravities well below 0.2, (e.g. below 0.15 or even below about 0.1) with attendant significant cost savings.

EXAMPLES 9A to 9D

Example 9A

A loose fluffy staple fiber batt weighing about 4 ounces per square yard (about 100 g/m²) and having a thickness of (very roughly) about 2 to 3 mm, as viewed from a cut edge thereof, is needle punched to a square-woven open scrim of yarns (woven about 8 ends per cm in each direction) weighing about 1.7 ounces per square yard (about 40g per square meter). The needle punching is effected by means of the usual barbed reciprocating needles. Each needle is pushed into the batt (from its face which is not in contact with the scrim) in one direction (say "upward"); its barbs engage one or more of the fibers and it thus forces those fibers through the batt and through the openings in the scrim. Then the needle is moved in the opposite direction (say "downward") and thus withdrawn back through the scrim and fiber batt, leaving fiber loops extending through the scrim and forming a sort of nap (principally of loops) on the free face of the scrim. The barbs are small pointed or flared extensions or projections of the needle; they are open "upward" to catch fibers on the "upward" stroke and leave them in place on the "downward" stroke. There are about 300 to 350 more or less randomly located needle punches per square inch of the batt surface. The needle punching causes about $\frac{1}{2}$ oz/yd² of staple fiber to project from, or lie on, the free face of the scrim.

The staple fiber batt is made of conventional polyester (polyethylene terephthalate) staple fibers of about 2 denier per filament about 1 1/2 to 3 inches long; the fibers are crimped, as is conventional, as seen in Fig. 25, having about 12 crimps per inch. The scrim is woven of yarns made of polyester staple fibers.

The scrim face of the needle-punched material is laminated to a web of microporous polyurethane about 20 mils thick having a specific gravity of about 0.33 and having the microporous structure shown in Figures 1 and 2, made by mechanically slitting a thicker sheet as described in Example 1. The laminating is effected as in Example 1 or 2, using the macro-apertured web of elastomeric polyurethane. The resulting laminate has excellent strength, softness and tear resistance, despite the relatively small extent of fiber entanglement (the density of needle punches, about 300—350 per square inch, is much less than that employed in the making of the needle-punched material used in Examples 1 and 2). This indicates that the bonding at one face, but the lamination, greatly improves the coherency and strength of the relatively loose needle punched material. The fibrous material is compacted considerably; the thickness of the laminate is about 48 mils while the thickness of the original needle-punched fibrous structure is about 86 mils (as measured with an Ames 560 series thickness gauge according to ASTM D1814—70).

Figures 25 to 26A are photomicrographs, all taken edge-on, with a light microscope, of the needle punched material of this Example.

In the view at low magnification, Figure 25, the general arrangement of fibers and scrim before lamination is apparent. In Figure 25A which shows a portion of the same structure, at higher magnification, one can see a group of fibers which have been acted on by the punching needle to more or less align them transversely to the web and to force them through the scrim.

The laminate is seen at the same two magnifications in Figures 26 and 26A. The bonding effect that the lamination has on the fibers is seen in Figures 27 to 28A. Figures 27 and 27A are views of thin cross-sections made by embedding the laminate in a water-soluble medium and then making a slice with a microtome; the tight cluster of fibers at the center of each view is a thread of the scrim. Figures 28 and 28A show the same cross-sections after the water-soluble embedding material has been dissolved away; it will be seen that fibers are still bonded to the microporous material M by fingers of adhesive (as at 160) which extend some distance into the fibrous structure and encapsulate portions of the fibers. It will be understood that in most cases these encapsulated portions are parts of individual fibers which (out of the planes of the thin slices shown in Figs. 28 and 28A) extend transversely through the fibrous web (although some of the encapsulated portions are parts of individual fibers of the scrim threads which extend longitudinally of that web). Thus when one gently teases individual fibers from the fibrous side of the laminate, one end of the teased fiber generally remains anchored to the laminate; in contrast one can readily tease out and remove (without fiber breakage) individual fibers of the needled material before laminating.

B. Example 9A is repeated using about 250 to 300 needle punches per square inch and impregnating the needle-punched structure with about 5 or 10% of its weight of an elastomeric binder (e.g. a butadiene-acrylonitrile rubber) which is applied as an aqueous latex and then cured.

C. Example 9B is repeated using about 500 needle punches per square inch.

D. Examples 9A—9C are repeated using a microporous material about 30 mils (instead of 20 mils) thick.

In the laminating procedure used in this Example 9, the loose fibrous web is passed under tension around a hot roll having a temperature of, say, about 345 to 380°F (about 170 to 195°C) and then through the nip between the hot roll and the locally deformed rubber surface of the backup roll. It is known that at these temperatures a batt of polyester staple fibers tends to shrink. In the procedure used herein the batt is restrained against shrinkage in area (as by the pressure exerted thereon by the tensioned microporous sheet and, then by the nip pressure and the anchoring and binding action of the macroapertured adhesive, as well as the stabilizing effect of the scrim). In the nip, owing to the deformation of the rubber surface of the backup roll and the consequent variations in the linear speed of that surface, the compressed assemblage of batt and microporous material may be subjected to shearing forces, first in one direction and then in the other, which may have some compacting or felting effect on the batt.

The needle punched structure used in this Example 9 contains (as previously mentioned) about 4 ounces per yard of relatively loose staple fibers (not counting the staple fibers which are in twisted compacted form in the yarns of the scrim) and is about 86 mils thick; the specific gravity of the loose staple fiber in the needle-punched structure is thus well below 0.2, i.e. below 0.1. specifically about 0.07. In the process this loose staple fiber becomes compacted and set, so that the specific gravity of the loose staple fiber in the final product is well above 0.15, i.e. above about 0.2, specifically about 0.24.

As previously noted, products of various thicknesses may be produced by the system described herein. Generally for shoe uppers an overall laminate thickness within the range of about 40 to 80 mils (about 1 to 2 mm) is desirable for men's shoes and an overall thickness within the range of about 35 to 50 mils (about 0.8 to 1.2 mm) is desirable for women's shoes. For upholstery it may be about 20 to 40 mils (about 0.5 to 1 mm).

As previously noted, in the preferred process a thin preformed skin is laminated to the outer surface of the microporous layer, or that outer surface is directly embossed without a skin (giving a product having a dull, suede-like appearance). Alternatively, the outer surface of the microporous layer may be finished in other ways before or after it is laminated to the fibrous material. Thus a thin skin (as of elastomeric polyurethane) may be applied by spraying or printing. The presence of this skin usually reduces the moisture vapor transmission somewhat; for instance a material finished in this way may have an MVT of about 70 after finishing, as compared to an MVT of about 200 g/sq.m./hr. in the absence of the finish.

In the most preferred constructions according to this invention the fiber:elastomer weight ratio is in the range of about 0.8:1 to 1.2:1 such as about 1:1. (The weight of elastomer includes not only the weight of the microporous layer, which constitutes well over 50% of the weight of elastomer, but also the weight of binder that may be present in the fibrous layer which binder preferably makes up less than 30% of the total weight of elastomer). In the laminated product, the specific gravity of the fibrous layer (including any binder therein), is preferably below about 0.3, such as 0.28, 0.25 or 0.2, and above 0.1. This makes it possible to produce a shoe upper material whose lower layer is readily compressible in the shoe-making process (e.g. in lasting which involves significant bending of the shoe upper material at the toe portion, which bending compresses the fibrous underside of the shoe upper material) while also having sufficient cohesive strength to resist conventional shoe making forces without breaking. In such products the thickness of the microporous layer is, as previously mentioned, in the range of about 20 to 35 or 40 mils, and the thickness of the fibrous layer is at least about 20 mils such as about 25, 30, 40 or 50 mils or more. Preferably the total amount of fibers is in the range of about 2 or 3 to 6 ounces per square yard (such as may be provided by using a scrim weighing about 1 to 2 or 3 [e.g. 1 1/2] ounces per square yard, into which about 2 to 3 or more ounces per square yard of staple fiber have been punched) and the amount of added impregnant or binder, if any, is about 1/2 ounce or less per square yard. The weight of elastomer supplied in the macro-reticulated web is preferably in the range of about 0.4 to 0.8 ounce (more preferably about 0.6 ounce) per square yard.

In the following Examples the fibrous sheet to which the microporous layer is laminated in accordance with the invention is a combination of a cellular elastomeric sheet (such as the microporous sheets previously described) and a nonwoven fiber batt having fibers of said batt extending transversely into said elastomeric sheet.

EXAMPLE 10

In this Example a thin sheet of microporous elastomeric polyurethane is combined with a nonwoven polyester staple fiber web by needle punching fibers of the web into the microporous sheet. The microporous sheet is like that used in Example 1 except that its thickness is about 15 mils (3/8 mm). The nonwoven fiber web is the same loose fluffy batt (weighing about 4 ounces per square yard) used as a starting material in Example 9 and the needle-punching is effected in the manner generally described in Example 9 except that the fibers are punched into and through a microporous sheet. During the "upstroke" each needle punches a crater into the "lower" face of the microporous sheet and thus tears the microporous material locally, forming a small resilient flap or flaps of the elastomeric polyurethane; the flap presses against the fiber(s) in the hole to hold them frictionally. Figures 29 and 30 show the appearance of the "lower" and "upper" faces (respectively) of a microporous sheet from which the fibers have been removed mechanically (by peeling the fibrous batt away from the microporous sheet thereby pulling the frictionally held needled fibers back out of their holes in the microporous sheet). Figures 31, 31A, 32 show the needled fibers held in the holes. The needling is carried out to form about 300 to 350 more or less randomly positioned holes per square inch of the microporous sheet.

The upper surface is laminated to a microporous sheet as described in the earlier examples.

EXAMPLE 11

Example 10 is repeated except that a woven scrim of polyester fiber is placed between the nonwoven batt and the microporous sheet before needling, so that the resulting needled fibers are punched through the openings in the scrim and then into the microporous sheet and thus serve to hold the whole assemblage together. The scrim used in this Example is the same square-woven scrim described in Example 9. The presence of the scrim results in a laminate having a greater stability and a higher modulus at low elongations.

EXAMPLE 12

Examples 10 and 11 are repeated, except that the microporous sheet to which the batt is needled is 30 mils thick and the number of needle punches is about 600—800 per square inch and the distribution of the needle holes is such that a criss cross overall pattern (of fibrous material) is apparent on the "lower" face of the microporous sheet with areas which are essentially fiber-free (or of much lower fiber density) readily visible, between the criss-crossing lines.

In the needle-punching of the microporous material the "upward" strokes of the needles may be such that they move to positions considerably above (e.g. 1/4 inch or more above) the "upper" surface of the microporous material, so that there is a considerable length of fiber on the upper face; these lengths tend to form curls of fibers (Figure 32) unless brushed out. Alternatively the upward strokes may terminate a much shorter distance above that upper surface or all (or some of) those upward strokes may even terminate within the microporous material so that the fibers (e.g. fiber loops) are retained within the material without being exposed at that upper surface.

The number of needles punches per square inch will generally be well over 100 and is preferably over 200, such as about 300, about 400, about 500 or even more.

The needle punching may be effected so that only a relatively small amount of fibre is present on the "upper" surface of the microporous material, e.g. about 0.2 to 1 (such as about 0.4 to 0.6) oz/yd².

The "upper" partly fibrous surface of the needle-punched microporous material (such as the materials of Examples 10—12) may be treated in various ways prior to being laminated to the microporous material.

It may be treated to melt back the protruding surface fibres, thus forming fused nubs at the fibre ends; the presence of these nubs makes it more difficult to pull these fibres out through the microporous material and thus strengthens the physical bond between the fibrous batt and the microporous material. Such fibre-melting treatments may be effected by flaming (or infra-red heating) without significantly affecting the microporous material. One may also subject the "upper" surface of the needle-punched microporous material to influences which tend to fuse or soften the microporous material, such as infra-red heating or flaming of that surface with or without preliminary treatment of that surface with an agent which lowers the fusion temperature (e.g. a solvent such a dimethyl formamide). The protruding fibres at the "upper" surface of the needle-punched microporous material may also be abraded (as by sanding, to break the protruding loops of fibre) or brushed (to pull out such loops) thereby providing a nap having numerous free fibre ends; this nap may, if desired, be sheared in conventional manner, to a uniform nap length or thickness with or without preliminary or subsequent bonding (as described earlier) of the fibres to the microporous surface.

Before or after (or during) the operation of needle-punching the batt to the microporous layer, the batt may be treated to increase its coherence as by applying a binding agent, e.g. up to about 40%, such as 5, 10, or 20% of binding agent as an elastomeric latex (previously described) or solution.

The treated needle-punched microporous material may be used in various ways. For instance, it may be used as a lining for shoes.

In the operation of the system described herein, very goods results have been obtained by using fibrous layers comprising fibres of polyethylene terephthalate. It will be understood that other fibres such as nylon (e.g. nylon 66), polyolefin (e.g. polypropylene), rayon, or polyacrylonitrile (e.g. Orlon) be employed.

Also, while very good results have been obtained with macro-apertured webs of elastomeric polyurethane, it will be understood that other thermoplastic elastomers may be employed, such as the polymers of diolefins sold as Kraton (a butadiene-styrene copolymer) and Solprene. Preferred thermoplastic elastomers set to a bond which is resistant to steam treatment; such treatment may be used in processing lasted shoe uppers. Their melting-sticking temperatures are preferably above 100°C, more preferably above about 110°C. Reactive elastomers which become cross-linked on heating during the processing of the laminate may also be used.

The skin material preferably comprises elastomeric material, preferably a polyurethane or a polyacrylate, and is preferably substantially free of solvent. Preferably, also, the outer, visible, portion of the skin is resistant to discoloration on exposure to air, light, or heat. Other components may also be present in the skin and these need not be elastomeric (see, for instance the uppermost layer in Figure 20A and note the "top coating" materials employed in U.S. patent 4,073,984). Excellent results are obtained with thermoplastic skins, including those whose melting-sticking temperatures are about the same as, or even higher than that of the microporous material and those whose melting-sticking temperatures are well below that of the microporous material and well below the temperature of the hot embossing roll. For instance, polyurethane materials, such as described in Example 4 above, may have melting-sticking temperatures of about 130°C. When the process involves bringing the skin-contacting surface of the microporous material up to its melting-sticking temperature (as is the case in the preferred grain-embossing process), or higher, the skin material may be a cross-linked non-thermoplastic polymer (or a polymer having a higher fusion temperature) since adhesion to the microporous material may then be obtained by fusion of the latter; accordingly the skin may comprise a layer of cross-linked polyurethane or polyacrylate. As noted there may be a release agent in or on the skin; this may be a readily fusible material which may form a non-tacky liquid film (such as a wax) or a finely divided material such as a flatting agent (e.g. a silica gel or silicate flatting agent of conventional type) that reduces the tackiness and adhesion of the heat-softened material. Of course the hot rolls may be coated with a non-adhering type of polymer such as a tetrafluoroethylene polymer (e.g. Teflon).

WHAT WE CLAIM IS:—

1. A process for making artificial leather which comprises:

(a) providing a supply of a continuous web of fibrous material and a separate supply of a continuous sheet of microporous elastomeric polyurethane and a separate supply of a macro-apertured web of a fusible elastomeric polymer the said microporous elastomeric polyurethane having a higher melting point than the fusible polymer of the macro-apertured web such as to remain in a microporous condition at the fusion temperature of the said macro-apertured web;

(b) continuously pulling the said webs and sheet lengthwise under tension from the said supplies to an assembling zone;

(c) continuously pre-heating the said fibrous web during its passage to the said assembling zone;

(d) continuously bringing the said macro-apertured web into contact with the said pre-heated fibrous web and transferring heat from and through the said fibrous web to the said macro-apertued web to raise the said macro-apertured web to its fusion temperature;

(e) bringing the said microporous sheet into contact with the said macro-apertured web before the said macro-apertured web attained its fusion temperature and before the said macro-apertured web attains its network breakdown temperature whereby the said macro-apertured web adheres to the said microporous sheet without substantial network breakdown;

(f) passing the resulting assemblage of webs and sheet lengthwise through a nip between two rotating rolls, the said rolls exerting high pressure to compress the said microporous sheet and cause the said fusible elastomeric polymer to flow around fibres of the said fibrous web to encase and bond the said fibres while leaving unbonded breathable areas corresponding to the macro-apertures of the said web; and

(g) cooling the resulting assemblage to set the said fusible polymer in solid condition.

2. A process as claimed in Claim 1, in which the said fibrous web comprises needle-punched staple fibres.

3. A process as claimed in Claim 1 or Claim 2 in which the said macro-apertured web is a stretchable web having a thickness of about 3 to 5 mils, and weighs about 0.5 to 0.08 oz/yd^2.

4. A process as claimed in Claim 1, 2 or

3, in which the said tension on the said macro-apertured web is maintained sufficiently low that the said web stretches less than 10% in passing from its supply to the said nip.

5. A process as claimed in Claim 1, 2, 3 or 4, in which the said fibrous web comprises an elastomeric binder in amount of about 2 to 40%, based on the total weight of the said fibrous web.

6. A process as claimed in Claim 1, 2, 3, 4 or 5, in which the said two rolls comprise a metal roll having a hot surface and an elastomer surfaced backup roll.

7. A process as claimed in any one of Claims 1 to 6, in which prior to cooling the resulting assemblage, the said assemblage is passed continuously lengthwise onto a rotating roll having a hot surface for providing a finish on the said microporous sheet, and is continuously removed lengthwise from the said hot roll.

8. A process as claimed in Claim 7, in which the said assemblage is maintained in a relaxation step under substantial absence of tension and in lengthwise arcuate form with its hot-finished surface convex at an elevated temperature such as to cause lengthwise relaxation of the microporous material thereby causing the said fibrous web laminated thereto to undergo lengthwise contraction.

9. A process as claimed in Claim 7 or Claim 8, in which the said hot surface has a temperature which is within about 15°C of the melting-sticking temperature of the said microporous material.

10. A process as claimed in Claim 7, 8 or 9, in which the said assemblage travels in contact with the said hot surface of the said rotating roll for a residence time of more than 1/2 second while the said assemblage is in arcuate form with its fibrous surface convex, and the said assemblage then, directly after its removal from the said hot surface of the said rotating roll, travels continuously in an arcuate form as set forth in Claim 8.

11. A process as claimed in Claim 7, 8, 9 or 10, in which the said hot surface is an embossing surface having ridges penetrating into the said microporous material.

12. A process as claimed in any one of Claims 7 to 11, in which the said microporous material is directly in contact with the said hot surface.

15. A process as claimed in any one of Claims 8 to 12, in which the said microporous sheet is about 10 to 50 mils thick and the said fibrous web has a thickness of about 20 to 50 mils during the said relaxation step, the overall thickness of the laminate during the said relaxation step being about 35 to 80 mils.

14. A process as claimed in any one of Claims 7 to 13, in which the fibre to elastomer weight ratio in the said assemblage is about 0.8:1 to 1.2:1.

15. A process as claimed in any one of Claims 1 to 14, in which a grain pattern is imparted to the microporous polyurethane sheet by passing the said sheet material continuously to the nip between a roll having a hot grain-embossing surface having hot grain-embossing projections and another roll, compressing the said sheet in the said nip and thereby forcing the said projections into the said sheet, passing the said sheet material out of the said nip and maintaining the said sheet material on the said grain embossing surface to transfer heat from the said projections into the said sheet while the said sheet is substantially uncompressed, and then continuously removing the said sheet material from the said hot roll.

16. A process as claimed in any one of Claims 7 to 15, in which the said hot surface is afforded by the surface of the one of the two rotating rolls to which the microporous sheet is juxtaposed.

17. A process as claimed in any one of Claims 7 to 16, in which when the said assemblage is on the said hot roll there is a thin elastomeric skin between the said microporous material and the said hot surface of the said roll.

18. A process as claimed in Claim 17, in which the said thin elastomeric skin has a thickness of less than about 15 mils.

19. A process as claimed in any one of Claims 15 to 18, in which the residence time of the said sheet material in the said nip is less than about 0.1 second and its residence time on the said hot surface while substantially uncompressed is at least about 1/2 second.

20. A process as claimed in any one of Claims 15 to 19, in which the said microporous polyurethane has a melting-sticking temperature of at least about 130°C.

21. A process as claimed in any one of Claims 15 to 20, in which the said melting-sticking temperature is about 155—185°C.

22. A process as claimed in any one of Claims 15 to 22, in which the said residence time in the said hot nip is so short that the said microporous sheet recovers to substantially its original thickness in the said process.

23. A process as claimed in any one of Claims 1 to 22, in which a surface showing a depth of surface colour is imparted to the microporous sheet which comprises continuously supplying a transparent coloured skin having an elastomeric layer onto a hot roll, continuously supplying a web having a coloured microporous elastomeric surface layer into contact with the said coloured skin, and while the said skin is on the said roll, fusing the said elastomeric layer to the said microporous elastomeric sheet to form a

product in which the colour of the said microporous zone is visible through the said coloured skin.

24. A process as claimed in Claim 23, in which the said skin is supported on a carrier sheet in its passage to and on the said hot roll and the heat to effect the said fusion is supplied from the said roll through the said carrier sheet.

25. A process as claimed in Claim 24, and including the steps of making the said skin by gravure coating a plurality of different shades of material successively onto the said carrier sheet, the said different shades of material being differently distributed on the same overall area of the said carrier sheet to form a mottled pattern.

26. A process as claimed in any one of Claims 1 to 25, in which the fibrous web supplied before the process commences is a ligated web and has a specific gravity below about 0.15 and in which the continuous sheet of microporous elastomeric polyurethane supplied before the process commences has a specific gravity above 0.2, and in which the process is such as to compact the said web to raise its specific gravity to above about 0.2.

27. A process as claimed in Claim 26, in which the said fibrous web comprises heat-settable fibres, and at least one of the said rolls has a hot surface maintained at temperature at which heat-setting of the said heat-settable fibres occurs.

28. A process as claimed in Claim 26 or Claim 27, in which the said fibrous web is passed through a web-preheating zone under tension before passing through the said nip.

29. A process as claimed in Claim 27 or Claim 28, in which the said heat-settable fibres comprise polyethylene terephthalate staple fibres and the said hot surface is maintained at a temperature of at least about 170°C but below the fusing temperature of the said heat-settable fibres.

30. A process as claimed in Claim 26, 27, 28 or 29, in which the said ligated fibrous web comprises needle-punched staple fibres and comprises about 0.05 to 0.1 gram of staple fibres per cubic centimetre.

31. A process as claimed in any one of Claims 1 to 30, for making artificial leather which includes:

(a) placing a thin preformed skin on the outer surface of the said microporous polyurethane, the said skin having a surface, in contact with the said microporous outer surface, which is heat fusible to the said outer surface;

(b) passing the said assemblage continuously lengthwise onto a rotating embossing roll having a hot grain-embossing surface in contact with the said skin at a temperature above the temperature at which the said skin fuses to the said outer surface; and

(c) continuously removing the said assemblage lengthwise from the said embossing roll.

32. A process as claimed in Claim 31, in which the said grain-embossing surface is afforded by the surface of the one of the two rotating rolls to which the microporous sheet is juxtaposed.

33. A process as claimed in Claim 30, 31 or 32, in which the said skin is heat-adhered to the said outer surface of the said microporous polyurethane sheet prior to the said embossing step (b).

34. A process as claimed in any one of Claims 30 to 33, including the steps of providing a supply of a continuous supporting film carrying the said skin, continuously drawing off the said skin-carrying film from the said supply onto the surface of a rotating roll having a hot surface in contact with the said supporting film at a temperature above the said skin-outer surface fusion temperature and maintaining the said outer surface of the said microporous polyurethane in contact with the said skin on the said film-contacted roll so as to adhere the said skin to the said outer microporous surface, and thereafter stripping the said film from the said assemblage prior to the said embossing step (b).

35. A process as claimed in Claim 34, in which the said film is of polyethylene terephthalate.

36. A process as claimed in any one of Claims 30 to 35, in which the said fusible surface of the said skin is of elastomeric polyurethane having a lower melting point than the polyurethane of the said outer microporous surface.

37. A process as claimed in any one of Claims 30 to 36, in which the face of the said skin which is in contact with the said embossing surface carries a release agent.

38. A process as claimed in any one of Claims 30 to 37, in which in the said embossing step (b) the said assemblage passes through the nip between the said embossing roll and an elastomer surfaced roll biased toward the said embossing roll, the conditions being such that at the said nip the said microporous polyurethane is compressed and the said elastomer roll surface is deformed, the said microporous polyurethane then expands to substantially its original thickness on leaving the said nip and the said assemblage, with the said skin, then remains in contact with the said embossing roll for a period of at least about 1/2 second, the residence time in the said nip being less than about 0.1 second.

39. A process as claimed in Claim 38, in which the said hot grain-embossing surface is at a temperature within about 15°C of the melting-sticking temperature of the said microporous material.

40. A process as claimed in any one of

Claims 30 to 39, in which the weight ratio of fibrous material to elastomer in the said assemblage is about 0.8:1 to 1.2:1 and the thickness of the said assemblage is about 20 to 80 mils.

41. A process as claimed in any one of Claims 33 to 40, in which the said skin comprises a plurality of layers including a layer adjacent to the said film and carrying a release agent to reduce adhesion to the said embossing surface and another layer, further from the said film than the said first mentioned layer, of elastomeric polyurethane.

42. A process for making an artificial leather substantially as specifically described herein with reference to the examples.

43. An artificial leather whenever made by a process as claimed in any one of Claims 1 to 42.

44. A highly air-permeable grain-embossed artificial leather having a dull grained surface comprising a fibrous non-woven material and a microporous elastomeric layer laminated thereto by fused elastomeric material bonded by the process claimed in any one of Claims 1 to 6 to the said microporous layer in a discontinuous or open pattern and embedding adjacent surface portions of fibres of the said non-woven layer, the said microporous layer being produced by coagulation of a solution of elastomer followed by mechanical removal of coagulated surface material to expose the inner structure of the coagulated microporous material and thereby provide an open surface having exposed microscopic open cells, the said microporous material being embossed by contact with a hot grain-embossing surface at a temperature within 15°C of the melting-sticking temperature of the said microporous material, the said embossing being effected to an extent sufficient to impart a visible grain pattern but insufficient to close the said exposed open cells.

45. An artificial leather as claimed in Claim 44 showing a depth of surface colour which comprises a base sheet having a coloured microporous surface zone heat-laminated to a preformed coloured transparent substantially continuous skin, the colour of the said microporous zone being visible through the said skin.

46. An artificial leather as claimed in Claim 45, in which the said microporous zone is coloured brown or black.

47. An artificial leather as claimed in Claim 45 or Claim 46, in which the said skin is less than 20 mils thick.

48. An artificial leather as claimed in Claim 45, 46 or 47, in which the microporous zone is of pigmented elastomeric polyurethane and the said skin comprises a layer of pigmented elastomer fused to the said microporous zone.

49. An artificial leather as claimed in any one of Claims 45 to 48, in which the polyurethane of the said microporous zone is thermoplastic and has a fusing temperature above that of the polyurethane of the said skin.

50. An artificial leather as claimed in any one of Claims 45 to 49, in which the said skin comprises at least two layers including an outer layer which is harder than the said elastomer layer.

51. An artificial leather as claimed in any one of Claims 44 to 50, in which the fibrous non-woven material comprises a batt of non-woven fibrous material needle punched to a microporous elastomeric polyurethane sheet having a thickness of about 10 to 40 mils and a specific gravity of about 0.2 to 0.6 so that fibres of the said batt extend transversely from one face of the said sheet into the said microporous sheet.

52. An artificial leather as claimed in Claim 51, in which the said needle punched fibres extend through the said microporous sheet onto the opposite face thereof, the amount of fibres being above about 2 ounces per square yard on the said one face and less than about 1 ounce per square yard on the said opposite face.

53. An artificial leather substantially as specifically described herein with reference to the Examples and the accompanying drawings.

KILBURN & STRODE,
Chartered Patent Agents,
Agents for the Applicants.

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1603487 COMPLETE SPECIFICATION

14 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

FIG 1

FIG 2

FIG 3

← 1mm →

FIG 4

1603487 COMPLETE SPECIFICATION

14 SHEETS *This drawing is a reproduction o the Original on a reduced scale*

Sheet 2

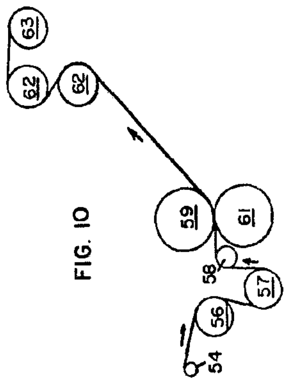


FIG. 10

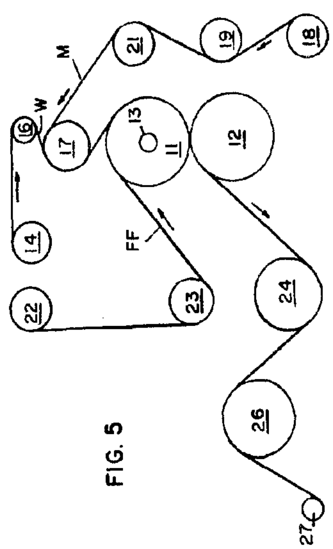


FIG. 5

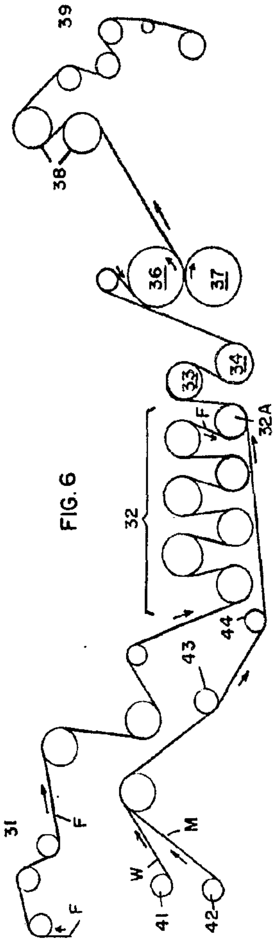


FIG. 6

FIG 7 51 ~0.3mm 51

0.3mm FIG 9

52

53

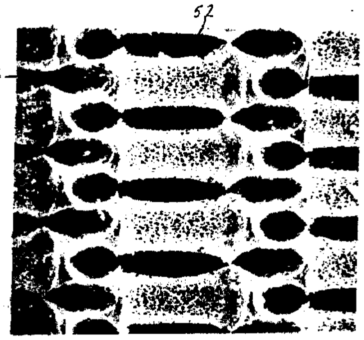
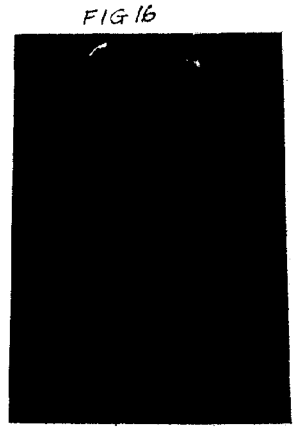


FIG 8

FIG 15

2mm

FIG 16



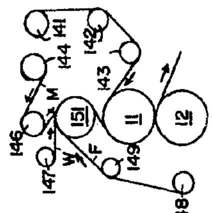


FIG. 35

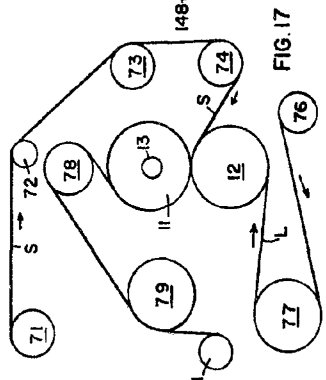


FIG. 17

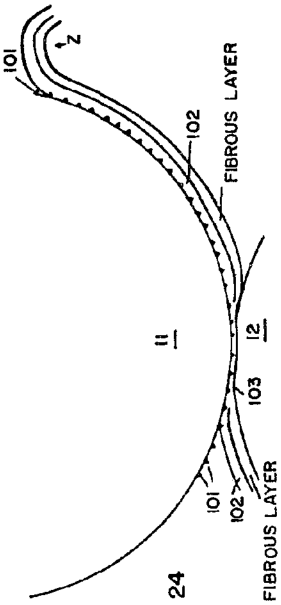


FIG. 24

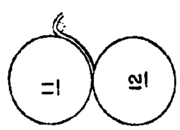


FIG. 11

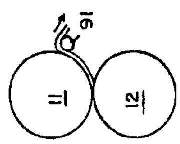


FIG. 11A

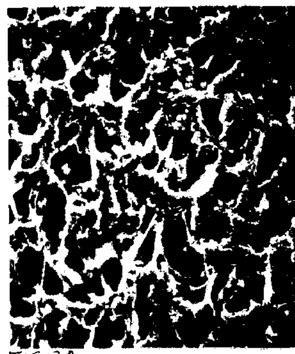


FIG 12A

FIG 12
FIG 13

⊢ 0.5mm ⊣

⊢ 0.1mm ⊣

FIG 13A

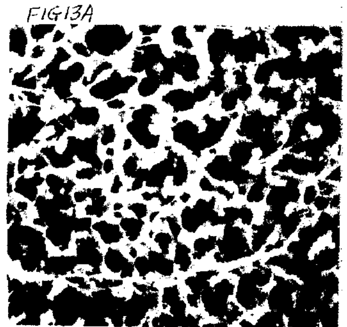
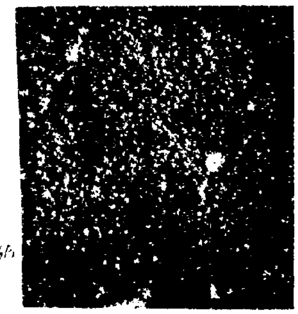


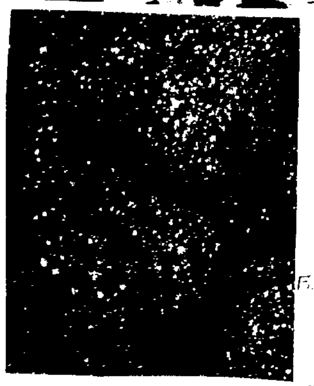
FIG 34

⊢ 0.1mm ⊣

FIG 14

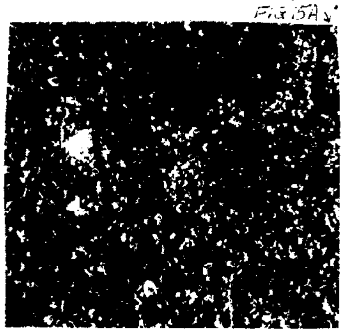


scale for 15B, 16B



scale for 15A, 16A

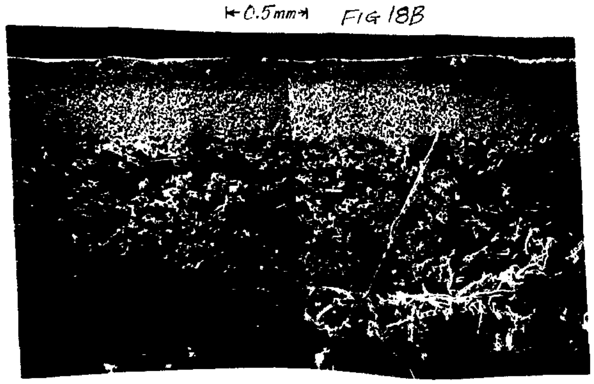
FIG 15A



⊢— 50μ —⊣ FIG 18

⊢ 10μ ⊣ FIG 18A

⊢ 0.5mm ⊣ FIG 18B



1603487 COMPLETE SPECIFICATION

14 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 8

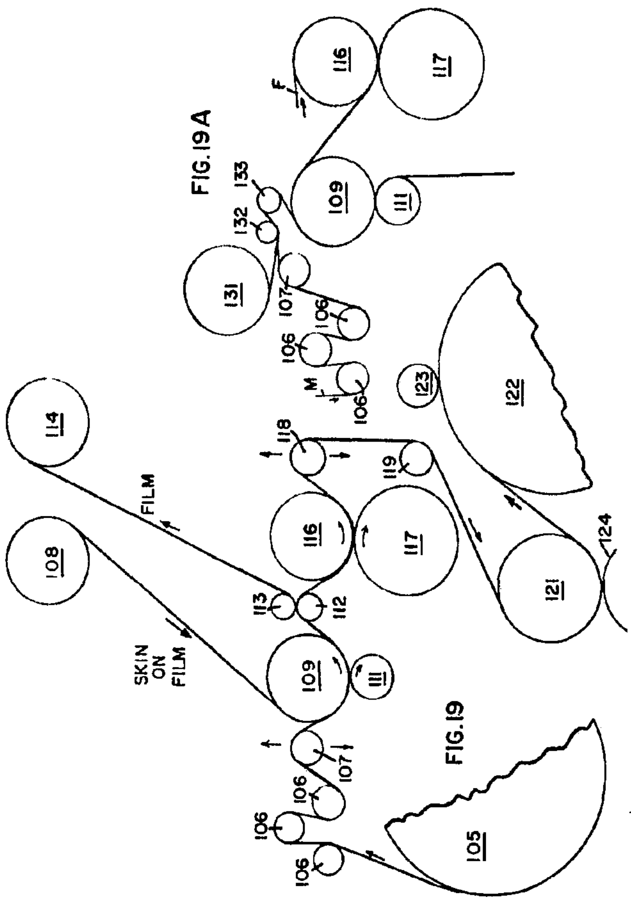


FIG. 19

FIG. 19A

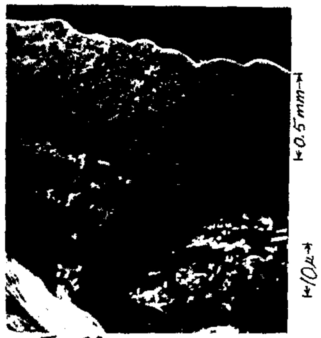


FIG 20

FIG 20A

FIG 20B

FIG 20C

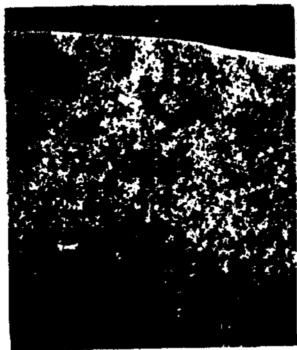


FIG 21

0.3mm

10μ

FIG 21A

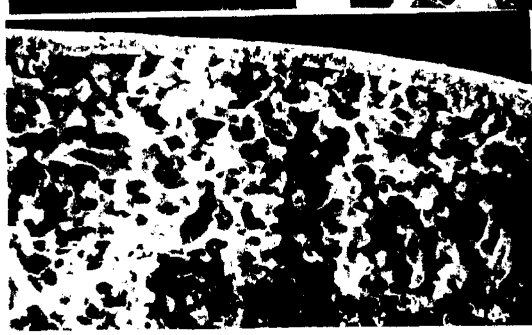


FIG 21B

50μ

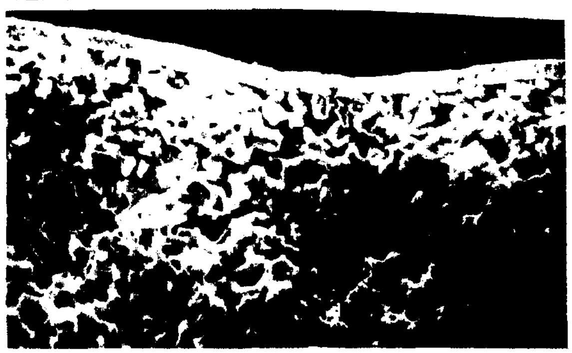


FIG 21C

50μ

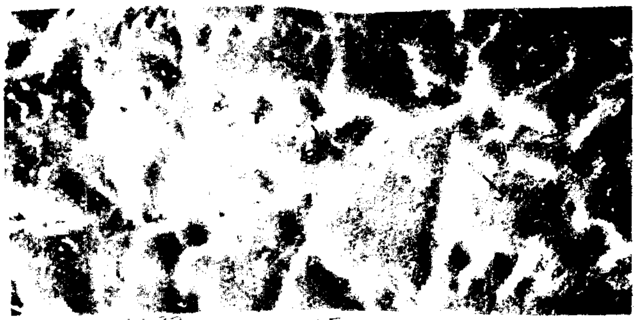


FIG 22 ←0.5mm→

FIG 23 ←0.5mm→ FIG 23A

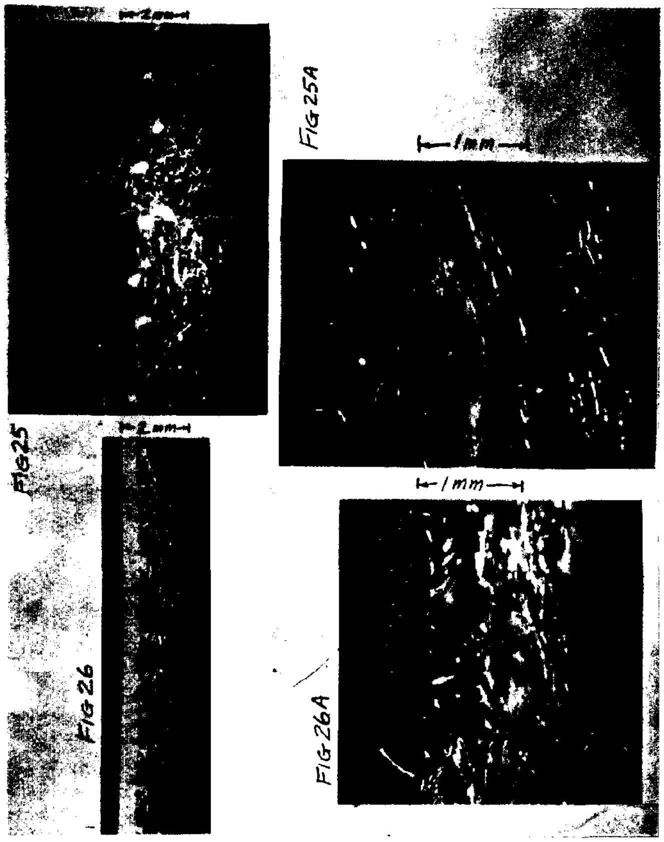


FIG 25
FIG 25A
FIG 26
FIG 26A

FIG 31 |← 1mm →|

|← 1mm →| FIG 31A

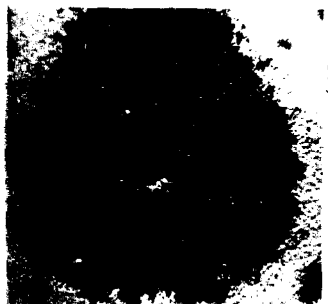


FIG 30

FIG 32

FIG 29

FIG 27

FIG 28

|—0.5mm—|
same scale for all

FIG 27A

FIG 28A

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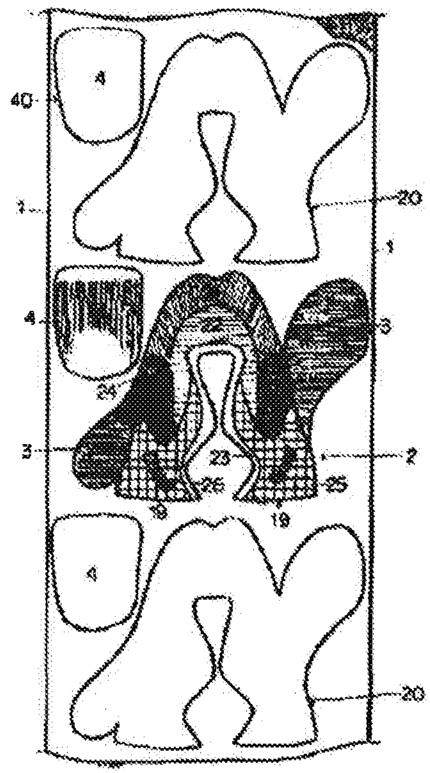
(74) Agent: Osamu Sugawara, Patent Attorney

(54) Title of Invention: Uppers material for shoes

(57) Abstract

[Objective] To develop uppers material for shoes indispensable to manufacturing methods that increase the economic efficiency of production by reducing the quantity of uppers materials for shoes as much as possible thus simplifying the stitching process.
[Configuration] The configuration is one sheet of cloth wherein, as uppers material for shoes, all the outlines of the main uppers for the shoe of one foot are continuous and the interiors thereof are woven using Jacquard weave in a variety of weave structures and/or patterns for each location. It is configured with yarn count of 250 per inch or greater and each pattern element is $25cm^2$ to $80cm^2$.



[start of original P2]

What is claimed is:

1. Uppers material for shoes configured of one sheet of cloth wherein all the outlines of the main uppers materials for the shoe of one foot are continuous and the interiors therein are woven in a variety of weave structures and/or patterns.

2. The uppers material for shoes according to claim 1 wherein said weave structure is Jacquard weave.

3. The uppers material for shoes according to claim 1 or claim 2 wherein the yarn count of said weave structure is 250 per inch and one pattern is $25cm^2$ to $80cm^2$.

BACKGROUND OF THE INVENTION

[0001]

[Field of the Invention] The present invention relates to uppers material for shoes and more particularly that for sport shoes. In particular, the shoe uppers material of the present invention is uppers material comprising one sheet of woven fabric.

[0002]

[Description of the Related Art] The uppers material used in sport shoes and the like is configured of several types of parts. For example, when using woven fabric and/or knitted fabric as uppers materials for shoes, as shown in Figure 2, the material is made into many parts, such as the tip part A, upper surface part B, edge part C, side surface parts D, E, and F, ankle edge part G, heel parts H and I, and the material and shape of each is selected according to the function of that location. Parts of many types are provided, such as woven fabrics and/or knitted fabrics of various surface structure and design (A, B, I), natural leather or manmade leather (C, E, G), and plastic (D, F, H). A sheet of shoe uppers material is formed by attaching each part with adhesive or by sewing/stitching, with the parts stitched together 3-dimensionally in specified locations.

[0003] A configuration that assembles uppers material as parts, enabling parts to be designated on a surface according to the mobility or protection required at each site on the foot, meets the demand for emphasis on functionality and the requirement for ever smaller material parts.

[0004]

[Problem the Invention Seeks to Solve] As mentioned above, with the conventional shoe manufacturing methods based on parts, a variety of materials come to be assembled into the shoe for one foot. To do this, there is the difficulty of procuring each material and losses of each material are large, with the loss having to be borne by the shoe factory. In addition, because the structure is complicated, effort is required for cutting and stitching together and skill-training is required. The actual labor cost, domestically, for cutting and sewing/stitching work has increased by 10 to 100% or more. The trend toward a "parts approach" results in an increase in the component of specialized fabrication work and a steep rise in personnel cost, coupled with the fact that domestic sewing/stitching factories are unprofitable. Thus shoe manufacturing that involves a large number of individual parts has become difficult in practice. Further, in respect to economies of manufacturing, because a process where each part of a shoe is designed and cut and a process where these parts of complicated shapes are stitched together accurately and with uniform elasticity are involved, for mass production, there were the issues that high-level techniques were required and simplification/reduction of the number of process steps was difficult.

[0005]

[Means of solving the problem] The present invention solves these problems. It develops material for shoes indispensable to manufacturing methods that increase economic efficiency of production by reducing the quantity of shoe uppers materials as much as possible, thus enabling smooth provision of materials and reducing labor cost through simplification of the sewing/stitching process. The present invention, by setting up the conventional parts as a single sheet of main uppers materials as much as possible, reduces the number of parts and the number of sewing/stitching operations, thus improving overall efficiency. To sum up, uppers material is provided which, on a single sheet of Jacquard weave cloth, forms an integration of almost all the uppers material for a shoe. The present invention is uppers material configured of one sheet of cloth wherein all the outlines of the main uppers materials for the shoe of one foot are continuous and the interiors therein are woven in a variety of weave structures, designs and/or patterns. The weave structure is Jacquard weave, the yarn count of the weave structure is 250 per inch or greater, and one pattern element is $25cm^2$ to $80cm^2$. This configuration can handle the strengthening of shoes and the demands of design quite adequately.

[0006] Furthermore, the present invention forms the uppers material on one sheet of Jacquard weave cloth, and on top of them other elements can be sewn on, water-proofing material can be applied, decorative elements can be sewn on, and of course water-proofing can be done as a secondary production step.

[0007]

[Embodiments] Figure 1 shows an embodiment of uppers material for shoes according to the present invention. The uppers material for shoes is configured of one sheet of cloth wherein, the main uppers material 2 for the shoe of one foot are woven on elongated foundation cloth 1, all the outlines thereof are connected, and within those outlines at each appropriate location 21 through 26 are many kinds of weave structures, designs and patterns. The weave structure is a comparatively heavy Jacquard weave, the weave structure being changed for each part corresponding to each location on the shoe or being woven in a pattern that changes the design/pattern. On foundation cloth 1, all of the main uppers material 2 for the shoe of one foot are woven, and continuous thereto middle sheet 3 and, and separated a little therefrom, shoe tongue flap shaped cover 4, are woven in. Middle sheet 3 is a sole-shape divided in half, roughly diagonally, formed continuous with the edge of the outline of main uppers material 2, to the right and left thereof. Middle sheet 3, formed divided, will become the shape of the sole by being 3-dimensionally folded in and stitched together when main uppers material 2 is formed 3-dimensionally on the shoe mold. Also, the shoe tongue flap shaped cover 4 is sown in on the inside of main uppers material 2. In this embodiment, main uppers material 2, middle sheet 3, and tongue flap shaped cover 4 are positioned appropriately on elongated foundation cloth 1, forming an elongated weaving with a continuous pattern. Main uppers material 2, middle sheet 3, and tongue flap shaped cover 4 are cut along the outline line of each 20 and 40, to form two parts. The above-mentioned main uppers material 2 is configured of a weave structure with a yarn count of 250 per inch or more, one pattern element being from $25cm^2$ to $80cm^2$ in size. Because this yarn count meets the strength demanded of sports shoes, it is in the preferred range, and making one pattern element about $25cm^2$ to $80cm^2$ in size is desirable, not only in terms of design, but also to maintain flexibility and strength.

[start of original P3]

[0008] For weaving yarn, material is selected that is outstanding in terms of wear resistance, weather resistance, elasticity, and flexibility. By "punch-out" cutting of main uppers 2, middle sheet 3, and tongue flap shaped cover 4, parts are made in the least number possible.

[0009] Figure 3 shows the main uppers 2 after cutting. Overall they make one sheet of woven fabric and each pattern element 10 through 18 therein is formed of a different weave structure and/or different pattern. For each shoe location, the appropriate weave structure is used. For example, toe cap tip 10 is formed of a weave structure of high yarn count and density, and upper surface 11 is formed of a weave structure with high breathability. Furthermore, by using a weaving yarn materials such as those with nylon fiber blended in and cutting the outline lines by thermal cutting, the cut edges melt and will not fray.

[0010] The main uppers 2, configured in this way, become 3-dimensional shoe uppers by stitching together the parts for joining by stitching 19 at the rear-most part of those main uppers.

[0011] When the elongated foundation cloth 1 of Figure 2 is fully woven, the shoe uppers parts can be procured as just main uppers 2, middle sheet 3, and tongue flap shaped cover 4, and he work of stitching together the parts can be greatly simplified. The thickness of the main uppers 2 can be as appropriate, but in this embodiment, the rough average is 2mm.

[0012] In this connection, the shape of main uppers 2 enables various types of computer-generated designs and patterns to be used, and by designating patterns or other software to weaving machines, this can be applied both to small lot production and to mass production.

[0013]

[Effects of the Invention] The uppers material for shoes according to the present invention, which is the above configuration, is advantageous in terms of material procurement, enables simplification of manufacturing processes, and will lead to a main transformation of shoe manufacturing methods. In addition it has the following unique technical effects.

[0014] (1) It is desirable to make shoes that are matched to the individuality of each shoe wearer's foot, but with the movement toward mass production and standardization of each part, it becomes difficult to make shoes matched to that individuality. However, with Jacquard weave cloth, if pattern, size, characteristics of the upper part of the foot, and the like are inputted to a computer connected to a weaving machine, from the stage of material [selection] shoes can be made that are matched to the wearer.

(2) Because the shoes are made with the main uppers as one sheet, the conventional work of stitching together numerous parts can be abbreviated and the production process can be greatly shortened. As a result, large numbers of skilled technicians are no longer needed and streamlining can be done. Moreover, production times can be shortened and production cost can be reduced.

(3) Because the shoes are made with one sheet of main uppers, they can be lightened.

(4) Because the setting for yarn count, the size setting of each pattern element, and the arrangement and shape of each pattern element enable any desired pattern to be made, designs can deal precisely with the strength and flexibility demanded at each location.

(5) Because the number of stitching sites is greatly reduced, water resistance will be very improved compared to conventional products. Also, because the load applied to the shoe surface can be distributed, shoes will be subject to less breakage.

[0015] In this way the uppers material for shoes according to the present invention will greatly change the manufacturing method for fabric-made sports shoes. This is a very useful and outstanding invention that not only enables the easy forming of popular designs, patterns and the like, but also achieves outstanding economic efficiency in manufacturing through easy stylization of materials, simplification of manufacturing processes, shortening of production time, etc., and contributes to the reduction of manufacturing cost.

[Brief Description of the Drawings]

Figure 1 is a plane view of one embodiment of the uppers material for shoes according to the present invention and shows an elongated foundation cloth in the state where the uppers are woven thereon;

Figure 2 is a plane view of conventional parts-type uppers material for shoes prior to being stitched together; and

Figure 3 is a plane view of another embodiment of uppers material for shoes according to the present invention in the state where the main uppers have been cut out.

[Explanation of Key Numbers]

1	Elongated foundation cloth
2	Main uppers
3	Middle sheet
4	Tongue flap shaped cover
10 through 18	Pattern elements
19	Parts for joining by stitching
21 through 26	Locations inside outlines of main uppers
20 and 40	Outline lines

[start of original P4]

Fig. 1

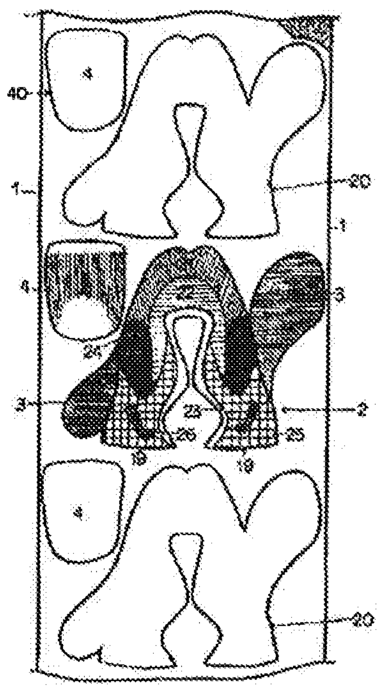


Fig. 2

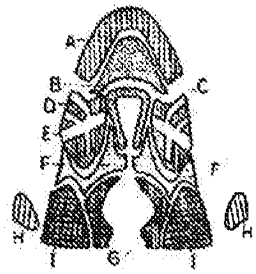
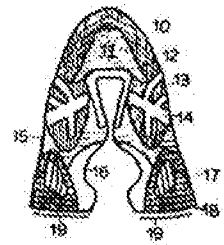


Fig. 3



GlobalPath TRANSLATIONS

Translation Certification by GlobalPath Translations, Inc., November 8, 2012

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(43)公開日　平成６年(1994) ４月26日

(51)Int.Cl.⁵		識別記号	庁内整理番号	ＦＩ	技術表示箇所
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	13/00		8016－4F		

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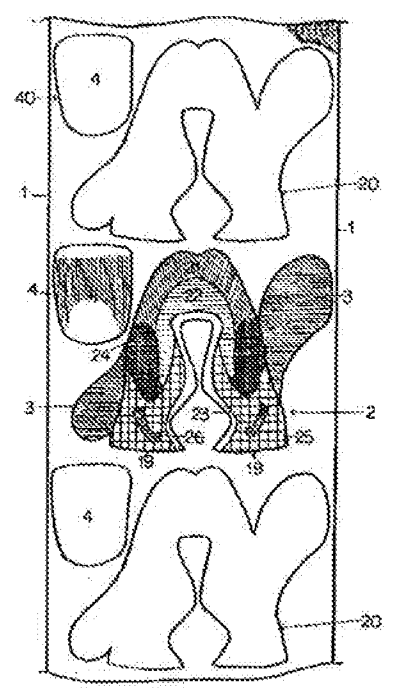
(54)【発明の名称】　シューズ用胛被材

(57)【要約】
【目的】　シューズの胛被のパーツを極力少なくして縫製工程を簡略化し、作業経済性を高める製法に不可欠なシューズ用胛被素材を開発する。
【構成】　シューズ用胛被材として、シューズの片足分の主たる胛被を、全輪郭が連続しかつその内部を各部位ごとに多種類の織り組織及び又は模様によって、ジャガード織で織り立てた一枚の布で構成した。織り組織の糸本数が、２５０本／インチ以上、かつ一の柄を２５ｃｍ^2～８０ｃｍ^2 で構成する。



【特許請求の範囲】

【請求項1】　シューズの片足分の主たる胛被を、全輪郭が連続しかつその内部を多種類の織り組織及び又は模様によって織り立てた一枚の布で構成したことを特徴とするシューズ用胛被材。

【請求項2】　前記織り組織がジャガード織である特許請求の範囲第1項記載のシューズ用胛被材。

【請求項3】　前記織り組織の糸本数が、250本／インチ以上からなり、かつ一の柄を25cm²～80cm²で構成した特許請求の範囲第1項および第2項記載のシューズ用胛被材。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、シューズ、特にスポーツ用シューズの胛被材に関する。特に、本発明のシューズの胛被材は一枚の織物からなる胛被材である。

【0002】

【従来の技術】スポーツシューズなどに使用されている胛被材は、数種類のパーツから構成されている。例えば、従来、織物、編物をシューズ用胛被材として利用する場合は、図2に示すように、先端部分パーツA、上面パーツB、縁パーツC、側面パーツD・E・F、足首縁パーツG、踵部分パーツH・Iなど、部位の機能に応じた素材や形状が選定され、多数にパーツ化されている。表面の組織、意匠の違う織物や編物（A・B・I）、天然皮革や人工皮革（C・E・G）、プラスチック（D・F・H）等を多数のパーツ部品を準備し、パーツ部品はそれぞれ接着及び縫製し、一枚の胛被材となり、所定の個所で立体的に縫合されてシューズの胛被を形成する。

【0003】パーツ部品で胛被材を組合せる構成は、ある面では足の各部位ごとに要請される運動性や保護部材などに応じたパーツを選定でき、機能重視の要請や材料の小片化の要請に叶うものであった。

【0004】

【発明が解決しようとする課題】前記のように従来のパーツ部品によるシューズ製法は、様々な素材が1足のシューズに組み合わされてきている。これには、各素材の調達の複雑さがあるとともに、各材料のロスが大きいし、しかもこのロスはシューズ工場の負担となっており、また複雑な構造のため、それにともなう裁断、縫合に手間がかかり、技能教育の必要性もある。事実国内の裁断・縫製工賃は、10～100％以上も上がってきている。このようにパーツ化の方向は、専門的加工作業の部分を増大させ、人件費の高騰とともあいまって、国内での縫合加工は採算が合わず、多数個のパーツ部品からなるシューズ生産は、事実上困難になってきている。また製造経済性の面でも、シューズの各部位を設計切断してパーツ化する工程と、その複雑な形状のパーツを正確にかつ均等な張力で縫合する工程があるため、量産する場合にも高度な技術が必要であり、工程数の簡略化に課題があった。

【0005】

【課題を解決するための手段】本発明は、これらの課題を解決するもので、スムーズな材料手配を可能にし、縫製工程を簡略化して工賃を下げるべく、シューズの胛被のパーツを極力少なくして作業経済性を高める製法に不可欠な素材を開発するものであり、従来のパーツ部品を極力主たる胛被として一枚仕立とし、パーツ部品及び、縫製部の数を減らし、すべての効率を上げるものである。要約するとジャガード織り生地一枚で、シューズの胛被のほぼ全部を一括形成した胛被材を提供する。ここに本発明は、シューズの片足分の主たる胛被を、全輪郭が連続しかつその内部を多種類の織り組織及び又は意匠・模様によって織り立てた一枚の布で構成したことを特徴とするシューズ用胛被材である。織り組織はジャガード織で、織り組織の糸本数が、250本／インチ以上からなり、かつ一の柄を25cm²～80cm²で構成している。この構成は、シューズの強度およびデザインの要請にも極めて適切に対応できる。

【0006】なお、本発明は、その一枚のジャガード織り布で胛被を形成するが、他の部材をその上から縫い合わせたり、防水部材を張り合せたり、装飾部材を縫合したり、防水処理を二次加工することなども当然にできる。

【0007】

【実施例】図1は、本発明に係るシューズ用胛被材を示す実施例である。シューズ用胛被材は、長尺基布1に、シューズの片足分の主たる胛被2を、全輪郭が連続しかつその輪郭内部を適宜部位21～26ごとに多種類の織り組織及び意匠・模様によって織り立てた一枚の布で構成している。織り組織は、比較的厚手のジャガード織で、シューズの各部位に相応する部分ごとに織り組織を変えて、あるいは意匠模様を変えた柄に織っている。長尺基布1には、シューズの片足分の主たる胛被2の全部を織り、これに連続して中敷布3、および少し離してシューズの舌片状カバー4を織り込んでいる。中敷布3は、足底型を略斜め半分に分割して主たる胛被2の輪郭線に連続して左右に形成している。分割形成された中敷布3は、主たる胛被2が足型に立体化されたときの3次元的折り込みと縫合で足底の形となる。また舌片状カバー4は、主たる胛被2の内部に縫合される。この実施例では、長尺基布1に、主たる胛被2と中敷布3、舌片状カバー4を適宜位置に配して、連続模様長尺織物として形成している。主たる胛被2と中敷布3と舌片状カバー4とはそれぞれその輪郭線20・40で裁断され、2つのパーツ部品を形成する。前記主たる胛被2は、織り組織の糸本数が、250本／インチ以上からなり、かつ一の柄を25cm²～80cm²で構成している。この糸本数は、スポーツシューズとしての強度の要請にかなうために好適な範囲であり、一つの柄は25cm²～80

㎝² 位にするのがデザイン上ばかりでなく柔軟性や強度を維持するのに好ましい。

【０００８】織り糸は、ひっかき耐摩耗性、耐候性、弾性、柔軟性に優れた素材が選定され、主たる胛被２と中敷布３、舌片状カバー４を打ち抜き裁断して、極力少ないパーツを作成する。

【０００９】図３は、裁断した主たる胛被２を示すもので、全体が一枚の織物であって、その中のそれぞれの柄１０～１８は、異なる織り組織・異なる模様で形成されている。例えば、つま先先端部１０は、糸本数を多く密度の高い織り組織で形成し、上面１１は通気性の高い織り組織で形成して、シューズの各部位に適応した織り組織を用いる。なお織り糸にナイロン繊維を混紡しておいた素材等によって、輪郭線を加熱裁断をすれば裁断線が溶融してほつれない。

【００１０】このように構成された主たる胛被２は、その最後方部の縫製結合部１９をあわせて縫合され、立体的なシューズの胛被になる。

【００１１】図２の長尺基布１を織りあげると、主たる胛被２と中敷布３、舌片状カバー４のパーツ部品だけでシューズの胛被部品が調達できることになり、そしてパーツの縫合作業は、極めて簡略化されることになる。主たる胛被２は、厚さは適宜でよいが、実施例では略平均２㎜である。

【００１２】図に、主たる胛被２の形状は、コンピュータにより種々の設計・デザインが可能であり、織機にパターンやソフトを指示することにより、少数個の生産にも量産化にも適応できる。

【００１３】

【発明の効果】以上の構成である本発明に係るシューズ用胛被材は、材料調達上有利であり、製造上もその工程が簡略化でき、シューズの製法を大きく変革することになる。そして次のような特有な技術的効果がある。

【００１４】①シューズは、履く人の足の個性にあわせて作成されるのが好ましいが、パーツ部品で規格化して量産してゆくと、その個性に適合したシューズができにくいが、ジャガード織り生地の場合は、織機に接続するコンピュータにパターンや大きさ・足甲の形状の特性などを入力すれば、材料の時点から履く人に適合したシューズを作成できる。

②一枚の主たる胛被で、作成するので、従来のような多数のパーツの縫合という作業が省略でき、作業工程が大幅に短縮できる。そのため熟練技術者を多く要しない簡素化ができ、かつ作業時間の短縮化ができ、製造コストを引き下げることが可能である。

③一枚の主たる胛被で作成されているため、軽量化ができる。

④糸本数の設定と、一つの柄の大きさの設定、一つの柄の配置や形状が自由にパターン化できるので、各部位ごとに要請される強度や柔軟性に、しっかりと対応できる。

⑤縫合箇所が極端に少なくなるので、防水性は従来品に比してたいへんよくなり、またシューズ表面にかかる負荷も分散できるので破損も少ないものとなっている

【００１５】このように、本発明に係るシューズ用胛被材は、布製のスポーツシューズの製法を大きく変えるもので、流行のデザインや柄などを容易に形成できるばかりでなく、材料の定型化、製造工程の簡略化、製造時間の短縮化など、製造上の優れた経済性を達成するものであり、製造コストの低廉化に寄与することができるきわめて有用な優れた発明である。

【図面の簡単な説明】

【図１】本発明に係るシューズ用胛被材の一実施例を示すもので長尺基布に織り込んだ状態を示す平面図。

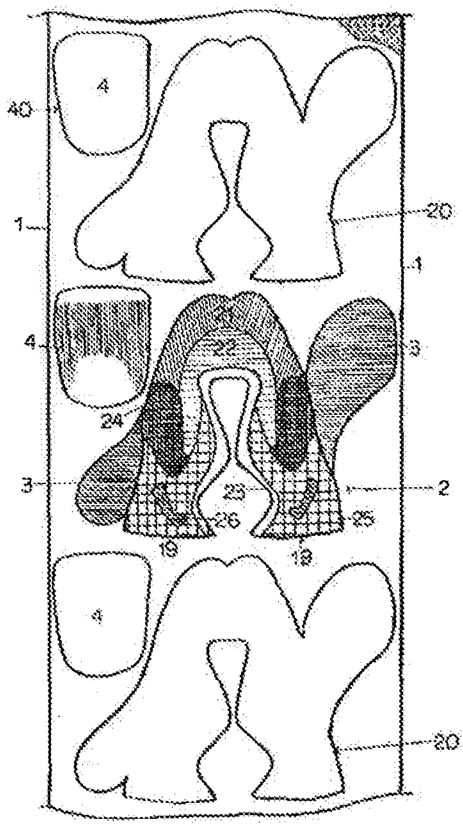
【図２】従来のパーツ化したシューズ用胛被材の縫合前の平面図。

【図３】本発明に係るシューズ用胛被材の他の実施例で、主たる胛被を打ち抜いた状態平面図。

【符号の説明】

１	長尺基布
２	主たる胛被
３	中敷布
４	舌片状カバー
１０～１８	柄
１９	縫製結合部
２１～２６	主たる胛被の輪郭内部の部位
２０・４０	輪郭線

【図1】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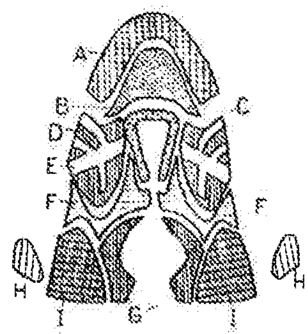
【図2】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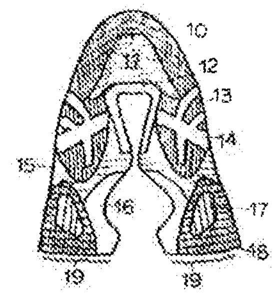
【図3】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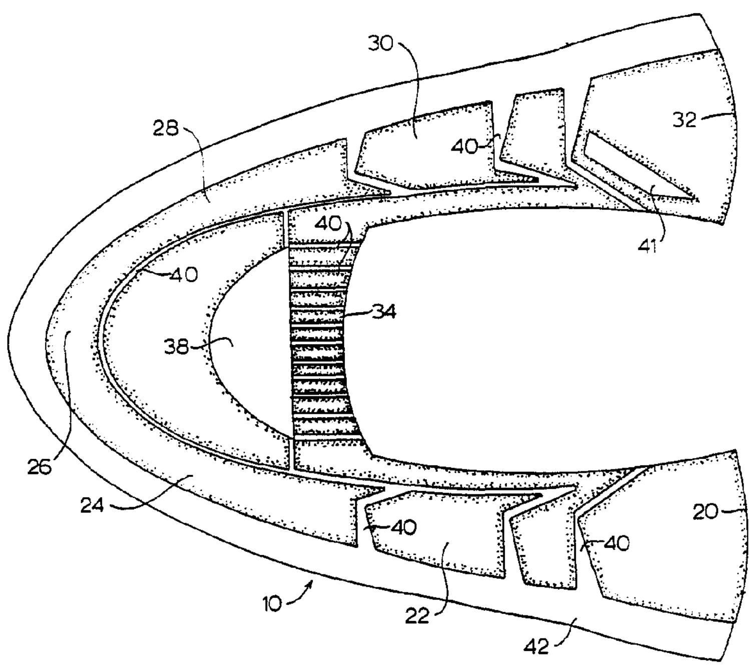

(57) Abstract

A labor-saving shoe making process provides multilayered, heat embossed, shoe components including a one-piece upper. The components comprise a resilient foam layer and other layers for flexibility, strength and durability. Embossing of the shoe components serves to reduce the thickness of the material, provide sealing of the material, provide form and shape to the shoe, and allow strain control management. The connecting of shoe components is accomplished in part through the use of thermoplastic rivets which are heated and melted by the application of a high frequency field.

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HEAT EMBOSSED SHOES

Background of the Invention

The process of shoe manufacturing is generally very labor intensive and the most expensive component of the manufacturing process today is labor. For a particular shoe style, after the pattern is made for all sizes and the production schedule of manufacturing steps is determined, the labor-intensive assembly process occurs. The assembly process for a shoe having its specific design and number of pieces begins with the process of cutting the upper material. With a more complicated shoe pattern or with more pieces in the shoe design, more elaborate cutting procedures must be designed to minimize waste of materials.

In a typical shoe manufacturing process, after the upper pieces are cut, they are prepared for stitching in the fitting process. The upper pieces are first marked for stitching. The edges of the pieces that are to be joined to other pieces must be reduced in thickness in the skiving process in which a machine cuts a bevel on the edge of the material on the flesh side, or underside of each piece. Some or all of the upper parts, particularly thick leather uppers, may also need to be reduced in thickness or made more even in thickness by a "splitting" machine. Each of these steps requires handling of the individual upper pieces and skilled manipulation to achieve the desired change in the upper.

After the upper pieces are prepared by skiving and splitting, in a typical process, the interlining is cemented to the upper in the doubling process to add thickness and to improve the comfort and smoothness of the interior of the shoe. This requires careful alignment of the interlining and the upper. To further improve the comfort and to add strength, the insides of the seams are often "rubbed" to reduce their bulk and then reinforced with fabric tape that is adhesive coated. Similar fabric tape is also often applied to the edges of the uppers that are around the top of the shoe opening. Each of these top edges as well as other visible edges may also have cement applied to them prior to folding them into a narrow fold and heat-cementing or stitching the fold in place to provide a neat appearance to the edge.

If the shoe has eyelets, these are applied by a machine that punches, spaces, and aligns the holes and sets the eyelets in the appropriate place. The eyelets then are laced by a machine with thread so that the piece(s) are held in the correct position in the subsequent steps.

The upper pieces are stitched together after or during the fitting process depending on the manufacturing steps for the particular shoe. The stitching process may be by machine or by hand and may include reinforcement stitching at the front corners in laced shoes and decorative stitching.

In the final segment of the traditional shoe manufacturing process, the uppers are then shaped over a last (a shoe form shaped like a foot). A variety of lasting techniques may be used to assemble the upper and interlining over the last and to fasten them to the insole. In this process the heel, toe and side portions of the shoe upper are pulled into place around the last so that they are in the desired shape of the final shoe product. The shoe upper may then remain in that pulled position for several days to set the shape.

Alternatively, the position of the upper may be set by a heat setting process. The bottoms of the shoes are added in the "bottoming" process by cementing, molding or sewing. Laces are then added and the product is boxed and warehoused.

Summary of the Invention

Provided with the present invention is a component of a shoe comprising a multi-layered material embossed in a manner which serves several functions, including but not limited to closing or sealing of edges, incorporation of functional design or pattern lines to facilitate flexing for contouring to maintain shape, and for strain management. The embossing seals the layers of the material together at the edge and reduces the thickness of the material in the embossed regions. One layer of the multi-layered material is a breathable porous foam which, when subjected to heat, or other forms of fusing energy, becomes viscous to a point that an internal bonding of the foam cell matrix is accomplished.

The shoe component is any one of a number of different elements of the shoe. Possible components include an entire one-piece upper or overlay portions. The shoe component may have embossing away from the edges of the material, such as embossing to facilitate design or pattern. Such embossing serves to control shape and texture of the shoe component, and may additionally serve to provide specific strain performance factors in end use application.

Also provided in the present invention is a method of fastening together portions of a shoe. The method involves aligning the shoe portions and inserting a thermoplastic connector through the material of the shoe portions. The thermoplastic connector is then subjected to sufficient energy to soften the thermoplastic connector. The shape of the connector is then deformed such that when it hardens its new shape restricts the shoe portions from separating from one another.

The first thermoplastic connector may be inserted through a second thermoplastic member as well as the aligned portions of the shoe. The connector may be subjected to a high frequency electromagnetic field of sufficient energy to melt the two pieces of the connector to the point that they adhere to one another, thus securing the shoe portions together.

Brief Description of the Drawings

Figure 1 is a sectional perspective view of the layered upper material prior to heat embossing.

Figure 2 is a sectional perspective view of the layered upper material after heat embossing.

Figure 3 is a plan view of a first embodiment of an embossed pattern for an upper.

Figure 4 is a plan view of a second embodiment of an embossed pattern for an upper showing one side of the upper.

Figure 5 is a plan view of a third embodiment of an embossed pattern for an upper.

Figure 6 is a plan view of a fourth embodiment of an embossed pattern for an upper.

Figure 7 is a plan view of a fifth embodiment of an embossed pattern for an upper.

Figure 8 is a perspective drawing of a shoe made from the first embodiment of the upper.

Figure 9 is a schematic drawing of placement of uppers in a multiple-upper cutting pattern.

Figure 10 is an elevational view of an embossing mold as used in the process of the invention.

Figure 11 is a partial sectional side view of the upper material on the bottom mold plate prior to embossing.

Figure 12 is a partial sectional side view of the upper material on the bottom mold plate after embossing.

Figure 13 is a perspective view of a mold used according to the process of the invention.

Figure 14 is a side view of a shoe having a quarter overlay secured by a thermoplastic rivet.

Figure 15 is a side view of the thermoplastic rivet of Figure 14.

Figure 16 is a plan view of a one-piece upper used in the shoe of Figure 14.

Figure 17 is a side view of a shoe having a quarter overlay, a forefoot stabilizer, and a tougue secured by thermoplastic rivets.

Figure 18A is a plan view of the one-piece upper used in the shoe of Figure 17.

Figure 18B is a cross section of Figure 18A.

Figure 19A is a plan view of two quarter overlays of a thermal plastic urethane material.

Figure 19B is a cross section of Figure 19A.

Figure 20A is a plan view of a forefoot stabilizer of a thermal plastic urethane material.

Figure 20B is a cross section of Figure 20A.

Figure 21A is a plan view of two quarter overlays of a heat embossed foam/fabric material.

Figure 21B is a cross section of Figure 21A.

Figure 22A is a plan view of a forefoot stabilizer of a heat embossed foam/fabric material.

Figure 23A is a perspective view of a thermoplastic fastener.

Figure 23B is a side view of an unfolded thermoplastic fastener.

Figure 23C is a rear view of a shoe upper partially fastened at the heel by a thermoplastic fastener.

Figure 24 is a side view of a casual shoe embodying the present invention.

Figure 25 is a plan view of a main upper portion used to form the shoe of Figure 24.

Figure 26 is a plan view of a quarter overlay in the shoe of Figure 24.

Figure 27 is a cross sectional view of the overlay of Figure 26 taken along line 27-27.

Figure 28 is an alternative quarter overlay.

Figure 29 is a side view of a shoe using the upper of Figure 28.

Detailed Description of the Preferred Embodiments

The present invention comprises a method for making shoes and shoe components and the shoes and shoe components made by this process.

Most types of shoes may be made with the method of the invention. Thus, flat heeled shoes, high-heeled shoes, and shoes with buckles, straps connected to both sides of the shoe and extending across the top of the foot, lacing, velcro attachment straps or other fasteners may be made with the process of the invention. Additional decorations or cut outs may also be added to the basic show pattern.

As shown in Figures 1 and 2, the upper 10 is preferably comprised of a plurality of layers and most preferably of three layers. Additional layers may be added for durability or strength. A process known as a combining process which is well known in the footwear manufacturing field, may be used to make a layer of fabric adhere to each side of a foam core 12 layer. In the preferred embodiment, the layers are held together by neoprene cement. The bottom sheet (lining) is placed in a mold and coated with cement and then the foam layer is placed on the lining. Finally, another layer of cement is applied and the fluid layer is added. The mold is then closed to press the layers together. Other methods of layer formation may be used.

In a preferred embodiment, the layers are held together by adhesive systems of a thermo-set (cross-linked) nature. However, adhesives in the thermoplastic family may also be used providing they exhibit melting properties in excess of the process temperatures associated with the other components of the material. Alternatively, flame lamination techniques can be used which eliminate the need for adhesives altogether.

A preferred core material 12 is a foam product of the polyurethane family of an ether origin (i.e. polypropylene glycol), which is treated with a diisocyanate in the presence of water and catalyst agents. Density of preferred foams run 1.5 - 4.0 lbs/ft but foams of higher and lower density have application in some end use catagories. Many foam core materials originate from variations inside of the polyurethane family. Others utilizing polymer backbones which fall outside the polyurethane group can also be used as core materials.

In one preferred embodiment, the outer layer is a warp knit fabric classified as "tricot." The term refers to a fairly wide range of finished goods, some of which are acceptable in a shoe molding process, and some which are not. In particular, two bar knits such as full tricots and warp lockknit have shown particularly good characteristics with regard to the molding process as well as end use.

In another preferred embodiment, the outer layer is a weft knit fabric of jersey, rib, or purl designation. Variations of the jersey designation show particularly good properties due to their dimensional equality in elasticity. Many other variations of weft knitted fabric have also shown good success in the process and end use.

In still another preferred embodiment, the outer layer is of the woven classification. In utilizing woven structure fabrics in the fabrication process, success is more dependent upon yarn schemes than in knit fabrics. While a characteristic of knitted structures is fabric stretch or elasticity, wovens possess lower stretch values due to the somewhat linear relationship between fabric and yarn width/length. Therefore, in utilizing woven materials in the process, it is necessary to focus on yarn elasticity properties. Methods of incorporating elasticity in yarns are well known and may include texturing or using bi-component or bi-constituent yarn or fiber.

A different preferred embodiment uses an outer layer made of a product of the leather designation. Such leathers may be derived from cow, steer, bull, water buffalo, pig, calf, etc. Hides can be tanned by methods which produce leather products compatible to the shoe fabrication method of the present invention. Considering the durability of general leather products, a property necessary to use leather successfully is multi-directional extension with a low corresponding loss of basic strength properties such as tear. In one application, this is accomplished by splitting the leather hide down to relatively low gauge (0.4 - 0.6 mm.) and laminating the resulting veneer to a substrate of substantial properties. Substrate nomination is contingent upon final component requirements.

In another preferred embodiment, the outer layer is of synthetic polymer products such as polyurethane, P.V.C., or synthetic rubbers, in either cellular or solid state. Industrial processes may be used to to fabricate products that use synthetic skins or coatings on a fabric substrate. Two such methods used extensively in the industry are "wet" and "dry" processing. Because of their low cost, such materials can be engineered in a multitude of methods to produce a wide range of physical properties and appearances.

Considerations governing choice of inner and outer layer materials include embossability of the outer layer, which includes scorch resistance to heat but also requires ability to take the embossing and retain the form in conjunction with the foam layer; sufficient tear strength of one or both layer; comfort of the inner layer; durability of both layers; appearance of the outer layer; and flexibility of both layers.

The uppers 10 are cut from the embossed, layered material using a variety of methods. These include, but are not limited to, standard knife edge die, knife edge gang die, dual function mold/die method, automated vertical die cutting, automated roller die cutting, automated laser method, and template/guide automated cutting. The die or template may be designed to cut one or more uppers at a time.

One example is the spacing of four upper patterns 18 as shown in Figure 9 on a single cutting die or template guide will allow interlocking of the patterns on the upper material and will minimize material waste. Generally, a square sheet of material about the size of the mold is used. After embossing, the embossed sheet is demolded and the molded upper is then cut out of the square sheet. A gang cutting die with a template guide is generally used for a multi-cavity mold.

The shape of the upper 10 is constrained by the shape and size of the foot but may be designed for a wide variety of shoe styles. As shown in Figure 3, beginning on one side of the shoe, the one-piece shoe upper 10 extends in a "U" or "V" shape from a first central back side 20 of the upper to a first shoe side 22 to the first side front 24, to the toe area 26; and then the second side extends in mirror image to the first side from the toe area 26 to the second side front 28, the second shoe side 30 and the second back side 32 of the upper 10. The dotted line in Figures 4-7 show the central point on each side of which the shape of the shoe is a rough mirror image of the other side, the difference between sides being that the shoe side 22 or 40 which is on the inside of the foot may be cut with a small indentation or other variation to assist in lasting the side of the shoe that will be on the inside of the foot. A strap 34 may extend over the top of the foot connecting the sides 22,30 or the side fronts 24, 28 (Figures 3 and 4); or each side may have a laceable strap 36 (Figures 5 and 6) or a strap from the other side. The upper 10 over the top of the foot may be solid without a cut away area 38 or there may be no strap(s) at all (Figure 7).

Before the layered material is cut (trimmed), it is placed in a heat molding press to emboss a design 40 on the material and to flatten the edges 42. The embossing process heat-fuses the edge seams including the upper edges 48 thus making the multi-layered material totally enclosed without stitching the edge seams and thus enables the labor-saving use of the one-piece upper.

Embossing 40 in the toe area 26 and side fronts 24,28 (Figure 3) helps maintain the toe box shape and embossing lines 40 on the strap 34 help curve the strap across the instep. Additional embossing adds to the rigidity of the shoe upper so that it better retains a desired shape. All of the embossing may be shaped for aesthetic styling. Edge 42 is the lasting margin that is lasted under during the lasting process. A logo may be placed on the shoe in a logo area 41 embossed on the shoe. The design may be formed on any portion of the shoe. In Figures 3-7, a variety of side designs are shown. The design may extend across the strap 34 as shown in Figures 3-4. It is important to note that the heat fusing and embossing of a design on natural materials such as cotton or leather as well as on nylons, polyesters, and other synthetic materials to form a three-layered laminate shoe upper is a unique and important aspect of this invention.

Embossing additionally serves to manage strain in end use. Since embossing lines are used extensively to create designs and patterns, it is possible to use these points, or add additional points which become part of the design pattern. This embossing then serves to control upper component strain by "locking off" outer shell or substrate fiber length. This technology serves to provide the shoe designer with unlimited control over shoe upper end use dynamic properties, by allowing extensive adjustment of specific modulus properties in locations of stress and associated strain. For example, it is well known that basketball shoe top collars which are properly functional stretch to a degree to allow the wearer a snug fit around the lower portion of the leg when fully laced. However, the shoe portions known as the in/out quarters, when properly engineered, require stretch properties which are considerably less than those of the top collar. By using the described method, a shoe designer may make function an inherent part of the shoe design. The method allows function to be incorporated into the shoe in the fabrication step itself.

A typical embossing mold 100 which is used in the process of the invention is comprised of hydraulic cylinders 102 and 104 that drive a top press plate 106 against a bottom press plate 108, while mold 110 is located in between (Figure 10). Both of the press plates 106,108 contain heating elements 112 and 114. The heating elements 112,114 heat the press plates 106,108 which in turn heat the top mold plate 116 and the bottom mold plate 118 to the desired temperature. It is important to note that it is possible to use different temperature settings between the top press plate 106 and the bottom press plate 112 during the molding operation. This allows the top mold plate 116 to be either a higher or lower temperature than bottom mold plate 118 of mold 110 during the same molding process, thus allowing a more heat sensitive material such as thermoplastic urethane or PVC to be used on one of the surfaces.

For example, Figures 11 and 12 show partial cross sections of mold 110 and an upper prior to and during the embossing process. The use of mold alignment pins 120 on one of the mold plates as shown in perspective view in Figure 13 and mold pin alignment holes 122 enables proper alignment of the mold plates 116, 118. If outer layer 14 happens to be a heat sensitive material such as PVC, mold press plate 106 may be set at a lower temperature so as not to heat top mold plate 116 above the softening point of layer 14. The temperature of bottom mold plate 118 may or may not need to be increased to compensate for the lower temperature of top plate 116 in order to achieve the proper heat fusing of layers 14 and 16 to foam core 12. After the desired heating time, the top press plate 106 is raised and the embossing mold 110 is removed. The embossed, molded upper is removed and is ready for trimming of the excess material. In a preferred method of the invention with polyurethane foam, a three minute heating cycle at 200 degrees C is used. This temperature, in the presence of molding pressure, is adequate to accomplish internal cell wall bonding. Such bonding is a consequence of the heat and pressure which renders the cell matrix viscous to a point of internal tack. This internal tack accomplishes setting of the areas of embossing. Although the heating of the foam is likely to be to a temperature less than its melting temperature, the embossed regions are here referenced as melted regions. Leather products, fabrics of natural and synthetic fiber, and synthetic material of P.V.C or polyurethane in combination with the foam can withstand this heating treatment without distortion or degradation of original physical properties.

As an alternate method of embossing, ultra-sonic, or high frequency welding techniques could be used for embossing materials such as certain plastics that are not porous or discontinuous and have the requisite characteristics to enable embossing upon exposure to the high frequencies. High frequency heat is produced by using a transformer to raise the main voltage, a rectifier to change alternating current to direct current, and an oscillator valve to stop and start the current at speeds of about 28 million cycles per second or greater, to establish a field between two metal plates.

High frequency heating differs from radiant and conducted heat in that the temperature is raised uniformly throughout a material without a necessary waiting period for heat to spread from an exterior heat source to the interior of the material. In using high frequency heating with the invention an oscillating electronic field is created between two surfaces between which is positioned the upper material. Exposure to this field results in movement of the molecules in the upper and uniform generation of frictional heat throughout the upper. The use of a high frequency heating field plus pressure from the protruding portions of a mold result in the embossed design on the upper. The mold may also be used to cut the perimeter of the upper by having a raised edge around the outside edge of the mold.

High frequency welding with a welding die also may be used to fuse two pieces of material, such as the two back edges of the upper, or to add extra components to the upper (such as a tongue, trim, buckles, etc.). High frequency (HF) welding is particularly suited to such materials as PVC and would allow the fusing of color pigments or appliques to the embossed areas.

After the upper 10 is completely embossed, a back strip 44 is attached to the back sides 20, 32 of the upper 10 using stitching methods known in the art as shown in Figure 8. The back strip 44 may be a straight narrow strip of 3/8 to 1/2 inch width and approximately double the length of the backside so that it may be sewn to both the inside and outside of the back shoe seam forming a fold 46 at the top edge 48 of the shoe 50. Alternatively, the back strip 44 may only be placed on the exterior to the shoe 50. The back strip 44 may also be decoratively designed in color and/or shape. If the back strip 44 is omitted, an alternative method of attaching the back sides of the upper, such as overlapping the back sides and stitching, or heat embossing the two sides together may be used.

According to a method of the invention, the shoe 50 is lasted with any of several conventional techniques. Preferably, of these techniques, cold cement lasting is used because it is the simplest lasting method and is less costly than others, but California lasting (full sock lasting) may also be used. The insole board that is used is preferably made of non-woven, cellulose base fiber board prepared by conventional techniques, but it may be made of other hard or soft fiber lasting boards. The sock liner preferably is made of Tricot-covered rubber sponge, but it could be made of any fabric-covered cushioning material. When the shoe is lasted, lines A and B are aligned in parallel in shoes with a strap 34 (Figure 3).

Following attachment of the back strip and lasting, the bottom 52 of the shoe is attached, preferably by a cementing method. Cold cementing is preferably used because it is inexpensive and simple. The bottom 52 is preferably made using molded ethyl vinyl acetate (EVA) by methods known in the art; however cut EVA may be used as may thermal plastic rubber. Other bottoming methods that do not entail the cement process may be used. These would require "direct-attached" polyurethane or thermal plastic rubber. Both of these latter techniques require California lasted shoes.

A preferred embodiment of the invention involves preparation of a three layered upper having an outer layer which is a warp knit, weft knit, woven fabric, leather product, or synthetic coated material. The central layer of the material is a polyurethane foam, and the inner liner may be any one of a number of materials. The laminate is heat embossed at 200 degrees C for approximately three minutes, after which the backsides of the the upper are attached together by means of stitching to a back strip. The upper is then lasted and attached to the bottom of the shoe by cold cementing or other conventional means.

A number of different components of a shoe may be made using heat embossing methods such as those previously described for the one piece upper. The heat embossing of shoe components is decorative as well as functional in several ways. For a multi-layered material having a layer of porous foam such as polyurethane foam, the heat and pressure of the heat embossing selectively causes the inner cell wall matrix to become viscous to a point that the resulting tack is adequate to accomplish bonding. Thus, when heated, the polyurethane foam becomes a strong bonding adhesive which adheres firmly to surrounding material. For a material having the foam as a central layer between two outer fabric layers, the embossing serves to firmly seal the three layers together. The shoe components of the present invention are embossed along the edges and are thus sealed along the edges, removing the need for any edge stitching to hold the material layers together.

Another function of the heat embossing is to reduce the thickness of the material in the region of the embossing. Since shoe components are often joined at the edges, it is desireable to have the edges relatively thin compared to the rest of the material to prevent from forming an unusually thick region of the shoe where the connected shoe components overlap. Heat embossing along the edges of a shoe component provide this thinner region without the necessity of skiving, which is the traditional method of edge thickness reduction.

Shown in Figure 14 is a side view of a typical shoe 130 made with a heat embossing process. The shoe 130 has a heat embossed upper 132 and a quarter overlay 134 which is also heat embossed. The edges of the overlay 134 are embossed to reduce and seal them, while a more central region 135 of the overlay is embossed to hold eyelets 136, which in turn hold the laces of the shoe 130. The overlay 134 is stitched to the lasting margin of the upper and may be additionally secured by a thermoplastic rivet 138. During assembly, the two-piece rivet 138 is passed through aligned holes in both the overlay 134 and the upper 132.

A side view of thermoplastic rivet 138 passing through two pieces of material 139,141 shown in Figure 15. Front rivet plate 140 has two pins 142 which fit into the receiving holes 146 of back plate 144. Heating of the thermoplastic rivet 138 causes the two pieces of the rivet to melt and bond together forming a secure ,, permanent connection. This heating is preferably done with a high frequency electromagnetic field, which is particularly good for providing uniform heating of the thermoplastic material. Alternative heating methods such as ultrasonic heating or thermal welding may also be used. The pins 142 of the front plate 140 of the rivet 138 may extend through holes 146 and beyond the rear surface of back plate 144. In such a case, pressure applied to the back of the rivet 138 during heating then causes the end of the pins 142 to spread and flatten out along the rear surface of the back plate 144. Thus when the rivet hardens, the pins 142 are even further prevented from moving back through the holes in the back plate 144.

Using certain thermoplastic materials, the thermoplastic rivet 138 may alternatively consist of just the front plate 140. Once the pins 142 pass through the material to be joined, they are heated and the pins 142 are flattened out to restrict the rivet 138 from passing back through the material. Such a deformation of the rivet 138 may be accomplished through the use of a pressure device which applies pressure to the rivet 138 during heating.

Figure 16 shows a plan view of the upper of the shoe in Figure 14. Quarter region 148 is embossed flat to provide a seat for a quarter overlay 134. The lasting margin 150 is also embossed to seal the edge and to reduce the thickness of the lasting margin 150 without skiving. The upper is shown with one of two quarter overlays 134 in place. The other quarter overlay is left out to show the quarter region 148 of the upper, which is embossed flat to accomodate an overlay 134. Embossing this region 148 prevents the shoe from being abnormally wide in the overlapping quarter region of the shoe. Rivet holes 149 are also shown in both the upper 132 and the quarter overlay 134.

In Figure 17 is shown a shoe 152 having an upper 153 and a number of overlay components. A heel stabilizer 154, a quarter overlay 156, and a forefoot stabilizer 158 are each attached to the shoe 152 during a bottoming process. A tongue 160 is also included, and both the tongue 160 and the forefoot stabilizer 158 are attached to the vamp 162 of the upper by way of a thermoplastic rivet 164. In this case the rivet 164 serves to secure both the tongue 160 and the forefoot stabilizer 158, thus providing an economical use of connection elements.

The overlay components 154,156,158 of the shoe 152 of Figure 17 are preferably made by an injection molding process using materials such as thermoplastic elastomers, or in some cases engineering thermoplastics. Some alternatives to the injection molding method include flow molding, casting, and extrusion process. The molded overlays are easy and inexpensive to produce and add support and aesthetic value to the shoe. Other materials such as the foam/fabric material of the upper or a natural material such as leather are also used as overlay material. A combination of different overlay components of different materials is often used on the same shoe.

Both the tongue 160 and the upper 153 of the shoe 152 are formed of a material with a central resilient foam layer. Heat embossing seals and reduces the material in selected areas. Figures 18A and 18B show a plan view and a cross sectional view, respectively, of the upper 153 of Figure 17. The lasting margin 156 of the upper 153 is embossed. Futher embossing of the upper 153 provides seats for the overlays shown in the assembled shoe of Figure 17. Since the non-shaded portions of Figure 18A are the regions depressed by heat embossing, it is apparent that the embossed regions seat the heel stabilizer 154, the quarter overlay 156, and the forefoot stabilizer 156 perfectly. The cross section of Figure 18B shows the relative thickness difference between an embossed region 168 and a non-embossed region 170 of the upper 153.

Figure 19A is a plan view of the quarter overlays 156 and 156' of the shoe 152 of Figure 17 (overlay 156' is not shown in Figure 17). It can be seen from this view that the injection molded components are fabricated in a manner to reduce thickness gauge in the bottom region. These portions of the overlays are turned under during bottoming of the shoe, and it is therefore advantageous to have the thickness reduced in these regions 172. Figure 19B is a cross section of one of the quarter overlays 156, 156' and shows the difference in thickness in different regions of the TPU material. Much of the molded pattern is decorative, but it additionally serves to allow a certain degree of bending movement to the overlay. The mold also gives shape and texture to the surface of the overlay.

Shown in Figure 20A is a plan view of the forefoot stabilizer 158 of the shoe 152 of Figure 17. Like the quarter overlays 156, 156', this particular forefoot stabilizer 158 is made of a TPU material. The forefoot stabilizer is made flat in a central region 174 and at the ends 176 of the extending portions 177. Molded lines 178 in the remainder of the material provide texture and improve bending properties in this region. Holes 180 in the central region 174, support the pins 142 of thermoplastic rivet 138. The cross section of Figure 20B shows the difference in thickness between the different regions of the forefoot stabilizer.

Figure 21A is a plan view of an alternative embodiment of the quarter overlays 156 and 156′ of Figures 17 and 19. Quarter overlays 180 and 180′ still fit within the recessed regions of the shoe upper 153 of Figure 17, but are made of foam/fabric material instead of a TPU. The foam/fabric material is like that previously disclosed for the upper, and is embossed along the edges to seat the material. The quarter overlays 180 and 180′ are also embossed at the bottom portions 182 and in the eyelet regions 184. The eyelets (not shown) are mounted in the regions 184, and the bottom portions 182 are attached to the lasting margin of the upper 153 prior to bottoming of the shoe. The raised non-embossed central regions 186 of the quarter overlays 180, 180′ are instrumental in keeping the shape of the overlays. A cross section of one of the quarter overlays is shown in Figure 21B. From this cross section the thickness difference between the embossed and non-embossed regions of the foam/fabric material is apparent.

The forefoot stabilizer 188 of Figure 22A is similarly shaped to the forefoot stabilizer 158 of Figures 17 and 20, but is made of the foam/fabric material. The forefoot stabilizer 188 is embossed in the bottom regions 190, in the eyelet regions 192, in the rivet region 194, and along the edges. The embossing along the bottom region 190 allows proper attachment to the shoe upper. The embossing in the eyelet regions 192 provides a flat region for attachment of the eyelet (not shown). The embossing in the rivet region 194 provides a flat, recessed region in which the rivet 164 fits, passing through rivet holes 196. The raised, non-embossed region 198 gives shape and texture to the surface of the forefoot stabilizer 188. A cross section of the forefoot stabilizer is correspondingly shown in Figure 22B.

Figures 23A-23C show a folding thermoplastic fastener 200 designed particularly for binding together the left and right heel portions of an upper. The fastener 200 is shown folded up in Figure 23A and partially unfolded in Figure 23B. Two rows of pins 202 on fastener rear plate 204 align with the two rows of holes 206 on fastener hole plate 208 when the fastener i folded over. As shown in Figure 23C, the reduced areas of the heel portions 210 of a shoe upper 212 are punched with holes 214 which align with the pins 202 of the fastener 200 when the heel portions 210 are pulled together. The pins 202 of the fastener 200 are then pushed through the holes 214 of the heel portions 210. The fastener is then closed along a hinge between the rear plate 204 and the hole plate 208, such that the holes 206 in the hole plate 208 engage the ends of the pins 202 sticking through the heel portions 210. Once engaged, the fastener is heated to melt the pin/hole connections such that when rehardened they are permanently secured. Decorative cover plate 216 is hinged to hole plate 208 and is folded over to cover the pin/hole connections. The cover plate 216 has a lip which meshes with a lip on the hole plate 208 to keep it tightly secured when folded over and pressed into engagement with the hole plate 208.

As noted above, the embossing allows for control of stress, contouring and flexibility of various portions o the shoe. Figure 24 illustrates a women's casual shoe which utilizes such functional embossing. The shoe uppe is formed of a one-piece upper, illustrated in Figure 25 and quarter overlays, one of which is illustrated in

thickness of the embossed lines 226 and 228 also allows bending along the embossing lines.

Figure 28 illustrates an alternative quarter overlay, and a shoe incorporating that overlay is illustrated in Figure 29. In this design, stretch from the eyelets to the sole is controlled by the horizontal embossing lines such as 236. Depending on the weave of the fabric layers, some stretching is allowed between the embossing lines. In this design, stretching from the eyelets to the shoe must be limited to a larger extent by the weave of the fabric than in the prior design, but the embossing lines allow for greater flexibility which allows the overlay to fold over the foot more readily.

The invention has great industrial applicability particularly in countries with a labor shortage or where it is essential to minimize labor costs to be competitive. The method of the invention may be used in the shoe manufacturing industry to make durable, attractive, inexpensive shoes through elimination or diminishing of most of the labor-intensive shoe fitting steps, such as skiving, multiple-piece stitching, prefitting, splitting, interlining, and edge taping.

While the invention has been described with reference to specific embodiments thereof, it will be appreciated that numerous variations, modifications, and embodiments are possible, and accordingly, all such variations, modifications, and embodiments are to be regarded as being within the the spirit and scope of the invention.

CLAIMS

1. A shoe comprising an upper portion formed substantially of resilient foam material sandwiched between inner and outer layers, the upper portion being embossed by melted, depressed regions of the foam.

2. A shoe as claimed in Claim 1 wherein the upper portion has an embossed lasting margin.

3. A shoe as claimed in Claim 1 wherein edges of the upper portion are embossed to seal said edges.

4. The shoe component of Claim 1 wherein the resilient foam material is a porous breathable foam which in the presence of heat and pressure transforms internally to a point that the inner cell wall matrix of the foam becomes viscous, providing sufficient tack to accomplish a bonding within the matrix.

5. The shoe component of Claim 1 wherein embossing of the shoe component provides a predetermined functional design pattern on the shoe component.

6. The shoe component of Claim 1 wherein embossing of the shoe component contributes to specific strain performance factors in the shoe component.

7. The shoe component of Claim 1 wherein the embossing of the shoe component contributes to the maintaining of the proper shape of the shoe component.

8. The shoe component of Claim 1 wherein the shoe component is a one-piece upper.

9. The shoe component of Claim 1 wherein the shoe component is an eyestay overlay.

10. The shoe component of Claim 1 wherein the shoe component is a quarter overlay.

11. A component of a shoe comprising a multi-layered material embossed along the edges of the material, the embossing sealing the layers of the material together at the edge and reducing the thickness of the material in the embossed regions.

12. The shoe component of Claim 11 wherein the multi-layered material includes a layer of porous breathable foam which in the presence of heat and pressure transforms internally to a point that the inner cell wall matrix of the foam becomes viscous, providing sufficient tack to accomplish a monogamous bonding within the matrix.

13. The shoe component of Claim 1 wherein the shoe component is further embossed away from the edges of the material.

14. A shoe comprising an upper portion having back sides, sides and a toe area formed from a single sheet of material, the material being selectively embossed relative to the shoe structure such that depressions embossed in the material help maintain a proper shape of the shoe.

15. A shoe as claimed in Claim 14 wherein the shoe comprises a depression curved about the toe area to separate upper and side portions of the toe area.

16. A shoe as claimed in Claim 14 wherein said upper portion comprises a strap formed between sides of the shoe, the strap having transverse depressions thereacross.

17. A shoe as claimed in Claim 14 wherein said upper portion has a depressed lasting margin.

18. A shoe as claimed in Claim 14 wherein upper edges of back sides and sides of said upper portion are sealed by depressions.

19. A shoe as claimed in Claim 14 wherein the sheet of material comprises a resilient foam layer sandwiched between inner and outer layers.

20. A shoe as claimed in Claim 14 wherein the said upper portion has a depressed lasting margin.

21. A shoe as claimed in Claim 14 wherein upper edges of back sides and sides of said upper portion are sealed by depressions.

22. A shoe comprising an upper portion having back sides, sides and a toe area formed in a single sheet of material, the sheet of material comprising resilient foam material sandwiched between inner and outer layers, the material being embossed by melted, depressed regions of the foam to help maintain the shape of the shoe, the depressed regions including a lasting margin and upper edges of the back sides and sides.

23. A shoe as claimed in Claim 22 comprising a depression curved about the toe area to separate upper and side portions of the toe area.

24. A shoe comprising a plurality of heat-embossed, multi-layered shoe portions fastened together with a thermoplastic connector, the connector passing through the material of the connected portions and being such that once heated it restricts separation of said materials.

25. A shoe as claimed in Claim 24 wherein the thermoplastic connector comprises a first member having pins which extend through the material being fastened together, and a second member having holes which engage the pins of the first member while they are extended through said material.

26. The shoe of Claim 24 wherein the shoe portions comprise the left and right heel portions of a one-piece upper.

27. The shoe of Claim 24 wherein the multi-layer composition of said shoe portions includes a central layer of porous foam sandwiched between an inner layer and an outer layer.

28. A method of making a shoe component, comprising:
fabricating the shoe component in a desired shape from a multi-layered material; and
embossing the shoe component in select regions, the embossing sealing the layers of the material together at the edge and reducing the thickness of the material in the embossed regions.

29. The method of Claim 28 wherein said embossing of the shoe component comprises embossing with heat.

30. The method of Claim 28 wherein embossing said shoe component comprises embossing with high frequency energy.

31. The method of Claim 28 wherein said shoe component comprises a one-piece upper.

32. The method of Claim 28 wherein said shoe component comprises a multi-layered material having an outer layer, a resilient central layer, and an inner layer.

33. The method of Claim 32 wherein said resilient central layer is a porous foam which when heated, melts to a bonding adhesive.

34. The method of Claim 32 wherein said outer layer and said inner layer are tricot.

35. The method of Claim 32 wherein said outer layer and said inner layer are woven cotton.

36. The method of Claim 32 wherein the outer layer comprises leather.

37. The method of Claim 32 wherein said central resilient layer comprises polyurethane.

38. A method of fastening together portions of a shoe, the method comprising:

aligning the shoe portions with one another in a desired fashion;

inserting a thermoplastic connector through the shoe portions such that the shoe portions are adjacent one another with the thermoplastic connector passing through each of them;

subjecting the thermoplastic connector to sufficient energy to melt the thermoplastic connector such that when rehardened, the connector restricts the shoe portions from separating from one another.

39. The method of Claim 38 wherein the thermoplastic connector comprises a first member having pins which extend through the shoe portions, and a second member having holes which engage the pins of the first member while the connector is subjected to the melting energy.

40. The method of Claim 38 wherein the shoe portions comprise the left and right heel portions of a one-piece upper.

41. The method of Claim 38 wherein the shoe portions include a tongue.

42. The method of Claim 38 wherein the shoe portions include a portion formed of a multi-layer material, the material having a layer of porous foam, and heat-embossed depressed regions in the material.

43. The method of Claim 38 wherein the shoe portions include an overlay.

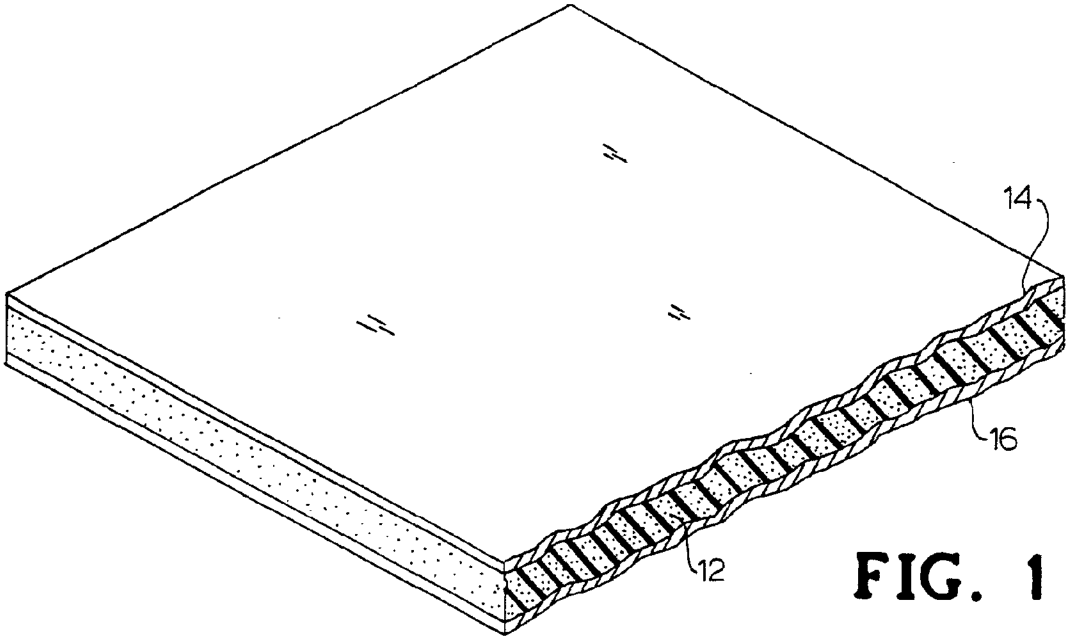

FIG. 1

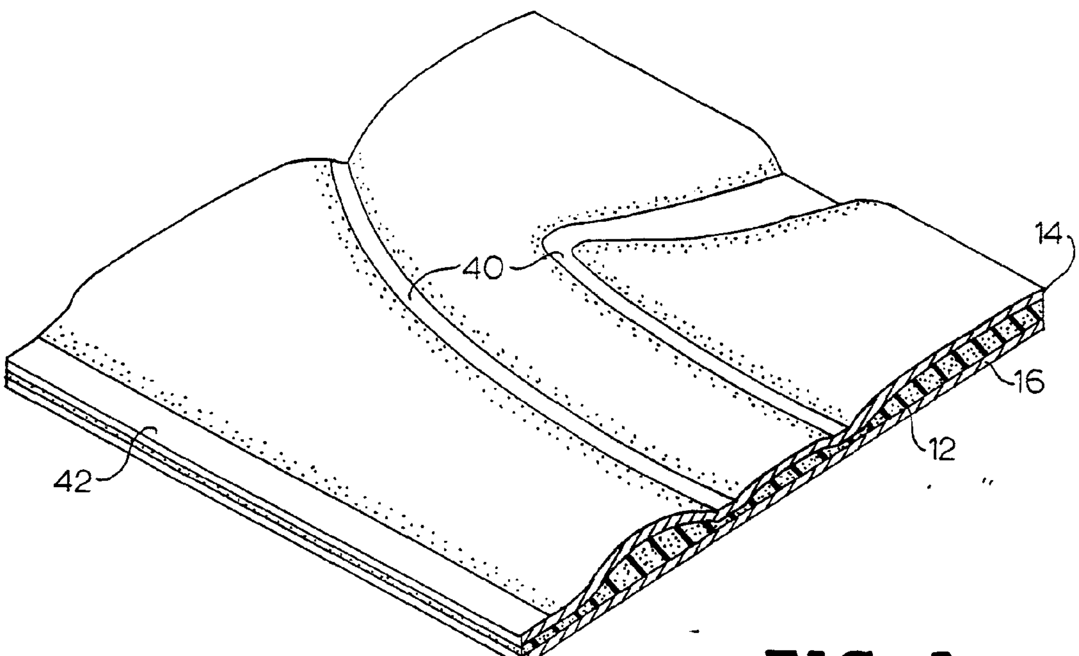

FIG. 2

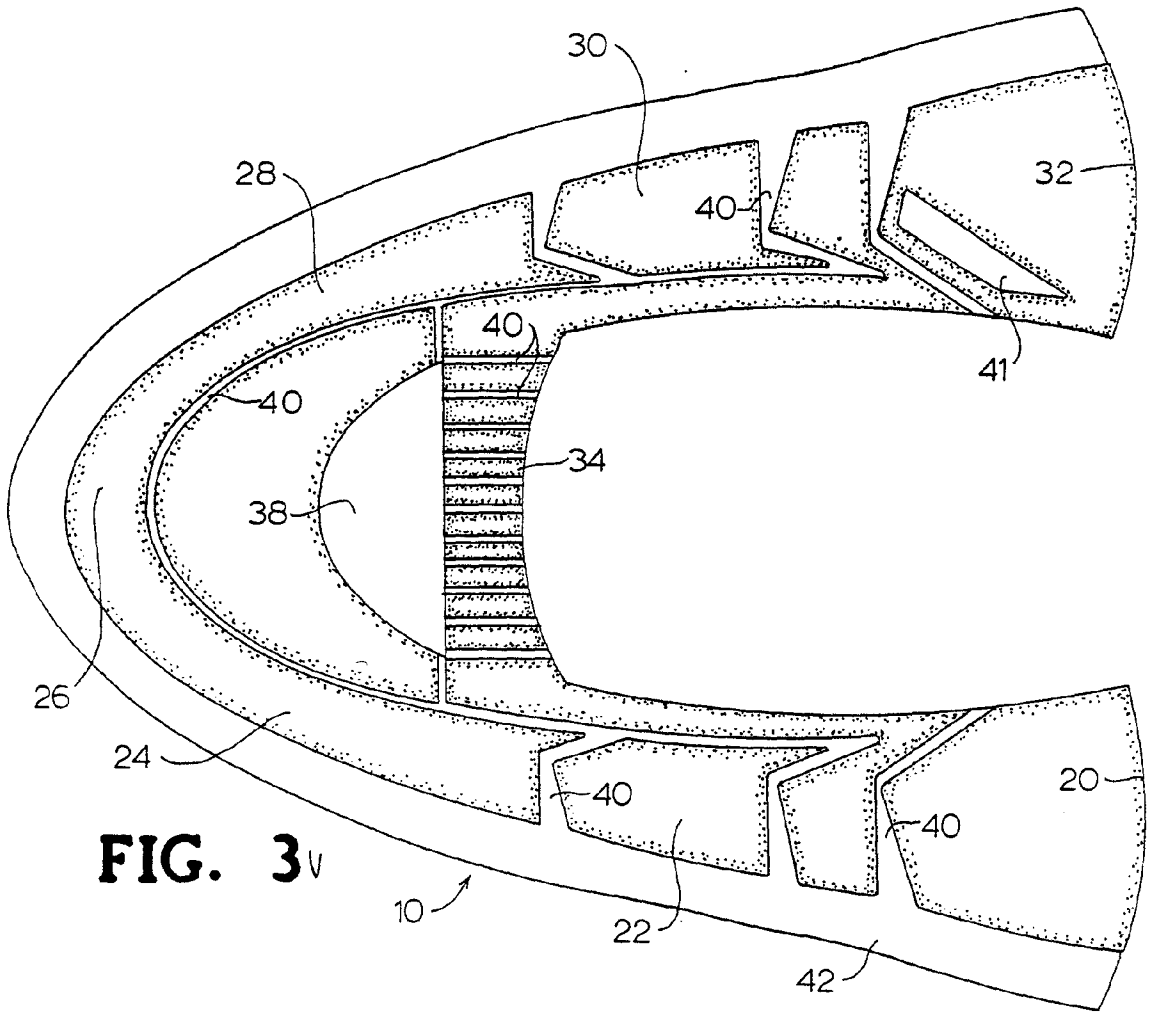
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FIG. 3

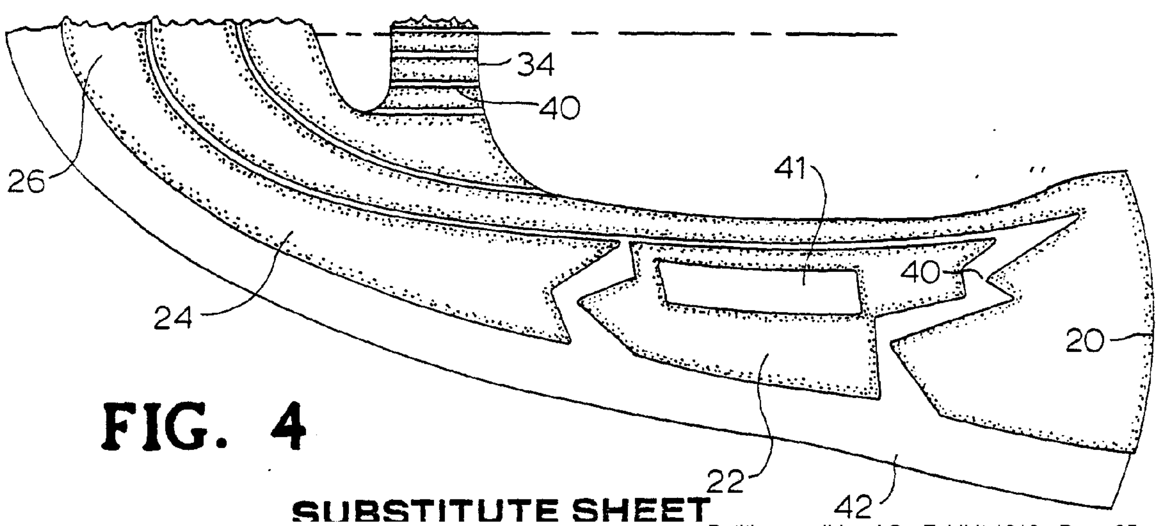
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FIG. 4

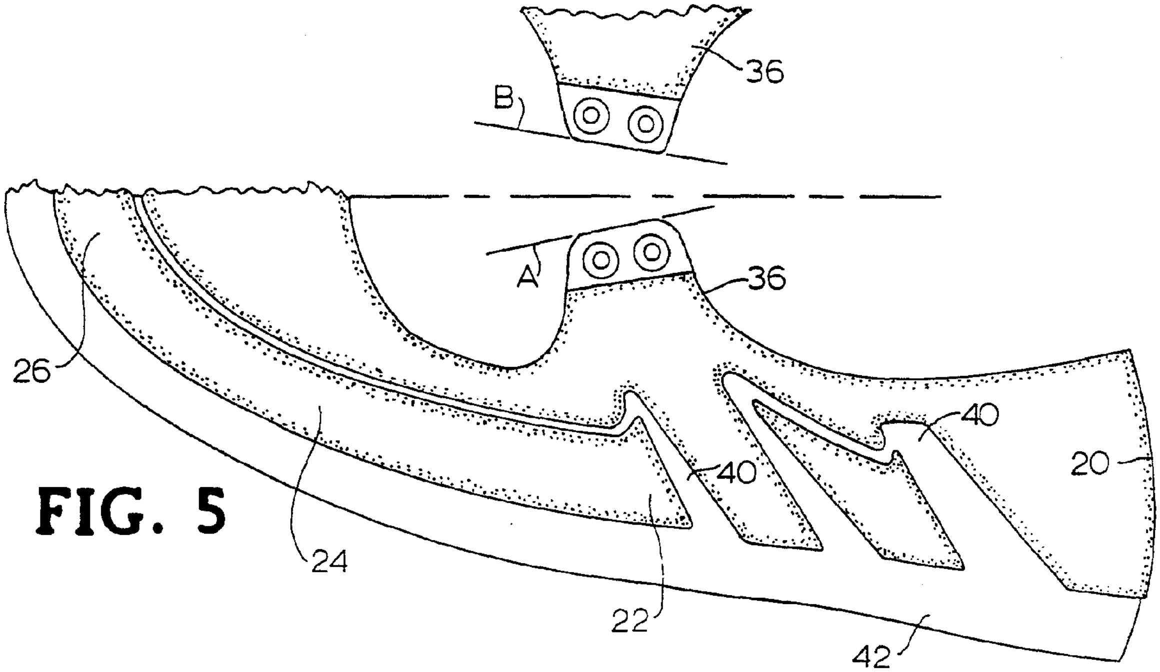

FIG. 5

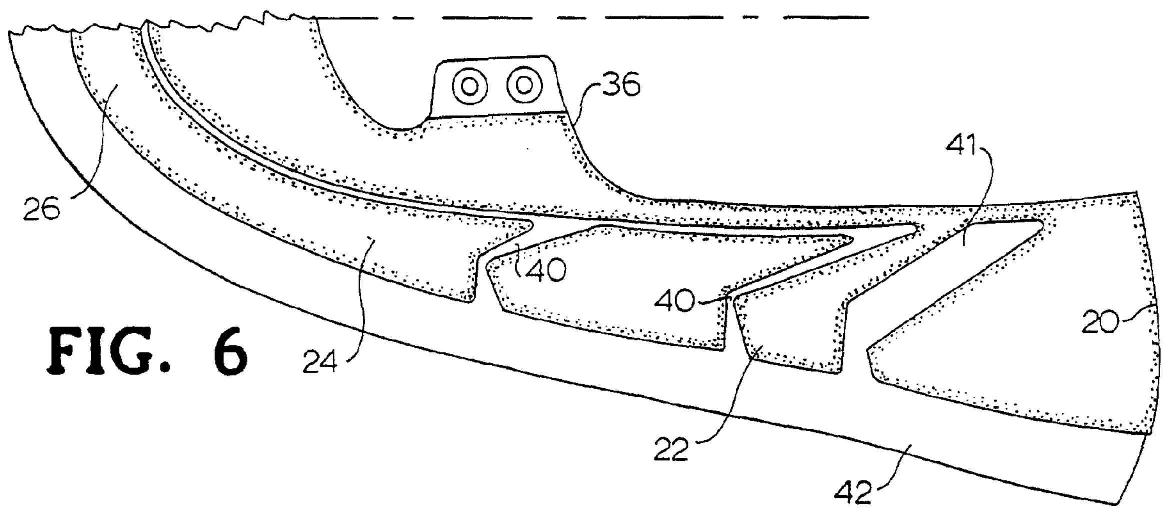

FIG. 6

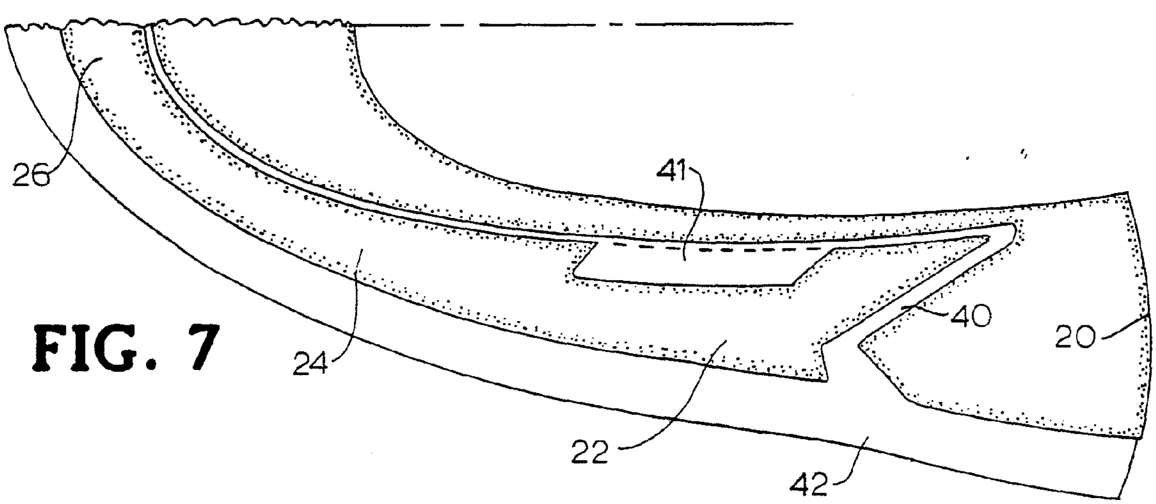

FIG. 7

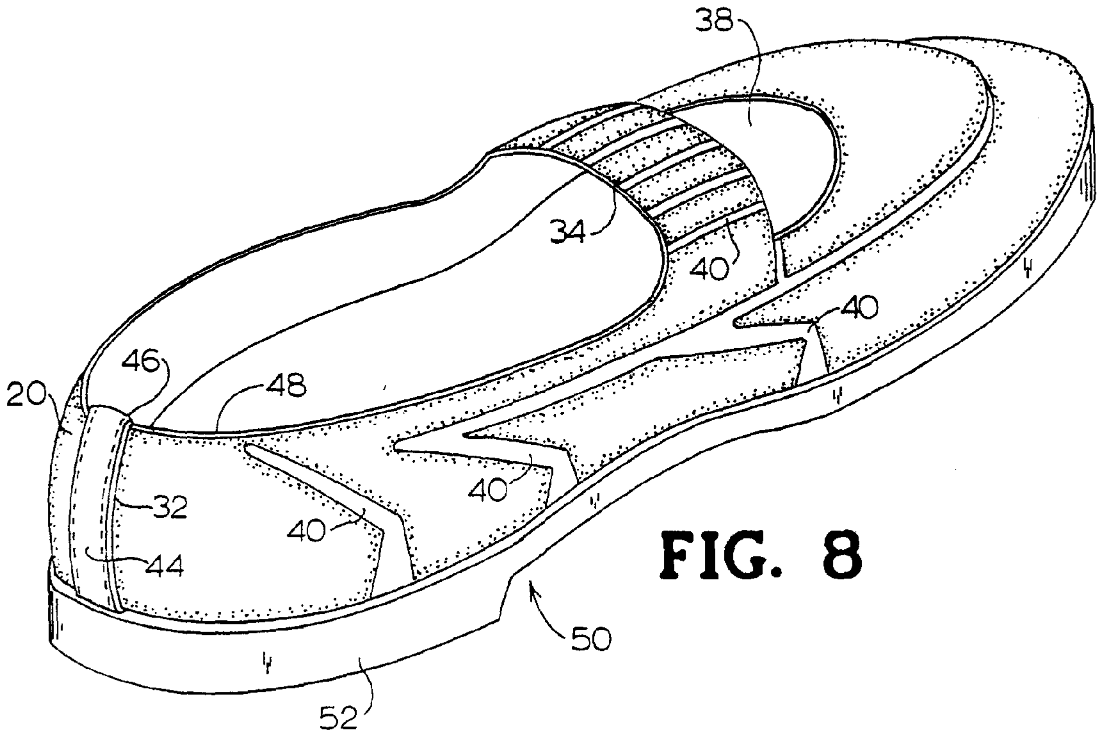

FIG. 8

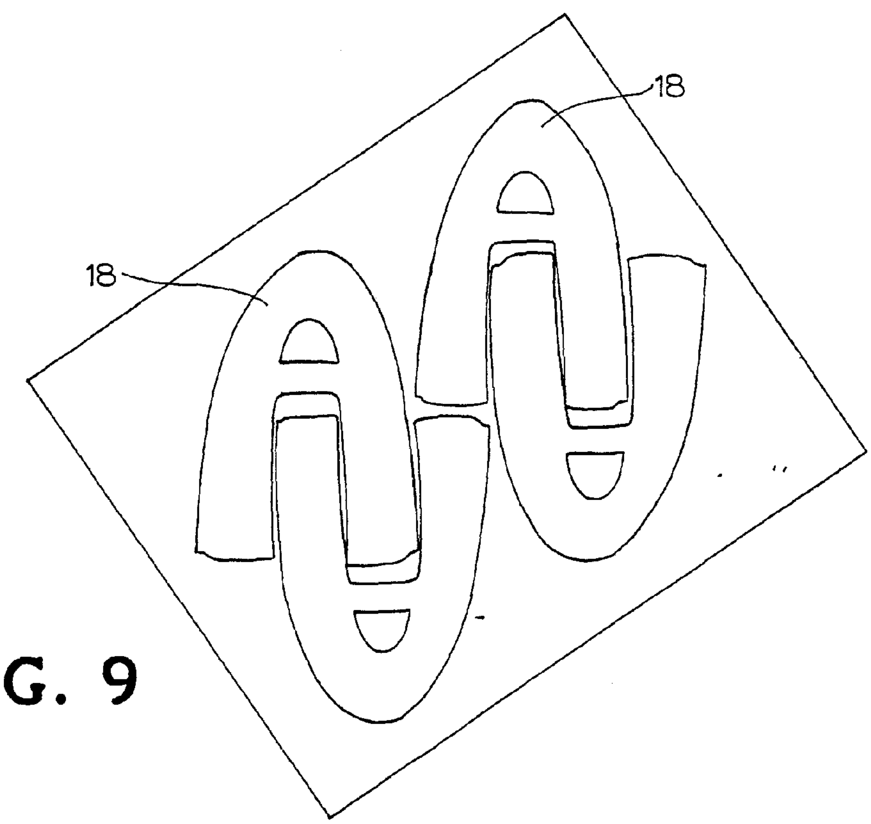

FIG. 9

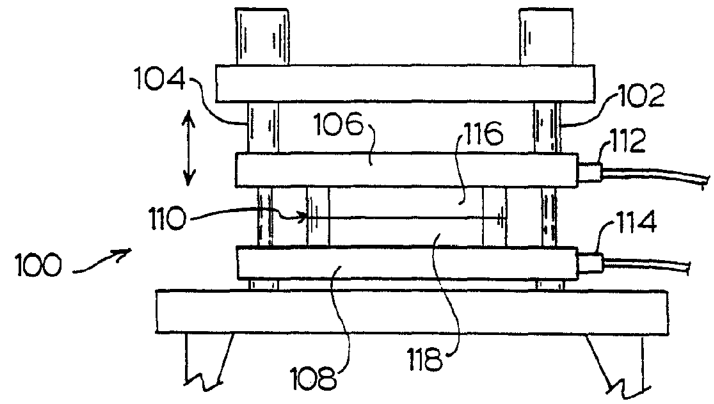

FIG. 10

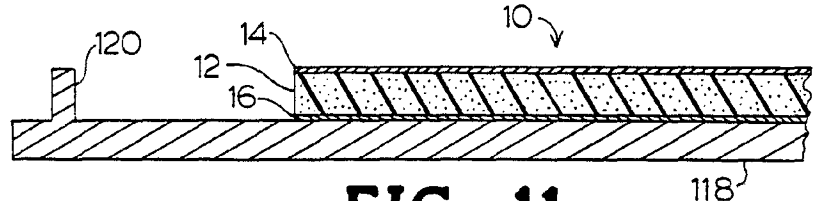

FIG. 11

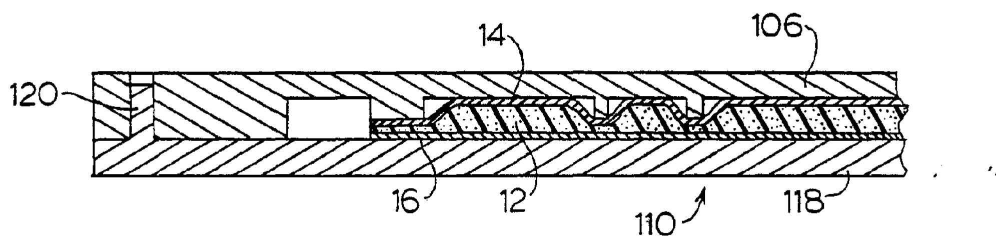

FIG. 12

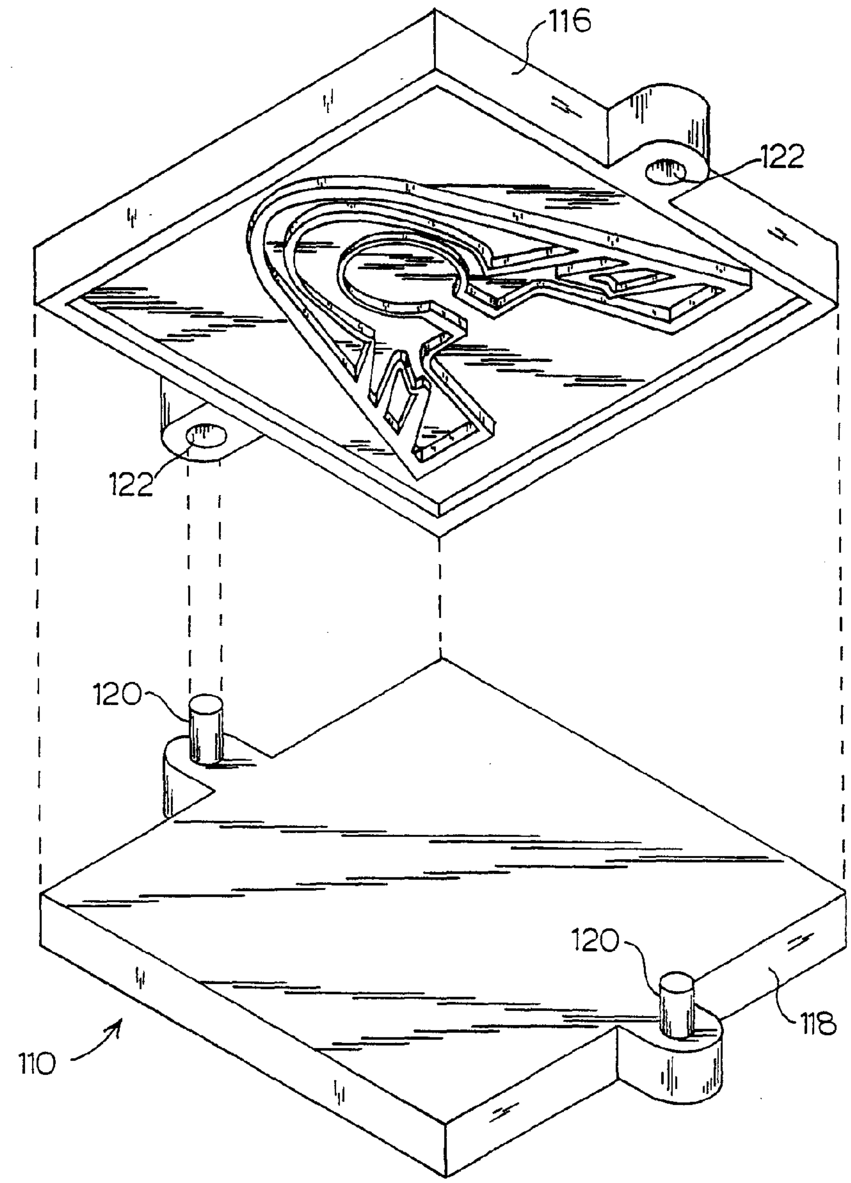

FIG. 13

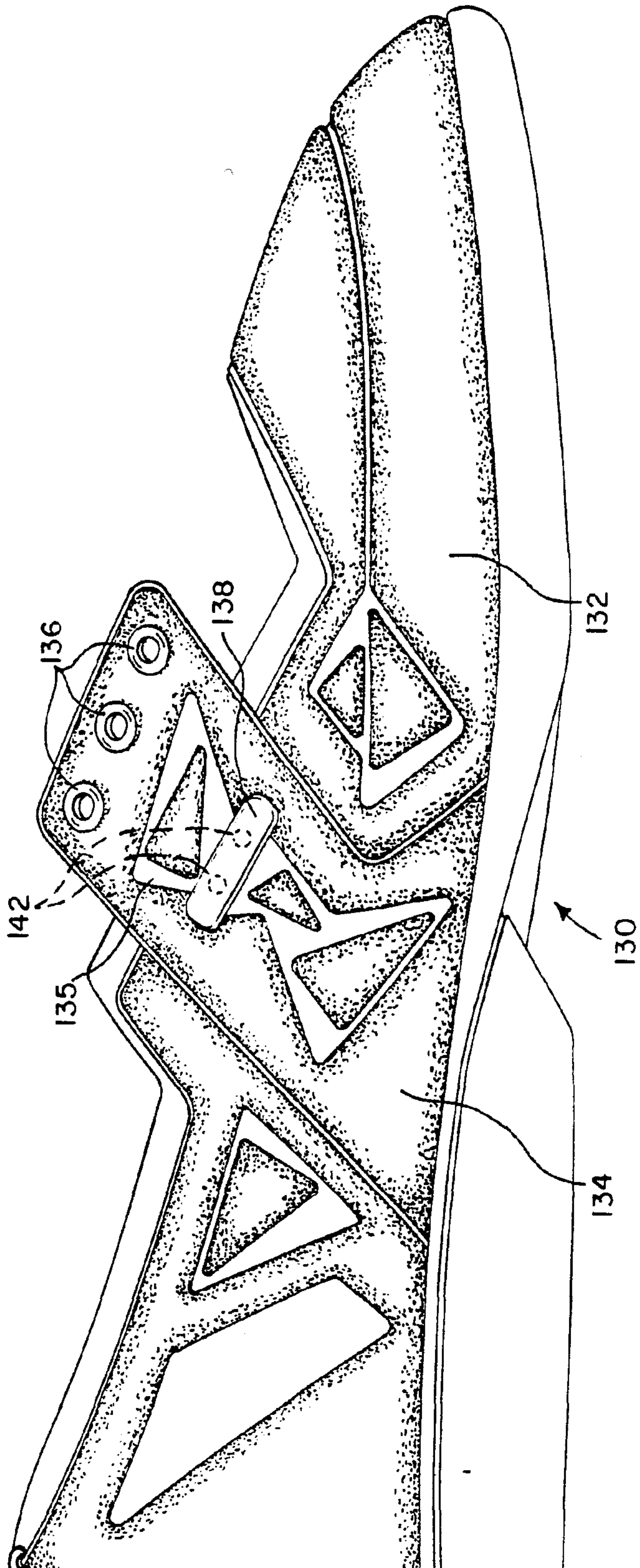

FIG.14

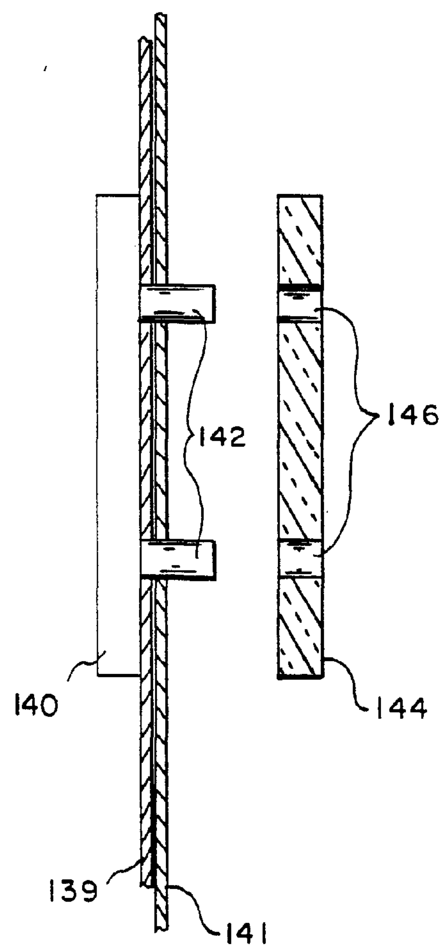

FIG. 15

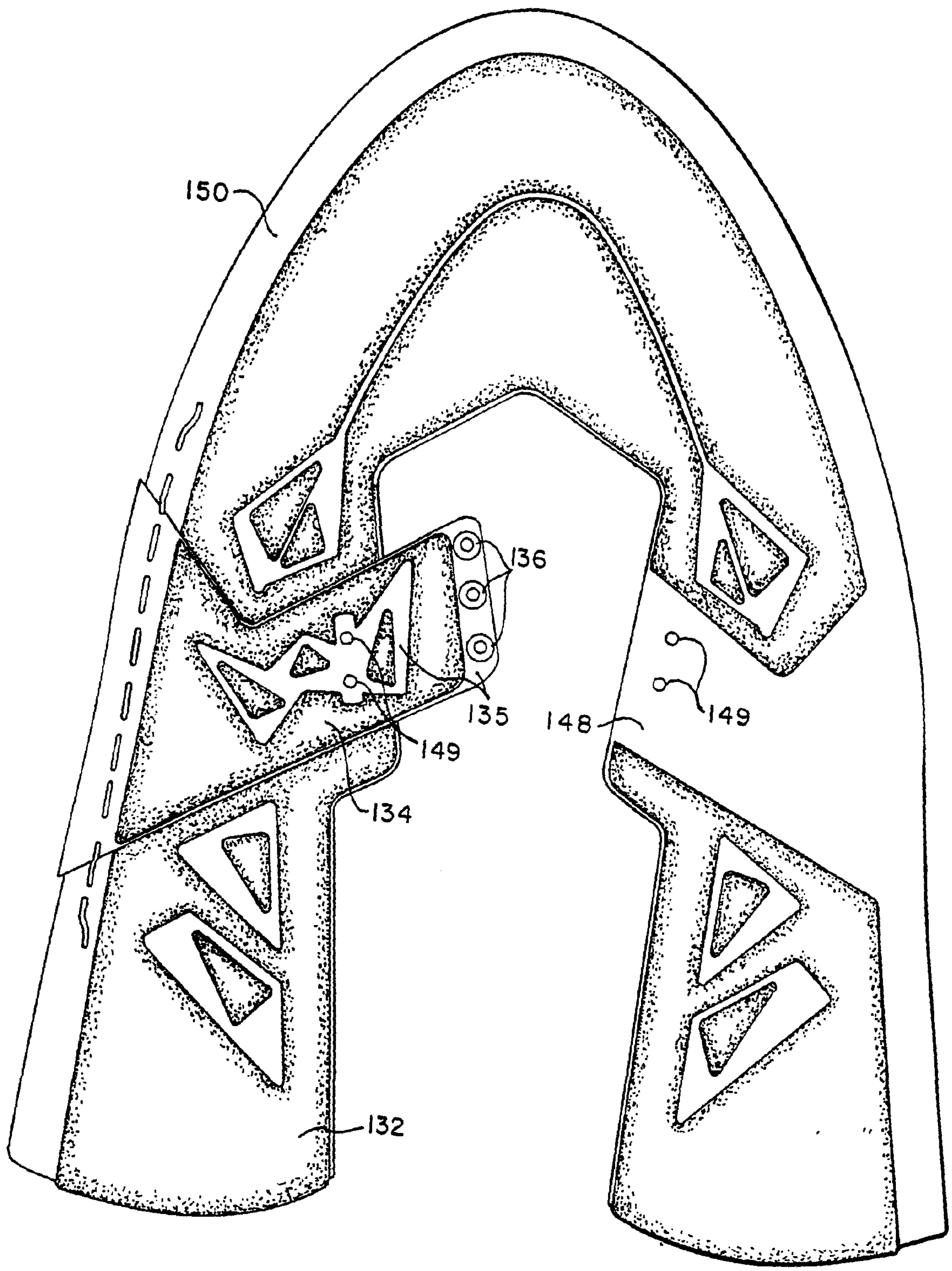

FIG.16

SUBSTITUTE SHEET

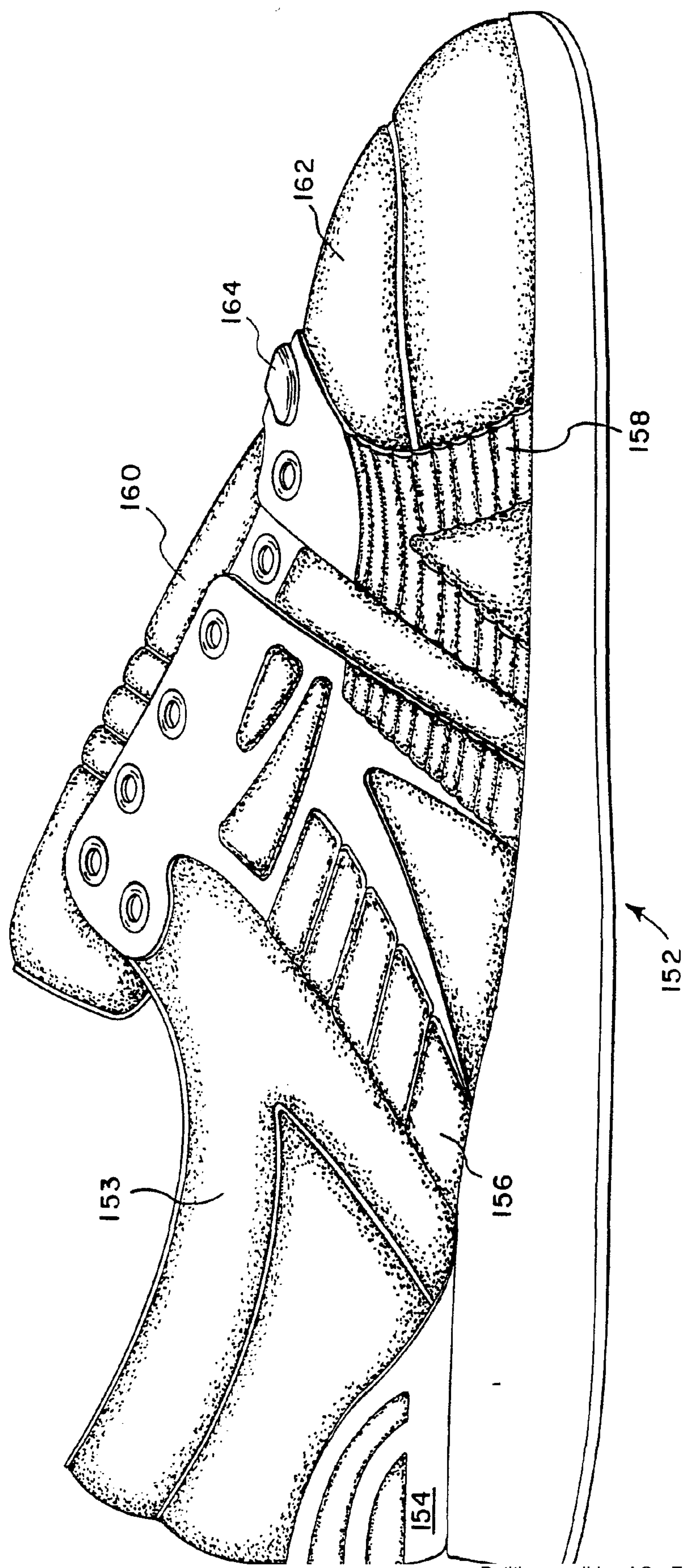

FIG. 17

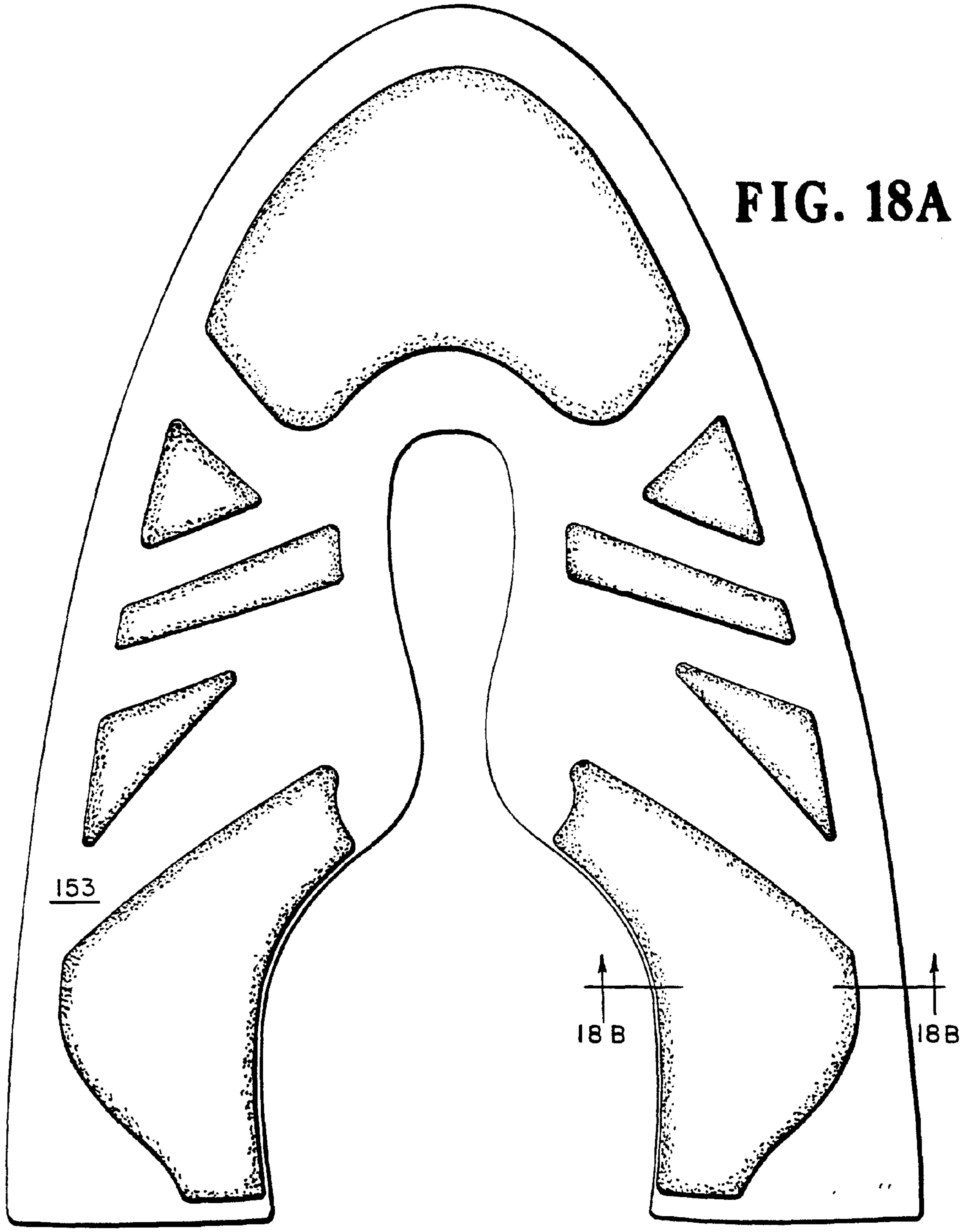

FIG. 18A

FIG. 18B

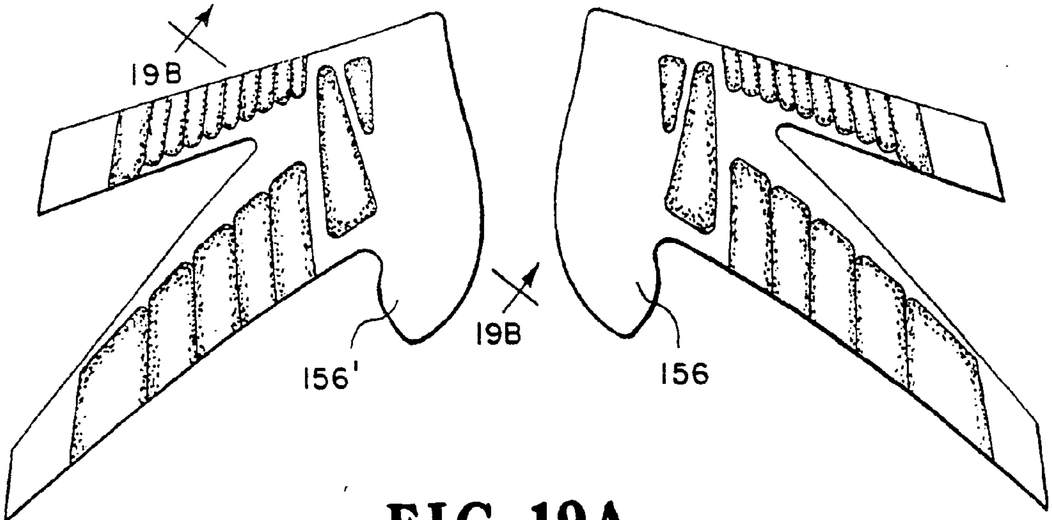

FIG. 19A

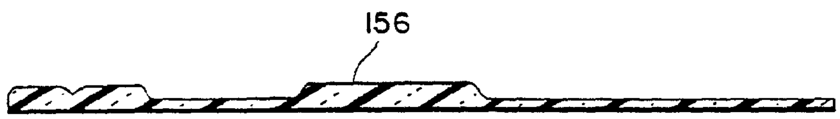

FIG. 19B

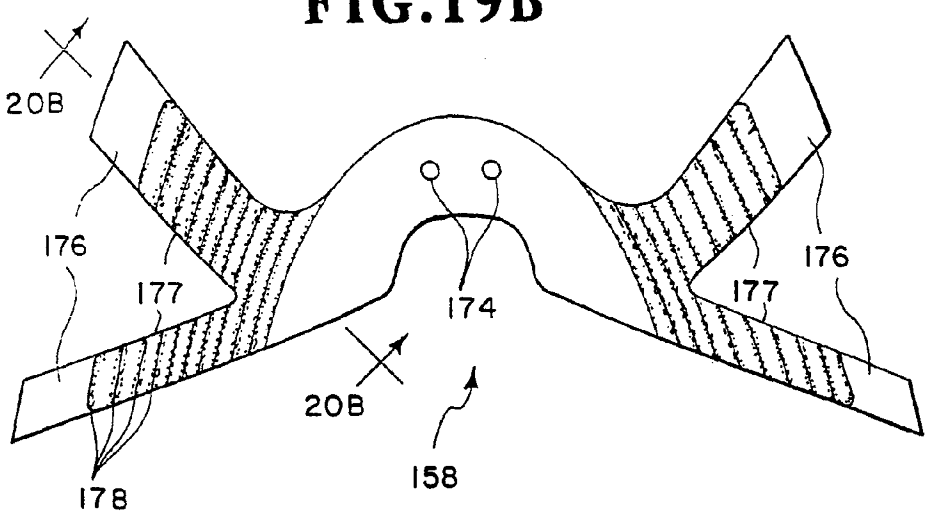

FIG. 20A

FIG. 20B

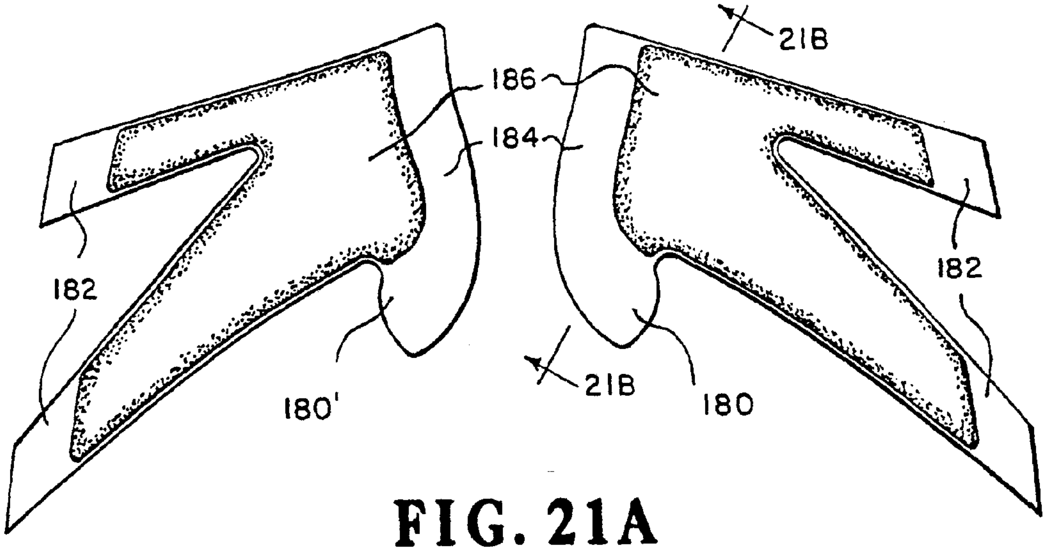

FIG. 21A

FIG. 21B

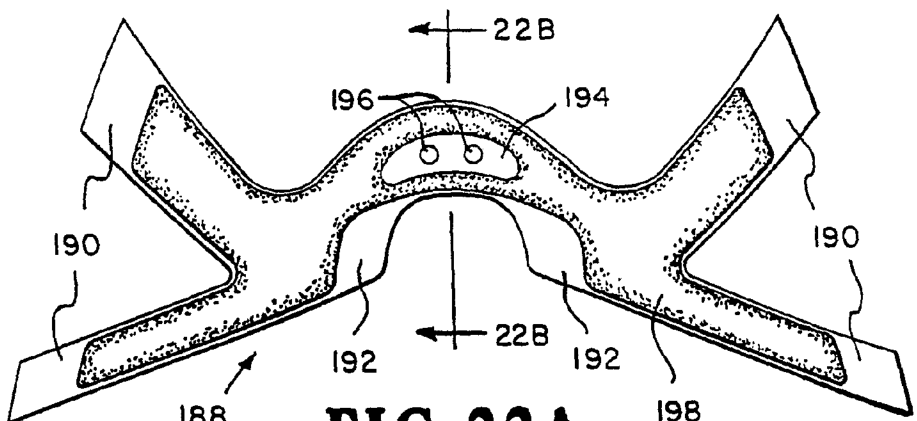

FIG. 22A

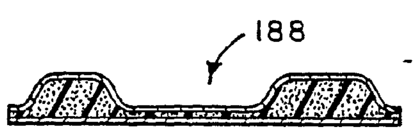

FIG. 22B

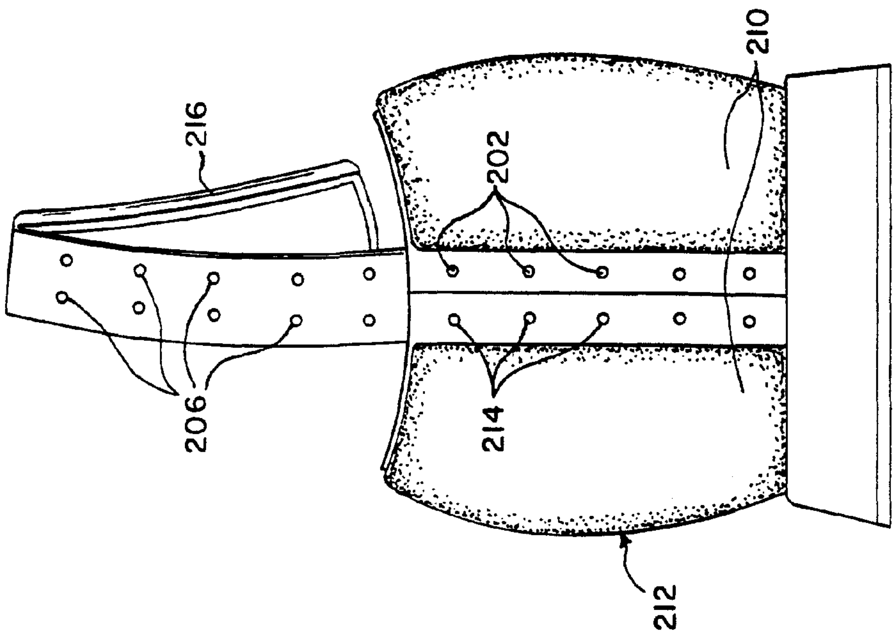

FIG. 23C

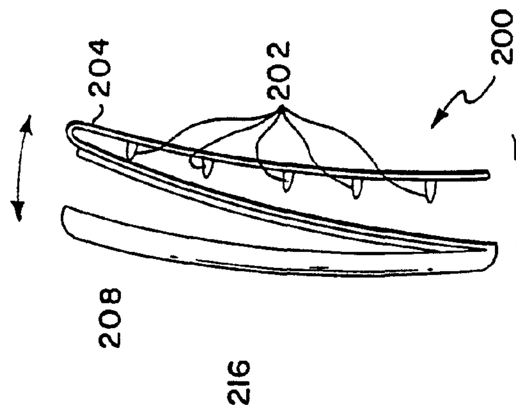

FIG. 23B

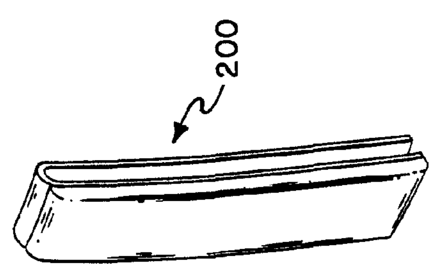

FIG. 23A

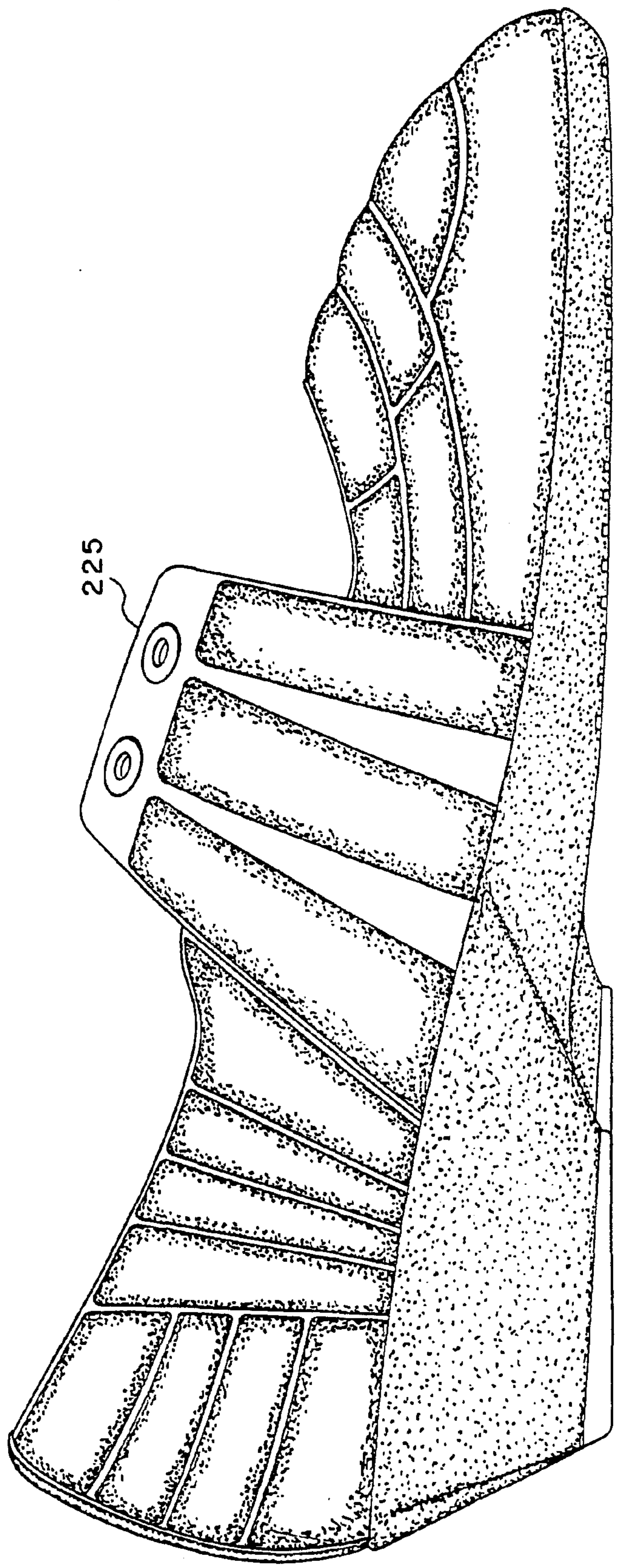

FIG. 24

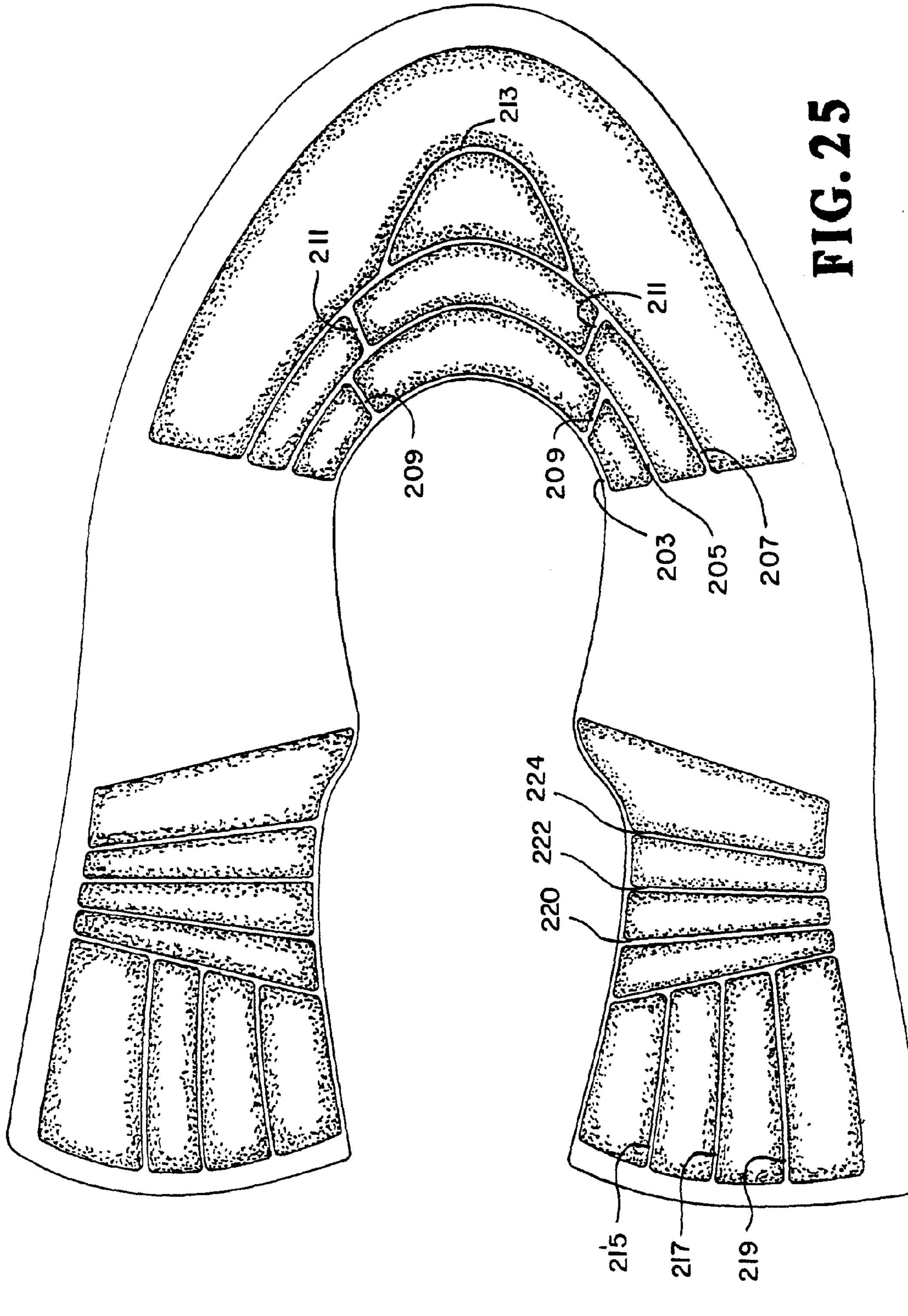

FIG. 25

17/18

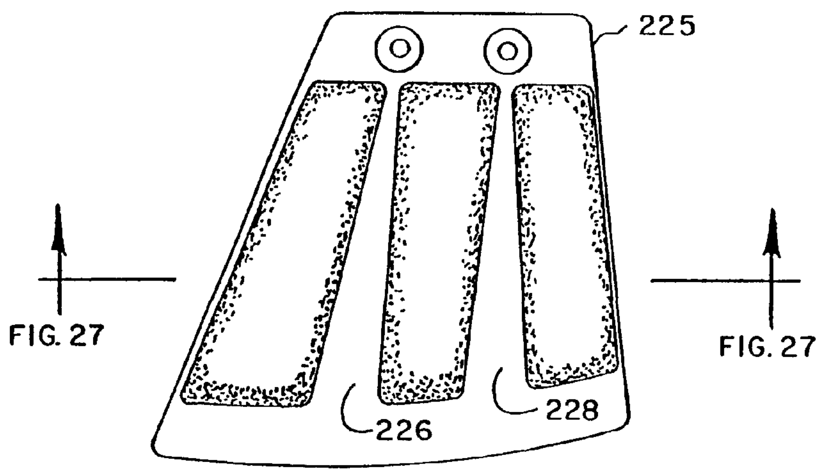

FIG. 26

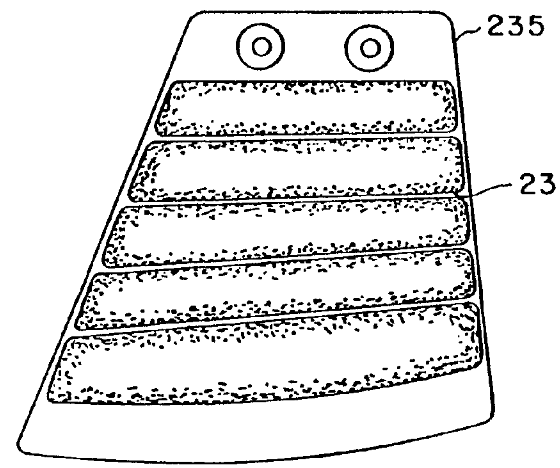

FIG. 28

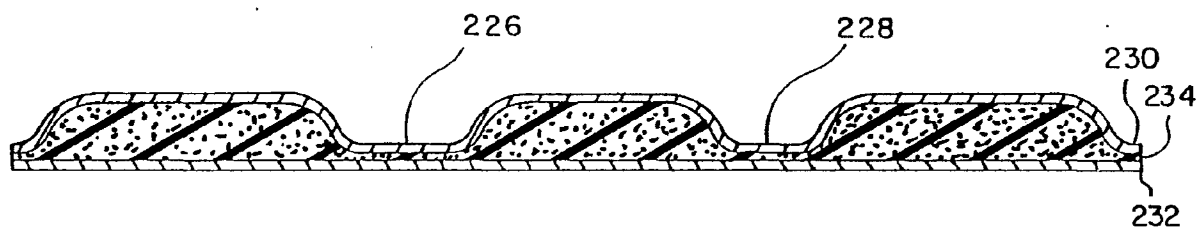

FIG. 27

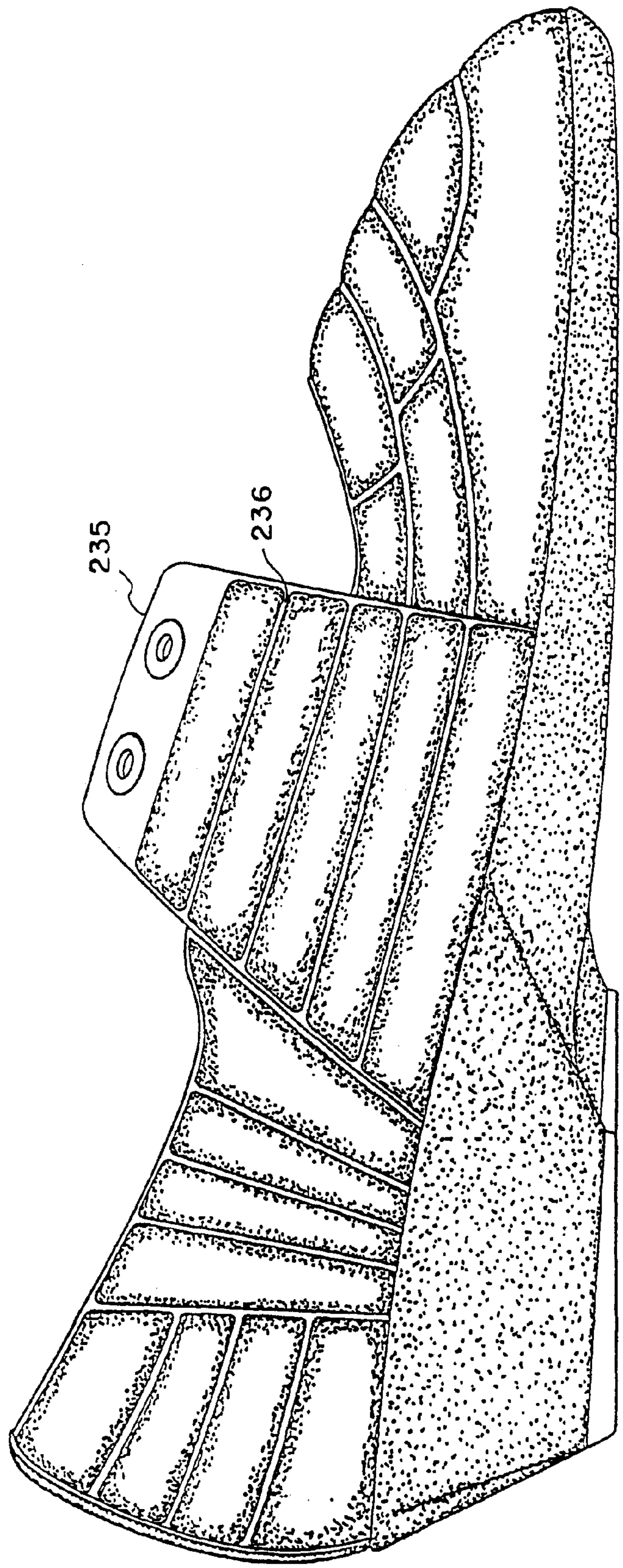

FIG. 29

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 89/04370

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: A 43 D 8/24

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC5	A 43 D; A 43 B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [*]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	US, A, 2622052 (J.D. CHANDLER) 16 December 1952, see the whole document --	1-43
A	US, A, 3130505 (I.I. MARKEVITCH) 28 April 1964, see the whole document --	1-43
A	US, A, 3583081 (HIDEO HAYASHI) 8 June 1971, see the whole document --	1-43
A	DE, B2, 2235819 (FRITZ WAGNER, MASCHINENFABRIK GMBH & CO KG) 14 February 1974, see the whole document --	1-43

----

* Special categories of cited documents: [10]
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- "E" earlier document 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 another 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
- "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.
- "&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
17th January 1990	12.02.90
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	C.D. v.d. Vliet

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/US 89/04370

SA 31867

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on 08/11/89
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A- 2622052	16/12/52	NONE		
US-A- 3130505	28/04/64	NONE		
US-A- 3583081	08/06/71	FR-A-	1578531	14/08/69
		GB-A-	1223285	24/02/71
		DE-A-	1785183	04/11/71
		DE-U-	6753371	24/04/69
		DE-U-	6753380	24/04/69
DE-B2- 2235819	14/02/74	DE-A-	2265494	02/12/82

EPO FORM P0479

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

Electronic Acknowledgement Receipt

EFS ID:	16995661
Application Number:	13781551
International Application Number:	
Confirmation Number:	8567
Title of Invention:	Method Of Knitting A Knitted Component With An Integral Knit Tongue
First Named Inventor/Applicant Name:	Adrian Meir
Customer Number:	57618
Filer:	Eric M. Gibson/Julizza Reyes
Filer Authorized By:	Eric M. Gibson
Attorney Docket Number:	51-3238
Receipt Date:	30-SEP-2013
Filing Date:	28-FEB-2013
Time Stamp:	16:11:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2013-09-30_51-3238_IDS.pdf	43251 b58c08323cc4f564f92bdac8ccbf5969d0bdae72	no	6

Warnings:

Information:

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2	Foreign Reference	2013-09-30_IDS_DE19728848A1.pdf	355348 828dd72391b1ff088d66e0f9ee910b9aa302d56a	no	8
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Information:					
3	Foreign Reference	2013-09-30_IDS_EP0448714.pdf	4706170 e65bea6110db961eb0a30f9aaea58fa45e7b0197	no	23
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Information:					
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Information:					
5	Foreign Reference	2013-09-30_IDS_WO0231247A1.pdf	982580 45ac327a6fa1fe948cc99c6ccf108c14b256561d	no	22
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6	Foreign Reference	2013-09-30_IDS_JPH11302943A.pdf	217323 961d2e337306f3e5b43bbaee5c3e8d730ff7bed3	no	5
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Information:					
7	Foreign Reference	2013-09-30_IDS_DE19738433A1.pdf	146099 61b2b4636226520372f4e3bbc57b1677aac99b25	no	2
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Information:					
8	Foreign Reference	2013-09-30_IDS_EP0758693A1.pdf	571302 fe92fb0ce9cadfb3d27b87d675f07c8aa1535f54	no	9
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Information:					
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Warnings:					
Information:					
11	Foreign Reference	2013-09-30_IDS_WO0032861A1.pdf	494341 2f225206ae068a00d9fa48b5de5abd3c93447d7a	no	14
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12	Foreign Reference	2013-09-30_IDS_GB538865A.pdf	1320396 229a43f9fc5c304c99970ddaf2e6cffd5c37d615	no	14
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13	Foreign Reference	2013-09-30_IDS_EP0728860A1.pdf	1315568 0ee241ff854126377aebd78161bc24bd87b02450	no	17
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19	Non Patent Literature	2013-09-30_IDS_NPL1.pdf	10407685 8b41733b071f05d5fec2873a0ea93bbd318888c2	no	178

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Information:					
20	Non Patent Literature	2013-09-30_IDS_NPL2.pdf	7842912 fe160df360e69d1a0f66ca644dc42a1372afe958	no	413
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Information:					
21	Non Patent Literature	2013-09-30_IDS_NPL3.pdf	422220 2b26e8e741236f03bda5a4317f3e9945481c88fa	no	3
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Information:					
		Total Files Size (in bytes):	36279286		

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<u>New Applications Under 35 U.S.C. 111</u>
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.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
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.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
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.

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/781,551	02/28/2013	Adrian Meir	51-3238

CONFIRMATION NO. 8567

PUBLICATION NOTICE

OC000000063882557

57618
PLUMSEA LAW GROUP, LLC
10411 MOTOR CITY DRIVE
SUITE 320
BETHESDA, MD 20817

Title: Method Of Knitting A Knitted Component With An Integral Knit Tongue

Publication No.US-2013-0239625-A1
Publication Date:09/19/2013

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/.

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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 Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/781,551	02/28/2013	Adrian Meir	51-3238

CONFIRMATION NO. 8567

POA ACCEPTANCE LETTER

OC000000062738893

57618
PLUMSEA LAW GROUP, LLC
10411 MOTOR CITY DRIVE
SUITE 320
BETHESDA, MD 20817

Date Mailed: 07/26/2013

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/17/2013.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/sibrahim/

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

PTO/AIA/82A (07-12)
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NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B or equivalent) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5. If the Power of Attorney by Applicant form is not accompanied by this transmittal form or an equivalent, the Power of Attorney will not be recognized in the application.

Application Number	13/781,551
Filing Date	February 28, 2013
First Named Inventor	Method Of Knitting A Knitted Component With An Integral Knit Tongue
Title	Adrian Meir et al.
Art Unit	3765
Examiner Name	TBA
Attorney Docket Number	51-3238

SIGNATURE of Applicant or Patent Practitioner

Signature	/Eric M. Gibson/	Date	July 17, 2013
Name	Eric M. Gibson	Telephone	301-365-9040
Registration Number	59,058		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications.

☐ *Total of ____________ forms are submitted.

Doc Code: PA..

Document Description: Power of Attorney

PTO/AIA/82B(07-12)
Approved for use through 11/30/2014. OMB 0651-0035
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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in the attached transmittal letter.

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent): **57618**

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

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Please recognize or change the correspondence address for the application identified in the attached transmittal letter to:

☒ The address associated with the above-mentioned Customer Number.

OR

☐ The address associated with Customer Number: 57618

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant:

☐ Inventor or Joint Inventor

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor

☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (*e.g.*, a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document)

SIGNATURE of Applicant for Patent

Signature	John F. Coburn	Date	November 28, 2012
Name	John F. Coburn III	Telephone	503-671-6453
Title and Company	Secretary, Nike, Inc.		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms for more than one signature, see below *.

☐ *Total of ________ forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	Method Of Knitting A Knitted Component With An Integral Knit Tongue

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 13/781,551 filed on February 28, 2013.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Adrian Meir Date (Optional): 06/14/13

Signature: Adrian Meir

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA01 form for each additional inventor.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	Method Of Knitting A Knitted Component With An Integral Knit Tongue

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 13/781,551 filed on February 28, 2013.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Daniel A. Podhajny Date (Optional): June 17 2013

Signature:

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA01 form for each additional inventor.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	Method Of Knitting A Knitted Component With An Integral Knit Tongue

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 13/781,551 filed on February 28, 2013.

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LEGAL NAME OF INVENTOR

Inventor: Daren P. Tatler Date (Optional): 6/14/13

Signature: [signature]

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/SB/AIA01 form for each additional inventor.

Electronic Acknowledgement Receipt

EFS ID:	16344151
Application Number:	13781551
International Application Number:	
Confirmation Number:	8567
Title of Invention:	Method Of Knitting A Knitted Component With An Integral Knit Tongue
First Named Inventor/Applicant Name:	Adrian Meir
Customer Number:	57618
Filer:	Eric M. Gibson/Lisa Boone-Kennerly
Filer Authorized By:	Eric M. Gibson
Attorney Docket Number:	51-3238
Receipt Date:	17-JUL-2013
Filing Date:	28-FEB-2013
Time Stamp:	16:36:12
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	2013-07-17_51-3238_POA.pdf	254776 523804b5f2773b367372cb12319dafdab3e7e59a	no	2

Warnings:

Information:

2	Oath or Declaration filed	2013-07-17_51-3238_Executed_Declarations.pdf	296953 ac9224199013b2fcf7b13d908211770d9a0a0215	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	551729		

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.

<u>New Applications Under 35 U.S.C. 111</u>
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.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
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.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/781,551

APPLICATION AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	600
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(i))	23 minus 20 =	* 3			OR	x 80 =	240
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 420 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
			TOTAL			TOTAL	1840

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE($)	ADDITIONAL FEE($)	OR	RATE($)	ADDITIONAL FEE($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/781,551	02/28/2013	Adrian Meir	51-3238

CONFIRMATION NO. 8567

57618
PLUMSEA LAW GROUP, LLC
10411 MOTOR CITY DRIVE
SUITE 320
BETHESDA, MD 20817

NOTICE

OC000000061779593

Date Mailed: 06/12/2013

INFORMATIONAL NOTICE TO APPLICANT

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
  All
  Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

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 NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/781,551	02/28/2013	3765	1980	51-3238	23	3

CONFIRMATION NO. 8567

UPDATED FILING RECEIPT

OC000000061779592

57618
PLUMSEA LAW GROUP, LLC
10411 MOTOR CITY DRIVE
SUITE 320
BETHESDA, MD 20817

Date Mailed: 06/12/2013

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Adrian Meir, Portland, OR;
Daniel A. Podhajny, Beaverton, OR;
Daren P. Tatler, Hillsboro, OR;

Applicant(s)

Nike, Inc., Beaverton, OR

Assignment For Published Patent Application

Nike, Inc., Beaverton, OR

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CIP of 13/400,511 02/20/2012 PAT 8448474

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 03/25/2013
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/781,551**
Projected Publication Date: 09/19/2013

Non-Publication Request: No

Early Publication Request: No
Title

Method Of Knitting A Knitted Component With An Integral Knit Tongue

Preliminary Class

066

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

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PLUMSEA LAW GROUP

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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/781,551	02/28/2013	Adrian Meir	51-3238

CONFIRMATION NO. 8567

57618
PLUMSEA LAW GROUP, LLC
10411 MOTOR CITY DRIVE
SUITE 320
BETHESDA, MD 20817

DOCKETED
PDF VMT/LM
APR 05 2013
Response to MP
Due 6/3/2013

FORMALITIES LETTER

OC000000060054926

Date Mailed: 04/02/2013

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  Applicant must submit ***$280*** *to complete the basic filing fee for an undiscounted entity. If appropriate, applicant may make a written assertion of entitlement to small entity status and pay the small entity filing fee (37 CFR 1.27) or make a certification of entitlement to micro entity status and pay the micro entity filing fee (37 CFR 1.29).*

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Additional claim fees of $ **240** as an undiscounted entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.
- A surcharge (for late submission of the basic filing fee, search fee, examination fee or inventor's oath or declaration) as set forth in 37 CFR 1.16(f) of $ **140** for an undiscounted entity, must be submitted.

SUMMARY OF FEES DUE:

Total fee(s) required within **TWO MONTHS** from the date of this Notice is $ **1980** for an undiscounted entity

- $ **280** Statutory basic filing fee.
- $ **140** Surcharge.
- The application search fee has not been paid. Applicant must submit $ **600** to complete the search fee.
- The application examination fee has not been paid. Applicant must submit $ **720** to complete the examination fee for an undiscounted entity.
- Total additional claim fee(s) for this application is $ **240**
  - $ **240** for **3** total claims over 20.

Items Required To Avoid Processing Delays:

COPY

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
  All
  Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/bcao/

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

Electronic Patent Application Fee Transmittal

Application Number:	13781551
Filing Date:	28-Feb-2013
Title of Invention:	Method Of Knitting A Knitted Component With An Integral Knit Tongue
First Named Inventor/Applicant Name:	Adrian Meir
Filer:	Eric M. Gibson/Lisa Boone-Kennerly
Attorney Docket Number:	51-3238

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	280	280
Utility Search Fee	1111	1	600	600
Utility Examination Fee	1311	1	720	720
Pages:				
Claims:				
Claims in Excess of 20	1202	3	80	240
Miscellaneous-Filing:				
Late Filing Fee for Oath or Declaration	1051	1	140	140

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1980**

Electronic Acknowledgement Receipt

EFS ID:	15916193
Application Number:	13781551
International Application Number:	
Confirmation Number:	8567
Title of Invention:	Method Of Knitting A Knitted Component With An Integral Knit Tongue
First Named Inventor/Applicant Name:	Adrian Meir
Customer Number:	57618
Filer:	Eric M. Gibson/Lisa Boone-Kennerly
Filer Authorized By:	Eric M. Gibson
Attorney Docket Number:	51-3238
Receipt Date:	31-MAY-2013
Filing Date:	28-FEB-2013
Time Stamp:	12:36:20
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Electronic Funds Transfer
Payment was successfully received in RAM	$1980
RAM confirmation Number	10076
Deposit Account	
Authorized User	

File Listing:

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

1	Miscellaneous Incoming Letter	2013-05-31_51-3238_NTFMP.pdf	336595 4019f67a568e7adf5ab9d366a1d72678cfd5869b	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	38270 70176518f29d065ea49b4a75778005ed0378097e	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	374865	

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
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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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13781551
	Filing Date	2013-02-28
	First Named Inventor	Meir
	Art Unit	3765
	Examiner Name	TBD
	Attorney Docket Number	51-3238

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	0601192		1898-03-22	Woodside	
	2	1215198		1917-02-06	Rothstein	
	3	1597934	A	1926-08-31	Stimpson	
	4	1888172	A	1932-11-15	Joha	
	5	1902780	A	1933-03-21	Holden	
	6	1910251	A	1933-05-23	Joha	
	7	2001293	A	1935-05-14	Wilson	
	8	2047724	A	1936-07-14	Zuckerman	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	13781551
Filing Date	2013-02-28
First Named Inventor	Meir
Art Unit	3765
Examiner Name	TBD
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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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	Art Unit	3765
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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Non-Final Office Action mailed October 17, 2012 in US Patent Application No. 13/400,511.	☐
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number	13781551
	Filing Date	2013-02-28
	First Named Inventor	Meir
	Art Unit	3765
	Examiner Name	TBD
	Attorney Docket Number	51-3238

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Eric M. Gibson/	Date (YYYY-MM-DD)	2013-05-09
Name/Print	Eric M. Gibson	Registration Number	59058

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(54) Metatarsal protection for safety footwear

(57) It is constituted on the basis of a tongue (1) which is conveniently attached to the boot, which is divided into a number of sectors (3), in which are some receptacles (5) which hold sheets (6) of material resistant to impact and ductile in order to facilitate the adaptation thereof to the form of the boot when closed. The sectors (3) are delimited by some lines of stitching (4) which facilitate the relative inclination between sectors (3) and therefore the articulation of the tongue (1) when the boot is flexed achieving greater user comfort.

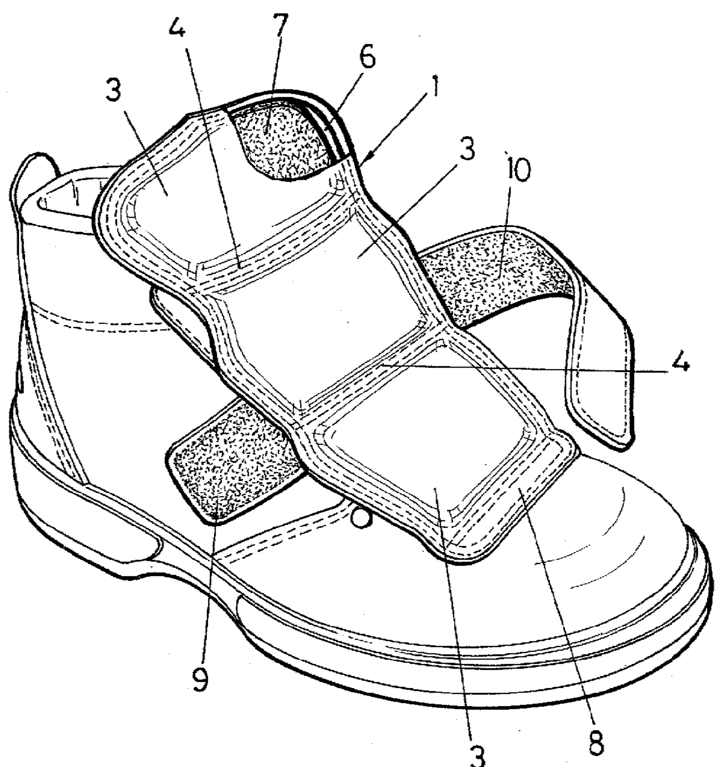

FIG.1

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Description

OBJECT OF THE INVENTION

[0001] The present invention is of application for safety footwear employed in industry, of the type of that which incorporates protection to protect the user's feet fundamentally from impacts, as well as additionally from heat and the action of aggressive liquids.

[0002] The object of the invention is a metatarsal protection for safety footwear which is highly resistant to impact, whilst having the capability to adapt its form to the elastic deformation which is produced in the boot when walking or when the foot is flexed in a stationary position, achieving in this way greater comfort in the use of this type of footwear.

BACKGROUND OF THE INVENTION

[0003] Safety boots conventionally incorporate a toecap with metallic reinforcement to avoid injuries which could arise from the impact of an object which fell accidentally on the worker's boot. As a supplement to this reinforcing element it is envisaged, not only to protect the toecap area of the foot, but also to confer an added value to the boot through the incorporation of protection in the area of the instep.

[0004] This protection, usually termed metatarsal, is formed by means of a stiff tongue which reduces movement and articulation capacity, especially in the metatarsal area.

[0005] The protection normally hinges with respect to an emerging flap defined in the toecap of the boot to which it is joined by stitching or by means of rivets and is formed in a single material, which can be plastic or metallic, and also have curved forms which adapt to the shape of the metatarsal sector of the safety boot and in some developments it is envisaged that it be of reduced length without managing to cover the height of the boot with the object of guaranteeing a minimum articulation of the foot.

[0006] This solution however is not completely satisfactory since, by not covering the whole extension of the metatarsal sector there remains an extensive area of the foot, ankle and area where the leg joins the ankle exposed to impacts, and also the discomfort and cutting effect that the stiff tongue has on the user.

[0007] The development of protection for safety footwear in which a compromise is reached between resistance to impact and flexibility, whilst guaranteeing the protection of the whole metatarsal area makes the invention feasible which is disclosed below.

DESCRIPTION OF THE INVENTION

[0008] The metatarsal protection which constitutes the object of this invention fully covers the expressed expectations in the measure that it offers effective protection for the whole metatarsal area whilst providing flexibility for its adaptation to the movement of the boot resulting therefore in substantial comfort for the user.

[0009] The metatarsal protection fundamentally comprises a tongue formed by individual layers of leather or of appropriate material, which is divided into sectors in which receptacles are defined which hold sheets of impact-resistant material and at the same time offer a certain ductility to allow a certain deformation of the tongue and thereby good adaptation to the morphology of the boot, when worn on the foot and closed. These sectors are delimited by lines of stitching sewn transversally which facilitate the articulation of the tongue when the boot is flexed eliminating in this way the stiffness which usually accompanies other systems of protection.

[0010] The sheet of impact-resistant and ductile material (for example aluminium) can be clad with a padded material, like latex foam for example, which constitutes a covering which prevents the cutting effect of the sheet, whilst increasing comfort.

[0011] The tongue is secured by stitching to the toecap of the boot and could even be reinforced by means of rivets.

[0012] The protection so constituted guarantees the absorption of impacts by means of the sheets of resistant material which are located in different sectors of the tongue, preferably parallel and separated by a short distance. This separating gap facilitates articulation between said sectors, allowing the tongue to adapt to the form of the instep of the boot when flexed.

[0013] The incorporation of this protection does not constitute any impediment whatsoever for the adoption of any boot closing system, be it by means of a Velcro strip, laces or any other solution.

DESCRIPTION OF THE DRAWINGS

[0014] To complete the description that is being made and with the object of assisting in a better understanding of the characteristics of the invention, in accordance with a preferred example of practical embodiment thereof, accompanying said description as an integral part thereof, is a set of drawings wherein, by way of illustration and not restrictively, the following has been represented:

Figure 1. - It shows a view in perspective of an open boot in which the metatarsal protection is appreciated with a section in which one can observe the resistant sheet and the padded material inside one of the sectors.

Figure 2. - It shows a side view of a longitudinal section of the protection.

Figure 3. - It shows a side view of the flexed boot in which one can observe how the protection articulates to adapt to the form of the boot.

PREFERRED EMBODIMENT OF THE INVENTION

[0015] Taking the figures represented as reference a preferred mode of embodiment is described of the metatarsal protection for safety footwear which constitutes the object of this invention.

[0016] The metatarsal protection is constituted on the basis of a tongue (1) which is conveniently attached to the boot, be this by stitching, rivets, a combination of both or any other means.

[0017] The tongue (1) is formed by two layers of leather or of appropriate material (2-2') between which are defined a number of sectors (3), delimited by lines of stitching (4) which allow articulation of the boot, in which some receptacles (5) are to be found which hold sheets (6) of impact-resistant and ductile material, to facilitate the adaptation thereof to the form of the boot when worn and closed.

[0018] The resistant sheets (6) are clad with padding (7) inside the receptacles (5).

[0019] The sectors (3) of the tongue (1) can be extended transversally thereto in a parallel arrangement and separated at a short distance by the transversal lines of stitching (4) which facilitate the relative inclination between sectors (3) and therefore the articulation of the tongue (1) when the boot is flexed.

[0020] Furthermore the tongue (1) comes with a flap (8) which constitutes the connecting element with the boot, to which it is conveniently articulated.

[0021] As can be appreciated in figure 1 the boot can have a Velcro strip (9) to which adhere the band (10) which can previously enwrap the tongue (1) to establish the closing of the boot, although as has been indicated above, the form of closing can be by laces, buckles or of any other nature.

Claims

1. Metatarsal protection for safety footwear which is constituted on the basis of a tongue (1) fitted with resistant elements which is conveniently attached to the boot, be this by stitching, rivets, a combination of both or other means, **characterised in that** the tongue is divided into a number of sectors (3), in which are receptacles (5) which hold sheets (6) of material, resistant to impact, and having a certain ductility to facilitate the adaptation thereof to the form of the boot when closed, the sectors (3) being delimited by some lines of stitching (4) which facilitate the relative inclination between sectors (3) and therefore the articulation of the tongue (1) and its adaptation to the form of the boot.

2. Metatarsal protection for safety footwear according to claim 1 **characterised in that** the resistant sheets (6) are clad with padding (7) inside the receptacles (5).

3. Metatarsal protection for safety footwear according to claim 1 **characterised in that** the sectors (3) of the tongue (1) are extended transversally thereto in a parallel arrangement and separated by a short distance to facilitate their articulation.

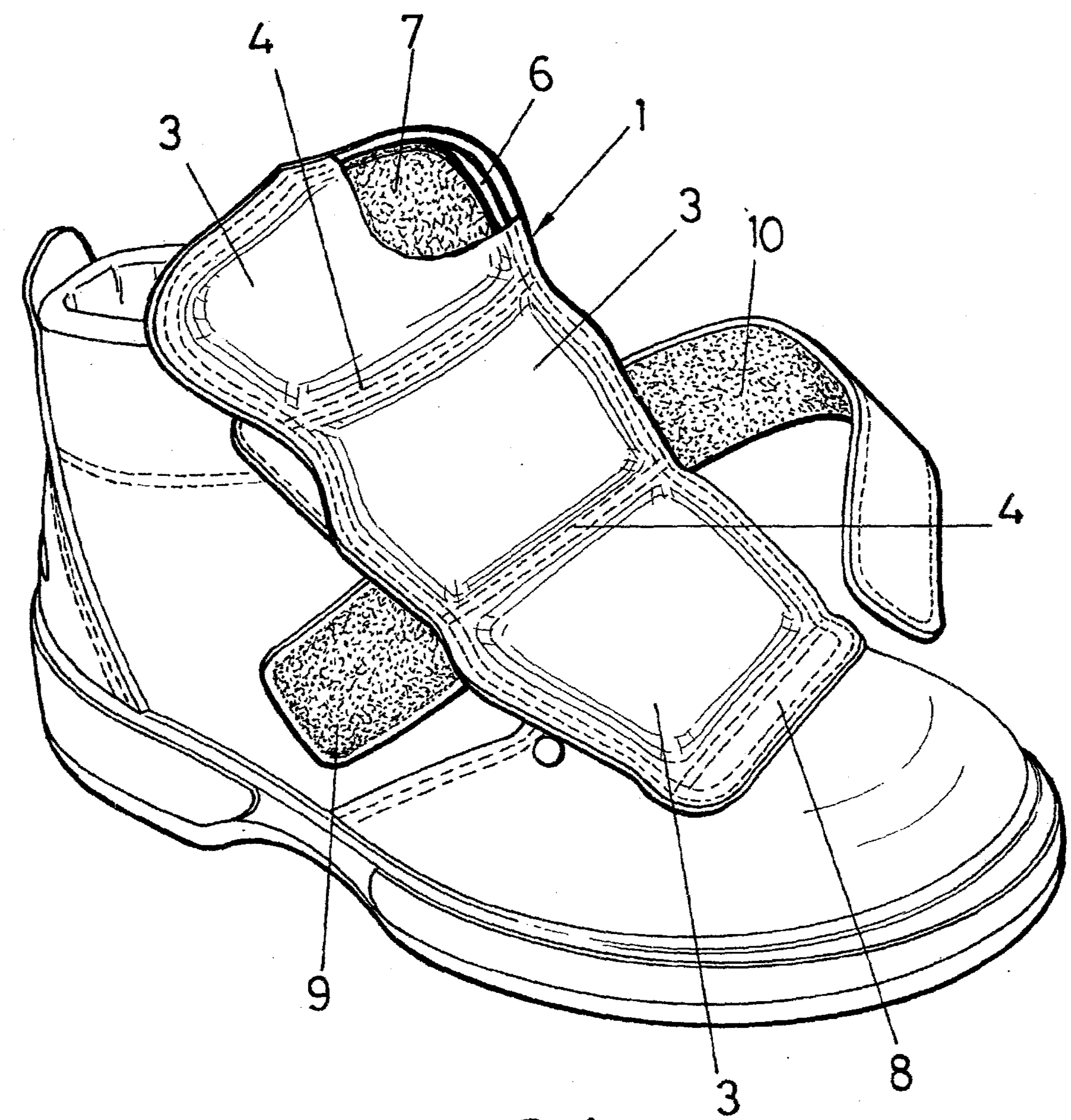

FIG.1

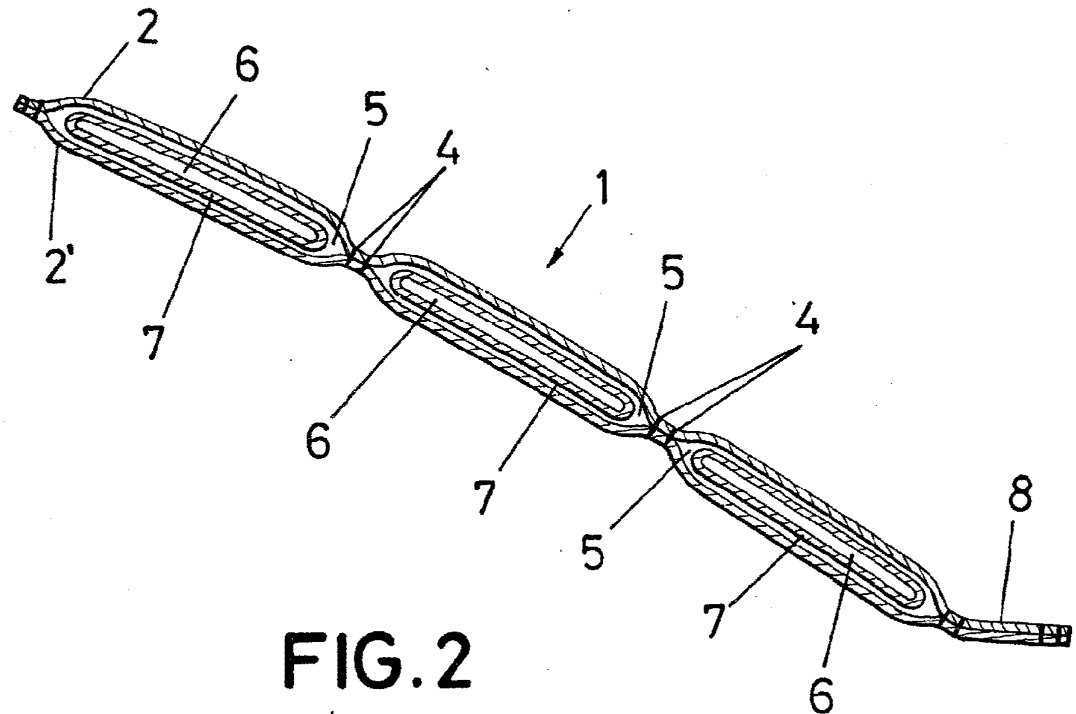

FIG. 2

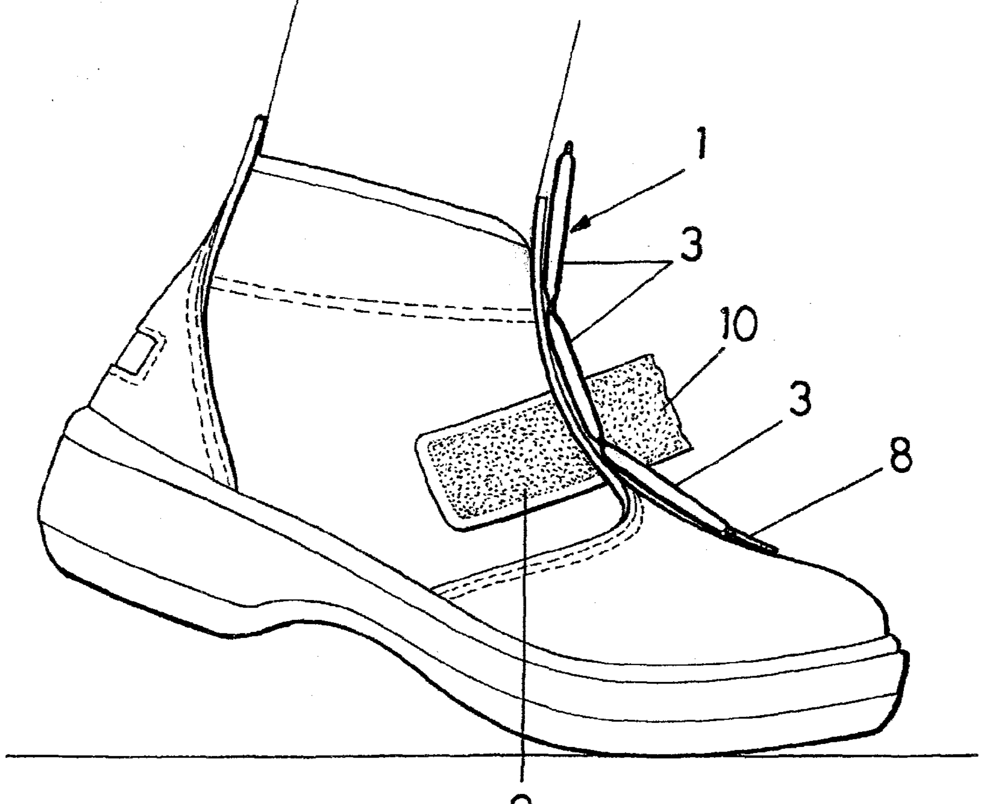

FIG. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 38 0085

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The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	28 April 2005	Claudel, B

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X : particularly relevant if taken alone
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

No documents available for this priority number.

Espacenet

Bibliographic data: DE870963 (C) — 1953-03-19

Lasche fuer Stiefel, insbesondere fuer Skistiefel

Inventor(s):	HOFER GEORG + (HOFER GEORG)	
Applicant(s):	HOFER GEORG + (HOFER GEORG)	
Classification:	**- international:**	*A43B23/28*
	- cooperative:	A43B23/28; A43B3/0031
Application number:	DE1951H007841 19510313	
Priority number(s):	DE1951H007841 19510313	

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Last updated: 13.03.2013 Worldwide Database 5.8.6.6; 93p

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(WiGBl. S. 175)

BUNDESREPUBLIK DEUTSCHLAND

AUSGEGEBEN AM
19. MÄRZ 1953

DEUTSCHES PATENTAMT

PATENTSCHRIFT

Nr. 870 963
KLASSE 71a GRUPPE 17₁₁
H 7841 VII/71 a

Georg Hofer, Grassau (Obb.)
ist als Erfinder genannt worden

Georg Hofer, Grassau (Obb.)

Lasche für Stiefel, insbesondere für Skistiefel

Patentiert im Gebiet der Bundesrepublik Deutschland vom 13. März 1951 an
Patentanmeldung bekanntgemacht am 24. Juli 1952
Patenterteilung bekanntgemacht am 5. Februar 1953

Die Erfindung bezieht sich auf Laschen von Schuhen, die der Feuchtigkeit ausgesetzt werden, insbesondere Schuhe für den Wintersport, wie Skistiefel.

Bei solchen Schuhen ist das Oberleder gewöhnlich viel fester und wasserundurchlässiger als das meist dünne Leder der Schuhlaschen. Während das Oberleder der Schuhe der Feuchtigkeit ziemlich lange standhält, ohne daß sie durchzudringen vermag, schlägt die Feuchtigkeit durch die dünne Lasche viel schneller hindurch und erzeugt nasse Füße mit allen bekannten Folgeerscheinungen, zumal der Schnee sich leicht in die Lücken an den Schuhlaschen festsetzt und dort durch die Körperwärme zum Schmelzen kommt. Besonders ist dies der Fall, wenn eine Schuhlasche Polstereinlagen aus weichen Stoffen, wie z. B. Schwammgummi, hat, um den Druck der Verschnürung vom Fuß fernzuhalten. In diesem Fall saugt sich der Schwammgummi voll Wasser, näßt nach innen durch und ist nur sehr schwer trocken zu bekommen, weil das von ihm aufgesogene Wasser nur ganz allmählich durch das Leder der Lasche hindurch verdunsten kann.

Die Erfindung besteht nun darin, die weiche Polstereinlage auswechselbar zu machen.

Fig. 1 zeigt schematisch den Erfindungsgegenstand in der Draufsicht,

Fig. 2 im Schnitt *A-B*.

Die als Tasche 1 ausgebildete Lasche wird nicht, wie bisher, allseitig zugenäht, sondern sie bleibt an einer Seite, zweckmäßig an der Oberseite 2, offen. Das Polster 3, z. B. der Schwammgummi, wird in die Laschentasche 1 eingelegt und kann, wenn es feucht ist, herausgenommen und gesondert getrocknet werden.

Man kann den Vorderteil 4 oder den Rückteil 5 der Lasche noch über die für den Gebrauch erforderliche Länge hinaus, z. B. an der Oberseite der Lasche an der Stelle 6, verlängern und in die Tasche hinein um die Oberkante des Polsters herumklappen, damit die Einlage nicht herausrutscht, wie es in der Abbildung gestrichelt gezeichnet ist.

Wenn die Lasche nicht in Form einer Tasche ausgebildet ist, kann man das Polster auch an der Rückseite der Lasche an einigen Punkten abnehmbar befestigen, z. B. mit einer Verschnürung, mit kleinen Druckknöpfen od. dgl.

Die Beschreibung und die Abbildungen zeigen nur eine Ausführungsform der erfindungsgemäßen taschenförmigen Lasche, ohne daß die Erfindung jedoch auf diese besondere Ausführungsform beschränkt sein soll.

PATENTANSPRÜCHE:

1. Lasche für Stiefel, insbesondere für Skistiefel, die mit Polster versehen ist, dadurch gekennzeichnet, daß Mittel vorgesehen sind, um das Polster leicht auswechselbar mit der Lasche zu verbinden.

2. Lasche nach Anspruch 1, dadurch gekennzeichnet, daß sie als einseitig, insbesondere an ihrer Oberseite offene Tasche ausgebildet ist, in die das Poster eingelegt werden kann.

3. Lasche nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Fläche der Lasche derart vergrößert ist, daß sie um einen Teil des Polsters herumgelegt werden kann.

4. Lasche nach Anspruch 1, dadurch gekennzeichnet, daß das Polster an der Rückseite der Lasche z. B. mit einer Verschnürung oder mit kleinen Druckknöpfen befestigt ist.

Hierzu 1 Blatt Zeichnungen

5785 3.53

Fig. 2

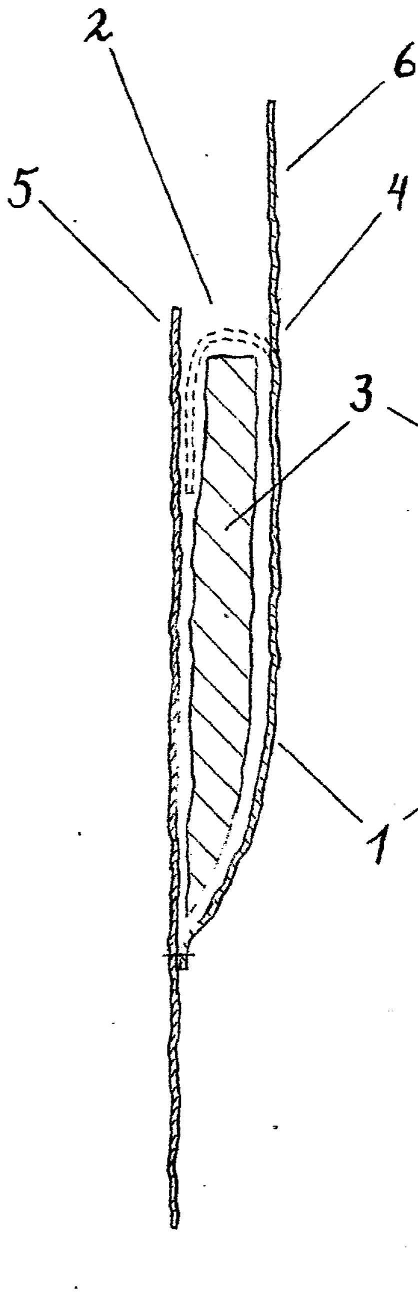
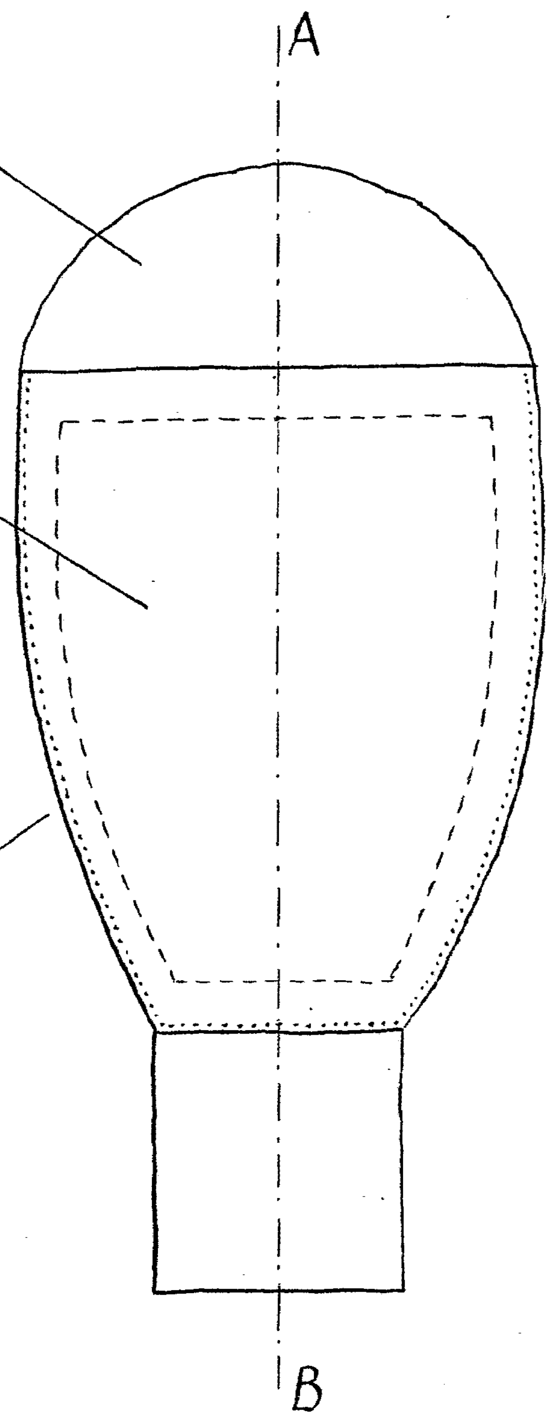


Fig. 1



Electronic Acknowledgement Receipt

EFS ID:	15736441
Application Number:	13781551
International Application Number:	
Confirmation Number:	8567
Title of Invention:	Method Of Knitting A Knitted Component With An Integral Knit Tongue
First Named Inventor/Applicant Name:	Adrian Meir
Customer Number:	57618
Filer:	Eric M. Gibson/Jose Espejo
Filer Authorized By:	Eric M. Gibson
Attorney Docket Number:	51-3238
Receipt Date:	09-MAY-2013
Filing Date:	28-FEB-2013
Time Stamp:	16:02:26
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2013-05-09_51-3238_IDS.pdf	53547 21fde84edbadfb625551c243ad8a2c9d44f2c5a5	no	11

Warnings:

Information:

This is not an USPTO supplied IDS fillable form

2	Foreign Reference	2013-05-09_51-3238_IDS_EP1563752A1.pdf	304138 e2bfbc9ad4ef48b194cdf0c266858b5add1a15c2	no	7
Warnings:					
Information:					
3	Foreign Reference	2013-05-09_51-3238_IDS_DE870963C.pdf	210775 dc31551fe35426b4f2f309253e9599a2fcc95c50	no	4
Warnings:					
Information:					
4	Non Patent Literature	2013-05-09_51-3238_IDS_OA_2012-10-17.pdf	1039874 63f41b406c167dc499cb4039aa4320d21ef24ef0	no	19
Warnings:					
Information:					
5	Non Patent Literature	2013-05-09_51-3238_IDS_OA_2012-12-19.pdf	1520728 9d55eeee21be2dd09da3b48e3b17f4ef7892ec4f	no	19
Warnings:					
Information:					
6	Non Patent Literature	2013-05-09_51-3238_IDS_NOA.pdf	624437 6d84a1809bc68173cfa0c28f0dd5a8b193a28bc7	no	5
Warnings:					
Information:					
		Total Files Size (in bytes):	3753499		

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.

<u>New Applications Under 35 U.S.C. 111</u>
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.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
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.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
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.

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 NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/781,551	02/28/2013	Adrian Meir	51-3238

CONFIRMATION NO. 8567

FORMALITIES LETTER

OC000000060054926

57618
PLUMSEA LAW GROUP, LLC
10411 MOTOR CITY DRIVE
SUITE 320
BETHESDA, MD 20817

Date Mailed: 04/02/2013

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  *Applicant must submit $**280** to complete the basic filing fee for an undiscounted entity. If appropriate, applicant may make a written assertion of entitlement to small entity status and pay the small entity filing fee (37 CFR 1.27) or make a certification of entitlement to micro entity status and pay the micro entity filing fee (37 CFR 1.29).*

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Additional claim fees of $ **240** as an undiscounted entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.
- A surcharge (for late submission of the basic filing fee, search fee, examination fee or inventor's oath or declaration) as set forth in 37 CFR 1.16(f) of $ **140** for an undiscounted entity, must be submitted.

SUMMARY OF FEES DUE:

Total fee(s) required within **TWO MONTHS** from the date of this Notice is $ **1980** for an undiscounted entity

- $ **280** Statutory basic filing fee.
- $ **140** Surcharge.
- The application search fee has not been paid. Applicant must submit $ **600** to complete the search fee.
- The application examination fee has not been paid. Applicant must submit $ **720** to complete the examination fee for an undiscounted entity.
- Total additional claim fee(s) for this application is $ **240**
  - $ **240** for **3** total claims over 20.

Items Required To Avoid Processing Delays:

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
  All
  Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/bcao/

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

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 NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/781,551	02/28/2013	3765	0.00	51-3238	23	3

CONFIRMATION NO. 8567

57618
PLUMSEA LAW GROUP, LLC
10411 MOTOR CITY DRIVE
SUITE 320
BETHESDA, MD 20817

FILING RECEIPT

OC000000060054925

Date Mailed: 04/02/2013

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Adrian Meir, Portland, OR;
Daniel A. Podhajny, Beaverton, OR;
Daren P. Tatler, Hillsboro, OR;

Applicant(s)

Nike, Inc., Beaverton, OR

Assignment For Published Patent Application

Nike, Inc., Beaverton, OR

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CIP of 13/400,511 02/20/2012

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 03/25/2013
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/781,551**
Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No
Title

Method Of Knitting A Knitted Component With An Integral Knit Tongue

Preliminary Class

066

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number
13/781,551

APPLICATION AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	600
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(i))	23 minus 20 =	* 3			OR	x 80 =	240
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 420 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
			TOTAL			TOTAL	1840

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	51-3238
First Inventor	Adrian Meir
Title	Method Of Knitting A Knitted...
Express Mail Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: **Commissioner for Patents**
P.O. Box 1450
Alexandria VA 22313-1450

1. ☐ **Fee Transmittal Form.** (PTO/SB/17 or equivalent)
2. ☐ **Applicant claims small entity status.** See 37 CFR 1.27.
3. ☑ **Specification.** [*Total Pages* 51]
   Both the claims and abstract must start on a new page
   (For information on the preferred arrangement, see MPEP § 608.01(a))
4. ☑ **Drawing(s).** (*35 U.S.C. 113*) [*Total Sheets* 28]
5. **Inventor's Oath or Declaration.** [*Total Sheets* ____]
   (including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e))
   a. ☐ Newly executed (original or copy)
   b. ☐ A copy from a prior application (37 CFR 1.63(d))
6. ☑ **Application Data Sheet.** **See Note below.*
   See 37 CFR 1.76 (PTO/AIA/14 or equivalent)
7. ☐ **CD-ROM or CD-R.**
   in duplicate, large table or Computer Program *(Appendix)*
   ☐ Landscape Table on CD
8. **Nucleotide and/or Amino Acid Sequence Submission.**
   (if applicable, items a. – c. are required)
   a. ☐ Computer Readable Form (CRF)
   b. ☐ Specification Sequence Listing on:
      i. ☐ CD-ROM or CD-R (2 copies); or
      ii. ☐ Paper
   c. ☐ Statements verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. ☐ **Assignment Papers.** (cover sheet & document(s))
   Name of Assignee Nike, Inc. for the U.S.A. and
   Nike International Ltd. for all other territories
10. ☐ **37 CFR 3.73(c) Statement.** *(when there is an assignee)* ☐ **Power of Attorney.**
11. ☐ **English Translation Document.** *(if applicable)*
12. ☐ **Information Disclosure Statement.** (PTO/SB/08 or PTO-1449)
    ☐ Copies of citations attached
13. ☐ **Preliminary Amendment.**
14. ☐ **Return Receipt Postcard.** *(MPEP § 503) (Should be specifically itemized)*
15. ☐ **Certified Copy of Priority Document(s).** *(if foreign priority is claimed)*
16. ☐ **Nonpublication Request.** Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
17. ☐ **Other:** ____

***Note:** (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

18. CORRESPONDENCE ADDRESS

☑ The address associated with Customer Number: 57618 ***OR*** ☐ Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone		Email	

Signature	/Eric M. Gibson/	Date	February 28, 2013
Name (Print/Type)	Eric M. Gibson	Registration No. (Attorney/Agent)	59,058

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	51-3238
	Application Number	

Title of Invention	Method Of Knitting A Knitted Component With An Integral Knit Tongue

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Adrian		Meir	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Portland	State/Province	OR	Country of Residence	US

Mailing Address of Inventor:

Address 1	c/o Nike, Inc.		
Address 2	One Bowerman Drive		
City	Beaverton	State/Province	OR
Postal Code	97005-6453	Country	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Daniel	A.	Podhajny	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Beaverton	State/Province	OR	Country of Residence	US

Mailing Address of Inventor:

Address 1	c/o Nike, Inc.		
Address 2	One Bowerman Drive		
City	Beaverton	State/Province	OR
Postal Code	97005-6453	Country	US

Inventor 3 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Daren	P.	Tatler	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	51-3238
	Application Number	
Title of Invention	Method Of Knitting A Knitted Component With An Integral Knit Tongue	

City	Hillsboro	State/Province	OR	Country of Residence	US

Mailing Address of Inventor:

Address 1	c/o Nike, Inc.		
Address 2	One Bowerman Drive		
City	Beaverton	State/Province	OR
Postal Code	97005-6453	Country	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	57618	
Email Address		Add Email Remove Email

Application Information:

Title of the Invention	Method Of Knitting A Knitted Component With An Integral Knit Tongue		
Attorney Docket Number	51-3238	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	28	Suggested Figure for Publication (if any)	20

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	51-3238
	Application Number	

Title of Invention	Method Of Knitting A Knitted Component With An Integral Knit Tongue

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	57618		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation in part of	13/400511	2012-02-20

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

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This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Priority Claimed
			○ Yes ◉ No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Authorization to Permit Access:

☒ Authorization to Permit Access to the Instant Application by the Participating Offices

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	51-3238
	Application Number	
Title of Invention	Method Of Knitting A Knitted Component With An Integral Knit Tongue	

If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

- (●) Assignee
- ( ) Legal Representative under 35 U.S.C. 117
- ( ) Person to whom the inventor is obligated to assign.
- ( ) Person who shows sufficient proprietary interest

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor :

If the Assignee is an Organization check here. ☒

Organization Name	Nike, Inc.		
Mailing Address Information:			
Address 1	One Bowerman Drive		
Address 2			
City	Beaverton	**State/Province**	OR
Country	US	Postal Code	97005-6453
Phone Number		Fax Number	

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	51-3238
	Application Number	

Title of Invention	Method Of Knitting A Knitted Component With An Integral Knit Tongue

Email Address	

Additional Applicant Data may be generated within this form by selecting the Add button.

Signature:

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications

Signature	/Eric M. Gibson/			Date (YYYY-MM-DD)	2013-02-28
First Name	Eric M.	Last Name	Gibson	Registration Number	59058

Additional Signature may be generated within this form by selecting the Add button.

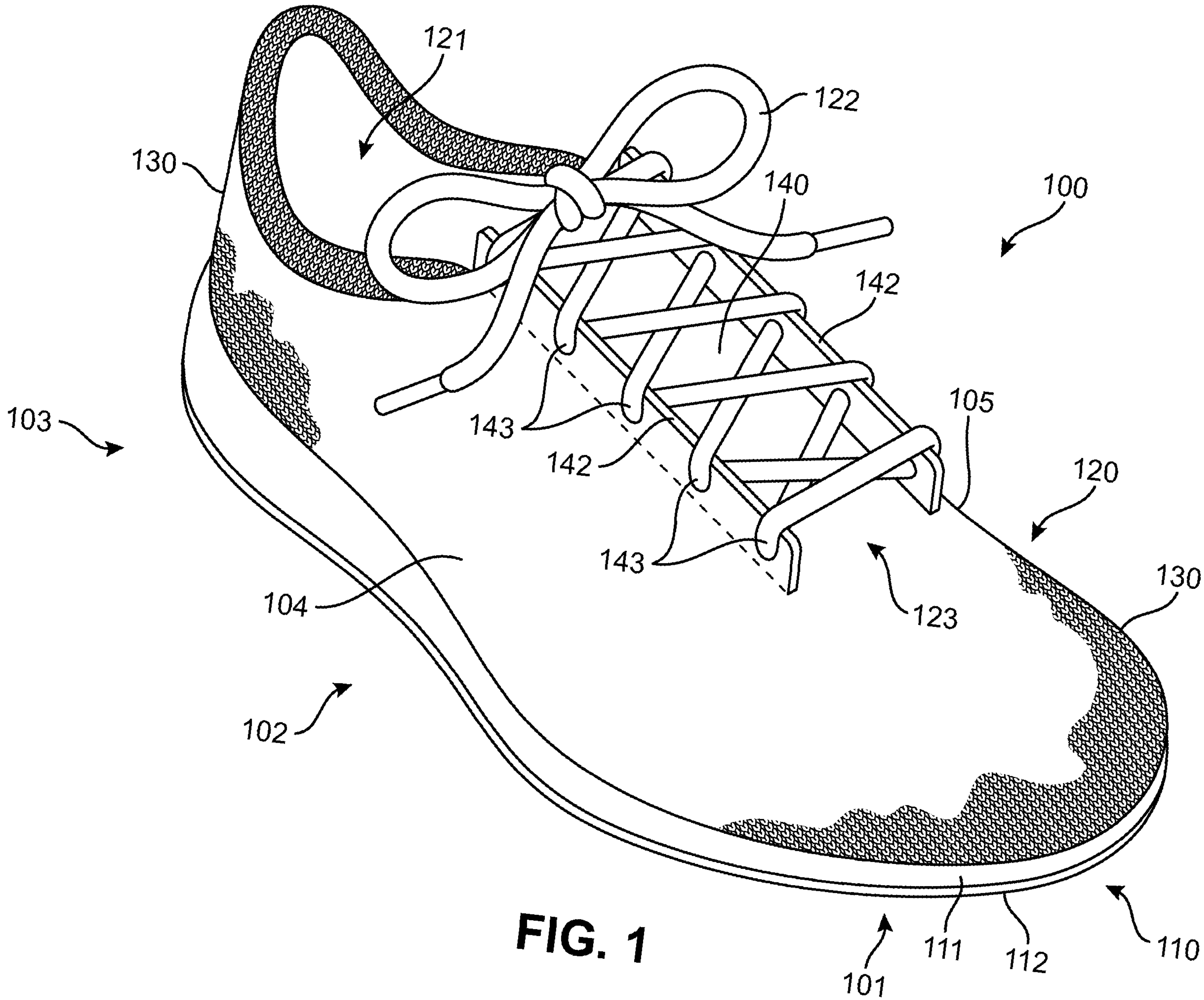
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FIG. 1

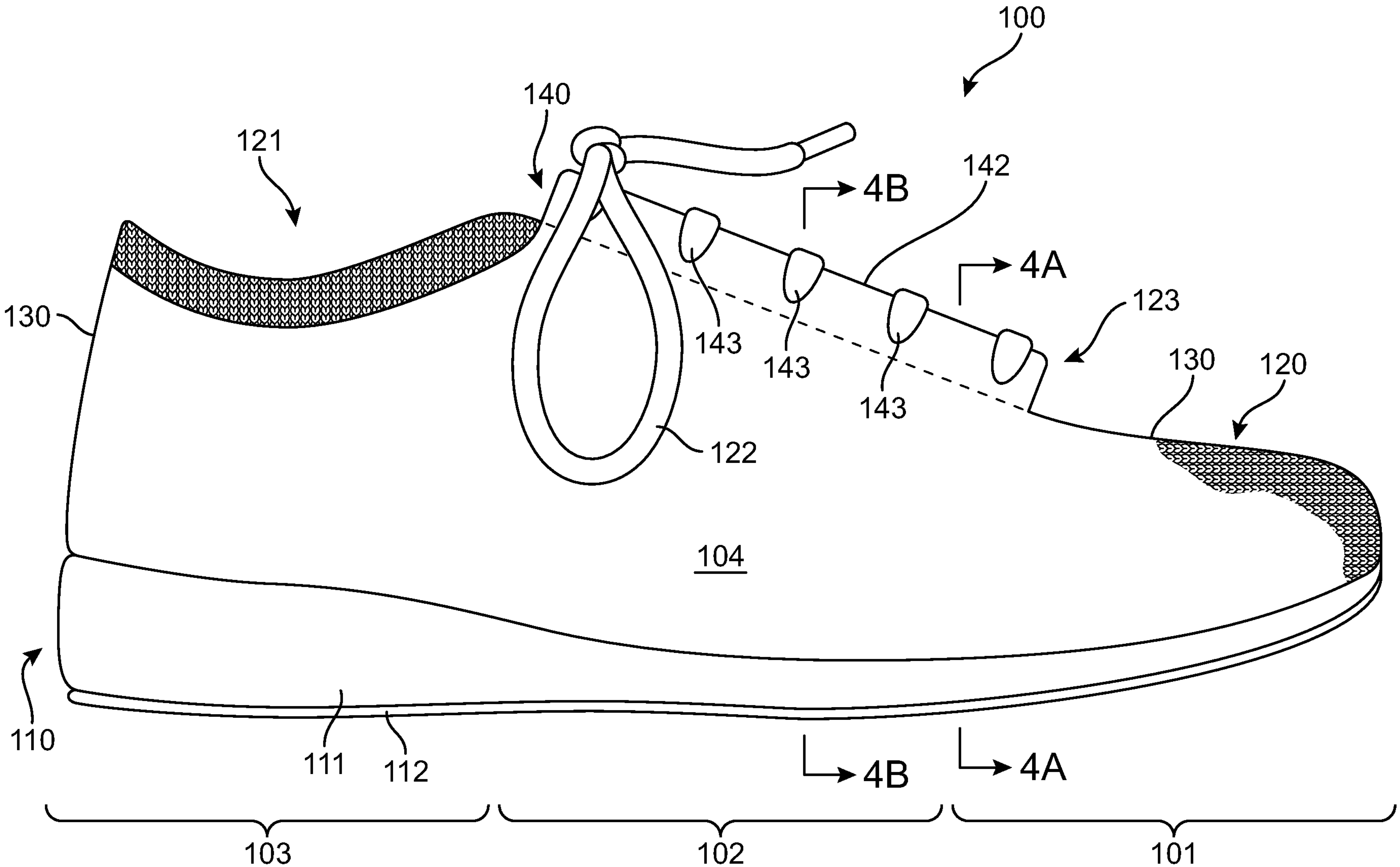
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FIG. 2

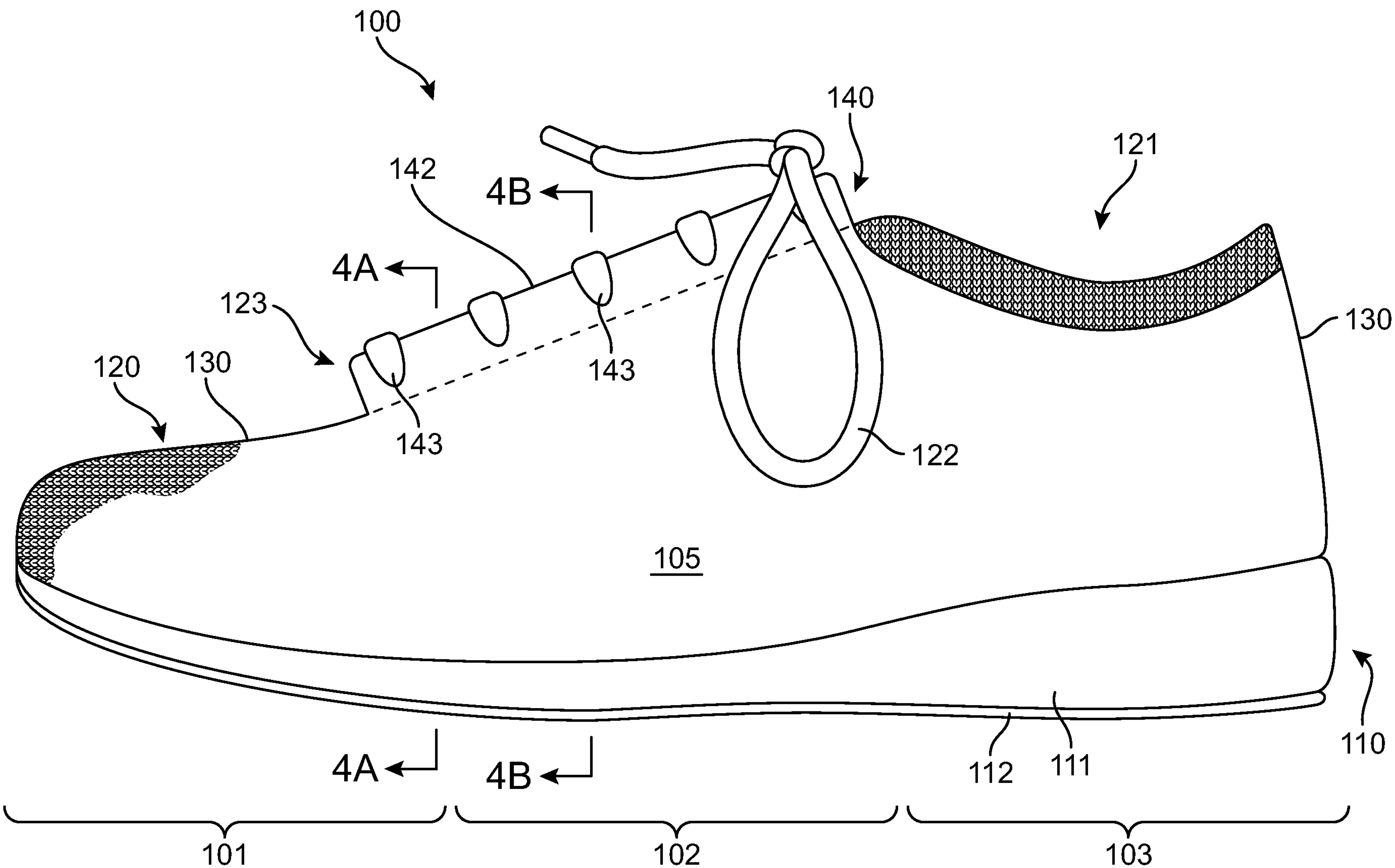
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FIG. 3

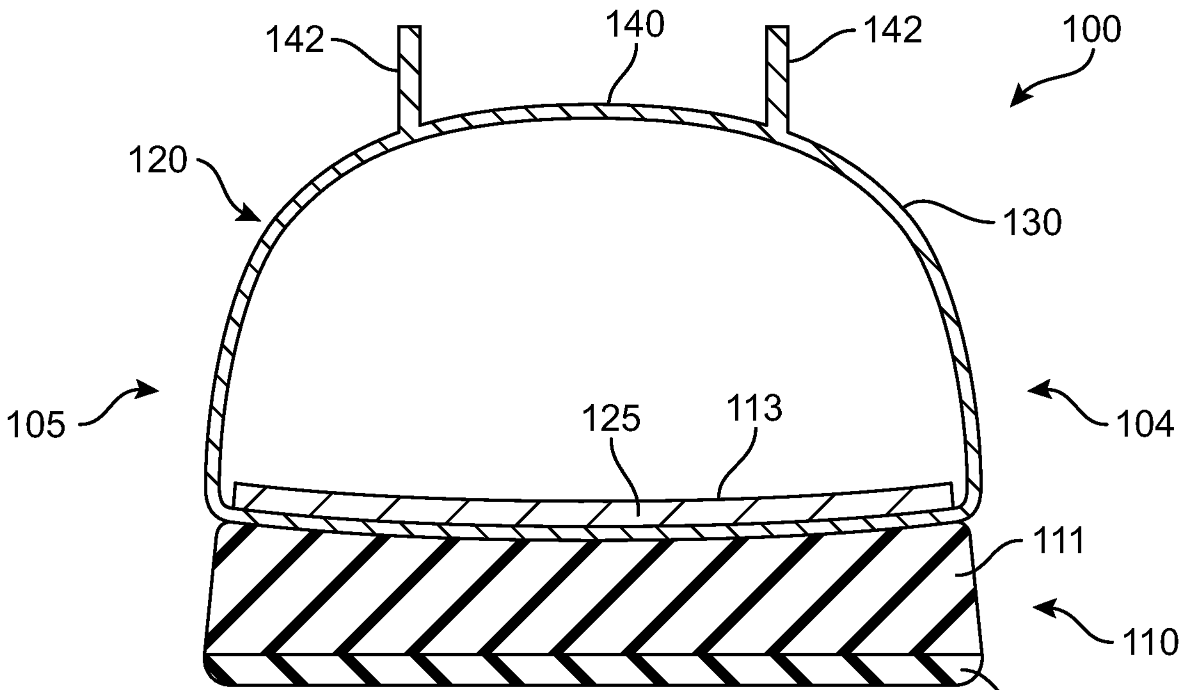
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FIG. 4A

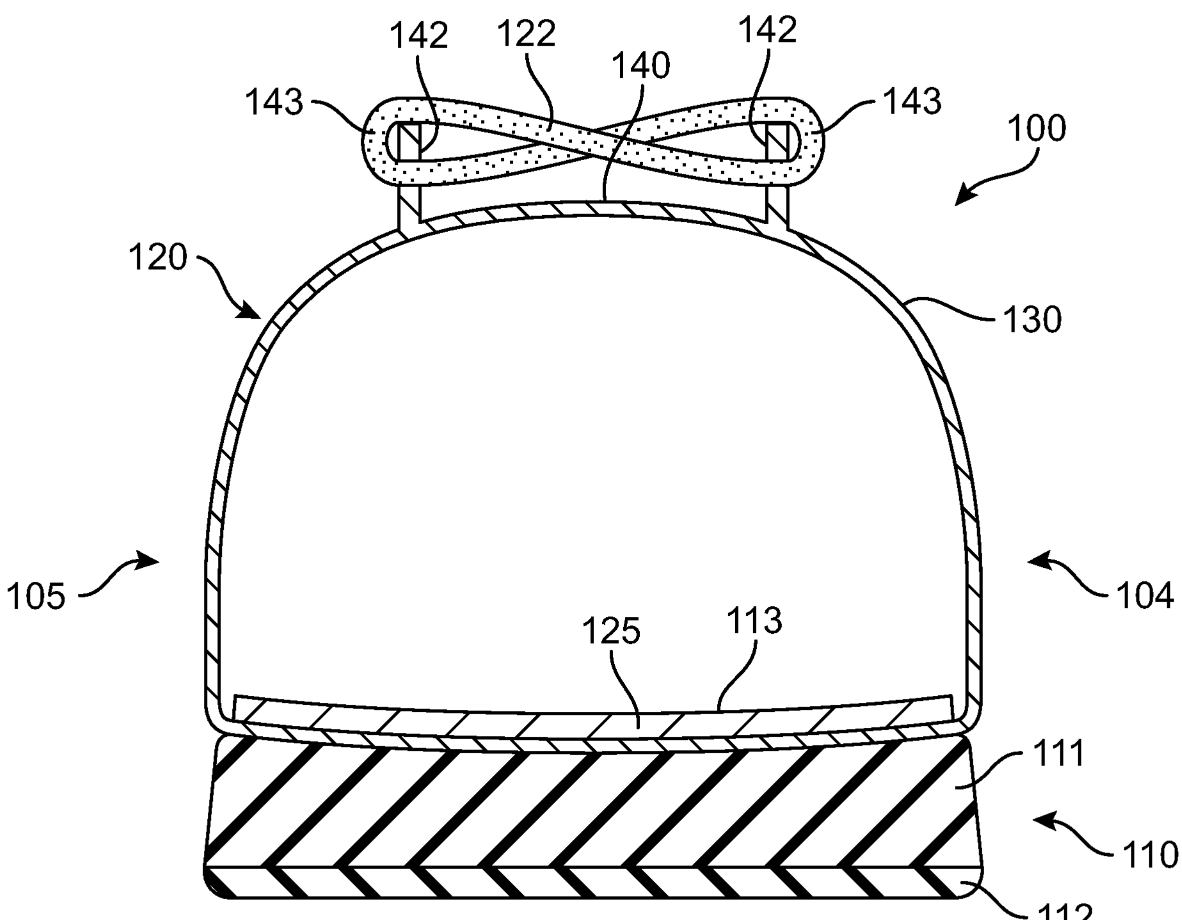
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FIG. 4B

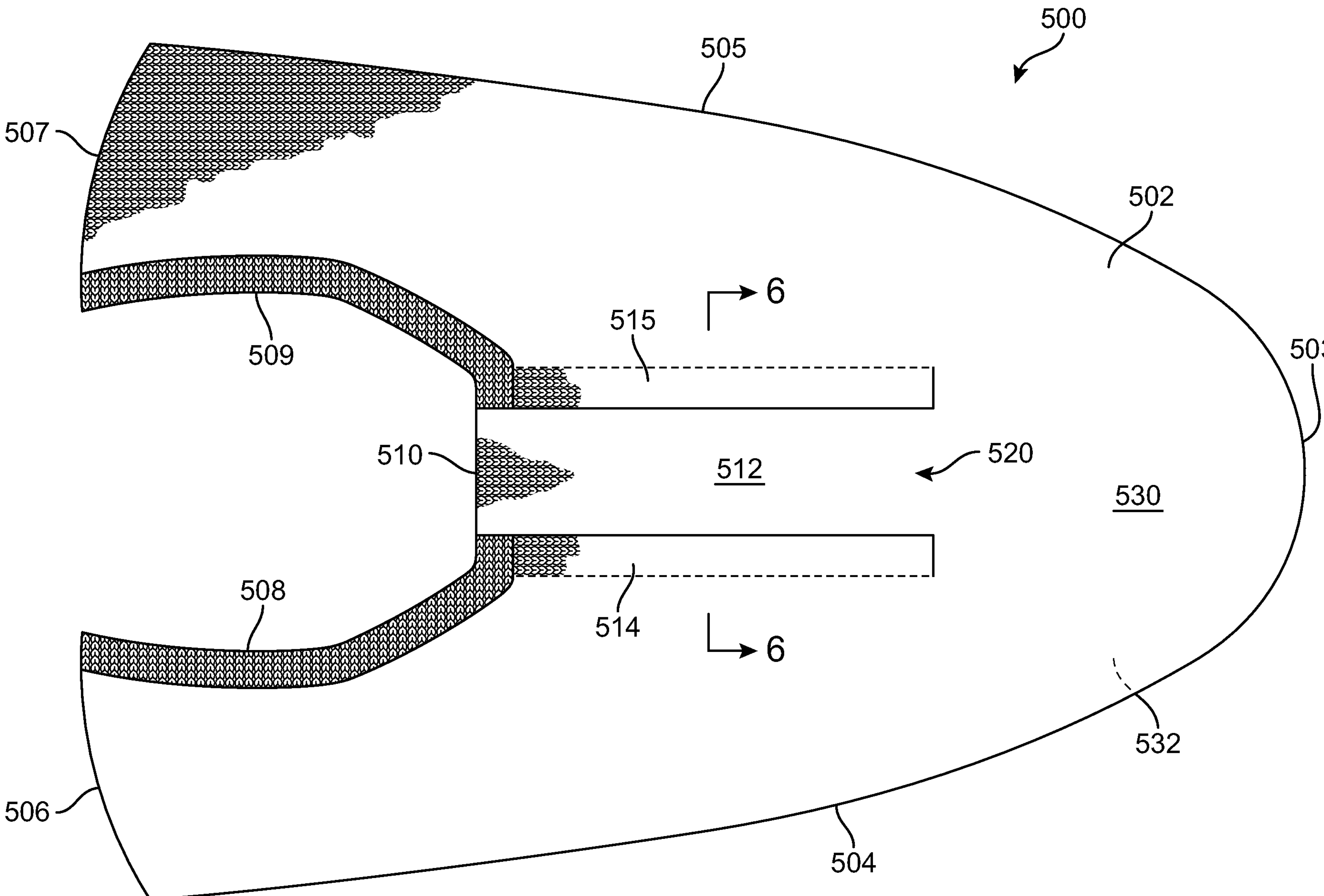
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FIG. 5

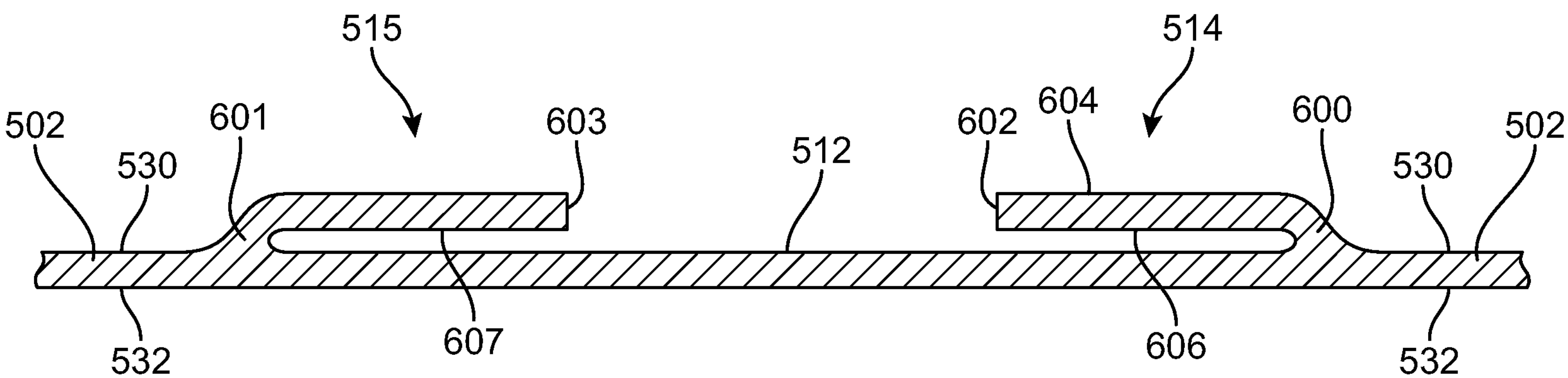

FIG. 6

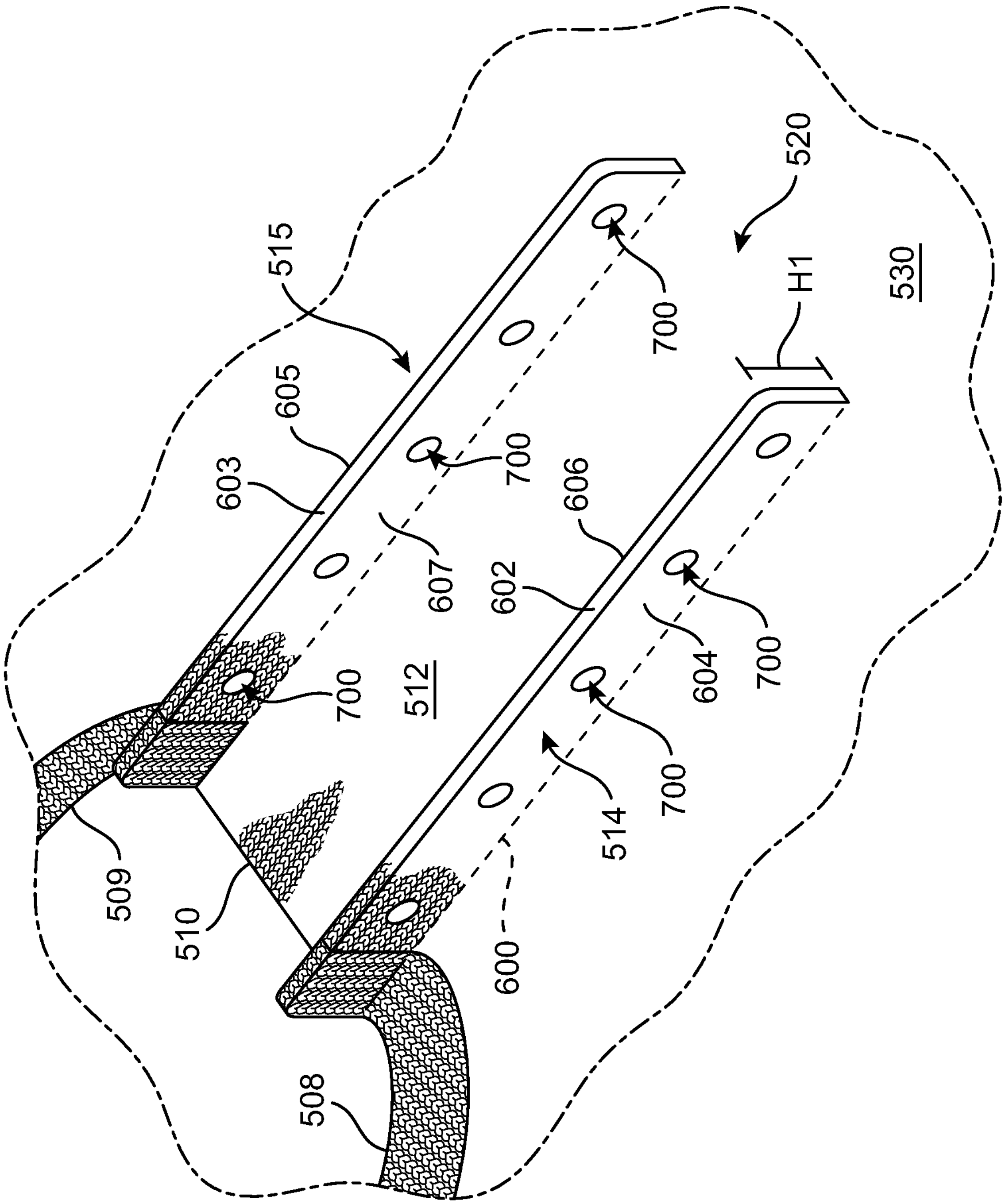
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FIG. 7

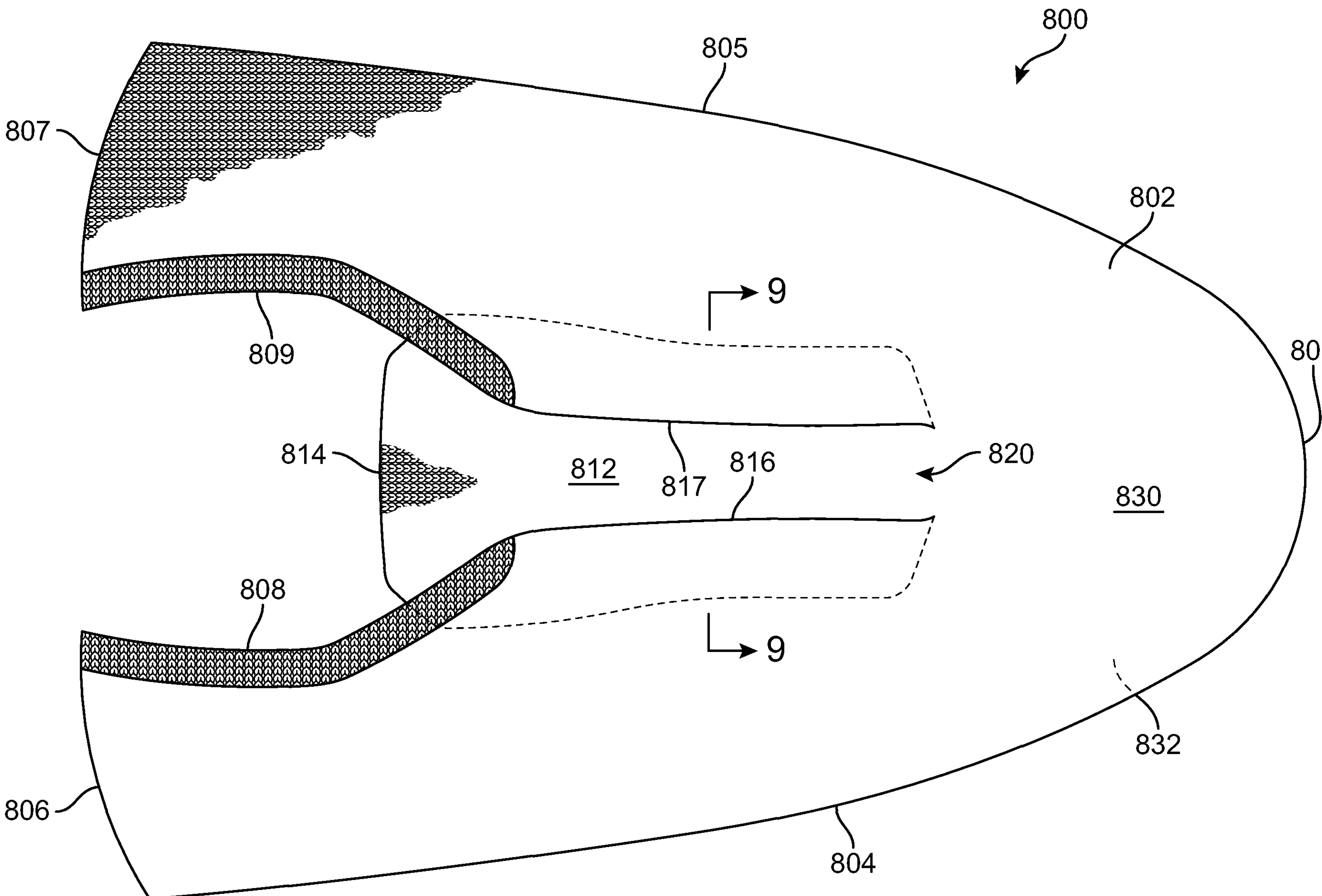

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FIG. 8

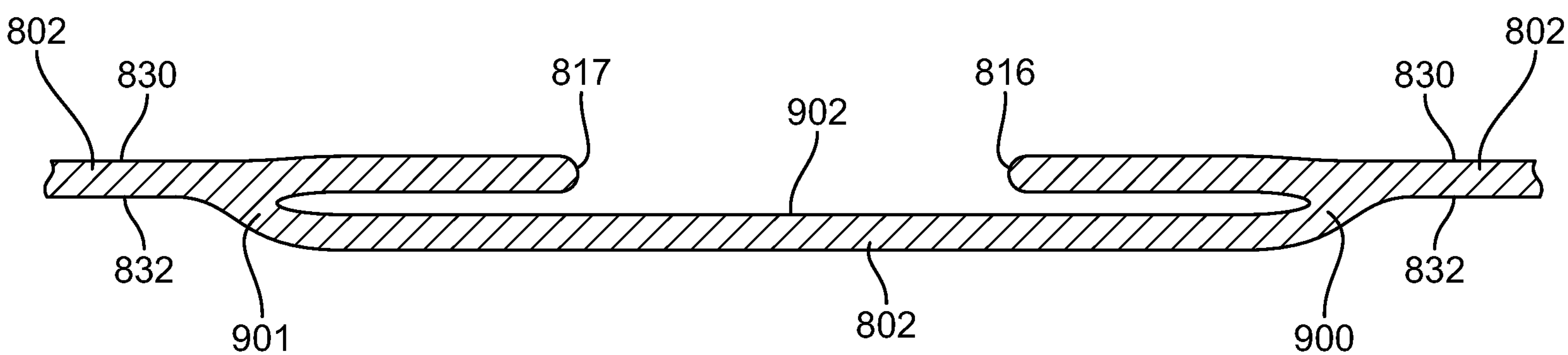

FIG. 9

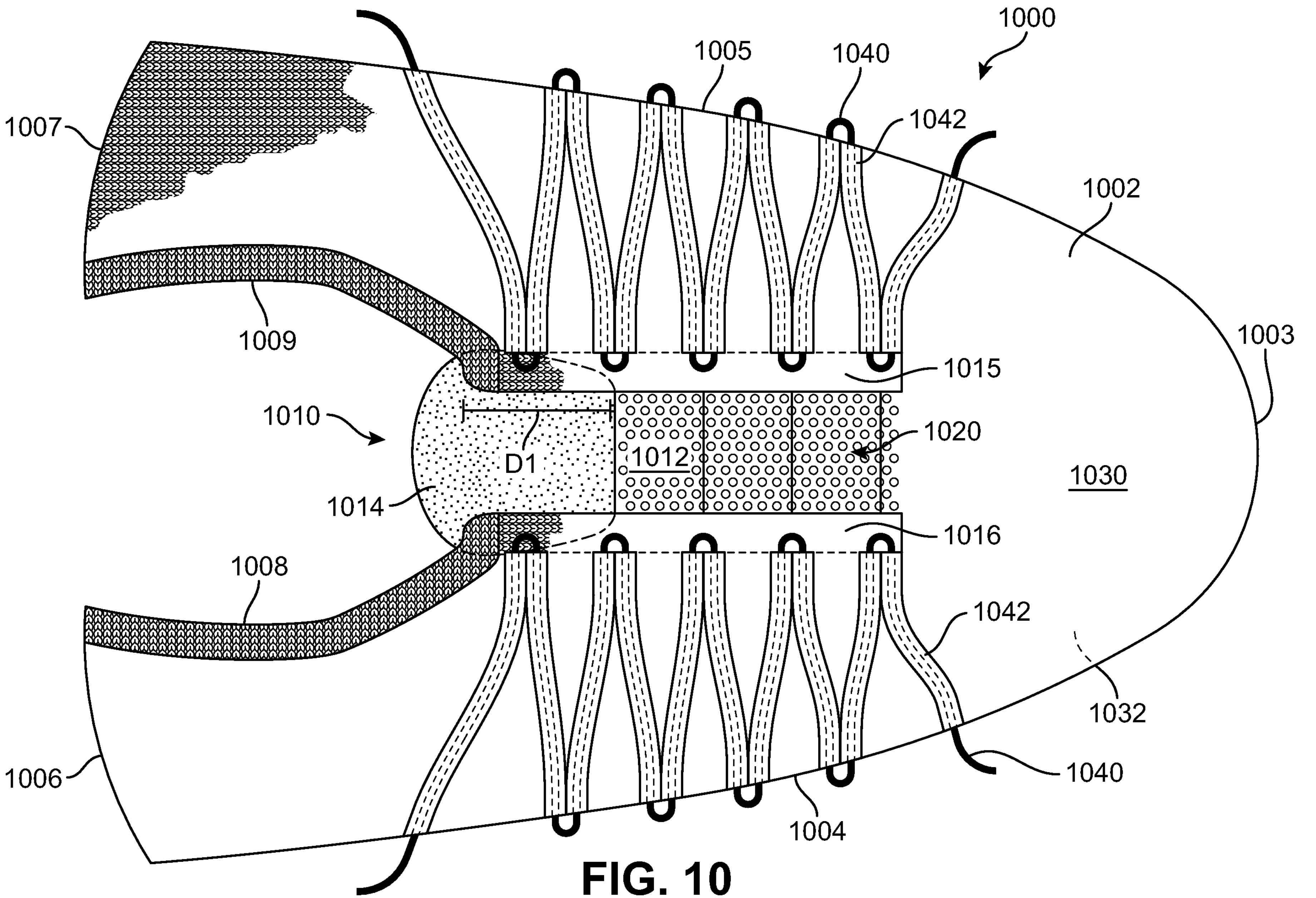
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FIG. 10

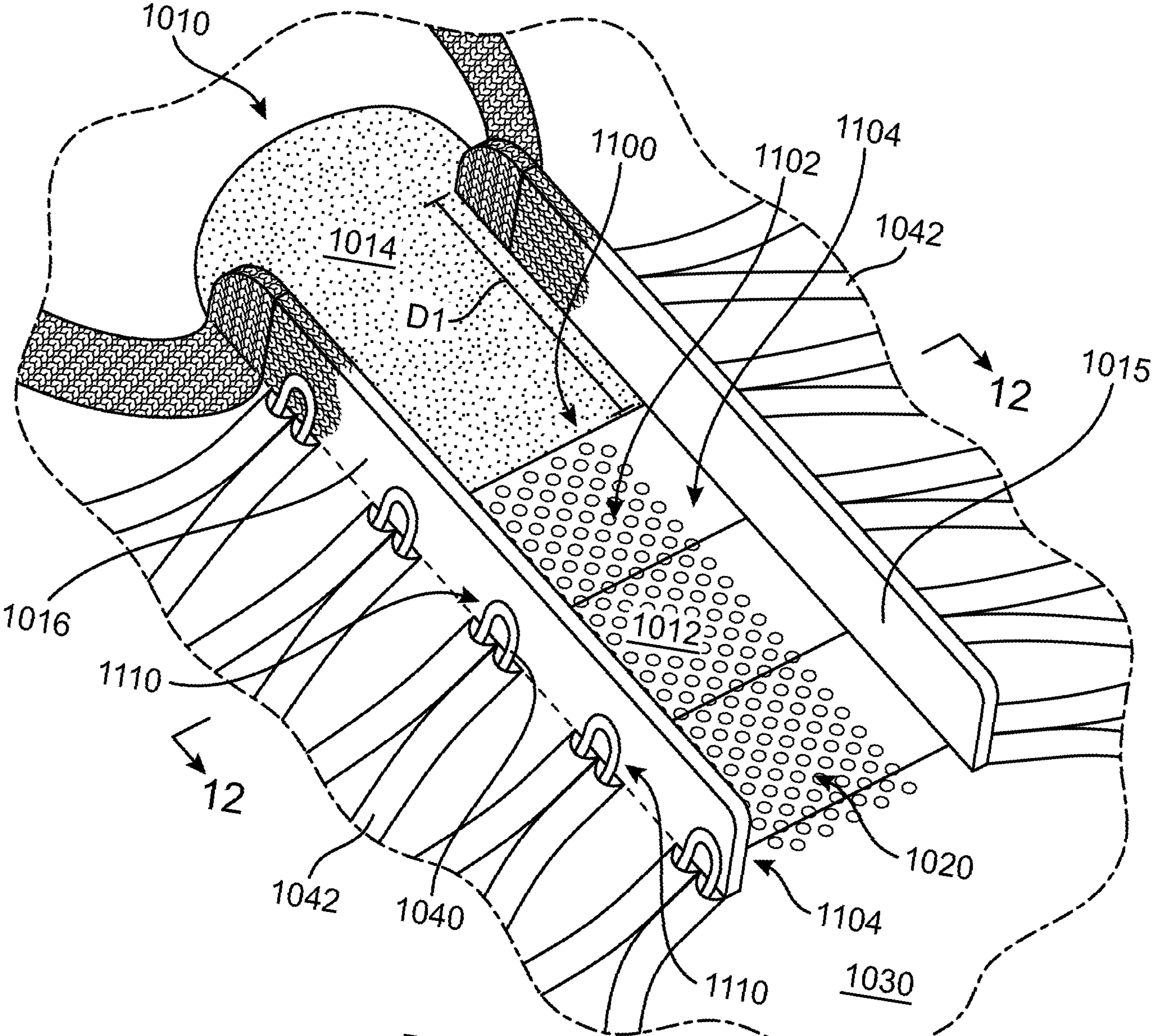
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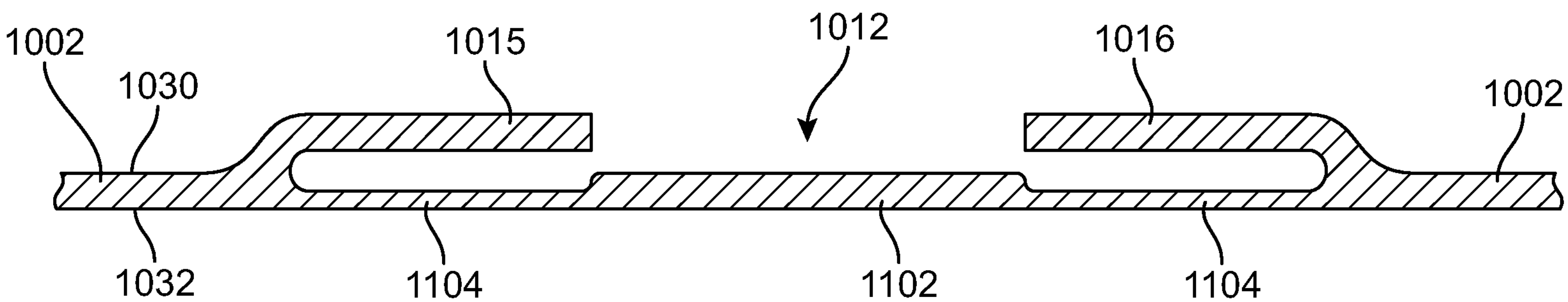
FIG. 11



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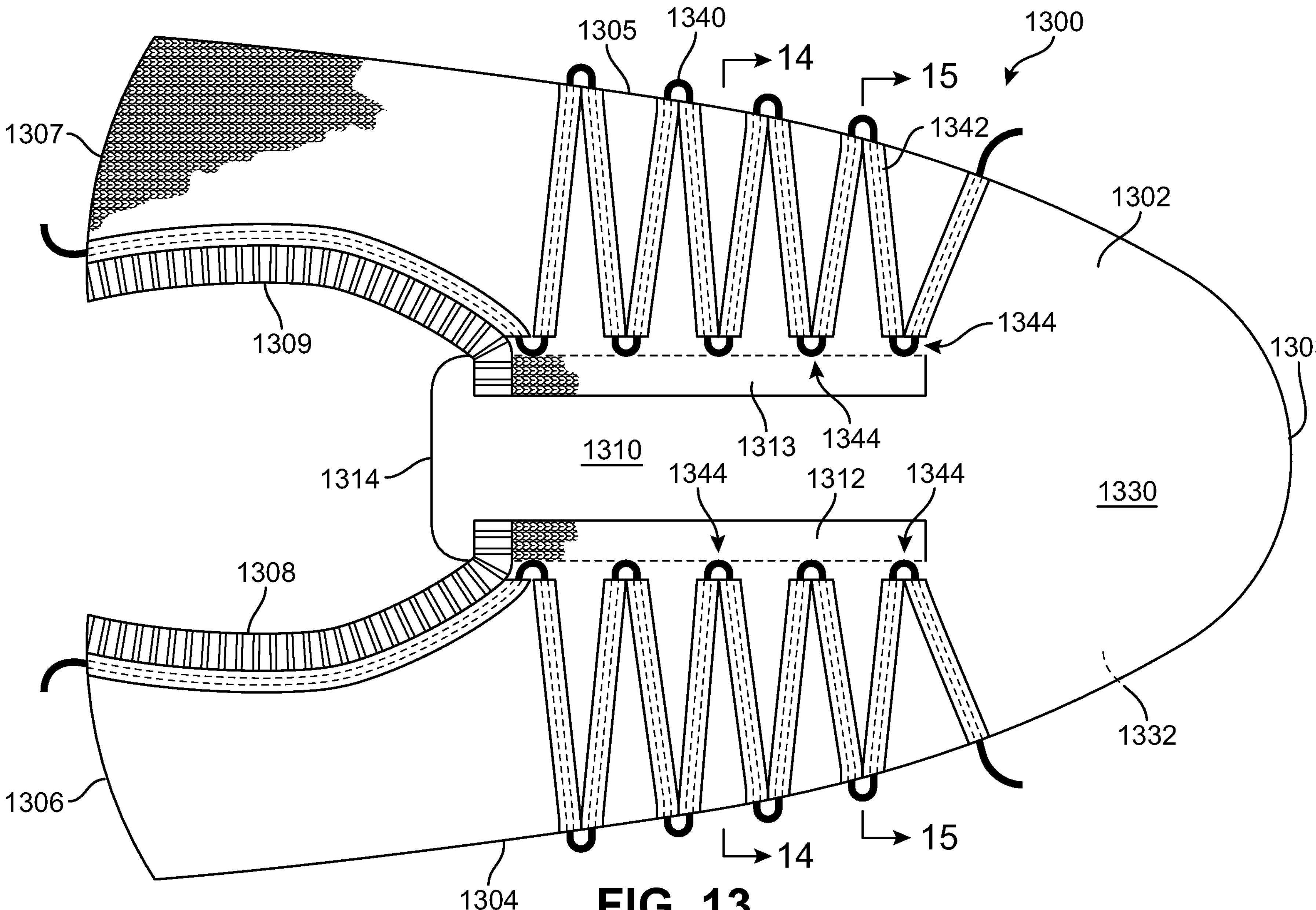
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FIG. 13

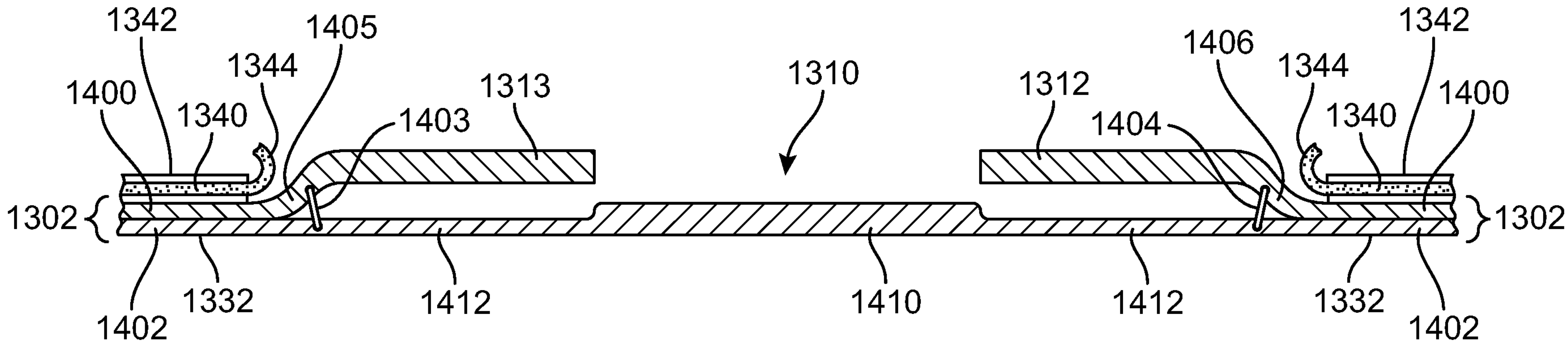
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FIG. 14

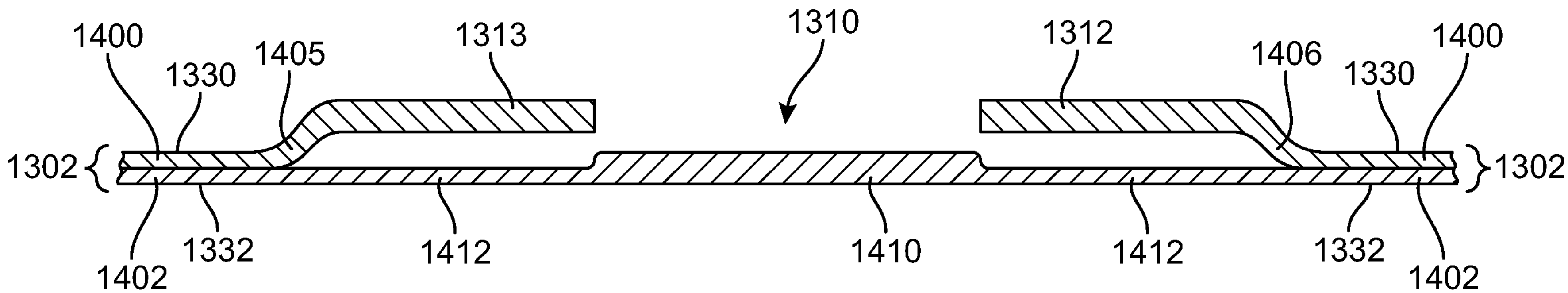
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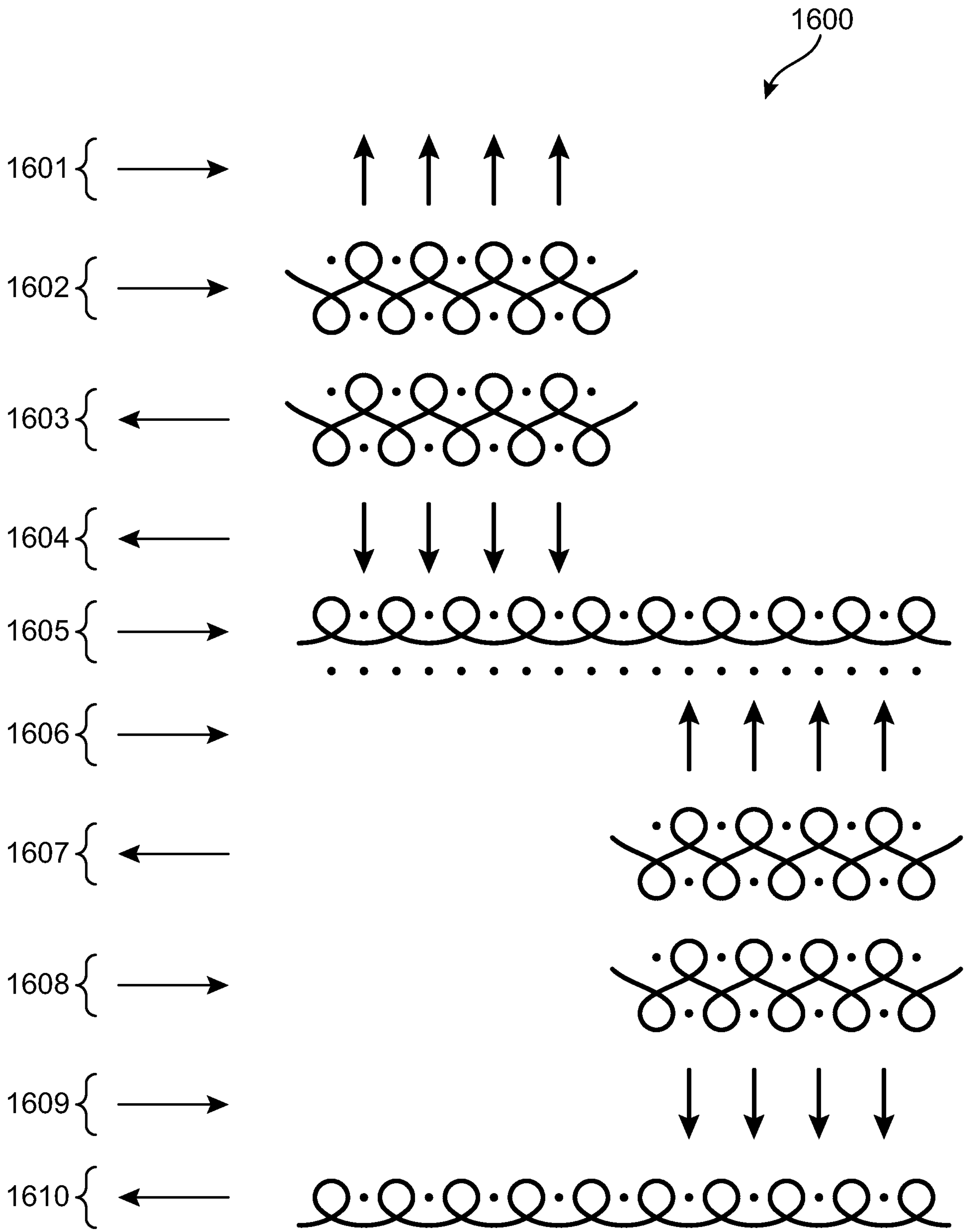
FIG. 15



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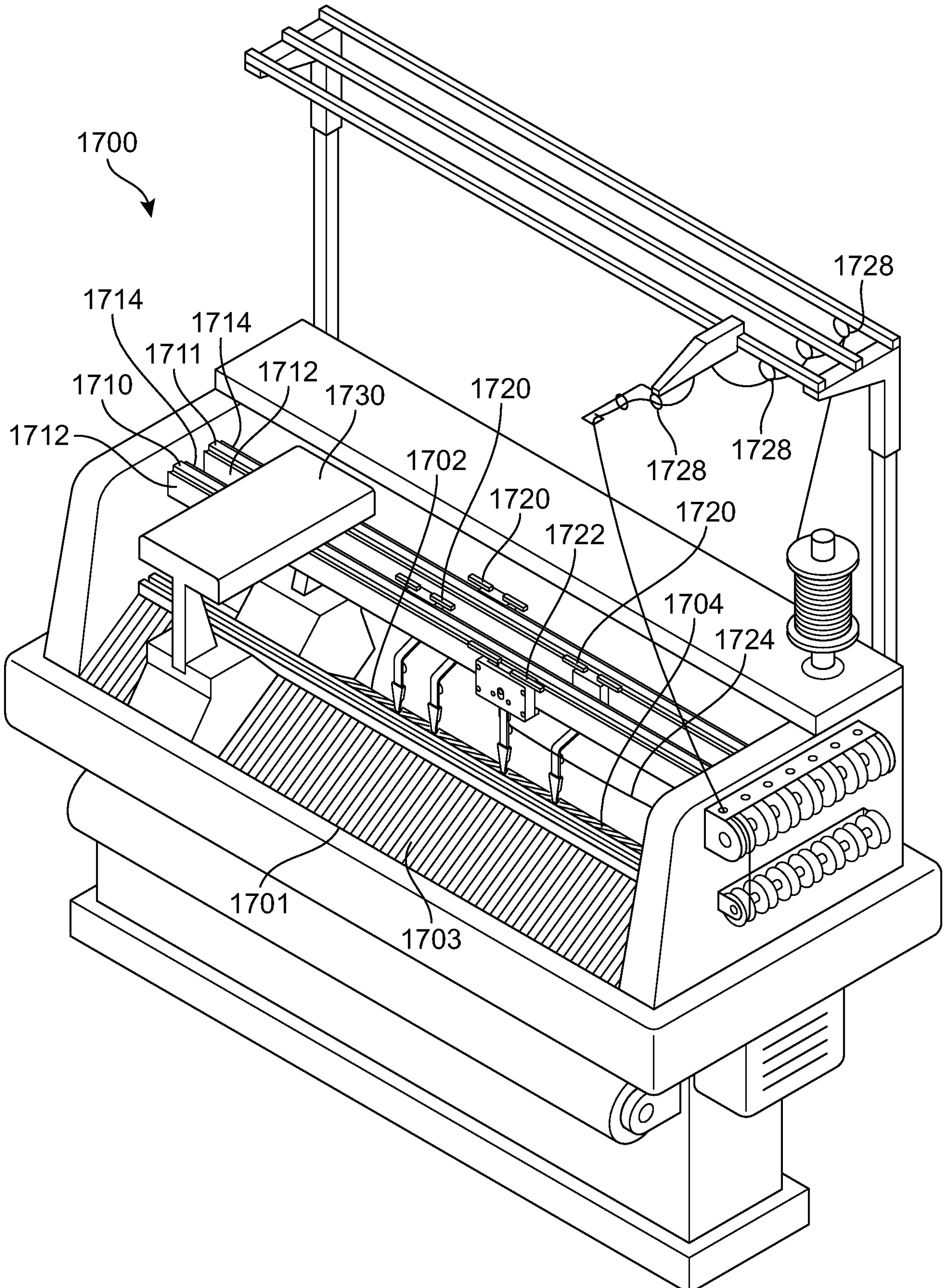
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FIG. 17

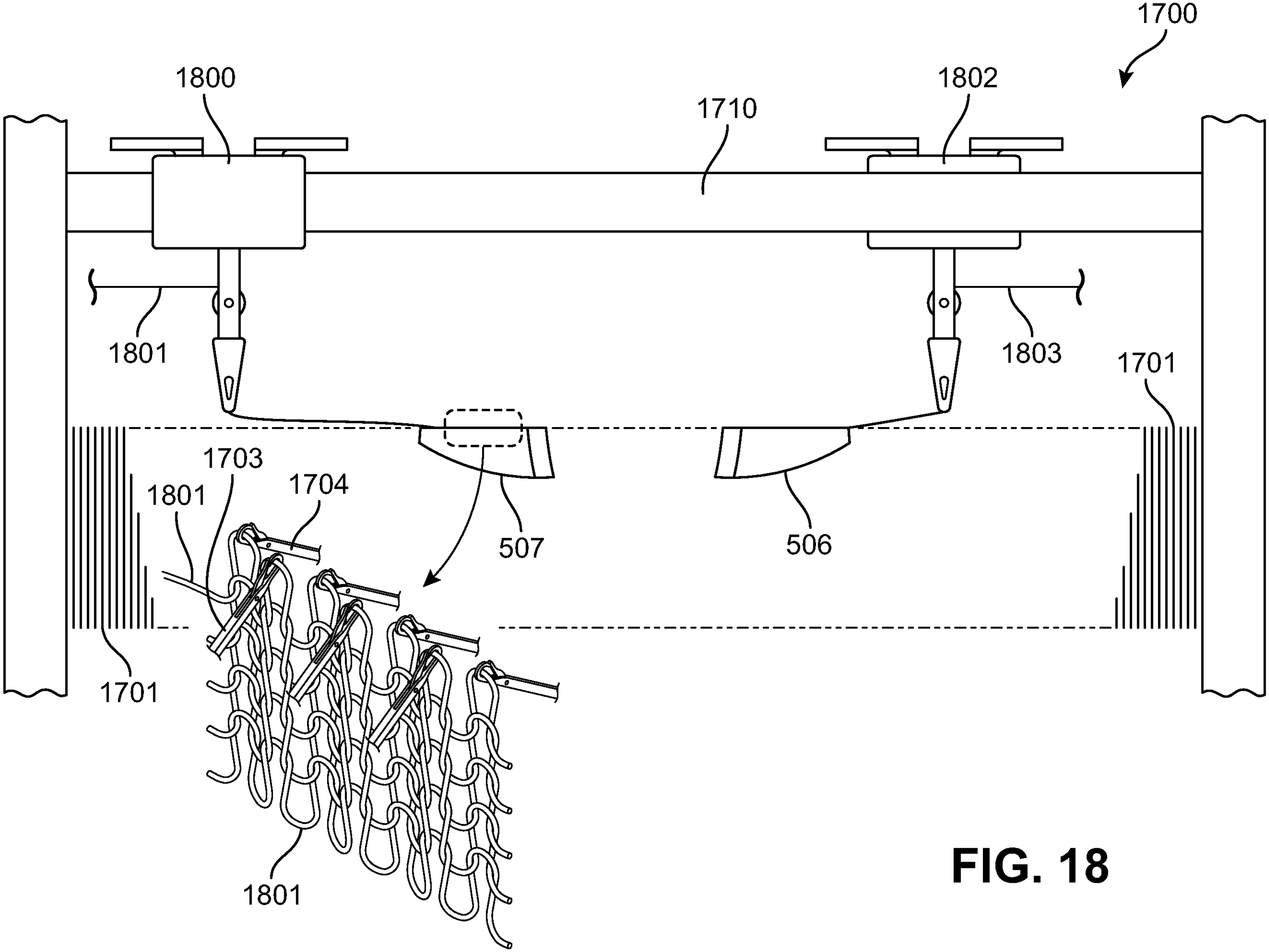
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FIG. 18

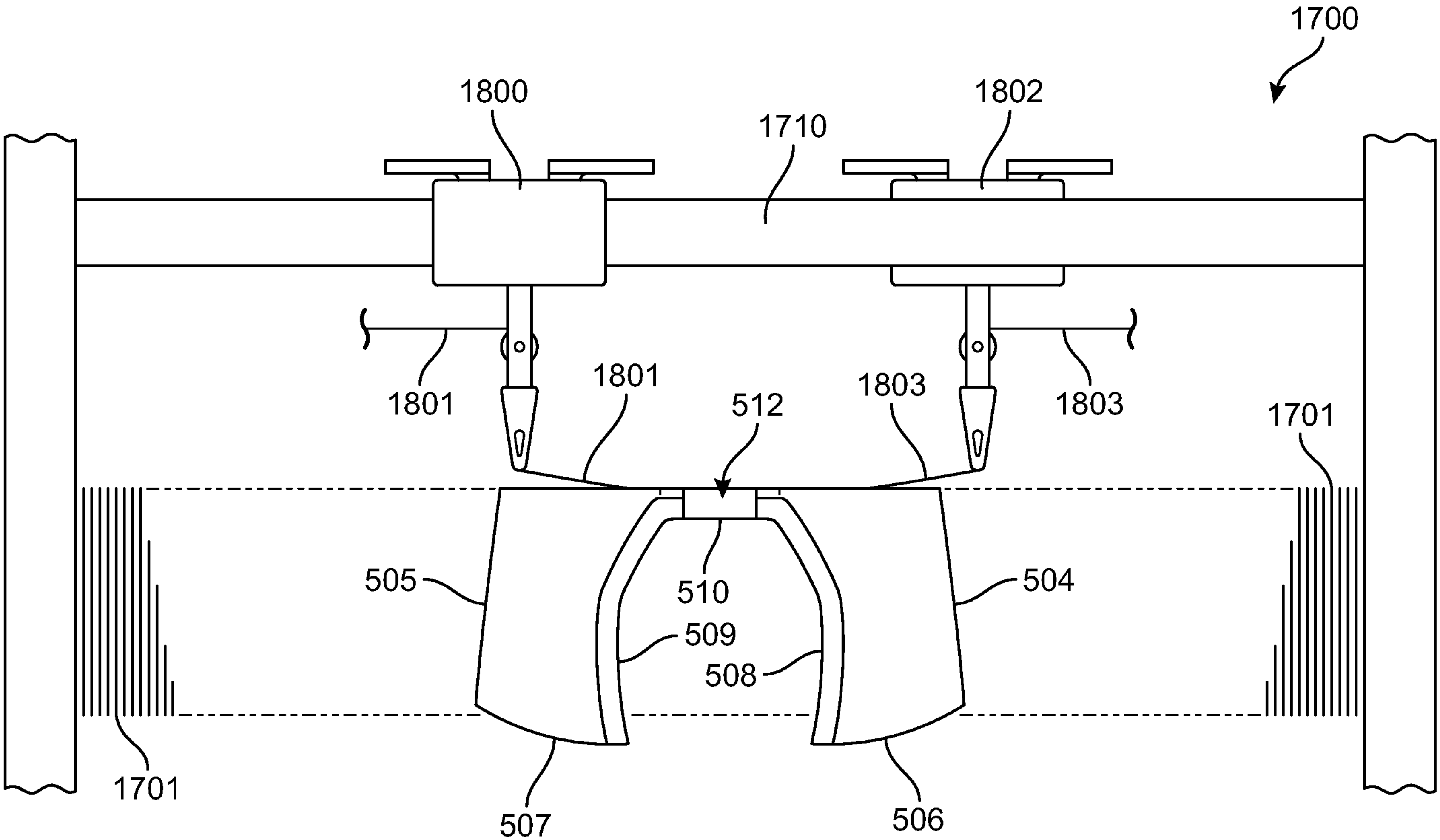
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FIG. 19

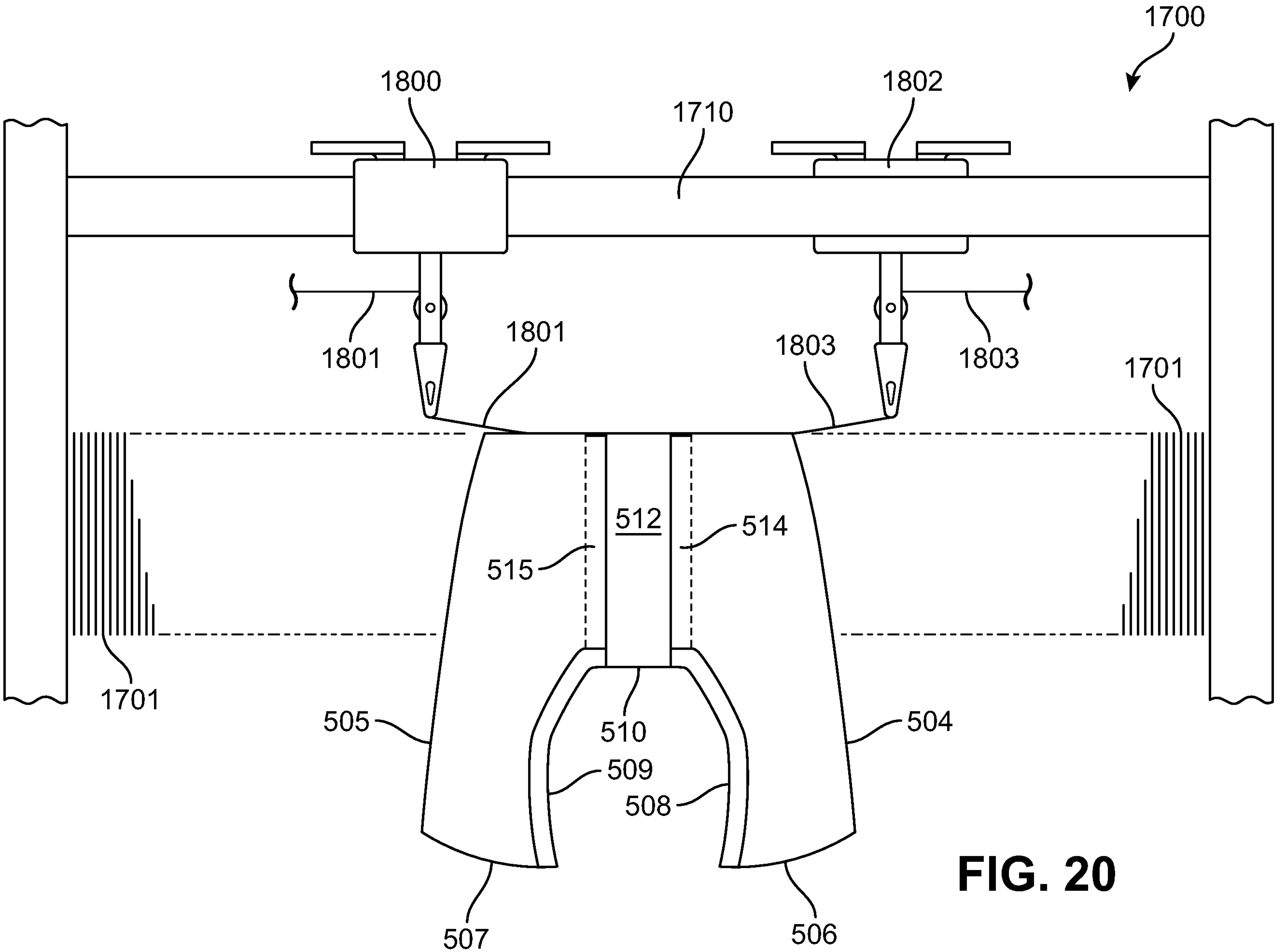
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FIG. 20

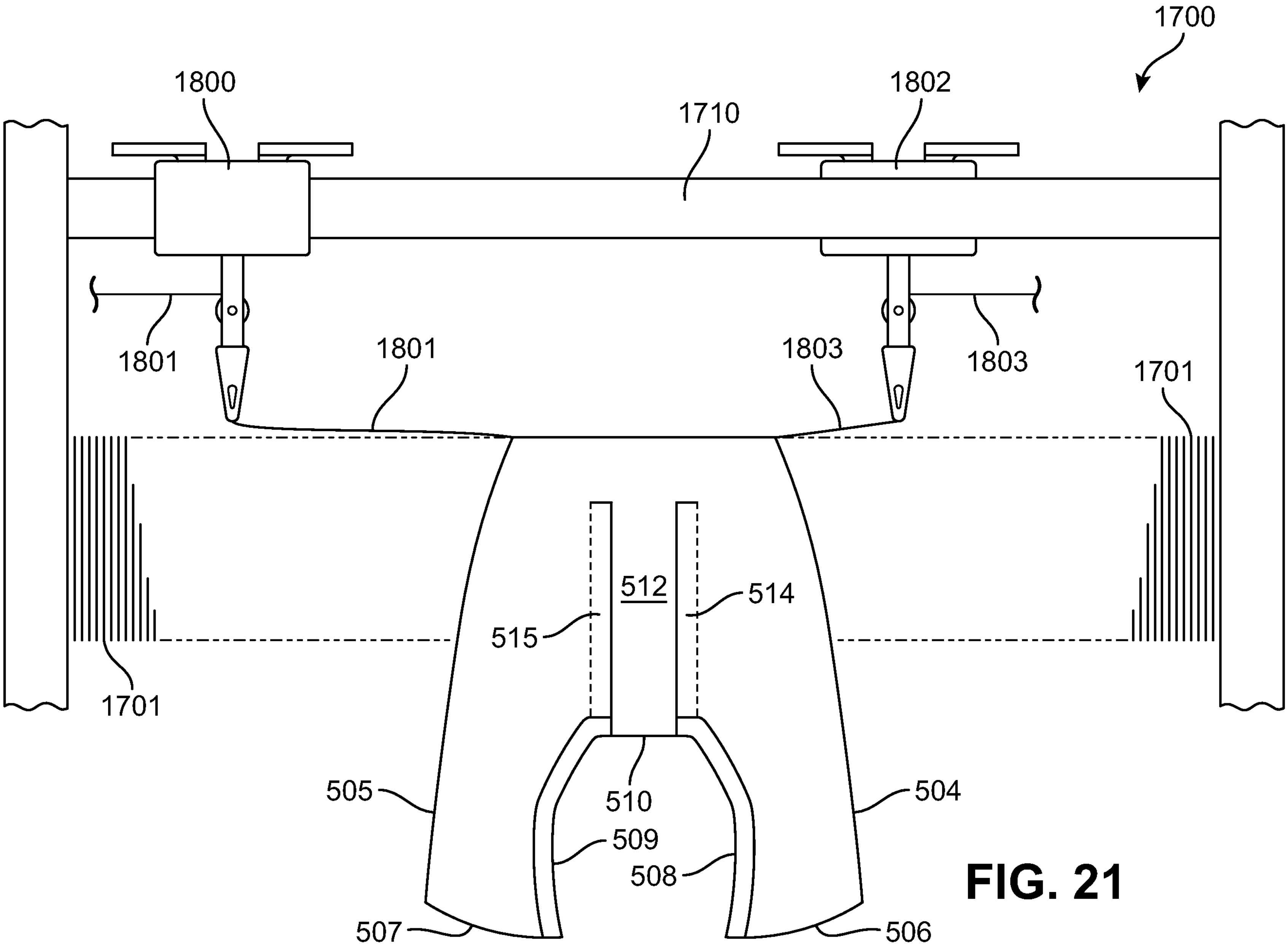
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FIG. 21

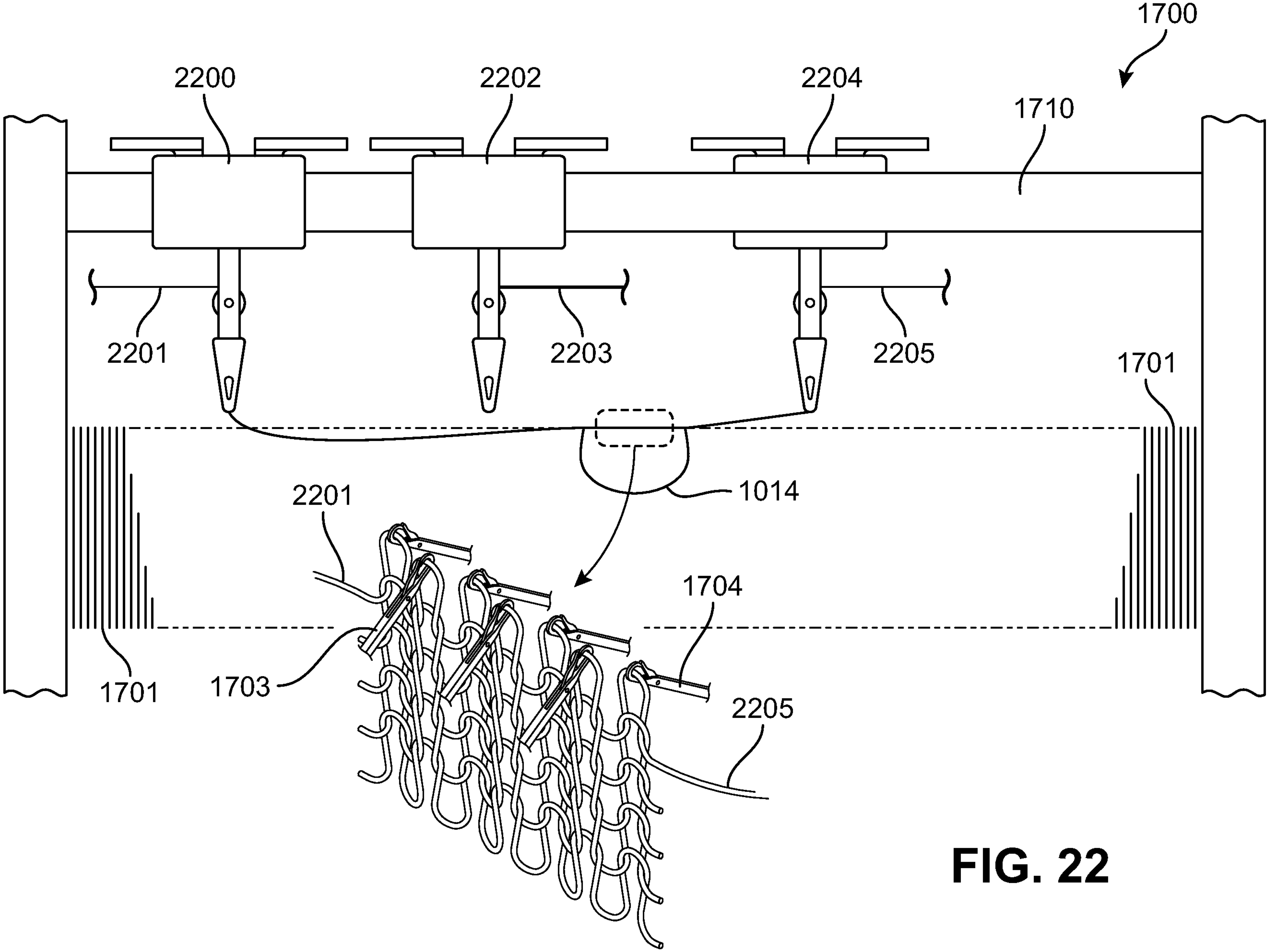
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FIG. 22

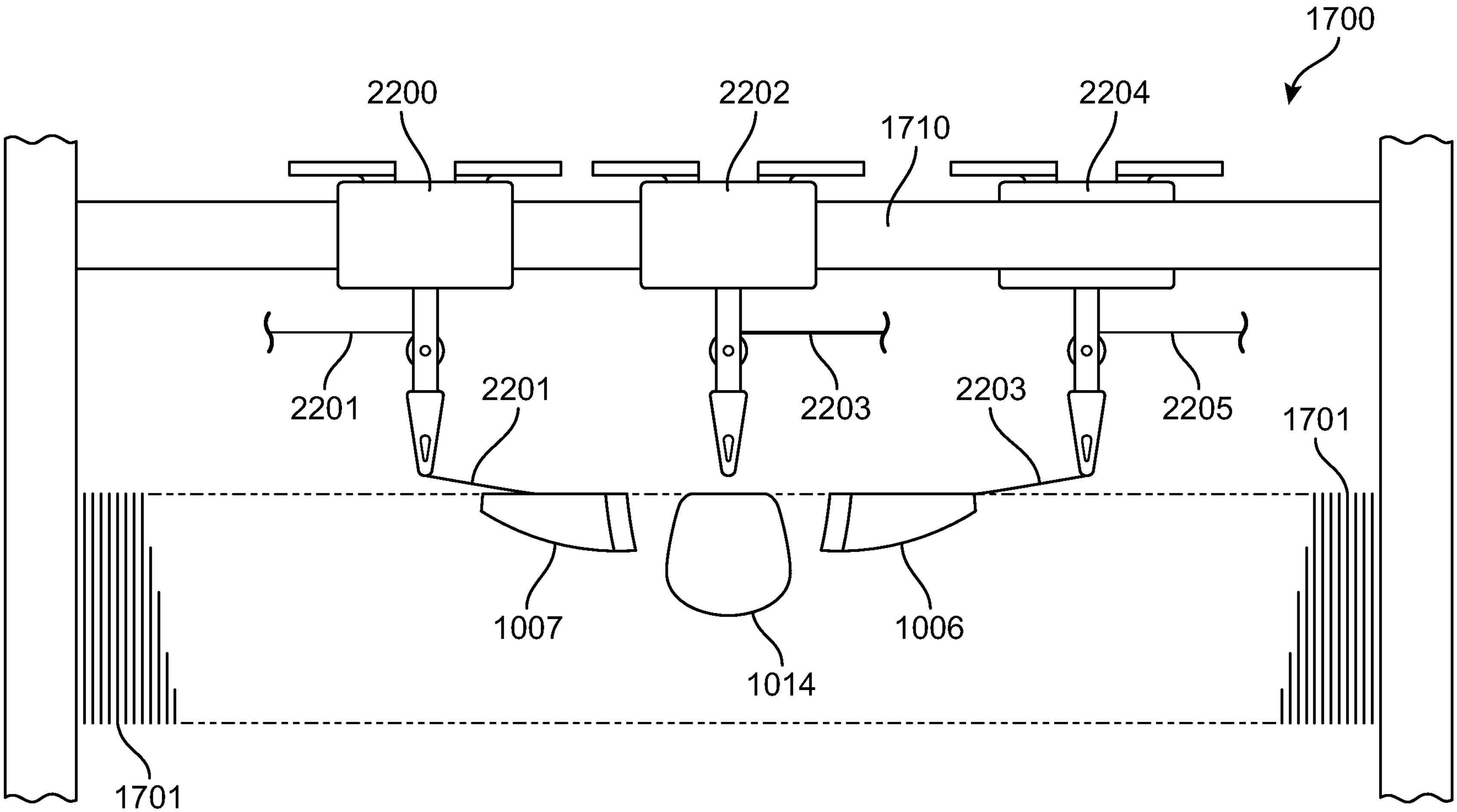
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FIG. 23

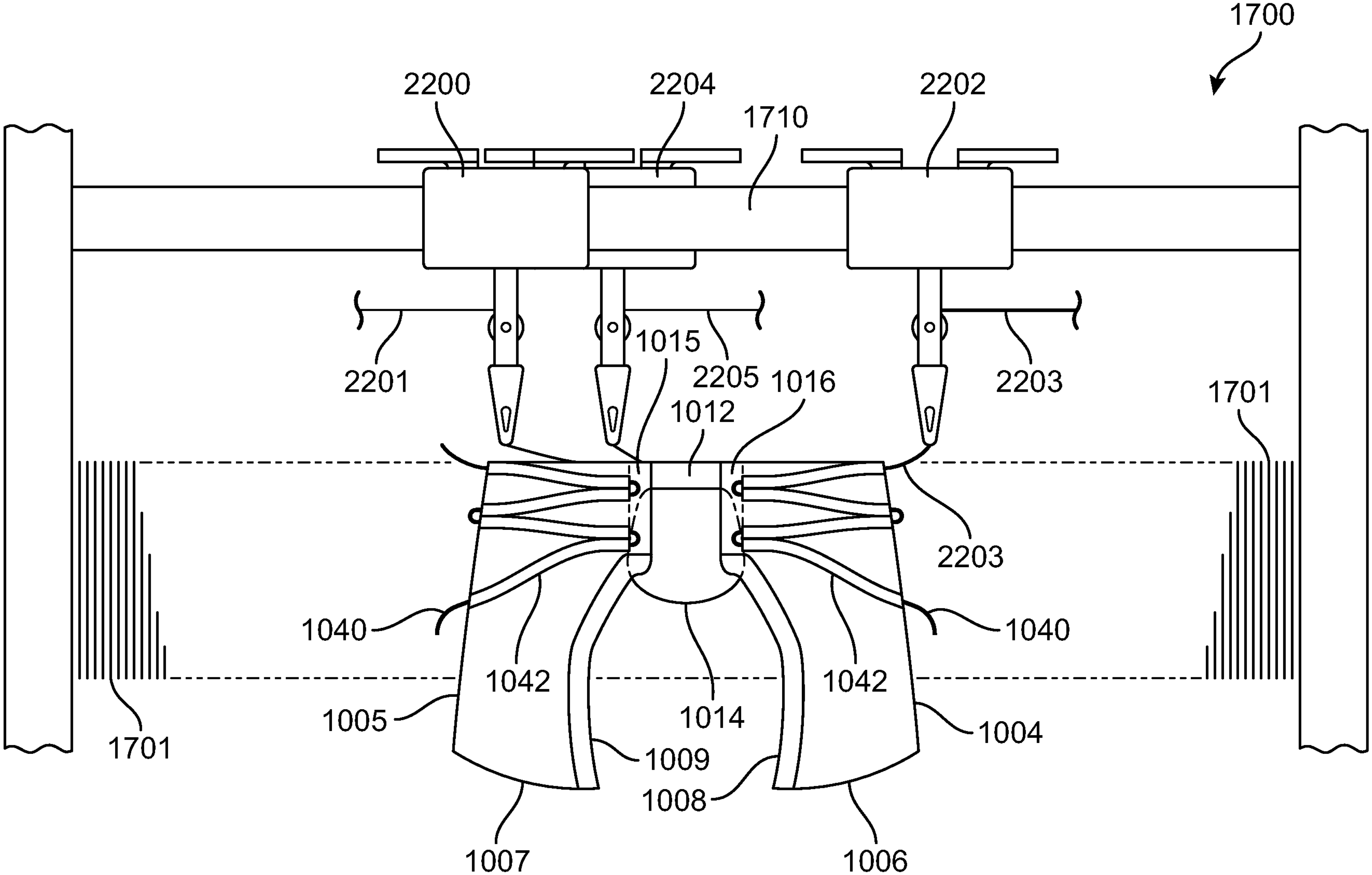
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FIG. 24

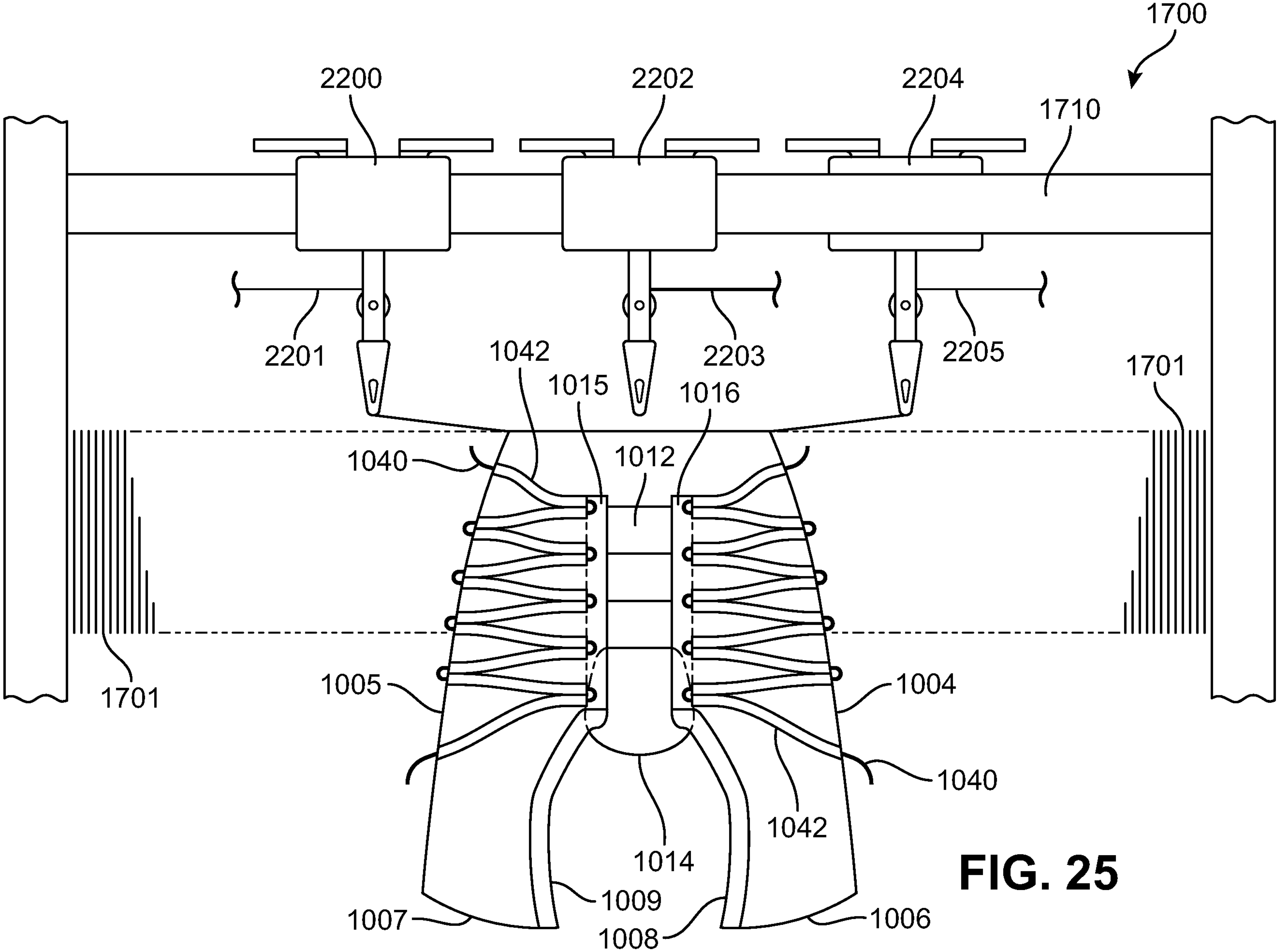
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FIG. 25

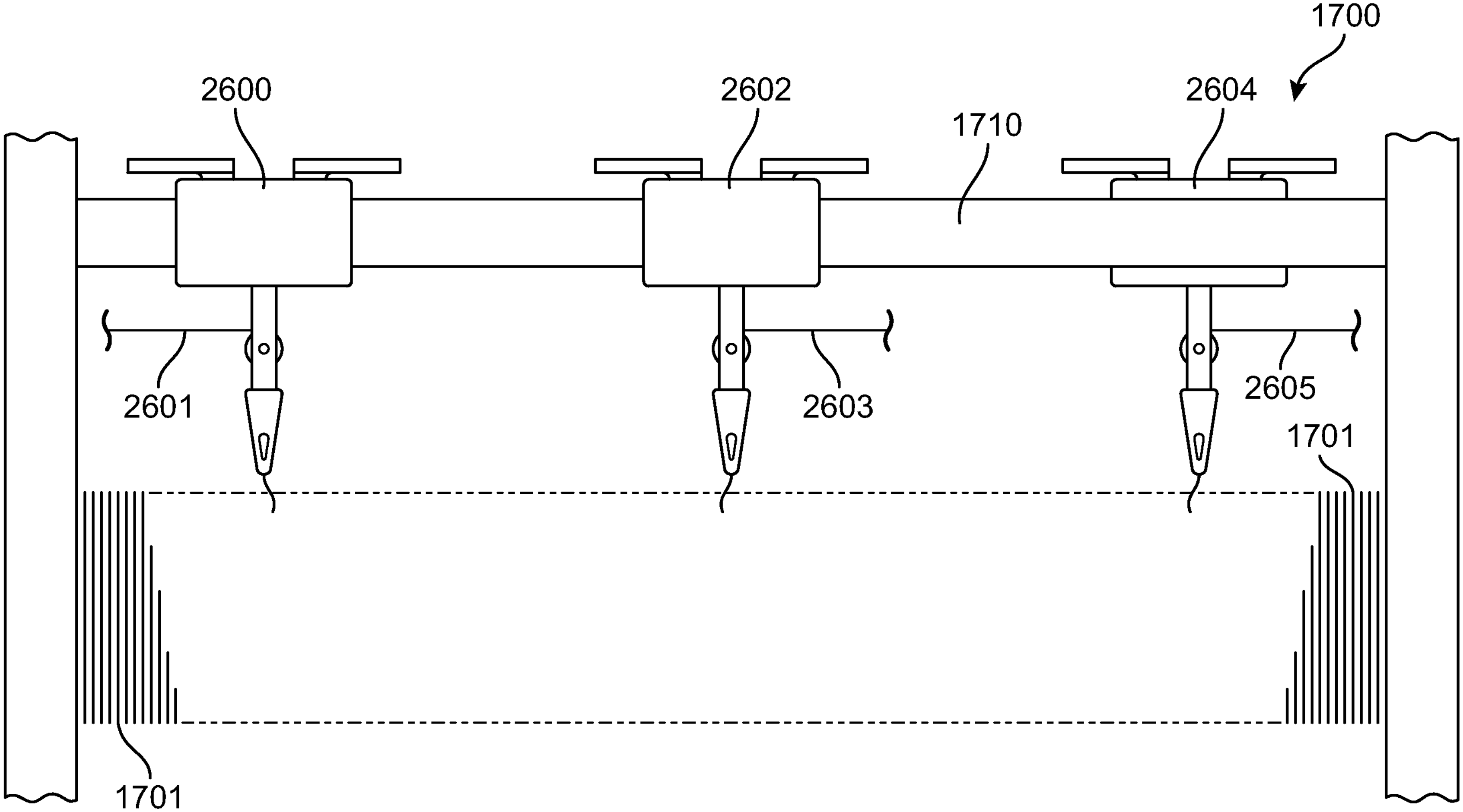

FIG. 26

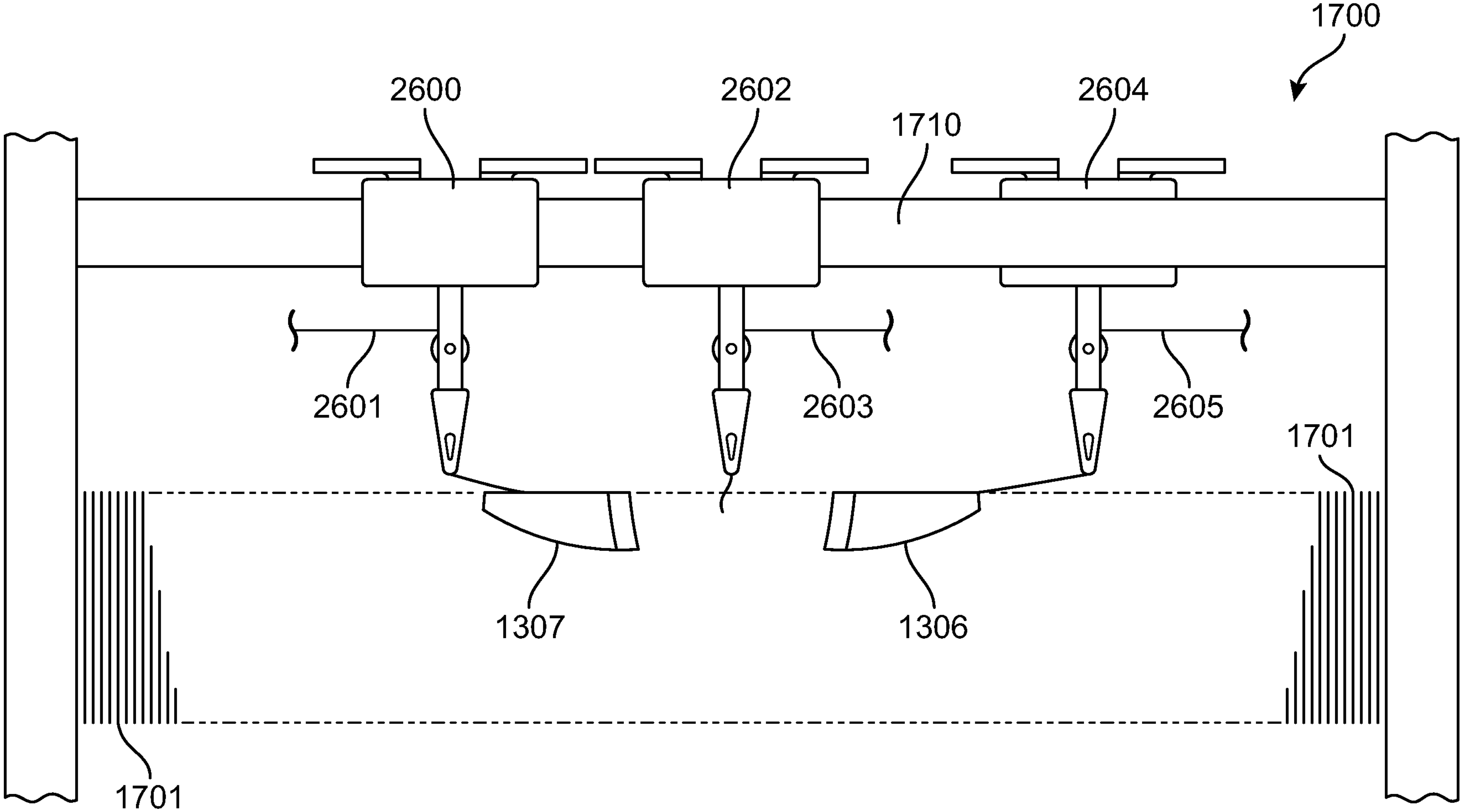

FIG. 27

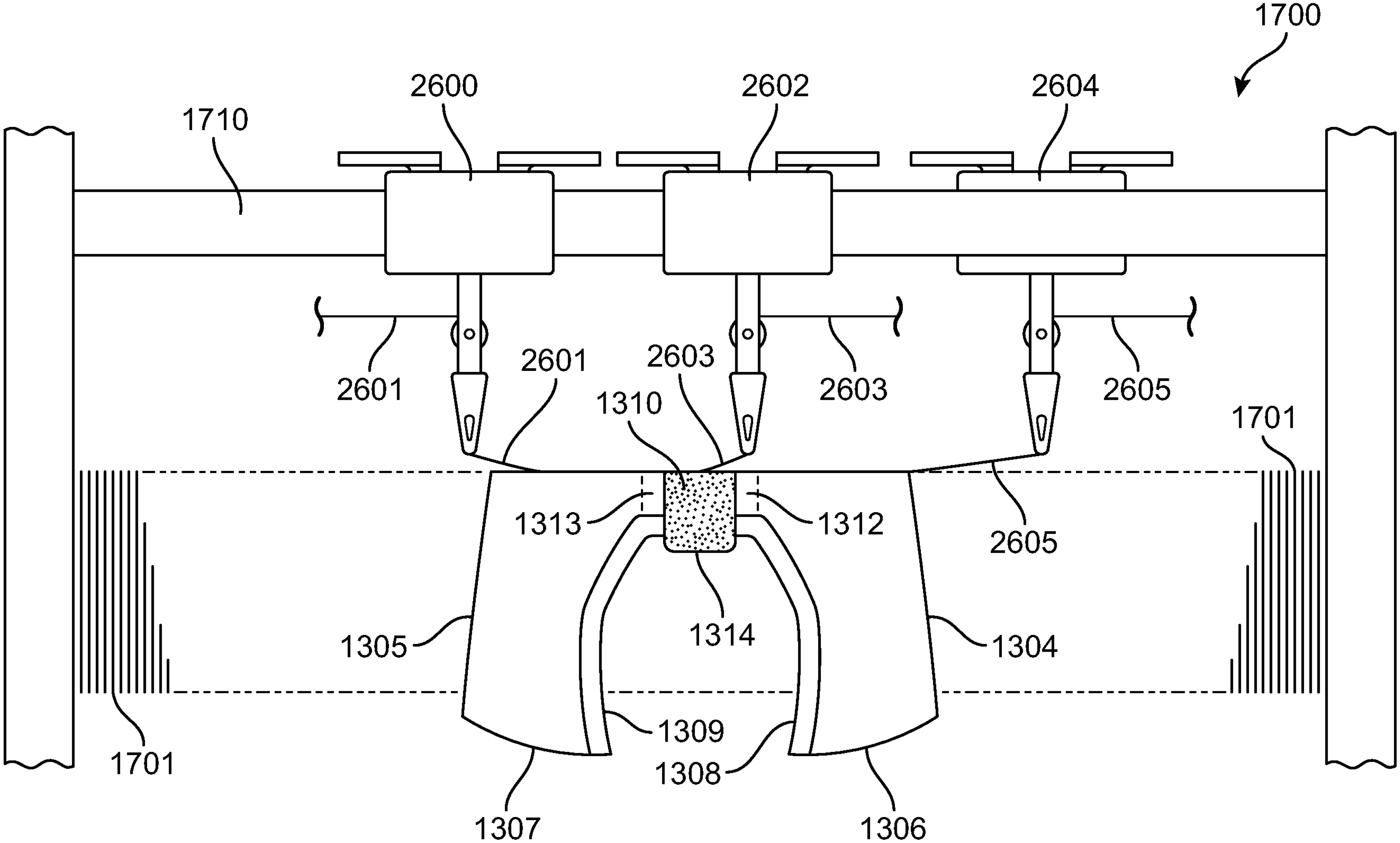
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FIG. 28

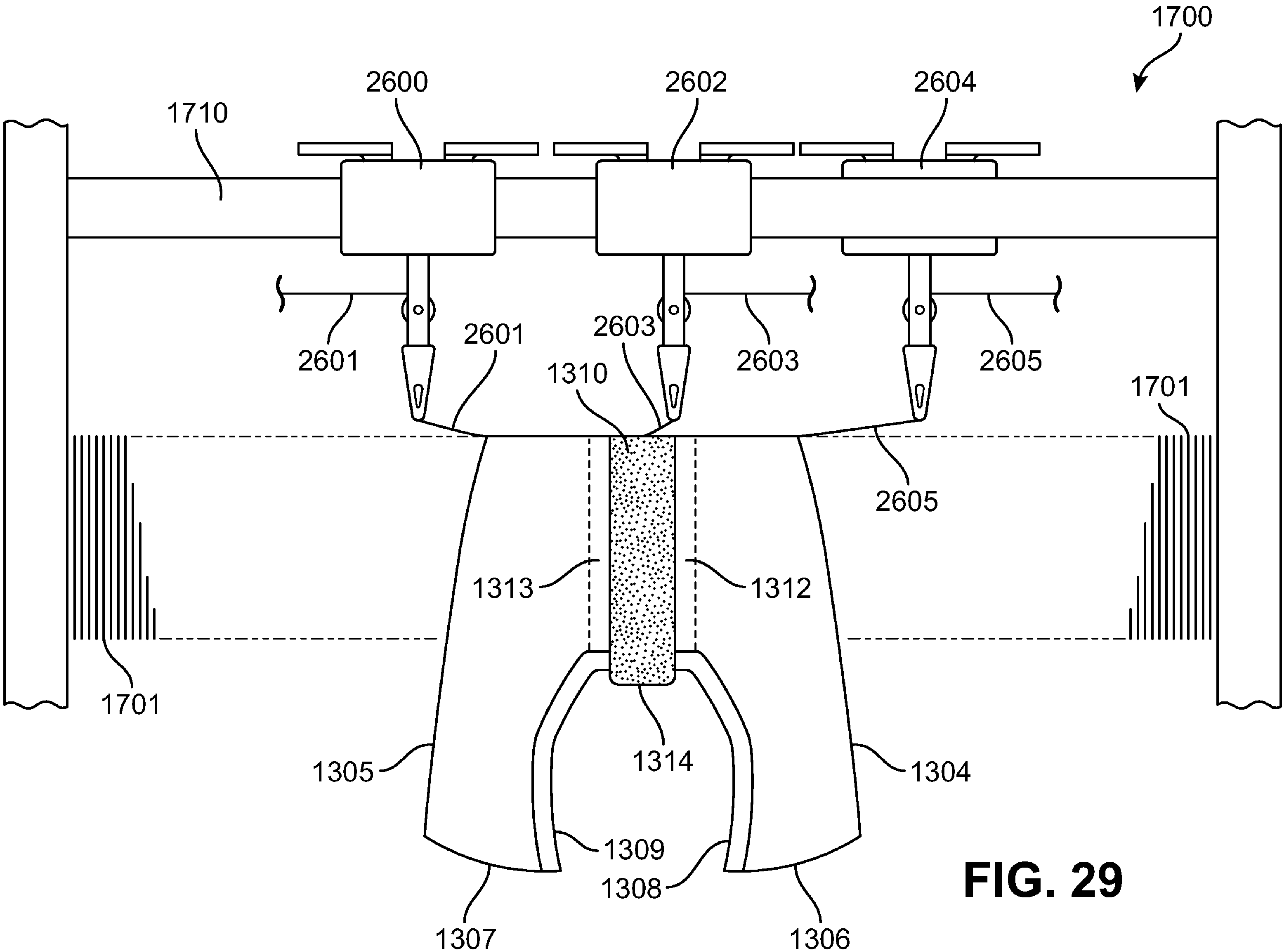
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FIG. 29

METHOD OF KNITTING A KNITTED COMPONENT WITH AN INTEGRAL KNIT TONGUE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation-in-part of co-pending U.S. Patent Application Serial Number 13/400,511, entitled “Article Of Footwear Incorporating A Knitted Component With A Tongue”, filed on February 20, 2012, which application is hereby incorporated by reference in its entirety.

BACKGROUND

[0002] The present invention relates generally to methods of manufacturing articles of footwear, and, in particular, to a knitting process for a knitted component with an integral knit tongue for an article of footwear.

[0003] Conventional articles of footwear generally include two primary elements, an upper and a sole structure. The upper is secured to the sole structure and forms a void on the interior of the footwear for comfortably and securely receiving a foot. The sole structure is secured to a lower area of the upper, thereby being positioned between the upper and the ground. In athletic footwear, for example, the sole structure may include a midsole and an outsole. The midsole often includes a polymer foam material that attenuates ground reaction forces to lessen stresses upon the foot and leg during walking, running, and other ambulatory activities. Additionally, the midsole may include fluid-filled chambers, plates, moderators, or other elements that further attenuate forces, enhance stability, or influence the motions of the foot. The outsole is secured to a lower surface of the midsole and provides a ground-engaging portion of the sole structure formed from a durable and wear-resistant material, such as rubber. The sole structure may also include a sockliner positioned within the void and proximal a lower surface of the foot to enhance footwear comfort.

[0004] The upper generally extends over the instep and toe areas of the foot, along the medial and lateral sides of the foot, under the foot, and around the heel area of the foot. In some articles of footwear, such as basketball footwear and boots, the upper may extend upward and around the ankle to provide support or protection for the ankle. Access to the void on the interior of the upper is generally provided by an ankle opening in a heel region of the footwear. A lacing system is often incorporated into the upper to adjust the fit of the upper, thereby permitting entry and removal of the foot from the void within the upper. The lacing system also permits the wearer to modify certain dimensions of the upper, particularly girth, to accommodate feet with varying dimensions. In addition, the upper may include a tongue that extends under the lacing system to enhance adjustability of the footwear, and the upper may incorporate a heel counter to limit movement of the heel.

[0005] A variety of material elements (e.g., textiles, polymer foam, polymer sheets, leather, synthetic leather) are conventionally used in manufacturing the upper. In athletic footwear, for example, the upper may have multiple layers that each include a variety of joined material elements. As examples, the material elements may be selected to impart stretch-resistance, wear-resistance, flexibility, air-permeability, compressibility, comfort, and moisture-wicking to different areas of the upper. In order to impart the different properties to different areas of the upper, material elements are often cut to desired shapes and then joined together, usually with stitching or adhesive bonding. Moreover, the material elements are often joined in a layered configuration to impart multiple properties to the same areas. As the number and type of material elements incorporated into the upper increases, the time and expense associated with transporting, stocking, cutting, and joining the material elements may also increase. Waste material from cutting and stitching processes also accumulates to a greater degree as the number and type of material elements incorporated into the upper increases. Moreover, uppers with a greater number of material elements may be more difficult to recycle than uppers formed from fewer types and numbers of material elements. By decreasing the number of material elements used in the upper, therefore, waste may be decreased while increasing the manufacturing efficiency and recyclability of the upper.

[0006] Therefore, there exists a need for an article of footwear that incorporates a knitted component with an integral knit tongue.

SUMMARY

[0007] Various configurations of an article of footwear may have an upper and a sole structure secured to the upper. A knitted component including the upper and an integral knit tongue is incorporated into the article of footwear. The upper and the integral knit tongue are formed as a one-piece knit element. The knit element defines a portion of an exterior surface of the upper and an opposite interior surface of the upper, with the interior surface defining a void for receiving a foot. The integral knit tongue is formed of unitary knit construction with the upper as a one-piece knit element and extends through a throat area of the upper. The integral knit tongue incorporates raised elements providing lace apertures for a lacing system.

[0008] In one aspect, the invention provides a method of manufacturing a knitted component for an article of footwear, the method comprising: knitting a portion of the knitted component defining an upper with a knitting machine, the upper including a portion of at least one of an exterior surface of the knitted component and an opposite interior surface of the knitted component; and knitting an integral knit tongue that is of unitary knit construction with the upper with the knitting machine, the integral knit tongue extending through a throat area of the knitted component; and wherein the integral knit tongue is joined by knitting with the knitting machine to a forward portion of the throat area and at least along a portion of a lateral side and a medial side of the throat area of the knitted component extending from the forward portion to an ankle opening of the upper.

[0009] In another aspect, the invention provides a method of manufacturing a knitted component for an article of footwear, the method comprising: knitting a first portion of the knitted component defining an upper with a first feeder of a knitting machine, the upper including a portion of at least one of an exterior surface of the knitted component and an opposite interior surface of the knitted component; knitting a second portion of the knitted component defining the upper with a second feeder of the knitting machine; and knitting an integral knit tongue that is of unitary knit construction with the upper with at least one of the first feeder and the second feeder of the knitting machine, the integral knit tongue extending through a throat area of the knitted component; and wherein the integral knit tongue is joined by knitting with the knitting machine to a forward portion of the throat area and at least along a portion of a lateral side and a medial side of the throat area of the knitted component extending from the forward portion to an ankle opening of the upper.

[0010] In another aspect, the invention provides a method of manufacturing a knitted component for an article of footwear, the method comprising: knitting a first portion of the knitted component defining an upper with a first feeder of a knitting machine, the upper including a portion of at least one of an exterior surface of the knitted component and an opposite interior surface of the knitted component; knitting a second portion of the knitted component defining the upper with a second feeder of the knitting machine; and knitting an integral knit tongue that is of unitary knit construction with the upper with a third feeder of the knitting machine, the integral knit tongue extending through a throat area of the knitted component; and wherein the integral knit tongue is joined by knitting with the knitting machine to a forward portion of the throat area and at least along a portion of a lateral side and a medial side of the throat area of the knitted component extending from the forward portion to an ankle opening of the upper.

[0011] Other systems, methods, features and advantages of the invention will be, or will become, apparent to one of ordinary skill in the art upon examination of the following figures and detailed description. It is intended that all such additional systems, methods, features and advantages be included within this description and this summary, be within the scope of the invention, and be protected by the following claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The invention can be better understood with reference to the following drawings and description. The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention. Moreover, in the figures, like reference numerals designate corresponding parts throughout the different views.

[0013] FIG. 1 is an isometric view of an exemplary embodiment of an article of footwear;

[0014] FIG. 2 is a lateral side view of an exemplary embodiment of an article of footwear;

[0015] FIG. 3 is a medial side view of an exemplary embodiment of an article of footwear;

[0016] FIG. 4A is a cross-sectional view of the article of footwear, as defined by section lines 4A in FIGS. 2 and 3;

[0017] FIG. 4B is a cross-sectional view of the article of footwear, as defined by section lines 4B in FIGS. 2 and 3;

[0018] FIG. 5 is a top plan view of an exemplary embodiment of a knitted component with an integral knit tongue;

[0019] FIG. 6 is a cross-sectional view of the knitted component with the integral knit tongue, as defined by section line 6 in FIG. 5;

[0020] FIG. 7 is an enlarged schematic view of the integral knit tongue of the knitted component;

[0021] FIG. 8 is a top plan view of an alternate embodiment of a knitted component with an integral knit tongue;

[0022] FIG. 9 is a cross-sectional view of the knitted component with the integral knit tongue, as defined by section line 9 in FIG. 8;

[0023] FIG. 10 is a top plan view of an alternate embodiment of a knitted component with an integral knit tongue having a partially integral portion;

[0024] FIG. 11 is an enlarged schematic view of the integral knit tongue of the knitted component having a partially integral portion;

[0025] FIG. 12 is a cross-sectional view of the knitted component with the integral knit tongue having a partially integral portion, as defined by section line 12 in FIG. 11;

[0026] FIG. 13 is a top plan view of an alternate embodiment of a knitted component with an integral knit tongue having partially decoupled knit elements;

[0027] FIG. 14 is a cross-sectional view of the integral knit tongue of the knitted component having partially decoupled knit elements, as defined by section line 14 in FIG. 13;

[0028] FIG. 15 is a cross-sectional view of the integral knit tongue of the knitted component having partially decoupled knit elements, as defined by section line 15 in FIG. 13;

[0029] FIG. 16 is a loop diagram of an exemplary embodiment of an integral knit tongue;

[0030] FIG. 17 is an isometric view of an exemplary embodiment of a knitting machine;

[0031] FIG. 18 is a schematic view of internal components of the knitting machine in operation;

[0032] FIG. 19 is a schematic view of internal components of the knitting machine in operation to manufacture a knitted component with an integral knit tongue;

[0033] FIG. 20 is a schematic view of internal components of the knitting machine in operation to manufacture a knitted component with an integral knit tongue;

[0034] FIG. 21 is a schematic view of internal components of the knitting machine in operation to manufacture a knitted component with an integral knit tongue;

[0035] FIG. 22 is a schematic view of internal components of the knitting machine in operation to manufacture a knitted component with an integral knit tongue having a partially integral portion;

[0036] FIG. 23 is a schematic view of internal components of the knitting machine in operation to manufacture a knitted component with an integral knit tongue having a partially integral portion;

[0037] FIG. 24 is a schematic view of internal components of the knitting machine in operation to manufacture a knitted component with an integral knit tongue having a partially integral portion;

[0038] FIG. 25 is a schematic view of internal components of the knitting machine in operation to manufacture a knitted component with an integral knit tongue having a partially integral portion;

[0039] FIG. 26 is a schematic view of internal components of the knitting machine in operation to manufacture a knitted component with an integral knit tongue having partially decoupled knit layers;

[0040] FIG. 27 is a schematic view of internal components of the knitting machine in operation to manufacture a knitted component with an integral knit tongue having partially decoupled knit layers;

[0041] FIG. 28 is a schematic view of internal components of the knitting machine in operation to manufacture a knitted component with an integral knit tongue having partially decoupled knit layers; and

[0042] FIG. 29 is a schematic view of internal components of the knitting machine in operation to manufacture a knitted component with an integral knit tongue having partially decoupled knit layers.

DETAILED DESCRIPTION

[0043] The following discussion and accompanying figures disclose a variety of concepts relating to knitted components and the manufacture of knitted components. Although the knitted components may be used in a variety of products, an article of footwear that incorporates one of the knitted components is disclosed below as an example. In addition to footwear, the knitted components may be used in other types of apparel (e.g., shirts, pants, socks, jackets, undergarments), athletic equipment (e.g., golf bags, baseball and football gloves, soccer ball restriction structures), containers (e.g., backpacks, bags), and upholstery for furniture (e.g., chairs, couches, car seats). The knitted components may also be used in bed coverings (e.g., sheets, blankets), table coverings, towels, flags, tents, sails, and parachutes. The knitted components may be used as technical textiles for industrial purposes, including structures for automotive and aerospace applications, filter materials, medical textiles (e.g. bandages, swabs, implants), geotextiles for reinforcing embankments, agrotextiles for crop protection, and industrial apparel that protects or insulates against heat and radiation. Accordingly, the knitted components and other concepts disclosed herein may be incorporated into a variety of products for both personal and industrial purposes.

[0044] Footwear Configurations

[0045] FIGS. 1 through 15 illustrate various footwear configurations according to the principles described and illustrated herein. In particular, FIGS. 1-4B illustrate an exemplary embodiment of an article of footwear incorporating a knitted component including an upper and an integral knit tongue.

[0046] FIGS. 1 through 4B illustrate an exemplary embodiment of an article of footwear 100, also referred to simply as footwear 100. In some embodiments, article of footwear 100 may include a sole structure 110 and an upper 120. Although footwear 100 is illustrated as having a general configuration suitable for running, concepts associated with footwear 100 may also be applied to a variety of other athletic footwear types, including baseball shoes, basketball shoes, cycling shoes, football shoes, tennis shoes, soccer shoes, training shoes, walking shoes, and hiking boots, for example. The concepts may also be applied to footwear types that are generally considered to be non-athletic, including dress shoes, loafers, sandals, and work boots. Accordingly, the concepts disclosed with respect to footwear 100 may be applied to a wide variety of footwear types.

[0047] For reference purposes, footwear 100 may be divided into three general regions: a forefoot region 101, a midfoot region 102, and a heel region 103, as shown in FIGS. 1, 2, and 3. Forefoot region 101 generally includes portions of footwear 100 corresponding with the toes and the joints connecting the metatarsals with the phalanges. Midfoot region 102 generally includes portions of footwear 100 corresponding with an arch area of the foot. Heel region 103 generally corresponds with rear portions of the foot, including the calcaneus bone. Footwear 100 also includes a lateral side 104 and a medial side 105, which extend through each of forefoot region 101, midfoot region 102, and heel region 103 and correspond with opposite sides of footwear 100. More particularly, lateral side 104 corresponds with an outside area of the foot (i.e., the surface that faces away from the other foot), and medial side 105 corresponds with an inside area of the foot (i.e., the surface that faces toward the other foot). Forefoot region 101, midfoot region 102, and heel region 103 and lateral side 104, medial side 105 are not intended to demarcate precise areas of footwear 100. Rather, forefoot region 101, midfoot region 102, and heel region 103 and lateral side 104, medial side 105 are intended to represent general areas of footwear 100 to aid in the following discussion. In addition to footwear 100, forefoot region 101, midfoot region 102, and heel region 103 and lateral side 104, medial side 105 may also be applied to sole structure 110, upper 120, and individual elements thereof.

[0048] In an exemplary embodiment, sole structure 110 is secured to upper 120 and extends between the foot and the ground when footwear 100 is worn. In some embodiments, the primary elements of sole structure 110 are a midsole 111, an outsole 112, and a sockliner 113 (shown in FIGS. 4A and 4B).

Midsole 111 is secured to a lower surface of upper 120 and may be formed from a compressible polymer foam element (e.g., a polyurethane or ethylvinylacetate foam) that attenuates ground reaction forces (i.e., provides cushioning) when compressed between the foot and the ground during walking, running, or other ambulatory activities. In other embodiments, midsole 111 may incorporate plates, moderators, fluid-filled chambers, lasting elements, or motion control members that further attenuate forces, enhance stability, or influence the motions of the foot, or midsole 111 may be primarily formed from a fluid-filled chamber. Outsole 112 is secured to a lower surface of midsole 111 and may be formed from a wear-resistant rubber material that is textured to impart traction. Sockliner 113 is located within upper 120 and is positioned to extend under a lower surface of the foot to enhance the comfort of footwear 100. Although this configuration for sole structure 110 provides an example of a sole structure that may be used in connection with upper 120, a variety of other conventional or nonconventional configurations for sole structure 110 may also be used. Accordingly, in other embodiments, the features of sole structure 110 or any sole structure used with upper 120 may vary.

[0049] In some embodiments, upper 120 defines a void within footwear 100 for receiving and securing a foot relative to sole structure 110. The void is shaped to accommodate the foot and extends along a lateral side of the foot, along a medial side of the foot, over the foot, around the heel, and under the foot. Access to the void is provided by an ankle opening 121 located in at least heel region 103. In some embodiments, a throat area 123 extends from ankle opening 121 in heel region 103 over an area corresponding to an instep of the foot to an area adjacent to forefoot region 101. In an exemplary embodiment, an integral knit tongue 140 is formed of unitary knit construction with upper 120 and extends through throat area 123 of upper 120 between lateral side 104 and medial side 105.

[0050] A lace 122 extends through various lace apertures 143 in raised elements 142 of integral knit tongue 140 and permits the wearer to modify dimensions of upper 120 to accommodate proportions of the foot. More particularly, lace 122 permits the wearer to tighten upper 120 around the foot, and lace 122 permits the wearer to loosen upper 120 to facilitate entry and removal of the foot from the void (i.e., through ankle opening 121). In addition, integral knit tongue 140 of upper 120 extends under lace 122 to enhance the comfort of footwear 100. In further configurations, upper 120 may include additional elements, such as (a) a heel counter in heel region 103 that enhances stability, (b) a toe guard in forefoot region 101 that is formed of a wear-resistant material, and (c) logos, trademarks, and placards with care instructions and material information.

[0051] Many conventional footwear uppers are formed from multiple material elements (e.g., textiles, polymer foam, polymer sheets, leather, synthetic leather) that are joined through stitching or bonding, for example. In contrast, a majority of upper 120 is formed from a knitted component 130, which extends through each of forefoot region 101, midfoot region 102, and heel region 103, along both lateral side 104 and medial side 105, over forefoot region 101, and around heel region 103. In addition, knitted component 130 forms portions of both an exterior surface and an opposite interior surface of upper 120. As such, knitted component 130 defines at least a portion of the void within upper 120. In some configurations, knitted component 130 may also extend under the foot. Referring to FIGS. 4A and 4B, however, a strobel sock 125 is secured to knitted component 130 and an upper surface of midsole 111, thereby forming a portion of upper 120 that extends under sockliner 113.

[0052] In some embodiments, knitted component 130 may include upper 120 and integral knit tongue 140 formed of unitary knit construction. Knitted components that include upper 120 and integral knit tongue 140 may be formed with a relatively smaller number of material elements. As discussed in the Background section above, decreasing the number of material elements used in forming an upper may decrease waste, while also increasing the manufacturing efficiency and recyclability of the upper. The tongue and other portions, such as the collar, of conventional uppers are often formed from multiple separate material elements that are later joined together. As discussed in greater detail below, however, integral knit tongue element may be primarily formed through knitting processes (rather than stitch and turn methods) that decrease waste and increase manufacturing efficiency and recyclability. Additionally, the structure of integral knit tongue element 140 may incorporate smaller numbers of seams or other discontinuities, thereby enhancing the overall comfort of footwear 100.

[0053] Additional advantages of constructing integral knit tongue 140 during the knitting process and of unitary knit construction with upper 120 include providing more efficient manufacture and common properties. More particularly, manufacturing efficiency may be increased by forming more of knitted component 130 during the knitting process and eliminating various steps (e.g., making a separate tongue, securing the tongue) that are often performed manually. Integral knit tongue 140 and upper 120 may also have common properties when formed from the same yarn (or type of yarn) or with similar knit structures. For example, using the same yarn in both of integral knit tongue 140 and upper 120 imparts similar durability, strength, stretch, wear-resistance, biodegradability, thermal, and hydrophobic properties. In addition to physical properties, using the same yarn in both of integral knit tongue 140 and upper 120 may impart common aesthetic or tactile properties, such as color, sheen, and texture. Using the same knit structures in both of integral knit tongue 140 and upper 120 may also impart common physical properties and aesthetic properties. These advantages may also be present when at least a portion of integral knit tongue 140 and at least a portion of upper 120 are formed from a common yarn (or type of yarn) or with common knit structures.

[0054] Knitted Component Configurations

[0055] FIGS. 5 through 15 illustrate various embodiments of knitted components that may be incorporated into articles of footwear in a similar manner as the exemplary embodiment of FIGS. 1 through 4B. The knitted components illustrated in FIGS. 5 through 15 are depicted separate from a remainder of footwear 100. However, it should be understood that each of the embodiments of knitted components described herein may be combined with the elements of footwear 100, described above, to form an article of footwear incorporating the knitted component.

[0056] Referring now to FIG. 5, an exemplary embodiment of a first knitted component 500 is shown in a top plan view. First knitted component 500 may be substantially similar to knitted component 130, described above. In some embodiments, first knitted component 500 includes a first portion defining an upper 502 and a second portion defining an integral knit tongue 512. In an exemplary embodiment, first knitted component 500 incorporates upper 502 and integral knit tongue element 512 formed of unitary knit construction. As used herein and in the claims, a knitted component (e.g., first knitted component 500, or other knitted components described herein) is defined as being formed of "unitary knit construction" when formed as a one-piece element through a knitting process. That is, the knitting process substantially forms the various features and structures of first knitted component 500 without the need for significant additional manufacturing steps or processes. A unitary knit construction may be used to form a knitted component having structures or elements (including upper 502 and integral knit tongue 512) that include one or more courses of yarn or other knit material that are joined such that the structures or elements include at least one course in common (i.e., sharing a common yarn) and/or include courses that are substantially continuous between each of the structures or elements. With this arrangement, a one-piece element of unitary knit construction is provided.

[0057] Although portions of first knitted component 500 may be joined to each other (e.g., edges of first knitted component 500 being joined together) following the knitting process, first knitted component 500 remains formed of unitary knit construction because it is formed as a one-piece knit element.

Moreover, first knitted component 500 remains formed of unitary knit construction when other elements (e.g., a lace, logos, trademarks, placards with care instructions and material information, structural elements) are added following the knitting process.

[0058] In an exemplary embodiment, the primary element of first knitted component 500 is a knit element forming upper 502 and integral knit tongue 512. A knit element may be formed from at least one yarn that is manipulated (e.g., with a knitting machine) to form a plurality of intermeshed loops that define a variety of courses and wales. That is, the knit element forming first knitted component 500 has the structure of a knit textile. Other embodiments of knitted components, including the embodiments described below, may include a knit element and at least one tensile element.

[0059] First knitted component 500 has a generally U-shaped configuration that is outlined by an outer perimeter and an inner perimeter. In this embodiment, the outer perimeter includes a front perimeter edge 503, a lateral perimeter edge 504, a medial perimeter edge 505, and a pair of heel edges, including a lateral heel edge 506 and a medial heel edge 507. The inner perimeter of first knitted component 500 includes a lateral inner edge 508, a medial inner edge 509, and a front inner edge 510. When incorporated into an article of footwear, including footwear 100, front perimeter edge 503, lateral perimeter edge 504, medial perimeter edge 505, and at least a portion of lateral heel edge 506 and medial heel edge 507 lays against an upper surface of a midsole and is joined to a strobel sock (e.g., midsole 111 and strobel sock 125, described above). In addition, lateral heel edge 506 and medial heel edge 507 are joined to each other and extend vertically in a heel region. In some configurations of footwear, a material element may cover a seam between lateral heel edge 506 and medial heel edge 507 to reinforce the seam and enhance the aesthetic appeal of the footwear. Taken together, lateral inner edge 508, medial inner edge 509, and front inner edge 510 form an ankle opening, including ankle opening 121 described above, and extends forward to a throat area 520 where integral knit tongue 512 is located. Additionally, in some embodiments, throat area 520 may further include a lace and lace apertures for receiving the lace.

[0060] In addition, first knitted component 500 may have a first surface 530 and an opposite second surface 532. First surface 530 forms a portion of the exterior surface of upper 502, whereas second surface 532 forms a portion of the interior surface of upper 502, thereby defining at least a portion of the void within upper 502.

[0061] In various embodiments, a knitted component may incorporate various types of yarn that impart different properties to separate areas of the upper. For example, one area of first knitted component 500 may be formed from a first type of yarn that imparts a first set of properties, and another area of first knitted component 500 may be formed from a second type of yarn that imparts a second set of properties. In this configuration, properties may vary throughout upper 502 by selecting specific yarns for different areas of first knitted component 500.

[0062] The properties that a particular type of yarn will impart to an area of a knitted component partially depend upon the materials that form the various filaments and fibers within the yarn. Cotton, for example, provides a soft hand, natural aesthetics, and biodegradability. Elastane and stretch polyester each provide substantial stretch and recovery, with stretch polyester also providing recyclability. Rayon provides high luster and moisture absorption. Wool also provides high moisture absorption, in addition to insulating properties and biodegradability. Nylon is a durable and abrasion-resistant material with relatively high strength. Polyester is a hydrophobic material that also provides relatively high durability.

[0063] In addition to materials, other aspects of the yarns selected for a knitted component may affect the properties of the upper. For example, a yarn forming first knitted component 500 may be a monofilament yarn or a multifilament yarn. The yarn may also include separate filaments that are each formed of different materials. In addition, the yarn may include filaments that are each formed of two or more different materials, such as a bi-component yarn with filaments having a sheath-core configuration or two halves formed of different materials. Different degrees of twist and crimping, as well as different deniers, may also affect the properties of upper 502. Accordingly, both the materials forming the yarn and other aspects of the yarn may be selected to impart a variety of properties to separate areas of upper 502.

[0064] In some embodiments, integral knit tongue 512 may be centrally-located in throat area 520 of first knitted component 500 and may extend from an ankle opening in a heel region over an area corresponding to an instep of the foot to an area adjacent to a forefoot region, as well as extending between a lateral side and a medial side of first knitted component. In an exemplary embodiment, integral knit tongue 512 is formed of unitary knit construction with upper 502 at a forward portion of throat area 520 of first knitted component 500. That is, integral knit tongue 512 is joined through knitting to upper 502 at the forward portion of throat area 520 such that integral knit tongue 512 and upper 502 include at least one course in common and/or include courses that are substantially continuous between integral knit tongue 512 and upper 502 at the forward portion of throat area 520.

[0065] In an exemplary embodiment, integral knit tongue 512 may be further formed of unitary knit construction with upper 502 along the sides of integral knit tongue 512 extending along a length of throat area 520 of first knitted component 500. Accordingly, integral knit tongue 512 is joined through knitting to upper 502 along each of a lateral side and a medial side of throat area 520 such that integral knit tongue 512 and upper 502 include at least one course in common and/or include courses that are substantially continuous between integral knit tongue 512 and upper 502 along the sides extending through throat area 520.

[0066] In some embodiments, integral knit tongue 512 may include raised elements disposed on opposite sides of throat area 520 and extending along the length of integral knit tongue 512. Raised elements may be a portion of integral knit tongue 512 that are formed through the knitting process to be a flap or overhanging portion of integral knit tongue 512 that extends outward away from first surface 530 of upper 502. As shown in FIG. 5, integral knit tongue 512 includes a lateral raised element 514 and a medial raised element 515. In an exemplary embodiment, lateral raised element 514 and medial raised element 515 are formed of unitary knit construction with integral knit tongue 512 and upper 502 according to the method below. With this arrangement, lateral raised element 514 and medial raised element 515 include one or more common courses and/or courses that are substantially continuous with integral knit tongue 512 and upper 502.

[0067] In some embodiments, raised elements associated with an integral knit tongue, including lateral raised element 514 and medial raised element 515 associated with integral knit tongue 512, may include one or more lace apertures disposed at various locations along the raised element for receiving a lace. In some cases, the lace apertures may be a void or opening within the knitted structure forming the raised element that is sufficient to allow a lace to pass through. In other cases, the lace apertures may be a hole or opening that is cut or removed from the material forming the raised elements. In still other cases, the lace apertures may include additional elements, including, but not limited to loops, grommets, eyelets, eye hooks, or other suitable lace receiving members.

[0068] Referring now to FIG. 6, a cross-sectional view of integral knit tongue 512 is illustrated. In an exemplary embodiment, raised elements are formed of unitary knit construction with integral knit tongue 512 and upper 502 such that first knitted component 500 is a one-piece element. In this embodiment, lateral raised element 514 is joined with upper 502 at a first proximal end 600 and medial raised element 515 is joined with upper 502 at a second proximal end 601. Each raised element extends outward from first surface 530 of upper 502 in a flap-like arrangement to form an overhanging portion of integral knit tongue 512. In this embodiment, lateral raised element 514 extends outward from first proximal end 600 to a first distal end 602 and includes a first outward facing side 604 and a first inward facing side 606. Similarly, medial raised element 515 extends outward from second proximal end 601 to a second distal end 603 and includes a second outward facing side 605 and a second inward facing side 607. In an exemplary embodiment, first outward facing side 604 and/or second outward facing side 605 may be oriented towards each side of first knitted component 500, while first inward facing side 606 and/or second inward facing side 607 may be oriented towards the center of first knitted component 500 where integral knit tongue 512 is located.

[0069] In addition, as shown in FIG. 6, lateral raised element 514 and medial raised element 515 are shown in a flat configuration such that first inward facing side 606 and/or second inward facing side 607 is oriented towards first surface 530. In various embodiments, however, raised elements, including lateral raised element 514 and medial raised element 515, may be positioned in an upright configuration. Referring now to FIG. 7, lateral raised element 514 and medial raised element 515 are shown in an upright configuration such that first inward facing side 606 and/or second inward facing side 607 is oriented generally perpendicular to or at a raised angle with regard to first surface 530. In some embodiments, the process of pulling upper 502 tight on opposite sides of integral knit tongue 512 (for example, by joining first knitted component 500 with a sole structure to form an article of footwear) may cause each of lateral raised element 514 and medial raised element 515 to move from the flat configuration to the upright configuration.

[0070] In an exemplary embodiment, lateral raised element 514 and medial raised element 515 of integral knit tongue 512 may extend a first height H1 above first surface 530 of first knitted component 500. In some embodiments, upright configuration of lateral raised element 514 and medial raised element 515 may be used to incorporate lace apertures into integral knit tongue 512. In this embodiment, a plurality of lace apertures 700 are shown disposed along the respective sides of lateral raised element 514 and medial raised element 515 and extending through from first outward facing side 604 to first inward facing side 606 and from second outward facing side 605 to second inward facing side 607. In some cases, plurality of lace apertures 700 may be a void or opening within the knitted structure of integral knit tongue 512 forming the raised elements. In other cases, plurality of lace apertures 700 may have a different structure, including any of the suitable structures for lace apertures described above.

[0071] Referring to FIGS. 8 and 9, an exemplary embodiment of a second knitted component 800 is shown in a top plan view. Second knitted component 800 may be substantially similar to knitted component 130 and/or first knitted component 500, described above. In some embodiments, second knitted component 800 includes a first portion defining an upper 802 and a second portion defining an integral knit tongue 812. In an exemplary embodiment, second knitted component 800 incorporates upper 802 and integral knit tongue 812 formed of unitary knit construction.

[0072] As with first knitted component 500, second knitted component 800 has a generally U-shaped configuration that is outlined by an outer perimeter and an inner perimeter. In this embodiment, the outer perimeter includes a front perimeter edge 803, a lateral perimeter edge 804, a medial perimeter edge 805, and a pair of heel edges, including a lateral heel edge 806 and a medial heel edge 807. The inner perimeter of second knitted component 800 includes a lateral inner edge 808 and a medial inner edge 809 which may form an ankle opening. In addition, second knitted component 800 may have a first surface 830 forming a portion of the exterior surface of upper 802 and an opposite second surface 832 forming a portion of the interior surface of upper 802.

[0073] In an exemplary embodiment, second knitted component 800 may include integral knit tongue 812 that includes a top end 814 that extends into the portion of second knitted component 800 that is associated with an ankle opening. Top end 814 may be generally free from other portions of second knitted component 800. Integral knit tongue 812 may be formed of unitary knit construction with upper 802 at a forward portion of a throat area 820 of second knitted component 800 and along the sides of integral knit tongue 812 extending along a length of throat area 820. In an exemplary embodiment, integral tongue

812 of second knitted component 800 does not include raised elements. Accordingly, in contrast with first knitted component 500, second knitted component 800 includes a portion of upper 802 that extends over integral knit tongue 812 to form a lateral inner edge 816 and a medial inner edge 817. More particularly, edges of integral knit tongue 812 are knit to an area of second knitted component 800 that is spaced outward from lateral inner edge 816 and medial inner edge 817.

[0074] Referring now to FIG. 9, a cross-sectional view of integral knit tongue 812 is illustrated. In an exemplary embodiment, edges of integral knit tongue 812 are formed of unitary knit construction with upper 802 such that second knitted component 800 is a one-piece element. In this embodiment, first edge 900 and second edge 902 of integral knit tongue 812 are joined with second surface 832 of upper 802 such that integral knit tongue 812 extends below lateral inner edge 816 and medial inner edge 817 of upper 802. With this arrangement, a top surface of integral knit tongue 812 may be oriented facing towards second surface 832 of second knitted component 800 disposed on the portion of upper 802 extending out to lateral inner edge 816 and medial inner edge 817. In an exemplary embodiment, the configuration of integral knit tongue 812 included in second knitted component 800 may be provided to lay in a substantially flat condition.

[0075] In various embodiments, provisions may be made within a knitted component to assist a wearer with inserting and/or removing a foot from an ankle opening of an article of footwear. In some embodiments, an integral knit tongue of a knitted component may be modified to allow for a larger ankle opening. FIGS. 10 through 15 illustrate alternate embodiments of knitted components that have been provided with mechanisms to allow a larger ankle opening when incorporated into an article of footwear.

[0076] FIGS. 10 through 12 illustrate an alternate embodiment of a knitted component that includes a mechanism to allow a larger ankle opening when incorporated into an article of footwear. Referring now to FIG. 10, a top plan view of an alternate embodiment of a knitted component with an integral knit tongue having a partially integral portion is illustrated. In some embodiments, a third knitted component 1000 may include a first portion defining an upper 1002 and a second portion defining an integral knit tongue 1010. Third knitted component 1000 may be substantially similar to knitted component 130, first knitted component 500, and/or second knitted component 800, described above. As with first knitted component 500 and/or second knitted component 800, third knitted component 1000 may have a generally U-shaped configuration that is outlined by an outer perimeter and an inner perimeter. In this embodiment, the outer perimeter includes a front perimeter edge 1003, a lateral perimeter edge 1004, a medial perimeter edge 1005, and a pair of heel edges, including a lateral heel edge 1006 and a medial heel edge 1007. The inner perimeter of third knitted component 1000 includes a lateral inner edge 1008 and a medial inner edge 1009 which may form an ankle opening. In addition, third knitted component 1000 may have a first surface 1030 forming a portion of the exterior surface of upper 1002 and an opposite second surface 1032 forming a portion of the interior surface of upper 1002.

[0077] In some embodiments, third knitted component 1000 may further include additional structures. In an exemplary embodiment, third knitted component 1000 may include at least one tensile element 1040 that is inlaid within the knit structure of third knitted component 1000. Suitable materials for tensile element 1040 may include, but is not limited to, yarn or an inlaid strand in the configuration of a filament (e.g., a monofilament), thread, rope, webbing, cable, or chain. Tensile element 1040 extends through third knitted component 1000 and passes between the various loops within a knit structure 1042 formed within third knitted component 1000. Although tensile element 1040 generally extends along courses within knit structure 1042, tensile element 1040 may also extend along wales within knit structure 1042. Advantages of tensile element 1040 include providing support, stability, and structure. For example, tensile element 1040 assists with securing upper 1002 around the foot, limits deformation in areas of upper 1002 (e.g., imparts stretch-resistance) and operates in connection with a lace to enhance the fit of the article of footwear incorporating third knitted component.

[0078] A tensile element in the form of an inlaid strand or other suitable element, as well as the method of manufacturing a knitted component incorporating an inlaid strand and knit structures, for use in the embodiments described herein is disclosed in one or more of commonly-owned U.S. Patent Application Serial Number 12/338,726 to Dua et al., entitled "Article of Footwear Having An Upper Incorporating A Knitted Component", filed on December 18, 2008 and published as U.S. Patent Application Publication Number 2010/0154256 on June 24, 2010, and U.S. Patent Application Serial Number 13/048,514 to Huffa et al., entitled "Article Of Footwear Incorporating A Knitted Component", filed on March 15, 2011 and published as U.S. Patent Application Publication Number 2012/0233882 on September 20, 2012, both of which applications are hereby incorporated by reference in their entirety (collectively referred to herein as the "Inlaid Strand cases").

[0079] In an exemplary embodiment, third knitted component 1000 incorporates upper 1002 and integral knit tongue 1010 formed of unitary knit construction such that at least a portion of upper 1002 and a portion of integral knit tongue 1010 are a one-piece element. In one embodiment, integral knit tongue 1010 may further include a first portion that is formed of unitary knit construction with upper 1002 along the sides of integral knit tongue 1010 and a second portion that is formed of unitary knit construction with the first portion, but is otherwise free from upper 1002. In this embodiment, third knitted component 1000 includes integral knit tongue 1010 having a partially integral portion 1012 and a free portion 1014.

[0080] In an exemplary embodiment, partially integral portion 1012 may be centrally-located in a throat area 1020 of third knitted component 1000 and may extend from a distance D1 adjacent to an ankle opening in a heel region over an area corresponding to an instep of the foot to an area adjacent to a forefoot region, as well as extending between a lateral side and a medial side of third knitted component 1000. In one embodiment, partially integral portion 1012 is formed of unitary knit construction with upper 1002 at a forward portion of throat area 1020 as well as along the sides extending along a length of throat area 1020 of third knitted component 1000. Accordingly, partially integral portion 1012 is joined through knitting to upper 1002 along the forward portion and each of a lateral side and a medial side of throat area 1020 such that partially integral portion 1012 and upper 1002 include at least one course in common and/or include courses that are substantially continuous.

[0081] In an exemplary embodiment, integral knit tongue 1010 may include raised elements disposed on opposite sides of throat area 1020 and extending along the length of integral knit tongue 1010. Raised elements may be a portion of integral knit tongue 1010 that are formed through the knitting process to be a flap or overhanging portion of integral knit tongue 1010 that extends outward away from first surface 1030 of upper 1002. As shown in FIGS. 10 and 11, integral knit tongue 1010 includes a lateral raised element 1016 and a medial raised element 1015 that are formed of unitary knit construction with upper 1002 and partially integral portion 1012 of integral knit tongue 1010. Lateral raised element 1016 and/or medial raised element 1015 may be substantially similar to, and similarly formed as lateral raised element 514 and medial raised element 515, described above.

[0082] Referring now to FIG. 11, in an exemplary embodiment, free portion 1014 may be disposed at a top end of throat area 1020 of third knitted component 1000 adjacent to the ankle opening. In one embodiment, free portion 1014 is formed of a unitary knit construction with partially integral portion 1012 at a rearward portion 1100 of throat area 1020, but is otherwise not joined or attached to other portions of upper 1002 and/or third knitted component 1000. With this arrangement, an ankle opening may be provided with a larger opening corresponding to the location of rearward portion 1100 of partially integral portion 1012 of integral knit tongue 1010 that extends distance D1 from the ankle opening along throat area 1020 of third knitted component 1000. Free portion 1014 of integral knit tongue 1010 may serve to cover a foot of a wearer disposed within the ankle opening to enhance the comfort of the article of footwear incorporating third knitted component 1000.

[0083] In some embodiments, partially integral portion 1012 of integral knit tongue 1010 may include multiple knit structures, including knit structures of different types. For example, partially integral portion 1012 may include a first knit structure 1102 and a second knit structure 1104. First knit structure 1102 may be associated with a first knit type and may be centrally located and extending along integral knit tongue 1010 from rearward portion 1100 to the forward portion of throat area 1020. Second knit structure 1104 may be associated with a second knit type and may be located along peripheral sides of integral knit tongue 1010 between first knit structure 1102 and each of lateral raised element 1016 and medial raised element 1015 extending similarly from rearward portion 1100 to the forward portion of throat area 1020. In one embodiment, first knit structure 1102 and second knit structure 1104 may be different knit structures or different types of knit structures. For example, in some cases, first knit structure 1102 may be a mesh or similar knit type and second knit structure 1104 may be a jersey or similar knit type. In other cases, first knit structure 1102 may be a double-knit jersey structure and second knit structure 1104 may be a single-knit jersey structure. As shown in FIG. 12, first knit structure 1102 may have a greater thickness than second knit structure 1104 disposed on either peripheral side of first knit structure 1102 extending along the length of partially integral portion 1012 of integral knit tongue 1010.

[0084] In some embodiments, lace apertures for receiving a lace may be provided by tensile element 1040. In an exemplary embodiment, a plurality of lace loops 1110 may be disposed at portions of tensile element 1040 that extend out from knit structure 1042 adjacent to lateral raised element 1016 and medial raised element 1015 on opposite sides of throat area 1020 of third knitted component 1000. With this configuration, a lace (not shown) may be disposed through plurality of lace loops 1110 to assist with securing an article of footwear incorporating third knitted component 1000 onto a foot of a wearer. In other embodiments, lace apertures may have a different structure, including any of the suitable structures for lace apertures described above.

[0085] FIGS. 13 through 15 illustrate another alternate embodiment of a knitted component with a mechanism to allow a larger ankle opening when incorporated into an article of footwear. Referring now to FIG. 13, a top plan view of an alternate embodiment of a knitted component with an integral knit tongue having partially decoupled knit elements is illustrated. In some embodiments, a fourth knitted component 1300 may include a first portion defining an upper 1302 and a second portion defining an integral knit tongue 1310. Fourth knitted component 1300 may share one or more substantially similar features with knitted component 130, first knitted component 500, second knitted component 800, and/or third knitted component 1000, described above. As with the previous embodiments of knitted components, fourth knitted component 1300 may similarly have a generally U-shaped configuration that is outlined by an outer perimeter and an inner perimeter. In this embodiment, the outer perimeter includes a front perimeter edge 1303, a lateral perimeter edge 1304, a medial perimeter edge 1305, and a pair of heel edges, including a lateral heel edge 1306 and a medial heel edge 1307. The inner perimeter of fourth knitted component 1300 includes a lateral inner edge 1308 and a medial inner edge 1309 which may form an ankle opening. In addition, fourth knitted component 1300 may have a first surface 1330 forming a portion of the exterior surface of upper 1302 and an opposite second surface 1332 forming a portion of the interior surface of upper 1302.

[0086] In some embodiments, fourth knitted component 1300 may further include additional structures, including at least one tensile element 1340 that is inlaid within a knit structure 1342 of fourth knitted component 1300. Tensile element 1340 may be substantially similar to tensile element 1040, described above, including suitable materials and methods of manufacturing a knitted component incorporating tensile elements and knit structures disclosed in the

Inlaid Strand cases. In an exemplary embodiment, tensile element 1340 may further include a plurality of lace loops 1344 that may be configured to receive a lace. Plurality of lace loops 1344 may be disposed at portions of tensile element 1340 that extend out from knit structure 1342 and may have a substantially similar structure as lace loops 1110, described above. In some cases, lace loops 1344 may serve as lace apertures for receiving a lace. In other cases, lace loops 1344 may coordinate with one or more lace apertures disposed within raised elements of integral knit tongue 1310 to receive a lace. In still other cases, lace loops 1344 may be disposed through lace apertures disposed within raised elements and may receive a lace that extends through a throat area 1320 of upper 1302.

[0087] In an exemplary embodiment, fourth knitted component 1300 incorporates upper 1302 and integral knit tongue 1310 formed of unitary knit construction such that at least a portion of upper 1302 and a portion of integral knit tongue 1310 are a one-piece element. In one embodiment, portions of upper 1302 may be formed from multiple knit element layers. Accordingly, integral knit tongue 1310 may be formed of unitary knit construction with at least one of the knit element layers.

[0088] In some embodiments, integral knit tongue 1310 may be centrally-located in throat area 1320 of fourth knitted component 1300 and may extend from a top end 1314 adjacent to an ankle opening in a heel region over an area corresponding to an instep of the foot to an area adjacent to a forefoot region, as well as extending between a lateral side and a medial side of upper 1302. In an exemplary embodiment, integral knit tongue 1310 is formed of unitary knit construction with at least one knit element layer associated with upper 1302 at a forward portion of throat area 1320 and along the sides extending along a length of throat area 1320 of fourth knitted component 1300.

[0089] In an exemplary embodiment, fourth knitted component 1300 may further include raised elements disposed on opposite sides of throat area 1320 and extending along the length of integral knit tongue 1310. As shown in FIGS. 13 through 15, fourth knitted component 1300 includes a lateral raised element 1312 and a medial raised element 1313 that are formed of unitary knit construction with at least one knit element layer of upper 1302. Lateral raised element 1312 and/or medial raised element 1313 may be substantially similar to, and similarly formed as lateral raised elements 514, 1016 and/or medial raised elements 515, 1015, described above.

[0090] In some embodiments, the portion of fourth knitted component 1300 forming integral knit tongue 1310 may made from a different material than the remaining portion of fourth knitted component 1300. In an exemplary embodiment, integral knit tongue 1310 may be made from an elastic yarn that has a large degree of elasticity, while the remaining portions of fourth knitted component 1300 may be made from a regular yarn that is substantially inelastic or that has a smaller degree of elasticity compared with the elastic yarn. With this arrangement, integral knit tongue portion 1310 of fourth knitted component 1300 may be configured with throat area 1320 that is allowed to stretch to accommodate a foot of a wearer inserted through an ankle opening of an article of footwear incorporating fourth knitted component 1300.

[0091] Additionally, in some embodiments, by forming integral knit tongue 1310 of unitary knit construction with a first knit element layer of fourth knitted component 1300 that is partially decoupled from a second knit element layer, the throat area 1320 may further be permitted to stretch to allow a larger ankle opening for an article of footwear incorporating fourth knitted component 1300. The partial decoupling of the first knit element layer and the second knit element layer may be shown in FIGS. 14 and 15.

[0092] Referring now to FIGS. 14 and 15, in this embodiment, upper 1302 may include a first knit element layer 1400 associated with first surface 1330 of fourth knitted component 1300 and a second knit element layer 1402 associated with second surface 1332 of fourth knitted component 1300. In an exemplary embodiment, first knit element layer 1400 and second knit element layer 1402 may be partially decoupled at the portion of fourth knitted component 1300 associated with integral knit tongue 1310. That is, while other portions of fourth knitted component 1300 may include a single knit element having first surface 1330 on one side and second surface 1332 on the opposite side, the partially decoupled portion of fourth knitted component 1300 includes separate first knit element layer 1400 and second knit element layer 1402 disposed adjacent to one another, but not joined along the entirety of their surfaces. Accordingly, first surface 1330 is disposed on one side of first knit element layer 1400 and second surface 1332 is disposed on one side of second knit element layer 1402. At other portions of fourth knitted component 1300, first knit element layer 1400 and second knit element layer 1402 may be rejoined with one another through the knitting process so as to form a single knit element extending through the remaining portion of fourth knitted component 1300.

[0093] In an exemplary embodiment, integral knit tongue 1310 may be formed of unitary knit construction with at least one knit element layer. In one embodiment, integral knit tongue 1310 is formed of unitary knit construction with second knit element layer 1402. As shown in FIGS. 14 and 15, integral knit tongue 1310 is joined through knitting to second knit element layer 1402 of upper 1302 along each of a lateral side and a medial side of throat area 1320 such that integral knit tongue 1310 and second knit element layer 1402 include at least one course in common and/or include courses that are substantially continuous between integral knit tongue 1310 and second knit element layer 1402 along the sides of upper 1302 extending through throat area 1320. Similarly, in an exemplary embodiment, raised elements, including lateral raised element 1312 and medial raised element 1313, may be formed of unitary knit construction with first knit element layer 1400.

[0094] In some embodiments, integral knit tongue 1310 may include multiple knit structures, including knit structures of different types, as described above. For example, integral knit tongue 1310 may include a first knit structure 1410 and a second knit structure 1412. First knit structure 1410 may be associated with a first knit type and may be centrally located and extending along integral knit tongue 1310 from a rearward portion to the forward portion of throat area 1320. Second knit structure 1412 may be associated with a second knit type and may be located along peripheral sides of integral knit tongue 1310 between first knit structure 1410 and each of lateral raised element 1312 and medial raised element 1313 extending similarly from the rearward portion to the forward portion of throat area 1320. In this embodiment, first knit structure 1410 and second knit structure 1412 may be similar made of an elastic yarn, however, first knit structure 1410 may be a double-knit jersey structure and second knit structure 1412 may be a single-knit jersey structure. As shown in FIGS. 14 and 15, first knit structure 1410 may have a greater thickness than second knit structure 1412.

[0095] In some embodiments, portions of first knit element layer 1400 and second knit element layer 1402 may be joined to secure first knit element layer 1400 and second knit element layer 1402 at desired locations along integral knit tongue 1310. As shown in FIG. 14, a first yarn 1404 may be used to join first knit element layer 1400 to second knit element layer 1402 at a first end 1406 where lateral raised element 1312 begins to extend outward over integral knit tongue 1310. Similarly, a second yarn 1403 may be used to join first knit element layer 1400 to second knit element layer 1402 at a second end 1405 where medial raised element 1313 begins to extend outward over integral knit tongue 1310. In some cases, first yarn 1404 and/or second yarn 1403 may include a single yarn or a plurality of yarns from fourth knitted component 1300 that join first knit element layer 1400 to second knit element layer 1402 during the knitting process. In other cases, first yarn 1404 and/or second yarn 1403 may include a stitch or a plurality of stitches that are used to join first knit element layer 1400 to second knit element layer 1402 after the knitting process.

[0096] In one embodiment, the location of first yarn 1404 and/or second yarn 1403 may be chosen to coincide with one or more of lace loops 1344 of tensile element 1340. With this arrangement, first knit element layer 1400 and second knit element layer 1402 may be secured to each other at the location that corresponds to where a lace may be used to secure throat area 1320 of upper 1302 to fit onto a foot of a wearer of an article of footwear incorporating fourth knitted component 1300. In contrast, the partially decoupled portion of fourth knitted component 1300 shown in FIG. 15 does not include first yarn 1404 and/or second yarn 1403 joining first knit element layer 1400 to second knit element layer 1402. Accordingly, at the partially decoupled portion, first knit element layer 1400 and second knit element layer 1402 may be allowed to move independently of one another. This arrangement, together with the use of an elastic yarn to form one or more portions of second knit element layer forming integral knit tongue 1310, allows throat area 1320 to stretch to allow a larger ankle opening for an article of footwear incorporating fourth knitted component 1300.

[0097] Knitting Process for a Knitted Component

[0098] FIGS. 16 through 29 illustrate various knitting processes that may be used to manufacture a knitted component in accordance with the principles described herein. In various embodiments described herein, the different knit structures of a particular knitted component may be made using various types of knit structures, including knit types and yarn types.

[0099] In an exemplary embodiment, the integral knit tongue of a knitted component that includes raised elements along a medial side and a lateral side may be formed using a specific knitting process. For purposes of reference, FIG. 16 depicts a loop diagram of the manner in which raised elements associated with an integral knit tongue, including, for example, any of raised elements 142, raised elements 514, 515, raised elements 1015, 1016, and/or raised elements 1312, 1313 is formed with a knitting process 1600.

[00100] As shown in FIG. 16, knitting process 1600 for an integral knit tongue having raised elements may include loop diagrams indicating the direction and type of knitting operation being performed to make the integral knit tongue. It should be understood that the remaining portion of a knitted component may be made according to any suitable knitting process, knitting process 1600 details an exemplary knitting process for an integral knit tongue portion of the overall knitted component. Accordingly, in a first step 1601, yarn is transferred to a back bed of a knitting machine. Next, in a second step 1602, the yarn is knit along a first direction as shown, then back along a second, opposite direction in a third step 1603. Next, in a fourth step 1604, the yarn is transferred to a front bed of the knitting machine and the yarn is knit along the first direction in a fifth step 1605. With this process, a raised element along one side of the integral knit tongue is formed. While an exemplary knit type is illustrated for fifth step 1605 which may form the central portion of an integral knit tongue, any suitable knit type may be used to make a central portion of the integral knit tongue having any desired knit structure.

[00101] Similarly, from fifth step 1605, a raised element disposed on the opposite side of the integral knit tongue may also be formed. As shown in FIG. 16, after completing knitting associated with fifth step 1605, the yarn may be transferred to the back bed of the knitting machine at a sixth step 1606 and the yarn is knit along the second direction as shown in a seventh step 1607, then back along in the opposite, first direction in an eighth step 1608. The yarn may then be transferred back to the front bed of the knitting machine at a ninth step 1609 and the yarn is knit along the second direction in a tenth step 1610 along the entirety of the width of the integral knit tongue. The exemplary knitting process 1600 may be repeated multiple times to make an integral knit tongue with raised elements having the desired length along the knitted component. Similarly, portions of the integral knit tongue may be made wider or narrower by changing a number of needles that are associated with knitting process 1600. For example, portions of knitting process 1600, including fifth step 1605 and/or tenth step 1610, may be varied to include a larger or smaller number of needles to correspondingly increase or decrease the width of the integral knit tongue. In addition, as noted above, other knitting processes not shown here may be used to make the remaining portions of the knitted component.

[00102] Additionally, the knit types illustrated in FIG. 16 are exemplary and in different embodiments may be varied. For example, as shown in knitting process 1600, each raised element is made from a double-jersey half-gauge knit, whereas the central portion of the integral knit tongue is made from a single-jersey half-gauge knit. However, in other embodiments, one or more knit types may vary. For example, in some cases, the central portion of the integral knit tongue may include one or more portions of full-gauge (or “all-needle”) single or double-jersey knit. In other cases, the width of various knit types along the central portion of the integral tongue may be varied repeatedly, for example, by using different numbers of needles, as noted above. Still other cases may include a combination of knit types and/or knit structures employing various combinations of knit, tuck, or float stitches.

[00103] Although knitting may be performed by hand, the commercial manufacture of knitted components is generally performed by knitting machines. FIG. 17 illustrates an exemplary embodiment of a knitting machine 1700 that is suitable for producing any of the knitted components described in the previous embodiments, including knitted component 130, first knitted component 500, second knitted component 800, third knitted component 1000, and/or fourth knitted component 1300, as well as other configurations of knitted components not explicitly illustrated or described but made according to the principles described herein. In this embodiment, knitting machine 1700 has a configuration of a V-bed flat knitting machine for purposes of example, but any of the knitted components or portions of knitted components may be produced on other types of knitting machines.

[00104] In an exemplary embodiment, knitting machine 1700 may include two needle beds, including a front needle bed 1701 and a back needle bed 1702, that are angled with respect to each other, thereby forming a V-bed. Each of front needle bed 1701 and back needle bed 1702 include a plurality of individual needles that lay on a common plane, including needles 1703 associated with front bed 1701 and needles 1704 associated with back bed 1702. That is, needles 1703 from front needle bed 1701 lay on a first plane, and needles 1704 from back needle bed 1702 lay on a second plane. The first plane and the second plane (i.e., the two needle beds 1701, 1702) are angled relative to each other and meet to form an intersection that extends along a majority of a width of knitting machine

1700. As described in greater detail below, needles 1703, 1704 each have a first position where they are retracted and a second position where they are extended. In the first position, needles 1703, 1704 are spaced from the intersection where the first plane and the second plane meet. In the second position, however, needles 1703, 1704 pass through the intersection where the first plane and the second plane meet.

[00105] A pair of rails, including a forward rail 1710 and a rear rail 1711, extends above and parallel to the intersection of needle beds 1701, 1702 and provide attachment points for multiple standard feeders 1720 and combination feeders 1722. Each rail 1710, 1711 has two sides, each of which accommodates either one standard feeder 1720 or one combination feeder 1722. In this embodiment, rails 1710, 1711 include a front side 1712 and a back side 1714. As such, knitting machine 1700 may include a total of four feeders 1720 and 1722. As depicted, the forward-most rail, forward rail 1710, includes one combination feeder 1722 and one standard feeder 1720 on opposite sides, and the rearward-most rail, rear rail 1711, includes two standard feeders 1720 on opposite sides. Although two rails 1710, 1711 are depicted, further configurations of knitting machine 1700 may incorporate additional rails to provide attachment points for more standard feeders 1720 and/or combination feeders 1722.

[00106] Due to the action of a carriage 1730, feeders 1720 and 1722 move along rails 1710, 1711 and needle beds 1701, 1702, thereby supplying yarns to needles 1703, 1704. As shown in FIG. 17, a yarn 1724 is provided to combination feeder 1722 by a spool 1726. More particularly, yarn 1724 extends from spool 1726 to various yarn guides 1728, a yarn take-back spring, and a yarn tensioner before entering combination feeder 1722. Although not depicted, additional spools may be used to provide yarns to feeders 1720 in a substantially similar manner as spool 1726.

[00107] Standard feeders 1720 are conventionally-used for a V-bed flat knitting machine, such as knitting machine 1700. That is, existing knitting machines incorporate standard feeders 1720. Each standard feeder 1720 has the ability to supply a yarn that needles 1703, 1704 manipulate to knit, tuck, and float. As a comparison, combination feeder 1722 has the ability to supply a yarn (e.g., yarn 1724) that needles 1703, 1704 knit, tuck, and float, and combination feeder 1722 further has the ability to inlay the yarn. Moreover, combination feeder 1722 has the ability to inlay a variety of different tensile elements, including yarn or other types of strands (e.g., filament, thread, rope, webbing, cable, or chain). Accordingly, combination feeder 1722 exhibits greater versatility than each standard feeder 1720.

[00108] Standard feeders 1720 and combination feeder 1722 may have substantially similar configurations as the structure of standard feeders and the combination feeder described in U.S. Patent Application Serial Number 13/400,511, entitled "Article Of Footwear Incorporating A Knitted Component With A Tongue", filed on February 20, 2012, the disclosure of which has been incorporated by reference above.

[00109] The manner in which knitting machine 1700 operates to manufacture a knitted component will now be discussed in detail. Moreover, the following discussion will demonstrate the operation of one or more standard feeders 1720 and/or combination feeders 1722 during a knitting process. The knitting process discussed herein relates to the formation of various knitted components, which may be any knitted component, including knitted components that are similar to knitted components in the embodiments described above. For purposes of the discussion, only a relatively small section of a knitted component may be shown in the figures in order to permit the knit structure to be illustrated. Moreover, the scale or proportions of the various elements of knitting machine 1700 and a knitted component may be enhanced to better illustrate the knitting process. It should be understood that although a knitted component is formed between needle beds 1701, 1702, for purposes of illustration in FIGS. 18 through 29, a knitted component is shown adjacent to needle beds 1701, 1702 to (a) be more visible during discussion of the knitting process and (b) show the position of portions of the knitted component relative to each other and needle beds 1701,

1702. Also, although one rail, and limited numbers of standard feeders and combination feeders are depicted, additional rails, standard feeders, and combination feeders may be used. Accordingly, the general structure of knitting machine 1700 is simplified for purposes of explaining the knitting process.

[00110] FIGS. 18 through 21 illustrate an exemplary process of knitting a knitted component in the form of first knitted component 500, described above. Referring to FIG. 18, a portion of knitting machine 1700 that includes needles 1703 associated with front needle bed 1701, needles 1704 associated with back needle bed 1702, and forward rail 1710 is shown. Additionally, in this embodiment, knitting machine 1700 may include a first standard feeder 1800 and a second standard feeder 1802 that are substantially similar to standard feeder 1720, described above. First standard feeder 1800 may be secured to a front side of front rail 1710 and second standard feeder 1802 may be secured to a rear side of front rail 1710. In other embodiments, additional feeders may be used and may be located on the front or rear side of front rail 1710 and/or rear rail 1711.

[00111] In this embodiment, a first yarn 1801 from a spool (not shown) passes through first standard feeder 1800 and an end of yarn 1801 extends outward from a dispensing tip at the end of first standard feeder 1800. Although yarn 1801 is depicted, any other strand (e.g., filament, thread, rope, webbing, cable, chain, or yarn) may pass through first standard feeder 1800. A second yarn 1803 similarly passes through second standard feeder 1802 and extends outward from a dispensing tip. In an exemplary embodiment, first yarn 1801 and second yarn 1803 may be used to form portions of second knitted component 500. In this embodiment, loops of first yarn 1801 are shown forming an uppermost course of medial heel edge 507 of second knitted component 500 and are held by hooks located on ends of needles 1703 and needles 1704. Similarly, loops of second yarn 1803 may be used to form lateral heel edge 506 of second knitted component 500.

[00112] Next, as shown in FIG. 19, knitting machine 1700 may use a similar process to add additional courses to the material forming second knitted component 500 to form further portions, including lateral perimeter edge 504, medial perimeter edge 505, lateral inner edge 508, medial inner edge 509, and front inner edge 510 of integral knit tongue 512. In this embodiment, first standard feeder 1800 and second standard feeder 1802 may form integral knit tongue 512 according to the loop diagram illustrated in FIG. 16, above. FIG. 20 illustrates knitting machine 1700 completing the courses associated with knitting integral knit tongue 512, lateral raised element 514, medial raised element 515, and a portion of the rest of second knitted component 500 forming upper 502. FIG. 21 illustrates knitting machine 1700 nearly completing the knitting process of forming second knitted component 500. By adding additional courses using a similar process, second knitted component 500 may be completed.

[00113] FIGS. 22 through 25 illustrate an exemplary process of knitting a knitted component in the form of third knitted component 1000, described above. Referring to FIG. 22, a portion of knitting machine 1700 that includes needles 1703 associated with front needle bed 1701, needles 1704 associated with back needle bed 1702, and forward rail 1710 is shown. Additionally, in this embodiment, knitting machine 1700 may include a first standard feeder 2200 and a second standard feeder 2204 that are substantially similar to standard feeder 1720, described above and a combination feeder 2202 that is substantially similar to combination feeder 1722, described above. First standard feeder 1800 and combination feeder 2202 may be secured to a front side of front rail 1710 and second standard feeder 2204 may be secured to a rear side of front rail 1710. In other embodiments, additional feeders may be used and may be located on the front or rear side of front rail 1710 and/or rear rail 1711.

[00114] In this embodiment, a first yarn 2201 from a spool (not shown) passes through first standard feeder 2200 and an end of yarn 2201 extends outward from a dispensing tip at the end of first standard feeder 2200. Although yarn 2201 is depicted, any other strand (e.g., filament, thread, rope, webbing, cable, chain, or yarn) may pass through first standard feeder 2200. A second yarn 2205 similarly passes through second standard feeder 2204 and extends outward from a dispensing tip. A third yarn 2203 passes through combination feeder 2202 to a dispensing tip. In an exemplary embodiment, third yarn 2203 may be a different type of yarn than first yarn 2201 and/or second yarn 2205. In this embodiment, third yarn 2203 may be a tensile element or other inlaid strand. In an exemplary embodiment, first yarn 2201 and second yarn 2205 may be used to form portions of a knit element of third knitted component 1000, whereas third yarn 2203 may be inlaid within the knit element as a tensile element of third knitted component 1000. In other embodiments, however, third yarn 2203 may be used to form portions of a knit element of third knitted component 1000.

[00115] In this embodiment, loops of first yarn 2201 and loops of second yarn 2205 are shown forming free portion 1014 of integral knit tongue 1010 of third knitted component 1000 and are held by hooks located on ends of needles 1703 and needles 1704. Additionally, FIG. 23 illustrates knitting machine 1700 completing the courses forming free portion 1014. In some embodiments, at least the final course of free portion 1014 may include cross-tuck stitches with a relatively tight or dense knit to ensure that free portion 1014 of integral knit tongue 1010 remains properly positioned on needles 1701, 1702 during later stages of the knitting process to be joined with the remaining portion of integral knit tongue 1010.

[00116] Knitting machine 1700 now begins the process of forming the remaining portion of the knit element forming third knitted component 1000, in accordance with a similar knitting process discussed above. In an exemplary embodiment, loops of first yarn 2201 may then begin to form an uppermost course of medial heel edge 1007 of third knitted component 1000 and loops of second yarn 2205 may be used to form lateral heel edge 1006 of third knitted component 1000.

[00117] Referring now to FIG. 24, as the knitting process continues, first standard feeder 2200 and second standard feeder 2204 may continue adding courses to third knitting component 1000, including lateral perimeter edge 1004, medial perimeter edge 1005, lateral inner edge 1008, medial inner edge 1009, and partially integral portion 1012 of integral knit tongue 1010. In this embodiment,

first standard feeder 2200 and second standard feeder 2204 may form partially integral portion 1012 of integral knit tongue 1010 according to the loop diagram illustrated in FIG. 16, above. Additionally, in this embodiment, combination feeder 2202 inlays third yarn 2203 to form tensile element 1040, as depicted in FIG. 24, also in accordance with the knitting process discussed in the Inlaid Strand cases.

[00118] In an exemplary embodiment, during the knitting process depicted between FIG. 23 and FIG. 24, free portion 1014 of integral knit tongue 1010 may remain stationary relative to needle beds 1701, 1702, as the portions of third knitted component 1000 move downward and may overlap free portion 1014 as successive courses are formed in third knitted component 1000. This continues until a course is formed that is intended to join free portion 1014 to the partially integral portion 1012 of integral knit tongue 1010 formed with the rest of third knitted component 1000. FIG. 25 illustrates knitting machine 1700 nearly completing the knitting process of forming third knitted component 1000. By adding additional courses using a similar process, third knitted component 1000 may be completed.

[00119] Additionally, in the knitting process depicted in FIGS. 22 through 25, the relative position of the various feeders on first rail 1710 may restrict the portions of third knitted component 1000 that may be formed by each respective feeder. For example, because of the placement of combination feeder 2202, first standard feeder 2200 may be permitted to form both a front and back portion (associated with first surface 1030 and second surface 1032, respectively) of third knitted component 1000 along a medial side and across partially integral portion 1012 of integral knit tongue 1010, but be restricted from forming a portion of third knitted component 1000 along a lateral side. Similarly, second standard feeder 2204 may be permitted to form both the front and back portion of third knitted component 1000 along the lateral side and across partially integral portion 1012 of integral knit tongue 1010, but be restricted from forming a portion of third knitted component 1000 along the medial side. With this arrangement, the knitting process depicted in FIGS. 22-25 may require that specific feeders are used to form specific portions of third knitted component 1000.

[00120] FIGS. 26 through 29 illustrate an exemplary process of knitting a knitted component similar to fourth knitted component 1300, described above. Referring to FIG. 26, a portion of knitting machine 1700 that includes needles 1703 associated with front needle bed 1701, needles 1704 associated with back needle bed 1702, and forward rail 1710 is shown. Additionally, in this embodiment, knitting machine 1700 may include a first standard feeder 2600, a second standard feeder 2602, and a third standard feeder 2604 that are substantially similar to standard feeder 1720, described above. In addition, in embodiments where fourth knitted component 1300 includes tensile elements, a combination feeder (not shown) that is substantially similar to combination feeder 1722, described above, may be included to form tensile element 1340 according to the process described above with regard to the knitting process of third knitted component 1000 and as described in the Inlaid Strand cases. For the purposes of ease of illustration, therefore, fourth knitted component 1300 will be illustrated in FIGS. 26 through 29 without tensile element 1340.

[00121] Referring again to FIG. 26, first standard feeder 2600 and second standard feeder 2602 may be secured to a front side of front rail 1710 and third standard feeder 2604 may be secured to a rear side of front rail 1710. In other embodiments, additional feeders may be used and may be located on the front or rear side of front rail 1710 and/or rear rail 1711.

[00122] In this embodiment, a first yarn 2601 from a spool (not shown) passes through first standard feeder 2600 and an end of yarn 2601 extends outward from a dispensing tip at the end of first standard feeder 2600. Although yarn 2601 is depicted, any other strand (e.g., filament, thread, rope, webbing, cable, chain, or yarn) may pass through first standard feeder 2600. A second yarn 2603 similarly passes through second standard feeder 2602 and extends outward from a dispensing tip. A third yarn 2605 also passes through third standard feeder 2604 to a dispensing tip in a similar manner. In an exemplary embodiment, second yarn 2603 may be a different type of yarn than first yarn 2601 and/or third yarn 2605. In this embodiment, second yarn 2603 may be an elastic yarn that has a larger amount or degree of elasticity than first yarn 2601 and/or third yarn 2605, which may be a substantially inelastic yarn or a yarn with a small amount or degree of elasticity. In an exemplary embodiment, first yarn 2601 and third yarn 2605 may be used to form lateral and medial portions of a knit element forming fourth knitted component 1300, whereas second yarn 2603 may be used to form the elastic portion of integral knit tongue 1310 that is centrally-located within throat area 1320 of fourth knitted component 1300. In other embodiments, however, second yarn 2603 may be further used to form other portions of the knit element of fourth knitted component 1300.

[00123] Referring now to FIG. 27, loops of first yarn 2601 are shown forming an uppermost course of medial heel edge 1307 of fourth knitted component 1300 and loops of third yarn 2605 may be used to form lateral heel edge 1306 of fourth knitted component 1300. Second yarn 2603 may not yet be used to form any portion of fourth knitted component 1300. Next, as shown in FIG. 28, knitting machine 1700 may use a similar process to add additional courses to the material forming fourth knitted component 1300 to form further portions, including lateral perimeter edge 1304, medial perimeter edge 1305, lateral inner edge 1308, and medial inner edge 1309. In addition, at this point, second standard feeder 2602 may have begun to use second yarn 2603 to form portions of fourth knitted component 1300, including integral knit tongue 1312, which extends from needles 1701, 1702 to the completed top end 1314.

[00124] In this embodiment, second standard feeder 2602 may form integral knit tongue 1310 using an elastic yarn so as to permit throat area 1320 of fourth knitted component 1300 to stretch. In addition, fourth knitted component 1300 may be formed with one or more decoupled knit layers, as described above. FIG. 29 illustrates knitting machine 1700 completing the courses associated with knitting integral knit tongue 1310 and the rest of fourth knitted component 1300 forming upper 1302. By adding additional courses using a similar process, fourth knitted component 1300 may be completed.

[00125] Additionally, in the knitting process depicted in FIGS. 26 through 29, the relative position of the various feeders on first rail 1710 may restrict the portions of fourth knitted component 1300 that may be formed by each respective feeder. For example, because the placement of second standard feeder 2602 is needed to form integral knit tongue 1310 with an elastic second yarn 2603, first standard feeder 2600 may be permitted to form both a front and back portion (associated with first surface 1330 and second surface 1332, respectively) of fourth knitted component 1300 along only a medial side of fourth knitted component 1300. Similarly, third standard feeder 2604 may be permitted to form both the front and back portion of fourth knitted component 1300 along only a lateral side of fourth knitted component 1300. Accordingly, second standard feeder 2602 may be used to form integral knit tongue 1310 spanning between the lateral side and the medial side of fourth knitted component 1300. With this arrangement, the knitting process depicted in FIGS. 26-29 may require that specific feeders are used to form specific portions of fourth knitted component 1300.

[00126] The processes and methods for knitting a knitted component described above and illustrated in FIGS. 16 through 29 are exemplary and are not meant to be exhaustive. Therefore, it should be understood that additional knitted components including the features of the embodiments described herein, as well as similar knitted components not explicitly described herein, may be made using one or more knitting processes that are substantially similar to the knitting methods for knitted components described above and/or in the Inlaid Strands cases.

[00127] While various embodiments of the invention have been described, the description is intended to be exemplary, rather than limiting and it will be apparent to those of ordinary skill in the art that many more embodiments and implementations are possible that are within the scope of the invention.

Accordingly, the invention is not to be restricted except in light of the attached claims and their equivalents. Also, various modifications and changes may be made within the scope of the attached claims.

WHAT IS CLAIMED IS:

1. A method of manufacturing a knitted component for an article of footwear, the method comprising:

knitting a portion of the knitted component defining an upper with a knitting machine, the upper including a portion of at least one of an exterior surface of the knitted component and an opposite interior surface of the knitted component; and

knitting an integral knit tongue that is of unitary knit construction with the upper with the knitting machine, the integral knit tongue extending through a throat area of the knitted component; and

wherein the integral knit tongue is joined by knitting with the knitting machine to a forward portion of the throat area and at least along a portion of a lateral side and a medial side of the throat area of the knitted component extending from the forward portion to an ankle opening of the upper.

2. The method recited in claim 1, further including a step of selecting the knitting machine to be a flat knitting machine.

3. The method recited in claim 1, wherein the step of knitting the integral knit tongue includes forming a course of the integral knit tongue to include at least one common yarn with the upper.

4. The method recited in claim 1, wherein the step of joining the integral knit tongue by knitting includes forming a course with the knitting machine that joins the integral knit tongue to the upper.

5. The method recited in claim 1, wherein the integral knit tongue comprises a partially integral portion and a free portion, the method further comprising:

knitting the partially integral portion with the knitting machine of unitary knit construction with the upper at the forward portion of the throat area and at least along the portion of the lateral side and the medial side of the throat area of the knitted component; and

knitting the free portion with the knitting machines of unitary knit construction with the partially integral portion at a rearward portion of the integral knit tongue and remaining unattached to the remaining portions of the knitted component.

6. The method recited in claim 5, wherein the step of knitting the free portion further comprises:

knitting the free portion of the integral knit tongue with the knitting machine;

holding the free portion on needles of the knitting machine;

knitting a first portion of the upper with the knitting machine while the free portion is held on the needles, the first portion of the upper including at least the rearward portion of the integral knit tongue;

joining the free portion to the integral knit tongue at the rearward portion; and

knitting a second portion of the upper with the knitting machine.

7. The method recited in claim 6, wherein the step of knitting the first portion further comprises holding the free portion stationary with respect to a needle bed of the knitting machine during knitting of the first portion of the upper, and the first portion of the upper moving with respect to the free portion during knitting of the first portion of the upper;

wherein the step of joining the free portion includes forming a course with the knitting machine that joins the free portion to the integral knit tongue; and

wherein the step of knitting the second portion further comprises moving the free portion and the upper together during knitting of the second portion of the upper.

8. A method of manufacturing a knitted component for an article of footwear, the method comprising:

knitting a first portion of the knitted component defining an upper with a first feeder of a knitting machine, the upper including a portion of at least one of an exterior surface of the knitted component and an opposite interior surface of the knitted component;

knitting a second portion of the knitted component defining the upper with a second feeder of the knitting machine; and

knitting an integral knit tongue that is of unitary knit construction with the upper with at least one of the first feeder and the second feeder of the knitting machine, the integral knit tongue extending through a throat area of the knitted component; and

wherein the integral knit tongue is joined by knitting with the knitting machine to a forward portion of the throat area and at least along a portion of a lateral side and a medial side of the throat area of the knitted component extending from the forward portion to an ankle opening of the upper.

9. The method recited in claim 8, wherein the step of knitting the first portion further comprises:

knitting the exterior surface of the first portion of the upper with the first feeder;

knitting the opposite interior surface of the first portion of the upper with the first feeder; and

knitting at least a portion of the integral knit tongue with the first feeder.

10. The method recited in claim 9, wherein the step of knitting the second portion further comprises:

knitting the exterior surface of the first portion of the upper with the second feeder;

knitting the opposite interior surface of the second portion of the upper with the second feeder; and

knitting at least a portion of the integral knit tongue with the second feeder.

11. The method recited in claim 8, wherein the first portion of the upper is one of a medial side and a lateral side of the knitted component.

12. The method recited in claim 8, wherein the step of knitting the integral knit tongue includes forming a course of the integral knit tongue to include at least one common yarn with the upper.

13. The method recited in claim 12, further comprising forming at least one course of the first portion of the upper or the second portion of the upper with the knitting machine that is substantially continuous with at least one course of the integral knit tongue at the forward portion of the throat area of the upper.

14. The method recited in claim 12, further comprising:

forming at least one course of the first portion of the upper that is substantially continuous with at least one course of the integral knit tongue along the lateral side of the throat area of the upper; and

forming at least one course of the second portion of the upper that is substantially continuous with at least one course of the integral knit tongue along the medial side of the throat area of the upper.

15. The method recited in claim 8, wherein the integral knit tongue comprises a partially integral portion and a free portion, the method further comprising:

knitting the free portion of the integral knit tongue with at least one feeder of the knitting machine;

holding the free portion on needles of the knitting machine;

knitting the first portion of the upper with the first feeder of the knitting machine and knitting the second portion of the upper with the second feeder while the free portion is held on the needles, the first portion of the upper and the second portion of the upper including at least a rearward portion of the integral knit tongue;

joining the free portion to the integral knit tongue at the rearward portion; and

resuming knitting the first portion of the upper with the first feeder of the knitting machine and resuming knitting the second portion of the upper with the second feeder of the knitting machine.

16. A method of manufacturing a knitted component for an article of footwear, the method comprising:

knitting a first portion of the knitted component defining an upper with a first feeder of a knitting machine, the upper including a portion of at least one of an exterior surface of the knitted component and an opposite interior surface of the knitted component;

knitting a second portion of the knitted component defining the upper with a second feeder of the knitting machine; and

knitting an integral knit tongue that is of unitary knit construction with the upper with a third feeder of the knitting machine, the integral knit tongue extending through a throat area of the knitted component; and

wherein the integral knit tongue is joined by knitting with the knitting machine to a forward portion of the throat area and at least along a portion of a lateral side and a medial side of the throat area of the knitted component extending from the forward portion to an ankle opening of the upper.

17. The method recited in claim 16, wherein the upper comprises a first type of yarn; and

wherein the integral knit tongue comprises a second type of yarn, the second type of yarn being different from the first type of yarn.

18. The method recited in claim 17, wherein the second type of yarn is an elastic yarn.

19. The method recited in claim 16, wherein the step of knitting the integral knit tongue includes forming a course of the integral knit tongue to include at least one common yarn with the upper.

20. The method recited in claim 19, further comprising forming at least one course of the first portion of the upper or the second portion of the upper with the knitting machine that is substantially continuous with at least one course of the integral knit tongue at the forward portion of the throat area of the upper.

21. The method recited in claim 19, further comprising:

forming at least one course of the first portion of the upper that is substantially continuous with at least one course of the integral knit tongue along the lateral side of the throat area of the upper; and

forming at least one course of the second portion of the upper that is substantially continuous with at least one course of the integral knit tongue along the medial side of the throat area of the upper.

22. The method recited in claim 16, wherein the step of knitting the first portion further comprises:

knitting the exterior surface of the first portion of the upper with the first feeder; and

knitting the opposite interior surface of the first portion of the upper with the first feeder.

23. The method recited in claim 22, wherein the step of knitting the second portion further comprises:

knitting the exterior surface of the first portion of the upper with the second feeder;

knitting the opposite interior surface of the second portion of the upper with the second feeder.

METHOD OF KNITTING A KNITTED COMPONENT WITH AN INTEGRAL KNIT TONGUE

ABSTRACT

Methods of manufacturing a knitted component for an article of footwear that include knitting an upper with an integral knit tongue during a knitting process on a knitting machine are described. The knitting process forms the integral knit tongue of unitary knit construction with the upper so that the integral knit tongue extends through a throat area of the knitted component. The integral knit tongue can include raised elements formed of unitary knit construction with the tongue.

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1	Transmittal of New Application	2013-02-28_51-3238_Transmittal.pdf	63281 14f7f4bd8439d4c627e702e63a5f3baba7ab6c8e	no	1

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2	Application Data Sheet	2013-02-28_51-3238_ADS.pdf	53220 de86b20ea823fe241f7a148cad55ce3c58b5382f	no	5
Warnings:					
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3	Drawings-only black and white line drawings	2013-02-28_51-3238_Drawings.pdf	402408 8917df44b9dc84473cc5f813d239790c9afdc62b	no	28
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4		2013-02-28_51-3238_Specification.pdf	194648 5fff793a24bd6acb9479dacb615becc8e1cb16c8	yes	51

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	43
Claims	44	50
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