METHOD AND FABRIC FOR A KNITTED PRESSURE BANDAGE USING TWO SETS OF NEEDLES AND INTERKNOTTING A STRETCHED ELASTOMERIC YARN

A knitted fabric comprising at least first and second threads or yams knitted into a tube of interlock fabric comprising respective first and second interlocked rib courses (200 & 202 respectively), and a third thread or yarn (204) of elastomeric material forming a periodic plated jersey course interknitted with one of the first and second interlocked rib courses. The knitted fabric is particularly useful and suitable for elastic tubular pressure bandages or sleeve bandages, and can be advantageously employed as a lining sleeve for a moulded plastic or rubber article. The interlock stitches of the first and second threads provide a closely knit structure which prevents or reduces the liquid mould material from penetrating or permeating through the lining during the moulding procedure. The interknit elastomeric material provides elasticity of the fabric, so that the lining fits around the mould structure. The fabric may be formed on a circular knitting machine having first and second sets of knitting needles, by knitting courses of interlock using both the first and second needle sets, and periodically interknitting or plating a course of elastomeric material using one of the first and second needle sets.
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METHOD & FABRIC FOR A KNITTED PRESSURE BANDAGE USING TWO SETS OF NEEDLES & INTERKNITTING A STRETCHED ELASTOMERIC YARN

This invention relates to a knitted fabric and a method of producing a knitted fabric.

In accordance with the invention there is provided a method of forming a tubular fabric on a circular knitting machine having first and second sets of knitting needles, comprising knitting courses of interlock using both the first and second sets of needles, and periodically interknitting or plating a course of an elastomeric material using one of the first and second sets of needles.

Preferably the courses of elastomeric material are interknitted in a suitably stretched condition.

Preferably the circular knitting machine has a reduced number of needles in both the first and second sets, so as to reduce the effective knitting diameter thereof. In one form of the invention, two of every three needles in both the first and second sets are removed. Alternatively, the knitting machine may be specially adapted to knit with a reduced number of needles as compared to a standard circular knitting machine of the same diameter.

Preferably, the circular knitting machine is provided with at least one feeder which is arranged to feed a thread or yarn to alternate needles of both the first and second sets and simultaneously feed the elastomeric material to alternate needles of one of the first and second sets. The elastomeric material may be interknitted or plated into the fabric using either of the dial knitting needles or the cylinder knitting needles or both the dial and cylinder needles.

The invention also provides a relatively small diameter knitted tube of interlock fabric incorporating an integrally knitted elastomeric thread.
The invention further provides a fabric comprising at least first and second threads or yarns knitted into a tube of interlock fabric comprising respective first and second interlocked rib courses, and a third thread or yarn of elastomeric material forming a periodic plated jersey course with one of the first and second interlocked rib courses.

Preferably the elastomeric third thread or yarn is in a stretched condition when interknitted with the first and second threads or yarns, such that the tubular fabric contracts by action of the elastomeric material after formation thereof.

In one form of the invention the tubular material is useful for forming a pressure bandage or protective sleeve which may be utilised for humans or animals. In another form of the invention the tubular material can be utilised for forming a lining for a moulded product, such as a rubber or plastic footwear layer, wherein the interknitted elastomeric thread or yarn allows form fitting of the fabric liner and the doubled layered structure of the interlock material prevents leakage of the rubber or plastic of the footwear layer when it is moulded onto the fabric liner.

The invention is described in greater detail hereinafter, by way of example only, with reference to a preferred embodiment thereof illustrated in the accompanying drawings, wherein:

Figures 1A and 1B are cutaway schematic views of needles in a knitting machine;
Figure 2 is an illustrative view of needles arranged for producing interlock fabric;
Figure 3 shows a single course of several wales of interlock fabric;
Figure 4 is a simplified view of a cam system for producing interlock fabric;
Figures 5A to 5J diagrammatically illustrate the formation of several types of knitting stitches;
Figures 6A, 6B and 6C are simplified diagrams showing the formation of stitches in accordance with an embodiment of the invention;
Figure 7 illustrates a feeder arrangement;
Figure 8 representationally illustrates an arrangement of knitting needles.;
Figure 9 shows the formation of a course of rib knit with plaited jersey; and
Figures 10 and 11 illustrate a stitch formation according to an embodiment of the
present invention.

The preferred embodiment of the present invention is implemented on a cylinder
and dial type weft knitting machine modified from a variety which is known in the
knitting industry. The basis of weft knitting is to draw a portion of yarn through a
previously formed yarn loop so as to form a further loop through which yarn may be
drawn. For this purpose the knitting machine is provided with a series of hooked knitting
needles 50, illustrated in Figures 1A and 1B. In a cylinder and dial type knitting machine
the knitting needles are arranged in two sets, with the cylinder needles extending
vertically and arranged in a circular configuration with hooks facing outwardly, and dial
needles arranged radially in a single plane with hooks facing upwards. The hooked
portions of the cylinder needles and the dial needles are disposed adjacent a yarn feeding
area where yarn is fed by a yarn feeder to a position whereby to enable the knitting needle
hooks to grasp the yarn. In the preferred form of the knitting machine, the cylinder and
dial knitting needles rotate with respect to the yarn feeders rotate so as to feed yarn to the
circularly disposed sets of needle hooks. It is equally possible, however, for the needles
to remain stationary and the yarn feeders to rotate. Also, as can be seen in Figure 1A, a
reciprocating linear motion of the knitting needles is required to effect the knitting loop
formations, and this is brought about by knitting cams 46 and needle butts 48 which act
as cam followers. Thus, relative rotational movement of the knitting cams with respect
to the needles synchronous with the yarn feeders.

With reference particularly to Figures 1A and 1B, the knitting action of a cylinder
and dial knitting machine can be seen. A cutaway portion of the cylinder 42 is shown
with a series of needles 60, 62, 64, 66 and 68 disposed in needle slots 70. Each needle
is provided with a hook 52 and latch 54 at one end thereof, and a protruding needle butt
48 at the other end. The needle butt 48 is acted upon by knitting cams 46 which have
relative movement with respect to the needles in the direction indicated by arrow 44,
synchronous with a yarn feeder (not shown in Figure 1) which guides yarn 58 to the
to position shown for access by the knitting needles. Knitting needle 60 is shown in a rest
position where the head of the needle hook is level with the top of the needle slot 70 and
a previously formed loop 56 held in the hook 52 closed by latch 54. As the knitting cams
46 rotate past the needles the circular motion of the cams is transformed into a
reciprocating linear motion of the needles as can be seen by the relative positions of
needles 62, 64, 66 and 68. Knitting needle 62 can be seen where the needle butt passes
up the incline of a clearing cam 47, wherein the previously formed loop 56 slides inside
the hook 52 and contacts the latch 54, turning and opening it. Needle 64 is shown at the
top of the clearing cam 47 where the previously formed loop 56 is cleared from the hook
and latch onto the body of the needle. At this point the hook 52 is positioned above the
feeding yarn 58, such that when the needle descends down the clearing cam 47 the yarn
58 is grasped by the hook 52, whilst the previously formed loop 56 contacts the underside
of the latch 54 causing it to close onto the hook 52. Finally, as the head of the knitting
needle descends to the position of needle 68 a newly formed loop 59 is created by
drawing yarn 58 downwards whilst the previously formed loop 56 passes over the latch
54. The distance which the needle descends after forming a new loop 59, and before
returning to the rest position shown by needle 60 controls the loop length of the knitted
fabric.

Two types of knitted fabric which are commonly produced on cylinder and dial
type knitting machines are single-faced knitted structures and double-faced knitted
structures. A single-faced knitted structure is produced by a single set of knitting
needles, e.g. the cylinder needles. Double-faced structures, on the other hand, are
produced when two sets independently controlled needles are employed with the hooks
of one set knitting or facing in a transverse direction to the other set. The two sets of
needles thus draw their loops from the same yarn in transverse directions, so that the
fabric, formed in the gap between the two sets, shows the face loops of one set on one
side and the face loops of the other set on the opposite side of the fabric. A common form
of single-faced fabric is a plain or single jersey fabric, whereas a common double-faced
fabric is a rib fabric.
Another form of double faced fabric is an interlock fabric, in which one course of interlock resembles two interlocking courses of rib fabric. Each interlock course requires two feeder courses each with a separate yarn which knits on separate alternate needles, wherein the yarn from one feeder produces alternate wales on each side of the fabric and the other feeder produces the other alternate wales of loops on each side. The structure of the interlock fabric is illustrated in Figure 3 which shows a course of interlock comprising two threads 80, 82 which alternate wales on each side of the course.

A knitting machine for producing interlock is generally constructed slightly differently from a machine used exclusively for rib or jersey fabric, as can be ascertained with reference to Figures 2 and 4. Figure 2 illustrates needles of a cylinder and dial knitting machine arranged for producing interlock. Figure 4 is a diagrammatic illustration of a cam arrangement for an interlock machine. As can be seen in Figure 2, the needles in the cylinder and dial of the interlock producing machine are arranged so as to be aligned with one another such that only one of the aligned needles from the cylinder and dial can knit at a particular time. Thus, only one of the aligned needles from the cylinder and dial can grasp the thread or yarn from any particular feeder. Furthermore, the needles in each of the cylinder and dial are arranged into two sets. As shown in Figure 2, the cylinder needles comprise a first set of needles 90 and a second set of needles 92, the needles from the first and second sets 90, 92 being arranged in an alternating interleaved fashion around the cylinder. Similarly, the dial is constructed with first and second sets of needles 94, 96 respectively, which are also arranged in alternating fashion around the dial. The first and second sets of needles in the cylinder (90, 92) and dial (94, 96) are each controlled separately by separate cams, as illustrated in Figure 4. To enable this, the needles 90 and 94 in the cylinder and dial respectively are longer than the needles 92, 96 so that they can be controlled by different cams. As shown in Figure 2, the first set of needles 90 in the cylinder are aligned with the second set of needles 96 in the dial, whereas the second set of needles 92 in the cylinder are aligned with the first set of needles 94 in the dial. The first and second cylinder needle sets and first and second dial needle sets 90, 92, 94 and 96 are each respectively controlled by cams 100, 102, 104 and 106, as shown in Figure 4. The cams 100 controlling the first cylinder needle set are
synchronised with the cams 104 controlling the first dial needle set, which are both synchronised with a first feeder 110 (Figure 4). Similarly, the cams 102, 106 for the second needle sets are synchronised with one another and with a second feeder 112.

In order to form a fabric in accordance with an embodiment of the invention, it is preferred that a relatively small diameter knitting machine be utilised, such as in the range of 4 to 24 inches in diameter. It is also preferred that relatively fine needles be employed, although needles in the range of 6 gauge to 28 guage can be used. Generally, the larger needles (i.e. smaller guage) would be employed for coarser materials, such as horse bandages or the like and smaller needles (i.e. larger guage) used for finer fabrics such as moulded boot linings where fine fabric is required to prevent the liquid molding material from penetrating during the molding process. The knitting machine is modified by the removal of a proportion of the needles from both the dial and cylinder. In one form, two of every three needles in both the cylinder and dial are removed, wherein the needle pattern in the cylinder and dial resembles that illustrated diagrammatically in Figure 9, with the alternating short and long needles each being separated by two spaces where needles have been removed from the machine. It will be understood, however, that other proportions of needles can be removed from the machine, a useful range being between 1 and 5 needles removed for every one needle remaining. Alternatively, as mentioned, instead of removing needles from a standard knitting machine, the invention may be practical using a specially prepared dial and cylinder having an accordingly reduced number of needles.

The knitting machine for producing a fabric according to an embodiment of the invention is also provided with a guiding feeder which is illustrated diagrammatically in Figure 7. The feeder 120 shown in Figure 7 is provided with a first guide 122 which guides a first thread or yarn 130 to a position where it can be grasped by both the cylinder needles (90, 92) and the dial needles (94, 96). The first thread 130 is thus formed by the action of the transverse reciprocating cylinder and dial needles into one half of an interlock course. The feeder 120 is also provided with a projecting attachment 124 having a second guide 126 there at, which is spaced laterally from the first guide 122, and thus
spaced laterally from the cylinder needles (90, 92). The effect of this lateral spacing of the second guide 126 is that an elastomeric second thread or yarn 132 which is guided by the second 126 is laterally spaced from the cylinder needles, and thus unable to be grasped by those needles. Consequently, the second thread 132 is only knitted by the dial needles 94, 96, forming a course of single jersey knitting of the thread 132 which is interknitted with the interlock course of the thread 130. In fact, since each feeder in the interlock knitting machine is arranged to be synchronised with only one set of needles from each of the cylinder and dial, the second thread 132 is knitted by only one set of the dial needles, forming a course of half gauge jersey since only alternating needles on the dial pickup the thread 132. It is possible, however, that tuck stitches are formed on the intervening needles, as will be apparent to those skilled in the art.

Alternatively, the feeder 120 may be arranged, to feed the second thread 132 to a set of needles from the cylinder rather than the dial, in which case the second thread would be fed through a guide 127 spaced laterally with respect to the dial needles (94, 96). Separate elastomeric thread feeders may be provided to feed only to the dial and cylinder, respectively, or to both in the same fabric.

The fabric according to the preferred embodiment of the invention basically comprises a tube of interlock fabric periodically plated or interknitted with a course of an elastomeric material which is fed to only one set of either the cylinder or dial needles using a feeder guide arrangement as described above. Plated refers to a knitted structure where one thread follows the loops of another thread in the knitted fabric, although in this case the elastomeric thread only follows alternate loops of either those formed on the cylinder or dial. Thus, the second guide 126 shown in Figure 7 would be utilised to feed the elastomeric thread only to one set of the dial needles. If a greater amount of elastomeric thread is desired in a fabric, separate elastomeric threads can be fed to each set of needles on the cylinder and/or dial. It is preferred that the elastomeric thread is fed to the needles in a substantially stretched condition. This causes the tubular fabric to contract after leaving the knitting needles, which is further facilitated by the use of only the selected needles in the machine or the specially constructed cylinder and dial in which
a reduced number of needles are included. By removal of needles from the dial and cylinder the effective knitting diameter is reduced. For example, on a 10 inch diameter machine which might ordinarily carry 756 needles, in a preferred form of the present invention only 252 needles are employed, which corresponds to one out of every three needles in operation.

It is preferred that the threads or yarns forming the interlock courses are of a natural fibre, such as cotton or wool, however synthetic fibres may also be used. The elastomeric thread or yarn is preferably a lycra material, although other elastomeric materials may similarly be employed. In the preferred form of the invention, the elastomeric thread is fed through a secondary driving mechanism at a speed which is reduced with respect to the primary feeding speed so as to facilitate the required contraction of the fabric after manufacture and stretch recovery when in use.

In one form of the fabric only three threads or yarns are required, with one of these being the elastomeric material. Figures 5A and 5B illustrate diagrammatically the formation of half gauge rib courses by separate threads on respective alternating sets of needles of the cylinder and dial, which are combined to form the interlock chain in Figure 5C. Figures 5D, 5E, 5F and 5G illustrate various types of jersey knit courses which can be formed by the elastomeric thread fed to one or other set of the alternating sets of needles on the cylinder and/or dial. The thread courses of Figures 5A and 5B are fed from separate feeders, whilst the elastomeric thread of Figure 5D, for example, can be fed from the same feeder as either that of Figure 5A in the manner described in relation to Figure 7. Similarly, the thread forming the jersey course shown in Figure 5E can be fed from the same feeder as that used to form the stitches illustrated in Figure 5B. The jersey knit formation of Figure 5F could be formed by feeding the dial and cylinder needles, respectively, with elastomeric thread fed from the first and second guides 126, 127 (Figure 7) of the feeder used to form stitches on the first set of needles, corresponding to Figure 5A. Figure 5G illustrates a modification wherein the jersey stitches formed on the dial needles include tuck stitches, as are known in the art, on the dial needles in the second set of needles.
Figure 5H illustrates a jersey knit course formed on the cylinder needles of set two in combination with a rib knit formed on both the cylinder and dial needles of the second set of needles. This structure is also shown in Figure 9.

A diagrammatic representation of an embodiment of the final fabric is shown in Figure 5I in which three threads are combined: two complementary rib knits forming an interlock structure and an interknitted or plaited jersey knit, in this case on the cylinder needles. Also, the manner in which the three separate threads are taken up by the needles from the two separate feeders is illustrated in Figures 6A, 6B and 6C, with Figure 6A showing the knitting formation from the feeder which carries the elastomeric thread, represented by the reference numeral 140.

Figures 10 and 11 are diagrammatic illustrations of a portion of a course of fabric knitted according to an embodiment of the present invention, in this case incorporating three threads one of which is elastomeric. First and second courses of rib fabric 200 and 202 knitted on first and second sets of needles, respectively, on the cylinder and dial combine to form an interlock structure. The second rib course 202 is plaited with jersey stitches of an elastomeric thread 204 knitted using only the cylinder needles of the second set of needles. It will of course now be apparent to those skilled in the art that the elastomeric thread utilised in embodiments of the present invention can be incorporated with the interlock knit structure by interknitting the interlock stitches with the elastomeric thread as formed by any one of the knitting processes illustrated in Figures 5D to 5G or combinations thereof, and only the simplest structure has been illustrated in Figures 10 and 11 for ease of description.

The frequency with which the elastomeric thread is knitted into the fabric can be selected depending upon the elasticity required of the material. It is preferred that the elastic thread is added in only, for example, every second or third course or less. As mentioned above, however, with various feeder combinations the elastomeric thread may be interknitted in the fabric as often as desired and can, in fact, be plaited into courses knitted by either or both of the cylinder and dial. Although the invention has been
described thus far with reference to only two feeders, it will be recognised by those of ordinary skill in the art that a plurality of pairs of feeders could easily be employed to the same end, and is in fact preferred where this is allowed by the knitting machine, since the production of the material is then faster. This also allows a number of different threads or thread types to be used in the same fabric. Thus, if four pairs of feeders are provided, one of these could be arranged to feed the elastic thread such that only every fourth course of the fabric contains the interknitted elastomeric material.

In a specific form of the fabric which is useful for producing tubular pressure bandages and lining for moulded footwear, for example, the two non-elastic threads forming the interlock course are of different thicknesses where an elastomeric thread is to be incorporated. For example, the first feeder (Figure 6B) may be arranged to feed the short needles of the knitting machine, which are used to knit a row of stitches using the thicker yarn (e.g. 1/20 cc). The second feeder (Figure 6A) is then used to feed the long needles of the knitting machine so as to knit a row of stitches using the finer yarn (1/30 cc) and feed the elastomeric yarn to the dial needles as described hereinabove. The elastomeric yarn may comprise, for example, 40 denier lycra material.

The fabric thus formed, with the elastomeric material knitted thereinto in a stretched condition provides a fabric which is stretchable in both dimensions, which is useful for such applications as tubular pressure bandages and protective sleeve bandages for humans or animals and linings for moulded footwear. Because the material is stretchable, when it is used in a lining such as for a moulded boot, the lining can form fit to the ankle and other wider parts of the boot without having wrinkles. Also, because the interlock fabric is relatively impermeable, the moulded material such as rubber or plastic (e.g. PVC) does not permeate or penetrate through the lining when moulded thereon during the moulding process.

The invention has been described in detail hereinabove by way of example only, and is not intended that this description be considered limiting to the invention which is defined in the appended claims.
CLAIMS:

1. A method of forming a tubular fabric on a circular knitting machine having first and second sets of knitting needles, comprising knitting courses of interlock using both the first and second sets of needles, and periodically interknitting or plating a course of an elastomeric material with the interlock using one of the first and second sets of needles.

2. A method as claimed in claim 1, wherein the elastomeric material is in a stretched condition when interknitted with the interlock courses.

3. A method as claimed in claim 2, wherein the elastomeric material is fed to the said one of the first and second sets of needles at a rate slower than thread or yarn used to form the interlock courses, so as to facilitate said stretched condition.

4. A method as claimed in claim 1, wherein the first set of needles comprises alternating operative needles on the cylinder and dial of the circular knitting machine, and the second set of needles comprises alternating operative needles on the cylinder and dial of the circular knitting machine which alternate with the respective cylinder and dial needles of the first set of needles.

5. A method as claimed in claim 1, wherein the circular knitting machine is provided with at least one feeder which is arranged to feed a thread or yarn to alternate needles of both the first and second sets and simultaneously feed the elastomeric material to alternate needles of one of the first and second sets.

6. A method as claimed in claim 1, wherein threads of separate elastomeric materials are periodically interknitted or plated into courses formed by the first and second sets of needles, respectively.

7. A method as claimed in claim 1, wherein the first and second sets of knitting
needles comprise one knitting needle of every two to six possible knitting needles in the circular knitting machine, evenly spaced around the cylinder and dial, with the remaining needles of the knitting machine removed or inoperative.

5 8. A method as claimed in claim 1, wherein the elastomeric material is interknitted or plated with the interlock courses by jersey stitches formed by alternate needles of said one of the first and second sets of needles.

9. A method as claimed in claim 8, wherein the elastomeric material is formed with a tuck stitch between each of the plated jersey stitches.

10. A fabric comprising at least first and second threads or yarns knitted into a tube of interlock fabric comprising respective first and second interlocked rib courses, and a third thread or yarn of elastomeric material forming a periodic plated jersey course with alternate face loops of one of the first and second interlocked rib courses.

11. A fabric as claimed in claim 10, wherein the elastomeric third thread or yarn is in a stretched condition when interknitted with the first and second threads or yarns so that the tubular fabric is contracted by action of the elastomeric material after formation thereof.

12. A knitted fabric formed by the method of any one of claims 1 to 9.

13. A tubular pressure bandage or bandage sleeve comprising a length of tubular fabric formed by the method of any one of claims 1 to 9.

14. A tubular pressure bandage or bandage sleeve comprising a length of tubular knitted fabric according to claim 10 or 11.

15. A fabric lining for a moulded rubber or plastic product comprising a length of tubular fabric formed by the method of any one of claims 1 to 9.
16. A lining for moulded rubber or plastic footwear comprising the fabric lining of claim 15.

17. A moulded plastic or rubber product having a lining comprising a length of tubular fabric according to claim 10 or 11 or formed by the method of any one of claims 1 to 9.
Figure 4.
FIGURE 5D

JERSEY KNIT (SET 1, DIAL)

FIGURE 5E

JERSEY KNIT (SET 2, DIAL)

FIGURE 5F

JERSEY KNIT (SET 1, DIAL & CYLINDER)

FIGURE 5G

JERSEY KNIT (SET 1, DIAL & CYLINDER WITH TUCKING ON DIAL SET 2)
FIGURE 5H

FIGURE 5I

FIGURE 5J
FIGURE 6B.

SUBSTITUTE SHEET (Rule 26)
S X X L X X S X X  

DIAL

L X X S X X L X X  

CYLINDER

S = short needle (1st needle set)
L = long needle (2nd needle set)
X = needle removed

FIGURE 8.

SUBSTITUTE SHEET (Rule 26)
INTERLOCK WITH PLAITED ELASTOMERIC

FIGURE 11

SUBSTITUTE SHEET (Rule 26)
### INTERNATIONAL SEARCH REPORT

**International Application No.**  
PCT/AU 96/00682

#### A. CLASSIFICATION OF SUBJECT MATTER

Int Cl: D04B 9/08, 9/52

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 9/08, 9/52

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

AU: IPC as above

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

DERWENT: interknit: or plating: and elastomeric (yarn or thread or filament)

#### C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 1910932, (PHILLIPS), 7 May 1929 page 3, figure 1 and 6 whole document</td>
<td>1,4-6,10,12-17</td>
</tr>
<tr>
<td>Y</td>
<td>GB 441024, (M. BROMLEY &amp; CO. LTD.) 10 January 1936 page 1, page 4 lines 127-130, page 5 lines 15-58, page 6 line 32, figure 1</td>
<td>2,3,7-9,11</td>
</tr>
<tr>
<td>X</td>
<td>US 3478544, (E.P. HOMAN) 18 November 1969 column 2 lines 12-23, column 9 lines 23-34, 45-59, figure 3</td>
<td>1,4,6,8,9,10,12-17</td>
</tr>
<tr>
<td>Y</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

| X        | Further documents are listed in the continuation of Box C                        |

* 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 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

3 February 1997

#### Date of mailing of the international search report

20.02.97

#### Name and mailing address of the ISA/AU

AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION  
PO BOX 200  
WODEN ACT 2606  
AUSTRALIA  
Facsimile No.: (06) 285 3929

#### Authorized officer

ADRIANO GIACOBETTI  
Telephone No.: (06) 283 2579
## INTERNATIONAL SEARCH REPORT

### DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>GB 959627, (BURLINGTON INDUSTRIES INC.), 3 June 1964 page 1 lines 11-28 &amp; 40-49, page 2 lines 3-11, figure 2</td>
<td>1,2,3,10,13</td>
</tr>
<tr>
<td>Y</td>
<td>GB 1146726, (MONSANTO COMPANY), 26 March 1969 page 1 lines 11-15, line 55 &amp; lines 77-86, page 2 lines 1-7, page 5 lines 11-14</td>
<td>1,2,3,10</td>
</tr>
<tr>
<td>A</td>
<td>GB 572908, (WILDT et al.), 29 October 1945 page 1 lines 15-24, 42-53 &amp; 77-83, figure 1</td>
<td>1,4,12</td>
</tr>
<tr>
<td>A</td>
<td>US 3098368, (MILES), 23 July 1963 column 1 lines 18, 49-50, 59-62, figure 2</td>
<td>1,10,12</td>
</tr>
</tbody>
</table>
INTERNATIONAL SEARCH REPORT

Box I  Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
   because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II  Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

   Claim 1, claim 10, claims 12, 13, 15-17 and claims 14 & 17 lack unity of invention a posteriori. See the continuation sheet of Box II.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims

   ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest  ☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet(1)) (July 1992) copgil
The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

Claim 1 is directed to a method of forming a tubular fabric characterised in that two sets of needles knit courses of interlock and periodically interknit or plate a course of elastomeric material.

Claim 10 is directed to a fabric having first and second yarns knitted into a tube of interlock fabric comprising two interlocked rib courses. An elastomeric material forms a periodic plated jersey course with the alternate face loops of one of the rib courses.

Claims 12, 13, 15, 16 and 17 are directed towards articles made by the method characterised by the features of claim 1.

Claims 14 and 17 are directed towards articles made by the fabric having the features of claim 10.

The common subject matter of claims 1, 10 and 12-17 is a tube of interlock fabric periodically plated with a course of an elastomeric material. This common subject matter does not involve an inventive step in the light of the prior art found. For example refer to patent documents US 3098368, US 1910932, US 3478544 and GB 441024. Since the common subject matter of claims 1, 10 and 12-17 lacks an inventive step, and thus there is no single inventive concept, these claims are found to exhibit lack of unity of invention a posteriori.