

March 9, 1971

M. PHILIP

3,568,475

INSULATING FABRIC

Filed Nov. 25, 1966

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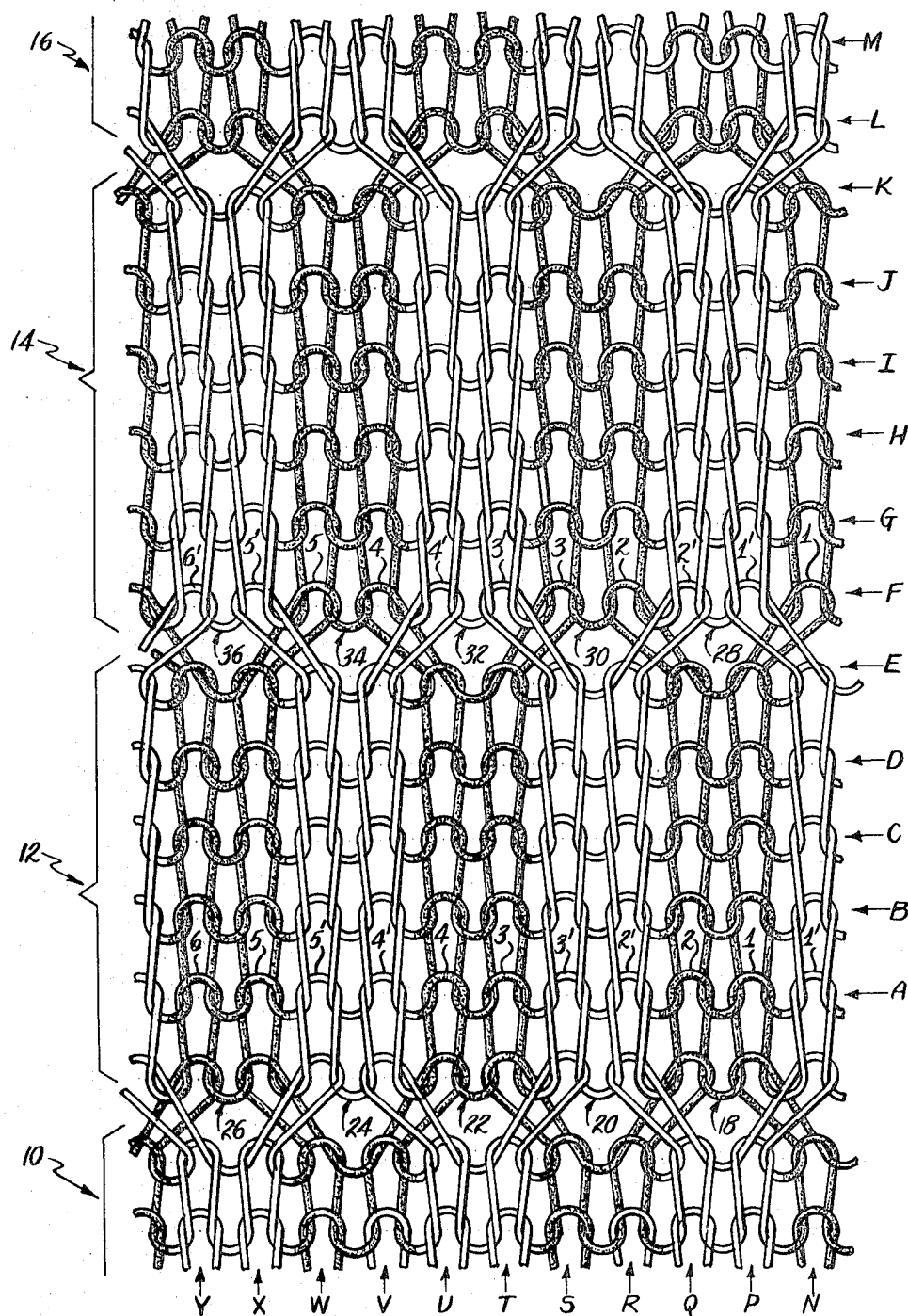


Fig. 1.

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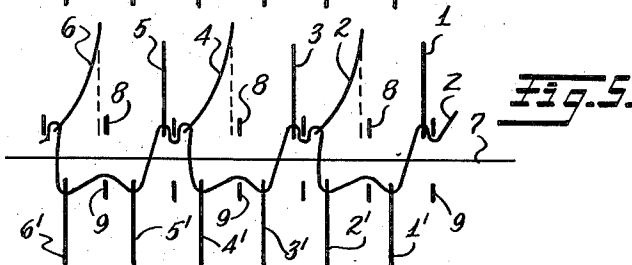
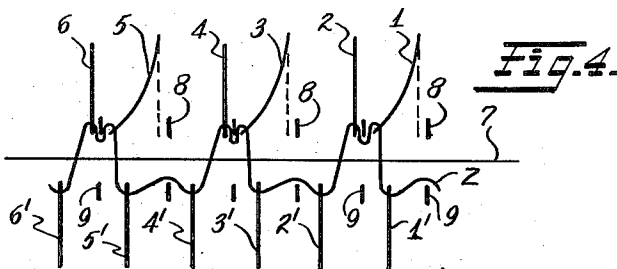
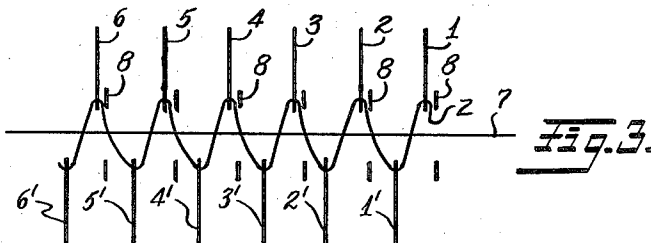
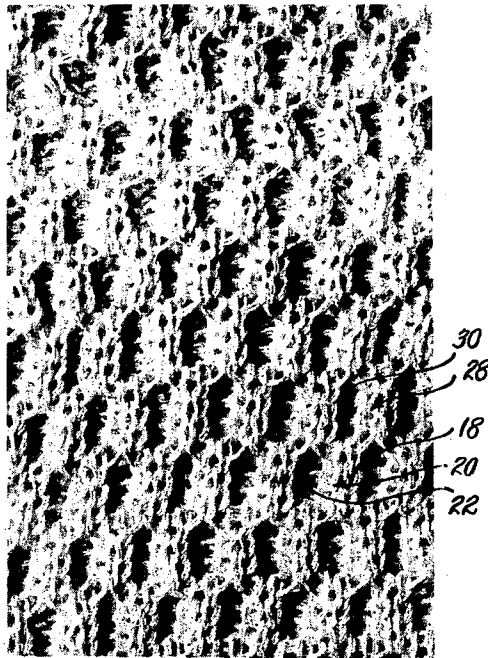
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Fig. 2.



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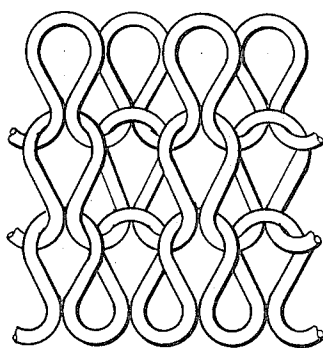


Fig. 6

Fig. 1

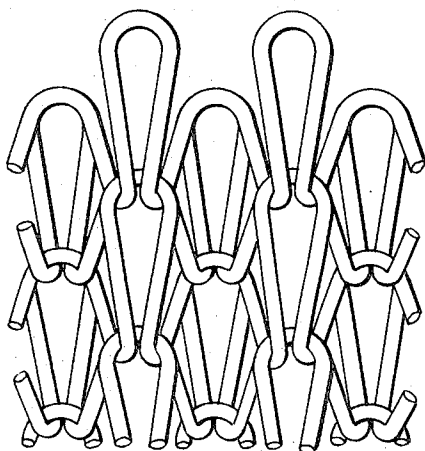
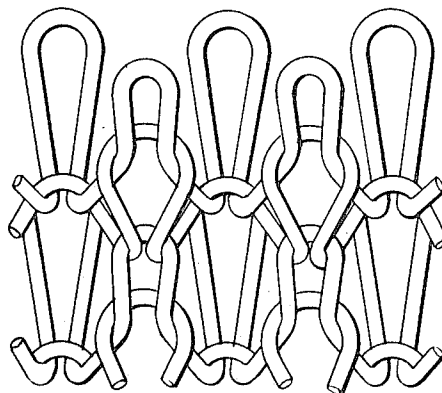


Fig. 2

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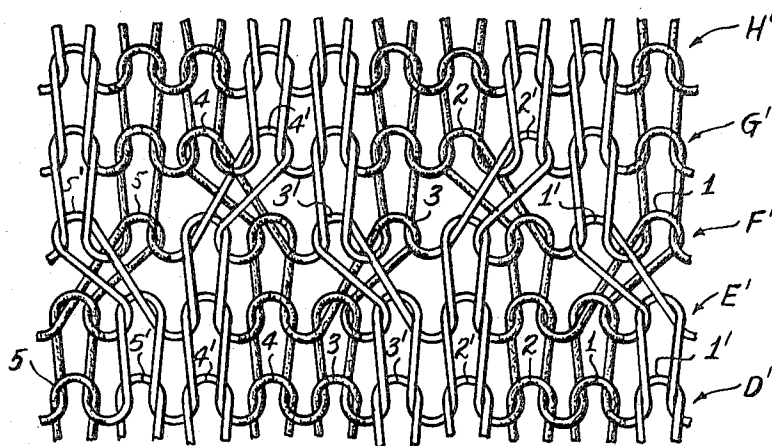


Fig. 9.

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3,568,475

INSULATING FABRIC

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U.S. Cl. 66—199

11 Claims

ABSTRACT OF THE DISCLOSURE

This invention is directed to an insulating weft knit fabric comprising a plurality of longitudinally extending sections, each of said sections comprising a plurality of courses defining laterally alternating obverse portions and reverse portions, each portion comprising a plurality of wales, the loops of the obverse portion facing one side of the fabric and the loops of the reverse portion facing the other side of the fabric, the obverse portions and the reverse portions of each section being substantially aligned with the reverse portions and the obverse portions, respectively, of the section on either side thereof so as to form insulating cells in said fabric.

The present invention relates to an insulating fabric, and more particularly to an insulating weft knit fabric. The invention also relates to garments made from said fabric, and particularly under garments.

In recent years, insulating fabrics have been produced which owe their insulating properties primarily to the knitted pattern rather than to the fiber content. A very desirable type of fabric has been made by knitting the fabric on a Raschel machine, that is, warp knitting, but these fabrics are expensive to produce. These fabrics are knit so as to produce cells therein which form air pockets to produce the insulating effect.

According to the present invention, fabrics can be produced which have insulating properties and appearance comparable to the Raschel fabrics, but the fabrics of the present invention are produced by weft knitting, and, therefore, can be produced more easily and more cheaply. The weft knitted fabrics of the invention also have insulating cells formed during the knitting.

More particularly, according to one aspect of the present invention, there is provided an insulating weft knit fabric comprising a plurality of longitudinally extending sections, each of said sections comprising a plurality of courses defining laterally alternating obverse portions and reverse portions, each portion comprising a plurality of wales, the loops of the obverse portion facing one side of the fabric and the loops of the reverse portion facing the other side of the fabric, the obverse portions and the reverse portions of each section being substantially aligned with the reverse portions and the obverse portions, respectively, of the section on either side thereof so as to form insulating cells in said fabric.

According to the preferred embodiment of the invention, the obverse and reverse portions are preferably defined by a 2 x 2 rib. Any desirable type of stitch can be used in knitting these portions, such as for example, the ordinary rib stitch, half cardigan stitch, or full cardigan stitch.

These and other aspects of the present invention will be readily apparent from the following description, together with the accompanying drawings, in which:

FIG. 1 is a plan diagrammatic view of an exemplary fabric of the invention, wherein the stitch shown is an ordinary rib stitch;

FIG. 2 is a plan view to illustrate the actual appearance of a fabric according to the invention, said figure being a photograph of a fabric knit with a 2 x 2 full cardigan stitch, which was knit on relatively coarse needles, so as

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to illustrate the appearance of the fabric, although for insulating purposes, the fabric will be knit on finger gauge needles;

FIG. 3 is a schematic diagrammatic view, showing the position of dial and cylinder needles when knitting a 1 x 1 stitch;

FIG. 4 is a schematic diagrammatic view showing the position of dial and cylinder needles with alternating dial needles being racked or flexed to produce a 2 x 2 rib stitch.

FIG. 5 is a schematic diagrammatic view showing the position of dial and cylinder needles with the needles which were racked in FIG. 4 returned to normal position, and with the alternating needles, which were not racked in FIG. 4 now being racked or flexed to produce a 2 x 2 rib.

FIG. 6 is a plan diagrammatic view of a 1 x 1 plain rib knit fabric.

FIG. 7 is a plan diagrammatic view of a 1 x 1 half cardigan knit fabric.

FIG. 8 is a plan diagrammatic view of a 1 x 1 full cardigan knit fabric.

FIG. 9 is a plan diagrammatic view of a portion of an exemplary fabric of the invention, the stitch being a plain rib stitch, and showing a modification wherein there is at least one intermediate course between the sections.

By way of example, the fabric of the present invention can be knit on the apparatus, and pursuant to the method, disclosed in applicant's U.S. Pat. No. 3,084,528, the disclosure of which is hereby incorporated by reference. Particular attention is directed to FIGS. 1-12 and 27-34 of said Pat. No. 3,084,528. Briefly, Pat. No. 3,084,528 discloses a machine and method of knitting wherein individual needles can be racked or flexed during the knitting operation to convert the knitting from 1 x 1 to 2 x 2. This patent also discloses shifting a pattern to produce a zigzag effect.

Since the manipulative techniques used in the present invention are described in said patent, it is not considered necessary, for the purpose of the present application, to specifically describe the operation of the machine, except, in the exemplary embodiment, to show which needles flex or rack to produce the desired result.

Referring to FIG. 1, in this exemplary embodiment, there are shown four adjacent longitudinally extending sections 10, 12, 14 and 16, the first knitted section 10 and the section being knitted 16 being only partially shown. This figure shows the fabric as conventionally illustrated in the knitting art, so that the courses shown at the bottom of the drawing are the first knitted courses, and the courses shown at the top of the drawing being the last knitted courses.

In other words, in FIG. 1, sections 10, 12 and 14 have already been knitted in that order, and section 16 is being knitted. The fabric shown in this figure is knit on opposed needle banks, such as, for example, are found in a cylinder machine, with the shaded loops being the loops knitted by the dial needles, and the unshaded loops being the loops knitted on the cylinder needles. Briefly, this fabric has formed therein a plurality of cells 18, 20, 22, 24, 26, 28, 30, 32, 34 and 36. Similar cells are shown in FIG. 2. Cells 18, 22, 26, 30 and 34 are open on the obverse side of the fabric, that is the side facing the viewer and are produced by the dial needles, while the other cells are open on the reverse side of the fabric and are produced by the cylinder needles. The loops of cells 18, 22, 26, 30 and 34 are formed by the dial needles and face the reverse side of the fabric while the loops of the other cells are formed by the cylinder needles and face the obverse side of the fabric. It will be appreciated from viewing FIGS. 1 and 2, that the cells alternate, and thereby produce the insulating effect desired in the fabric.

It will be appreciated that each of longitudinally extending sections 10, 12, 14 and 16 comprise a plurality of courses (such as courses A, B, C, D and E of section 12; and courses F, G, H, I, J and K of section 14) defining laterally alternating obverse portions and reverse portions, each comprising a plurality of wales, the loops of the obverse portion facing one side of the fabric and the loops of the reverse portion facing the other side of the fabric.

More specifically, section 12 comprises courses A, B, C, D and E, which form alternating portions 18, 20, 22, 24 and 26. Portions 18, 22 and 26 are reverse portions, since their loops are formed by the dial needles, and, therefore, face the reverse side of the fabric. Portions 20 and 24 are obverse portions, since their loops are formed on the cylinder needles, and therefore, face the obverse side of the fabric.

In the exemplary embodiment, wales P and Q form portion 18, wales R and S form portion 20, wales T and W form portion 22, wales V and X form portion 24, and wales Y and Z form portion 26. Wale N forms part of the portion preceding portion 18.

It is also apparent from FIG. 1 that wales P and Q form portion 28 of section 14, wales R and S form portion 30, wales T and U form portion 32, wales V and W form portion 34, and wales X and Y form portion 36. It is noted that the wales which form the obverse portion in one section form the reverse portion in the section adjacent thereto, so that it can be said that the obverse portions of one section are substantially aligned with the reverse portion of an adjacent section, and vice versa, and it is this reversal of the direction of the loops of longitudinally aligned portions which forms the insulating cells.

As has been stated, any appropriate type of stitch can be used in knitting the fabric of the invention, such as for example, ordinary rib stitch, half cardigan stitch or full cardigan stitch or any other combination of knit tuck or welt stitches. However, for purposes of exemplification, in FIG. 1, there has only been shown the ordinary rib stitch, since a drawing showing the ordinary rib stitch is more easily understood.

For this same reason, there will now be described a method of knitting the fabric, bearing in mind that other techniques can be used, and that the same principle which is applied to the ordinary rib stitch can be applied to such stitches as the half cardigan stitch or the full cardigan stitch. It is also pointed out that a fabric having excellent insulating qualities is produced when using a fine gauge machine, and excellent results are produced when using needles having a fineness of 8-cut per inch or finer. Furthermore, because of the inherent nature of the half cardigan and cardigan stitches, a better insulating value is produced than when using the ordinary rib stitch.

In the description of the method, reference will be made to a cylinder machine having opposed needle banks, but it is apparent that other types of machines, such as flat machines, can be used, as long as they are capable of producing ribs.

In FIG. 3 is shown a schematic diagrammatic view of needles arranged to produce a 1 x 1 rib. Needles 1, 2, 3, 4, 5 and 6 are the dial needles, and needles 1', 2', 3', 4', 5' and 6' are the cylinder needles. Numeral 7 represents the space between the dial and cylinder, 8 represents the dial combing teeth, and 9 represents the cylinder combing teeth. It will be appreciated that when the needles are in the position shown in FIG. 3, with the cylinder needles being positioned between the dial needles, the yarn Z will knit plain 1 x 1 rib, and an example of such a fabric is shown in FIG. 6.

The odd numbered dial needles are flexed, as described in the aforementioned Pat. No. 3,084,528 to bring said needles into the position shown in FIG. 4. The curved line for each of these needles represents the flexed position, with the dotted lines representing the position be-

fore flexing. When these odd numbered dial needles are flexed in the position shown in FIG. 4, the fabric produced will be a 2 x 2 rib, with the pairs of needles 1, 2; 3, 4; and 5, 6 producing the two reverse wales, and with the pairs of cylinder needles 2', 3'; and 4', 5' producing the obverse wales. When the needles are in the position shown in FIG. 4, section 12 of FIG. 1 is being knitted, and the loops of course A are marked with the needles producing the loops. Successive courses B, C, D and E are knit with the needles in the position shown in FIG. 4.

Then, in the immediately succeeding course F, the odd numbered dial needles 1, 3, 5 are permitted to return to the unflexed position and in the same course the even numbered dial needles 2, 4 and 6 are flexed as shown in FIG. 5. When the needles are in the position shown in FIG. 5, the machine will again knit a 2 x 2 rib, but this time the reverse wales will be formed with pairs of needles 2, 3; 4, 5, etc., and the obverse wales will be formed with pairs of cylinder needles 1', 2'; 3', 4'; 5', 6'. The first course knit with the needles in FIG. 5 is shown in the course F. In this description of FIGS. 3, 4 and 5, there have only been described some of the needles which cooperate in pairs, and it will be appreciated that there are many more needles in each needle bank, and that these additional needles follow the same pattern of knitting.

Knitting is continued with the needles in the position shown in FIG. 5 to knit courses G, H, I, J and K, and complete knitting of section 14. The needles are then returned to the position shown in FIG. 4 to knit courses L and M of section 16, and so on, shown in the successive sections.

It will be appreciated that in this illustrated embodiment, each section of 2 x 2 rib immediately follows the preceding section of 2 x 2 rib. Optionally, there may be between the sections one or more courses of 1 x 1 rib, which at times may enhance the knitting operation and/or the appearance of the fabric and a portion of such fabric is shown in FIG. 9.

In such an instance, after course E, the needles are restored to the position shown in FIG. 3 for one or more courses, and then the needles are shifted to the position shown in FIG. 5 to begin the next section. FIG. 9 shows a portion of such a fabric illustrating the transition from one section to another section. In this figure courses D' and E' correspond to courses D and E of FIG. 1, and have been knitted with the odd numbered dial needles flexed as shown in FIG. 4 to produce a 2 x 2 rib, reference numerals 1, 2, 3, 4 and 5 showing the loops knit with the dial needles and reference numerals 1', 2', 3', 4' and 5' showing the loops knit with the cylinder needles. Course F' was knit with the odd numbered dial needles (1, 3 and 5) having been returned to the unflexed position as shown in FIG. 3, thereby producing in course F' a 1 x 1 rib. One or more courses (only one course being shown) are knit with the needles in this position. Then, for the next course G', the even numbered dial needles (2 and 4) are flexed to the position shown in FIG. 5, thereby producing in course G' a 2 x 2 rib. Course H' is knit with the needles in the same position as course G' and knitting is continued in this manner for the number of additional 2 x 2 courses desired, and so on.

In FIGS. 7 and 8 there are shown respectively a 1 x 1 half cardigan rib and a 1 x 1 full cardigan rib. These figures correspond to that shown in FIG. 6 for a 1 x 1 plain rib in that all three figures show the type of fabric which would be produced before the needles are flexed. It will be appreciated that when it is desired to produce the fabric of the present invention with either a half cardigan stitch or a full cardigan stitch, the principles used in connection with the exemplary embodiment can be followed. Although the term "full cardigan" is frequently used to mean a 1 x 1 full cardigan, technically speaking it is not so limited. "Full cardigan," technically speaking, means that in one course all the needles of one bank tuck while during that course the needles of the

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other bank knit, and in the next course the needles of that bank which tucked in the previous course now knit and those which knit in the previous course now tuck, and so on in alternation. If the needles are arranged in a 1 x 1 arrangement there is produced a 1 x 1 full cardigan and if the needles are arranged in a 2 x 2 arrangement there is knit a 2 x 2 full cardigan.

The number of courses used to knit each section may be varied as desired, depending upon the insulating qualities and the appearance desired. Excellent results have been obtained for an insulating fabric when at least six courses are used to produce each section, but as many as eighteen courses or even higher can be used.

The fabric of the invention with its excellent insulating qualities can be used wherever an insulating fabric is desired. A particularly large market at the present time for insulating fabrics is in the field of knit under garments, such as underpants, undershirts and vests. Such under garments are frequently called thermal under garments and the fabric of the present invention may readily be utilized for the production of such garments.

What is claimed is:

1. An insulating weft knit fabric comprising a plurality of longitudinally extending sections, each of said sections comprising a plurality of courses defining laterally alternating obverse portions and reverse portions, each portion comprising a plurality of wales, the loops of the obverse portion facing one side of the fabric and the loops of the reverse portion facing the other side of the fabric, the obverse portions and the reverse portions of each section being substantially aligned with the reverse portions and the obverse portions, respectively, of the section on either side thereof so as to form insulating cells in said fabric.

2. A fabric according to claim 1 wherein there is at least one course of 1 x 1 rib between said sections.

3. A fabric according to claim 2 wherein said sections are composed of 2 x 2 rib.

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4. A fabric according to claim 1, wherein said sections are immediately adjacent each other.

5. A fabric according to claim 4 wherein said sections are composed of 2 x 2 rib.

5 6. A fabric according to claim 1, wherein said sections are composed of 2 x 2 rib.

7. A fabric according to claim 1, wherein said sections are plain rib knit.

10 8. A fabric according to claim 1, wherein said sections are half cardigan knit.

9. A fabric according to claim 1, wherein said sections are full cardigan knit.

10. A fabric according to claim 1, which is a tubular knit fabric.

15 11. A fabric according to claim 9, wherein there is at least one course of 1 x 1 rib between said sections.

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