Nov. 18, 1969 O. ENGELHARD 3,478,545

WARP KNIT FABRIC

Filed Feb. 16, 1968 2 Sheets-Sheet 1

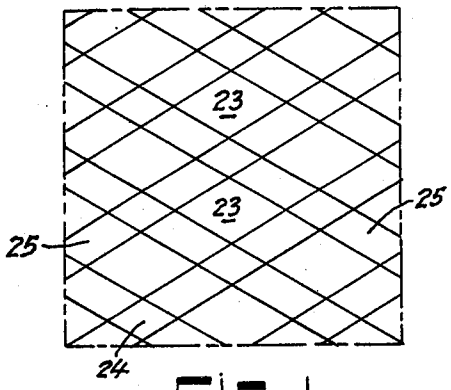


Fig. 1.

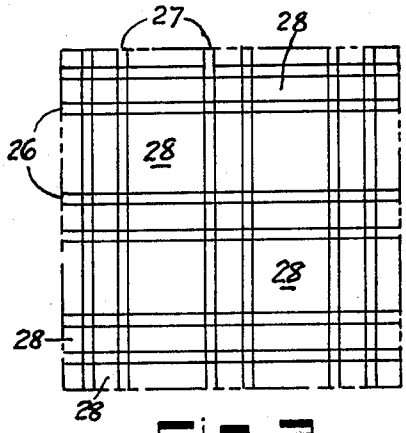


Fig. 2.

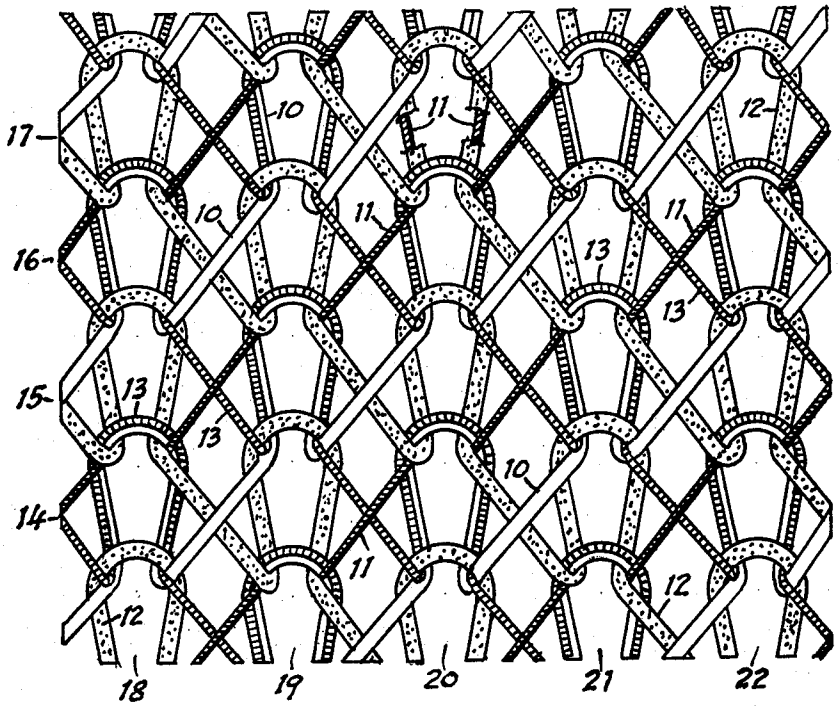


Fig. 3.

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WARP KNIT FABRIC

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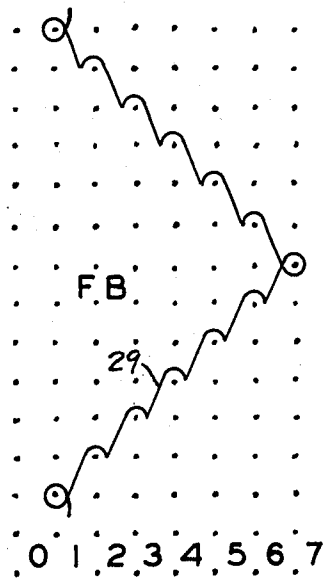


Fig. 4.

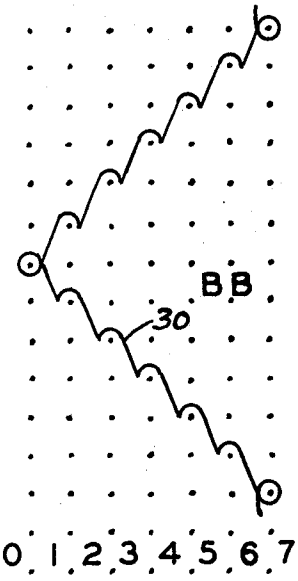


Fig. 5.

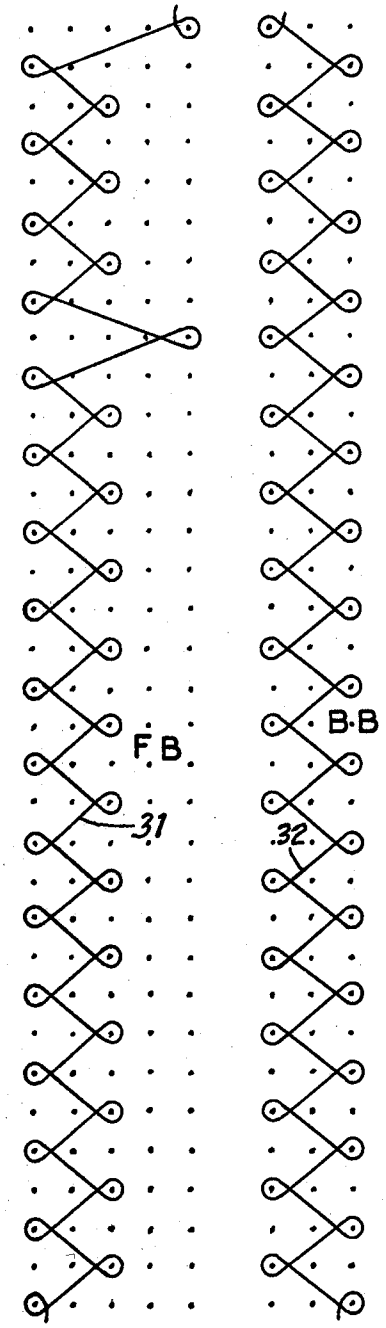


Fig. 6. Fig. 7.

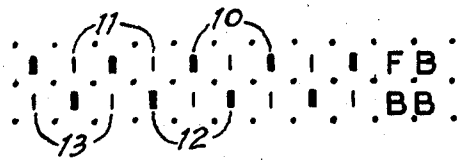


Fig. 8.

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WARP KNIT FABRIC

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Int. Cl. D04b 21/04
U.S. Cl. 66—195 12 Claims

ABSTRACT OF THE DISCLOSURE

Warp knit fabric composed of two sets of yarns in each set of which thick and thin yarns alternate, with the yarns so disposed that a thin and a thick yarn is contained in each stitch of the fabric. The relative deniers of the thick and of the thin yarns is such that the appearance of a design in the fabric is determined by the appearance of the thick yarns. The fabric is made on a two bar warp knitting machine wherein each bar is fully threaded, with said thick and thin yarns arranged in alternation, and wherein the bars feed a thick and a thin yarn to each needle in each course of knitting.

The present invention relates generally to the art of knitting and more particularly to warp knit fabric and to the method of operating the machine upon which the fabric is made, and has for its basic object the provision of a warp knit fabric composed of and having therein a novel arrangement of yarns of varying characteristics.

It is one of the important objects of the invention to provide a warp knit jersey fabric of two sets of yarns in each set of which there are alternate thick and thin yarns with the yarns disposed so that each stitch of the fabric is uniformly formed of a thick and of a thin yarn.

It is also an object of the present invention to provide a warp knit jersey fabric of two sets of yarns in each set of which there are yarns, too weak to be knittable, in alternation with reinforced yarns, with the yarns disposed so that each stitch of the fabric is uniformly formed of the weak and of the reinforced yarn.

It is still further object of the invention to provide a warp knit jersey fabric with a design therein of two sets of yarns in each set of which there are alternate thick and thin yarns disposed so that each stitch of the fabric is uniformly formed of a thick and of a thin yarn, the said yarns being of such relative denier that the appearance of said design is determined primarily by the characteristics of said thick yarns.

The several objects and advantages of the present invention will be readily apparent from the following detailed description of preferred embodiments thereof to be read in connection with the accompanying drawings showing the same, and from the appended claims.

In the drawings:

FIG. 1 is a face view of a section of warp knit jersey fabric made of relatively thick and of thin yarns according to the present invention and wherein a design extending generally at an angle to the wales and courses of the fabric is incorporated.

FIG. 2 is a face view of a section of another warp knit jersey fabric also made of relatively thick and of thin yarns according to the present invention and wherein a design extending generally parallel to the wales and courses of the fabric is incorporated.

FIG. 3 is a schematic enlarged stitch diagram of a portion of the fabric shown in FIG. 1 wherein each stitch is composed of a thick and of a thin yarn, the yarns being arranged in two sets in each of which the thick and the thin yarns alternate and wherein the sets of yarns are shogged a distance of one wale in opposite directions in each of successive courses so that a thick and a thin yarn is present in each of the stitches of the fabric.

FIGS. 4 and 5 are schematic notational views of the movements of the front and back yarn guide bars of a tricot warp knitting machine showing the manner in which the yarns in the bars are fed to the needles of the machine in each repeat of the pattern design shown in the fabric of FIG. 1.

FIGS. 6 and 7 are schematic notational views of other movements of the front and back yarn guide bars of a tricot warp knitting machine showing the manner in which the yarns in the bars are fed to the needles of the machine in each repeat of the pattern design shown in the fabric of FIG. 2, and

FIG. 8 is a schematic view showing the manner in which the yarn guide bars are threaded in the present invention, so far as thick and thin yarns are concerned, for the manufacture of the fabrics of FIGS. 1 and 2, the thick and the thin yarns being arranged in alternation in each of the fully threaded front and back yarn guide bars.

The improved fabric, in accordance with the invention, is preferably made on a tricot or similar warp knitting machine employing a needle bank or bar and at least two yarn guide bars respectively known as the back guide bar and the front guide bar. The needle bar is provided with a bank of needles which may vary in number according to the gauge of the machine, and each guide bar has a bank of yarn guides corresponding to the number of needles of the needle bar. In the present description reference will be made to a 28 gauge machine by way of example only in relation to certain yarn deniers to be described, the invention being obviously applicable to machines of other gauges using yarns of corresponding other deniers. The guide bars are each able to be shogged under pattern control a distance of one or more needles in opposite directions lengthwise of the needle bar and both bars are also swingable transversely of the needle bar to permit their yarn guides to pass between the needles, the combined shogging and swinging movements permitting the yarns to be fed to the needles to be knit thereby.

In the present invention, the nature and denier of the yarns used, the manner in which they are threaded into the yarn guide bars and the shogging of the guide bars all contribute to the novel fabrics produced. As may be seen in FIG. 8, the front guide bar, designated FB, is fully threaded with alternate thick yarns **10** and thin yarns **11**. The back guide bar, designated BB, is similarly threaded with thick yarns **12** and thin yarns **13**. The sizes or deniers of the yarns used in any machine is normally dependent upon the gauge of the machine, the coarser gauge machines using the coarser yarns while the finer gauge machines use the finer yarns. In the present instance a 28 gauge machine is being considered and for this machine it is preferred that the thick yarns be generally of 200 denier while the thin yarns be generally of 15 denier. It is within the scope of the present invention, however, that the thick yarns may range in sizes generally from 100 to 300 denier while the thin yarns may range generally in sizes from 10 to 30 denier for a 28 gauge machine although it is to be understood that the principle of the invention is not limited thereby and also that the range of yarn deniers will vary in accordance with machines of other gauges upon which the invention may be practiced.

The guide bars so threaded are specially shogged for each fabric design in such manner that each stitch of the fabric is knit of a thin and of a thick yarn. This may be seen in FIG. 3 in courses **14**, **15**, **16** and **17** of wales **18**, **19**, **20**, **21** and **22** wherein the rear side of the fabric is shown. It will be noted that the stitches of thin yarn **13** of the back bar are plated on the rear side of the stitches

of thick yarn **10** of the front bar and that the stitches of thin yarn **11** of the front bar are plated on the front side of stitches of thick yarn **12** of the back bar. In the stitch of course **17** of wale **20** the yarn **12** thereof is broken away to show the yarn **11** normally plated on the face thereof.

There are a number of advantages to be derived from the present choice of relative yarn deniers, their arrangement in the guide bars and the movements of the latter which results in each stitch containing a thick and a thin yarn. Consider certain yarns such as cellulose acetate, triacetate, viscose or similar yarns which are too weak to be normally machine knittable. By the use of the present invention wherein certain thin yarns, which may be of nylon, polyamide, polyester, polypropylene or the like and which are relatively strong, are knitted with the said weak yarns it is possible to provide commercially acceptable fabric wherein the thin yarns serve as a reinforce for the thick yarns. In so doing, the thin yarns, particularly when they are of transparent nylon, by reason of their character and of their plated relation in the stitches, do not materially affect the appearance of any design incorporated in the fabric by the thick yarns and the appearance of the fabric design is determined primarily by the appearance of the thick yarn stitches. Of course, it will be understood that the thin yarns may be colored to add the effect thereof to the appearance of the fabric design, if it be so desired.

Another advantage of the present invention is that it is possible to knit the present warp fabric of thick yarns, whether such yarns are too weak to be knittable or are strong enough to be knittable, of a larger denier than can normally be combined into stitches upon a machine of any given gauge. In other words, in terms of a 28 gauge machine the needles can not form a stitch of yarns having a combined denier in excess of 300. Thus, while stitches cannot be formed, for example, of two 200 denier yarns, it is possible, by means of the disclosed method, to knit the 200 denier thick yarns on this gauge of machine by knitting them only with thin yarns of denier not exceeding 100. By knitting them with thin yarns of from 10 to 30 denier there is formed relatively fine gauge fabrics incorporating coarse yarns in a wide range of designs. The present invention is readily adaptable to machines of other gauges which have other limits on yarn sizes.

FIGS. 1 and 2 show but two of the many designs which can be made with the threading and yarn disposition of the present invention. In FIG. 1 the design extends diagonally at an angle to the wales and courses with the larger diamond shaped areas **23** of one solid color, the smaller diamond shaped areas **24** of a second color and the areas **25** between said diamond shaped areas of a general stripe effect of both of said colors. In FIG. 2 the design extends parallel to the wales and courses and is of intersecting horizontal and vertical lines **26** and **27** each of one solid color while the areas **28** between said lines are of a general striped effect of said one color and of a second color. The design of FIG. 1 is of a balanced construction wherein the guide bars always shog like distances in opposite directions whereas the design of FIG. 2 is not of balanced construction wherein the guide bars at times are shogged different distances.

In FIGS. 4 and 5 the stitch construction of the fabric of FIG. 1 is notationally set out and shows that the yarns of the front bar, one of which is indicated at **29**, have the back and forth or zig-zag movements to adjacent needles in successive courses as indicated by the numbers: **1–0**; **1–2**; **2–3**; **3–4**; **4–5**; **5–6**; **6–7**; **6–5**; **5–4**; **4–3**; **3–2** and **2–1** and that the yarns of the back bar, one of which is indicated at **30**, have movements which are the reverse of the front bar yarns as indicated in FIG. 5 by the numbers: **6–7**; **6–5**; **5–4**; **4–3**; **3–2**; **2–1**; **1–0**; **1–2**; **2–3**; **3–4**; **4–5** and **5–6**. For the color effect of FIG. 1. the two bars are threaded so that a number of consecutively placed thick yarns **10** and **12** are of one color followed by a number of consecutively placed thick yarns **10** and **12** of the second color after which the color sequence is repeated for the remaining thick yarns. The design of FIG. 1 is such that it may be varied by varying the number of open laps of the yarns, of which **29** and **30** are examples, between the end closed laps **1–0**; **6–7** of FIG. 4 and **6–7**; **1–0** of FIG. 5. This design may also be varied by varying the number of thick yarns which are of the contrast colors.

In FIGS. 6 and 7 the stitch construction of the fabric of FIG. 2 is notationally set out and shows that the yarns of the front bar, one of which is indicated at **31** in FIG. 6, have back and forth movements to non-adjacent needles in successive courses as indicated by the numbers: **1–0**; **2–3**, repeated 12 times; **1–0**; **4–5**; [**1–0**; **2–3**,] repeated 3 times **1–0** and **4–5** and that the yarns of the back bar, one of which is indicated at **32** in FIG. 7, have back and forth movements to non-adjacent needles in successive courses as indicated by the numbers: **2–3**; **1–0**, continuously repeated. For the two color effect of FIG. 2, the front bar is threaded so that all of its thick yarns **10** are of one color while the back bar is threaded so that a first and fourth thick yarn **12** is of said one color and so that the intervening three thick yarns and the following nine thick yarns (following said fourth thick yarn) are of the second color. The horizontal lines **26** are formed when the front bar has its **1–0**; **4–5** movements and the vertical lines **27** are formed due to the common color threading at selected places along the two bars. The design of FIG. 2 is such that it may be varied, as to the placement of its horizontal lines **26**, by the frequency with which the front bar is given the **1–0**; **4–5** movement. This design may also be varied as to the placement of its vertical lines **27** by varying the arrangement of the two colors in the back bar.

It will be understood that the design range is unlimited within the requirements of the present invention, that the numbers of colors to be used is not limited to two, that self-color raised pattern designs may be made wherein all of the thick yarns are of like color and are differentiated by being of varying deniers so that the thicker yarns will be more prominent in the raised pattern. It is also within the scope of the invention to have the yarns differentiated by having varying surface characteristics by means of which a design may be created in the fabric.

What is claimed is:

1. A warp knit jersey fabric of wales and of courses having a design therein and formed of at least two sets of yarns each of which comprises a series of spaced thick and thin yarns the number of which is equal to the number of wales of said fabric, wherein certain of said thick yarns are of contrasting appearance to others thereof, the yarns of each of said sets thereof being disposed in said wales and courses so that each stitch of said fabric is composed of a thick and of a thin yarn and wherein the appearance of said design is primarily determined by the appearance of said thick yarns in said fabric stitches.

2. A fabric as set forth in claim **1** wherein said thick and said thin yarns alternate in each set thereof.

3. A fabric as set forth in claim **2** wherein said thick yarns are too weak to be knittable and wherein said thin yarns serve as reinforce yarns for said thick yarns in said fabric stitches.

4. A fabric as set forth in claim **2** wherein said thin yarns are of transparent formation.

5. A fabric as set forth in claim **2** wherein said thick yarns are of cellulose acetate and said thin yarns are of nylon or polyester.

6. A fabric as set forth in claim **2** wherein said thick yarns are of 200 denier cellulose acetate and said thin yarns are of 15 denier nylon or polyester.

7. A fabric as set forth in claim **2** wherein the denier of said thick yarns may be in the range of 100 to 300 and the denier of said thin yarns may be in the range of 10 to 30.

8. A fabric as set forth in claim **2** wherein selected ones of said thick yarns are of a contrasting color to the color of others thereof.

9. A fabric as set forth in claim 2 wherein the thin yarns of one of said sets of yarns is plated on the front side of the fabric while the thin yarns of the other of said sets of yarns is plated on the rear side of the fabric.

10. A fabric as set forth in claim 2 wherein said thin yarns are of a contrasting color to the color of said thick yarns.

11. A fabric as set forth in claim 2 wherein selected ones of said thick yarns are of a denier other than the denier of others thereof.

12. A method of operating a two guide bar warp knitting machine having a needle bar comprising the step of fully threading each of said guide bars with a set of alternately arranged thick and thin yarns, the step of moving said guide bars to feed a thick and a thin yarn to each needle of said needle bar, the step of knitting stitches of said thick and thin yarns on each of said needles to form a course of stitches each of which is composed of a thick and of a thin yarn and repeating said feeding and said knitting steps to form a fabric of said courses of stitches.

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RONALD FELDBAUM, Primary Examiner

U.S. Cl. X.R.

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