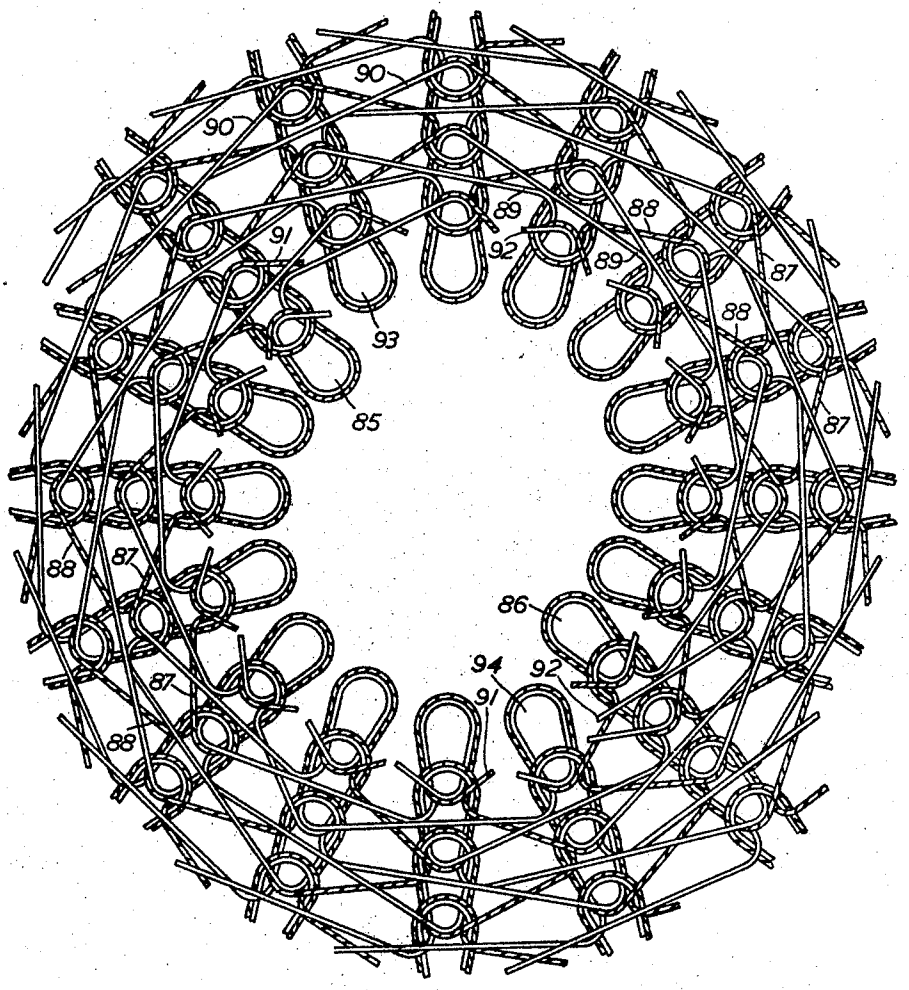
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PRODUCTION OF KNITTED FABRICS

Original Filed Jan. 29, 1941 2 Sheets-Sheet 1

FIG. 1



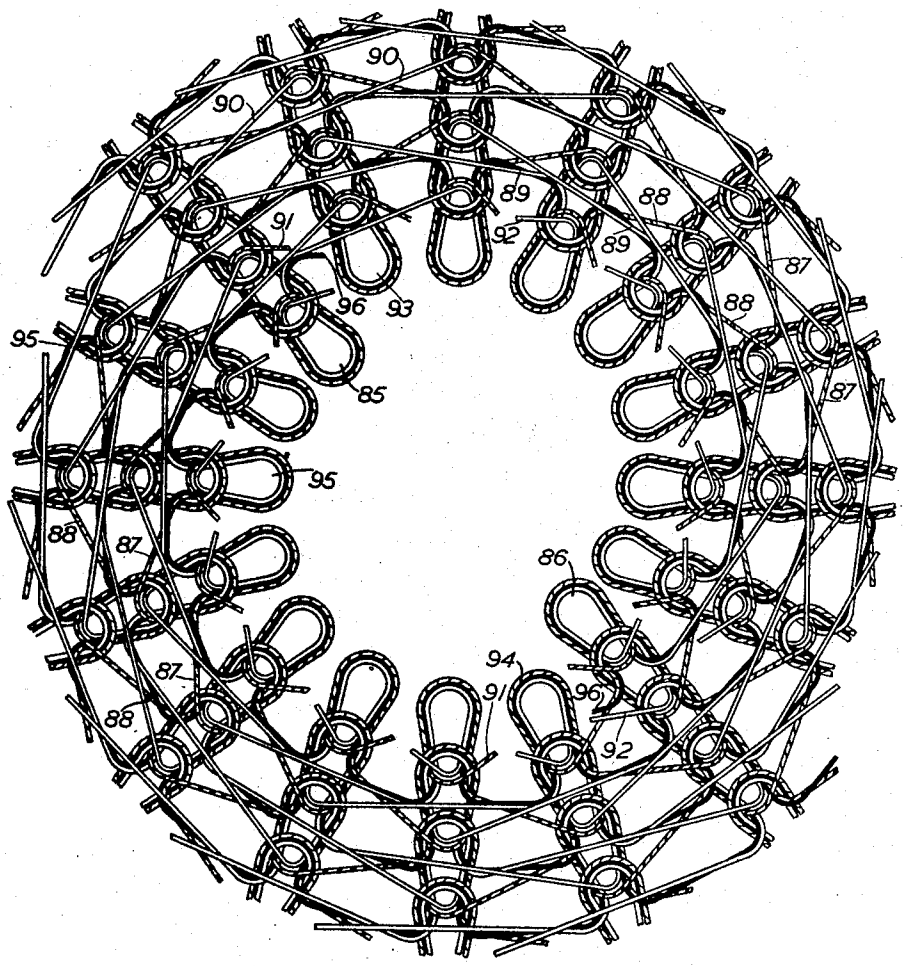
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FIG. 2



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2,312,334

PRODUCTION OF KNITTED FABRICS

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Original application January 29, 1941, Serial No. 376,432. Divided and this application August 19, 1941, Serial No. 407,398. In Great Britain February 3, 1940

8 Claims. (Cl. 66—195)

This invention relates to knitted fabrics and especially to warp-knitted fabrics, i. e. fabrics comprising a large number of warp threads knitted together and running, on the whole, parallel to the length of the fabric in which they are knitted. The application is a divisional application of U. S. application Serial No. 376,432 filed January 29, 1941. It is an object of the present invention to provide novel warp-knitted fabrics in tubular form.

According to the present invention, a tubular warp-knitted fabric comprises a large number of warp threads knitted together in a plurality of continuous helical courses of stitches, the repeated knitting of each stitch into a preceding stitch forming a large number of wales crossing said helical series, each warp thread being confined to a few of said wales and passing from one wale to another between successive stitches into which said thread is knitted. Since each thread moves to and fro over only a few wales of the fabric, being knitted on only a few needles of the machine on which it is produced, the number of threads necessary in the series of warp threads for producing a tubular fabric is exactly equal to the number of needles, or in exceptional cases to a multiple or submultiple thereof. It is not necessary, as it is in U. S. Patent No. 1,998,474 describing the production of fabrics of the "Milanese" type, to provide a number of threads slightly greater or slightly less than the number of wales to allow for the fact that the threads are moving always in one direction or the other helically round the fabric and across the wales of the fabric.

A method and machine for producing tubular warp-knitted fabric according to the invention form the subject matter of U. S. application Serial No. 376,432, which describes in detail the method and mechanism for bringing about the appropriate relative motion between the warp thread guides and a series of independently movable cam-operated needles in a circular knitting machine. By the method and machine thus described, a circular series of threads are knitted in turn into previously formed stitches, and, in the intervals between the occasions on which each thread is knitted, that thread is guided to and fro within a small range circumferentially of said circular series, whereby each thread is confined to a small number of wales in the resulting warp-knitted fabric. By this continuous method of knitting a very high rate of production can be achieved since a large number of sets of knitting cams may be arranged round the circular series of needles, and while the knitting cams may be rotated relatively slowly so as to keep down the speed of the moving parts the production is multiplied by the large number of cams employed. In spite of the high rate of production, the knitting action is very steady, so producing very little noise, vibration or wear, the machine possessing in this respect the advantages of speed and steadiness possessed by multi-feeder circular knitting machines while producing warp-knit fabrics of a kind that have hitherto been produced only in machines having heavy and rapidly reciprocating parts, each consisting of a large number of knitting elements similarly and simultaneously operated.

The invention thus provides for the production in tubular form of fabrics that have hitherto been produced only in the flat form. The fabric, being already in the form of a tube does not need to be sewn up in that form for purposes of inspection and subsequent processing, e. g. dyeing, finishing and the like. In fact, as the steadiness of the machine on which the fabric is produced enables it to be placed, in large numbers if desired, on an upper floor, the fabric, as it is formed and without being wound, may pass directly from the machine through the floor, to be inspected and wound on the floor below. Having no edges to curl, the fabric may be wound as a neat roll without creases.

By way of example, two forms of fabric according to the invention will now be described in greater detail with reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatic view of an idealised form of fabric which enables the tubular structure of the fabric to be visualised, and

Fig. 2 is a view similar to Fig. 1 of a fabric containing weft-knit threads as well as warp-knit threads.

The fabric shown in Fig. 1 is an idealised fabric having only 16 wales, in order that the tubular structure of the fabric may more readily be followed, though it will be understood that commercially satisfactory fabrics will have many hundreds, or even several thousands of wales. The figure is a distorted view of the fabric, obtained by looking downwards on the tubular fabric as it is produced on the machine and imagining the lower part of the tube as increasing gradually in radius and at the same time rising up to the level of the uppermost edge, which consists of the stitches last knitted.

The fabric is such as would be formed on a machine having two sets of knitting cams, and

the loops indicated at 85, 86 are the loops last formed by the two sets of cams respectively. The shaded threads 87, 88 are fed by one series of guides, which are moved according to a 1 x 1 pattern, and it will be seen that these threads form short floats, each passing from one wale to the adjacent wale. The floats thus formed in each thread extend alternately in opposite directions round the fabric, first in the same direction as the knitting cams as indicated at 87 and then in the opposite direction as indicated at 88.

The plain threads indicated at 89, 90, are controlled by a series of guides moved according to a 2 x 2 pattern, and form longer floats, each extending from one wale to the wale next but one, alternately in opposite directions. Thus the long floats 89 extend in the same direction as the knitting cams and the long floats 90 extend in the opposite direction. As may be seen by following back the loops of the fabric, starting at loops 85, 86, the loops form two slow spirals round the diagram, representing two slow helices of loops in the tubular fabric as actually knitted. The next loops to be formed after the loops 85, 86 are to be formed from the threads 91, 92, which will be drawn through the loops indicated at 93, 94 to form fresh loops similar to the loops 85, 86 and the preceding loops.

Thus the fabric exemplified in Figure 1 is a two-bar fabric having a 1 x 1; 2 x 2 pattern. By moving the guides in the proper manner and by the provision, if necessary, of more than two series of guides, multi-bar fabrics of many other types may be produced.

Since knitting proceeds continuously from needle to needle by means of knitting cams, instead of proceeding simultaneously on all the needles at once, weft thread may be introduced into the fabrics at any or all of the sets of knitting cams employed in the machine. Figure 2 is a diagram similar in nature to Figure 1 and differing from that figure only by the provision of weft thread, fed at each of the two sets of knitting cams employed. The weft thread is indicated by a thick black line as may be clearly seen, for example in the loops 93, 95 and it will be seen that this thread follows the slow spiral path of each of the two series of knitted loops formed by the two sets of knitting cams. The two ends of the weft threads are indicated at 96, and these threads will be drawn, together with the warp threads 91, 92 through the loops 93, 94 to form fresh loops similar to the loops 85, 86 last knitted. Instead of knitting the weft thread in the ordinary way as described above, the weft thread may be laid in by suitable manipulation of sinkers and needles. Thus, heavy effect threads, or rubber threads may be incorporated in the fabric in this manner to produce a distinctive appearance or to give a high degree of elasticity to the fabric.

Patterned fabrics may be produced according to the invention. In general, the patterning will be limited by the number of sets of knitting cams and by the maximum range of movement of the thread guides but any desired degree of patterning within this range is possible. In addition, pattern effects may be produced, with bearded needles, by a suitable manipulation of the pressers employed for pressing the beards of the needles. It will be understood that any patterning that may be produced in the way of longitudinal or zigzag stripes and the like, by employing warp threads of different colours or other characteristics arranged in a desired order may readily be utilised in the present invention.

Having described our invention, what we desire to secure by Letters Patent is:

1. Tubular warp-knitted fabric comprising a large number of warp threads knitted together in at least two continuous helical series of stitches, the repeated knitting of each stitch into a preceding stitch forming a large number of wales crossing said helical series, each warp thread being confined to a few of said wales and passing from one wale to another between successive stitches into which said thread is knitted.

2. Tubular warp-knitted fabric comprising a plurality of sets of warp threads, each consisting of a large number of warp threads, knitted together in at least two continuous helical series of stitches, the repeated knitting of each stitch into a preceding stitch forming a large number of wales crossing said helical series, each warp thread being confined to a few of said wales and passing from one wale to another between successive stitches into which said thread is knitted, all the threads of each set passing in this way in the same manner as one another and independently of the remaining threads.

3. Tubular warp-knitted fabric comprising two sets, each consisting of a large number of warp threads, knitted together in at least two continuous helical series of stitches, the repeated knitting of each stitch into a preceding stitch forming a large number of wales crossing said helical series, each warp thread of one set passing alternately to and fro from one wale to the adjacent wale and back between successive stitches into which said thread is knitted, and each warp thread of the other set passing to and fro from one wale to the next wale but one and back between successive stitches into which said thread is knitted.

4. Tubular warp-knitted fabric comprising a large number of warp threads knitted together in at least two continuous helical series of stitches, and at least one weft thread incorporated in the fabric and extending along at least one of said helical series of stitches, the repeated knitting of each stitch into a preceding stitch forming a large number of wales crossing said helical series, each warp thread being confined to a few of said wales and passing from one wale to another between successive stitches into which said thread is knitted.

5. Tubular warp-knitted fabric comprising a large number of warp threads knitted together in at least two continuous helical series of stitches, and at least one weft thread extending along and knitted into each stitch of at least one of said helical series, the repeated knitting of each stitch into a preceding stitch forming a large number of wales crossing said helical series, each warp thread being confined to a few of said wales and passing from one wale to another between successive stitches into which thread is knitted.

6. Tubular warp-knitted fabric comprising a plurality of sets of warp threads, each consisting of a large number of warp threads, knitted together in at least two continuous helical series of stitches, and at least one weft thread extending along and knitted into each stitch of at least one of said helical series, the repeated knitting of each stitch into a preceding stitch forming a large number of wales crossing said helical series, each warp thread being confined to a few of said wales and passing from one wale to another between successive stitches into which said

thread is knitted, all the threads of each set passing in this way in the same manner as one another and independently of the remaining threads.

7. Tubular warp-knitted fabric comprising a large number of warp threads knitted together in at least two continuous helical series of stitches, and a weft thread for each of said helical series incorporated in the fabric along the length of said helical series, the repeated knitting of each stitch into a preceding stitch forming a large number of wales crossing said helical series, each warp thread being confined to a few of said wales and passing from one wale to another between successive stitches into which said thread is knitted.

8. Tubular warp-knitted fabric comprising two sets, each consisting of a large number of warp threads knitted together in at least two continuous helical series of stitches, and a weft thread for each of said helical series knitted into each stitch along the length of said helical series, the repeated knitting of each stitch into a preceding stitch forming a large number of wales crossing said helical series, each warp thread of one set passing alternately to and fro from one wale to the adjacent wale and back between successive stitches into which said thread is knitted, and each warp thread of the other set passing to and fro from one wale to the next wale but one and back between successive stitches into which said thread is knitted.

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