March 12, 1935. S. A. WELCH ET AL 1,993,766

KNITTED FABRICS AND THE MANUFACTURE THEREOF

Filed Oct. 5, 1932

FIG. 1.

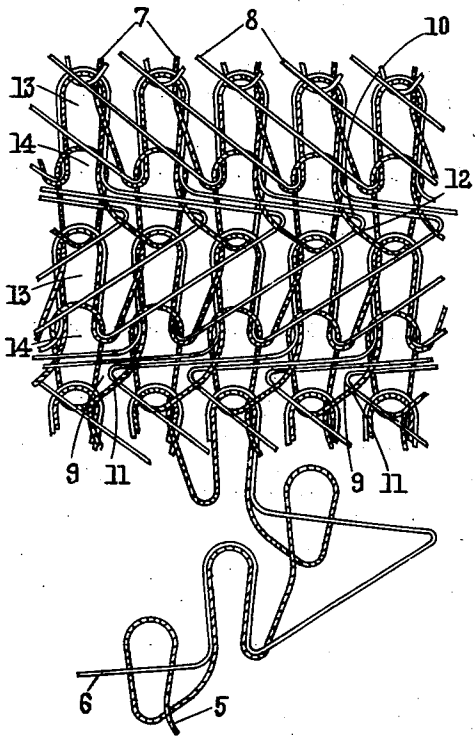
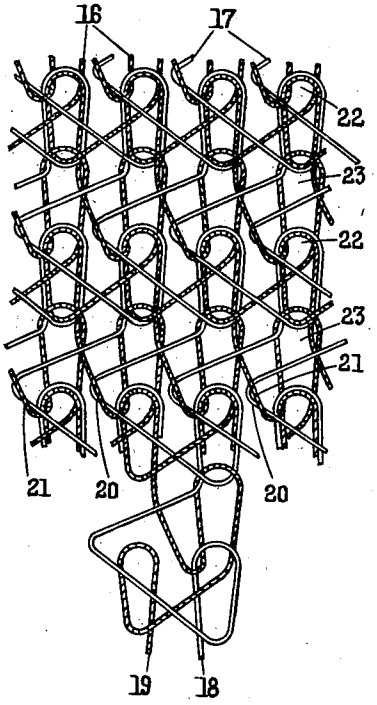


FIG. 2.



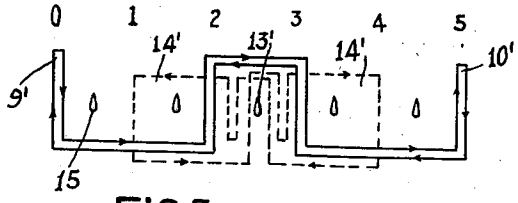


FIG. 3.

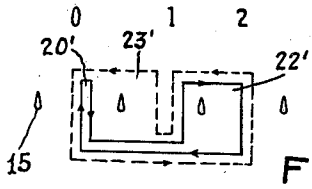


FIG. 4.

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KNITTED FABRICS AND THE MANUFACTURE THEREOF

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15 Claims. (Cl. 66—195)

This invention relates to knitted fabrics and their manufacture, and in particular to warp knitted fabrics.

The object of the invention is to produce a fabric of woven appearance in which the usual characteristics of warp knitted fabrics are more or less suppressed and replaced by a grained effect. In the production of warp knitted fabrics, a series of threads is fed by means of a number of guides to a series of needles. The needles are operated simultaneously at each course to knit the threads into the fabric, after which the thread guides are moved to lap the threads over new needles prior to the knitting of the next course. The motion of the guides comprises a forward motion of the guides between the needles, a cross-wise motion which crosses the thread in front of the beard of each needle and a rearward motion between the needles, these three motions being sometimes preceded by a cross-wise motion across the back of the needles.

The warp knitted fabric according to the invention is produced from two sets of warp threads, one of which, instead of moving regularly across the needles at successive courses, is periodically moved forward and back between needles without an intermediate cross-wise motion. As a result, the threads which are passed between needles in both directions without an intermediate cross-wise motion are not lapped across the beards of the needles and in consequence are not knitted into the fabric in the exact sense of the term "knitted", that is to say, are not drawn down by the needles to form loops, but are "laid in" the fabric, and secured by the crossing of the threads of the other set. The complete structure of the fabric is preserved by the fact that at every course, one of the two series of warp threads used are always properly drawn down into loops and knitted. Preferably the in and out motion of the thread guides between needles is preceded by a cross-wise motion of considerable extent across the back of the needles, i. e. a motion crossing more than one needle, and in this case it is preferable to relieve the tension of the threads taking part in the considerable movement. By a suitable disposition of successive motions of the thread guides successively to and fro through the same between-needle space, resulting in the missing of wales by such threads, a very pleasing grained surface can be produced on the fabric. All the threads of each set, of course, perform the same movements.

One form of warp knitted fabric according to the invention may be produced in the following manner. After being knitted into one wale, each thread of one thread bar is drawn through a space between two needles, moved to the right across one needle, drawn back through another pair of needles and then knitted. The thread is then moved forward through the same space through which it was drawn back, moved to the right again, drawn back and knitted. The thread is then moved to the left behind one needle, then forward between two needles, moved to the left across one needle again, drawn back and knitted. Following this the thread is again moved forward through the space by which it last moved back, moved to the left once more, drawn back, and knitted again, after which it is moved to the right behind the needles and the cycle recommences. This sequence of operations is preferably performed upon the front set of threads on the machine, that is to say, the set of threads which ultimately forms the back of the fabric, though in ordinary warp knitted fabrics, this side is usually regarded as the face of the fabric.

Each thread of the back series of threads, which produces the foregoing effect of the invention, and ultimately forms the front of the fabric, is passed between two needles, moved to the right, and back, and knitted, is then moved past three needles behind the needles, and forward and back without an intermediate cross-wise motion, after which knitting takes place, but not upon the threads of this set, which are nevertheless locked into position by the crossing over them of the threads of the other set. The threads are then moved past three needles to the left, forward, to the left, and back, and knitted, and then behind three needles to the left, forward and back, after which knitting takes place. The threads then move past three needles to the right behind the needles, and the cycle recommences.

It will be seen that each complete cycle of each set of threads covers a sequence of eight between-needle movements and four courses of knitting, there being a forward and a backward between-needle motion for each knitting course. Each thread of the front set of threads has a sideways motion across four needle spaces and is knitted in three wales, while each thread of the back set has a sideways motion across six of such spaces, but is only knitted into one wale, being "laid-in" the fabric and secured by the crossing over the threads of the other set.

The cycles above described may be represented by a sequence of numbers, each referring to the needle spaces between which the threads are passed alternately forward and back, knitting tak-

ing place after each pair of numbers, that is, after each forward and backward motion. Thus for the front bar, the threads follow a sequence 1:2; 2:3; 2:1; 1:0. Thus the threads are drawn forward through space 1, across to space 2, and back, and are knitted; forward through space 2, across to space 3, and back, and are knitted, across to space 2, forward, across to space 1, and back, and are knitted; forward through space 1, across to space 0, and back, and are knitted, after which the cycle is repeated. Meanwhile the threads of the back bar follow a motion expressed by the series 2:3; 5:5; 3:2; 0:0. That is, the threads move forward through space 2, across to space 3, and back, and are knitted; across to space 5, forward and back through space 5, after which knitting takes place though not upon these threads, since they have not been crossed in front of the beards of the needles between the forward and backward motion. The threads then move across to space 3, forward, across to space 2, and back, and are knitted; across to space 0, forward, and back, after which knitting takes place, and then across to space 2, after which the cycle recommences.

It is to be understood that the invention is in no way limited to fabrics embodying the particular sequence of thread movement specified above, and that modifications can be made in the amount of lapping taking place behind the needles prior to passing in and out between the needles, and, generally, in the knitting sequence which may take place before repetition occurs. Thus for example, a different form of fabric can be produced by displacing the cycle of one bar with respect to the cycle of the other. Taking the sequence given above, this may be replaced in the second bar by a sequence 0:0; 2:3; 5:5; 3:2. The result of this change is that when the threads of one set are in their mean position, the threads of the other set are to one side of the mean position. It is preferred, however, as in the example as first given, that the threads should be at their mean positions at the same time before they move sideways from their mean position, either in the same direction or in opposite directions, but preferably in opposite directions.

Other examples of sequences which may be carried out are as follows. A cycle which gives successful results involves a motion of the front bar in the sequence 1:2; 2:3; 2:1; 1:0; and of the back bar in the sequence 2:3; 5:5; 2;3; 5:5.

The front bar sequence of this, and of most of the fabrics according to the invention, may be modified by reversing the numbers of one or more pairs of between-needle motions. Thus the front bar sequence 1:2; 2:3; 2:1; 1:0 may be changed to 1:2; 3:2; 2:1; 0:1. The above modifications all extend over at least three wales, and over four courses of knitting, and to produce a well marked effect, this magnitude of motion is preferred. The wales or courses, however, may be made finer by reducing the magnitude of the wale motion, or the number of courses to the repeat respectively. Thus, if a rather smooth, fine grained fabric is desired, the front bar may follow a sequence 2:1; 1:0, and the back bar a sequence 1:1; 2:3. It will be seen here again, that the back bar moves forward and back through the same space 1 without an intermediate cross-wise motion prior to knitting.

A very great number of different cycles of motion having different characteristics may be put into practice on the lines described above. Thus, a given front bar sequence and a given back bar sequence may be used in a number of different ways by starting at different points of the sequence in the manner previously described. Further, as also described above, the sequence may be modified by interchanging the numbers of one or more pairs of the sequence, or, in the case of symmetrical cycles, by repeating the first or the second half to produce a new cycle. Again the number of possible sequences is greatly multiplied by the possibility of using different back bar sequences for a given front bar sequence. Thus for example, the front bar sequence 1:2; 2:3; 2:1; 1:0, or any of its variations may be used either in connection with the symmetrical back bar sequence 2:3; 5:5; 3:2; 0:0, or in connection with the first half of that cycle repeated, i. e. 2:3; 5:5; 2:3; 5:5, or alternating with the short sequence 2:3; 1:1, to form a new sequence 2:3; 5:5; 2:3; 1:1. Further, these sequences may be changed during knitting to give pattern effects or to produce a coarser surface effect in any desired manner.

In all of these modifications the common principle of the invention is retained, that the threads of one bar should be carried across and behind the needles, lapped into the fabric without knitting and held by the crossing of the threads of the other set. The effects generally produced in fabrics according to the invention may range from a smooth serge-like effect of relatively fine figure to a coarse rep effect, and form a crêpe-like effect of any degree of fineness to the effect of a fine pile fabric, produced by short, free loops of thread on the surface of the fabric.

The fabric according to the invention may be knitted from any suitable kind of yarn. For example it may be knitted from yarns, either matt or lustrous, consisting of wool, cotton, silk, artificial materials such as cellulose actate or other organic derivatives of cellulose, or viscose, cuprammonium, or nitrocellulose artificial silk. Further, the yarns may consist of staple fibres of continuous filaments such as natural silk or cellulose actate or other artificial materials as mentioned above. Again, more than one kind of yarn may be employed in the fabric; for example different yarns may be employed in the front and back sets respectively, e. g., matt yarns in one set, and lustrous yarns in the other. Again, the face of the fabric may be knitted with cellulose acetate yarn while the back of the fabric is knitted with wool. The invention is, however, more especially applicable to the production of fabrics from continuous filament yarns, such as for example cellulose acetate or other cellulose derivative yarns, such fabrics possessing a fine structure as well as the distinctive grained appearance characteristic of the invention. If desired the yarns employed may have a high or very high twist, such as crêpe twist in order to exaggerate the grainy effect on the face of the fabric due to the sideways positions of the knitted loops and the combined action of the two sets of threads in the fabric.

Two forms of fabric according to the invention will now be described in greater detail with reference to the accompanying drawing, but it is to be understood that this description is given by way of example only and is not in any respect limitative.

Figures 1 and 2 show diagrammatically, views of two fabrics according to the invention, these views showing what is normally the back of the fabric, but in the present instance is to be regarded as the face.

Figs. 3 and 4 show diagrammatically the move-

ments of the thread guides necessary to produce the fabrics shown in Figs. 1 and 2, respectively.

In Figure 1 the threads of the front bar, which are shown corded, perform the movement indicated by the numbers 2:1; 2:3; 3:4; 3:2; while the threads of the back bar, which are shown plain carry out the movement 0:0; 2:3; 5:5; 3:2. At the bottom of the figure two threads 5, 6 are shown, the thread 5 being a front bar thread, shown corded, while the thread 6 is a back bar thread and is shown plain. The two free threads clearly show the individual course of the threads, while the complete section of fabric indicated above, having a series of front bar threads 7, and a series of back bar threads 8, shows the interrelationship between the threads as two series of threads. The threads 8 are "laid in" the fabric at points 9 and 10 and it will be seen that after this laying in movement has been completed, floats of the corded threads 7 cross over the soformed loops at 11 and 12, and hold the loops in position. The points 9 represent the laying in movement 0:0 of the threads 8 while the points 10 represent the laying in movement 5:5, each thread being passed through the same space in successive between-needle motions, i. e. both in the motion in and in the motion out. It will also be observed that alternate rows of loops indicated at 13 consist of threads 7 and 8 of both bars, while the other rows shown at 14 consist only of the corded thread 7, the plain threads 8 during this course being laid in as at 9 and 10 and not knitted into the fabric.

In Figure 2 a somewhat simpler fabric is illustrated in which the threads of the front bar, shown corded at 16, carry out the movement indicated by the numbers 1:0; 2:1; while threads of the rear bar, shown plain at 17, carry out the movement 1:2; 0:0. As in Figure 1, a single plain thread 18 of the back bar and a single corded thread 19 of the front bar are shown at the bottom of the figure to indicate the individual movements of the thread. Again as in Figure 1 the plain threads are "laid in" the fabric at points indicated at 20, and a float thread of the front bar subsequently passes over each of the loops so formed, as illustrated at 21. Furthermore, in the courses 22, threads of both front and back bars are knitted into the fabric, while in the courses 23 only the threads of the front bar are knitted in, the threads of the back bar being "laid in" as at 20.

Fig. 4 shows the thread guide tracks for the fabric shown in Fig. 2, in the same way as Fig. 3 shows those in connection with Fig. 1. The laying in movements are shown at 20′ and the lapping in front of the needles at 22′ and 23′, corresponding respectively to the loops 22 and 23 of Fig. 2.

What we claim and desire to secure by Letters Patent is:—

1. A warp knitted fabric comprising at least two sets of warp threads, at least one of which has its threads knitted into some courses, and laid into others, each of such threads crossing wales of the fabric between successive points at which it is knitted or laid in, the threads of another set being knitted into the courses at which the threads of the one set are laid in.

2. A warp knitted fabric comprising at least two sets of warp threads, at least one of which has its threads knitted into alternate courses, and laid into intervening courses, each of such threads crossing wales of the fabric between successive points at which it is knitted or laid in, the threads of another set being knitted into the the courses at which the threads of the one set are laid in.

3. A warp knitted fabric comprising at least two sets of warp threads, at least one of which has its threads knitted into some courses, and laid into others, each of such threads crossing wales of the fabric between successive points at which it is knitted or laid in, the threads of another set being knitted into every course.

4. A warp knitted fabric comprising at least two sets of warp threads, at least one of which has its threads knitted into some courses, and laid into others, each of such threads crossing at least two wales of the fabric in opposite directions in proceeding to and from each point at which it is laid in, the threads of another set being knitted into the courses at which the threads of the one set are laid in.

5. A warp knitted fabric comprising at least two sets of warp threads, at least one of which has its threads knitted into alternate courses, and laid into intervening courses, each of such threads crossing at least two wales of the fabric in opposite directions in proceeding to and from each point at which it is laid in, the threads of another set being knitted into the courses at which the threads of the one set are laid in.

6. A warp knitted fabric comprising at least two sets of warp threads, at least one of which has its threads knitted into some courses, and laid into others, such threads being slacker than the remainder, and crossing wales of the fabric between successive points at which they are knitted or laid in, the threads of another set being knitted into the courses at which the threads of the one set are laid in.

7. A warp knitted fabric comprising at least two sets of warp threads, at least one of which has its threads knitted into alternate courses, and laid into intervening courses, each of such threads crossing at least two wales of the fabric in opposite directions in proceeding to and from each point at which it is laid in, such threads being slacker than the remainder, the threads of another set being knitted into the courses at which the threads of the one set are laid in.

8. A process for the production of warp knitted fabrics, comprising knitting at least two sets of warp threads, knitting the threads of at least one of said sets into some courses, and, after lapping, passing said threads through the needles and back at other courses so as to lay them into the fabric and knitting the threads of another of said sets into the courses in which the threads of the one set are laid.

9. A process for the production of warp knitted fabrics comprising knitting at least two sets of warp threads, knitting the threads of at least one of said sets into alternate courses, and, after lapping, passing said threads through the needles and back at intervening courses so as to lay them into the fabric and knitting the threads of another of said sets into the courses in which the threads of the one set are laid.

10. A process for the production of warp knitted fabrics, comprising knitting at least two sets of warp threads, knitting the threads of at least one of said sets into some courses, and, after lapping, passing said threads through the needles and back at other courses so as to lay them into the fabric and knitting the threads of another of said sets into every course.

11. A process for the production of warp knit-

ted fabrics, comprising knitting at least two sets of warp threads, knitting the threads of at least one of said sets into some courses, and passing said threads through the needles and back at other courses so as to lay them into the fabric, such threads being lapped over at least two wales in opposite directions before and after being so laid in, and knitting the threads of another of said sets in every course.

12. A process for the production of warp knitted fabrics, comprising knitting at least two sets of warp threads, knitting the threads of at least one of said sets into alternate courses, and passing said threads through the needles and back at intervening courses so as to lay them into the fabric, such threads being lapped over at least two wales in opposite directions before and after being so laid in, and knitting the threads of another of said sets into every course.

13. A process for the production of warp knitted fabrics, comprising knitting at least two sets of warp threads, knitting the threads of at least one of said sets into some courses, and, after lapping, passing said threads through the needles and back at other courses so as to lay them into the fabric, such threads being fed more slackly than the rest, and knitting the threads of another of said sets into the courses in which the threads of the one set are laid.

14. A process for the production of warp knitted fabrics, comprising knitting at least two sets of warp threads, knitting the threads of at least one of said sets into some courses, and passing said threads though the needles and back at other courses so as to lay them into the fabric, such threads being lapped over at least two wales in opposite directions before and after being so laid in, and being fed more slackly than the rest, and knitting the threads of another of said sets into every course.

15. A process for the production of warp knitted fabrics, comprising knitting at least two sets of warp threads, knitting the threads of at least one of said sets into alternate courses, and passing said threads through the needles and back at intervening courses so as to lay them into the fabric, such threads being lapped over at least two wales in opposite directions before and after being so laid in, and being fed more slackly than the rest, and knitting the threads of another of said sets into every course.

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THOMAS SILLS.

CERTIFICATE OF CORRECTION.

Patent No. 1,993,766. March 12, 1935.

SIDNEY ARTHUR WELCH, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, after line 52, insert the following paragraph:

Figs. 3 and 4 show diagrammatically the movements of the thread guides necessary to produce the fabrics shown in Figs. 1 and 2 respectively.

Page 4, first column, line 9, claim 11, for "in" read into; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of April, A. D. 1935.

Leslie Frazer

(Seal) Acting Commissioner of Patents.