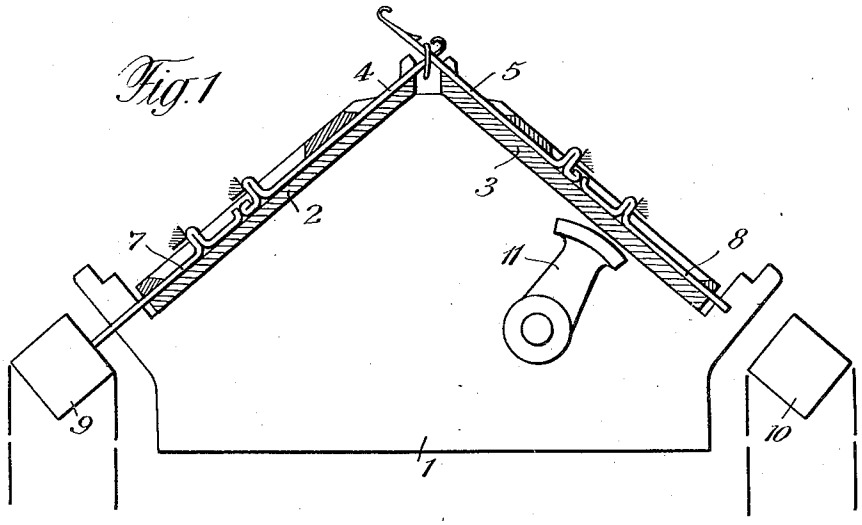
Nov. 3, 1936. H. DIEM 2,059,682

METHOD OF PRODUCING FABRICS SIMILAR TO RIBBED GOODS WITH THE AID OF KNITTING MACHINES

Filed Oct. 27, 1934 3 Sheets-Sheet 1

Fig. 1



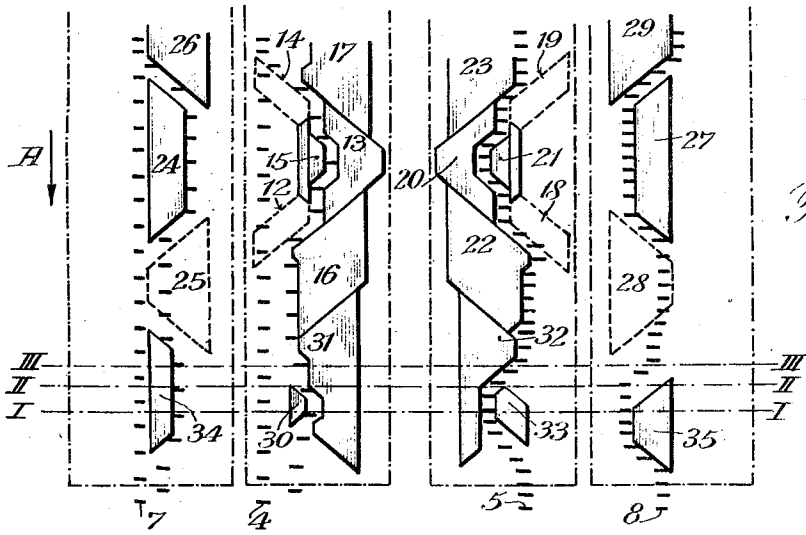


Fig. 2

Fig. 3

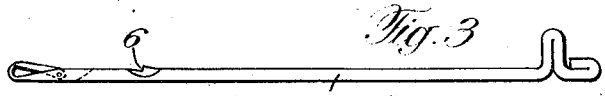
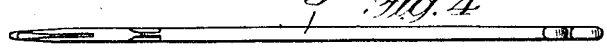


Fig. 4



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METHOD OF PRODUCING FABRICS SIMILAR TO RIBBED GOODS WITH THE AID OF KNITTING MACHINES

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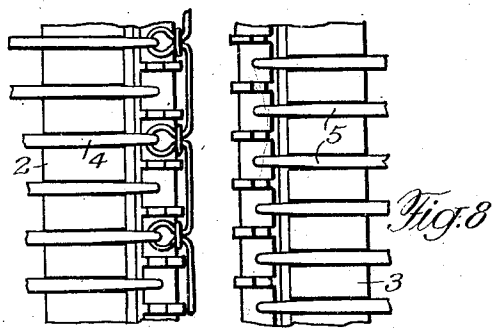


Fig. 8

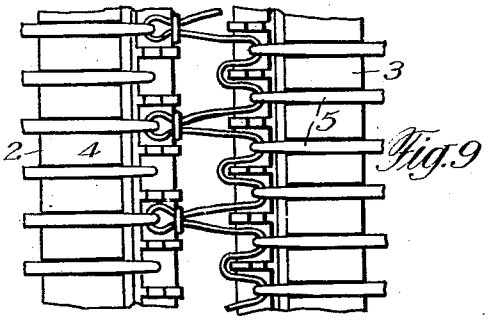


Fig. 9

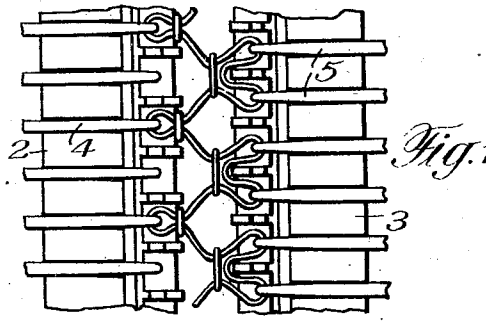


Fig. 10

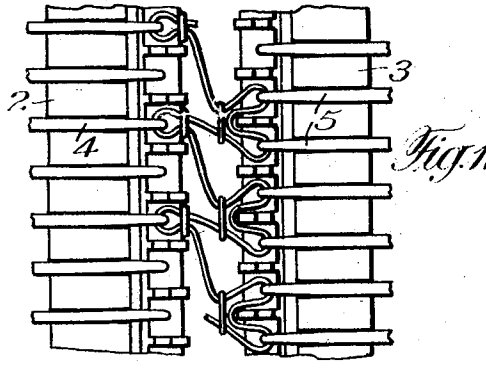


Fig. 11

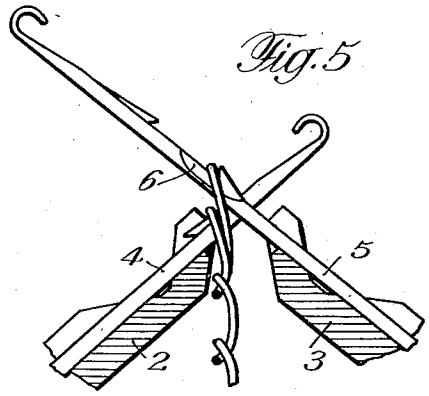


Fig. 5

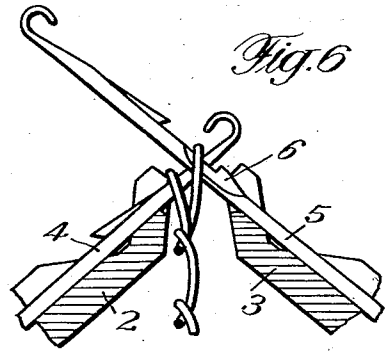


Fig. 6

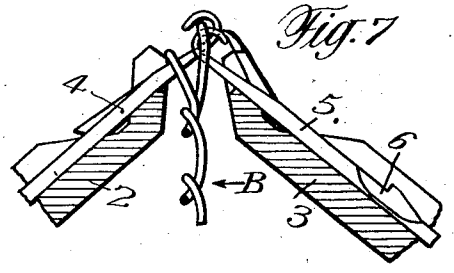


Fig. 7

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METHOD OF PRODUCING FABRICS SIMILAR TO RIBBED GOODS WITH THE AID OF KNITTING MACHINES

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Fig. 13

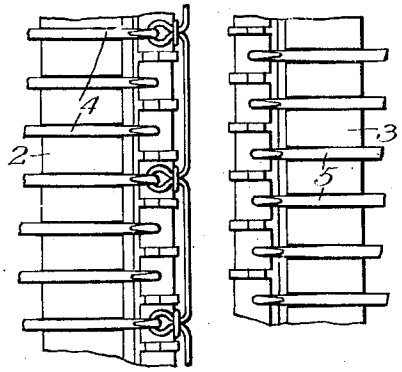


Fig. 12

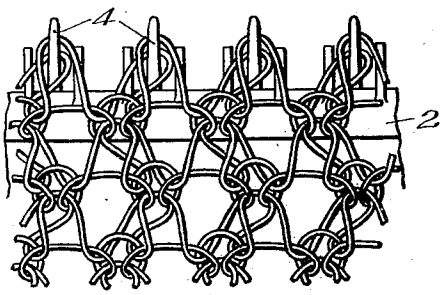


Fig. 14

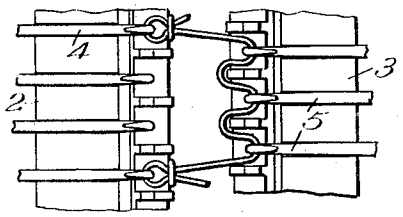


Fig. 17

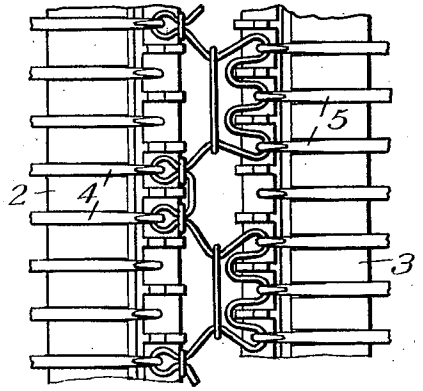


Fig. 15

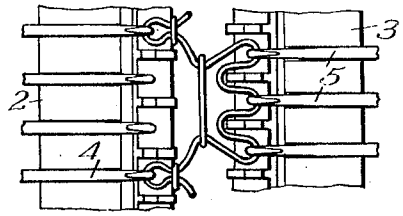


Fig. 18

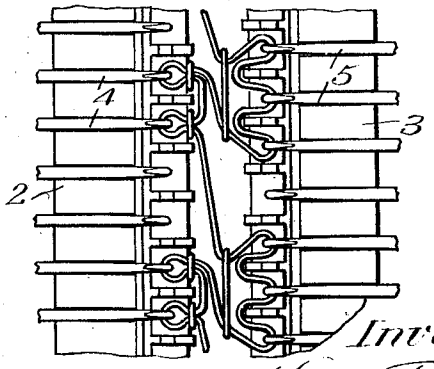
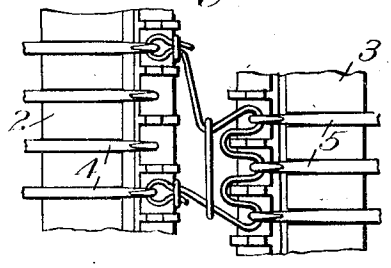


Fig. 16



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Patented Nov. 3, 1936 2,059,682

UNITED STATES PATENT OFFICE

2,059,682

METHOD OF PRODUCING FABRICS SIMILAR TO RIBBED GOODS WITH THE AID OF KNITTING MACHINES

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Application October 27, 1934, Serial No. 750,325
In Germany November 4, 1933

7 Claims. (Cl. 66—75)

This invention relates to methods of producing fabrics similar to ribbed goods with the aid of knitting machines. The two faces of these fabrics are dissimilar by the use of different yarn formations, viz, "stitches" and "stitches drawn through loops" that are intermeshed in such manner that the capability of the fabric of remaining true to form is increased and the elasticity of the same is reduced more or less depending on whether the fabric is required to stretch or to remain true to the original form at all times, but so that the fabric is nevertheless light and pliant, whereby the applicability of the fabric in the manufacture of garments of various kinds is considerably increased. By the distinction as made between "stitches" and "stitches drawn through loops" is intended to be brought out that in knitting fabrics of this kind "stitches", that is, yarn formations each consisting of a full needle loop and two halves of a sinker loop are used in combination with "stitches drawn through loops" each of which yarn formation consists of a superposition of two complete loops of stitch-shape, i. e. stitches, which are slid one over the other, so that the loop first formed straddles the loop last formed.

The fabrics as obtained by the known methods and cosposed for the most part of stitches of usual width, e. g. stitches formed on a single needle, or of stitches of this narrow width that are each drawn through a loop of the same width, have the drawback of being too light and too elastic in all directions and thus easily come out of shape. Other known looped fabrics are too thick to be able to yield in the two directions of stretch at least to some extent, unless they lose their elasticity altogether.

In carrying the known methods into effect for which in most cases knitting machines of special constructions are required, either by means of separate needles, hooks, jacks or the like at a time individual stitches are formed and passed or thrown over to oppositely disposed needles, or the arrangement is such that to each needle a forked jack is correlated for throwing over the stitches or the stitches that are drawn through loops which yarn formations are each formed by a single needle, whereby prior to the throwing over of these yarn formations separate weft threads may be inserted.

Furthermore, methods are existing in which to each barbed needle devoid of a latch two auxiliary jacks are correlated, each loop formed by the said barbed needles being at first deposited upon two auxiliary jacks and then passed over to the cylinder needles.

Therefore, in the known methods either stitches or stitches drawn through loops, of usual width, are formed each time by a single hook, jack or needle and then passed over to the respective opposite needle.

In distinction from the known methods, the method of producing fabrics similar to ribbed goods by means of knitting machines, according to this invention, is distinguished by the fact that while in one row of needles stitches drawn through loops are formed, at corresponding points in the other row of needles by conjoint action of at least two adjacent needles wider stitches are formed and passed over to the other row of needles so as to be each deposited upon a smaller number of opposite needles.

In this manner the method according to this invention, which can be carried out on any suitable knitting machine of ordinary construction, permits of producing extremely light and porous fabrics that are similar to ribbed goods and may be provided with any desired pattern effects, while these fabrics owing to their yieldingness are of a considerable elasticity and thus remain true to shape to an extent as required for the manufacture of garments. The invention also provides for incorporating weft threads in the fabric with a view to rendering the same similar to woven cloth in every respect except that the porosity of the fabric is equal to that of knitted goods, whereas in respect of stretching, the fabric is superior to knitted goods, as its elasticity in the direction of the weft threads is but slight or entirely eliminated, so that garments made of the fabric do not stretch permanently in the longitudinal direction.

The method according to the invention can be carried out, for example by means of a Jacquard-flat-knitting machine, in a manner as schematically illustratively exemplified in the accompanying drawings, in which

Fig. 1 shows a cross section through the needle beds of the machine;

Fig. 2 shows a plan view of the needle cam boxes with the cam slide and the face plates of the needle cam boxes omitted;

Fig. 3 shows a side elevation of a needle;

Fig. 4 is a top plan view of a needle;

Figs. 5, 6 and 7 each show on a larger scale a main position of the needles during passing over the stitches, thus sections along the lines I—I, II—II and III—III in Fig. 2 respectively;

Fig. 8 shows in a top plan view stitches drawn

through loops, of usual width, to be inserted in the hooks of every second needle of one of the rows of needles, for carrying out a first form of fabric according to the invention, the respective needles occupying their initial positions in the front needle bed;

Fig. 9 is a view similar to Fig. 8 but showing wider stitches formed by two consecutive needles of the rear needle bed hooked to these needles and additional stitches drawn through loops, of usual width, hooked to opposite needles of the front needle bed;

Fig. 10 is a view similar to Fig. 9 but showing the wider stitches each to be drawn through a loop of the same width and the yarn formations thus formed to be still held by the hooks of the needles of the rear row;

Fig. 11 is a view similar to Fig. 10 except that the rear needle bed is shown to be racked one needle space downwards as regards these figures, prior to the wider stitches being passed over to the opposite needles of the front needle bed;

Fig. 12 is a view of the fabric as seen in the direction of arrow B in Fig. 7 after the wider stitches are passed over from the rear needle bed;

Fig. 13 is a view similar to Fig. 8 showing stitches drawn through loops, of usual width, to be inserted in the hooks of every third needle of the front row of needles, for carrying out a second form of fabric according to the invention;

Fig. 14 is a view similar to Fig. 13 but showing a wider stitch formed by three consecutive needles to be inserted in the hooks of these needles in the rear needle bed;

Fig. 15 is a view similar to Fig. 14 but showing the wider stitch to be drawn through a loop of the same width and to be still held by the hooks of the needles of the rear row;

Fig. 16 is a view similar to Fig. 15 except that the rear needle bed is shown to be racked one needle space downwards as regards these figures, prior to the wider stitches being passed over to the opposite needles;

Fig. 17 is a view similar to Fig. 15 but showing stitches drawn through loops, of usual width, to be inserted in the hooks of occasional pairs of adjacent needles of the front needle row in connection with the wider stitches drawn through loops each held by three consecutive needles of the rear row, and

Fig. 18 is a view similar to Fig. 17 except that the rear needle bed is shown to be racked two needle spaces downwards as regards these figures, prior to the wider stitches being passed over to the opposite needles.

By **1** the frame of the Jacquard flat knitting machine of a known type is designated, **2** refers to the front and **3** to the rear needle bed, whereas **4** represents ordinary needles, and **5** needles having a notch **6** in the upper end of the shank. The numerals **7** and **8** indicate the jack sinkers, **9** and **10** the Jacquard drums with the laced-together pattern cards slung about the same. **11** is a segmental racking element for the needle beds. The numerals **12** to **23** indicate the usual cam portions of the needle cam boxes for displacing the needles in the guideways of the needle beds, **24** to **28** those for the jack sinkers, **30** to **33** special cam portions for actuating the needles for passing over stitches and stitches drawn through loops respectively, and **34** and **35** cam portions for the jack sinkers.

These special cam portions are situated on the rear and front cam face plates on both sides of the usual needle and jack sinker retracting cams.

The method of producing knitted goods by passing over stitches drawn through loops from groups of two adjacent needles of one of the needle beds of the knitting machine to single needles of the other bed, each single needle co-operating with one group, is carried into effect as follows:

Assuming that the cam slide is positioned on the left side of the machine, and that by the hooks of certain selected needles, in the present instance every second needle **4** of the front needle bed **2** a stitch drawn through a loop, of usual width, is held, whereas the hooks of the needles **5** of the rear needle bed are devoid of either stitches or stitches drawn through loops (Fig. 8).

On displacing the slide along the needle beds from left to right, by means of the usual cam portions **12** to **29**, those needles or jack sinkers respectively are shifted in the guideways of the needle beds by which stitches and stitches drawn through loops are formed (Fig. 9), that is, stitches drawn through loops, of usual width, are formed on those needles **4** of the front needle bed **2** in the hooks of which stitches drawn through loops, of usual width, are already inserted, and stitches of larger width than usual on the needles **5** of the rear needle bed **3**. If this operation is repeated by moving the slide in the direction from right to left, also by certain needles **5** of the rear needle bed **3** stitches that are drawn through loops of larger width, are formed (Fig. 10). It will be seen that the wider stitches are of more or less sinuous shape.

In order to permit of passing over the stitches that are drawn through loops, of larger width, and are held by the needles **5** of the rear needle bed **3**, which had remained inactive during the last traverse of the slide (Figs. 9 and 10), to the needles **4** of the front needle bed, the cam portions **12**, **14**, **25**, **18**, **19** and **28** in the cam slide are rendered inoperative by being raised as indicated by dotted lines in Fig. 2. The Jacquard-drum **10** shifts those jacks **8** into operative position the correlated needles **5** of which are holding wider stitches drawn through loops (Figs. 9 and 10) which must be passed over to opposite needles. The Jacquard drum **9** on the other hand shifts the jacks **7** into operative position the correlated needles **4** of which are to receive the stitches to be passed over.

Prior to moving the cam slide in the direction of arrow A in Fig. 2, that is, again in the direction from left to right, the rear needle bed is racked by one needle division from left to right in Fig. 10, that is, downwards in this figure to assume the position as shown in Fig. 11. In the rear needle bed **3** the jack sinkers **8** selected by the Jacquard-drum **10** are advanced in the needle bed guideways by the needle cam portion **35**, the respective needles **5** being moved by the cam portion **33** into their highest position as shown in Figs. 1 and 5, so that the stitches carried by these needles **5** are held in a certain position by a notch **6** in the upper shank end of each of these needles.

In the front needle bed **2** the jack sinkers **7** selected by the Jacquard drum **9** are advanced through the needle bed guideways by the needle box cam portion **34**, the corresponding needles **4** thus being moved by the cam portion **30** into their positions shown in Figs. 1 and 5, in such manner, that the hooks of these needles are passed through the stitches that are drawn through loops or, as the case may be, through

stitches that are not interknitted with loops, of the oppositely disposed needles, when the latter arrive at their highest position. Thereupon, the cam portion 32 retracts the needles 5 into initial position (Fig. 7). During this movement the stitches carried by these needles close the correlated needle latches by sliding across the same and then enter the hooks of the opposite needles which are simultaneously retracted in their needle bed guideways by the cam portion 31 (Fig. 2). Thereupon, the formation of stitches is continued by the usual needle cam portions in the described manner (Figs. 9 and 10).

The same operations can be repeated, provided that the needle cam portions occupy adequate positions, when the cam slide moves from right to left, thus in the opposite direction to arrow A (Fig. 2). Furthermore, both needle beds may be equipped with notched needles in order to provide for passing stitches in like manner from the needles of the front needle bed to those of the rear needle bed. In this case the special cam portions, which are arranged on the rear and on the front needle cam box face plate on both sides of the usual needle and jack sinker retracting cams, must be correspondingly constructed.

In the Figs. 13 to 16 the mode of manufacturing a second form of fabric according to the invention is schematically illustrated the knitting of which is effected as follows:

Assuming again that the slide is positioned on the left side of the machine to begin its traverse from left to right. In Fig. 13 it is evident that by the hook of every third needle 4 of the front needle bed 2 a stitch drawn through a loop, of usual width, is held while none of the needles of the rear needle bed 3 has taken up a fresh supply of yarn as yet. During the traverse of the slide further stitches of usual width on the needles 4 referred to are formed, and also stitches comprising sinuous needle loops of three times the usual width by groups of three consecutive needles 5 in cooperation with the inner ends of the ribs of the serrated knock over cam of the rear needle bed 3 (Fig. 4), each group being intended for transference to one of the said needles 4. On repeating this operation by shifting the slide from right to left, a stitch drawn through a loop is obtained on each group of needles 5 by sliding the sinuous needle loop previously formed thereon on a freshly formed stitch of similar shape (Fig. 15).

By rendering the cam portions 12, 14, 25, 18, 19 and 28 inoperative and shifting the jacks 7 and 8 as selected by the drums 9 and 10 respectively into operative position, racking the rear needle bed 3 one needle space from left to right and shifting the cam slide in the direction of arrow A in Fig. 2, the needles 4 and 5 are operated for passing over the wider stitches from the needles 5 to the cooperating needles 4, as explained in describing the manufacture of the previous example of the looped fabric.

The third example of the looped fabric according to the invention is effected as indicated by the Figs. 17 and 18, illustrating two stages of manufacture thereof.

In this case, during alternate traverses of the slide in a similar manner as explained in connection with the two previous examples, on the front needle bed 2, by pairs of adjacent needles 4, which pairs are spaced apart by three needle divisions, stitches drawn through loops, of usual width, are formed, while upon groups of again three consecutive needles 5 of the rear needle bed 3, each of which groups is intended for cooperation with one of the said pairs of needles 4, stitches comprising sinuous needle loops, of three times the usual width are deposited. On interknitting, these stitches are completed to stitches that are drawn through loops by forming further stitches comprising sinuous needle loops (Fig. 17) and continuing the knitting operation as also explained in connection with the two previous examples, the stitches are passed over to the respective needles 4, after the rear needle bed 3 has been racked two needle divisions from left to right (Fig. 18).

In order to provide for a still greater number of design combinations for patterns of this kind, these may be carried out in a known manner with insertions of weft threads, cross thread loops and so forth.

In each row of stitches one or more cross or weft threads may be inserted. While a knitted ware devoid of any such cross threads constitutes a porous fabric which is elastic in all directions, the inclusion of cross threads provides for a knitted ware which is altogether similar to a woven fabric.

In order to provide greater elasticity of the knitted goods also in the direction of the cross threads, as a material for these threads rubber or rubber containing textiles may be chosen. The latter materials may be used also for effecting the stitches as well as the stitches that are drawn through loops.

It will be observed that the stitches and the stitches drawn through loops to be passed over are each formed by two or more needles lying alongside of one another, as selected, while these stitches or the stitches drawn through loops, when passed over, are each received by a smaller number of opposite needles of the other needle bed. Thus, in one and the same row of needles any number of stitches or stitches drawn through loops can be formed selectively, at will, by any group of two, three or more needles and then these yarn formations are passed over to one, two or more opposite needles holding yarn formations, of usual width, or twice, three times usual width and so forth, as desired.

I claim:

1. In a method of producing fabrics similar to ribbed goods with the aid of a knitting machine operating with two opposite rows of needles, the steps of forming in one row of needles selectively on individual needles stitches drawn through loops, of usual width, forming in the second row of needles at correspondingly selected points wider stitches than usual to extend across at least two needles of said row, and passing over said wider stitches to the needles of said first row, so that said wider stitches are each deposited upon a number of needles of said first row smaller than the number of needles on which they were formed.

2. In a method of producing fabrics similar to ribbed goods with the aid of a knitting machine operating with two opposite rows of needles, the steps of forming in one row of needles selectively on individual needles stitches drawn through loops, of usual width, forming in the second row of needles at correspondingly selected points wider stitches than usual drawn through loops of the same width and extending across at least two needles of said row, forming in said second row of needles in any desired combination with said correspondingly selected points wider stitches

than usual to extend across at least two needles of said row, and passing over said wider stitches drawn through loops and said wider stitches to the needles of said first row, so that said wider stitches drawn through loops and said wider stitches are each deposited upon a number of needles of said first row smaller than the number of needles on which they were formed.

3. In a method of producing fabrics similar to ribbed goods with the aid of a knitting machine operating with two opposite rows of needles, the steps of forming in one row of needles on every second needle stitches drawn through loops, of usual width, forming in the second row of needles with all the needles wider stitches than usual each to extend across two adjacent needles of said row, racking said rows of needles relatively to each other by one needle space, and passing over said wider stitches to the needles of said first row, so that said wider stitches are each deposited upon a single needle of said first row.

4. In a method of producing fabrics similar to ribbed goods with the aid of a knitting machine operating with two opposite rows of needles, the steps of forming in one row of needles on every third needle stitches drawn through loops, of usual width, forming in the second row of needles by groups of three needles each wider stitches than usual to extend each across the respective three needles of said row, racking said rows of needles relatively to each other by one needle space, and passing over said wider stitches to the needles of said first row, so that said wider stitches are each deposited upon a single needle of said first row.

5. In a method of producing fabrics similar to ribbed goods with the aid of a knitting machine operating with two opposite rows of needles, the steps of forming in one row of needles on each needle of occasional pairs of adjacent needles stitches drawn through loops, of usual width, forming in the second row of needles by groups of three needles each equal in number to the number of said pairs wider stitches than usual to extend each across the respective three needles of said row, racking said rows of needles relatively to each other by one needle space, and passing over said wider stitches to the needles of said first row, so that said wider stitches are each deposited upon one of said pairs of adjacent needles of said first row.

6. In a method of producing fabrics similar to ribbed goods with the aid of a knitting machine operating with two opposite rows of needles, one row comprising notched needles, the steps of forming in the row of needles devoid of notches selectively on individual needles stitches drawn through loops, of usual width, forming in the second row of needles at correspondingly selected points wider stitches than usual to extend across at least two needles of said row, advancing the needles of said second row with said wider stitches engaging the notches of the respective needles, projecting the corresponding needles of said first row through said wider stitches, and retracting said projected needles of said first row with said wider stitches deposited thereon, so that said wider stitches are each deposited upon a number of needles of said first row smaller than the number of needles on which they were formed.

7. In a method of producing fabrics similar to ribbed goods with the aid of a knitting machine operating with two opposite rows of needles, the steps of forming in one needle row stitches that are each drawn through a loop of the same width, each stitch being formed by means of at least one needle of said row, forming wider stitches in the second needle row, each by means of a greater number of needles of said row at points thereof corresponding to said narrower stitches of said first row, and passing over said wider stitches formed in said second row to said narrower stitches formed in said first row.

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