April 20, 1937. W. J. BENISTON 2,078,050

WARP KNITTED FABRIC AND METHOD AND APPARATUS FOR MAKING SAME

Filed March 24, 1934 3 Sheets-Sheet 1

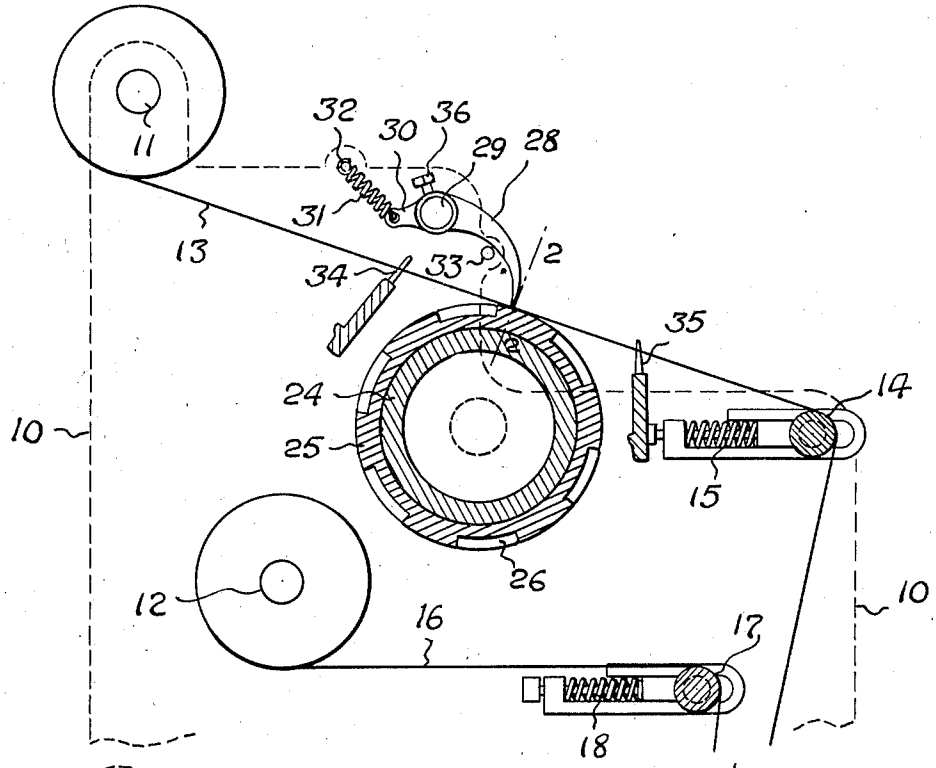


Fig. 1.

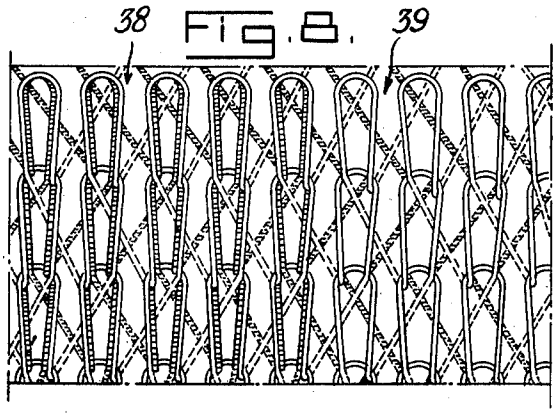
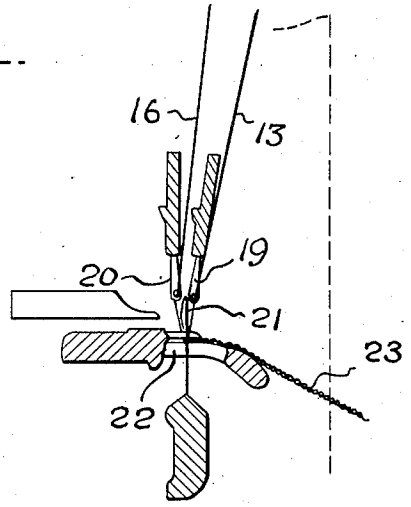


Fig. 8.



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WARP KNITTED FABRIC AND METHOD AND APPARATUS FOR MAKING SAME

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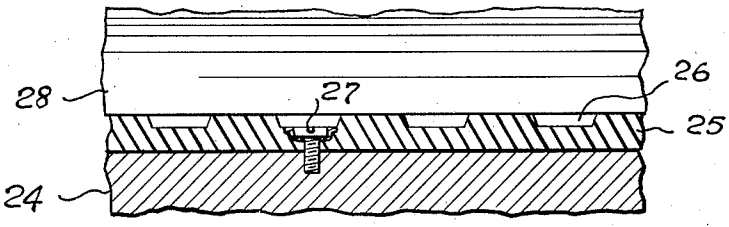

Fig. 2.

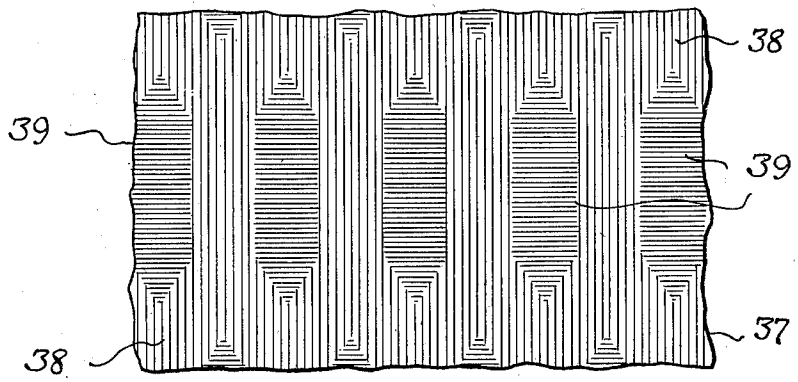

Fig. 3.

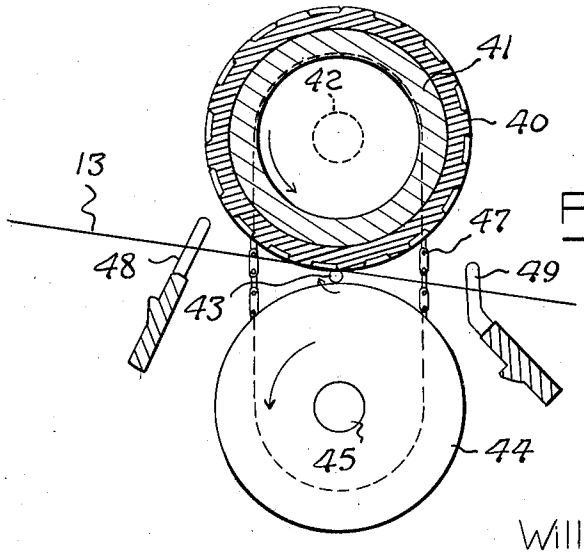

Fig. 4.

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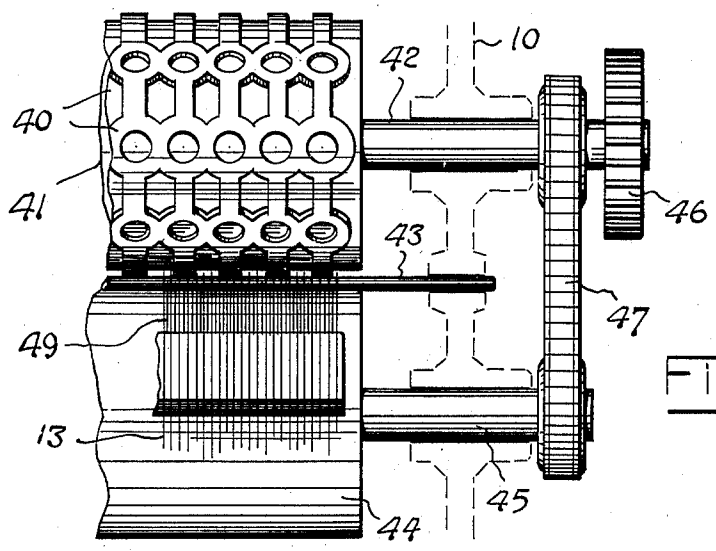


Fig. 5.

Fig. 6.

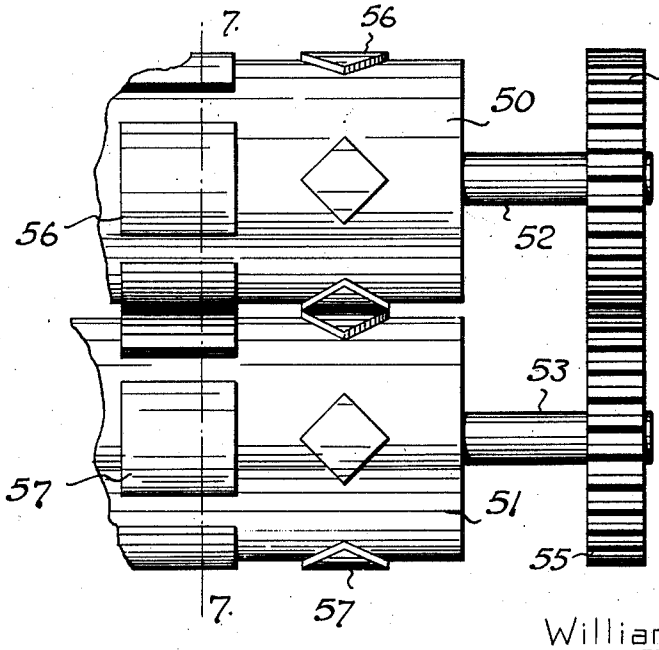
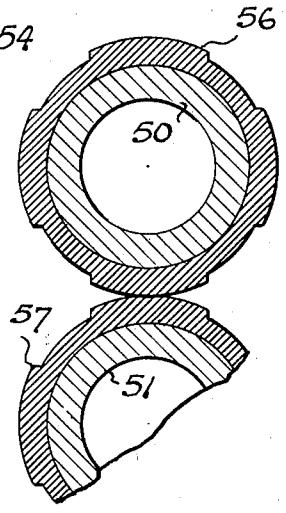


Fig. 7.



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Patented Apr. 20, 1937 2,078,050

UNITED STATES PATENT OFFICE

2,078,050

WARP KNITTED FABRIC AND METHOD AND APPARATUS FOR MAKING SAME

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Application March 24, 1934, Serial No. 717,169

6 Claims. (Cl. 66—195)

This invention relates to a warp knitted fabric and a novel method of producing same and to a warp knitting machine of the type in which two sets or banks of threads are simultaneously fed to the needles, two threads being fed to each needle.

One object of the invention is to regulate the tension of one of the banks of threads relatively to the other so that certain of the threads may at certain parts of the fabric be exposed to view and at certain other parts may be partially or wholly embedded in the thickness of the fabric.

A further object of my invention is to provide tension regulating means for one of the banks of threads for applying and relieving the tension of groups of such threads in the said bank so as to produce a predetermined pattern in the fabric.

It has been heretofore proposed in the knitting art to employ undyed yarns of different materials such for example as acetate yarns and rayon yarns which are uniformly distributed or otherwise arranged in the knitted fabric which is subsequently treated with dyes that affect only one of the two types of yarns employed and is thereafter treated with other dyes that affect only the threads of the other type, this being commonly known as "cross-dyeing" and being ordinarily resorted to for the production of striped fabrics, and while I prefer to employ "cross-dyeing" in the production of the fabric in accordance with the present invention, I may also employ threads of different colors or of contrasting materials or characteristics for the purpose of producing a patterned fabric by the use of my novel tension control mechanism.

A still further object of my invention is to vary or control the tension of the threads relatively to each other and to employ for one of the banks of threads a material that will not be affected by dyes that do affect the threads of the other bank so that by "cross-dyeing" the fabric predetermined patterns and designs may be produced.

With these and other objects in view my invention consists in the novel patterned fabric, the novel method of producing the fabric, and in the novel construction and arrangement of parts hereinafter described with reference to the accompanying drawings and particularly pointed out in the appended claims, it being understood that various changes may be made without departing from the spirit of the invention or sacrificing any of the advantages thereof.

In the drawings:

Fig. 1 is a diagrammatic view showing certain parts of a tricot warp knitting machine with portions thereof in cross-section;

Fig. 2 is an enlarged detail section taken on the line 2—2 Fig. 1;

Fig. 3 shows a fragment of a fabric produced according to this invention;

Fig. 4 is a detail cross-section showing a modified form of the improved apparatus according to my invention;

Fig. 5 is a view looking on the right hand side of Fig. 4;

Fig. 6 is a view corresponding to Fig. 5 but showing another form of the mechanism; and

Fig. 7 is a cross-sectional view taken on the line 7—7 Fig. 6;

Fig. 8 is an enlarged diagrammatic representation of the stitch structure in the background and figure sections, the full lines representing the portion of the threads as they normally appear on the front of the fabric and the dotted lines representing the portions of the threads which appear on the back of the fabric, but not perceptible on the front thereof.

Referring to Fig. 1 the warp knitting machine is of the well known type employed in the production of tricot warp fabric and comprises end frames 10 indicated in dotted lines and supporting upper and lower warp beams 11, 12, respectively. The yarns or threads 13 from the warp beam 11 pass in the usual well known manner over a tension roll or rod 14 equipped in the usual way with springs 15 for maintaining the tension of the threads, and from the beam 12 the threads 16 pass over a similar roll or rod 17 having similar springs 18 and the threads 13, 16 pass in the usual well known manner through guides 19, 20, respectively, one guide being provided for each thread; and these guides 19, 20 are manipulated in proper timed relation to the operation of the machine and to the movement of the usual needles 21 which latter co-operate with the said guides and with sinkers 22 to loop the threads and form the stitches to produce the fabric 23 which latter is received under uniform tension upon a take-up roller of any suitable or well known form and actuated in any convenient manner well known in the art.

In accordance with my invention, I produce patterns or designs in the knitted fabric by suitably varying at predetermined intervals the relative tension of certain of the threads 13 or 16 or of both the threads 13 and 16, and in the arrangement shown at Fig. 1, the lower threads 16 remain under uniform tension controlled by the usual tension device 17, 18 while the upper threads 13

are subjected to tensions varying relatively to the tension of the threads 16 in order to produce the desired pattern or design in the finished fabric. As shown at Figs. 1 and 2 a pattern roller or drum 24 of substantial diameter is mounted beneath the bank of threads 13 and has a rubber or other soft covering 25 formed with depressions 26 shaped and arranged to give the desired result. The covering 25 is secured on the roller or drum 24 by means of screws 27 or in other suitable manner. Above the threads 13 and between the end frames 10 of the machine a bar or blade 28 is mounted on pivot pins 29 free to turn in sockets in the end frames 10. An extension arm 30 on each of the pivot pins 29 forms an attachment for one end of a spring 31 whose opposite end is anchored at 32 to the frame 10 so that the blade 28 is swung towards the rubber covered drum 24. A stop-pin 33 may limit the downward movement of the blade, and each of the said arms 30 is connected to a pivot pin 29 by means of a screw 36 so that it may be adjusted in position on said pin to vary the pull of the springs 31 and thus cause the blade 28 to exert the proper degree of pressure upon the threads on the raised peripheral portions of the covering 25. The drum 24 is driven at a uniform speed which is so regulated that the surface speed of the outer peripheral surface of the covering 25 is about the same or just slightly less than the speed of the feed movement of the threads 13 and the lower edge of the blade 28 engages and retards the movement of such threads 13 as rest upon the outer peripheral surface of the drum covering 25 while those threads 13 that are located between the edge of the blade 28 and depressions 26 are not so retarded. In order to prevent side movement of the threads 13 and to ensure their proper alignment with the desired pattern in the cover 25, guides or "sley" points 34 and similar guides or "sley" points 35 are provided to separate adjacent threads 13 and maintain same in their proper lateral position.

The portion of fabric 37 shown at Fig. 3 is represented as having a background 38 such as would be formed by knitting in the usual way, with the threads 13 and 16 all under uniform tension, while the figures or sections 39 on the fabric are formed by knitting with the upper threads 13 retarded or subjected to increased tension so that the threads 13 are drawn tightly around the needles and are thus buried or concealed in the thickness of the fabric, and it will be readily understood that the use of different types, weights or colors of threads in the upper or lower banks 13, 16 thus results in a pattern or design clearly defined in the finished fabric, and by modifying the arrangement and contour of the depressions in the drum covering 25 and by the use of different colored threads, or by "cross-dyeing", an endless variety of patterns and designs may be produced in the fabrics.

In the modified arrangement shown at Figs. 4 and 5, the threads 13 engage and pass beneath a patterned covering 40 on a drum 41, which latter is carried by a shaft 42 mounted in bearings in the end frames 10 of the machine, and a rod 43 of very small diameter holds the threads 13 in engagement with the covering 40, the rod 43 being also mounted in bearings in the end frames 10 and being supported by a smooth drum 44 which has a shaft 45 mounted in the said frames 10, the shaft 42 of the drum 41 being driven at the proper speed through the medium of a gear wheel 46 from the main drive of the machine, while the motion of the shaft 42 is transmitted to the shaft 45 and thus to the drum 44 by sprocket gear 47 so that the said rod 43 is driven by contact with the drum 44 and with the patterned covering 40 on the drum 41. The rod 43 thus engages the threads 13 between its surface and the raised surfaces on the covering 40. Suitable guides or "sley" points 48, 49 are provided to prevent excessive side movement of the threads 13 to ensure their proper registry with the various raised portions of the covering 40.

The arrangement shown at Figs. 6 and 7 comprises a pair of pattern drums 50, 51 mounted on shafts 52, 53, respectively. These shafts are driven in any suitable manner in proper timed relation to the operation of the machine, and meshing gear wheels 54, 55 on the said shafts 52, 53 ensure simultaneous operation of the drums in opposite directions, and as the patterns on both drums are exactly similar, the threads which pass between said drums are engaged between raised portions 56 on the drum 50 and similarly shaped and correspondingly located portions 57 on the other drum 51.

While I have described and shown my tension mechanism as applied to one set or bank of threads, it should be understood that similar tension means might be applied to both sets or banks of threads, but the operation would of course be so regulated that the mechanisms would actuate in proper co-operation with each other to vary the relative tensions of the different threads to give the desired result.

In the operation of the different forms of my improved tension apparatus, the pressure exerted upon the threads by the raised portions of the patterned surfaces may be so regulated that the threads while engaged by said portions are permitted to slip under the pull of the knitting implements but under a tension substantially greater than the tension of the threads that are subjected only to the usual tensioning means (14, 15, 17, 18—Fig. 1).

Although the drawings and the above specification disclose the best modes in which I have contemplated embodying my invention, I desire to be in no way limited to the details of such disclosure, for in the further practical application of my invention many changes in the method of operation and in the form and construction of the mechanism may be made as circumstances require or experience may suggest, without departing from the spirit of the invention within the scope of the appended claims.

What I claim is:

1. A warp knitted fabric having a knitted background, and knitted figure sections distributed throughout its area, said background and said sections consisting entirely of pairs of companion loops knitted from two threads of different character, said background having substantially equal amounts of both threads forming its loops exposed to view upon the surface of the fabric and each figure section having one loop of each pair drawn beneath the other loop and buried in the thickness of the fabric whereby only the thread forming one loop of each pair is exposed to view upon the surface of the sections.

2. A warp knitted fabric having a knitted background, and knitted figure sections distributed throughout its area, said background and said sections consisting entirely of pairs of companion loops knitted from two threads of different character, said background having all its loops knitted uniformly whereby substantially equal amounts

of both threads forming said loops are exposed to view upon the surface of the fabric, and each figure section having one loop of each pair knitted in the thickness of the fabric and covered by the other loop whereby only the thread forming one loop of each pair is exposed to view upon the surface of the sections.

3. A warp knitted fabric having a knitted background and knitted figure sections arranged throughout its area according to a predetermined pattern, said background and said sections consisting entirely of pairs of companion loops knitted from two threads of different character, said background having substantially equal amounts of both threads forming its loops exposed to view upon the surface of the fabric and each figure section having one loop of each pair drawn beneath the other loop and buried in the thickness of the fabric whereby only the thread forming one loop of each pair is exposed to view upon the surface of the sections.

4. The method of knitting a warp fabric comprising feeding to the needles two sets of threads of different character to form pairs of companion loops and periodically and selectively increasing the tension of alternating groups of threads in one set to draw the loops formed by said groups of threads beneath the loops formed by the associated groups of threads in the other set, while maintaining the intermediate groups of threads in both sets under substantially uniform tension to produce localized sections of different surface ornamentation.

5. The method of knitting a warp fabric comprising feeding to the needles two sets of threads of different character to form pairs of companion loops throughout the fabric, feeding under substantially uniform tension groups of associated threads in both sets to exposed substantially equal amounts of both sets forming the pairs of loops in certain predetermined areas of the fabric, and periodically and selectively subjecting to increased tension groups of threads in one set to draw one loop of each pair beneath its companion loop whereby to expose only the thread forming one loop of each pair in certain other predetermined sections of the fabric for producing different surface ornamentations.

6. A method of knitting a warp fabric comprising feeding to each needle two threads of different character for forming pairs of companion loops throughout the fabric, periodically and selectively feeding the two threads under substantially uniform tension to expose substantially equal amounts of both threads forming the pairs of loops in certain predetermined areas of the fabric, and periodically and selectively subjecting one of the threads to increased tension to draw one loop of each pair beneath its companion loop whereby to expose only the thread forming one loop of each pair in certain other predetermined sections of the fabric for producing different surface ornamentations.

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