P. P. LA MONTAGNE.

KNITTING MACHINE.

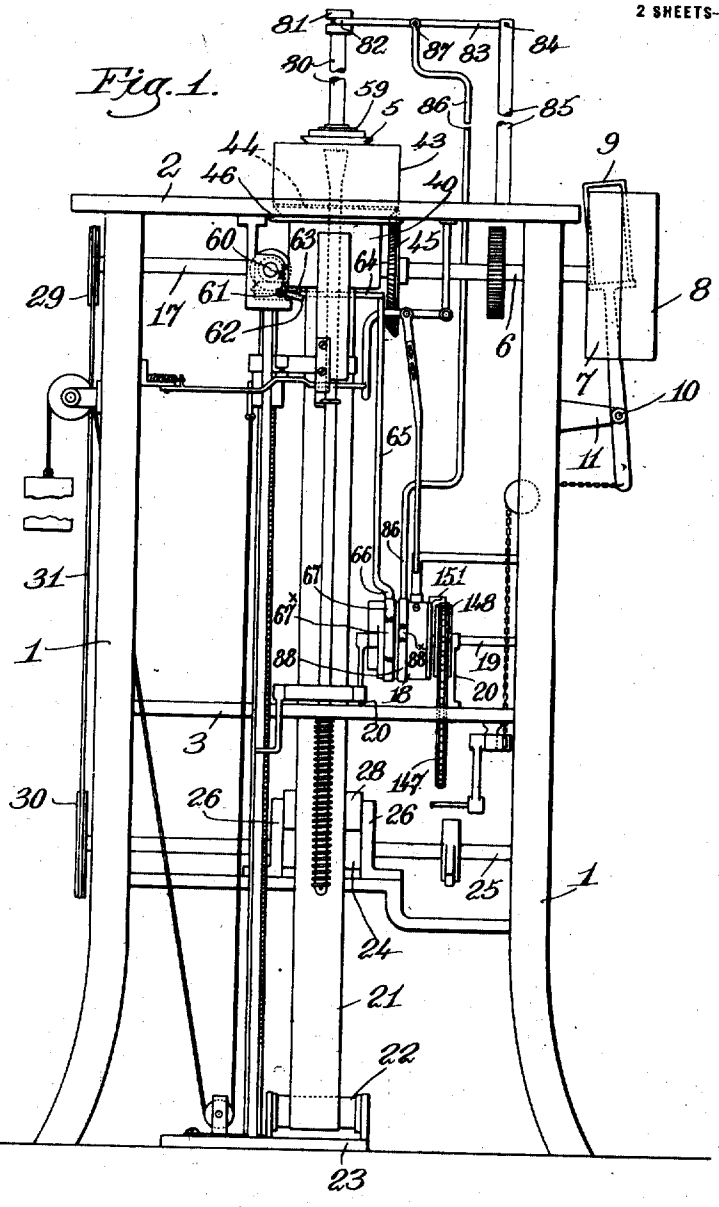
APPLICATION FILED JAN. 6, 1913.

1,247,972.

Patented Nov. 27, 1917.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses.

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2 SHEETS—SHEET 2.

Fig. 2.

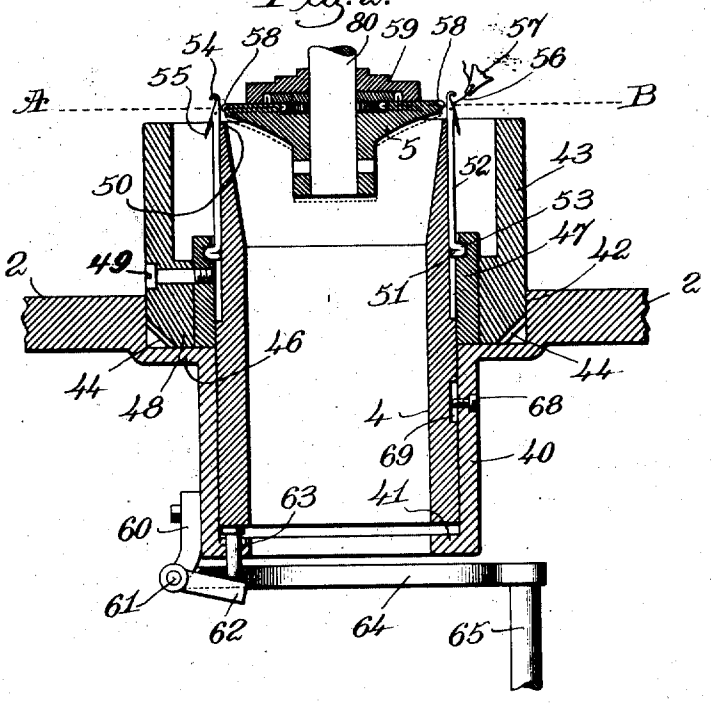


Fig. 3.

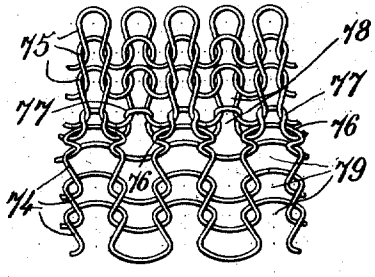


Fig. 5.

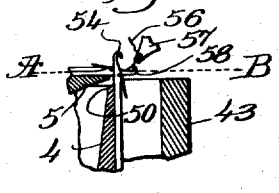
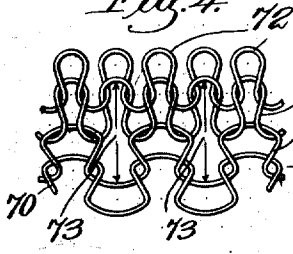


Fig. 4.



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UNITED STATES PATENT OFFICE.

PATRICK P. LA MONTAGNE, OF BOURBONNAIS, ILLINOIS, ASSIGNOR TO PARAMOUNT KNITTING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

KNITTING-MACHINE.

1,247,972. Specification of Letters Patent. Patented Nov. 27, 1917.

Application filed January 6, 1913. Serial No. 740,311.

To all whom it may concern:

Be it known that I, PATRICK P. LA MONTAGNE, a citizen of the United States, and resident of Bourbonnais, county of Kankakee, State of Illinois, have invented an Improvement in Knitting-Machines, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

In the production of tubular knitted fabric wherein a change is made in some part or parts thereof from plain to ribbed fabric, as for instance in stockings which have plain foot and ankle portions and ribbed leg portions, a series of holes or openings is formed in the fabric along the line where the change from plain to ribbed work is effected, unless some provision is made to reduce the size of such holes so that they will not be sufficiently obvious to mar the appearance of the fabric.

Various means have been devised, with more or less success, to overcome the defect mentioned, but so far as I am aware objectionable features of one kind or another are connected with the means heretofore employed, either in the way of increased cost of production or in the character of the resultant fabric.

My present invention has for its object the production of mechanism for making a knitted fabric of the character before referred to, that is, wherein a change is made from plain to ribbed work, but without objectionable holes along the line where the change occurs from the one to the other specified kind of work.

In the present practical embodiment of my invention I have arranged and constructed the mechanism for use in an automatic knitting machine adapted to knit the complete article, such as a stocking, entirely automatically, and herein I have shown my invention embodied in a machine having two usual sets of needles, such as the dial and cylinder needles, a machine of this general type being shown in patent to Huse and Huse, Reissue No. 12917 dated February 9, 1909. The cylinder needles knit the plain portion of the work in well known manner, and when ribbed work is to be made the second set of needles, as the dial needles, is thrown into action and the machine proceeds with rib knitting for the required number of courses.

Where the character of the work changes from plain to ribbed the openings or holes above referred to are formed, under ordinary conditions, and in accordance with my present invention I prevent such hole formation to any objectionable extent by a peculiar manipulation of the stitch-forming devices.

It will be understood to those skilled in the knitting art that in a machine of the type referred to the thread or yarn is delivered to the needles, whether cylinder or dial, by a suitable yarn carrier, and the length of the loops formed by the cylinder needles in plain knitting is controlled or governed by the distance the cylinder needles are retracted below the annular upper edge or curb of the cylinder, across which curb the previously formed round or course is supported.

Each new loop is drawn through one of the previously formed and supported loops when the needle is retracted, and to shorten the loops in process of formation the needle cylinder may be lowered or the cylinder-needle cam may be raised with respect to the normal position thereof, such change in the relation of the parts decreasing the distance between the hook of a retracted cylinder-needle and the curb of the cylinder and consequently a shorter loop is formed.

The holes formed in a knit fabric at the junction of plain and ribbed work are due to those loops of normal length—in the first course formed by the ribbing or dial needles—which are located opposite the spaces between two adjacent loops in the last course formed by the plain or cylinder needles, each hole being of a length equal to substantially twice the length of a normal loop. In other words, one end of such a hole is made by the bight of the loop formed by a ribbing needle in the first course of ribbed work while the other end of the hole is made by the yarn connecting the bases of two adjacent cylinder-needle loops in the last course of plain work. I have discovered that the length of such holes can be so diminished as to be unobjectionable in the completed fabric by shortening the loops

formed by the cylinder-needles for one course, or more, before the dial needles are thrown into action, and preferably by also forming one course, or more, of abnormally short loops by both sets of needles when the ribbing needles are first thrown into action.

This formation of the course or courses of abnormally short loops by the cylinder needles is effected at the proper time by a relative axial movement of the cylinder and the cylinder-needle cam toward each other, and the formation of the course or courses of abnormally short loops by both sets of needles is effected by a relative axial movement of the said cam and the dial toward each other.

In the particular embodiment of my invention herein illustrated the change in the normal relationship between the cylinder and the cylinder-needle cam to effect the desired shortening of the loops or stitches at the termination of plain knitting is brought about by lowering the cylinder. Similarly, the change in the normal relationship between said cam and the dial to cause the formation of the shorter stitches or loops by both sets of needles, in the first portion of ribbed work, is brought about by lowering the dial toward the cam, but it is to be understood that the structure shown and described herein is illustrative, and is not for the purpose of limitation of my invention.

It thus appears that to accomplish the desired results in the knit fabric I effect, in sequence, a change in the normal axial relationship between the cylinder and the cylinder-needle cam, and between said cam and the dial, each change being effective, in the present embodiment of my invention, to shorten the loops or stitches in a single course, one of plain and the other of ribbed work.

The normal relationship between the cylinder and the cam is restored at any time convenient prior to the resumption of plain knitting, for during ribbing the stitches are drawn from the level of the dial needles, and not over the curb of the cylinder, but normal relationship between the said cam and the dial is in the present instance restored immediately after the first course of ribbed work has been completed, in order that succeeding courses of ribbed work may be formed by stitches or loops of normal length.

The courses formed with abnormally short loops may be termed change courses, inasmuch as they mark the transition from normal plain knitting to normal ribbed knitting, and as the loops in such change courses are abnormally short the yarn therein extends in more nearly straight lines around the fabric and across the spaces or holes which otherwise would be formed, thereby so closing up or diminishing the length of the same that they are not noticeable in practice. In knit fabric where such holes show plainly the fabric at the joint between plain and ribbed work is in fact less firm than the rest of the fabric, but in the fabric produced in accordance with my invention that portion thereof at the joint between plain and ribbed work is as firm as any other portion of the fabric.

While I have herein shown the mechanism arranged to produce a change course of plain work and a succeeding change course of ribbed work it will be readily understood that a slight change in the controlling means would vary the operation according to circumstances. In the case of a fabric which is very loose normally it might be desirable to tighten the fabric by forming, say, two courses with the abnormally short loops before commencing ribbing, and to tighten the fabric by forming the first two courses of ribbed work with abnormally short loops. Thus, the two abnormal courses of plain work would be formed before the ribbing needles are thrown into action, and the normal relationship between the dial and the cylinder-needle cam would not be restored until the two abnormal courses of ribbed work are formed.

If the character of the fabric is such that the last course of plain work cannot be tightened conveniently, as described, it would be desirable to make the first course of ribbed work with the abnormally short loops, and vice versa.

As it is very difficult to start and stop any change on the same needle a course or round may not be exact, in that respect, and hereinafter in referring to the termination or completion of a course or round the phraseology is used in its general meaning, and does not mean starting and stopping the course on one and the same needle.

The various novel features of my invention will be fully described in the subjoined specification, and particularly pointed out in the following claims.

In the drawings I have illustrated a sufficient portion of a knitting machine to enable my present invention to be understood, and herein I have omitted well known parts which operate in usual manner.

Figure 1 is a front elevation of a sufficient portion of an automatic circular knitting machine, with one practical form of my present invention embodied therein, the parts being positioned for the production of plain knitting;

Fig. 2 is an enlarged vertical diametral section taken through the needle cylinder and the dial, to more clearly illustrate the novel features of my invention, the cylinder and dial being shown in their normal relationship to the cylinder-needle cam;

Fig. 3 is a greatly enlarged view of a piece

of knit fabric at the junction of the plain and ribbed portions thereof showing the change courses of yarn with abnormally short loops, whereby the formation of objectionable holes in the fabric is obviated in accordance with my present invention;

Fig. 4 is a similar view of a piece of knit fabric showing the holes formed at the junction of the plain and ribbed portions when no means is provided for overcoming the same;

Fig. 5 is a detail view similar to Fig. 2, but showing the abnormal change in the relative position of the cylinder-needle cam and the dial plate when the dial needles are thrown into action and the first course of ribbed work is to be formed.

As will appear hereinafter I close up or decrease the size of the spaces or holes without the use of an extra yarn at the change courses and without making a change in either face of the fabric at the junction of the plain and ribbed portions thereof, both modes of procedure having been devised heretofore.

Referring to Fig. 1 the legs 1, top 2 and central tie-plate 3 constitute a suitable supporting frame for the various instrumentalities which make up the complete machine.

The needle cylinder is indicated at 4, Fig. 2, and 5 is the dial plate, said parts and their respective needles and adjuncts being referred to hereinafter in detail in connection with Fig. 2.

The main shaft 6 has fast and loose pulleys 7, 8, a belt-shifter 9 being fulcrumed at 10 on a bracket 11, the said belt-shifter being actuated in any suitable manner, forming no part of my invention.

An auxiliary shaft 17 is mounted transversely near the top of the frame in suitable bearings and is driven from the main shaft 6 by usual connections, not herein shown.

Suitable pattern mechanism herein shown comprises the barrel 18, (provided with cam surfaces and pins) carried by a pattern shaft 19 journaled in standards 20, one of which is shown, on the tie-plate 3, a pattern chain 147, a sprocket wheel 148 loosely mounted on the shaft 19, a pawl 151, and suitable operating mechanism actuated from the main shaft, all similar in general to corresponding parts in United States Patent No. 726,178 granted to Mayo April 21, 1903, to which reference may be had.

The knitted web is indicated in outline at 21, Fig. 1, and extends from the interior of the needle cylinder vertically downward and about an idler roll 22 mounted on a stand 23 fixed to the floor, the web passing thence around a roll 24 on the shaft 25 journaled in suitable brackets 26.

Said roll 24 is in practice roughened, as by a covering of sand paper or emery cloth, to grip the web, the latter being held in contact with the roll 24 by the weight of a roll 28 mounted in slotted bearings in the brackets 26.

The shaft 25 is driven frictionally to insure the drawing of the knitted web through the machine, while preventing more tension than is necessary for the purpose.

Herein this frictional drive is effected by a belt 31 connecting pulleys 29 and 30 on the shafts 17 and 25 respectively, and when there is any amount of peripheral resistance at the roll 24 the belt will slip on one or the other of the pulleys.

So much of the general mechanism has been described as is necessary to a proper understanding thereof, and I will now describe in detail the novel features of my present invention in connection with certain well known structural devices.

Referring to Fig. 2 the needle cylinder 4 has its lower end extended into a cylindrical casing 40 depending from the top 2 of the main frame, the cylinder having a slight axial movement in the casing, and at its lower end the casing has an inturned annular shoulder 41 upon which the needle cylinder may seat when it is positioned abnormally with relation to the cylinder-needle cam, but under normal conditions the cylinder is raised above the shoulder, as shown.

The top 2 is socketed at the upper end of the casing, at 42, to receive the rotatable cam ring 43, provided with usual beveled gear teeth 44 for engagement with a beveled gear 45, Fig. 1, by or through which the cam ring is revolved in usual manner.

The external annular enlargement 46 at the upper end of the casing 40 forms a support for and upon which the cam ring revolves, the cylinder-needle cam 47 being interposed between the cylinder needles and the thickened base 48 of the revoluble cam ring 43, and the latter is positively connected with the cam 47 by a suitable screw-bolt 49, as clearly shown in Fig. 2.

The butts 51 of the cylinder needles 52 enter a groove 53 in the cam 47 in usual manner, said needles being shown as having hooks 54 and usual latches 55.

From an inspection of Fig. 2 it will be apparent that if the needle cylinder is lowered toward the flange or shoulder 41 the distance between the upper edge or curb 50 of the cylinder and the hooked end of a retracted cylinder-needle will be less than the normal distance, and consequently a stitch or loop shorter than normal will be formed by any cylinder needle when retracted by the rotation of the cam 47 in the formation of plain knitting.

Rotation of the cam ring will rotate the cam 47 to effect the proper operation of the cylinder needles whether the needle cylin-

der 4 is in its normal position, raised away from the shoulder 41 or whether it is lowered to abnormal position, near or seating upon the shoulder, but if the cylinder be lowered from its normal position the vertical movements of the needles will be changed with relation to the curb 50 of the cylinder, and retraction of the needles will draw down short or abnormal loops.

In Fig. 2 the plane of the path in which the yarn is delivered to the needles is indicated by the broken line A—B, the yarn 56 being shown as fed by a usual yarn-carrier 57, which has a circular motion about the axis of the needle cylinder and dial, in well known manner.

When plain knitting is being performed the dial needles are retracted and inoperative and the needle cylinder is positioned as shown in Fig. 2, that is, the cylinder and the cylinder-needle cam 47 occupy their usual or normal relative positions in a machine of the character herein referred to, the knitted web passing down through the cylinder and at the stitch forming point it is supported on the annular upper edge or curb of said cylinder.

To effect the relative axial movement of the cylinder and cam 47 toward each other to abnormal position, as hereinbefore referred to, I have in this embodiment of my invention made provision for lowering the needle cylinder when the last course of plain knitting is to be formed, just before the dial needles are thrown into action, and while any suitable means may be employed for the purpose I have shown herein one simple form of such means.

Referring to Fig. 2 the casing 40 has fixed to it a depending bracket 60 in which is mounted a horizontal rock shaft 61 having secured to it an inturned toe 62 which extends beneath a vertically movable headed stud 63 loosely mounted in a counterbored hole in the casing shoulder 41 and engaging the lower end of the needle cylinder 4.

The rock shaft 61 also has fixedly secured to it a preferably circularly curved arm 64 which extends under the shoulder 41 but out of the way of the knitted web, the free end of said arm having attached to it a depending link 65, Figs. 1 and 2, the lower end of which constitutes a follower 66 which rests upon a cam ring 67 on the pattern cylinder 18, the ring having a depression or low portion 67ˣ.

When said cylinder in its rotation brings the depression 67ˣ under the follower 66 the latter and the link 65 will be lowered, and through the arm 64 the shaft 61 will be rocked to depress the toe 62.

This permits the stud 63 and the needle cylinder 4 to descend a short distance, according to the amount the stitch is to be shortened, as shown in Fig. 5, such lowering of the cylinder being timed to take effect when the last course of plain knitting is to be formed just before the dial needles are thrown into action to form ribbed knitting.

Any suitable means is employed to prevent any rotative movement of the needle cylinder, as by a detaining screw 68 extended through the casing 40 into a vertical slot 69 in the exterior of the needle cylinder, Fig. 2.

The cam ring 67 is so shaped as to maintain the needle cylinder in abnormal position while the first change course of plain knitting is formed, and to restore the cylinder to normal position at any time before the resumption of normal plain knitting.

Upon the completion of the first or primary change course the dial needles 58 are thrown into action to form the secondary change course of ribbed knitting, but as this course is formed with abnormally shortened loops, as hereinbefore stated, it is necessary to lower the dial 5 and its adjuncts toward the cylinder-needle cam 47 either before or just as the dial needles are thrown into action.

Referring to Fig. 5 the parts are shown positioned for the secondary change course, the cylinder 4 being still in its lowered or abnormal position with relation to the cam 47, and the dial 5 is lowered to its abnormal position with relation to said cam, to substantially the dotted line position indicated in Fig. 2.

So, too, in Fig. 5, a cylinder needle is shown projected, and one of the dial needles is shown projected, the said needles being positioned for taking the yarn 56 to form a loop of ribbed work.

The revoluble cam 59 which controls the movements of the dial needles is of usual construction and is operated in any usual or well known manner.

During the formation of the secondary course of ribbed work the stitches or loops will be shorter than normal stitches because of the lowering of the dial and its adjuncts toward the cam 47 for during ribbing the loops are drawn from the level of the dial needles.

The dial and its adjuncts are returned to normal position with respect to the cam 47 immediately upon the completion of the secondary change course, so that subsequent courses of ribbed work will be formed by loops of normal length.

Any suitable means may be employed to vary the position of the dial with respect to the cylinder-needle cam, and one simple arrangement is herein shown.

Referring to Fig. 1, the central non-rotatable post 80 on which the dial 5 is secured is capable of a slight axial movement, and the upper end of the post has an annularly grooved collar 81 fast thereon, to coöperate

with the yoke-like end 82 of a lever-arm 83 fulcrumed at 84 on an upright 85 rigidly mounted on the top 2.

A link 86 is pivotally connected with the lever-arm 83 between its ends at 87 and depends therefrom, its lower end constituting a follower which travels upon a cam-ring 88 on the pattern cylinder 18, said cam-ring having a suitable depression indicated at 88^x, Fig. 1.

The depression is so located that the dial 5 and its adjuncts will be lowered to abnormal position shortly before or just as the dial needles are thrown into action, the dropping of the foot of the link 86 into the depression 88^x permitting such positioning of the dial and adjuncts, and in practice the length of said depression is sufficient to permit one course of ribbed work to be knitted with short loops, whereupon the high part of the cam-ring 88 will immediately restore the parts specified to normal position.

The showing of the cam-rings 67 and 88 in Fig. 1 is merely diagrammatic, and only for illustrative purposes.

From the foregoing description it will now be understood that when a change is to be made in the fabric from plain to ribbed work the last course of plain work will be formed with abnormally shortened loops, constituting what I have termed the primary change course, and the next or secondary change course will be ribbed work but with abnormally shortened loops, regular or normal ribbed work being formed immediately upon the completion of the secondary change course.

By reference now to illustrations of knitted fabric the effect of the operations hereinbefore described will be readily understood.

Referring to Fig. 4, where a piece of knitted fabric is shown composed of ordinary plain and ribbed work, the loops or stitches constituting the plain work are indicated at 70, and the set of loops 71 indicate the course ordinarily connecting the plain work with the ribbed work, the latter being indicated by the row of loops 72.

It will be seen that the loops of the connecting course 71 are of the same length as the plain loops 70 and the ribbing loops 72, and the spaces or holes 73 formed by the change from plain to ribbed work are equal in length to two of the loops 70 or 72, due to the fact that the loops of the connecting course 71 are of normal length.

Turning now to Fig. 3, which is a similar illustration of a piece of knitted fabric made in accordance with my present invention, the plain loops or stitches of normal length are indicated at 74 and the normal ribbing loops, which are of the same length, are indicated at 75, but it will be noted that the loops 76 and 77 of the primary and secondary change courses respectively, which intervene between and connect the last round or course of normal plain loops 74 and the first round or course of normal ribbing loops 75, are very much shorter, so much shorter in actual practice that the yarn constituting the change courses extends in nearly straight lines across the fabric.

The loops are of course exaggerated and opened out in both Figs. 3 and 4 in order to enable the formation of the fabric to be understood.

Still referring to Fig. 3 it will be seen that the shortening of the loops of the two change courses not only reduces the actual length of the spaces 78 but also causes the bights of the loops 77 which cross said spaces 78 to cross at a point substantially midway between the ends thereof, with the resultant effect that in practice the spaces are so diminished in appearance and size as to be substantially indistinguishable from the normal loop interstices 79 throughout the fabric.

Hence in the completed fabric I obviate the formation of objectionable holes or spaces, such as 73, Fig. 4, and this most desirable improvement is effected without the use of an extra yarn, or yarns, and without changing in any way the ordinary aspect of either face of the fabric.

It will be understood that the shortening of the loops 77 forming the secondary change course is due to the temporary and abnormal change in the relative positions of the dial and the cylinder-needle cam 47 when the dial needles are thrown into action and knit such course, for when the dial and the dial needles are abnormally positioned as in Fig. 5 the hooks 54 of the cylinder needles will when retracted draw down loops shorter than normal loops, for the retracted position of such a hook is at such time nearer the plane of the dial needles.

The two change courses knit with abnormal or shortened loops serve to make as firm a fabric at the joint between plain and ribbed portions of the web as are those portions, which is an improvement in itself, as thereby the fabric is practically homogeneous as regards firmness.

It will be understood from the foregoing description of the operation of the mechanism that as soon as the secondary change course is completed the stitch-forming instrumentalities return to normal operation, the formation of ribbed work being continued with both sets of needles as long as may be desired.

The additional mechanism for bringing about the desired results is very simple, and adds but little to the knitting machine as a whole.

Inasmuch as various devices may be employed to bring about the temporary and

abnormal operation of the knitting or stitch-forming instrumentalities my invention is not restricted to the precise construction, arrangement and operation herein shown and described, for various changes or modifications may be made by those skilled in the art without departing from the spirit and scope of my invention as set forth in the claims hereunto annexed.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a circular knitting machine, the combination with the dial and cylinder, and their needles, adapted to be operated to produce plain or ribbed work, and a cylinder-needle cam, of a support for the needle cylinder, in which the latter is movable vertically, and automatically actuated means to lower the needle cylinder toward the said cam just before the dial needles are thrown into action, to cause the cylinder needles to form a course of plain knitting with abnormally short loops at the termination of normal plain work, said automatically operated means restoring the cylinder to its normal position relatively to the cam prior to the resumption of plain knitting.

2. In a circular knitting machine, a cylinder and its needles, a concentric, revoluble cam to actuate said needles to produce plain work, a dial and its needles, the dial needles being adapted to coöperate with the cylinder needles to produce ribbed work, the dial and said cam being capable of relative axial movement, and automatically controlled means to effect such relative movement when the dial needles are thrown into action and decrease the distance between said dial and cam during the first course knit by both sets of needles, whereby such course will be formed by loops shorter than normal, said means restoring said cam and dial to normal position at the completion of the course, whereby subsequent ribbed courses will be formed by loops of normal length.

3. In a circular knitting machine, in combination, a non-rotatable, axially movable dial and its needles, a non-rotatable axially movable cylinder and its needles, the two sets of needles adapted to form plain or ribbed work, a controlling cam for the cylinder needles, means to cause the dial to move axially toward and away from said cam, thereby to vary the length of the loops formed when the dial needles are in action, said means maintaining the dial in abnormal position relative to the said cam while the initial ribbed course is being knit, to provide for the formation of abnormally short loops therein, means coöperating with the needle cylinder to move it axially toward the cylinder-needle cam just before the dial needles are thrown into action, to form a course adjoining the normal plain work but having abnormally short loops, and a pattern mechanism to govern the operation of both of said means, the primary change course of plain knitting and the adjacent secondary change course of ribbed knitting coöperating to prevent the formation of holes or spaces between normal plain and ribbed work.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

PATRICK P. LA MONTAGNE.

Witnesses:
HENRY POPE,
DUNCAN MCEWAN.