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S. A. WELCH ET AL

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KNITTING MACHINE

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FIG. 1.

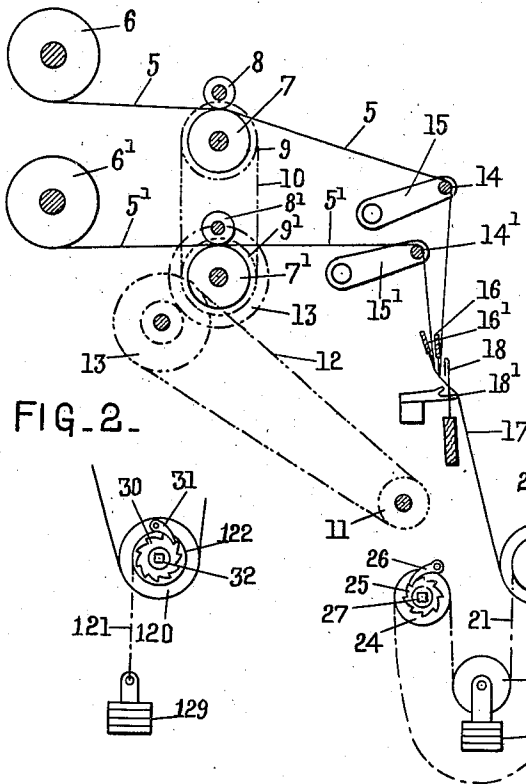


FIG. 2.

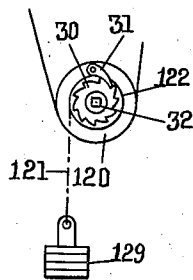


FIG. 4.

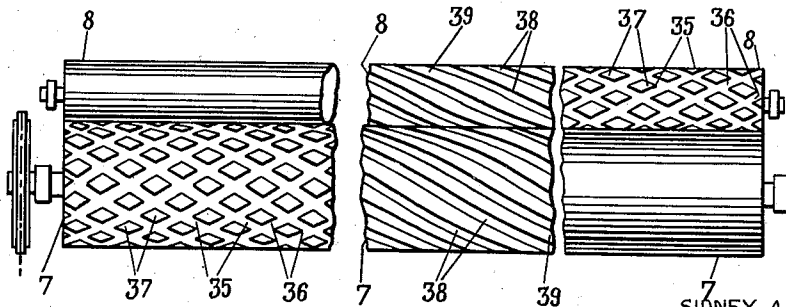


FIG. 3.

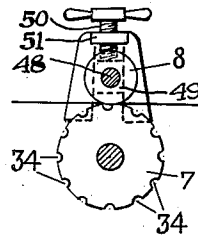
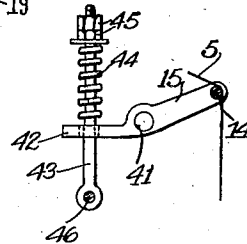


Fig. 5.



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KNITTING MACHINE

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This invention relates to the manufacture of knitted fabrics and particularly to the manufacture of warp knitted fabrics, that is, fabrics in which a number of warp threads are knitted together in each course.

In the usual method of producing such fabrics a number of warp threads are drawn from a creel, beam or a number of sectional beams by a feeding device, passed over a tension bar, and thence to thread guides which guide the threads to the needles, where they are knitted into fabric. Variations in the tension of the thread take place during knitting, and these variations cause the tension bar to move against the action of springs or weights by which it is loaded. The feeding device is driven through a friction clutch, operated by the movements of the tension bar, and in this manner is caused to feed the threads at a rate varying with the tension in the threads. The fabric is passed round a porcupine roller, i. e. a roller having a roughened surface, consisting of coarse emery cloth or the like, which grips the fabric across its whole width. The porcupine roller is generally driven at a constant speed, which determines the linear rate at which the fabric is produced, and the approximate tension under which it is knitted, but it may be driven under a constant torque, so that the fabric is removed from the needles under constant tension. After passing round the porcupine roller, the fabric is wound on to a take-up roller, generally driven by friction wheels.

According to this invention the warp threads are taken from a suitable source of supply by a feeding device, which forwards them at a constant rate to thread guides which lead them to the needles, a tension bar being interposed between the feeding device and the needles to equalize the tension during knitting. In this manner a fabric is produced which is uniform as regards the size of the loops and their shape, since the quantity of thread fed to each loop is uniform.

The warp threads may be taken from any suitable source of supply, such as a creel or a beam, or a number of sectional beams, and the threads may be divided into any desired number of sets, each fed by a separate feeding device, or they may all be fed by a single feeding device. When the warp threads are wound on a beam, or on a number of sectional beams, it may be that the threads have been wound on the beam with some slight irregularity. In this case, all the threads being fed uniformly by the feeding device, any slack threads will be drawn off by the tauter threads

and the slack will accumulate between the beam and the feeding device. Ultimately this accumulated slack may curl on itself and be drawn through the device in a knot, producing a blemish on the fabric. For this reason it is preferred to use a feeding device which will allow the slacker threads to pass through uniformly as they are wound off the beams, so that no slack accumulates. The slackness, which of course is only very slight, will then be distributed along the length of the fabric, where its effect will be negligible.

A convenient form of feeding device for this purpose comprises a pair of constantly driven nipping rollers, of any desired materials, between which the warp threads are passed. In this case the effect may be produced by making on the surface of one or both of the rollers a pattern of grooves or recesses. This causes the pressure at certain points, where the recesses cross the line of nip of the rollers, to be relieved, so that if the thread passing through at such points is slack behind the rollers, the slackness will be drawn through. At the same time nearly all the threads at any moment are nipped by the rollers so that they do not slip through uncontrolledly at once. The points of reduced pressure move along the line of nip so that the threads are successively provided for in this manner. For example either of the rollers may be formed with two sets of helical grooves running in opposite directions to divide the surface of the roller into a series of lozenges, or both rollers may have a single series of helical grooves, running in the same direction on the two rollers so that they cross each other at an angle in the nip of the rollers to produce the equivalent of a lozenge pattern on a single roller. One of the rollers may conveniently be covered with cork, rubber or other elastic material, while the other has a steel or other non-yielding surface. In such case, the grooves are preferably formed in the non-yielding roller. With such rollers the pressure between the steel and the rubber covered rollers may be varied to give a fine adjustment of the rate of feed of the threads.

The take-up of the fabric is preferably arranged to draw the fabric from the needles under constant tension, a constant torque being applied to the porcupine roller round which the fabric passes before proceeding to the take-up roller. A device which takes up the fabric at a constant rate may, however, be used but the rate of take-up must be carefully adjusted to correspond to the rate of feeding the warp threads.

It is convenient that means should be provided in the drive of the feeding device for changing the rate of feed of the threads, so that fabrics having different lengths of loops may be produced. If the fabric is taken up at constant tension, the tension also may be varied for the same purpose, particularly with regard to the proportions of the loops, as to whether they are long and narrow, or rather short and loosely knit. When the fabric is taken up at a constant rate, this rate must be adjusted to correspond to the rate of feeding of the threads, in order that no excess or deficiency of the thread fed to the needles may occur.

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 in no respect limitative.

Figure 1 is a diagrammatic side elevation of a knitting machine provided with feeding means and take-up device according to the invention;

Figure 2 shows a simplified form of fabric take-up device;

Figure 3 shows an elevation of a pair of feed rollers which may be used in carrying out the invention;

Figure 4 is a detailed front view showing several forms of feed roller; and

Figure 5 shows spring loading means for a tension bar.

Referring to Figure 1, warp threads 5, 5' are taken from warp beams 6, 6' through feeding devices which consist of nipping rollers 7, 7' and 8, 8'. One of each pair of these rollers, for example 7, 7' is covered with cork, rubber, or other elastic material while the other is of steel. Means may be provided for adjusting the pressure between the rollers 7 and 8 in order to give a fine adjustment of the rate of feed of the threads by varying the compression of the elastic rollers by the steel rollers.

The two rollers 7, 7' are connected together by means of a chain 10 and wheels 9, 9' and the lower of the rollers, 7' is driven from the drive 11 of the machine by means of a chain 12 and gears 13, the gears 13 being exchangeable for other gears of different sizes in order that the rate of drive of the feeding device may be altered at will, and different types of fabric produced as desired.

The warp threads 5 are forwarded by the rollers 7, 8 to tension bars 14 mounted on spring loaded arms 15. From the bars 14 the threads 5 pass to guides 16 of the knitting machine and are knitted into a fabric 17 by the action of needles 18 and pressers 18'. The fabric 17 passes to a take-up device which is adapted to collect the fabric under constant tension. This comprises a take-up roller 19 having a slipping friction drive roller 19'. Before reaching the roller 19 the fabric passes round a porcupine roller 20, the surface of which is covered with emery cloth or the like which causes the roller 20 to grip the fabric across its whole width. The roller 20 is driven with a constant torque by means of an endless chain 21 passing round a sprocket 22 on the shaft 23 of the roller 20. The chain 21 passes round a further sprocket 24 fitted with a ratchet 25 and a pawl 26. The shaft 27 of the sprocket 24 terminates in a square which enables the sprocket to be rotated by means of a suitable key. In one bight of the chain 21 is a floating sprocket 28 loaded with weights 29 which impart a constant torque to the porcupine roller 20. When the

weight 29 has dropped on account of the rotation of the porcupine roller 20 as it feeds the fabric 17, the chain 21 is wound up by rotating the sprocket 24, and the weight is again lifted, without however relieving the constant torque on the porcupine roller 20.

Figure 2 shows a simplified form of take-up device in which a constant torque is applied to the porcupine roller 120 by means of a chain or rope 121 passing round a sprocket or pulley 122, the chain terminating in a weight 129. The sprocket 122 is connected to the roller 120 through a ratchet 30 and a pawl 31. Thus the roller 120 is urged in a counter clockwise direction under the constant torque imparted by the weight 129. The ratchet 30 and sprocket 122 are, of course, able to rotate in a clockwise direction independent of the roller 120 so as to permit the weight to be wound up at intervals by means of the squared end of the shaft 32 to which the member 122 is secured. The take-up device of Fig. 2 is intended to replace the take-up mechanism represented by the reference characters 20 to 29 of Fig. 1, the porcupine roller 120 occupying exactly the position of the porcupine roller 20 in Fig. 1.

Referring to Figures 3 and 4, one of the rollers 7 and 8 is shown provided on its surface with a recessed pattern, forming grooves or hollows 34 which permit slack threads to pass through the rings of the rollers under the pull of the knitting mechanism, so avoiding accumulation of the slack in front of the rollers. As shown in Figure 3 the top roller 8 is carried on the shaft 48 which passes at each end through a block 49. Adjustment of the pressure between the rollers 7 and 8 may be made by means of a screw 50 bearing upon the upper side of the block 49 and passing through a rigid portion 51 of the machine frame.

In Figure 4 are shown three methods of providing these grooves or recesses in the feed rollers. On the left hand side of the figure the upper roller 8 is plain while the lower roller 7 is provided with helical grooves 35 and 36, the grooves 35 being right hand and the grooves 36 left hand. These combine to produce a pattern of lozenges 37 on the surface of the roller 7. On the right hand side of Figure 4 the roller 7 is plain while the roller 8 is provided with the lozenge pattern. In the middle portion of Figure 4, both rollers 7 and 8 each have helical grooves 38, the grooves in both rollers being right handed. Between the grooves lands 39 are left, the lands of the two rollers co-operating to produce an effect upon the threads as they pass the nip of the rollers; similar to that produced by a pair of rollers one of which is grooved in both directions.

In Figure 5 is shown a detailed elevation of a tension bar. The supporting arm 15 of the tension bar 14 is securely attached to a pivot bar 41 which carries at a point beyond the arm 15 a rearwardly extending member 42. The member 42 is perforated for the passage of the rod 43 which is surrounded by a compression spring 44. This spring acts between the extension 42 and lock nuts 45 on the rod 43 and so resists downward movement of the bar 14 under the tension of the warp. The lower end of the rod 43 is pivoted at 46 to a suitable part of the machine frame (not shown). It will be understood that the other tension bar 14' is similarly provided.

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

1. A warp knitting machine comprising a pair of nipping rollers adapted to be driven at a constant speed so as to feed the warp threads

at a substantially constant rate to the needles of the machine, wherein one of said rollers is provided with a number of helical grooves running in opposite directions along its surface and forming a lozenge pattern thereon so as to provide an interrupted line of contact between the rollers which permits any slack threads to be pulled therethrough by the tension imparted to the threads during knitting, and means interposed between the feed rollers and the needles to maintain the tension in each thread substantially constant during knitting.

2. A warp knitting machine comprising a pair of nipping rollers adapted to forward the warp threads at a substantially constant rate to the needles of the machine wherein both said rollers are provided with a number of helical grooves adapted to cross each other at the nip of the rollers so as to provide an interrupted line of contact between the rollers which permits any slack threads to be pulled therethrough by the tension imparted to the threads during knitting, and means interposed between the feeding means and the needles to maintain the tension in each thread substantially constant during knitting.

3. A warp knitting machine comprising means for feeding warp threads at a substantially constant rate to the needles of the machine, said means being such as to permit any slack threads to be pulled therethrough by the tension imparted to the threads during knitting, means interposed between the feeding means and the needles to maintain the tension in each thread substantially constant during knitting, and a take-up device adapted to draw the fabric from the needles under constant tension, said take-up device comprising a porcupine roller for drawing the fabric from the needles, an endless chain passing over a sprocket on the porcupine roller and over a second sprocket rotatable in one direction only, said chain being loaded to impart a constant torque to the porcupine roller, and a take-up roller adapted to collect the fabric delivered from the porcupine roller.

4. A warp knitting machine comprising a pair of nipping rollers adapted to forward the warp threads at a substantially constant rate to the needles of the machine wherein at least one of said rollers has its surface relieved to interrupt the line of contact between the rollers at points that move along the line as the rollers rotate, the interruption thus permitting the slack in any thread to be pulled through the nip of the rollers at intervals by the tension imparted to the threads during knitting, and means interposed

between the feeding means and the needles to maintain the tension in each thread substantially constant during knitting.

5. A warp knitting machine comprising a pair of nipping rollers adapted to forward the warp threads at a substantially constant rate to the needles of the machine wherein at least one of said rollers has its surface relieved to interrupt the line of contact between the rollers at points that move along the line as the rollers rotate, the interruption thus permitting the slack in any thread to be pulled through the nip of the rollers at intervals by the tension imparted to the threads during knitting, and a loaded tension bar interposed between the feeding means and the needles to maintain the tension in each thread substantially constant during knitting.

6. A warp knitting machine comprising a pair of nipping rollers adapted to be driven at a constant speed so as to feed the warp threads at a substantially constant rate to the needles of the machine, one of said rollers having a yielding surface, means for adjustably pressing the rollers together so as to control the feed rate of the threads, at least one of said rollers having its surface relieved to interrupt the line of contact between the rollers at points that move along the line as the rollers rotate, the interruption thus permitting the slack in any thread to be pulled through the nip of the rollers at intervals by the tension imparted to the threads during knitting, and means interposed between the feeding means and the needles to maintain the tension in each thread substantially constant during knitting.

7. A warp knitting machine comprising a pair of nipping rollers adapted to forward the warp threads at a substantially constant rate to the needles of the machine wherein at least one of said rollers has its surface relieved to interrupt the line of contact between the rollers at points that move along the line as the rollers rotate, the interruption thus permitting the slack in any thread to be pulled through the nip of the rollers at intervals by the tension imparted to the threads during knitting, means interposed between the feeding means and the needles to maintain the tension in each thread substantially constant during knitting, and a take-up device adapted to draw the fabric from the needles under constant tension.

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