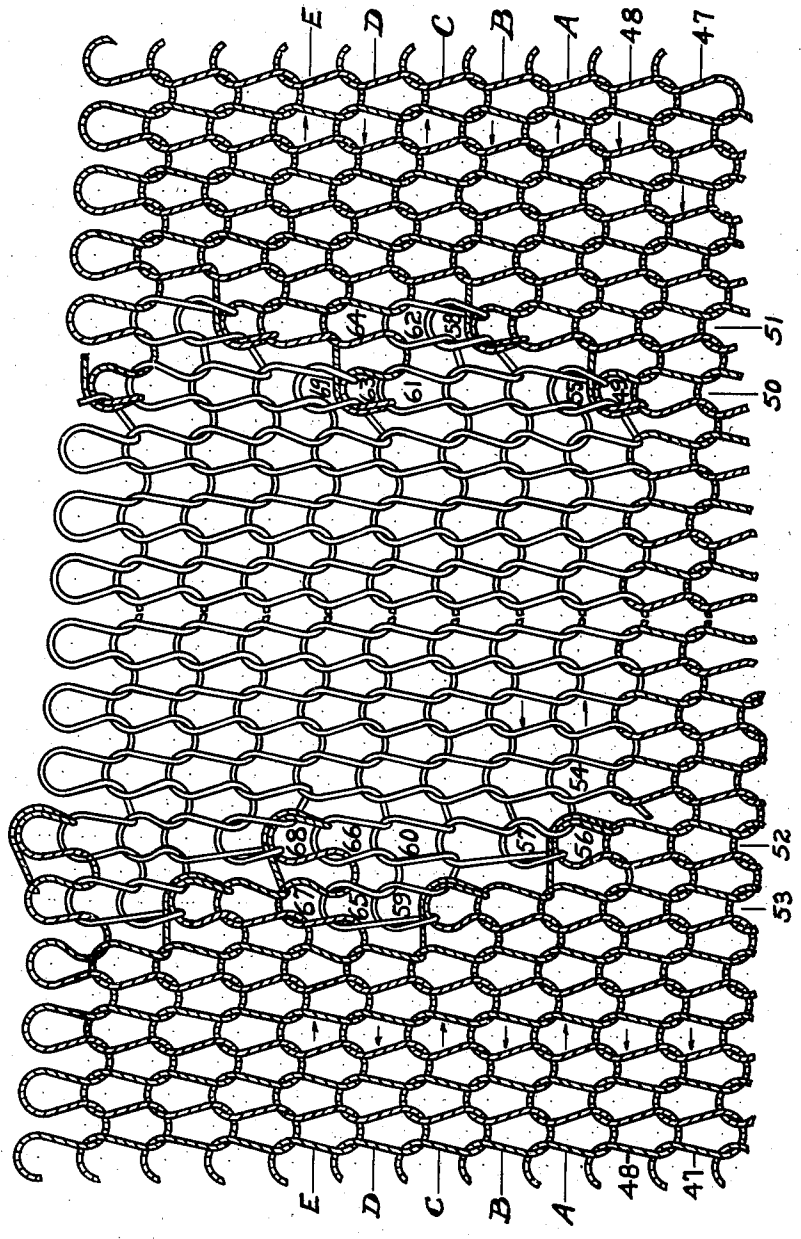
May 16, 1939. R. H. LAWSON ET AL 2,158,189

KNITTED FABRIC, METHOD, AND MACHINE

Filed May 21, 1937 4 Sheets-Sheet 1

FIG. 1.



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KNITTED FABRIC, METHOD, AND MACHINE

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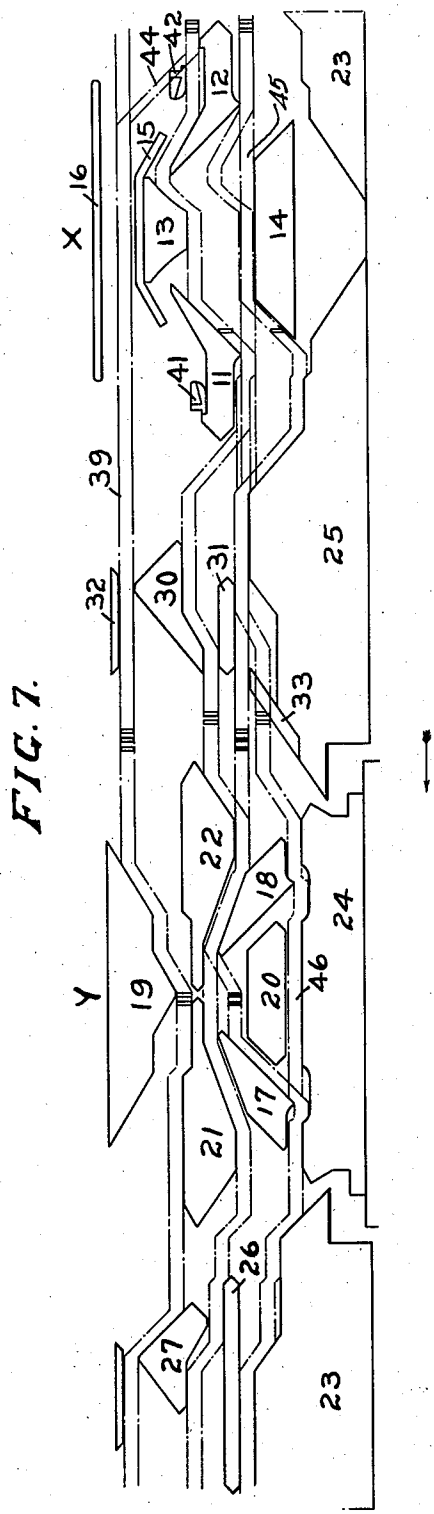


FIG. 7.

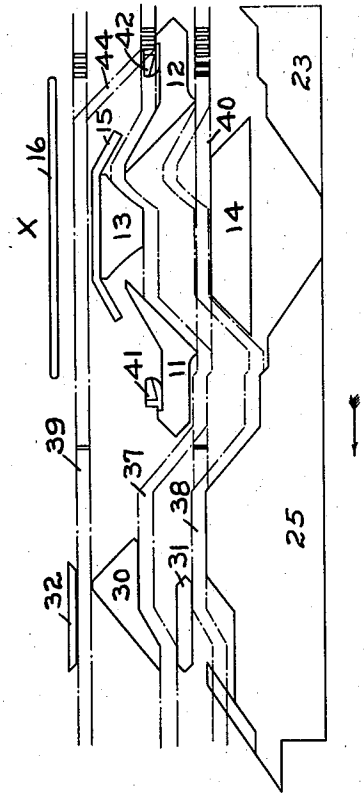


FIG. 5.

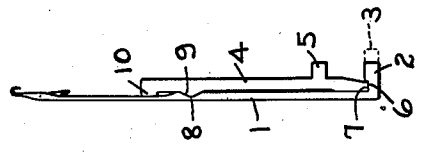


FIG. 2.

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KNITTED FABRIC, METHOD, AND MACHINE

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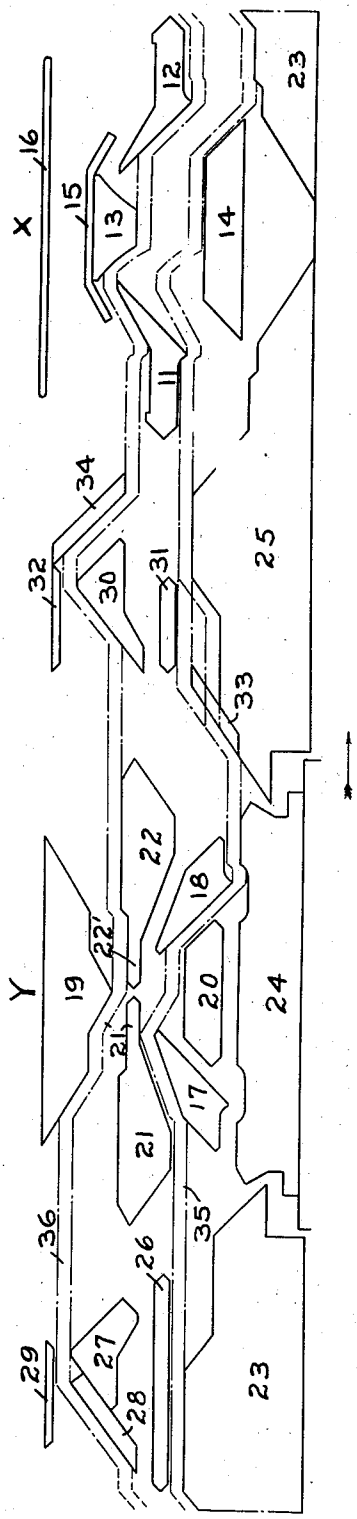


FIG. 3.

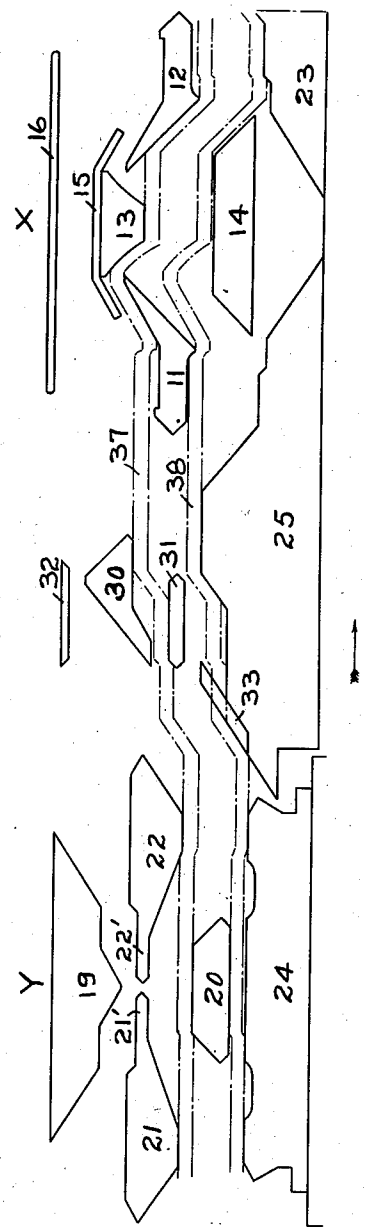


FIG. 4.

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KNITTED FABRIC, METHOD, AND MACHINE

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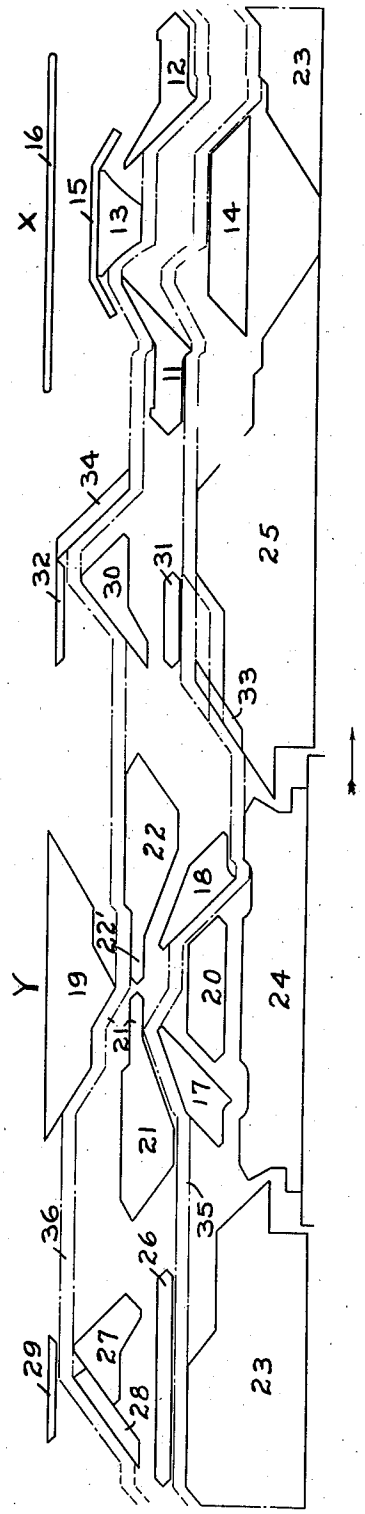


FIG. 3.

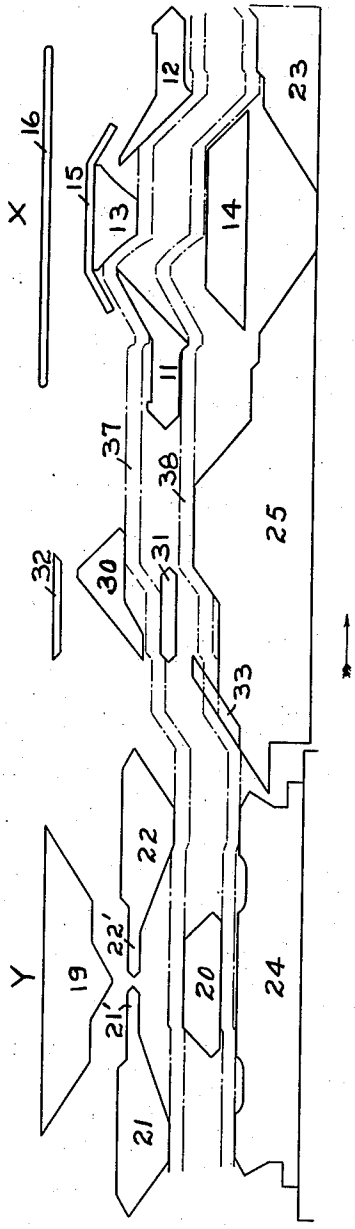


FIG. 4.

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KNITTED FABRIC, METHOD, AND MACHINE

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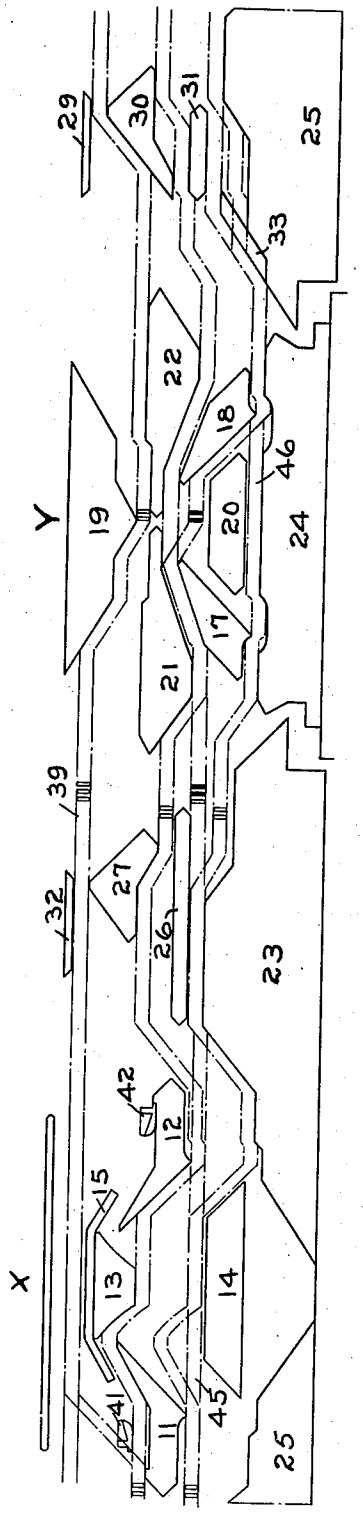


FIG. 8.

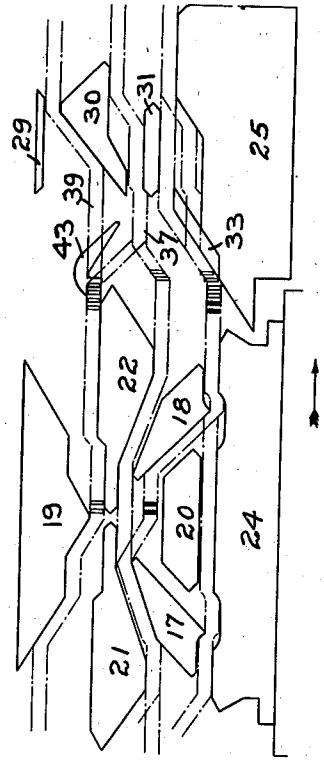


FIG. 6.

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Patented May 16, 1939 2,158,189

UNITED STATES PATENT OFFICE

2,158,189

KNITTED FABRIC, METHOD, AND MACHINE

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Application May 21, 1937, Serial No. 144,007

8 Claims. (Cl. 66—43)

This case concerns a new suture for knitted fabrics and the method of knitting the same. The suture is more or less interconnected with a particular method of knitting as results from use of a needle and jack such as forms the subject matter of copending application Ser. No. 695,154, now Patent No. 2,127,178.

In the figures of drawings:

Fig. 1 shows a section of knitted fabric comprising two parts joined by a suture knitted in accordance with the invention;

Fig. 2 is a detail showing the needle and jack used for the knitting of the fabric of Fig. 1;

Fig. 3 is a diagrammatic view showing the cam arrangement on a machine adapted to knit the fabric of Fig. 1, said view illustrating the knitting during straight-away or rotary work and during double feed knitting;

Fig. 4 is a similar view showing knitting in the heel or toe;

Fig. 5 is a similar view showing the knitting in the heel or toe and illustrating the narrowing movement;

Fig. 6 is a similar view to Fig. 5 showing the widening movement;

Figs. 7 and 8 are views diagrammatically showing the knitting in split-work to produce the fabric of Fig. 1, Fig. 7 showing knitting in a clockwise direction and Fig. 8 in the reverse or counter-clockwise direction.

In copending application Ser. No. 695,154 a needle and a jack have been shown and claimed over which the needle and jack shown in Fig. 2 herein are an improvement, although the principles applying are very much the same. This case is primarily directed to the knitting of split work with such a needle and jack and incidentally, to the knitting of a better suture which results from the particular mode of operation with the needle and jack as hereinafter described.

The suture itself is characterized by a pleasing appearance, unusual strength and lack of openings or eyelets such as very frequently detract from the appearance and strength, or at least from the apparent strength, of such knitted fabrics. The suture is flat, that is, does not present a raised appearance on the fabric and is not easily discovered except wherein the two halves of the fabric are of different materials thus making it possible to find the dividing line without the eye being drawn to the seam itself. The suture does not present any open appearance such as is characterized by the usual eyelets, the needles knitting on each stroke of knitting and not merely wrapping the yarn about the shank as is sometimes done. No auxiliary mechanism is necessary to avoid the formation of an eyelet at the change from rotary knitting to split work.

For purposes of describing the suture itself and the manner of making it, it has been thought best to illustrate the operation of the machine as is most satisfactorily done by means of diagrammatic views showing the knitting throughout the various phases. Referring to Fig. 2, a needle 1 which is preferably of the usual latch type, this invention applying to independent needle machines, has a butt 2 at its lower end. Some of these butts are to be short butts as shown in full lines, while other needles will have long butts 3 as illustrated by the dotted lines, Fig. 2. The long butt needles will occupy a position about substantially one half the circumference of the machine while the short butt needles will fill the remainder of that circumference. The long butt needles will correspond to the so-called instep side as is the usual practice and the short butt needles will be associated with the heel and toe and the sole of the stocking. Of course, any convenient number of these long and short butt needles may be arranged about the machine depending upon the size of heel and/or toe to be knitted, and upon other considerations such as will be evident to those skilled in the art. Each needle has a jack 4 intimately associated therewith, each of these jacks having a butt 5 by means of which movements may be imparted to the jack or to both jack and needle as will be explained more fully. The butts 2 and 3 as the case may be are cut out as shown at 6 to receive the lower end 7 of the jack and each needle is notched as at 8 to receive a correspondingly beveled projection 9 on the jack, this projection and notch serving to impart movement to the needle in accordance with the movements imparted to the jack in the event the jack is maintained in cooperating relationship with the needle as illustrated in this Fig. 2 but allowing the jack to be moved without moving the needle as is done at many phases throughout the knitting cycle and as will be explained in full as this description progresses. A projection 10 at the upper end of the jack bears against the shank of the needle and serves to maintain needles inwardly in their slots under influence of the usual springs (not shown). The angle of the beveled projection 9 and cooperating notch 10 is such that under normal circumstances, that is, while the instrumentalities are frictioned within their slots in the usual way, movements of either the jack or needle will impart corresponding movements to the

other instrumentality, however, the angle allows an easy disengagement of the jack from the needle when desired. To prevent accidental disengagement, certain cams are so formed about the machine as positively to hold the jack inwardly against the needle so that the two can not be disengaged at undesired times. The notch 8 and projection 9 are so constructed that there is a clearance on the lower beveled side. The bearing between the cooperating parts of the jack and needle is actually limited to the contact between the parts 6 and 7 and the upper beveled edge of the projection 9 as it engages the notch 8. When the jack is raised or disengaged from working connection with the needle, the part 10 will push inwardly on the shank of the needle and will convey to the needle the pressure exerted by the usual retaining springs.

While the copending application Ser. No. 695,154 mentioned above, clearly described certain types of knitting in detail, the split foot machine and method of knitting on the same has sufficient complications to make the entire method rather difficult to retain in mind, and it is deemed advisable to describe rather briefly the method of knitting in straight rotary work and in the heel and toe before entering into a description of the knitting in split work. All this will serve more satisfactorily to disclose the entire subject matter of the invention.

Referring to Fig. 3, the cams which are employed in the machine have been illustrated diagrammatically and the pathway of needle butts and jack butts have been shown as the needles and jacks pass through these cams while knitting rotary work, such as in a welt, ring top, leg, ring toe, etc. It is a novel and useful characteristic of this split foot machine that it is very easily adapted to double feed knitting during rotary work. Fig. 3 shows knitting in the straight-away at both the main and auxiliary feeds although it is to be understood that the parts of the stocking knitted in this manner may be knitted at either one of the feeds from a single yarn. It is probably more desirable to knit some of the rotary portions of the stocking at the main feed and other portions at the auxiliary feed, for instance, the leg and instep will generally be knitted from the same yarn, and for this reason, the leg may be knitted at the auxiliary side so that the instep can be knitted from the very same yarn. Of course, if double feed knitting is employed, the leg will be knitted from two yarns alternating in courses while the instep will be knitted from one of the yarns. The diagrammatic views herein shown represent the cams which are placed about the cylinder of the machine as they would be seen from the outside so that Fig. 3 shows knitting in a counter-clockwise direction, the usual practice.

The machine is to have a so-called main or regular cam set and an auxiliary cam set, these sets being identified by the letters X and Y. The main cam set X includes knitting cams 11 and 12, a guard cam 13 and a center raise cam 14. An auxiliary guard cam 15 having a downwardly inclined wing at either end is used in conjunction with the center guard cam 13, these wings serving to align the butts 5 of raised jacks in the event of improper action such as might result from jacks being too loosely frictioned within their slots. It is a characteristic of the particular mode of knitting herein practiced that the knitting cams 11 and 12 at the main feed function upon jack butts 5 to control needles while at the auxiliary feed Y, the knitting cams function upon the needle butts 2 and 3 to control the needles directly. Thus it may be seen that at the main feed jacks 4 must be held inwardly against the shanks of their needles to prevent accidental disengagement of the jack from its needle. The lower end of the jack will be retained in place as the end 7 fits within notch 6; the upper end of the jack will be held inwardly in a normal operating position by means of an elongated retaining element 16.

At the auxiliary feed Y the arrangement of cams is much less conventional when compared to the auxiliary cams of the usual split foot machine than are the cams at the main feed. Knitting cams 17 and 18 function upon butts 2 and 3 of needles to cause those needles to rise to a yarn taking position and thereafter to be drawn down to knit. A center cam 19 functions upon jack butts only to bring jacks down to a position wherein they meet needles raised by one or the other of stitch cams to engage the same and thereafter to lower needles slightly so as to be projected into a pathway of the second stitch cam and to be drawn downwardly. In this respect the center cam 19 has the usual function of a center cam differing only in that its effort is imparted to a jack and thence from the jack to the needle. A center raise cam 20 functions in the usual manner.

Two additional cams 21 and 22 prevent excessive upward movement of the needles and the ends 21' and 22' of these cams serve to hold the jacks at such times as the corresponding stitch cam 17 or 18 moves the needles downwardly to draw stitches and at the same time to become disengaged from the jacks. After disengagement these cams 21 or 22 will raise the jacks slightly to be guided within an intermediate pathway prior to contact with other cams.

The cams 23, 24 and 25 are raise cams which perform more or less the usual function of such cams and incidentally maintain the needles in such a position between knitting stations that the latches of the same will be held open by means of the last drawn stitches or as disclosed in copending application Serial No. 695,154.

Before reaching the auxiliary cam set Y needles and jacks pass through a series of cams 26, 27, 28 and 29. Jacks are separated from needles at this position, and although the separation may not be necessary there may be more or less of idle movements during some phases of knitting which are essential to the entire construction and method of operation. The cam 26 serves to hold needles downwardly while cam 28 raises jacks to effect a separation. Cam 29 merely prevents any overthrow of the jacks and serves to align them for proper contact with center cam 19. Cam 27 is essential to some phases of straight-away knitting, and is essential during clockwise movements in split work. Cam 21 is always in position while cam 28 is constructed and arranged for being projected into a position to engage butts 5 or to be withdrawn to an inactive position. Such a movement may be taken from any satisfactory drum or similar control on the machine.

Another group of cams is positioned in front of the main cam set X and comprises stationary cams 30, 31 and 32 and movable cams 33 and 34. Cam 30 functions upon jacks in both rotary and reciprocatory work in certain instances while cam 31 merely serves the purpose of holding needles down while jacks are separated from

which control long butt needles and back. On the first clockwise move of the cylinder the narrowing picks are brought into action and pick 42 will engage the leading short butt needle jack and raise it in pathway 44 to the group moving in pathway 39. This means that the corresponding needle acts as a long butt needle and will knit on the auxiliary side. The widening picks have not been brought into action at this time.

During the next counter-clockwise movement the leading short butt needle at the opposite side will be picked up by the narrowing pick 41. Then this short butt needle will knit in the long butt group at the auxiliary side so that at this stage, we have a short butt needle at either end of the group knitting at the auxiliary side with the long butts.

On the second clockwise stroke, that is, the third stroke in the split foot part, the jack of the second short butt needle is picked up by pick 42 so that there are two short butt needles at this side which are to knit with the long butt group. Of course, the first short butt needle at the opposite side is still knitting with the long butts and on this stroke will be the last needle to knit in the long butt group.

On the next counter-clockwise stroke, the fourth stroke in the split foot part, the second short butt needle is likewise caused to join the long butt group as its jack is picked up by pick 41; at this time we have two short butt needles at either end of the series knitting with the long butt needles at the auxiliary side. On this counter-clockwise stroke the widening pick 43, Fig. 6, will engage two jack butts at the head of the group of jacks which are passing in pathway 39 and will lower them to the pathway 37 where they will join the rest of the jacks which are identified with short butt needles. This means that those short butt needles which knitted on this counter-clockwise stroke at feed Y will immediately knit again with short butt needles as they pass through feed X. The effect of this will be pointed out in the fabric when that is described to tie the same in with the description of operation.

On the next stroke, the needles move in a clockwise direction and the first short butt needle jack, one which was just picked down by pick 43, will be raised by the pick 42 and its needle will immediately start knitting in the long butt group. On this same stroke the opposite widening pick (not shown) will bring down the two jacks at the opposite side of the group to join their short butt needles. These needles will likewise knit at both the auxiliary and main feeds on the same stroke.

On the next counter-clockwise stroke the first short butt needle jack will again be picked up by pick 41 and from this point on, the knitting will merely be repeated picking up the second short butt needle jacks at either side until we have two short butt needles knitting with the long butt group at either side of the fabric, and then bringing them down with the widening picks and repeating again. This results in repeats every four courses.

It makes no difference what yarns are used or whether the leg yarn knits at the feed X or Y, or whether double feed knitting was in operation except at the start of knitting the split part of the fabric. Once the suture is started these repeats at every four courses will continue until rotary work is resumed. We have described one method of knitting and one way of going from rotary work to split work; that is deemed sufficient for the purpose of this case to teach the knitting of the suture and the manipulation and arrangement of cams and picks for controlling the needles and jacks in a manner which is entirely distinct from anything we know of being practiced heretofore.

We will now describe the fabric itself as illustrated in Fig. 1. This figure shows a conventional representation of portions of the fabric at either side including the sutures and also shows the change from rotary work to split work. Courses 47 and 48 will be the last courses knitted in the rotary work, the course 48 ending at loop 49 knitted on the last short butt needle passing through the cams in a counter-clockwise direction. In accordance with the preceding description, it was during this last counter-clockwise revolution of the machine that the long butt needles were caused to pass through beneath the cams at the main side of the machine as their jacks were raised to an inactive level. The loop 49 knitted on a short butt needle determines the start of knitting split work, and from this point on, the instep will be shown as knitted from a yarn which is not cross-hatched while the high splice or sole portion is represented as knitted from a yarn which is cross-hatched for purposes of distinction. The fabric is shown greatly enlarged and includes only a few wales at either side of the knitted suture.

The sutures are formed by special manipulation of the two needles knitting at either end of the short butt group, and the wales knitted by these needles are designated as 50, 51 and 52, 53. At the first clockwise stroke, course A is knitted, the short butt needles knitting the cross-hatched yarn at the main side of the machine while the long butt needles knit the plain yarn at the auxiliary side. The plain yarn is herein shown as taken by the first long butt needle passing through the auxiliary side knitting in loop 54, but as before stated, this is merely for showing a simple form of the invention, since in actual practice jacks or the like would be used to bring up about two or three of the short butt needles at that side so as to form a suitable lap of the yarns, although there is no noticeable eyelet formed by the method shown. The loop 49, the last loop drawn on the termination of rotary work, or rather the needle drawing that loop, has the yarn wrapped about the shank at the start of knitting the clockwise stroke and then the short butt needles knit their part of course A, but the needle knitting wale 50 is picked up by the narrowing pick at the start of knitting this course so that the loop 55 just above loop 49 in wale 50 is knitted, not at the main side, but at the auxiliary side and from the yarn feeding at that side of the machine. It is to be noticed that at this particular part of course A the course is stepped up so that at the right hand side of Fig. 1, course A appears to be in a plane somewhat higher than the plane of the rest of the course. A similar distortion prevails throughout the entire fabric, but is not apparent in the finished article as it is in the conventional representation wherein loops are shown greatly enlarged.

On the next course in the opposite or counter-clockwise direction, course B, the needle knitting in wale 50 still knits at the auxiliary side and in addition, the end short butt needle at the opposite side which knits in wale 52 and had just knitted loop 56 does not knit again at the main side in course B, but is picked up to knit with the long butts at the auxiliary side and knits loop 57 at that side of the machine. At this point

we have wales 50 and 52 being knitted by the end short butt needles as though they were long butts at the auxiliary side.

The next course C is knitted in a clockwise direction and the needles knitting in wales 52 and 50 still knit in the long butt group at the auxiliary side. The second from the end short butt needle will have its jack picked up on this stroke so that the loop 58 is knitted of the instep yarn and at the auxiliary side. This loop 58 is knitted in wale 51, thus two needles at that side of the machine are caused to knit at the auxiliary side, their jacks having been picked up and passing in the pathway 39, Fig. 7. It can be seen from an inspection of Fig. 1, that due to distortion, the part of the course C which is knitted at the main side or at the sole or high-splice has gained or is stepped up above the part of the course which is knitted at the instep.

Now referring to course D knitted in a counter-clockwise direction, the needles knitting wales 50 and 51 knit again at the end of the long butt group. The second short butt needle at the opposite side, that is, the needle knitting in wale 53 is picked up and knits at the auxiliary side from the instep yarn along with the needle knitting in wale 52. These two needles knit loops 59 and 60 in wales 53 and 52 respectively. The needles knitting the wales 50 and 51, as was explained with respect to the second counter-clockwise stroke of reciprocation, knit at both sides of the machine on this particular reciprocation. They knit the loops 61 and 62 from the instep yarn at the auxiliary side, then encounter a widening pick, or rather, the jacks encounter the widening pick, so that those needles are returned to effective knitting at the main side. This occurs between the auxiliary and the main side and at such a time as to cause those needles to knit again drawing loops 63 and 64. At this time the needles knitting wales 50 and 51 are returned to the position they occupied at the start of the cycle.

In course E drawn in a clockwise direction the needles knitting in wales 53 and 52 will likewise draw loops 65 and 66 at the auxiliary side and from the instep yarn, then will have their jacks picked down and will knit over again on the same stroke drawing loops 67 and 68 at the main side of the machine. On this stroke the needle knitting wale 50 will again encounter the narrowing pick and will be returned to the long butt side so that it will draw its loop 69 at the auxiliary side. From an inspection it can be seen that course E corresponds to course A, in other words, the cycle started with course A and a similar cycle starts with course E. The only distinction is that the instep yarn was introduced in course A while there will be no yarn change throughout the remainder of the split work in the usual instance. By following through the fabric it can be seen that the remainder of the courses shown will merely duplicate courses B, C and D and it is not considered essential to explain more than one cycle.

No change of yarn at the high-splice or sole side has been shown in this illustration, although it is contemplated to knit from a different yarn at that side, but not absolutely necessary. The change would involve no more than a simple yarn change and has not been illustrated for purposes of clearness and to avoid the showing of any more than is absolutely essential to illustrate what is new in the case.

The suture which has been illustrated herein is confined to two wales and continues along the same two wales, however, variations may be apparent to those skilled in the art, and are contemplated by the inventors, which variations include sutures produced in a single wale or in more than two wales. Also the suture may be produced in any of its forms but is not necessarily confined to the same wales throughout the length of the fabric. As in the knitting of a tapered high-splice or a cradle-sole, the suture may progress across the wales to form a diagonal line, this being controlled by the drum control for the widening picks, for example the suture may be knitted by narrowing for three courses in succession and then bringing the widening picks into action for one course thereby gaining a wale every time the cycle is repeated. Other schemes will be apparent and are obviously included within the invention.

The invention has been described in more or less specific terms and with illustration of one particular form of the same, however, changes may be made which would be apparent to those skilled in the art without departing from the scope of the invention as originally conceived. The invention is defined in the following claims.

We claim:

1. A method of knitting a suture including the steps of feeding separate yarns at two feeding stations and controlling needles to knit at one feeding station at some of the courses and at the other feeding station at other courses by picking jacks associated with the needles to and from an active relationship with their respective needles.

2. A method of knitting a suture including the steps of feeding separate yarns to a bank of needles at different feeding stations and causing some of the needles knitting predetermined wales to draw their loops first at one station and then at the other station, and determining the station at which said needles knit by picking jacks associated with each needle to and from an active relationship with that needle.

3. In the process of knitting a suture by causing suture needles to knit alternately from one yarn and then another yarn and interlocking the stitches thereof, the step of picking needle controlling jacks to and from a needle engaging and controlling position and at one of the stations causing said jacks to move their respective needles to draw stitches.

4. A method of knitting split work including the knitting of separate yarns at two distinct feeding stations, controlling some of the needles to knit a suture by interlocking loops of the two yarns while knitting alternately at one feeding station and then the other, and controlling said needles knitting at one station and thereafter at the other by means of needle controlling jacks including the steps of separately picking jacks to an inactive position and thereafter picking a plurality of jacks to an active position.

5. A method of knitting a suture of split work including the steps of picking needle controlling jacks to and from active relationship with their respective needles, said picking of the jacks including the picking of single jacks on consecutive strokes to function with one group of the knitting needles and thereafter picking as many jacks as have been moved from one group to the other back to original position and then repeating the cycle.

6. A needle and jack in combination, said needle and jack each having a butt, said jack and needle being provided with an operating connection therebetween including interlocking parts at

the lower end of the jack and at the butt of the needle and other interlocking connections adjacent the upper end of the jack.

7. A combined jack and needle adapted at times to be operated as a unit and at other times to be separated and to function in a disconnected manner, both the needle and jack having a butt individual thereto, an interlocking connection between the bottom of the jack and the needle to prevent transverse movement of the jack with respect to the needle, and an interlocking connection at the top of the jack functioning with the needle to impart longitudinal movements of the jack to the needle.

8. A combined needle and jack as defined in claim 7, wherein the interlocking connection between the jack and the needle functioning to impart longitudinal movement to the needle is formed in such a manner as to allow separation of the jack from the needle when the needle is held and the jack is forced upwardly as described.

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