METHOD OF AND APPARATUS FOR REPAIRING FABRICS

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This invention relates to a method of and apparatus for repairing fabrics and more particularly for repairing runs, ravel, dropped stitches, and the like, in knitted goods such as hosiery, underwear, and similar articles.

The object of the invention is to provide a simple and efficient method, and a practical apparatus for carrying out the same of repairing runs, ravel, dropped stitches, and the like, in knitted fabrics, such as hosiery, underwear, and similar articles.

A further object is to provide a method and apparatus of the nature referred to which enables the repair of knitted fabrics to be effected quickly, easily and automatically without requiring the expenditure of tedious toil, care, or skilled attention on the part of the operator in carrying out the method.

A further object is to provide a simple, efficient, and easily constructed and operated apparatus of the nature and for the purpose referred to and which is economical to manufacture and reliable in operation.

Other objects of the invention will appear more fully hereinafter.

The invention consists substantially in steps and operations, and in the construction, combination, location, and relative arrangement of parts, all as will be more fully hereinafter set forth, as illustrated in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings, and to the various views and reference signs appearing thereon,—

Figure 1 is a view partly in side elevation and partly in vertical, longitudinal central section, of one form of apparatus embodying our invention and suitable for use in carrying out the method of operation in accordance with the principles of our invention.

Figure 2 is a broken view in top plan of a form of apparatus for automatically presenting, in step-by-step or successive order, the transverse threads of a run in a stocking, for example, to the action of automatically acting devices for forming said successively presented threads into loops and interengaging said loops together, and of feeding devices for the fabric, the fabric supporting cover or saddle being removed.

Figure 3 is a broken view in horizontal section on the line 3—3, Figure 4, looking in the direction of the arrows, showing the structure of Figure 2 in top plan with the cover or saddle in place.

Figure 4 is a similar view in central longitudinal section on the line 4—4, Figure 3, looking in the direction of the arrows.

Figure 5 is a view in vertical transverse section on the line 5—5, Figure 4, looking in the direction of the arrows.

Figures 6, 7, 8, 9, 10, and 11 are diagrammatic views illustrating the successive steps employed and mode of operation involved in effecting a repair of a fabric in accordance with our invention.

Figure 12 is a detached detail view in elevation of a portion of the apparatus concerned in successively presenting the transverse threads of a run, for example, into proper relation for the action of the loop forming and interengaging operations to be performed.

Figure 13 is a view in diagram of a portion of fabric to be repaired and illustrating the manner of repairing the same in accordance with our invention.

Figure 14 is a detached detail view of a form of looping tool or needle capable of use in connection with the apparatus and in carrying out the method of our invention.

The same part is designated by the same reference character wherever it occurs throughout the several views.

It is a common practice for commercial establishments engaged in the manufacture or sale of fabric products, particularly of products made of knitted fabrics, such, for example, as hosiery, underwear, and the like, to extend to the customers of their products the offer to repair any run, ravel, dropped stitch portion, or the like, occurring in the use by such customers of the purchased article. This practice has grown to be an important feature of many of the larger establishments inasmuch as it enables the establishment to make good on its repair offer and materially aids in satisfying and retaining its customers. The usual method heretofore employed in effecting the repair
of the fabric product from the effects of a run, ravel, dropped stitching, or the like, has been to manipulate by hand a specially constructed tool somewhat similar to a darning needle to effect the reestablishment of the interlooped relation of the threads of the fabric which cross the run, raveled or dropped stitch portion of the product to be repaired. This method is exceedingly tedious and slow, requiring patient toil and wearying physical concentration and labor, and the exercise of skill. By reason of these conditions this repair work is slow and expensive.

It is among the special purposes of our present invention to overcome these difficulties and to provide a method of repair of articles made from knitted fabrics, or of the repair of runs, ravel, dropped stitching, or the like, occurring therein which is exceedingly simple, efficient, expeditious, economical and automatic, and also to provide a form of apparatus suitable for carrying out said method which, likewise, is simple, efficient, and economical to manufacture, and which does not require any special skill to operate it in carrying out the method of our invention.

In accordance with the method of our invention we propose to successively pick up and form a loop in each successive thread of the fabric which extends transversely across the run, ravel, or the like, to be repaired and to interengage the successive loops each with the next succeeding one, the fabric being advanced step by step in predetermined timely relation to the loop forming operations, the successive transverse threads being properly spaced and presented in such spaced relation to form the loops and to permit the one loop to interengage with the next succeeding one, the entire operation being accomplished automatically in the several steps thereof.

While we have shown and will describe a structure of apparatus suitable for carrying out these automatic operations, and which we have devised for the purpose, it is to be understood that in the broad concept of the method of our invention, the manner of carrying it out is not dependent upon any specific mechanical structure. The essential steps of the method are, as above indicated, the successive looping of the individual threads which cross the run, ravel, or the like, the interengagement of the successive loops, the proper and timely successive spacing and presentation of the threads to be formed into loops, the feeding or progression of the fabric, and the proper tensioning of the interengaged loops, all these operations and steps being carried out and accomplished automatically and in timed relation to each other. So far as the carrying out of our method is concerned the particular structure of tool or needle employed to form a loop in each succeeding thread is immaterial, as is also the means for spacing and presenting the successive threads so as to be formed into loops and the means for the feeding or progressing of the fabric, and for tensioning the interengaged loops. In accordance with our invention we propose to utilize the combined action of spacing of the successive threads, the formation of the successive loops and the automatic progression of the fabric, all in timed relation to each other, to cause each loop to be formed through one or more of the precedingly formed loops, thereby effecting the interengagement of the successive loops.

For the purpose of explaining the nature of our invention, and the manner in which and a form of apparatus by which the same may be carried out, we will refer to a run in a stocking as being the repair to be made. It is to be understood, however, that our invention is equally well adapted for repairing ravel, dropped stitches and other equivalent defects existing or developing in fabrics whether such articles be stockings, under-wear, or otherwise.

In Fig. 1 we have illustrated a portion of a fabric, such, for example, as a stocking, having a run to be repaired, as indicated at 80, with threads C extending transversely across the run. Now, in carrying out our improved method of repairing we form a loop, as indicated at b, in the first transverse thread c where the repair operation is to commence. This loop, in carrying out the operation, is formed by picking or lifting up the thread out of the plane of the fabric, as indicated in Fig. 7. While this loop is being raised and held in raised position the fabric is advanced a definite space ahead and the next succeeding transverse thread c is brought within the area of the loop b, previously formed, and is also definitely spaced apart from the next succeeding transverse thread. The previously formed loop b is then released and another loop is formed in the next succeeding transverse thread c, which last mentioned loop while being raised or lifted is drawn through the previously formed loop b, as indicated in Fig. 11. While this operation is proceeding the fabric is again advanced another definite step and the next succeeding transverse thread is spaced definitely ahead of the one which succeeds it and within the area of the loop last to be formed. The operation thus continues in uniform and successive steps of advancement of the fabric, of spacing of the transverse threads, of forming the loops and interengaging them successively with each other, until the end of the run is reached when the operation is stopped and the repair finished in the usual manner by hand stitching. By applying suitable
tension in carrying out these several steps, the fabric is restored to its original condition, it being practically impossible to distinguish therein where the repair was made.

We regard as important features of our process the consecutive advancement of the fabric a definite and predetermined distance during the formation of each loop, the uniform spacing apart of the successive threads preparatory to the formation of the loop therein, and the formation of each succeeding loop through one or more preceding loops under a regulable, substantially uniform and constant tension, which features and characteristics contribute to the accomplishment of the best results.

Having described our improved process of repairing fabrics, and the various features and characteristics thereof, we will now describe a structure of apparatus which we have devised for carrying out the same.

This apparatus, in the form shown in the drawings as illustrative of the principles involved, and of the best form in which we at present contemplate carrying out our invention, includes, generally, a base 1 from which rises a hollow frame 2 having upper and lower laterally projecting arm portions 3 and 4 as shown in Figure 1. The upper arm 3 terminates in a head 5 through which a tubular member or sleeve 6 is mounted to slide. A floating rod 7 is mounted in said member 6. At one end the rod 7 is provided with a head 8 in which the loop pick up or needle member is suitably clamped as by means of a set screw 10. At its other end said rod 7 carries a lifting cam 11 pivoted thereto, as at 12, and bearing against the adjacent end of the member 6. A spring 13 is located between the head 8 of rod 7 and the adjacent end of the sleeve 6 and exerts a tension upon rod 7 whereby the cam 11 is firmly held against the opposite end of sleeve 6.

The tool or needle is constructed, in this instance, as illustrated in Fig. 14. The particular structure of the tool or needle illustrated has been found especially suitable for use in the machine when employed for repairing runs in hosiery. Other structures may be used for other classes of fabrics. The needle here shown comprises, in general, a hook-shaped member 15, having a shank portion 9 and a latch member 17 pivotally operating therewith. The latch member 17 is normally held under the influence of a slight spring tension applied thereto by means of a spring 8 fitted into a slot in the shank 9 of the needle behind the pivoted end of the latch. Adjacent the hook portion 15 the shank is inclined at an angle as at 16. It has been found in practice in this particular type of needle for repairing runs in hosiery, that the angle of the portion 16 of the shank of the needle member should be preferably about 45 degrees. The latch member 17 should be of such a length that when it is closed upon the bill of the hook portion 15 its free end will lie upon the tip of the hook. It has been found that the preferable length of the latch member when closed on the hook is approximately .140 of an inch. The width of the hook portion is proportioned so that when the latch is closed thereon, said latch will lie at a predetermined angle with respect to the bill of the hook. In order to have the latch coat with the hook at the desired angle in closed position, it has been found that the preferable width of the hook portion 15 should be approximately .048 of an inch.

The above specified proportions of the elements forming the structure of the needle and the angles at which these elements are disposed in respect to each other are important for the proper functioning of the needle in its action with the operation of the fabric feeding and thread spacer mechanism as will be more fully explained hereinafter.

At a convenient point intermediate its length the sleeve or member 6, in which the bar 7 is mounted, is formed with a forked projection 18 in which the end 19 of a rocking lever 20 is received, said lever 20 being pivoted at 21 within the arm 3. A block 22 is slidably adjustable upon the opposite end of lever 20 and is fixed in place by suitable means such as set screw 23. The block 22 is pivotally connected at 24 with the forked end of a link 25 forming part of and projecting radially from a ring 26 connected with or carried by an eccentric, the latter being mounted on the driving shaft 27, journaled in the frame 2. The shaft 27 carries a flywheel 28 (shown in dotted lines Fig. 1) and may be driven in any suitable manner, as, for example, by means such as an electric motor 30, a driving belt or chain and pulley 29. The motor 30 is shown as secured to the base 1 of the machine in any suitable manner such as by bolts 30.

The lower arm 4 of the machine terminates in a head 31 which is open towards the opposed end of arm 3, and normally closed by means of a removable saddle 32. A wheel 33, having its peripheral edges serrated to form teeth 34 and constituting what we term a thread spacer, is carried by a shaft 35 journaled in the head 31. The shaft 35 is located so as to cause the serrated periphery of the wheel 33 to project to a predetermined extent beyond the outer surface of the saddle 32 through a slot 36 with which the latter is provided. The serrations or teeth 34 of the wheel 33 are equally spaced apart to a predetermined extent in accordance with the character of the repair work for which the particular wheel 33 is intended. However we do not regard as our invention any preferred shape of the inclined
edges of the teeth or serrations of these spacing wheels. Different wheels 33 may be substituted having a different spacing of the teeth 34 to meet the requirements of different repair operations on different fabrics and articles and to engage with different structures of needles and different fabric feed speeds. The wheel 33 is preferably made with two spaced apart annular portions, having an annular groove 37, between them.

The annular members of the wheel 33 are formed with corresponding and respectively matching or coinciding teeth 34. The annular space 37 permits the needle 9 to pass between the annular portions of the thread spacer 53 to the required extent in the operation of the machine as will be more fully described hereinafter.

The thread spacer or wheel 33 may be rotatably advanced periodically and to a uniform and predetermined extent in any suitable manner, as by means of a pawl 38, positioned to successively engage the notches between the teeth thereof and rotate the spacer 33 wheel in a clockwise direction the space of one tooth or more at a time. The pawl 38 is shown pivotally connected to one end of a rock lever 39 pivoted at 40 within the arm 4 and provided at its opposite end (see Fig. 1), with a sliding block 41 fixed in an adjusted position thereon by means of a set screw 42. The block 41 is pivotally connected at 43 with the forked end of a link 44 projecting from a ring 45 which is carried by another eccentric on shaft 27.

The pawl 38 may be held in engagement with the teeth of the spacer wheel 37 in any suitable manner, as by the spring 46 secured to a removable plate 47 in any suitable manner, as by bolts 48. The tension of the spring 46 against pawl 38 may be adjusted as, for example, by means of a screw 49 mounted in plate 47. To prevent the pawl 38 from progressing the spacer wheel more than one notched space at a time, a spring 50 is provided which is secured to the rocking lever 39 and is positioned to bear against the pawl in opposition to the action of the spring 46.

The plate 47 is provided with an inwardly projecting member 51 which is secured in any suitable manner, an arm 51a. Pivoted to the arm 51a is a pawl 53. Also secured to the arm 51a is a spring 52 which is positioned so as to act against the pawl 53. The pawl 53 engages the notches between the teeth of the spacer wheel 53 and with the help of the tension of the spring 52 prevents back lash or a counter-clockwise movement of the spacer wheel.

In operation upon each rotation of the main drive shaft 27 one complete oscillation is imparted to rock lever 39. This causes one step of rotative movement of predetermined extent to be imparted to the spacer device 33 whereby accurately and to a predetermined extent spacing apart each of the succeeding threads which cross the run to be repaired thereby securing accurate and uniform spacing of said transverse threads.

We will now describe means to secure uniform feed or progression of the fabric to be repaired in proper timed relation to the step-by-step operation of the thread spacing device, and to the operation of the so-called needle member.

Upon a shaft 54 mounted in head 31, is a feed wheel 59, the peripheral surface of which extends outwardly through a slot 60 in the saddle 22, and over which protruding surface the fabric to be repaired is disposed. Relative movement is imparted to the feed wheel 59 from the thread spacer 33. This may be accomplished in various ways. A simple arrangement is shown wherein the members 33 and 59 have respectively connected to them, or to the shafts 35, 55, carrying them, the gears 58, 57. An intermediate shaft 54 mounted in head 31, carries a gear 56 which respectively meshes with the gears 58, 57. In this manner each step of rotative movement imparted to the thread spacer 33 imparts a corresponding predetermined step of relative fabric feed movement to feed roll 59.

The machine further includes a presser foot carried by a presser bar 62 slidably mounted in the head 5 so as to position the spring fingers 61, thereof on opposite sides of the slot 36 of the saddle 22 and so that the said spring fingers are spaced a predetermined distance on either side of the spacer wheel 33. A spring 63 interposed between the end of the presser bar 62 and the opposed end of an adjusting screw 64 serves to yieldingly maintain the presser foot fingers 61 in operative position. The screw 64 is threaded into the head 5 and is arranged to adjust the tension of the spring 63 as may be required. A knurled head 65 is provided on said screw 64 to facilitate its adjusting operation. A lifting cam 66 pivotally mounted upon the presser bar 62 is provided for moving the presser foot from and to its operative position. The cam is manipulated by means of a finger piece 67 which forms a part thereof.

A presser roll 70 to cooperate with the feed roll 69 is mounted in pivot links 69, and may be raised and lowered by manipulating the cam 66, through arms 67, 68. The wheel 70 is positioned to bear upon the wheel 39 and to rotate therewith.

The space 73 between the spring fingers of the presser foot (see Fig. 3) must be of such a width as to allow the proper disposal of the loops of the fabric being repaired after said loops have been formed by the operation of the needle and the fabric is being advanced by the feed wheel 59 and its cooper-
ating mechanism as will be presently explained.

Detachably mounted upon the head 31 of arm 4, in any suitable manner, is a member 74 shaped in such a manner as to form a support for the fabric to be repaired and while the repair operations are being performed to facilitate the feeding of the same to the repairing mechanism.

The operation of the entire mechanism may be outlined as follows:

Assuming that a run in a stocking is to be repaired, the stocking is placed over the saddle 32 with one end of the run in registry with the needle 9. The cross threads of the run at this point are separated apart from each other by the teeth of the spacer wheel 53 which protrudes through the opening 36 in said saddle. The presser foot 61 is then lowered to hold the stocking in place against the saddle 32 and in proper relation to the thread spacer wheel. The lowering of the presser foot also causes the presser roll 70 to be lowered so as to grip the portion of the stocking beyond the run between it and the feed wheel 50. The needle is then lowered by operating the wheel 28 by hand so that it descends through the first loop 6 of the run and down into the annular space 37 of the spacer wheel as indicated diagrammatically in Fig. 6. The wheel is then rotated sufficiently to raise the needle carrying with it the loop 6 which is grasped by the hook of the needle, thereby raising the same above the plane of the fabric and into the position indicated in Fig. 7. It will be understood that during this operation the spacer wheel is rotatively displaced in clockwise direction and that the latch 17 of the needle is in raised or open position being held in such position by means of the spring mounted in the shank of the needle as previously described.

The motor 30 is then started and by reason of its operative connection with the pulley 29, the arms 30 and 39 are caused to be rocked on their pivots 31 and 40. The rocking movement of the arm 20 by reason of its connection with the slidable sleeve 6 causes the bar 7 to raise and lower the needle 9 in and out of the space 37 of the spacer wheel 33. The rocking movement of the arm 39 by reason of its connection with the pawl 38 causes said pawl to advance the spacer wheel in successive steps in a clockwise direction.

The progressive rotative movement of the spacer wheel is timed with relation to the movement of the needle so as to allow the needle to dip into the annular space in the spacer wheel without striking the next cross thread on the downward movement but to bring said cross thread into such position that on the next upward movement of the needle it will be grasped by the hook of the needle. The progressive rotative movement of the spacer wheel also causes the intermeshing gears 58, 56 and 57 to rotatively actuate proportionally the feed wheel 59 to advance and guide the fabric away from the spacer wheel.

When the operation of the motor commences to effect the above mentioned action of the various parts the needle 9 proceeds to move from its position shown in Fig. 7 and the loop 6 slides along the shank of the needle. The sliding movement of the loop is facilitated by reason of the angularly disposed portion 16 of the shank of the needle. During this movement of the needle and as the hook thereof passes into the space 37 the spacer wheel progresses the next cross thread 6 of the run into such a position that the hook of the needle when it again moves out of the space 37 will grasp and raise said cross thread 6 through the previously formed or raised loop 6. It will be seen that when the needle reaches the limit of its movement, into the space 37 (see Fig. 9), the loop 6 has passed over and beyond the free end of the latch 17 and has forced said latch back against the shank of the needle. The forcing of the latch into this position on the stroke of the needle into the space 37 prevents the latch from becoming entangled with the next cross thread. As the needle again commences to ascend, the loop 6 slides down the same and forces the latch downwards so as to gradually close it upon the hook and just after the hook grasps the next succeeding cross thread 6 the latch closes on the hook and the loop 6 slides off the needle as the needle continues its upward movement and the cross thread 6 caught by the needle is drawn through the loop 6 to form a new loop. As the loop 6 falls off the needle it is caught over the teeth d of the spacer wheel (Fig. 11) and from there progressed between the wheels 59 and 70. The action of the spacer wheel and the needle continues in this manner until all the loops in the run are reestablished.

It will be understood that as the successive loops are interlocked with each other by the above described repairing operation the tension developed during the operative steps of the needle, the spacer wheel, the feeding devices, and their cooperating parts, on the fabric will draw the sides of the run together and will restore the fabric to its initial condition.

When the final cross thread 6 in the run has been reached and manipulated, as above described, it is secured in place in the stock or other fabric in any convenient manner, as for instance, by manually sewing it into the fabric with an ordinary needle. If the run is a multiple run, it may be necessary to repeat the above operation several times.
times by repassing said multiple run between the needle as often as may be required; by multiple run is meant a plurality of runs next adjacent to each other.

5 This application is a continuation in part of our application, Serial No. 183,941, filed April 15, 1927, for "machine for repairing fabrics".

Various changes in the specific form of the machine and its parts and details, as shown and described, may be made without departing from the spirit and scope of our invention.

What we claim as new and useful and desire to secure by Letters Patent is:

1. The method of repairing runs in knitted fabrics which comprises engaging and acting upon each thread which extends transversely across the run to be repaired to uniformly space the same from its adjacent thread, automatically looping successive spaced threads through loops formed in the respective preceding threads, under substantially uniform tension and progressively feeding the fabric.

2. The method of repairing runs in knitted fabrics which comprises automatically engaging and acting upon each successive thread which crosses the run to uniformly space the same from its adjacent thread and looping the same through a loop formed in the immediately preceding thread.

3. The method of repairing runs in knitted fabrics which comprises engaging and acting upon threads which extend across a run in the fabric to space the same, drawing the threads through loops formed in the said preceding threads under substantially constant tension and progressively movement of the fabric.

4. The method of repairing runs in knitted fabrics which comprises uniformly and individually engaging and spacing apart from each other the threads of the fabric which extend across the run in said fabric, and looping said spaced apart threads through loops formed in the preceding threads.

5. The method of repairing runs in knitted fabrics which comprises uniformly and individually engaging and spacing apart from each other the threads of the fabric which extend across the run in said fabric, and looping said spaced apart threads under substantially uniform tension through similar loops formed in the preceding spaced apart threads.

6. The method of repairing runs in knitted fabrics, which comprises uniformly and individually engaging and spacing apart from each other the threads of the fabric which extend across the run in said fabric, and looping said spaced apart threads under substantially uniform tension through similar loops formed in the preceding spaced apart threads and progressing the fabric substantially uniformly and in timed relation to the spacing and looping operations.

7. In an apparatus for repairing runs in knitted fabrics, means for engaging and acting upon each thread which extends across the run to be repaired, to uniformly space the same from its adjacent threads, means to automatically form loops in successive order in the threads of the fabric which cross the run to be repaired, and means to draw each of said loops successively through a similar loop formed in the preceding thread.

8. In an apparatus for repairing runs in knitted fabrics, means for engaging and acting upon each thread which extends across the run to be repaired, to uniformly space the same from its adjacent threads, means to successively loop the succeeding threads which cross the run to be repaired, means operating to draw each loop under uniform tension successively through a similar loop formed in a preceding cross thread.

9. In an apparatus for repairing runs in knitted fabrics, means for engaging and acting upon the succeeding threads of the run to be repaired, to uniformly space the same from the adjacent threads, means to automatically loop the succeeding threads of the run to be repaired, means coacting with said looping means to apply substantially uniform tension in forming said loops, and means to draw each successive loop through the loop formed in the preceding cross thread.

10. In an apparatus for repairing runs in knitted fabrics, means for engaging and acting upon the succeeding threads of the run to be repaired, to uniformly space the same from the adjacent threads, means to successively loop the succeeding threads of the run to be repaired, means operating to draw each successive loop through a similar loop formed in a preceding cross thread, and means cooperating with said looping means to apply substantially constant tension in the loop forming and drawing operations.

11. In an apparatus for repairing runs in knitted fabrics, means for engaging and acting upon the successive threads of the run to be repaired, to uniformly space the same from adjacent threads, means for forming a loop in each spaced thread of the run to be repaired, means for drawing each successive loop through the loop formed in the preceding cross thread under substantially constant and uniform tension, and means to automatically progress the fabric.

12. In an apparatus for repairing runs in knitted fabrics, means for individually engaging to uniformly space apart, the suc
cessive fabric threads which cross the run to be repaired, means to form loops in the spaced apart threads in successive order, and means to draw each loop through the loop formed in the preceding cross thread.

13. In an apparatus for repairing runs in knitted fabrics, means to engage and uniformly space apart the successive fabric threads which cross the run to be repaired, means to form loops in the spaced apart threads in successive order, means to draw each loop through the loop formed in the preceding cross thread, and means to form coating with said spacing and looping means to uniformly tension each looping operation.

14. In an apparatus for repairing runs in knitted fabrics, means to automatically advance the fabric uniformly and to individually engage and space apart the successive fabric threads which cross the run to be repaired, means to form loops in the spaced apart threads in successive order, means to draw each loop under uniform tension through the loop formed in the preceding cross thread, and means to hold the fabric under tension during the looping operations.

15. In an apparatus for repairing runs in a knitted fabric, the combination with means to automatically and uniformly engage and space apart from each other in successive order the fabric threads which cross the run to be repaired, of a reciprocable needle member having a hooked engaging portion arranged to operate between successive spaced apart cross threads to engage said threads, and means to operate said spacer means and needle member in timed relation to each other.

16. In an apparatus for repairing runs in a knitted fabric, the combination with means to individually engage and uniformly space apart from each other in successive order the fabric threads which cross the run to be repaired, of a needle member having a hooked engaging portion arranged to operate between successive spaced apart cross threads, a fabric progressing mechanism, and means to automatically operate said spacer, needle member and progressing mechanism in timed relation to each other.

17. In an apparatus for repairing runs in a knitted fabric, a spacer having teeth to space apart from each other the successive fabric threads which cross the run to be repaired, a needle member arranged to operate between successive spaced apart threads to engage and form loops therein, each succeeding loop being drawn through the preceding loop, feeding devices to progress the fabric, and means to coincidently actuate said spacer, needle member and feeding devices in timed relation to each other.

18. In an apparatus for repairing runs in a knitted fabric, a spacer wheel having peripheral teeth adapted to engage and space apart cross threads of a run, a hooked needle member, fabric feeding devices, and actuating means to operate automatically said spacer wheel, needle member and feeding devices all in timed relation to one another.

19. In an apparatus for repairing runs in a knitted fabric, a spacer having teeth arranged in parallel rows and adapted to engage and space apart cross threads of a run, a needle member operating between said rows of teeth to form loops in the successively spaced threads of the run to be repaired, and means to operate said spacer and needle member in timed relation to draw each loop through the preceding loop.

20. In an apparatus for repairing runs in a knitted fabric, a spacer having teeth arranged in parallel rows, a needle member operating between said rows of teeth to form loops in the successively spaced threads of the run to be repaired, and means to operate said spacer and needle member in timed relation to draw each loop through the preceding loop, said needle having an inclined portion to facilitate the loop forming operation.

21. In an apparatus for repairing runs in a knitted fabric, a spacer wheel having parallel toothed peripheral portions to uniformly space apart in successive order the fabric threads which cross the run to be repaired, a needle member mounted to reciprocate into and out of the space between said peripheral portions, and between successive spaced apart cross threads, to engage the latter and form loops therein, and means to operate said spacer wheel and needle in timed relation with each other to draw each succeeding loop through the preceding loop.

22. In an apparatus for repairing runs in a knitted fabric, a spacer wheel having parallel toothed peripheral portions to uniformly space apart in successive order the fabric threads which cross the run to be repaired, a needle member mounted to reciprocate into and out of the space between said peripheral portions, and between successive spaced apart cross threads, to engage the latter and form loops therein, means to operate said spacer wheel and needle in timed relation with each other to draw each succeeding loop through the preceding loop, and means cooperating with the spacer wheel and needle member to impose a substantially uniform tension upon the loop forming and drawing operations.

23. In an apparatus for repairing runs in a knitted fabric, a spacer wheel having parallel toothed peripheral portions, spaced in uniform order the fabric threads which cross the run to be repaired, a needle member mounted to reciprocate into and out of the space between said peripheral portions, and between successive spaced apart cross threads, to engage the
latter and form loops therein, means to operate said spacer wheel and needle in timed relation with each other to draw each succeeding loop through the preceding loop, and means to progressively feed the fabric past the point of operation of the needle.

24. In an apparatus for repairing runs in a knitted fabric, a spaced wheel having parallel toothed peripheral portions to uniformly space apart in successive order the fabric threads which cross the run to be repaired, a needle member mounted to reciprocate into and out of the space between said peripheral portions, and between successive spaced apart cross threads, to engage the latter and form loops therein, means to operate said spacer wheel and needle in timed relation with each other to draw each succeeding loop through the preceding loop, and a manually operable pressure foot cooperating with the spacer wheel to hold the fabric in position during the loop forming and drawing operations.

25. In an apparatus for repairing runs in a knitted fabric, a spacer wheel having parallel toothed peripheral portions to uniformly space apart in successive order the fabric threads which cross the run to be repaired, a needle member mounted to reciprocate into and out of the space between said peripheral portions, and between successive spaced apart cross threads, to engage the latter and form loops therein, means to operate said spacer wheel and needle in timed relation with each other to draw each succeeding loop through the preceding loop, a feed roll and a pressure roll cooperating therewith to feed the fabric, the spacer wheel and needle actuating means also operating to actuate said feed roll.

26. In an apparatus for repairing runs in a knitted fabric, a spacer wheel having parallel toothed peripheral portions to uniformly space apart in successive order the fabric threads which cross the run to be repaired, a needle member mounted to reciprocate into and out of the space between said peripheral portions, and between successive spaced apart cross threads, to engage the latter and form loops therein, means to operate said spacer wheel and needle in timed relation with each other to draw each succeeding loop through the preceding loop, and a manually controlled presser foot having spring fingers to straddle said spacer wheel and hold the fabric in position.

27. In an apparatus for repairing runs in a knitted fabric, a frame having spaced apart arms, a needle member mounted in one of said arms and spacer devices mounted in the other of said arms, the latter operating to uniformly space apart from each other in successive order the threads of the fabric which cross the run to be repaired, and means mounted in said framework to coincidently operate said needle and spacer devices.

In testimony whereof we have hereunto set our hands on this 21st day of January A. D., 1928.

WILLIAM H. LEAVIN.
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