Aug. 9, 1960 S. I. BURD ET AL 2,948,240

LOOPING MACHINE AND METHOD

Filed April 6, 1959 4 Sheets-Sheet 1

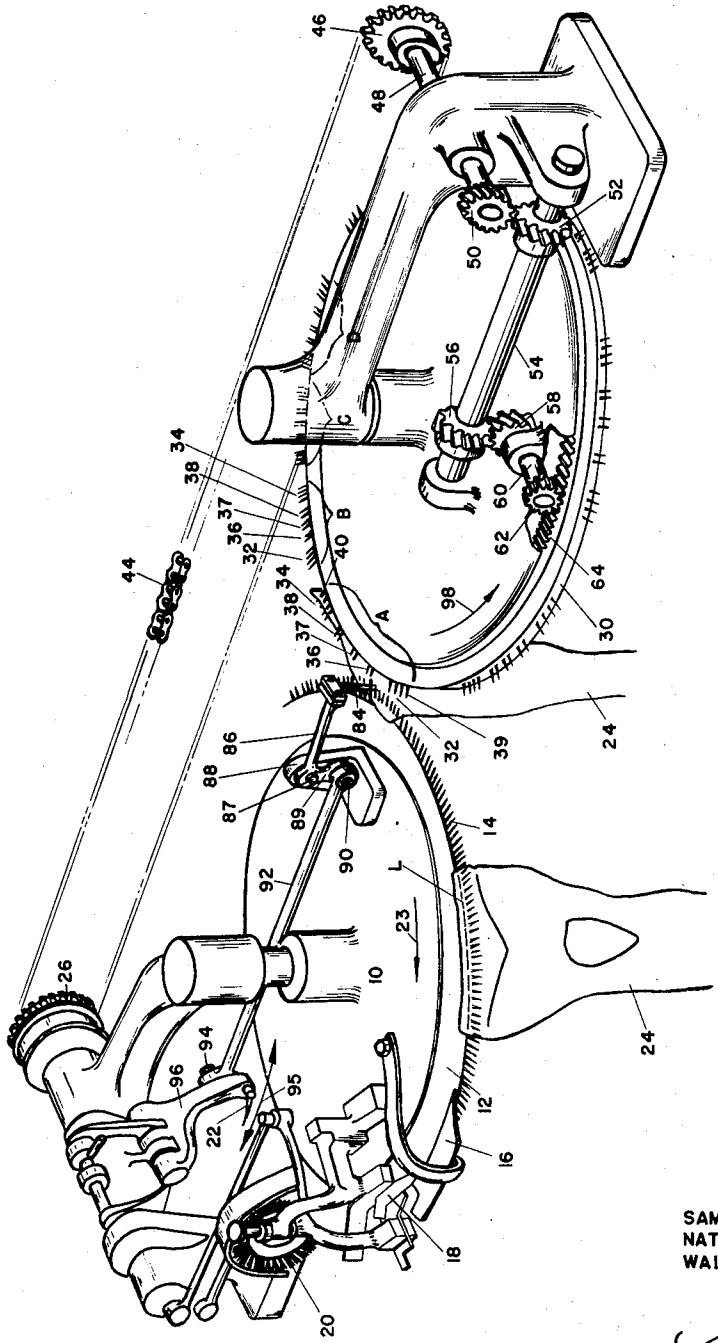


FIG. 1

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LOOPING MACHINE AND METHOD

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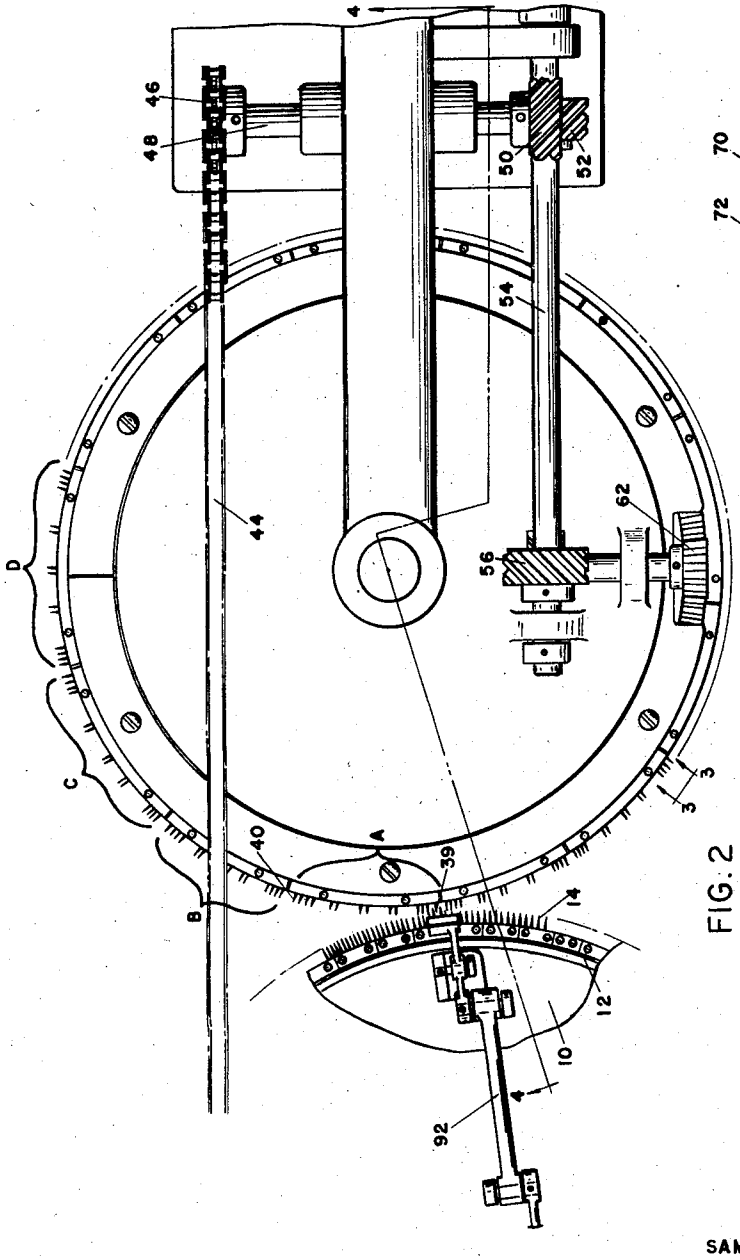


FIG. 2

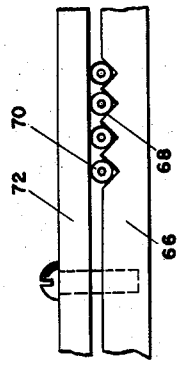


FIG. 3

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LOOPING MACHINE AND METHOD

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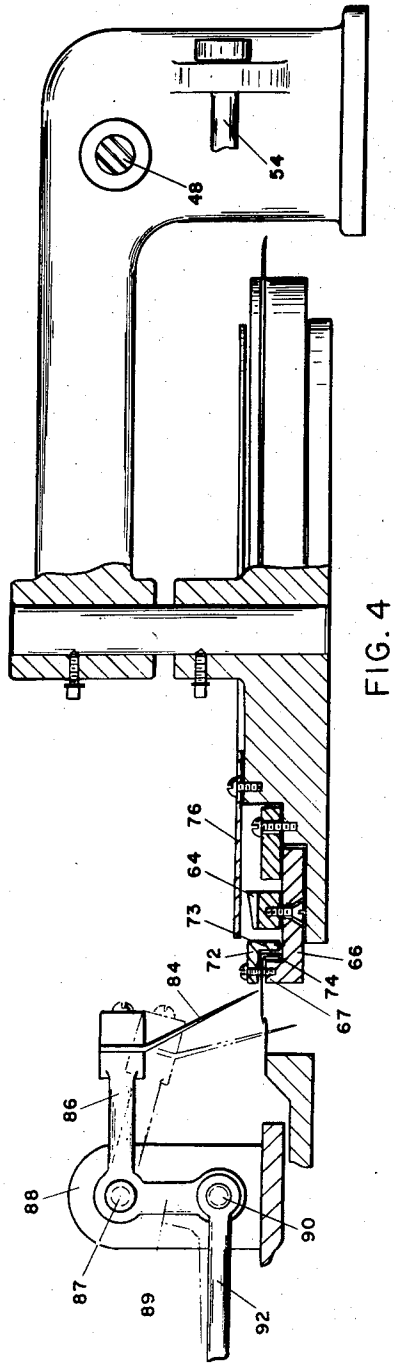


FIG. 4

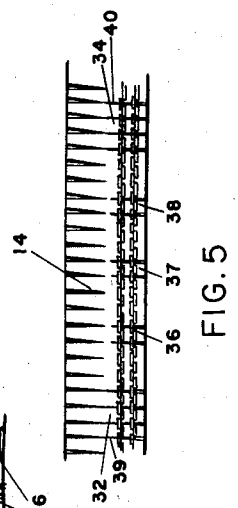


FIG. 5

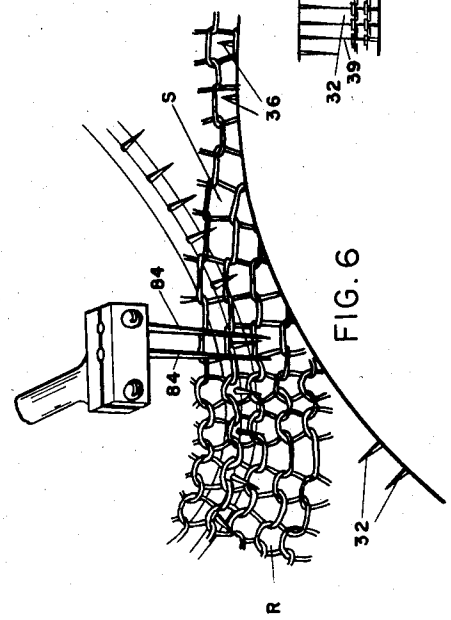


FIG. 6

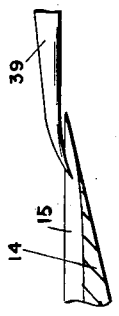


FIG. 7

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LOOPING MACHINE AND METHOD

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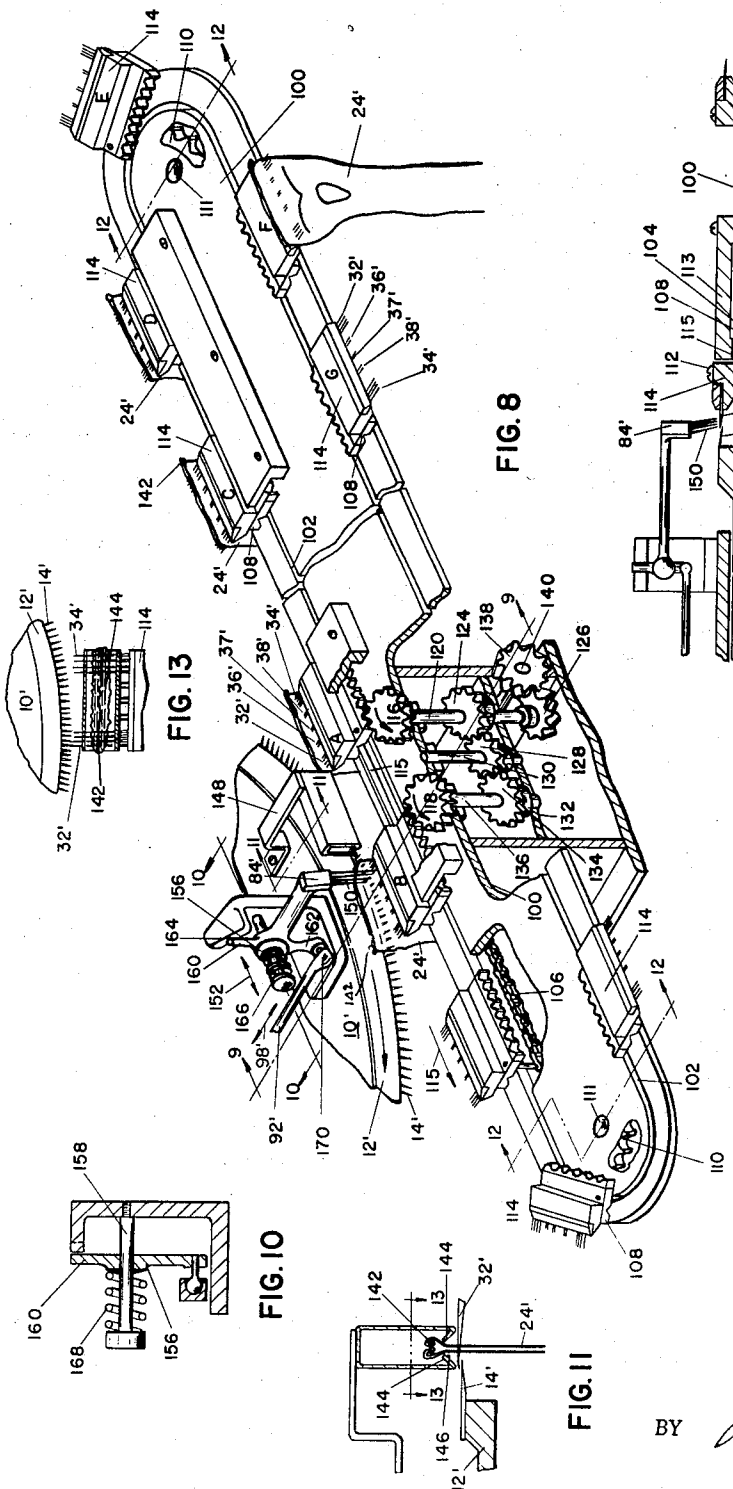


FIG. 8

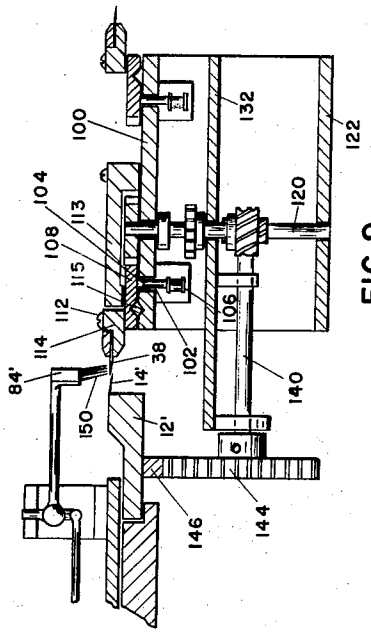


FIG. 9

FIG. 13

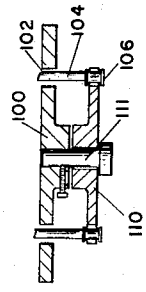


FIG. 12

FIG. 10

FIG. 11

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United States Patent Office 2,948,240 Patented Aug. 9, 1960

2,948,240

LOOPING MACHINE AND METHOD

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Filed Apr. 6, 1959, Ser. No. 804,535

12 Claims. (Cl. 112—25)

This invention relates to a looping machine of the type shown in Ivester Patent No. 2,828,707 of April 1, 1958, and in Bley Patent No. 2,871,806 of February 3, 1959.

Conventional machines of this type are used for closing the toe opening of a seamless stocking, or for looping an edge of a knit fabric, or for joining contiguous edges of two pieces of knit fabrics and so on.

As is well known to those skilled in the art, and as will be seen from the above mentioned, and from other patents and publications with which those skilled in the art are familiar, a looping machine includes a rotary sewing dial having peripheral points which support the fabric while its upper edge is trimmed and looped. To suspend the fabric from said points, it has heretofore been the practice manually to impale successive stitches of a course of the fabric on successive points on the looping dial. This operation is very difficult and time consuming and is responsible for a substantial fraction of the cost of manufacture of seamless stockings and other articles, and the larger the number of stitches to be impaled, the greater the cost. It must also be remembered that, if any stitches are misaligned or skipped, the stockings, or other articles, will run and must be mended or sold as "seconds."

Broadly speaking, the object of this invention is to reduce to a minimum the time and skill which have heretofore been required serially to impale the stitches of a course of the fabric to be looped on the points of the sewing dial of the looping machine.

In its broadest concept, the invention is carried out by manually impaling a small number of spaced stitches of the course of fabric to be looped on correspondingly spaced points which are extraneous to the sewing dial of the looping machine and then mechanically and automatically to impale all of the stitches of said course on the points on the sewing dial of the looping machine. In other words, by this invention, the operator need manually impale a very small number of stitches such as from 10% to 25% of the number of stitches in the course to be looped and the machine embodying this invention is relied on serially to impale all of the sitches of said course on the points of the looping dial. When the large number of stitches present in stockings, and other articles, is considered, it will be seen that a machine embodying this invention will effect very substantial savings.

In the accompanying drawings,

Fig. 1 is a perspective view showing one embodiment of the invention.

Fig. 2 is a fragmentary top plan view of Fig. 1.

Fig. 3 is an enlarged sectional view looking in the direction of line 3—3 on Fig. 2.

Fig. 4 is a view, partly in section and partly in elevation looking in the direction of line 4—4 on Fig. 2.

Fig. 5 is a fragmentary and diagrammatic top plan view showing the aligned stitches of the fabrics to be joined impaled on the points of the loading dial.

Fig. 6 is a diagrammatic perspective view showing how the stitches are transferred from the loading dial to the sewing dial of the looping machine, but, for simplicity, only one thickness of the fabric is shown.

Fig. 7 is a developed, diagrammatic and fragmentary view showing the structure and relation of the points on the loading dial to the points on the looping dial.

Fig. 8 is a fragmentary perspective view showing a second embodiment of the invention.

Figs. 9 to 13 are sectional views taken on the corresponding lines on Fig. 8.

A conventional looping machine includes a stationary support **10**, a rotary sewing dial **12** carrying supporting points **14**, on which the stitches of a knit fabric are impaled, a guide **16**, a trimming knife **18**, a brush **20** for removing the severed threads, and a looping needle **22**. These, and other parts, not shown, coact in the well known manner to loop the toe opening of a stocking **24** or to join the edges of two pieces of fabric. For the purpose of this invention it is sufficient to point out that, conventionally, the stitches of the fabric are manually impaled on points **14** and that the sewing dial is rotated in the direction of arrow **23** to present the upper edge of the fabric to the knife, to the brush, to the looping needle, etc. and that dial **12** and needle **22** and its adjuncts are actuated in the conventional manner from a conventional source of power, not shown, which also rotates sprocket wheel **26**, which will be hereinafter referred to. It is also pointed out that the parts hereinabove mentioned are the only ones which need be referred to for a proper understanding of the invention.

The present invention includes a loading dial **30** having a small number of points on which a small number of stitches of the pieces of fabric to be joined are initially manually impaled and means for automatically impaling all of the stitches from the loading dial onto the points of the looping dial.

As will be seen from Figs. 1 and 2, the loading dial is provided with spaced groups of points A, B, C, D, etc. each group being adapted to receive and support the two sides of a stocking or any two pieces of fabric to be joined. Each group of needles consists of end sets of points **32** and **34** and suitably spaced intermediate sets of points **36**, **37** and **38**. It will be noted that the points of the end sets are long enough to reach, or to overlap, the adjacent ends of corresponding points **14** on the sewing dial, as shown in Fig. 7 for the purpose hereinafter set forth. The intermediate sets are made shorter than the end points because, as will hereinafter appear, the points of intermediate sets need not reach, or overlap, the corresponding points **14** on the sewing dial. Also, preferably but not necessarily, the end sets **32** and **34** have a larger number of points than the intermediate sets and preferably, but not necessarily, more than one intermediate set of points is used. The total number of points used on the loading dial and the spacing of the intermediate sets depends on the width, and on the nature of the fabrics to be joined, it only being necessary that the upper edges of the fabric between end points **32** and **34**, be supported so as not to sag in the middle. It is also of the essence of this invention that the total number of points in any group of needles be a very small fraction of the total number of stitches in each of the pieces of fabric to be joined. It is also highly desirable, if not mandatory, that the span of each group of points, that is, the distance between endmost point **39** of point set **32** and endmost point **40** of set **34**, be slightly greater than the distance between the vertical edges of the fabric suspended from these points measured when the fabric is relaxed. For example, if a fabric, when impaled on the sewing dial of a looping machine, measures 4.6875", the distance between points **39** and **40** of each group of points will be 5.00" which, in terms of points, represents a ratio of 16 to 15. This ratio

can be mathematically adjusted to fabrics having a larger or smaller number of stitches. By this arrangement, the fabric suspended from any group of points, such as group A, will be stretched, as shown at S in the right hand portion of Fig. 6, and the same fabric, after it is transferred to points 14 of the sewing dial, will be relaxed as shown at R in the left hand portion of Fig. 6. This relationship will be hereinafter further referred to.

Loading dial 30 may be rotated in proper timed relation to the looping dial by any suitable means, such as by means of a sprocket chain 44 which engages sprocket wheel 26 and sprocket wheel 46 on shaft 48 which carries a pinion 50 which meshes with a gear 52 on shaft 54 which also carries gear 56 which meshes with gear 58 on shaft 60, which carries pinion 62 which meshes with a rack 64.

The points of groups A, B, C, etc., may be mounted on the loading dial by any suitable means. But, as shown in Figs. 3 and 4, rack 64 carries a ring 66 which has a lip 67, the upper edge of which has grooves 68 for receiving the shanks 70 of the points of groups A, B, C, etc. of the loading dial. The shanks of the points are clamped in position by a ring 72 which has a pendent flange 73 which clamps the pendent portions 74 of the points against lip 67 of ring 66, firmly to hold the points in place. Rack 64 and the adjacent parts are preferably covered with a guard 76 which has an opening through which gear 62 engages rack 64.

The stitches on the loading dial 30 are transferred onto the points on sewing dial 12, by a pair of fingers 84, Fig. 2, which are carried by one arm 86 of a lever which is pivoted at 87 to a fixed bracket 88 and the other end 89 of which is pivoted to a stub shaft 94 which is carried by the arm 96 which reciprocates needle 22 in the direction of arrow 95. By this arrangement, reciprocation of needle 22 reciprocates fingers 84 between the solid and broken line positions of Fig. 2, thereby pushing one stitch from a loading point on dial 30 onto a point on dial 12 with the movement of each point on dial 12 past needle 22.

It is to be assumed that the entire periphery of the loading dial is equipped with groups of points like groups A, B, C, D; that the loading dial rotates in the direction of arrow 98 in Fig. 1, and that its rate of rotation is such that any given point on dial 30, will move through a distance of 5" while a corresponding point on dial 12 moves a distance of 4.6875" so as to insure substantial alignment of the points in the leading and trailing sets of points 32 and 34 with corresponding points 14 on looping dial 12. It will be understood that this ratio holds for the example above set forth and that it can be used as a basis from which the actual travel of larger or smaller dials, or for different kinds of fabric can be worked out.

To carry out the invention, the operator takes the pieces of fabric on opposite sides of the toe opening of a seamless stocking, or other two pieces of fabric the edges of which are to be looped, and aligns the three or four end stitches of the leading margins of the pieces of fabric together and impales them serially on the points of set 32 of any group of points, with the endmost leading aligned pair of stitches impaled on point 39. The operator next aligns the three or four stitches of the trailing margins of the fabrics to be joined and impales them on the points of set 34 of the group with the endmost trailing pair of aligned stitches impaled on needle 40. Using the loop line now provided in stockings and which can readily be added to other fabrics, the operator now impales the intermediate portions of the fabrics indiscriminately on the short pins of sets 36, 37 and 38. This insures substantial alignment of the course, the stitches of which are to be impaled, with supporting points 14 on looping dial 12. It will also be understood that, in the structure which is illustrated and which has been found to work satisfactorily, each group of points, such as group A, has four leading and four trailing sets of points 32 and 34, so that the operator need only align, and impale, a total of eight pairs of stitches on eight points instead of having to align, and impale, a hundred, or more, pairs of stitches. For example, if the fabrics to be joined have two hundred stitches, and if the operator must align and impale eight stitches only, the saving in time is such as to increase the production by 100% to 150%, depending on the type of operation.

The points on the looping sewing dial preferably have grooves 15 for receiving the ends of the long points on the loading dial so that, in effect, the points on the looping dial form extensions of the long points on the loading dial.

With the fabrics to be joined thus impaled on the loading dial, and with the latter rotating in the direction of arrow 98, a group of points, such as group A, will progressively approach the points 14 of the sewing dial, as shown in Figs. 1, 2 and 5, and the constantly reciprocating fingers 84 will push the stitch on point 39 onto the registering point 14 on the sewing dial and will, as the dials rotate, similarly push subsequent stitches off successive points of group A onto corresponding points 14 of the sewing dial.

It will be noted that, when the fabric is stretched, as at S in Fig. 5, the stitches will be considerably larger than the diameter of the yarn forming the stitches, and therefore, the stitches on the loading dial points will be pushed onto the points of the sewing dial, even though the points of the loading dial are not in perfect, end to end, alignment with the points of the sewing dial as long as the misalignments are of an order as small, or smaller than the average size of the stitches. It will also be noted that the engagement of a stitch with a point 14 on the looping dial, automatically stretches the succeeding stitch and aligns it with the corresponding point 14 on the sewing dial and thus insures impalement of each succeeding stitch on the corresponding succeeding point on the sewing dial. This permits the intermediate points 36, 37 and 38 to be made shorter than the end points and this makes it unnecessary for these points to align perfectly with corresponding points on the looping dial. In other words, points 36, 37 and 38 merely serve to support the portions of the fabric intermediate its vertical margins against sagging and the engagement of each stitch with a point 14 is relied on to align the next stitch on the loading dial for engagement with the next point on the looping dial and so on. This is the relationship which makes it possible to limit proper aligning and impaling of stitches to three or four points at the leading end and to three or four points at the trailing end of the fabrics.

It will be seen from Fig. 1 that the periphery of the loading dial is capable of receiving a large number of groups of points, only groups A, B, C and D of which are shown and that, because the operator need only align and impale eight pairs of stitches on the loading dial, it can be rotated at a relatively high speed and that one operator can keep a loading dial as large as, or larger than, the looping dial fully loaded. Likewise, because the automatic transfer fingers 84 also operate rapidly, it is possible to rotate the looping dial several times faster than it can be rotated in a conventional, manually loaded looping machine.

In the embodiment shown in Figs. 8 to 12, loading dial 30' of Figs. 1 and 2 is replaced with a number of rectilinearly moving loading devices and since the sewing dial used in the second embodiment is the same as that used in the first embodiment, only a portion of the sewing dial is shown.

The loading device of the second embodiment includes an elongated bed plate 100 which is suitably mounted on a support, not shown, and which is provided with a continuous slot 102 through which are freely movable pins 104, the lower ends of which are secured to a sprocket chain 106 which travels around idler sprockets 110 which

are suspended from bed plate **100** by shafts **111**. The upper ends of pins **104** are secured to racks **108** to the upper sides of which are secured, as at **112**, a corresponding number of clips **114**. Racks **108** are preferably keyed to bed plate **100** as at **113**, to prevent lateral wobbling or meandering of the racks during their movement relative to bed plate **100**. Also, racks **108** are clamped down against tilting relative to bed plate **100** by cover **115**.

As best shown in Fig. 8, each clip **114** carries a set of loading points which is divided into groups **32'**, **36'**, **37'**, **38'** and **34'** which correspond to loading points **32**, **36**, **37**, **38** and **34** of Figs. 1 and 2. Clips **114** are propelled past sewing points **14'** of sewing dial **12'** which correspond to those shown in Figs. 1 and 2 by means of gears **116** and **118** which engage the teeth of the clip supporting racks **108** at positions A and B, respectively. Gear **116** is carried by shaft **120** which is journalled in bed plate **100** and in lower plate **122** and which carries center gear **124** and lower gear **126**. Center gear **122** meshes with gear **128** on shaft **130** which is journalled in bed plate **100** and in intermediate plate **132**. Gear **128** meshes with gear **134** on shaft **136** which is journalled in bed plate **100** and in plate **132** and which carries gear **118**. Gear **126** meshes with gear **138** on shaft **140** which is journalled in bearings **142** which are suspended from plate **132**. Shaft **140** carries gear **144** which meshes with conventional ring gear **146** on the underside of sewing dial **12** or **12'**. The manner in which ring gear **146** is driven forms no part of the present invention and is, therefore, not shown nor described. It is sufficient to say that rotation of sewing dial **12'** rotates gears **116** and **118** in the direction of the arrows shown in Fig. 8 and propels clips **114** in the direction of arrow **115** in Fig. 8.

The stocking **24'**, or other fabric, to be looped is provided with a marker called "looping line" and, beyond this line, there is usually provided a marginal portion which is cut off just prior to the actual looping. In a stocking, or other knit fabric, this marginal portion is formed by knitting a number of ravel courses of cotton or other inexpensive material. These marginal portions tend to curl, or tend to fall between the loading and the sewing points or wrinkle, as at **148**, thus interfering with the automatic impalement of the stitches of the stocking on sewing points **14'**. To overcome this difficulty we provide a guard **144** which is best shown in Fig. 11 and which consists of upwardly inclined flanges **146** which are spaced apart just enough to permit the movement therebetween of the fabric to be looped, but which are close enough together to prevent the downward passage therebetween of the curled, or wrinkled, ravel margins **148** of the fabric. Guard **144** is suitably secured to the pedestal **10'** sewing dial **12'** by a bracket, or the like, **150**.

The stitches of the fabric impaled on the loading points of a clip **114** are impaled, serially, on points **14'** of sewing dial **12'** by transfer finger **84'** which is reciprocated by rod **92'** which is connected to sewing needle **22** in the manner shown in Fig. 1.

The points **150** on transfer finger **84'** have to move in and out between points **14'** of the sewing dial while the latter is rotating and, therefore, provision is made to permit movement of the transfer finger in the direction of arrow **152** in addition to its reciprocation in the direction of arrow **154**. To this end, transfer finger **84'** is carried by a collar **156** which is fast on shaft **158** and which carries arms **160** and **162**. Arm **160** is adapted to ride on cam **164** and is biased against said cam by spring **168**. Arm **166** is connected by a ball and socket joint **170** with rod **92'** to permit universal movement in the usual manner.

The operation of the embodiment of Figs. 8 to 13 is as follows:

The rotation of sewing dial **12'** rotates gears **116** and **118** and thus propels clips **114** in the direction of arrow **115** so as to bring the loading points on said clips into aligning and slightly overlapping relation as best shown in Figs. 9 and 11. Reciprocation of sewing needle **22**, reciprocates rod **92'** so as to reciprocate transfer finger **84'** in the direction of arrow **98'** to push the needles impaled on the loading points of clips **114**, as well as the stitches therebetween, onto points **14'** of the sewing dial **12'**. The movement of arm **160** on cam **164** permits transfer finger **84'** to move in clockwise position during its movement in and out between similarly moving points **14'**, and spring **166** moves transfer finger **84'** in counterclockwise direction while the transfer finger is out of engagement with points **14'**, or while it is in the position of Fig. 9. It will be noted that, as the clips travel from position A to position B, that is, while the stitches are being transferred, the clips will be engaged by gear **160** or gear **118**. This does not only serve to propel the clips but it also provides a positive engagement which steadies the clips and insures proper alignment between the loading points on the clips and points **14'** on the sewing dial **12'**.

To the extent that the embodiment of Fig. 1 reduces the number of stitches that have to be manually impaled to about 10% of the total number, it represents a great advantage over the prior practice but, when a loading dial, such as loading dial **30** is used, the operator has to impale the stitches on circularly arranged points which is not as easy as impaling stitches on linearly arranged points. By the arrangement of Fig. 8, the operator impales the stitches on linearly arranged points thus further facilitating the work and speeding production. The loading operation which can be performed at stations C, D, E, F, and it will be noted that because of the large number of clips, one operator can keep all of the clips carried by the conveyor constantly loaded which, in turn, makes it possible to operate the sewing dial at several times the present speed and correspondingly increases the production per operator per hour. The upper marginal portions **142** which are formed of ravel courses tend to curl downwardly and may interfere with the transfer of the stitches. But, by providing the guard arrangement shown in Fig. 11, the portions of the fabrics above the looping line enter the slot formed by flanges **144** and are kept out of the path of the loading and sewing points.

It will be understood that transfer finger **84** of the embodiment of Fig. 1 can be operated by the mechanism shown in Fig. 8 and it will also be understood that the ratio of the loading points to the sewing points, in the embodiment of Fig. 8, both as to span and as to rate of movement may be the same as those in the embodiment of Fig. 1.

In the appended claims, the points on dial **12** or **12'** will be referred to as supporting points, the points on dial **30** or on clips **114** will be referred to as loading points, and the word fabric will be used to mean stockings, sweaters and any other material.

This application is a continuation, in part, of our application Serial No. 795,460 filed February 25, 1959, entitled Looping Machine, now abandoned.

It will thus be seen that, by impaling a few stitches of the fabric to be looped on a few loading points, the time required is reduced by 25%, more or less, serially to impale every stitch of the course onto a corresponding point on the sewing dial and that, therefore, the sewing dial can be operated at three times, more or less, the speed at which it is conventionally rotated, to permit an operator to impale the stitches directly onto the points of the moving sewing dial. It will be appreciated that impaling all of the stitches of a course of fabric on the points of the sewing dial is difficult enough and time consuming even if the sewing dial were held stationary. With the sewing dial rotating, the task becomes even more difficult and demands more skill and dexterity which in turn command high wages in the labor market. The present invention frees the sewing dial from the limitations of manual impalement thereon of the stitches

to be looped, and it can, therefore, be rotated at a much higher speed. Also, because the operator is not called upon to impale all of the stitches of the course on the sewing dial accurately and rapidly, less skilled and less expensive operators can be engaged to do the work. Furthermore, the training period under conventional practice extended over a period of several weeks during which the operator was paid with no corresponding production. By the present invention, the loading dial can be rotated slowly and, therefore, an operator needs very little training and very little skill and dexterity to impale the four leading end stitches on the leading four loading points **32** and the four trailing stitches on four trailing loading points **34** and then pushing the intermediate portion of the fabric onto the intermediate loading points **36**, **37** and **38**.

While we have disclosed dial to dial loading in Fig. 1 and straight bar to dial loading in Fig. 8, it will be understood that these mechanisms and methods are only by way of practically successful examples and that other forms of apparatus can be used as long as the essence of the invention, namely, limiting the manual impaling of stitches to a small fraction of the number of stitches in the course to be looped, is adhered to.

What we claim is:

1. The combination with the rotary dial of a looping machine which dial includes peripheral, equally spaced fabric supporting points adapted to receive all of the stitches of a course of knit fabric to support the fabric while its edge portion is being looped, of a support having spaced groups of loading points extraneous to said dial and engageable with corresponding groups of stitches of said course, means presenting said loading points to the corresponding supporting points on the dial to align all of the stitches of the entire course with said supporting points, and mechanical means for successively impaling all of the stitches of said course on said supporting points, the number of loading points being less than the number of supporting points for any given course of stitches, and the distance between the endmost of said loading points being greater than the distance between the endmost supporting points for any given course of stitches whereby the stitches in said course are presented to said points in a relatively stretched condition to facilitate impalment of said stitches on said supporting points.

2. The structure recited in claim 1 in which the number of loading points is less than one quarter of the number of supporting points for any given course.

3. The structure recited in claim 1 in which the distance between said endmost loading points is greater than the distance between said endmost supporting points by an amount sufficient to stretch each stitch in said course by an amount less than the space between any two adjacent supporting points to insure adequate alignment of said stitches with the corresponding supporting points.

4. The structure recited in claim 1 in which the distance between said endmost loading points is to the distance between the endmost supporting points, is approximately as 16 is to 15.

5. The structure recited in claim 1 in which said mechanical means includes a finger engageable with the stitches to be impaled on said supporting points and means reciprocating said finger axially of said supporting points to impale said stitches on successive loading points.

6. The structure recited in claim 1 in which said support is a second dial and means for rotating said second dial synchronously with the looping dial with the ends of the loading points in alignment with, and overlapping the ends of the corresponding supporting points.

7. The structure recited in claim 1 in which said support is a bar, and an endless conveyor for moving said bar tangentially of the supporting points on the dial, with the loading points on the bar in alignment with and overlapping the supporting points on the dial for successively presenting the stitches on the loading points to the supporting points on said loop dial.

8. The structure recited in claim 1 and a guard located adjacent said dial and above the plane of the supporting points on said dial and engageable with the marginal portion of the fabric above said supporting points to keep said marginal portion out of the path of engagement with any of said points.

9. The combination with the rotary dial of a looping machine, which dial includes peripheral, uniformly spaced, fabric-supporting points on which the stitches of a course of a knit fabric are adapted to be manually impaled to support said fabric while its edge portion is being looped, of first loading points engageable with the endmost stitches of said course, said first loading points being spaced apart a distance greater than the distance between said endmost supporting points for any given course, to stretch the stitches of said course, second loading points intermediate said first points and engageable with intermediate stitches of said course to prevent sagging of the fabric intermediate said first loading points, and means for automatically impaling all of the stitches of said course on corresponding supporting points.

10. The structure recited in claim 9 in which said first loading points are long enough so that their juxtaposed ends overlap the corresponding free ends of the supporting points and said second loading points are short so that their free ends are out of the reach of the corresponding supporting points.

11. The structure recited in claim 9 in which the total number of first and second loading points is about 10% of the number of supporting points for any given course.

12. The method of automatically impaling all of the stitches of a course of knit fabric on successive supporting points of the sewing dial of a looping machine, which method consists in impaling the endmost stitches of said course on spaced loading points extraneous to said dial, stretching and maintaining said course stretched while on said loading points to open the stitches of said course and to align them with the supporting points of the dial, and successively pushing said stitches onto successive supporting points.

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