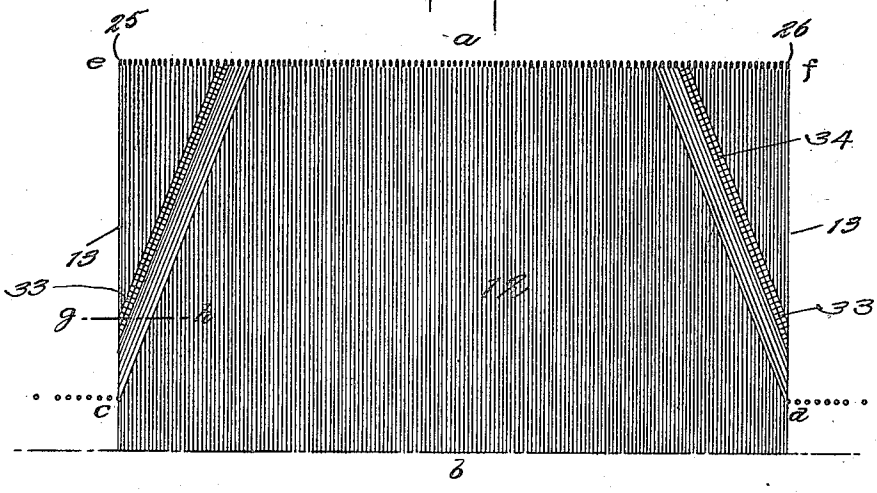
April 9, 1929. A. THIERFELDER 1,708,160

STOCKING CLOCK LACE FORMING MACHINE

Filed May 17, 1927 2 Sheets-Sheet 1

Fig. 1.



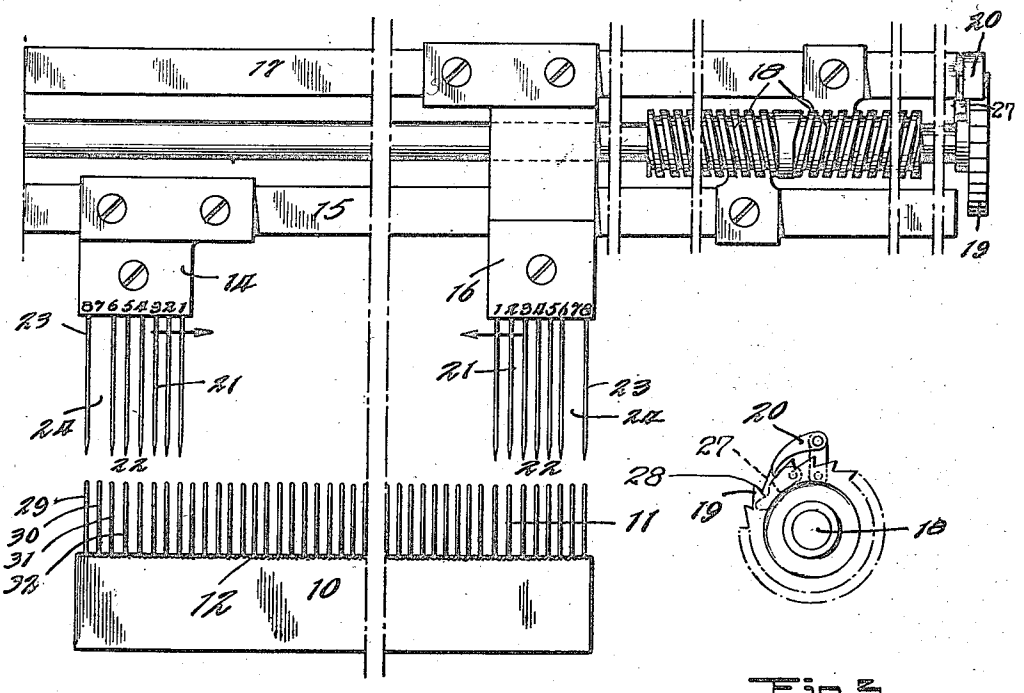


Fig. 2.

Fig. 3.

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STOCKING CLOCK LACE FORMING MACHINE

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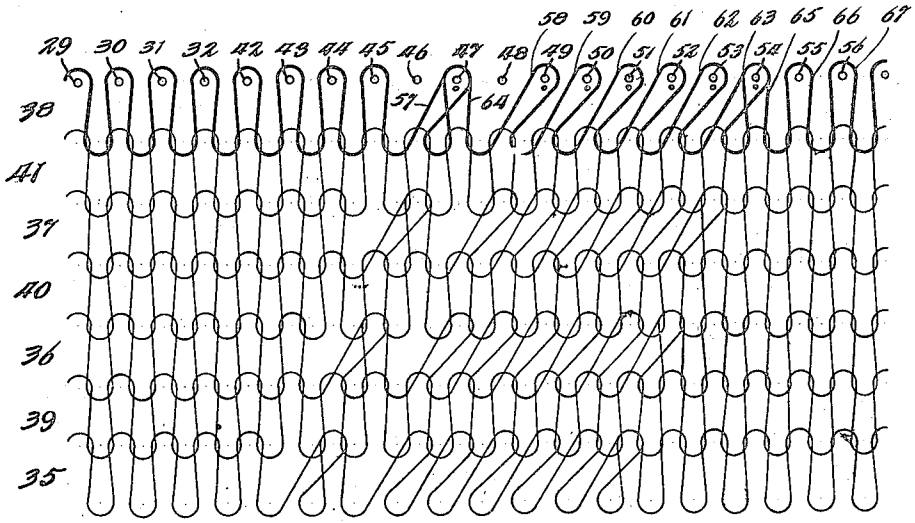


Fig. 4.

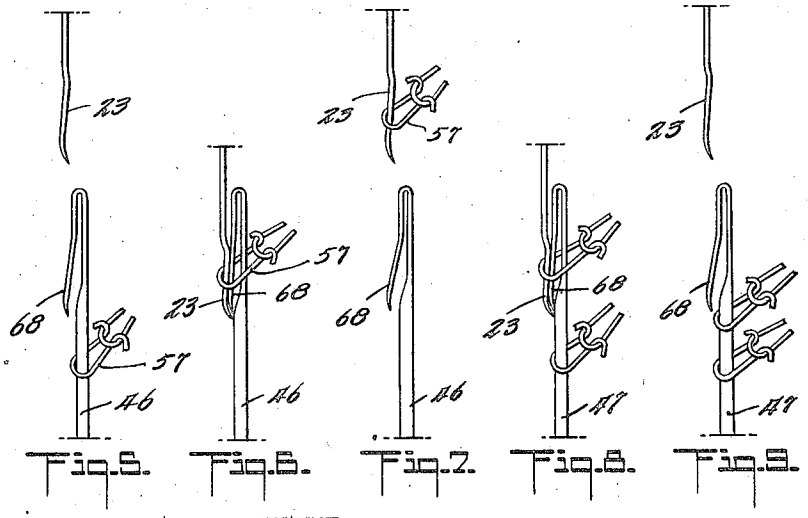


Fig. 5. Fig. 6. Fig. 7. Fig. 8. Fig. 9.

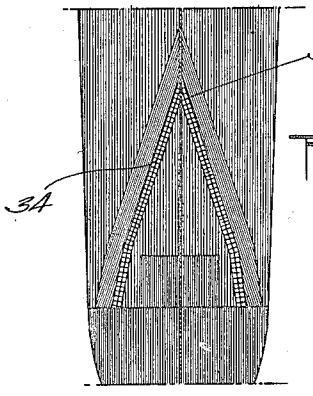


Fig. 10.

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UNITED STATES PATENT OFFICE.

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STOCKING CLOCK-LACE-FORMING MACHINE.

Application filed May 17, 1927. Serial No. 191,982.

The invention relates in general to an ornamentation in knitted fabric and specifically relates to an ornamental lace clock formed in full-fashioned hosiery and in the embodiment of the invention herein described it is shown as a heel decoration to take the place of the usual high splice. The invention also relates to a method for making such decorative effect and to an attachment or rather to a modification of a conventional form of full-fashioned stocking knitting machine for forming such clock lace decoration.

The primary object of the invention is to provide a simplified means for forming a novel form of design in a full-fashioned stocking blank or like knitted fabric and to do this economically and with the least possible change or modification of the conventional forms of stocking knitting machines now in general use.

In the art of forming clock lace in full-fashioned stockings, it is the usual practice to equip the conventional forms of machines used at present to knit and shape the stocking blank, with mechanism which coacts with attachments known as clocking attachments to form the lace clocks. These attachments are complicated in their structure, are bulky and comprise numerous component parts which contribute to the already existing complication and multiplicity of parts found on such machines. These attachments are quite expensive of themselves and must be coupled to the other mechanism with their separate controls, all of which contributes to the cost of forming clock lace ornamentations in stockings.

Accordingly another object of the present invention is to utilize an already existing part of the conventional full-fashioned stocking knitting machine so that in addition to its conventional function certain parts can be made to function additionally to provide lace clocks and in this way the invention features the omission of the clocking attachments heretofore necessary in order to make the decorative feature hereinafter described.

This object of the invention is attained by utilizing the usual narrowing mechanism to form lace clocks in the stocking blanks. This is attained by a modification of certain of the parts such as a repositioning of the narrowing points, should the design require such adjustment, and controlling the operation of the narrowing mechanism to give the requisite shifting of the stitches so as to form lace clocks in distinction from the formation of the usual narrowing operation attained when the narrowing device functions conventionally.

Another object of the invention is to provide an artistic form of heel decoration which can be formed simultaneously with the formation of the knitted fabric and without the necessity of adding to the stocking knitting web any additional threads to attain the new effect.

Broadly this phase of the invention is attained by starting the design forming action of the narrowing mechanism by first positioning the set of narrowing points to the outside of the selvage edges and advancing the set progressively and step by step inwardly of the selvage edge until the full set of narrowing points is acting to displace the stitches of alternate or other courses thereby to form adjacent each edge of the stocking blank a V-shaped strip, the wales of each course of which are inclined to the wales of the courses forming the major portion of the stocking blank.

The invention therefore features a novel method of utilizing the conventional narrowing mechanism for the purpose of forming a change in the character of knitting adjacent the selvage edges, and, if desired, the subsequent utilization of the narrowing mechanism for the purpose of forming one or more lines of clock lace in the stocking blank so that when the selvage edges are sewed together there will result a novel inverted V-shaped design formed of the same threads which form the adjacent leg portion of the completed stocking and distinguishing in one or more lines of lace clocks outlining the V-stripes.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of one form of mechanism embodying my invention, and the invention also consists in certain new and novel features of construction and combination of parts hereinafter set forth and claimed.

In the accompanying drawing:—

Fig. 1 is a plan view looking down upon

a portion of a stocking blank showing the decorative feature in process of formation and showing symbolically certain parts of the machine;

Fig. 2 is a view in front elevation of certain parts of the completed machine necessary to be referred to in describing the invention herein; showing the modification of the mounting of the narrowing points and showing in end elevation a modification of the conventional control for the narrowing mechanism;

Fig. 3 is a view in end elevation of the control shown in the right of Fig. 2;

Fig. 4 is an enlarged explanatory view of the knitting at the left hand side of Fig. 1 shown about the position indicated by the line *g*—*h* of this figure;

Figs. 5 to 9 inclusive are detailed explanatory views showing in succession the action of one of the narrowing points in removing a stitch from a needle on which it is formed to an adjacent needle to effect the narrowing and clock lace herein featured; and

Fig. 10 is a view in rear elevation at the angle portion of a stocking completed from the blank shown in Fig. 1.

Referring to the machine aspect of this disclosure it is to be understood that the machine used for forming the clock lace edge design herein featured is the conventional full-fashioned stocking knitting machine now in general use and which includes the conventional knitting mechanism for forming the fabric of the stocking blank and of which parts there is illustrated the bank 10 of upstanding spring beard needles 11 conventionally spaced apart as shown in Fig. 2. The machine also contains the usual narrowing mechanism for operating on the stocking blank 12 adjacent the selvage edges 13 for reducing the width of the blank in a prescribed order of operation to shape the finished stocking to the leg and ankle. The narrowing mechanism includes a left narrowing finger 14 carried by a narrowing bar 15 and a right narrowing finger 16 carried by a narrowing bar 17 and which narrowing bars are controlled conventionally by mechanism indicated symbolically by the left and right threaded control shaft 18 in turn actuated by a ratchet 19 fed by a pawl 20 in the usual timed sequence during the knitting operations and in turn regulated by a jacquard or other form of control usually forming part of such machines. It will be understood in general that the machine thus far described is of a well known type now in general use and that for this reason known details of construction have been omitted from this disclosure.

The machine as modified to perform the operations herein featured distinguished from conventional machines primarily in that it can form lace clocks without the necessity of employing the lace clock forming attachments commonly added to such stocking knitting machines.

In order to so function the number of narrowing points 21 forming the set 22 may be, and preferably is, reduced in number over the number usually employed in conventional narrowing operations and, one or more additional points 23 may be added to the set 22 but spaced therefrom or, differently expressed, one or more of the narrowing points may be omitted from a set of such points. In the showing in Fig. 2 one such additional point has been added to the set or, differently expressed, one point has been omitted from the set to form the space interval 24. The points forming the set 22 are equally spaced apart a distance equal to the spacing of the needles 11 and except for the omission of the point or points in the narrowing finger this part of the machine corresponds to the part as present constructed for narrowing operations.

In the usual narrowing operations the control is so designed that the narrowing mechanism in its transference of stitches from the selvage knitting needles 25 and 26 carries each of the stitches from the needle on which it was formed to the adjacent needle two removed therefrom. In the functioning of the machine to form clock lace as hereinafter described the corresponding action of the narrowing points is regulated so as to remove a stitch from the needle on which it is formed to the next adjacent needle. This requirement to change the distance of displacement of the stitches necessitates a modification of the control means for advancing the ratchet 19. Any conventional mechanism may be employed for changing the advancing action of the pawl feeding the ratchet to change the same from its conventional feed across a distance of two teeth into a single-tooth feed so that in each reciprocatory action of the narrowing bar it will be shifted in its operating direction inwardly towards the medial longitudinal line *a*—*b* of the blank a single-needle distance, that is, the distance equal to the interval between the centers of two succeeding points or needles. This is conveniently attained by positioning a cam plate 27 between the pawl and the ratchet and which plate is provided with a recess 28 to permit the pawl 20 to engage succeeding teeth of the ratchet even though it travels circumferentially of the ratchet a distance which normally would cause it to advance the ratchet the arc distance of two of its teeth.

Referring to the detailed showing in Fig. 1, it can be assumed that the stocking has been knitted conventionally down to the line *c*—*d* in Fig. 1, and that from *c*—*d* to the line *e*—*f* the knitting mechanism functions con-

ventionally to knit the ankle portion of the stocking blank above the heel which has not yet been knit in the showing in Fig. 1. It can be further assumed that the set of narrowing points 22 have previously been utilized to narrow and give shape to the leg and ankle portion of the stocking shown in advance of the line *c—d*.

When the course along the line *c—d* has been knit the control is changed so as to cause the narrowing mechanism to shift with a single instead of a double interval shift previously used in the narrowing operation. The controls are initially set that both of the narrowing fingers 14 and 16 are shown in the position indicated by the dots representing the correspondingly numbered point spaces 1—8 and shown in Fig. 1 in elongation of the line *c—d* and positioned so that point 1 of each set is at the adjacent selvage edge 13. The first actuation of the narrowing finger is to cause point 1 to pick off of the end needle 29 the loop which was formed thereon during the preceding knitting operation and to transfer this loop to the next adjacent needle 30. Two courses of conventional knitting are then laid and in the next succeeding operation of narrowing mechanism the two needles 1 and 2 act to transfer the two loops of the last laid course formed on needles 30 and 31 to the next adjacent needles 31 and 32. The single loop which was previously on needle 30 is transferred to needle 31 and the loop which was formed on needle 31 is transferred to needle 32. In the succeeding narrowing operations this displacement of a loop from the needle on which it is formed to the next adjacent needle is continued until all of the points forming the set 22, in this particular case shown to six, are displacing the loops from the six selvage forming needles inwardly one needle. With all of the set of narrowing points operating the knitting has advanced to the position shown by the line *g—h*, with the additional point 23 still positioned to the outside of and spaced from the selvage edge which at this time is in line with the blank space 24.

In the next succeeding narrowing actuation in its step by step inward movement the blank space 24 will be opposite to the first selvage knitting needle 29 and of course in this actuation of the narrowing mechanism the loop which is formed on the needle 29 is not removed but is permitted to remain in place while each point comprising the set of 22 is removing a loop from its associated needle and replacing the loop on the next adjacent needle. Leaving the loop on the end needle 29 and removing the loop from the next needle an opening spaced one needle distant inwardly from the selvage edge is formed. There is thus formed the first of the line of clock openings 33 featured in this disclosure. A straight locking course of conventional knitting is then laid followed by a course hereinafter identified as a clocking course. In each subsequent operation of the narrowing mechanism on the clocking course as the narrowing finger is advanced towards the medial line *a—b*, there will be formed in rear of the last needle of the set and in rear of each of the additional needles a clock opening and the succeeding clock openings will form one or more lines of clocks 34 as shown in Fig. 1. As the clock forming action is advanced inwardly and progressively of the stocking blank there is continued to be formed on opposite sides thereof the conventional knitted effect in which the loops or stitches extend at right angles to the courses as indicated adjacent the opposite edges of Fig. 4.

Referring to the explanatory Fig. 4 there is shown alternate lace clock forming courses 35 to 38 inclusive connected by linking or locking courses 39, 40 and 41.

Referring specifically to the last course 38 it will be noted that needles 29, 30, 31, 32, 42, 43, 44, 45 are knitting conventionally with loops remaining on the needles on which they are formed. It will be noted in each preceding clocking course such as course 37, 36 and 35 that the clocking effect was started at one less needle back to the course at *c—d* where but one needle 29 retained its loop. In knitting the course 38 loop 57 was originally formed on bare needle 46, loop 58 was originally formed on blank needle 48, loop 59 was originally formed on needle 49, loop 60 on needle 50, loop 61 on needle 51, loop 62 on needle 52, loop 63 on needle 53, with loops 64 and 65 remaining respectively on the needles 47 and 54 on which they were formed and this applies to all of the other loops across the body portion of the stocking until the clock forming and stripe forming stitches are reached on the opposite side where the arrangement of the corresponding parts are relatively reversed. It will be understood that there will be an opening formed in the space occupied by the needles 46 and 48 and it is these spaces which form the lace clock openings in the finished fabric.

Referring to the explanatory Figs. 5 to 9 inclusive, it may be assumed that the knitting needle is the needle 46 and that the loop is the loop 57 and that the narrowing point is the additional point 23. It is obvious, however, that the needle may be any of the knitting needles 11 involved in the clocking operation and that the point may be any one of the points in the set 22 in so far as their narrowing operation is concerned.

In the showing in Fig. 5 the parts are in their relative position after the locking course has been laid and just prior to the

actuation of the narrowing mechanism to form the stripe and clock lace.

Fig. 6 shows the pointer 23 descended into position to press inwardly the beard 68 of the needle and in position to engage the loop 57; Fig. 7 shows the pointer in its elevated position with the loop thereon leaving the needle 46 bare as shown in Fig. 4; Fig. 8 shows the next needle 47 with its previously formed loop 64 thereon and with the pointer 23 lowering the loop 57 into superposed relation on the previously formed loop 64; and Fig. 9 shows the pointer elevated with needle 47 carrying two loops or stitches as suggested at 47 in Fig. 4.

It is understood that the next succeeding course will correspond to the previously formed course 41 and link succeeding clock forming courses.

In the embodiment of the invention herein selected for specific discussion each alternate course is a clock forming course but it is obviously within the scope of the disclosure to insert more than one clocking course as shown at 39, 40 and 41 and which would have the effect in the finished product of reducing the angle of inclination of the stripe and line of clock openings and this same effect can also be produced by setting the narrowing mechanism so that the inward stepping of the narrowing fingers would take place after two or more replacements of the stitches or loops rather than a replacement of each alternate course as specifically shown herein.

Should it be desired to vary the width of the stripes needles are added or subtracted from the set 22 and should it be desired to increase the number of lines of clock openings additional needles are added to the narrowing finger, one additional needle being added for each additional line of clock openings required. In the illustrated form the one additional needle 23 was added to form the line in addition to the line formed by the last needle of the set and should it be desired for instance to have a third line of clock openings another needle is added in spaced relation to the needle 23 on the side thereof opposite the set 22.

When the requisite length of clock forming courses have been knit and it is desired to return to conventional knitting such for instance as the knitting of the remaining portion of the heel in the illustrated instance, the narrowing mechanism is thrown out of operation by conventional means at present under control of the jacquard and the stocking blank is finished conventionally.

In completing the stocking the selvage edges are sewed together following usual methods, and there results in the finished article an inverted V-shaped ornamental decoration shown in Fig. 10 and which takes the place of the usual high splice. This ornamentation is characterized by the sides of the V-shape formed of the inclined stripe outlined at opposite edges by the two lines of lace clock openings.

Having thus described my invention, I claim;

1. In a full-fashioned stocking knitting machine, the combination of means for knitting the fabric of the stocking blank, narrowing mechanism including a set of spring beard needles and a set of narrowing points, control means adapted to act on the set of narrowing points for causing the same to engage the stitches on those needles which are knitting the selvage edge of the stocking blank to remove the stitches from said needles inwardly a distance equal to the spacing of two of the needles thereby to effect a conventional narrowing of the blank between opposite selvage edges and other control means adapted to act on the same set of narrowing points for causing the same to engage the stitches on a set of needles which are knitting a portion of the blank spaced inwardly from the adjacent selvage edge to shift said interior stitches a distance equal to the space of one needle to effect a narrowing spaced inwardly from said adjacent selvage edge and leaving a clock lace opening between the part of the blank so narrowed and the adjacent selvage edge.

2. In a knitting machine, the combination of mechanism including knitting needles for knitting a fabric blank, narrowing mechanism including a narrowing finger mounted for reciprocatory movement, a set of narrowing points carried by the finger and conventionally spaced, an additional point carried by the finger spaced from said set of points to leave an opening equal to the space interval between alternate points, means adapted to cause said set of narrowing points to function during the knitting of the blank while reducing the yarn travel and thus reducing the width of the blank at one portion thereof while the additional point is idle and spaced outwardly away from the adjacent selvage edge and means adapted to operate during the knitting of another portion of the blank for causing all of said points to operate in spaced relation to the adjacent selvage edge to effect a successive transferring of two stitches in each course of knitting to the next adjacent knitting needles thereby to form two lines of clocks in the blank without reducing the yarn travel and thus without reduction in width of the blank during the formation of the clocks.

3. In a knitting machine, the combination of mechanism including knitting needles for knitting a fabric of the blank, narrowing mechanism including a narrowing finger mounted for reciprocatory movement, a set of narrowing points carried by

the finger and conventionally spaced, a plurality of additional points carried by the finger and spaced from the set and from each other to leave openings between each additional point and between the set and the next adjacent additional point in each case equal to the space interval between alternate points, and means adapted to act on the narrowing finger during the knitting of certain of the courses for causing all of said points to engage stitches on certain of the needles knitting portions of the blank spaced from the selvage edges to shift each of the stitches to the next adjacent knitting needle thereby to form a number of lines of clock lace equal to a number one more than the number of openings formed by the spacing of the additional narrowing points without reduction in yarn travel during the formation of said openings.

4. In a knitting machine, the combination of mechanism for knitting the fabric of a blank, a narrowing bar mounted for reciprocatory movement, a narrowing finger carried by the bar, a set of narrowing points carried by the finger for narrowing the fabric when overlapping the selvage edge and for forming a clock design when operating entirely within the outlines of the blank without narrowing the blank and control means adapted selectively to cause said narrowing bar to shift a distance equal to either two or one intervals of said narrowing points depending on whether the narrowing points are to function conventionally across the selvage edge as means for narrowing the width of the blank or to function within the outlines of the blank to form lace clocks in the blank without narrowing the same.

5. In a knitting machine, the combination of mechanism including needles for knitting the fabric of a blank, means including narrowing points for transferring stitches from one to another of the knitting needles and controlling mechanism adapted selectively to cause said means to shift the stitch from the needle knitting a selvage edge to the second needle therefrom to effect a narrowing of the blank and also to shift the stitch from a needle knitting an interior position of the blank to the next edjacent needle and thus leave a clock lace hole in the fabric without narrowing the blank.

6. In a knitting machine, the combination of mechanism including knitting needles for knitting a fabric blank, narrowing mechanism including a set of points fixed relative to each other and having an operative movement in one direction parallel to said line, each point of said set in said operative movement acting when within the outlines of the fabric blank to remove a stitch from one of the knitting needles in spaced relation to the adjacent selvage edge of the blank and replace the stitch so removed on the next adjacent knitting needle thereby to form a design in the fabric without narrowing the fabric and said narrowing mechanism acting when its points are extending across an edge of the blank to narrow the same.

7. In a knitting machine, the combination of mechanism for knitting a fabric blank, two sets of narrowing mechanism each including a set of fixed narrowing points and acting respectively on the stitches forming one of the selvage edges of the blank to reduce the width of the blank, means adapted to cause said narrowing points of each mechanism to act on stitches within the outlines of the fabric and in spaced relation to its selvage edges to form clock lace on opposite sides of the longitudinal medial line of the blank and means adapted to shift the narrowing mechanism during the knitting of succeeding courses to form lines of clock lace inclined to the wales and course of the knit fabric without reduction in yarn travel during the formation of said clock lace.

8. In a knitting machine, the combination of mechanism including a set of equally spaced knitting needles for knitting the fabric of the blank, narrowing mechanism including two sets of narrowing points coacting with certain of the knitting needles and acting on the stitches forming the selvage edges of the blank for reducing the width of the blank, and means adapted to cause said sets of narrowing points to approach each other with a step-by-step movement and said points acting progressively on stitches in spaced relation to the selvage edges to form a pair of inclined stripes on opposite sides of the longitudinal medial line of the blank.

9. In a knitting machine, the combination of mechanism including a set of equally spaced needles for knitting a blank, two narrowing mechanisms for shaping the blank from opposite selvage edges, each mechanism including a set of equally spaced narrowing points and an additional point fixed relative to and spaced outwardly from the equally spaced points of the corresponding set a distance greater than the distance between the equally spaced points and adapted when the points are functioning within the outlines of the blank to form two lines of lace clocks.

10. In a knitting machine, the combination of mechanism including a set of equally spaced needles for knitting a blank, two narrowing mechanisms for shaping the blank from opposite selvage edges, each mechanism including a set of equally spaced points and an additional point spaced from the equally spaced points of the corresponding set, a distance greater than the distance between the equally spaced points and means adapted to cause the sets of points progressively to

move towards each other, following succeeding actions of the knitting mechanism from a position with some of the points exteriorly of the adjacent edge of the stocking to a position in which all of the points are within the outlines of the stocking blank.

11. In a knitting machine, the combination of mechanism for knitting a blank with a line of lace clock therein, narrowing mechanism for shaping the blank, said narrowing mechanism including a set of equally spaced points, and including means adapted to advance the set of points from a position with some of the points exteriorly of the adjacent selvage edge to a position in which all of the points are within the outline of the blank and acting to form the lace clock without narrowing the blank.

12. In a full-fashioned stocking knitting machine, mechanism including a shiftable support, a line of stitch transferring points fixedly mounted in said support and adapted to function as design forming means in the stocking blank, certain of said points being arranged side by side, and equally spaced apart to form a set, said set adapted when operating across an edge of the stocking blank to function as a set of narrowing points and said line of points including an additional point spaced from one end of the set a distance equal to the distance between alternate points thereby to leave an opening in the line of points equivalent to the distance between alternate points whereby when operating within the outlines of the blank to form a line of lace clocks.

Signed at Milwaukee, in the County of Milwaukee, and State of Wisconsin, this 27th day of April, A. D. 1927.

ALBERT THIERFELDER.