

Jan. 27, 1942.

W. E. SHEELER

2,270,853

KNITTING ORNAMENTED NONRUN FABRIC

Filed Jan. 14, 1939

14 Sheets-Sheet 1

FIG. 1--

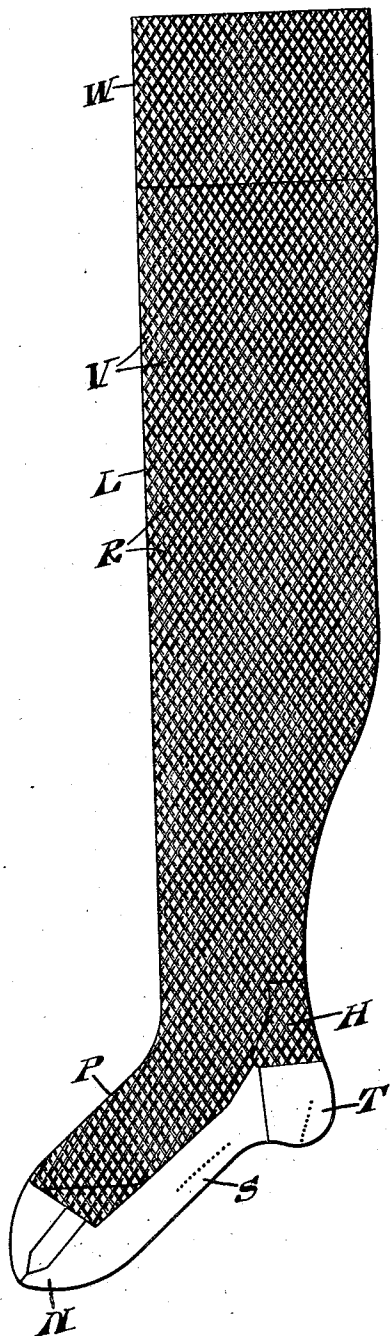
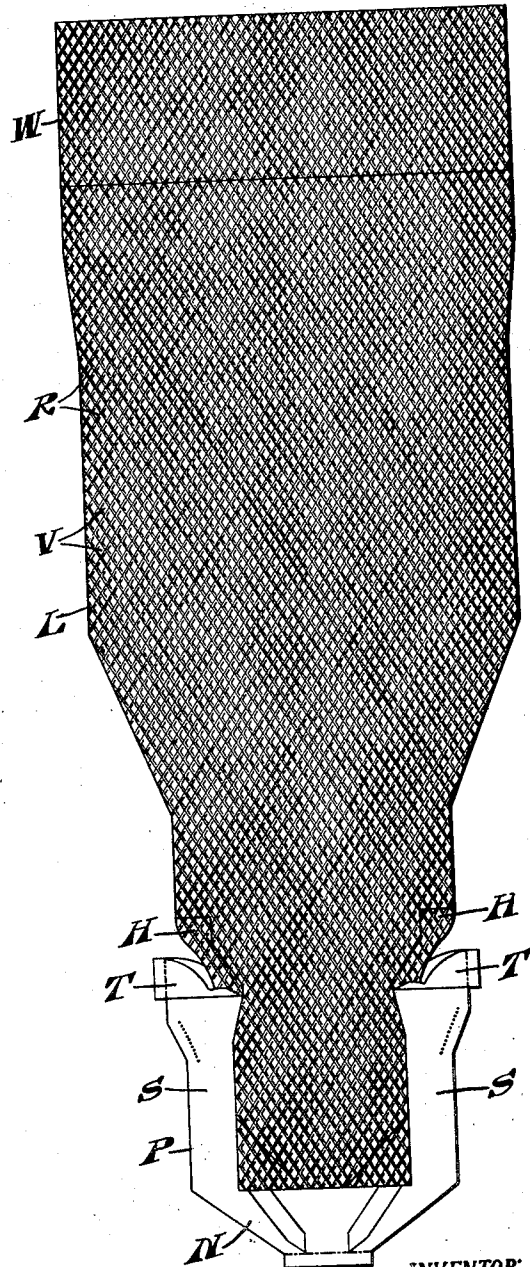


FIG. 2--



INVENTOR:
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KNITTING ORNAMENTED NONRUN FABRIC

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FIG. 3.

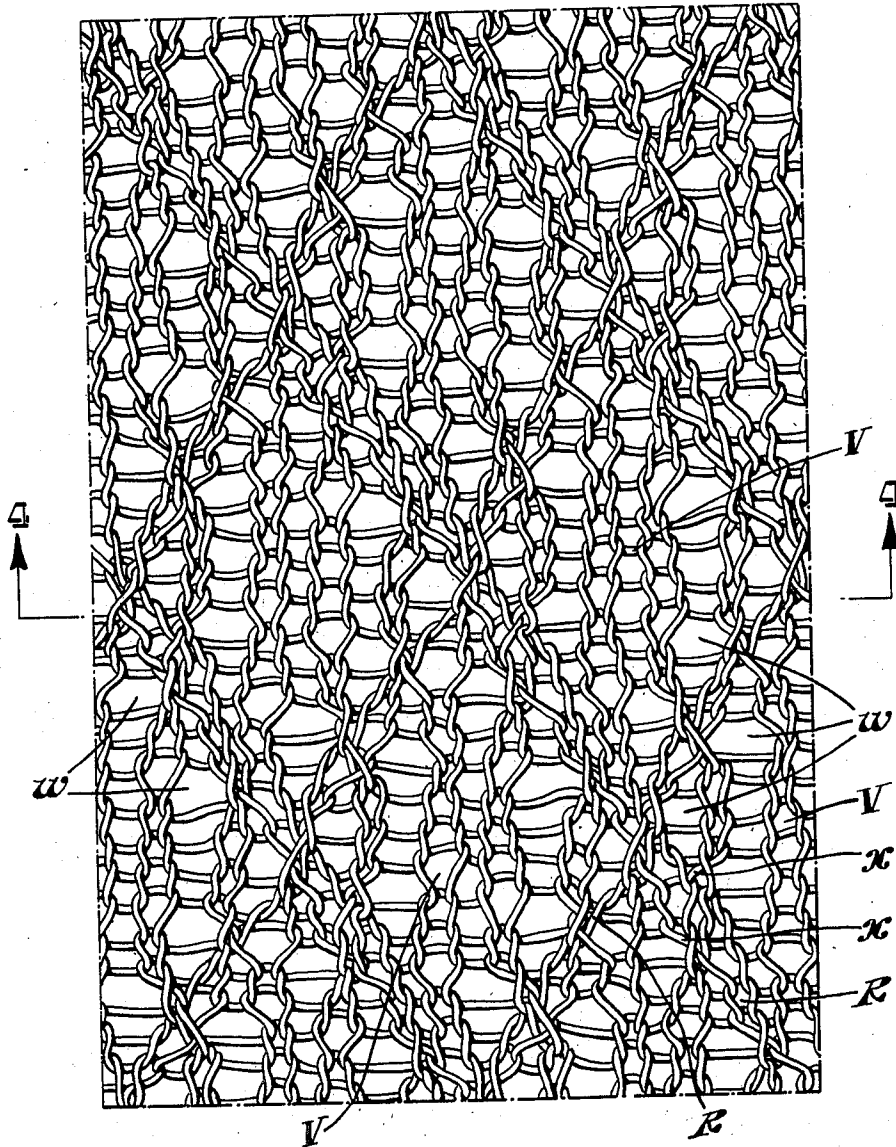
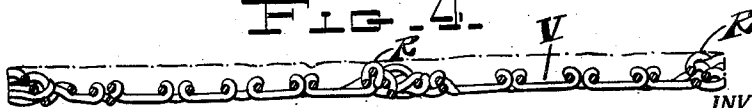


FIG. 4.



INVENTOR:
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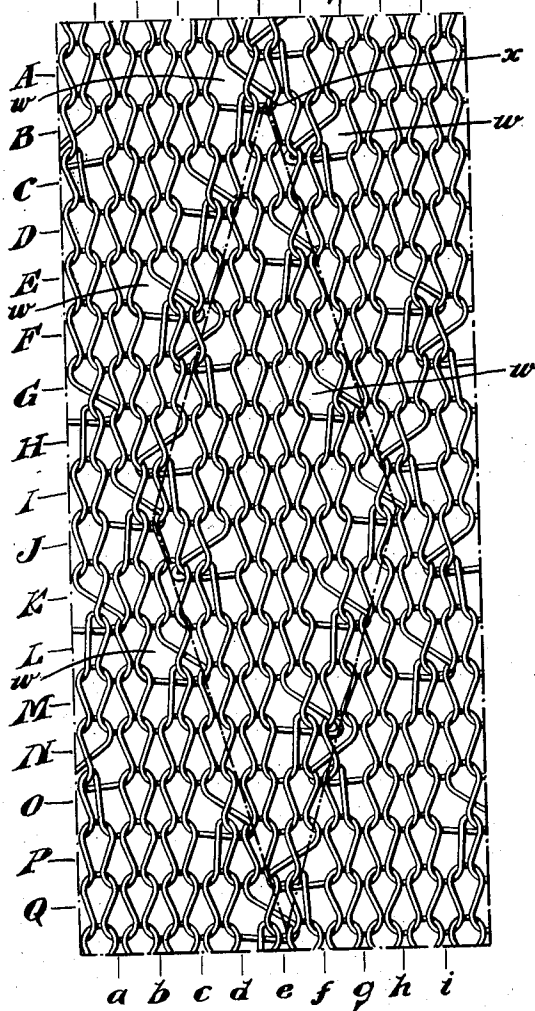
W. E. SHEELER

KNITTING ORNAMENTED NONRUN FABRIC

Filed Jan. 14, 1939

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INVENTOR:
William E. Sheeler,
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Jan. 27, 1942.

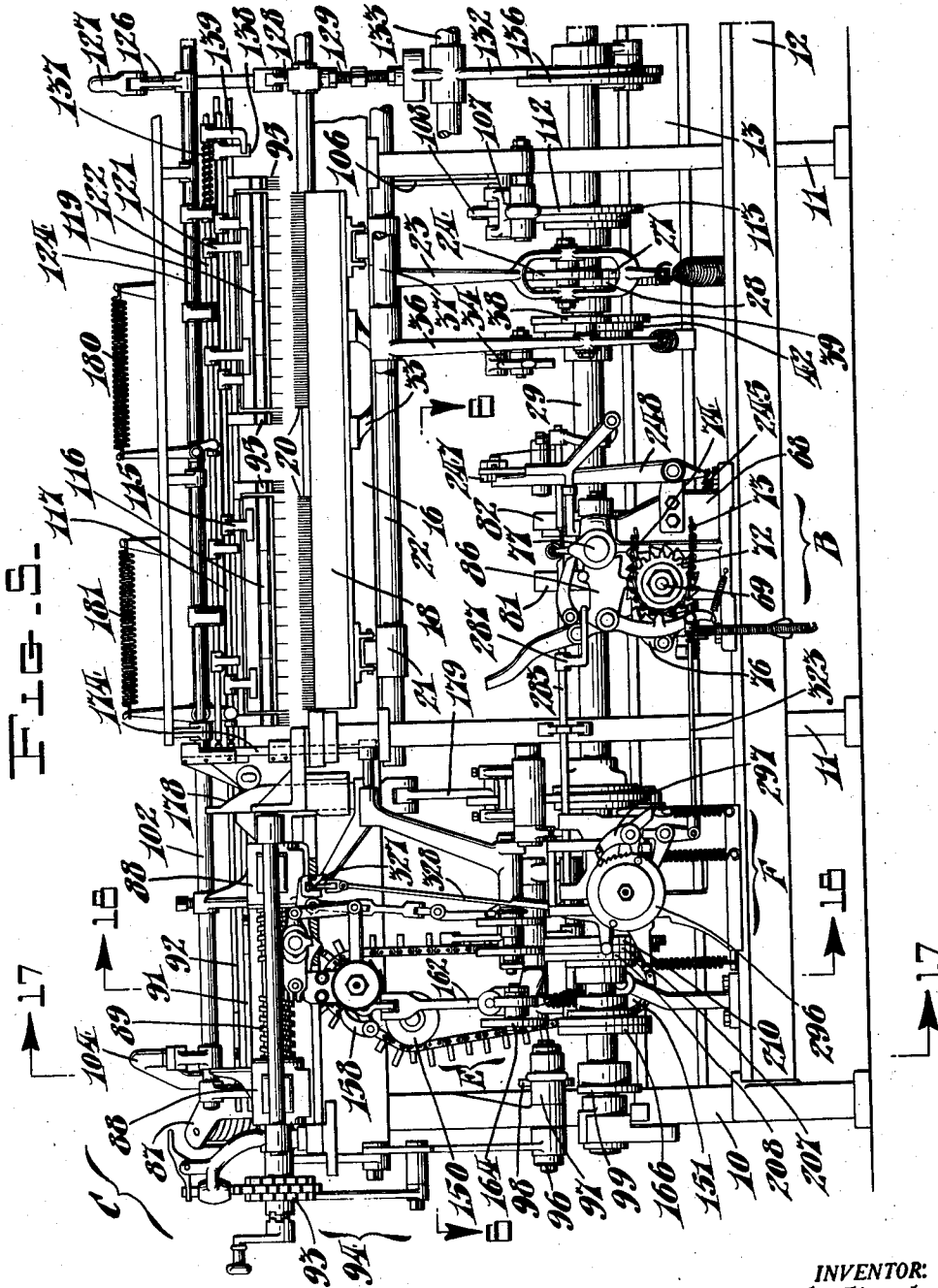
W. E. SHEELER

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KNITTING ORNAMENTED NONRUN FABRIC

Filed Jan. 14, 1939

14 Sheets-Sheet 4



INVENTOR:
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Jan. 27, 1942.

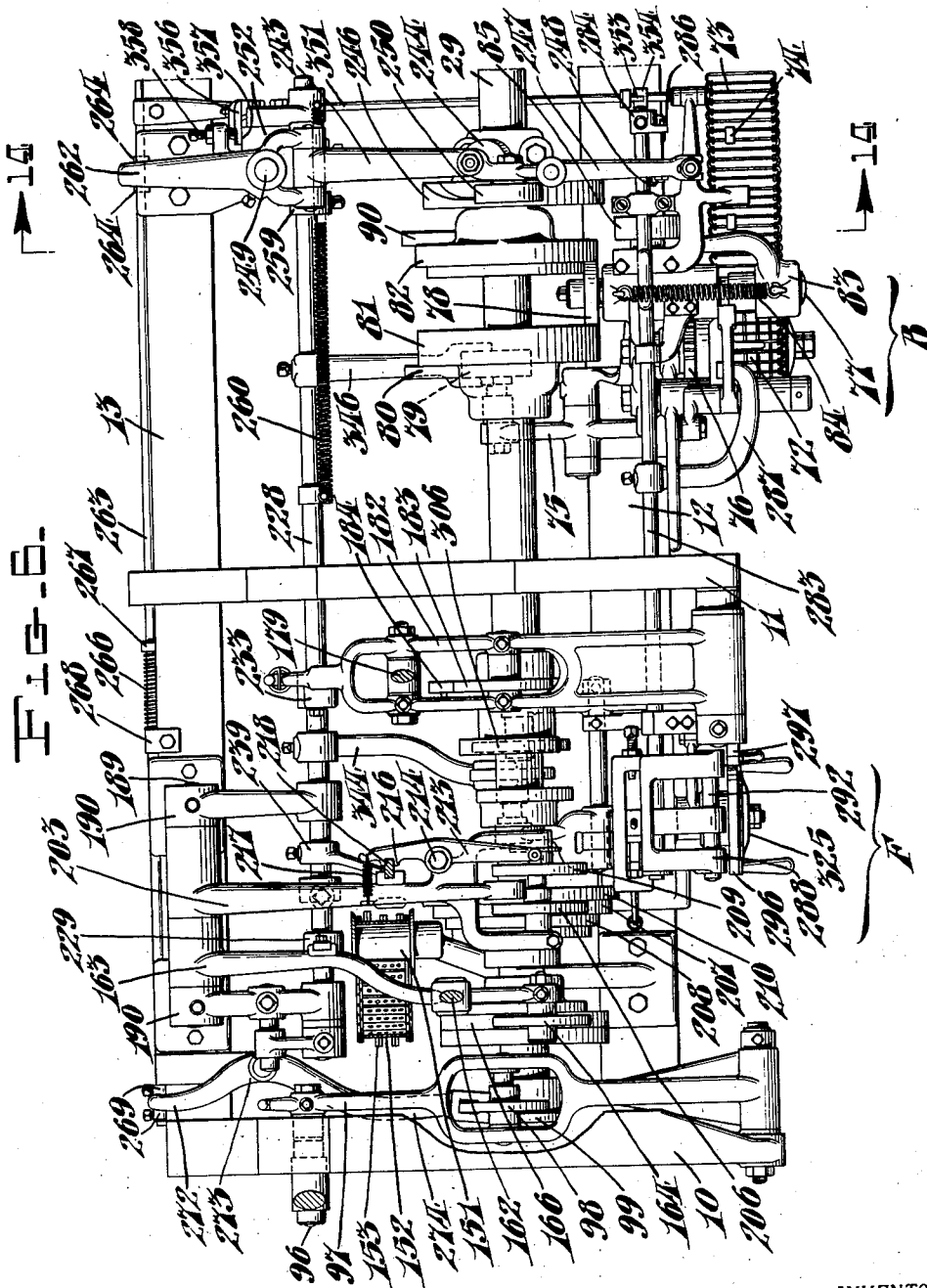
W. E. SHEELER

2,270,853

KNITTING ORNAMENTED NONRUN FABRIC

Filed Jan. 14, 1939

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INVENTOR:
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Jan. 27, 1942.

W. E. SHEELER

2,270,853

KNITTING ORNAMENTED NONRUN FABRIC

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FIG. 7.

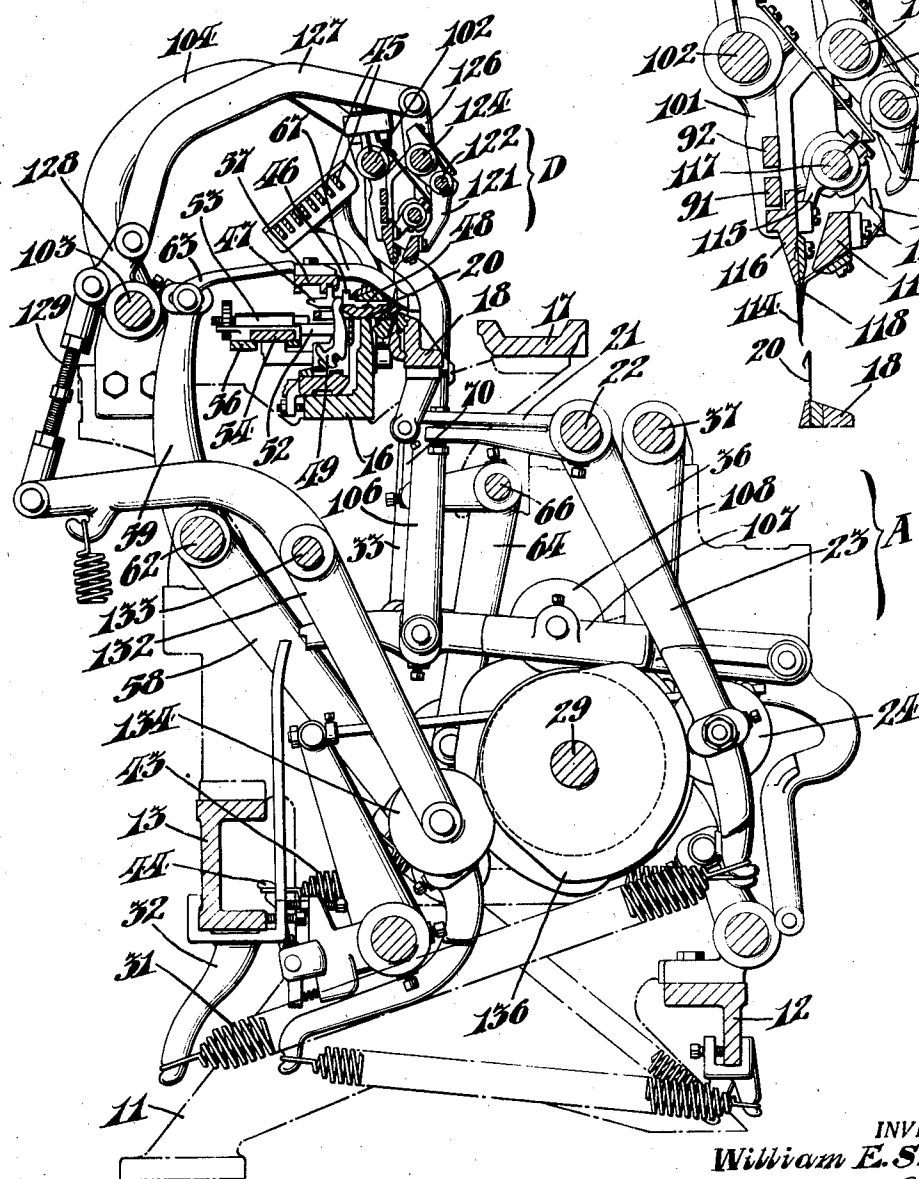
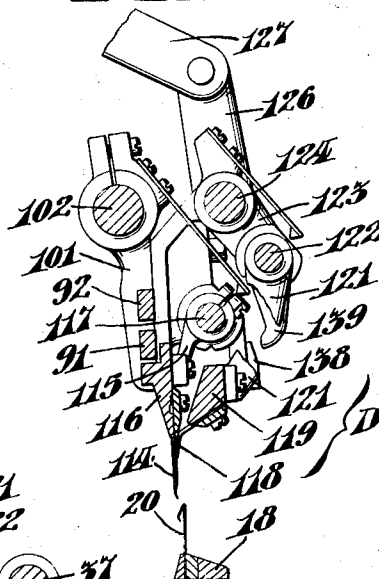


FIG. 8.



INVENTOR:
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Jan. 27, 1942.

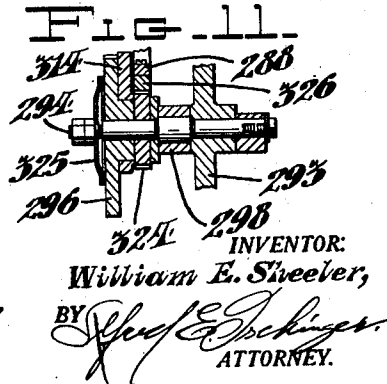
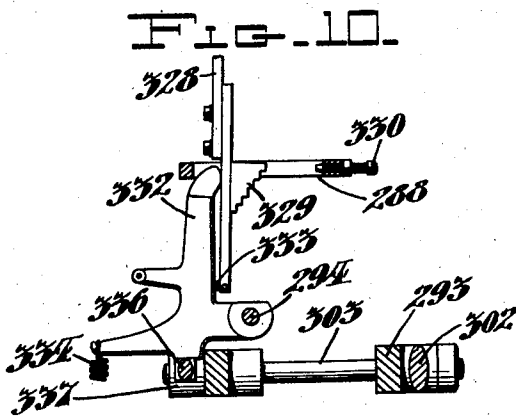
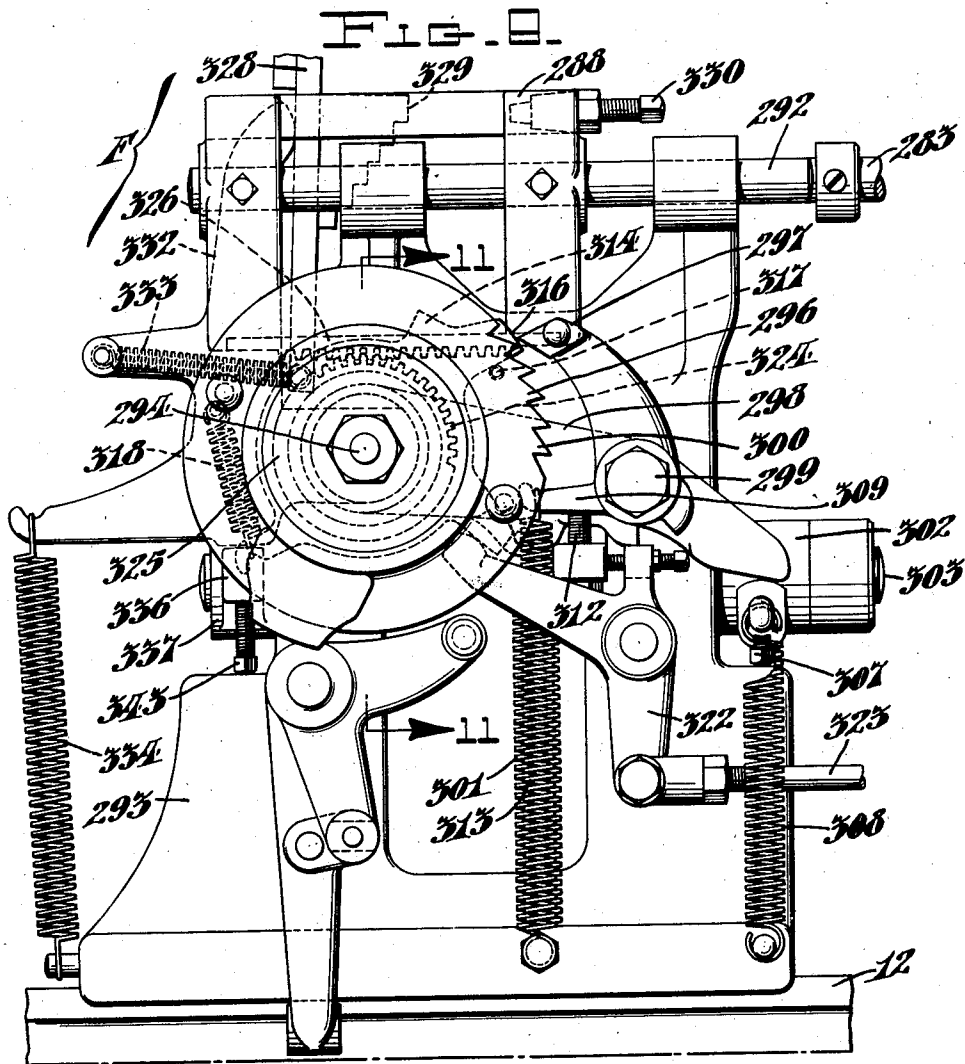
W. E. SHEELER

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KNITTING ORNAMENTED NONRUN FABRIC

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INVENTOR:
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Jan. 27, 1942.

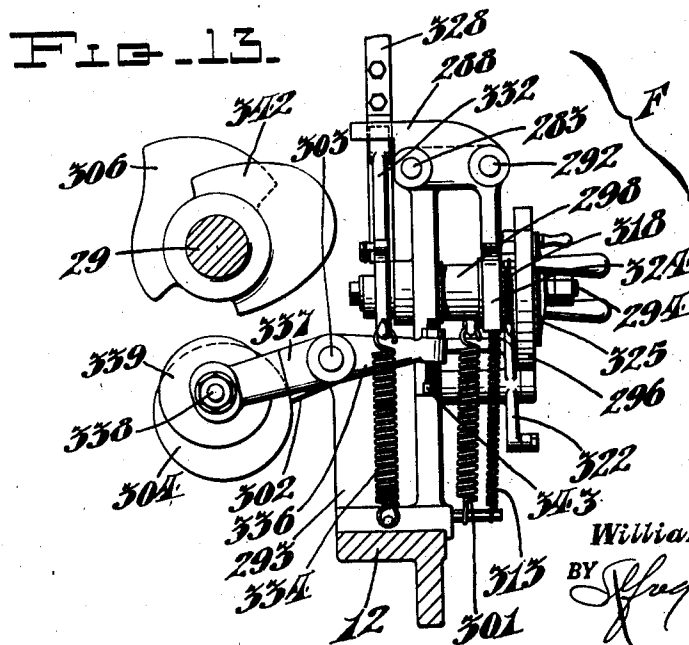
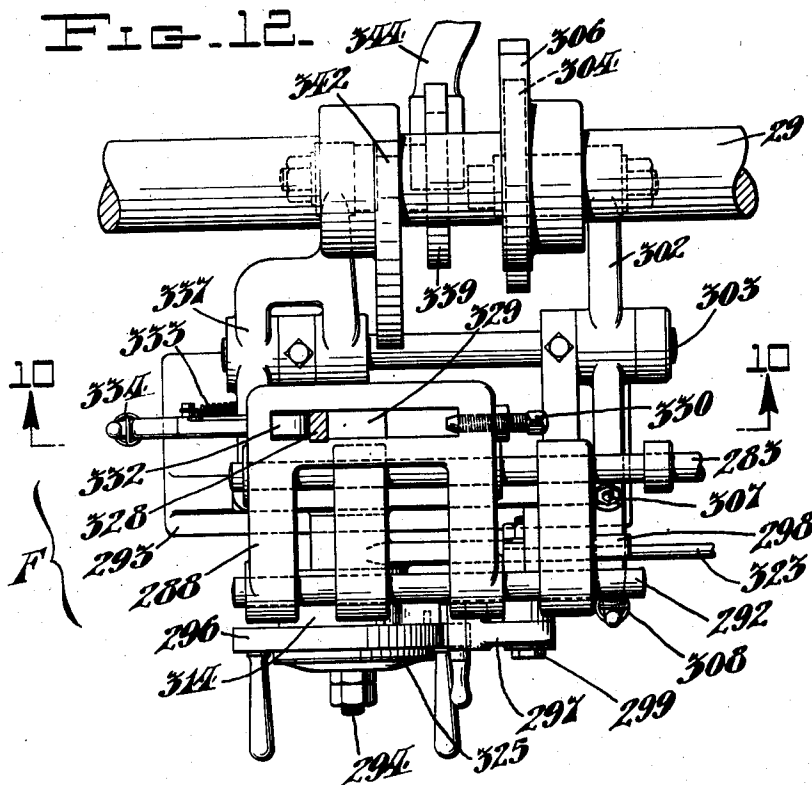
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KNITTING ORNAMENTED NONRUN FABRIC

Filed Jan. 14, 1939

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INVENTOR:
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2,270,853

KNITTING ORNAMENTED NONRUN FABRIC

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FIG. 15

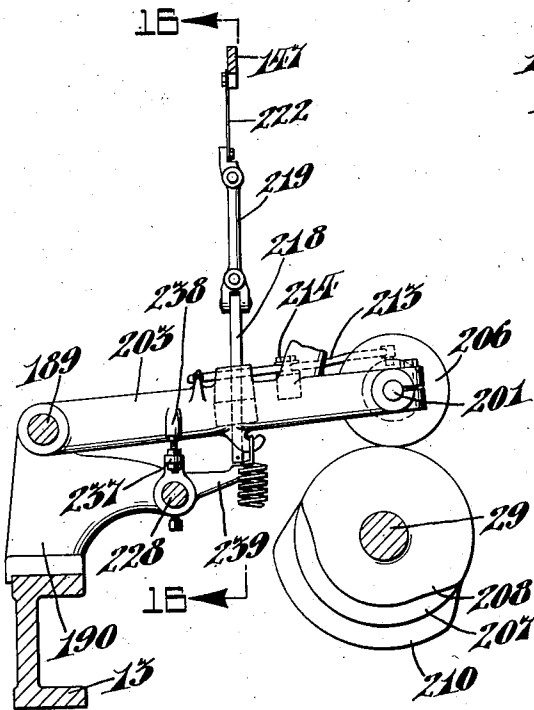


FIG. 16

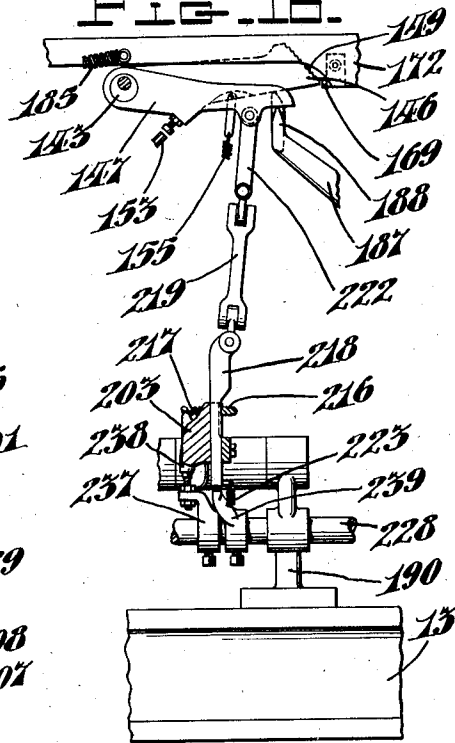
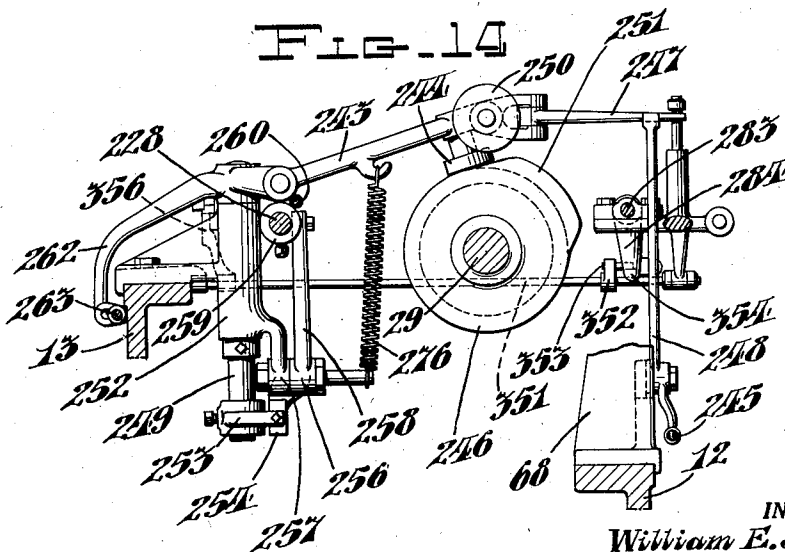


FIG. 14



INVENTOR:
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Jan. 27, 1942.

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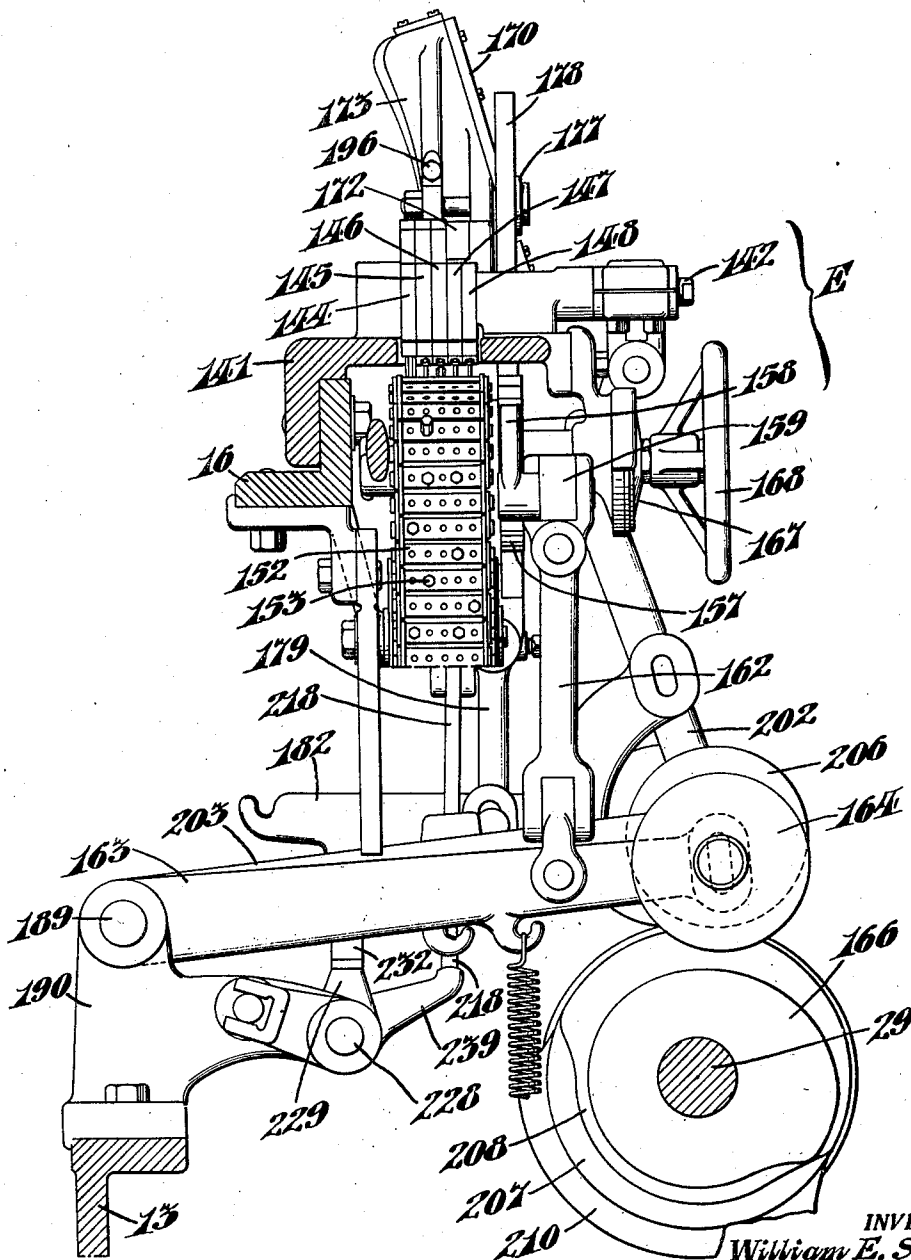
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FIG. 17.



INVENTOR:
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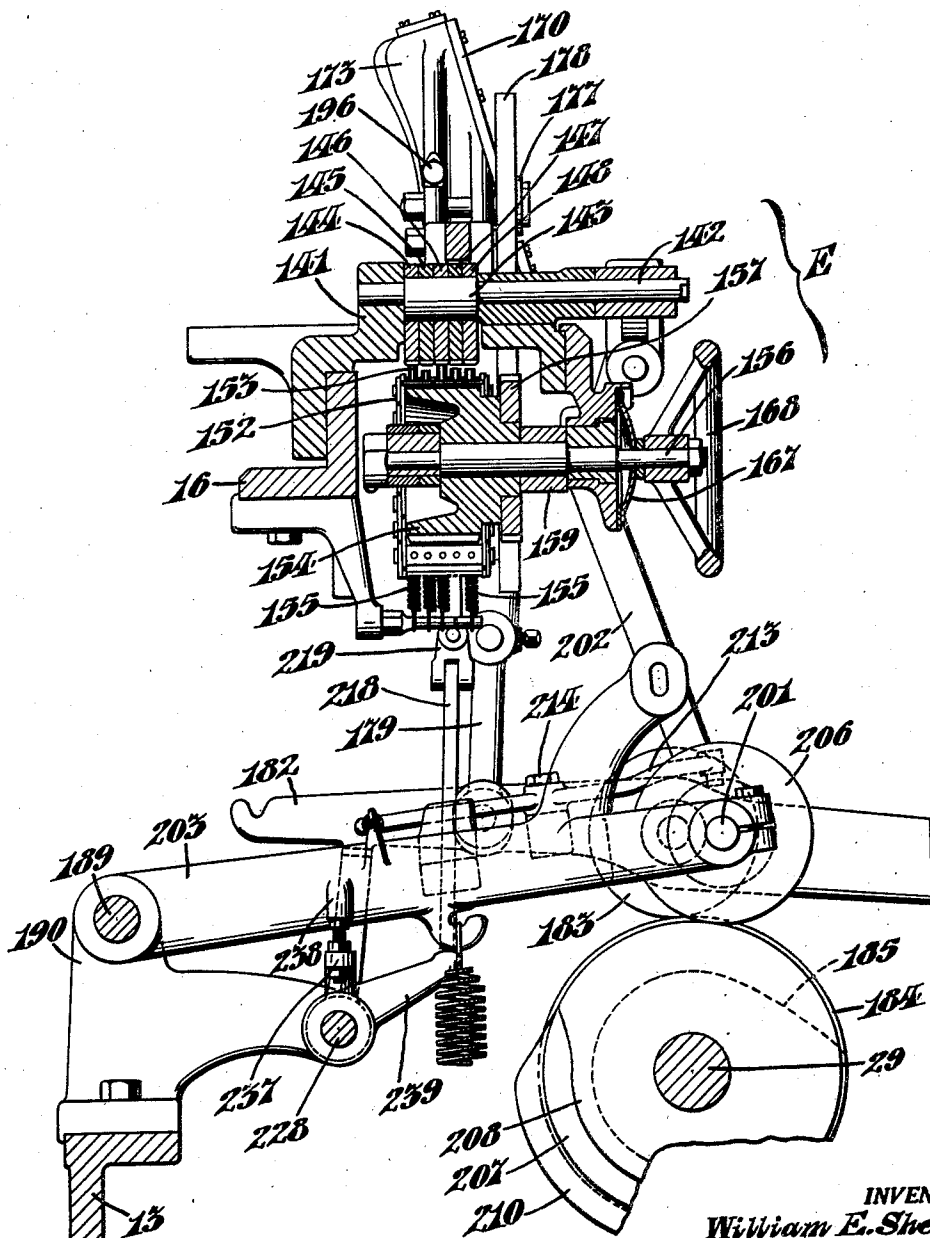
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FIG. 18.



INVENTOR:
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KNITTING ORNAMENTED NONRUN FABRIC

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Fig. 20.

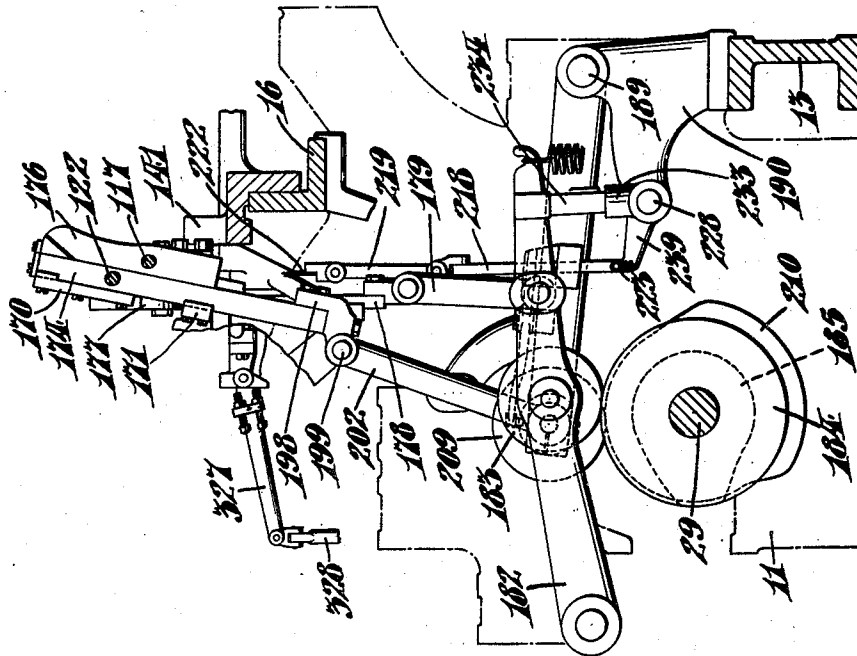
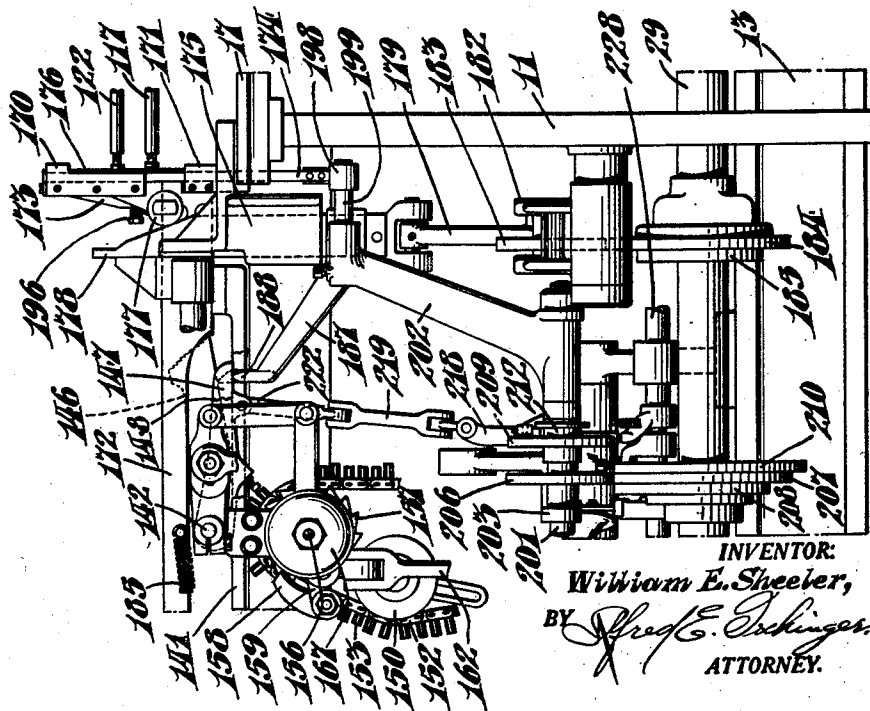


Fig. 18.



INVENTOR:
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Jan. 27, 1942.

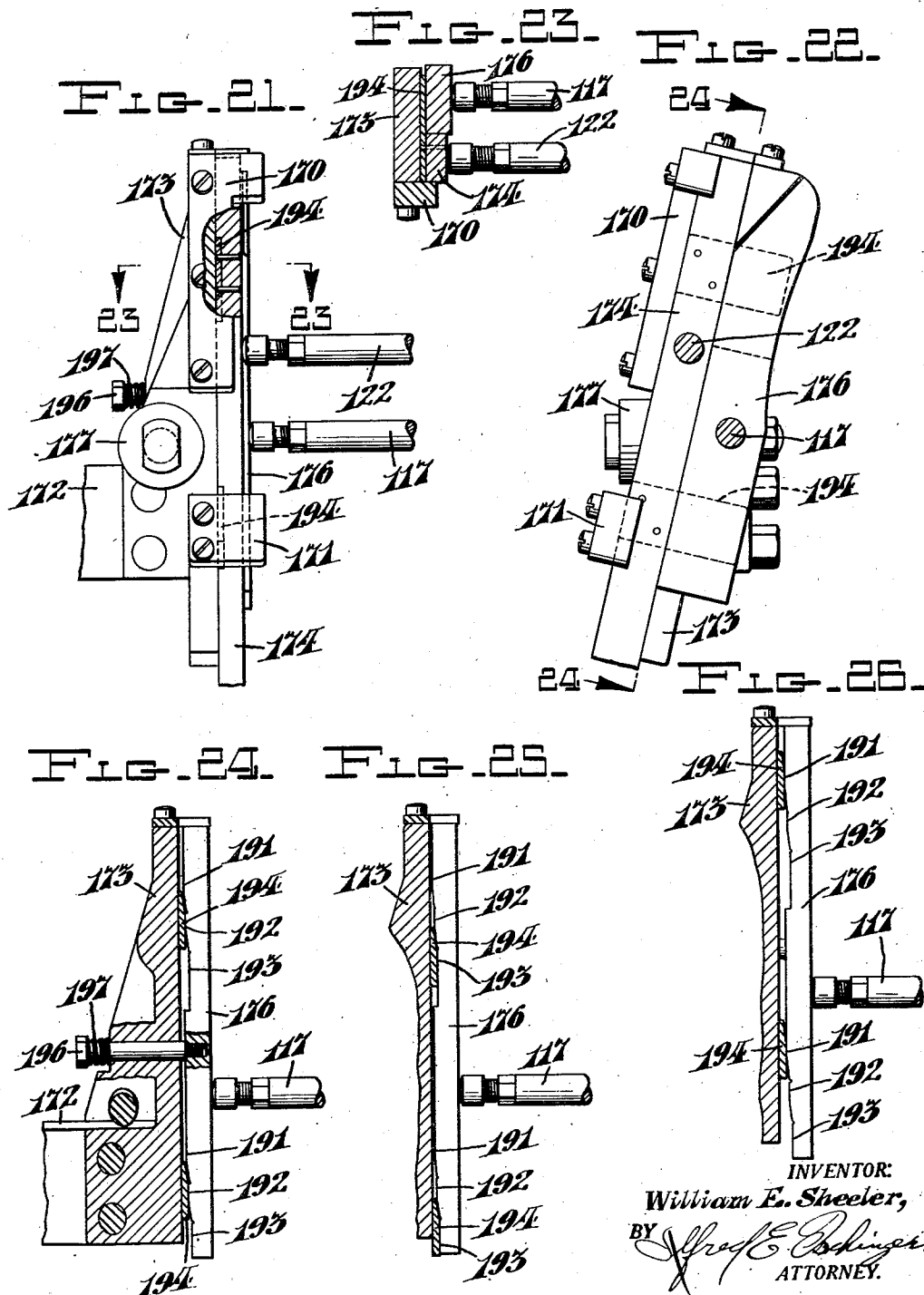
W. E. SHEELER

2,270,853

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Jan. 27, 1942.

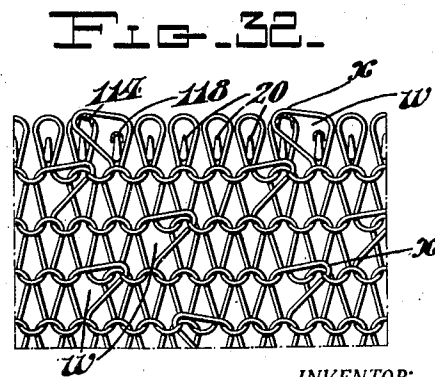
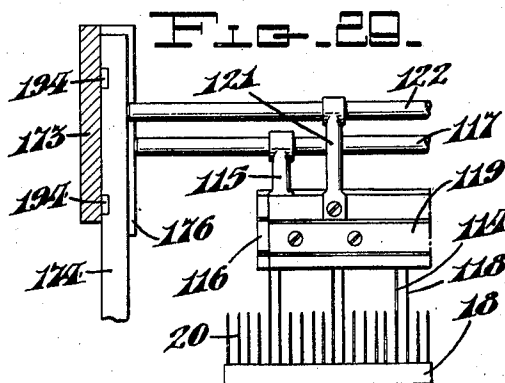
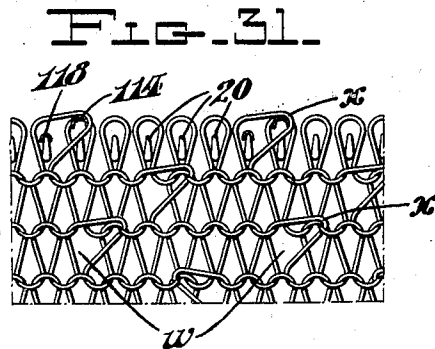
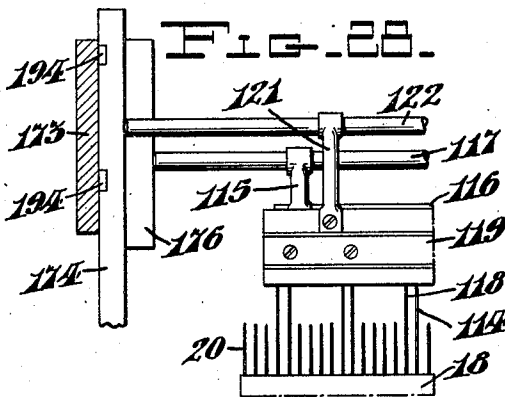
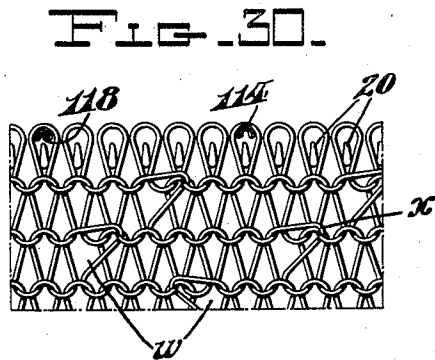
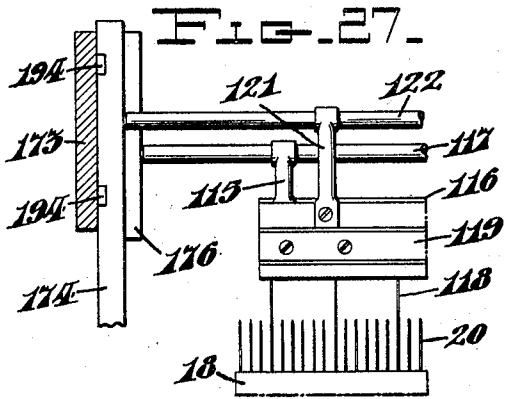
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KNITTING ORNAMENTED NONRUN FABRIC

Filed Jan. 14, 1939

14 Sheets-Sheet 14



INVENTOR:
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UNITED STATES PATENT OFFICE

2,270,853

KNITTING ORNAMENTED NONRUN FABRIC

William E. Sheeler, Sinking Spring, Pa., assignor
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a corporation of Pennsylvania

Application January 14, 1939, Serial No. 250,930

11 Claims. (Cl. 66—180)

This invention relates to knitted articles of wearing apparel, such as hosiery, as well as to means for and a method of knitting such articles so as to embody therein novel loop structures adapted to effect ornamentations of run-resisting character.

Heretofore, ornamented stocking fabrics have been produced by contrastingly arranging different loop formations according to a predetermined pattern. For example, lace loops and plain loops. Such designs heretofore produced were comparatively flat in structure or cross-section.

One object of my invention is to provide novel ornamented knitted fabrics, and articles of wearing apparel such as hosiery, in which the ornamentations or designs are defined by a raised or rib-like loop structure embodying non-run characteristics.

Another object of the invention is to produce, by a novel method, ornamented knitted fabrics having plain or other loop areas defined by lines formed of a raised or rib-like loop formation having run-resist and other characteristics effecting improved appearance and quality in the fabric.

Another object of the invention is to produce fabrics and articles of the indicated type, by novel means associated with a straight or full fashioned knitting machine.

With these and other objects in view which will become apparent from the following detailed description of the illustrative embodiment of the invention shown in the accompanying drawings, my invention resides in the novel elements, features of construction and cooperation of parts as hereinafter more particularly pointed out in the claims.

Fig. 1 is an elevational view of a stocking made in accordance with the invention;

Fig. 2 is a view of the blank of the stocking shown in Fig. 1;

Fig. 3 is a greatly enlarged view of a portion of the fabric shown in Figs. 1 and 2;

Fig. 3A is a diagrammatic plan view of a portion of the fabric illustrating the steps necessary in producing one of the diamond shaped ornamentations;

Fig. 4 is a sectional view taken substantially along the line 4—4 of Fig. 3;

Fig. 5 is a front elevation of the left end portion of a full fashioned knitting machine having my novel mechanism applied thereto for producing fabric of the type shown in Figs. 1 and 2;

Fig. 6 is a sectional plan view taken substantially on line 6—6 of Fig. 5;

Fig. 7 is a sectional view taken transversely through the knitting machine showing certain of the loop forming mechanisms and point bar operating mechanism constructed in accordance with the invention;

Fig. 8 is an enlarged detail view of the point bar mechanism shown at the top of Fig. 7;

Fig. 9 is a front elevation of the lace course regulator unit shown in Fig. 5, enlarged relative thereto;

Fig. 10 is a fragmentary vertical section taken substantially on line 10—10 of Fig. 12;

Fig. 11 is a sectional view taken substantially along the line 11—11 of Fig. 9;

Fig. 12 is a top plan view of the regulator unit as shown in Fig. 9;

Fig. 13 is a side elevation of the regulator unit taken from the left of Fig. 9;

Fig. 14 is a fragmentary vertical section taken substantially on line 14—14 of Fig. 6, showing certain details of the invention;

Fig. 15 is a vertical sectional view showing the follower shifting slide and associated parts;

Fig. 16 is a vertical section taken substantially on line 16—16 of Fig. 15;

Fig. 17 is a view taken along the line 17—17 of Fig. 5 showing the lace clock mechanism;

Fig. 18 is a sectional view taken substantially on line 18—18 of Fig. 5;

Fig. 19 is an enlarged front elevational view of certain of the mechanism shown at the left of Fig. 5, parts being omitted;

Fig. 20 is a side elevation of said mechanism taken from the right of Fig. 19;

Fig. 21 is a view partially in section of the point rod shifting mechanism shown at the upper right hand portion of Fig. 19, and enlarged relative thereto;

Fig. 22 is a side elevation of the point rod mechanism as viewed from the right of Fig. 21;

Fig. 23 is a sectional view taken on the line 23—23 of Fig. 21;

Fig. 24 is a sectional view taken substantially along the line 24—24 of Fig. 22;

Fig. 25 is a view similar to a portion of Fig. 24, the parts being shown in different operative positions;

Fig. 26 is a view similar to Fig. 25 but showing the parts in different operative positions relative thereto;

Figs. 27 to 29 are diagrammatic views of the needle points and the shifting mechanism for the points showing several of the steps necessary in producing a fabric in accordance with the invention;

Fig. 30 is a diagrammatic plan view of the fabric with the associated needles and points respectively positioned as illustrated in Fig. 27;

Fig. 31 is a view of the fabric similar to Fig. 30 with the associated needles and points respectively positioned as illustrated in Fig. 28; and

Fig. 32 is a view of the fabric similar to Fig. 31 with the associated needles and points respectively positioned as illustrated in Fig. 29.

In the drawings and description, only those parts necessary to a complete understanding of the invention have been set forth; further information as to the construction and operation of other elements not herein specifically pointed out, but which are usual and well known, being available in the pamphlet entitled "Full Fashioned Knitting Machines," copyright 1920, and in the "Reading" Full Fashioned Knitting Machine Catalogues, copyright 1929 and 1935, published by the Textile Machine Works, Reading, Penna., and in a pamphlet entitled "Knitting Machine Lectures," published in 1935 by the Wyomissing Polytechnic Institute, Wyomissing, Pennsylvania.

Referring to Figs. 1 and 2, a full fashioned stocking and a blank therefor, which may be produced in accordance with the invention, comprises, a folded welt W, a single yarn leg portion L, upper reinforced heel areas H, heel tab areas T, a foot portion P, reinforced sole areas S and a diamond point toe area N. Mechanism is provided whereby needle loops are selectively spread in opposite directions to produce a diamond shaped rib-like ornamental effect throughout the single yarn areas and certain of the reinforced areas of the fabric, the diamond shaped rib-like ornamentation providing run-resisting barriers defining plain loop areas whereby to limit runs, upon rupture of a yarn, to the plain loop areas of their origin, the mechanism being adapted to legger, footer and single unit machines to produce such ornamental effects.

As diagrammatically illustrated in Figs. 3, 4 and 30 to 32, inclusive, after a course of loops is formed by the needles and associated loop forming mechanism, loops *w*, in this instance every sixth needle loop in the course, are engaged by two series of interengaged points and removed from the needles. One of the series of points is then shifted laterally relative to the other series of points, spreading a portion *x* of each of the loops *w* to the next adjacent needle either to the right or left of the needles of origin of the loops. The spread loops are then returned to the needles, the portions *x* overlying the loops upon the next adjacent needles, causing a doubling or bunching of the loops at these points. The loops of subsequent courses are engaged in staggered relation to the loops of the preceding courses and selectively spread in opposite directions in such a manner that the bunched loops follow intersecting diagonal lines or ribs R slightly raised above the surface of the fabric, the diagonal line R being bounded on both sides by the spread loops *w* which, together with the diagonal lines, defines areas V composed of plain or unspread loops over the entire width of the fabric.

Fig. 3A diagrammatically illustrates the steps necessary to produce one of the diamond shaped panels of the present invention. In following these steps, as hereinafter set forth, the reference characters A, B, C, D, etc., starting at the top of the figure, are used to identify the courses, the characters *a*, *b*, *c*, *d*, etc., reading from left to right of the figure, identify the wales and the

character *w* identifies the loops having portions *x* spread to form the raised rib-like structure, shown in Fig. 3. Reference to the direction in which the loops are spread, refers to the appearance of the loops in Fig. 3A and not to the direction in which the loops are spread during production of the fabric.

For greater clarification, Fig. 3A shows the loop formation diagrammatically, the diamond shaped unit indicated by the dot-and-dash line is formed as follows:

Starting at course A, the portion *x* of the loop *w* intersecting course A at wale *d* is spread to the right; in course B, wale *g*, the loop *w* is spread to the left; in course C, wale *c*, the loop *w* is spread to the right; in course D, wale *e*, the loop *w* is spread to the right; in course E, wale *b*, the loop *w* is spread to the right; in course F, wale *d*, the loop *w* is spread to the left; in course G, wale *f*, the loop *w* is spread to the right; in course H, wales *c* and *i*, the loops *w* are spread to the left; in course I, wales *a* and *g*, the loops *w* are spread to the right; in course J, wale *d* the loop *w* is spread to the left; in course K, wale *f*, the loop *w* is spread to the right; in course L, wale *b*, the loop *w* is spread to the right; in course M, wale *e*, the loop *w* is spread to the right; in course N, wale *g*, the loop *w* is spread to the left; in course O, wale *c*, the loop *w* is spread to the right; in course P, wale *f*, the loop *w* is spread to the left; and in course Q, wale *d*, the loop *w* is spread to the right, this loop completing a cycle of steps to form one diamond started in wale *d* of course A and starting the cycle of steps to form the next succeeding diamond.

It will be understood upon consideration of Fig. 3 that the arrangement of the spread loops is such that every needle wale across the width of the fabric is protected by the spread loops, so that not only an ornamental line or rib effect is produced, but a non-run or run-resistant effect as well; the ornamental lines R providing an efficient barrier by means of which, a run, starting in one of the plain loop areas V, will be stopped by one of the spread loops at either side of the diagonal lines R before entering an adjacent plain loop area V, thus preventing destruction of the plain loop area and ornamental rib effect beyond the plain loop area in which the run originated and the diagonal line or rib R adjacent thereto.

It will also be understood that by rearranging the spread loops in different ways, various non-run or run-resistant ornamental rib-like designs defining plain loop areas may be produced, in which the spread loops forming the ribbed structure limits a run to a very small area of the fabric as compared to fabrics having similar ornamental rib-like appearance but which are effected by transferring selected needle loops. Thus, in fabrics of the latter type, runs originating upon rupture of a thread, extend over a plurality of the rib-like line portions and consequently destroy the ornamental rib effect over an extensive area of the fabric.

Machine frame

The machine frame in general is of the usual construction with the exception of modifications necessitated by the application of the invention thereto and includes the usual transverse end and center frames, on which are mounted longitudinal members such as the front and back beams, front and center beds and bearing blocks

and the like, generally of known form, for supporting the operating shafts of the machine.

Referring to the drawings and more particularly to Figs. 5, 6 and 7, the machine frame includes end and center frames 10 and 11 upon which are mounted a front beam 12, a back beam 13, a center bed 16, and a front bed 17 extending only between the center frames, to form a support for a loop forming mechanism A, a main pattern mechanism B, a narrowing mechanism C, a point bar mechanism D, an auxiliary pattern mechanism E, and a control device F for controlling the operation of the point bar and auxiliary pattern mechanisms.

Loop forming mechanism

In knitting a full fashioned stocking blank, after the yarn is laid by a yarn carrier, loops are formed by the usual loop forming elements such as needles, sinkers, dividers and knockover bits which are operated similarly to the manner in which these parts have been operated heretofore except where modifications are necessitated by the application of the invention.

The loop forming mechanism A, Figs. 5 and 7, comprises, a needle bar 18 in which are mounted needles 20, two banks of which are disposed between each pair of center frames 11, lifting arms 21 which are pivotally connected to the needle bar 18 and which are secured to a needle bar shaft 22, a needle bar lever 23 also secured to the shaft 22 and on which is pivotally mounted a cam follower 24 arranged to cooperate with a plain knitting cam 27, and a narrowing cam 28 carried by a cam shaft 29. The lever 23 is biased toward the cam shaft 29 by a spring 31 connected between the lever and a bracket 32 in turn fastened to the back beam 13.

Forward and rearward movement of the needles 20 is effected by a forked lever 33 secured to the needle bar 18 and pivotally connected to a lever 34 which is in turn connected to a presser lever 36 carried by a shaft 37. The lever 36 carries a cam follower 38 for cooperation with cams 39 and 42. The presser lever 36 is connected by a spring 43 to a bracket 44 on the back beam 13, for biasing the lever toward the cams.

Cooperating with the needles 20, in forming into loops yarn laid thereto by yarn carrier rods 45, are sinkers and dividers 46 and 47, respectively, mounted in a sinker head 48. The sinkers 46 are moved forwardly by jacks 49 which are slurred forwardly by a slur cam 52 carried by a slur cock box 53 mounted for slidable movement transverse to the sinkers on a guide rail 54. The cock box is secured to a connecting bar 56 which is reciprocated parallel to the front of the machine by the usual coulier mechanism.

The dividers 47 are moved forwardly and backwardly by a catch bar 57, Fig. 7, which receives its movements from cams (not shown) on the cam shaft 29 through a linkage including, a lever 58, a vertical shifting lever 59 mounted on a shaft 62, and a horizontal lever 63 which is secured to the catch bar 57. The sinkers 46 are engaged with and disengaged from the catch bar 57 by means of a front catch bar linkage including, cams on the cam shaft (not shown), a front catch lever 64, a link fixed on a front catch shaft 65, a vertical lever 70, and a horizontal link 67.

Main pattern mechanism

Pattern mechanism, by means of which the various operating mechanisms are controlled,

comprises a usual pattern chain having buttons mounted thereon, by means of which the operating mechanisms are thrown into and out of operation at the correct time.

A main pattern mechanism B, Figs. 5 and 6, comprises a bracket 68 on the front beam 12, a shaft 69 carried by the bracket, a sprocket wheel 72 rotatably mounted on the shaft, and a pattern chain 73 carried by the sprocket wheel. The pattern chain 73, carrying buttons 74, is supported along the front of the machine by idler-rollers (not shown).

The chain 73 is advanced about the sprocket wheel 72 by a pawl and ratchet device 76 which is operated by a lever 75, pivotally mounted on the bracket 68, the lever 75 carrying a cam follower 79 for cooperation with a cam 80, Fig. 6, on the cam shaft 29 in the usual manner. A stub shaft 77 is supported in the bracket 68 and carries a follower 78 disposed between cam shaft shogging cams 81 and 82 on the cam shaft 29. A member 83 mounted at one end of the stub shaft 77, is slidably mounted in the bracket 68, and is biased, by means of a spring 84, from a normal operating position between the cams 81 and 82, to a second position between the cams in which the cam shaft 29 is moved to shogged or narrowing position. Movement of the stub shaft 77 and the follower 78 between the normal operating and narrowing positions is controlled by a latch member 86 which normally holds the stub shaft and the follower in its normal operating position. The member 83 carries a cam follower 85 for engagement with a cam 90, in turn carried on the cam shaft 29, for moving the cam follower 78 to different positions between the cams 81 and 82.

Narrowing mechanism

Narrowing mechanism including a narrowing spindle mechanism, by means of which the stocking blank is narrowed to form a shaped stocking, comprises end stop nuts for controlling the movement of the carrier rods and narrowing nuts for controlling the movement of the narrowing rods.

A narrowing spindle mechanism C, Fig. 5, comprises end stops which are positioned at each end of the machine and which are carried by a nut 87 mounted on a threaded spindle (not shown), to control the strokes of the yarn carrier rods 45 (Fig. 7) in the usual manner. Narrowing nuts 88 carried on a spindle 89, operate narrowing rods 91 and 92 and narrowing points 95 carried thereby in the usual manner to narrow the fabric.

The nuts 87 and 88 are actuated by a pawl and ratchet device 93 through a linkage 94 connected by a pin 96 to one end of a lever 97 pivotally mounted on the end frame 10. The lever 97 is operated by a cam 99 on the cam shaft 29, and a cam follower 98 on said lever when the cam shaft is shifted to the narrowing position.

The narrowing rods 91 and 92 are slidably mounted in brackets 101, Fig. 8, carried on a front narrowing shaft 102 which is connected to a back narrowing shaft 103 by arms 104. Dipping movements of the front narrowing shaft 102 about the axis of the back narrowing shaft 103 are effected by the upward and downward movements of links, one of which is shown at 106, each of the links being connected at one end to the front narrowing shaft 102 and at its outer end to a lever 107 pivotally mounted on one of the center frames 11, Fig. 7. The lever

107 carries a cam follower 108 for cooperation with a cam disc 112 and a narrowing dipping cam 113 mounted on the cam shaft 29 for effecting the usual dipping movements of the front narrowing shaft 102.

Point bar mechanism

Point bar mechanism, by means of which predetermined loops are acted upon to produce a spread loop formation, comprises, a pair of point bars supported on the front narrowing shaft and arranged to dip therewith, and a cam linkage actuated from the cam shaft for moving the point bars vertically and horizontally relative to each other, a complete description of the parts involved in these relative movements and their operation being found in Patent No. 2,034,990, issued to Emil Richter, on March 24, 1936. By the present arrangement, however, loops may be spread in different directions in different courses to produce the ornamental designs described in connection with Figs. 1 and 2.

A point bar mechanism D within the present invention, Figs. 7 and 8, comprises a main row of points 114 carried in a bar 116 which is connected by means of arms 115 to a rod 117 carried in the bracket 101 supported from the front narrowing shaft 102. The rod 117 and the points 114 are arranged for longitudinal movement relative to the needles 20 by mechanism and for a purpose to be hereinafter set forth.

Auxiliary points 118, carried in a bar 119 are secured to a rod 122 by means of brackets 121, the rod 122 being supported for pivotal and longitudinal movement in arms 123 which are fixed to an operating shaft 124. The shaft 124, pivotally mounted in the brackets 101, also has fixed thereto a crank arm 126 which is connected to one end of a link 127 in turn connected to a bell crank lever 128 on the back narrowing shaft 103, Fig. 7. The bell crank lever 128 is connected by a link 129 to a cam lever 132 pivotally mounted on a shaft 133. A cam follower 134, carried by the lever 132, cooperates with a cam 136, mounted on the cam shaft 29, during the loop spreading operation.

For the purpose of controlling the turning movement of the shaft 122, a coil spring 137, Fig. 5, disposed around the shaft 122, is arranged to normally bias the points 118 toward the points 114. The rod 117 carries a cam element 138 for cooperation with a lever 139, mounted on the shaft 122, to move the points 118 away from the points 114 for the purpose as hereinafter described.

In order to produce the spread loop formation, the points 114 are dipped with the front narrowing shaft 102 to engage predetermined loops on the needles 20 after which the auxiliary points 118 are also moved downwardly, to engage said loops, by means of the cam 136 and the linkage operated thereby. Upon the upward movement of the needles and points to loop spreading position, the cam 136 and its linkage effects engagement of the lever 139 with the cam element 138 to move the points 118 forwardly to clear the grooves in the points 114 so as to permit the points 114 to be shifted laterally relative to the points 118, by means to be presently described. After the loops have been spread the points are dipped to engage the needles to return the portion of the loops on the points 118 to the needles from which the loops were removed and the portion of the loops on the points 114 to adjacent needles, thus completing a loop spreading operation.

Auxiliary pattern mechanism

Mechanism for controlling the selection of the loops to be spread and for effecting operation of the points to spread the loops to produce the fabric in accordance with the invention, comprises, an auxiliary pattern chain, a horizontally movable slide device for determining the loops to be spread by the points, and a vertically movable slide device for controlling the spreading of the loops either to the right or the left of the needles from which the loops were removed by the points.

An auxiliary pattern mechanism E, Figs. 5, 6 and 14 to 26, comprises, a shaft 142, Figs. 17 and 18, supported in a bracket 141, having an enlarged cylindrical portion 143 somewhat eccentric to the axis of shaft 142, and a series of control levers 144, 145, 146, 147 and 148, pivotally mounted on the portion 143, Fig. 18. The control levers 144, etc., have stepped surfaces 149 (Fig. 16) at the end remote from cylinder portion 143. A pattern chain 152 is provided with a series of varying height buttons 153 arranged to engage and selectively position the levers 144 to 148, inclusive, for purposes hereinafter set forth. The levers 144, 145, 146 and 148 are biased toward the buttons 153 by springs 155.

The chain 152 is supported on a sprocket wheel 154 (Fig. 18), mounted on a shaft 156 pivotally supported by the bracket 141, and on idler rollers 150 and 151 (Fig. 5) supported from the machine frame. A ratchet wheel 157, secured to the sprocket wheel 154, is operated by a pawl 158 carried by an arm 159, in turn pivotally mounted on the shaft 156. The arm 159 is connected by a linkage 162 to a lever 163 pivotally mounted on a shaft 189 which is carried in brackets 190 on the back beam 13. The lever 163 carries a cam follower 164, Fig. 17, for cooperation with a cam 166 mounted on the cam shaft 29 to turn the arm 159 and the pawl 158 about the shaft 156 to advance the pattern chain 152. The sprocket wheel 154 is prevented from moving accidentally by a brake arrangement 167, and may be manually rotated by means of a hand wheel 168 carried on the end of the shaft 156.

A stop portion 169, Fig. 16, carried by a member 172 slidably mounted in a bracket 175, Fig. 19, cooperates with stepped portions of the levers 144, 145 and 146; this cooperation of the levers and stop portion limiting the leftward movement of the member 172, in which direction the member 172 is biased by means of spring 185. A bracket or head member 173 (Figs. 17 and 21), carried by the member 172, slidably carries a member 174 (Figs. 21, 22 and 23), by means of guide brackets 170 and 171 which are secured to the head member 173, against which the point rod 122 is biased by means of a spring 180. The head member 173, also carries a cam member 176, against which the point rod 117 is held by a spring 181. With this arrangement, the position of the points 118 and 114 relative to the needles 20 is determined when the stop portion 169 of the member 172 is against one of the levers 144, 145 and 146, as controlled by the buttons 153 on the pattern chain 152.

In order to advance the pattern chain 152 to change the setting of the control levers 144, 145 and 146 and to reposition the point rods 117 and 122 and the points carried thereby, relative to the needles 20, it is necessary to displace the point rods to the right beyond the highest step on the control levers and to raise the control levers out of the path of the highest button 153

on the pattern chain. For this purpose, the head member 173 is provided with a cam follower 177 arranged to cooperate with a cam member 178 slidably mounted in the bracket 175. The cam member carries an arm 187 (Fig. 19) which is provided with a portion 188 disposed beneath the levers 144, 145, 146, 147 and 148. The cam member 178 is connected to a lever 182 by means of a link 179, the lever carrying a cam follower 183 for engagement with a cam 184 during the knitting operation, and for engagement with a cam 185 during loop spreading operations. During knitting operations the cam 184 maintains the slide member in a raised position, as shown in Fig. 19, thereby maintaining the point rods 117 and 122 to the right and the control levers in a raised position.

When the cam shaft 29 is shifted to the right from its position in Figs. 5 and 19, to the narrowing position, the followers 164 and 183 are aligned with the cams 166 and 185, respectively, whereupon, the cam member 178 is lowered permitting the levers 144 to 148 to be lowered into engagement with the respective buttons 153 on the chain 152, and permitting the bracket 173 and slide member 172 to move to the left, as viewed in Fig. 19, to engage the stop portion 169 with one of the levers 144, 145 and 146, as determined by the buttons 153, thus aligning the points 114 and 118 with selected needles. During this action, the cam 166 lowers the pawl lever 159 and the pawl 158 to position the pawl for the next advance of the pattern chain. After the loops have been spread by mechanism and in a manner herein-after set forth, the cam member 178 is raised to its position of Fig. 19, to move the slide 172 and the bracket 173 to the right and to raise the levers 144 to 148 out of the path of movement of the buttons 153, whereupon the pawl lever 159 is actuated by the cam 166 to advance the pattern chain 152 and the buttons 153 to control the position of the points 114 and 118 for the next loop spreading operation.

In order to laterally shift the points 114 relative to the points 118 in either direction after the points have removed the loops from selected needles, the cam member 176 is provided with cam surfaces 191, 192 and 193, Figs. 24, 25 and 26, for engagement with projections 194 extending from the member 174, Fig. 23. The cam member 176 is mounted on the bracket 173 by a pin 196. A spring 197, disposed around the pin 196, maintains the cam member in engagement with the projections 194, Fig. 24.

The projections 194 of the member 174 are normally in engagement with the cam surfaces 192, which in this instance is the neutral position, as shown in Fig. 24, or the position in which the points 114 are in engagement with the points 118 to take the loops from the needles 20, Figs. 27 and 30. In order to spread the loops to the right as shown in Fig. 31, the member 174 is raised to engage the projections 194 with the cam surfaces 191, Fig. 26, which action shifts the points 114 to the right relative to the points 118, as shown in Fig. 28. To spread the loops to the left, as shown in Fig. 32, the member 174 is lowered from the neutral position, to engage the projections 194 with the cam surfaces 193, Fig. 25, whereupon the points 114 are shifted to the left, relative to the points 118, as shown in Fig. 29 by the spring 181 (Fig. 5).

To move member 174 for effecting the right or left shifting movement of the points 114, the member 174 is connected to a bracket 198 (Fig.

19), pivotally and slidably mounted on a shaft 199 carried by a link 202, which is mounted on an axle 201 carried by a lever 203, pivotally carried by the shaft 189. A cam follower 206 carried on the axle 201 cooperates with cams 207 and 208 mounted on the cam shaft. A second cam follower 209 carried on the axle 201 is adapted to be shifted axially into alignment with a cam 210 on the cam shaft, the follower 209 being normally held in inoperative position relative to the cam 210, Fig. 19.

The follower 209 has a grooved portion 212 adapted to be engaged by one end of a shift lever 213 pivotally mounted on a stud 214 carried by the lever 203. The shift lever 213 has a cam follower portion 216, Figs. 6 and 16, which is biased by a spring 217 toward cooperative engagement with a cam member 218 slidably mounted in the lever 203. The cam member 218 is connected by a universal joint arrangement 219 to a link 222 connected to the control lever 147, Figs. 15 and 16; the cam member being biased downwardly by a spring 223 (Fig. 20).

When the cam shaft is shifted to the right or narrowing position to produce a spread loop formation, the cam 208 is moved into alignment with the cam follower 206, the lever 147 is lowered by the arm 187 into engagement with the buttons 153 on the pattern chain 152. At this time if it is desired to have the cam 208 control the movement of the slide 174, the lever 147 engages a high button 153, thereby preventing the cam member 218 from shifting the follower 209 into engagement with the cam 210, so that upon rotation of the cam shaft 29, the cam 208 will lower the member 174 to move the projections 194 from the neutral position out of engagement with cam surfaces 192 and into engagement with the cam surfaces 193, whereby the points 114 are shifted to the left relative to the points 118 by spring 181, as hereinbefore set forth, thereby spreading the loops to the left.

When it is desired to spread the loop in the opposite direction, a low button 153 is positioned beneath the lever 147, so that when the cam shaft is shifted to the narrowing position the follower 209 is shifted into alignment with the cam 210 by the cam member 218. With the follower 209 aligned with the cam 210, upon rotation of the cam shaft the member 174 will raise the projections 194 from the position in which the projections are in engagement with the cam surfaces 192 of the cam member 176 to the position in which the projections are in engagement with the cam surfaces 191. With this action the point rod 117 shifts the points 114 to the right relative to the points 118, thereby spreading the loops to the right.

During the production of a stocking fabric, incorporating both loop spreading and narrowing operations, narrowing may be effected by controlling the extent of movement of the carrier rods 45 by means of the nuts 87, during which the narrowing nuts 88 and the narrowing rods 91 and 92 are held inoperative by disengaging the pawl of the device 93 for the spindle 89. In view of the loop spreading and narrowing operations being performed when the cam shaft is in its right hand or narrowed position, these operations may be performed simultaneously or separately from each other. In this instance, it is desirable to perform the spreading and narrowing operations separately, therefore, when loop spreading operation is to be effected the narrowing mechanism is held inoperative, and when a narrowing

of the fabric is to be effected, the auxiliary pattern mechanism is held inoperative.

For this purpose, there is provided, a rod 228 on which is mounted a stop member 229 for cooperation with a projection 232 on the lever 163, Fig. 17, a stop member 233 for cooperation with a projection 234 on the lever 182, Fig. 20, a stop member 237 for cooperation with a projection 238 on the lever 203, Fig. 18, and a stop 239 for cooperation with the cam member 218, Figs. 15 and 16.

When the cam shaft 29 is shifted to narrowing position, if it is desired to produce a narrowing of the fabric, the rod 228 maintains the stop members 229, 233, 237 and 239 under the levers 163, 182 and 203, and cam member 218, respectively, thereby maintaining the pattern mechanism E inoperative and permitting the follower 98 to be aligned with the cam 99 to actuate the narrowing head mechanism C. However, when it is desired to produce a loop spreading operation when the cam shaft is shifted to the narrowing position, the rod 228 is shifted to remove the stops from beneath their said respective levers and cam member, and the cam follower 98 is prevented from becoming aligned with the cam 99 to prevent the operation of the narrowing head C.

Mechanism for shifting the stops from beneath the levers 163, 182 and 203, and the cam member 218, and for shifting the cam follower 98 to prevent the cam 99 from being aligned therewith, comprises, a lever 243, a cam follower 244 pivotally mounted on the lever for cooperation with a face cam 246 carried by the cam shaft 29, and a cam follower 250 for cooperation with a portion 251 of the face cam 246, Figs. 6 and 14. The lever 243 has an extension 247 arranged for engagement with a latch lever 248 pivotally mounted on the chain bracket 68. The lever 248 is biased in a clockwise direction into latching engagement with the extension 247, Fig. 5, by a spring 245. The lever 243 is secured to a shaft 249 pivotally carried in a bracket 252 mounted on the back beam 13. An arm 253, also secured to the shaft 248 cooperates with one arm 254 of a lever 256 pivotally carried by an extension 257 of the bracket 252. A second arm 258 cooperates with a collar 259 carried by the shaft 228 to shift the shaft to the left as viewed in Fig. 6, against the action of a spring 260 when lever 243 is swung about the axis of bracket 252, and to shift the said stops and cam member.

The lever 243 is provided with a second extension 262 having a forked portion embracing a rod 263 and disposed between collars 264 carried by the rod 263. A spring 266 disposed around the rod 263, between a collar 267 on the rod and a bracket 268 secured to the back beam 13, tends to bias the rod 263 to the right as viewed in Fig. 6. The rod 263 further carries collars 269 between which is disposed one arm 272 of a lever 273 pivotally mounted on the back beam 13. The lever 273 has a second arm 274 for engagement with the cam follower 98.

When it is desired to produce a loop spreading operation, the cam shaft is shifted to narrowing position and the latch lever 248 is moved from beneath the lever 243 whereupon the follower 244 is biased downwardly by a spring 276 into alignment with the face cam 246 so that upon rotation of the face cam the lever 243 is pivoted in a counterclockwise direction, as viewed in Fig. 6, in the bracket 252, thereby shifting the rods

228 and 263 to the left. With the movement of the rods 228 and 263 to the left, the follower 98 is moved to the right away from the cam 99 to prevent operation of the narrowing spindle mechanism, and the stop members 229, 233, 237 and 239 are removed from beneath the levers 163, 182 and 203, and the cam member 218, respectively, thereby permitting operation of the pattern mechanism E to produce the spread loops.

When the loop spreading operation is completed, the cam shaft 29 is shifted back to knitting position, the rods 228 and 263 are biased to the right, as viewed in Fig. 6, by the springs 260 and 266, respectively, and the cam portion 251 engages the follower 250 to raise the lever 243 and extension 247, thus permitting the latch lever 248 to engage the extension 247 to hold the lever 243 inoperative until the latch lever is again removed from beneath the extension 247.

Pattern mechanism control device

A control device is provided for determining the course in which a spreading operation is to take place, and comprises a counting device for determining the number of plain courses between spread courses, and a rod for effecting shifting of the cam shaft and operation of the point rod pattern mechanism.

A pattern mechanism control device F, Figs. 5, 6 and 9 to 14, comprises, a rod 283 slidably mounted in the chain bracket 68, a bracket 284 secured to the rod 283, a set screw 286 carried by the bracket for cooperation with the latch lever 248 for moving the same from beneath the extension 247 of the lever 243, and an arm 287 also secured to the rod for cooperation with the latch member 86 (Fig. 5) for effecting shifting of the cam shaft to narrowing position. The rod 283 is secured to a slide frame 288 (Fig. 13) carried on a guide rod 292, in turn slidably mounted in a bracket 293 secured to the front beam 12. A stud 294, secured to the bracket 293, carries a ratchet disc 296 (Fig. 9) having a predetermined number of teeth arranged to be engaged by a pawl 297 pivoted on a stud 299 carried by a lever 298 which is pivotally mounted on the stud 294. The lever 298 is operated by a lever 302 (Fig. 12) pivotally mounted on a shaft 303 carried by the bracket 293, through cooperation of a cam follower 304 mounted on the lever, and a cam 306 on the cam shaft 29. The lever 298 is held in engagement with the lever 302 by a spring 301. The lever 302 is provided with a stop screw 307 (Fig. 9) which is biased into engagement with a portion of the bracket 293 by a spring 308, the stop screw limiting the clockwise movement of the lever 302, as viewed in Fig. 13. The pawl 297 is provided with a portion 309 held in engagement with a stop 312, carried by the bracket 293, by means of a spring 313. The stop 312 limits the forward movement of the pawl 297 toward engagement with the teeth of the ratchet disc 296 when the lever 302 is in a rest position.

A member 314, pivotally mounted on a hub portion of the ratchet disc 296, Fig. 11, is provided with a stop portion 316 (Fig. 9) for cooperation with the pawl 297 or preventing the pawl 297 from engaging the teeth of the ratchet disc 296. The member 314 is biased by a spring 318, in a clockwise direction, Fig. 9, against a stop pin 317, carried by the ratchet disc 296, to move the stop portion 316 beneath the pawl 297. The member 314 is disposed in the path of movement of a bell crank lever 322, carried on the bracket 293, which is connected to a lever operated by a

button on the pattern chain 73, by means of a rod 323. With this arrangement the control device F may be set into operation or held inoperative as desired by the main pattern mechanism B, to control the loop spreading operations as produced by the auxiliary pattern mechanism E.

A segmental gear 324, mounted on the stud 294, is maintained in frictional engagement with the ratchet disc 296 by a spring disc brake 325, so that the ratchet disc and gear rotate as a unit. The disc brake 325 also provides a braking action on the ratchet disc 296 to prevent accidental turning movement thereof. The segmental gear 324 cooperates with a rack member 326 carried by the slide frame 288 for positioning the ratchet disc 296 to determine the number of plain knit courses of loops between loop spreading operations. This position of the ratchet disc 296 is controlled from the lever 148 as determined by a button 153 on the auxiliary pattern chain 152. The lever 148 cooperates with a lever 327 (Figs. 5 and 20), one end of which is pivotally connected to a link 328 having a stepped member 329 secured to the lower end thereof. The stepped member 329 is adapted to engage a screw 330 carried in the slide frame 288, for purposes hereinafter set forth. A lever 332, pivotally mounted on the stud 294 is held in cooperative engagement with the link 328 by means of a spring 333, Figs. 9 and 10.

The lever 332 is maintained in engagement, by a spring 334, with one arm 336 of an operating lever 337 which is pivotally mounted on the shaft 303, Fig. 13. The lever 337 carries a stud 338 on which is rotatably mounted a cam follower 339 for cooperation with a cam 342 on the cam shaft 29. The lever 337 carries a stop screw 343 for engagement with a portion of the bracket 293 for limiting the clockwise movement of the lever. The cam follower 339 is normally maintained out of alignment with the cam 342 by a forked arm 344 carried by the rod 228 and is shifted into alignment with its cam by the rod 228 at the same time the pattern mechanism is set into operation by the shifting of the cam shaft into narrowing position as above set forth.

When the cam shaft 29 is shifted to the narrowing position to produce spread loops, a button 153 on the pattern chain 152, positions one of the steps of the stepped member 329 in alignment with the screw 330 so that upon engagement of the cam 342 with the cam follower 339, the lever 337 will operate the lever 332 to swing the stepped member to the right, from its position in Fig. 9, so as to move the slide frame to the right a distance corresponding to the height of a stepped portion of member 329, this action rotating the gear 324 and the ratchet disc 296 in a clockwise direction to move a tooth corresponding to the height of the member 329 into position to be engaged by the pawl 297. Movement of the slide frame 288 to the right also moves the rod 283 to the right thus permitting the latch lever 248 to be positioned beneath the lever 243. Thus positioned, the lever 248 cannot be withdrawn from beneath lever 243 until the ratchet disc 296 has been returned to its original position. The disc 296 is returned to its original position by pawl 297, one tooth at a time and one tooth for each revolution of cam shaft 29 while in its knitting position until a last tooth 300 has been advanced by the pawl 297. Thus the mechanism F determines the number of plain courses between courses containing spread loops. At the same time that the lever 148 determines the number of

plain knitted courses of loops to be completed before the next loop spreading operation, the control levers 144, 145 and 146 determine the needles 20 with which the points 114 and 118 are to be aligned, and the lever 147 determines whether the loops are to be spread to the right or to the left.

After the cam shaft has been shifted back to knitting position, the ratchet disc 296 will be turned in a counterclockwise direction a distance equal to one tooth for every revolution of the cam shaft between loop spreading operations, this action also moving the rod 283 to the left. Upon racking the last tooth 300 of the disc 296, the set screw 286, carried by the bracket 284, engages the latch lever 248 to shift it from beneath the lever 243 to shift the rods 228 and 263 to the left, and the arm 287 engages the latch member 86 to effect the shifting of the cam shaft 29 to narrowing position, in a manner above set forth, to produce a loop spreading operation.

When it is desired to produce more than one loop spreading operation in the same course, the lowest step of the member 329 will be positioned above the screw 330, by the control lever 148, and the free end of link 328 in position to engage the screw upon the movement of the link and stepped member to the right to reset the ratchet disc 296. With the parts in this position the frame 288 and the rod 283 will not be moved to the right but will remain in its left hand position, in which position the arm 287 will hold the latch 86 out of engagement with the stub shaft to maintain the cam shaft in its narrowing position, and will maintain the latch lever 248 away from engagement with the lever 243. At this time it is also desirable to maintain the rods 228 and 263 in their right hand position to continue the operation of the auxiliary pattern mechanism E and to prevent the operation of the narrowing mechanism C.

For the purpose of preventing operation of the mechanism C there is supported from the machine frame, a rod 351 (Fig. 14) on the front end of which is mounted an arm 352 carrying a pin 353 for cooperation with an extension 354 of the bracket 284. The rear end of the rod 351 carries an arm 356 which is adapted to be biased, by spring means (not shown), toward the space between a shoulder 357 (Fig. 6) of the bracket 252 and a stop 358 carried by the lever 243. Upon movement of the rod 283 to the left to produce a loop spreading operation, the extension 354 is moved out of engagement with the pin 353 so that when the lever 243 is moved in a counterclockwise direction to shift the rods 228 and 263 to the left, the arm 356 will be moved between the shoulder 357 and the stop 358. With this arrangement, the lever 243 will hold the rods 228 and 263 to the left for one or more consecutive loop spreading operations or until the rod 283 is reset to the right, whereupon the extension 354 will engage the pin 353 to move the arm 356 from between the shoulder 357 and the stop 358, thereby permitting the latch lever 248 to again engage the lever 243.

When it is desired to produce a narrowing operation, a button 74 on the pattern chain 73 disengages the latch 86 from the stub shaft 77, to shift the cam shaft 29 to narrowing position, independently of the arm 287 carried by the rod 283, thereby maintaining the stops beneath the levers 163, 182 and 203 and the cam member 218 to prevent operation of the auxiliary pattern mechanism and to maintain the cam follower 98

in position to be engaged by the cam 99 to operate the end stop nuts 87 to narrow the fabric.

As is usual in knitting machines of this type, the pattern chain 73 is provided with a link for each knitted course and a link for each narrowing operation. However, there are no links provided for the loop spreading courses inasmuch as this operation is controlled by the control mechanism F. In order to prevent the chain 73 from being advanced during a loop spreading operation, the cam follower 79 is engaged by a lever 346 (Fig. 6) carried by the rod 228, so that when the rod 228 is shifted to the left, the follower is also shifted to the left out of alignment with the cam 80.

The operation of the mechanism described hereinabove will be evident to those skilled in the art. For purposes of convenience it will be summarized as follows:

The machine shown is in general of a well known full fashioned type but has both narrowing and loop spreading means, both of which operate when the main cam shaft is in the non-knitting or narrowing position. The narrowing and loop spreading operations must not, however, be performed at the same time and when spreading is to occur cam follower 98 (Fig. 6) is held out of the position in which it coacts with its cam 99, by rod 263 operated through lever 243 and cam follower 244 by the face cam 246. Except at times in which spreading is to occur, lever 243 is held up in inoperative position by the lever 248 so that narrowing operations can be carried out as determined by the main pattern chain 73. The courses in which narrowing is to occur are selected by the main pattern chain, but in case both narrowing and loop spreading operations are desired in a given course, the loop spreading operation, being controlled solely by the course counting means F, occurs first and then the narrowing is performed as initiated by the main pattern chain.

The number of plain courses between loop spreading operations is determined by the course counting device F whenever this mechanism is in operation, the ratchet disc 296 belonging to device F being reset automatically by the auxiliary pattern mechanism E after each spreading operation. The member 314 and its stop portion 316 being held out of the path of pawl 297 either by a continuous series of buttons on the main pattern chain or by blocking the lever 322 (Fig. 9) to hold portion 316 inoperative. It will be understood that ratchet disc 296 is operated automatically after each loop spreading operation. If it is turned clockwise so that only tooth 300 is in position to be acted upon by pawl 297, loop spreading operations will occur in successive courses as in the stocking illustrated in the drawings. If disc 296 is turned to tooth distances, a plain course will occur between two courses in which loops are spread.

The spreading operation being performed by two points for each loop that is spread, the loops are lifted entirely off the needles before being spread and then replaced after the spreading operation. The location of the spreading points with respect to the needle bar is determined by the auxiliary pattern chain 152 of mechanism E which thereby determines the pattern made by the spread loops. This is accomplished through the shiftable head 173 (Fig. 21) as actuated by the vertically shiftable cam 178 (Fig. 19). The shifting of one of the sets of points with respect to the other is directly accomplished by shifting

blade members 194 (Fig. 21) in contact with cam surfaces on a head 176 mounted to move slightly horizontally with respect to head 173 in either direction from a neutral position to move, or permit to be moved, the rod 117 of one point bar correspondingly.

Of course, the improvements specifically shown and described by which I obtain the above results, can be changed and modified in various ways without departing from the invention herein disclosed and hereinafter claimed.

I claim:

1. An ornamental knitted fabric comprising plain loop areas surrounded by intersecting raised rib-like lines formed by a portion of run stop loops in which the run stop loops are spread to the right and left toward the raised rib-like lines from both sides.
2. An ornamental knitted fabric comprising plain loop areas, a portion of selected loops spread to the right and left from one of said plain loop areas toward an adjacent plain loop area, a portion of selected loops spread to the left and right from said adjacent plain loop areas toward the first said plain loop area, said right and left spread loop portions providing run-resisting rib-like barriers defining said plain loop areas for limiting a runner upon rupture of a loop in one of said plain loop areas.
3. A knitted fabric comprising plain loop areas having a portion of selected loops spread outwardly to the right and left from said plain loop areas, the spread portions of said selected loops forming intersecting raised rib-like ornamentations on the surface of the fabric defining said plain loop areas.
4. A knitted fabric comprising plain loop areas having a portion of selected loops spread outwardly to the right and left from said plain loop areas, the spread portions of said loops forming a raised ornamental design defining said plain loop areas, said ornamental design together with said spread loops forming run-resisting intersecting barriers for limiting a runner upon rupture of a loop in one of said plain loop areas to the area of its origin.
5. A stocking fabric comprising plain loop areas alternating with series of spread loops, said series of spread loops having a portion of selected loops in one course spread to the right and a portion of selected loops in other courses selectively spread to the right or left from said plain loop areas, said right and left spread loop portions providing ornamental intersecting rib-like outlines defining said plain loop areas, and having a surface-plane extending beyond the surface-plane of said plain loop areas.
6. A method of knitting a run-resisting ornamental fabric including, forming courses of loops, engaging and spreading a portion of selected loops of a course, progressively engaging and spreading selected loops to the right and left in subsequent courses to form run-resisting intersecting rib-like barriers of spread loops outlining an area of plain loops.
7. A method of knitting a run-resisting ornamental stocking fabric including, forming courses of loops, engaging and spreading a portion of selected loops of a course in one direction, progressively engaging and spreading a portion of selected loops in subsequent courses in opposite directions, the spread portions of said spread loops forming raised intersecting rib-like ornamentations defining a plain loop area.
8. A knitted fabric comprising diamond shaped

panels of plain loops, rib-like elements defining said diamond shaped panels formed by spreading a portion of certain of the loops from said diamond shaped panels to the right and left thereby to extend the surfaces of said rib-like elements to a plane beyond the surface-plane of the diamond shaped panels.

9. An ornamental knitted fabric comprising diamond shaped panels of slip loops, rib-like elements defining said diamond shaped panels whose surface-plane is spaced from the surface-plane of the diamond shaped panels, said rib-like elements being formed by spreading a portion of certain of the loops from said diamond shaped panels to the right and left to provide a barrier for limiting a runner resulting from rupture of a loop in said diamond shaped panels. 15

10. A stocking blank comprising plain loop areas surrounded by intersecting raised rib-like lines formed by a portion of run stop loops in which the run stop loops are spread to the right and left toward the raised rib-like lines from both sides. 5

11. A knitted stocking comprising plain loop areas having a portion of selected loops spread outwardly to the right and left from said plain loop areas, the spread portions of said selected loops forming intersecting raised rib-like ornamentations on the surface of the fabric defining said plain loop areas.

WILLIAM E. SHEELER.

CERTIFICATE OF CORRECTION.

Patent No. 2,270,853.

January 27, 1942.

WILLIAM E. SHEELER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 72, for "charactrs" read --characters--; page 3, second column, line 74, for "outer" read --other--; page 6, first column, line 46, for "shaft 248" read --shaft 249--; page 8, first column, line 60, for "to" read --two--; and second column, line 27, claim 2, before "rib-like" insert --intersecting--; page 9, first column, line 15, claim 9, after "left" insert --thereby--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 24th day of March, A. D. 1942.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.