Aug. 5, 1941. G. W. RUEDT 2,251,805

MEANS FOR PRODUCING FLAT KNITTED FABRIC WITH INLAID ELASTIC YARN

Filed Nov. 16, 1938 7 Sheets-Sheet 1

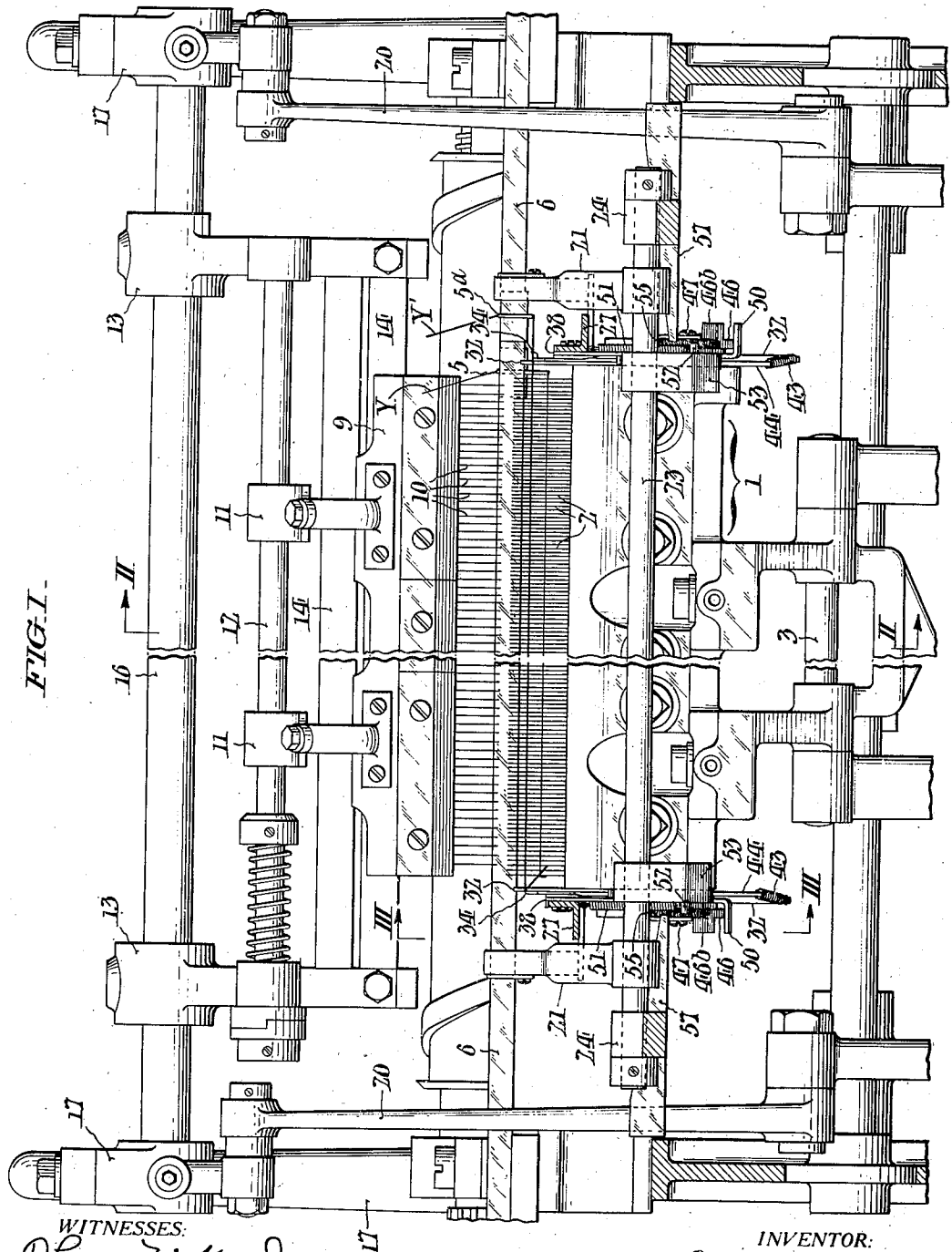


FIG. 1.

WITNESSES:
Thomas W. Kerr, Jr.
Woodrow Stevenson

INVENTOR:
George W. Ruedt,
BY Paul & Paul
ATTORNEYS.

Aug. 5, 1941. G. W. RUEDT 2,251,805

MEANS FOR PRODUCING FLAT KNITTED FABRIC WITH INLAID ELASTIC YARN

Filed Nov. 16, 1938 7 Sheets-Sheet 2

FIG. XVI.

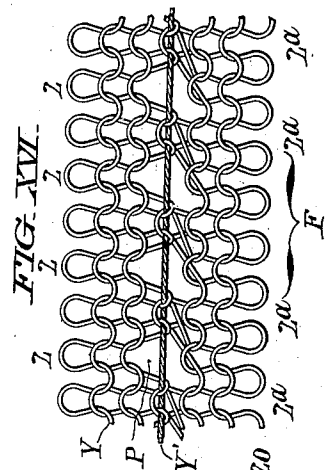


FIG. II.

WITNESSES:
Thomas W. Kerr, Jr.
Woodbridge Stevens

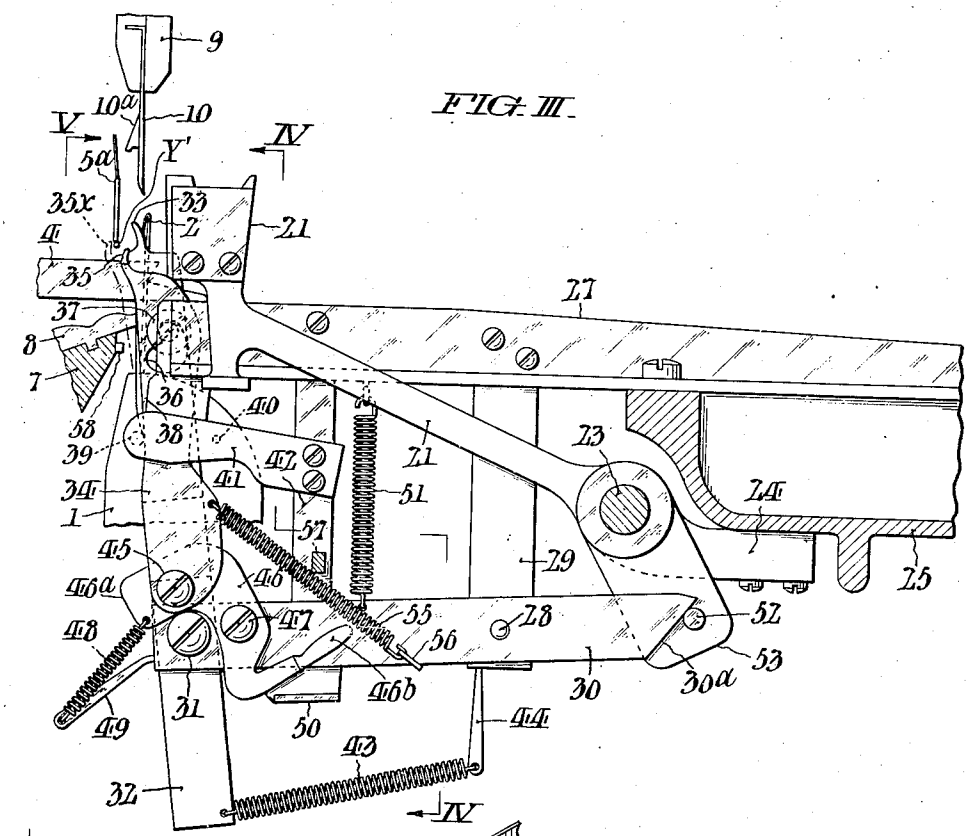
INVENTOR:
George W. Ruedt,
BY Paul & Paul
ATTORNEYS.

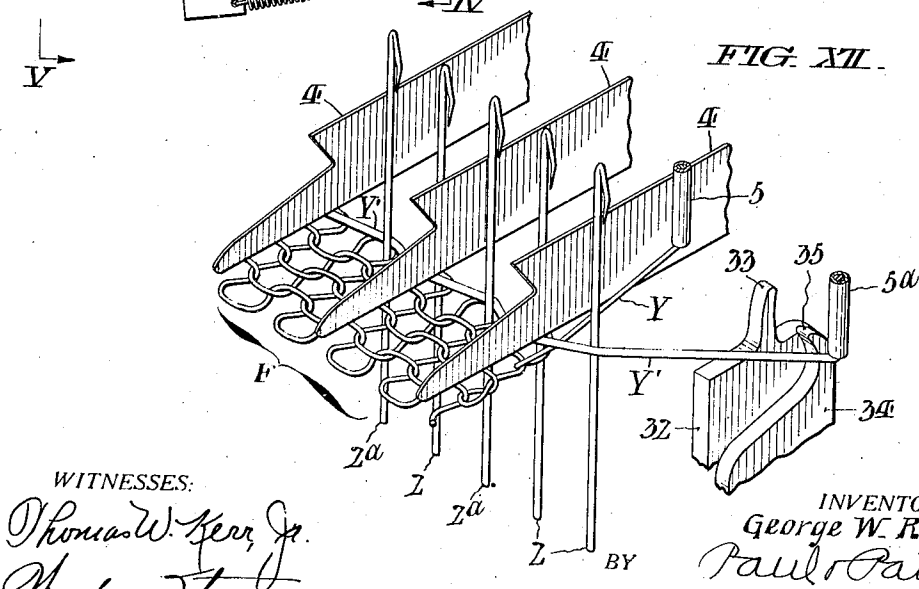
Aug. 5, 1941. G. W. RUEDT 2,251,805

MEANS FOR PRODUCING FLAT KNITTED FABRIC WITH INLAID ELASTIC YARN

Filed Nov. 16, 1938 7 Sheets-Sheet 3

FIG. III.





WITNESSES:

Thomas W. Kerr, Jr.

Woodrow Sturkow

INVENTOR:

George W. Ruedt

BY Paul & Paul

ATTORNEYS.

Aug. 5, 1941. G. W. RUEDT 2,251,805

MEANS FOR PRODUCING FLAT KNITTED FABRIC WITH INLAID ELASTIC YARN

Filed Nov. 16, 1938 7 Sheets-Sheet 4

FIG. IV.

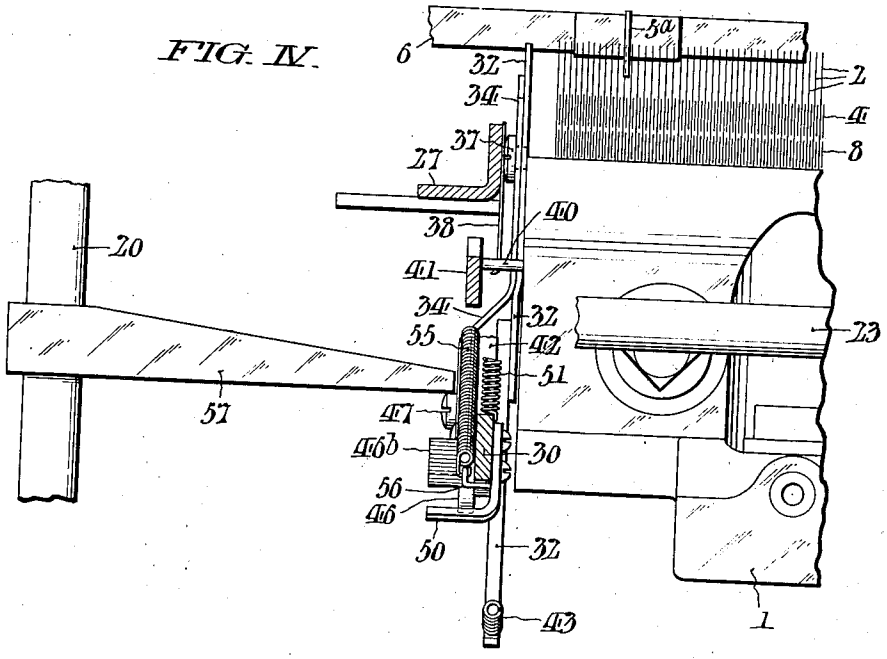
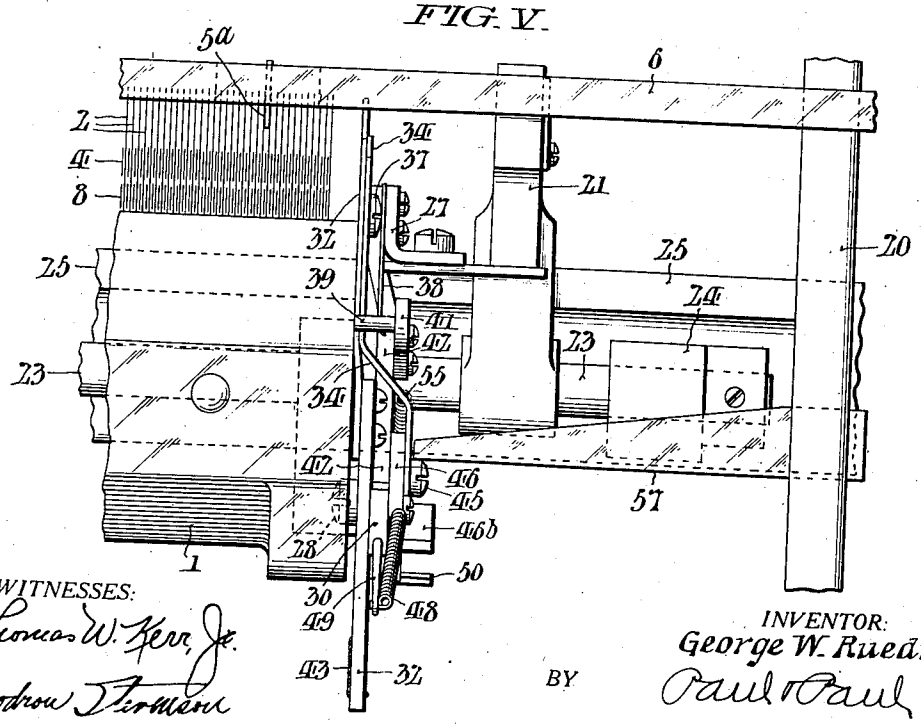


FIG. V.



WITNESSES:

Thomas W. Kerr, Jr.

Woodrow Stevenson

BY

INVENTOR:
George W. Ruedt,
Paul & Paul
ATTORNEYS.

Aug. 5, 1941. G. W. RUEDT 2,251,805

MEANS FOR PRODUCING FLAT KNITTED FABRIC WITH INLAID ELASTIC YARN

Filed Nov. 16, 1938 7 Sheets-Sheet 5

FIG. VI.

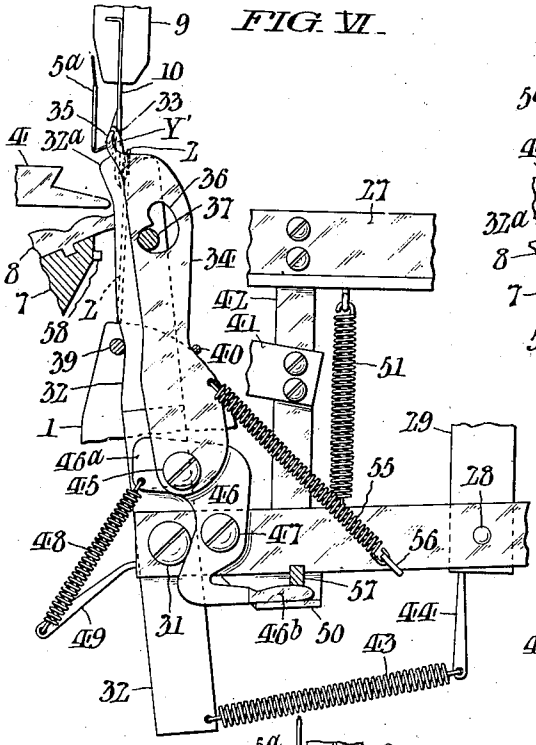


FIG. VII.

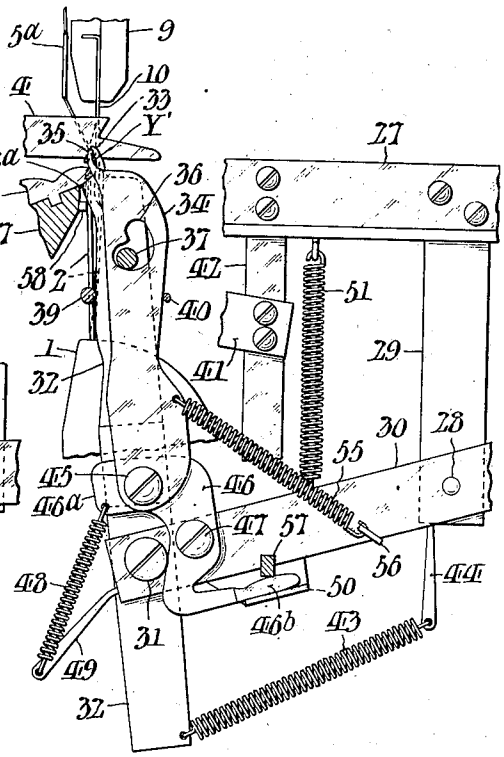
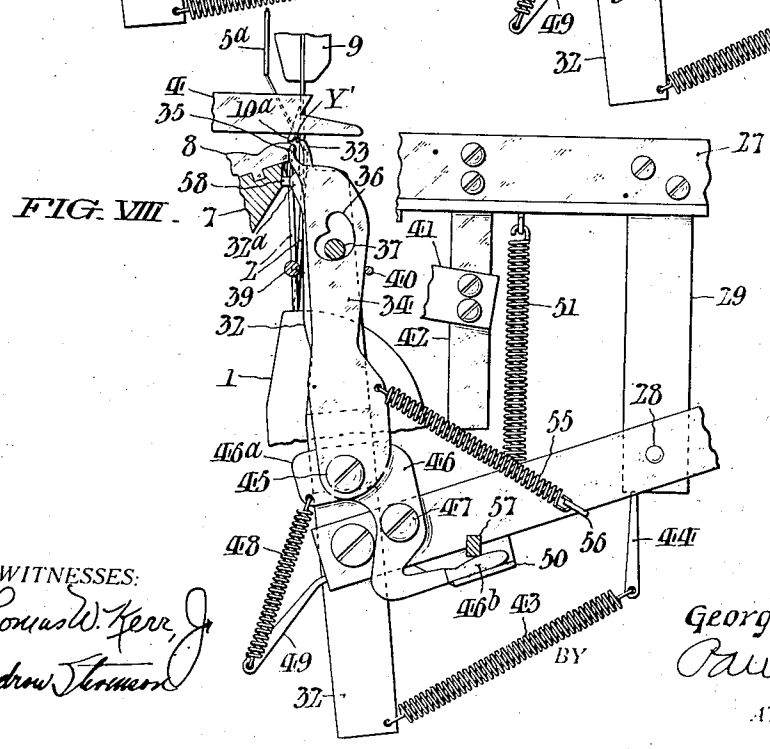


FIG. VIII.



WITNESSES:

Thomas W. Kerr, Jr.

Woodrow Stevens

INVENTOR:

George W. Ruedt,

BY

Paul & Paul

ATTORNEYS.

Aug. 5, 1941. G. W. RUEDT 2,251,805

MEANS FOR PRODUCING FLAT KNITTED FABRIC WITH INLAID ELASTIC YARN

Filed Nov. 16, 1938 7 Sheets-Sheet 6

FIG. IX.

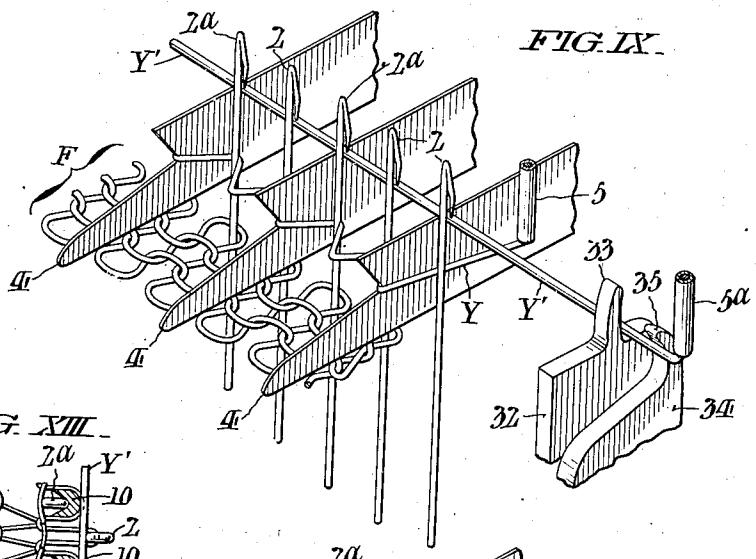


FIG. XIII.

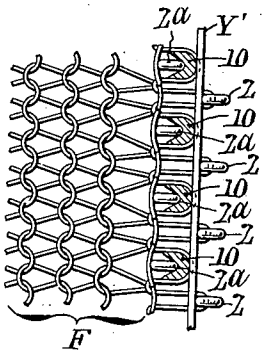


FIG. X.

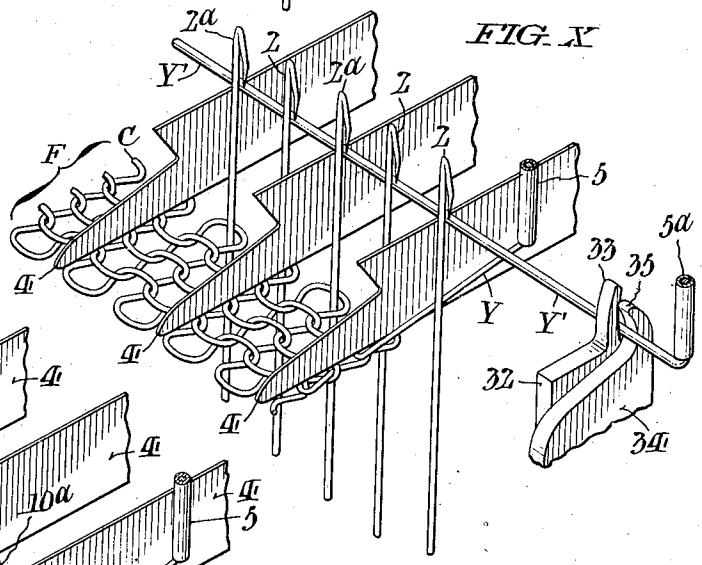
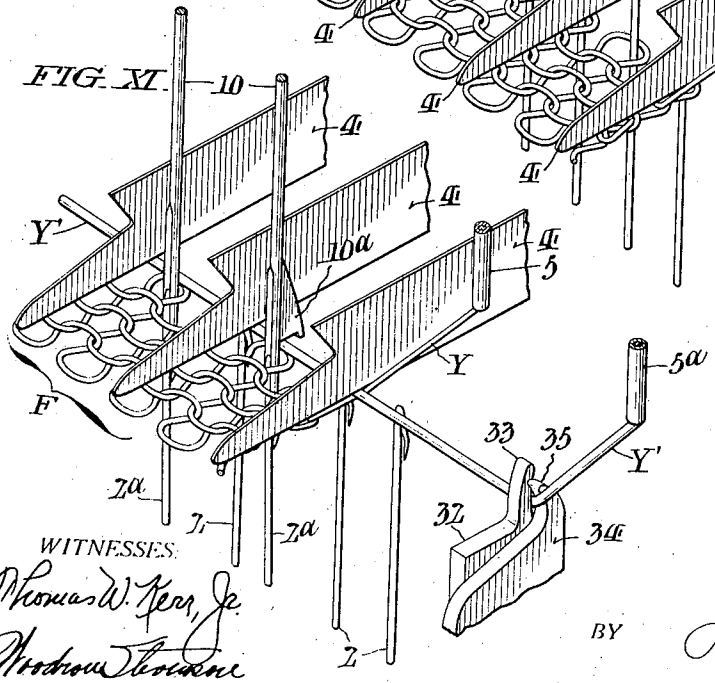


FIG. XI.



WITNESSES.

Thomas W. Kerr, Jr.

Woodrow Stevens

INVENTOR.

George W. Ruedt,

BY

Paul & Paul

ATTORNEYS.

Aug. 5, 1941. G. W. RUEDT 2,251,805

MEANS FOR PRODUCING FLAT KNITTED FABRIC WITH INLAID ELASTIC YARN

Filed Nov. 16, 1938 7 Sheets-Sheet 7

FIG. XIV.

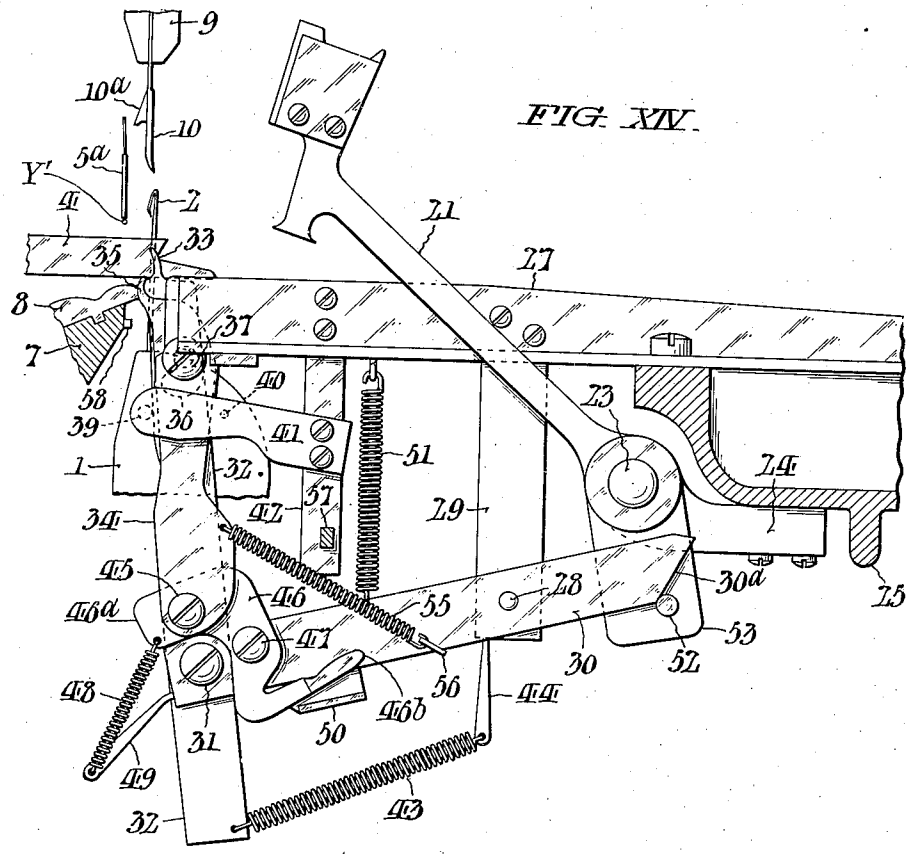
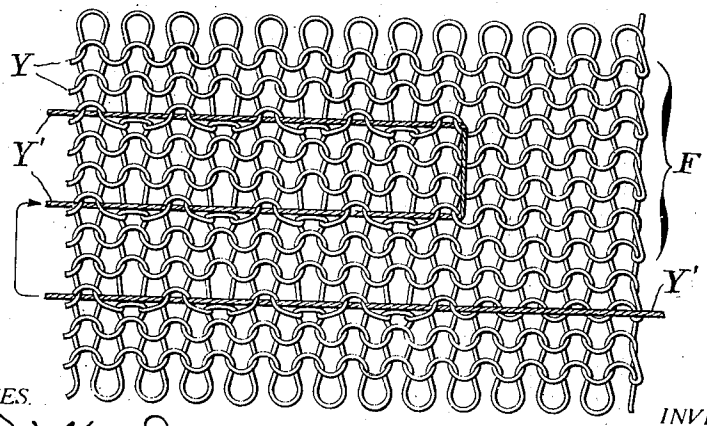


FIG. XV.



WITNESSES.

Thomas W. Kerr, Jr.

Woodrow Thomson

INVENTOR:

George W. Ruedt,

BY

Paul & Paul

ATTORNEYS.

Patented Aug. 5, 1941 2,251,805

UNITED STATES PATENT OFFICE

2,251,805

MEANS FOR PRODUCING FLAT KNITTED FABRIC WITH INLAID ELASTIC YARN

George W. Ruedt, Wauwatosa, Wis., assignor to Phoenix Hosiery Company, Milwaukee, Wis., a corporation of Wisconsin

Application November 16, 1938, Serial No. 240,601

6 Claims. (Cl. 66—83)

This invention is concerned with incorporation of elastic inlay yarns in plain knitted fabrics (as distinguished from ribbed fabrics), and also with mechanism for accomplishing this result.

The chief aim of my invention is to make possible such incorporation of elastic yarn incident to production of flat fabric on knitting machines of the "Cotton" type ordinarily employed in hosiery manufacture, particularly in band areas around the tops of the stockings for service in lieu of garters.

A further aim of my invention is to enable the inlaying to be accomplished without change in the usual construction of the knitting machines, or interfering with their normal mode of operation.

The foregoing and other objects and advantages I attain, as hereinafter more fully explained, through utilization of the picot mechanism of the machines as a means for displacing alternate needles from their normal plane so that the elastic yarn can be laid, either as an incident to normal knitting or as an incident to the formation of a row of picot stitches, in the interval thus formed between said displaced and the remaining needles, and through provision of simple elastic yarn manipulating mechanism capable of being easily embodied in the knitting machines for so laying the elastic yarn.

Other objects and attendant advantages of my invention will appear from the following detailed description of the attached drawings, wherein Fig. I is a fragmentary broken out view in front elevation of a flat knitting machine embodying my invention, with portions of the machine framework in the foreground shown in section.

Fig. II is a fragmentary view in cross section taken as indicated by the arrows II—II in Fig. I.

Fig. III is a detail sectional view taken as indicated by the arrows III—III in Fig. I.

Figs. IV and V are detail sections taken as indicated respectively by the arrows IV—IV and V—V in Fig. III.

Figs. VI, VII and VIII are views like Fig. II, drawn to a larger scale with the parts of the elastic yarn manipulating mechanism in different successive positions.

Figs. IX, X, XI and XII are fragmentary perspective views corresponding respectively to Figs. III, VI, VII and VIII.

Fig. XIII is a fragmentary plan sectional view corresponding to Fig. XI.

Fig. XIV is a view like Fig. II showing the parts of elastic yarn manipulating mechanism in inoperative position.

Fig. XV shows a fragment of plain knitted fabric with elastic yarn inlaid in accordance with my invention; and

Fig. XVI shows a fragment of knitted fabric with elastic yarn inlaid in a row of non-ravel or "picot" stitches in accordance with my invention.

For convenience of illustration herein, I have shown the elastic yarn manipulating mechanism of my invention as embodied in a flat knitting machine of the single unit type constructed after the manner disclosed in U. S. Patent No. 1,982,991, granted to Kenneth Howie and Charles C. Krieble on December 4, 1937, and designed for the production of full fashioned stocking blanks.

By suitable means not illustrated, the bar 1 (Figs. I–V) carrying the needles 2, 2*a* is bodily moved up and also swung in and out about a pivot axis 3 relative to the sinkers 4 and dividers (not illustrated) as required to form successive courses of fabric loops in the well known way. An inelastic yarn Y is fed by a guide 5 secured to one of a number of horizontal carrier bands 6 (Fig. I), said bands being oscillated to move the guides back and forth horizontally crosswise of the needles at the level of the sinker notches, likewise in a manner well known in the art. The sinkers 4 are slidable endwise, as ordinarily, in a head 7 which also carries the usual knock-overs 8. The picot bar 9 of the machine, in this instance, has loop-transferring points 10 corresponding to the alternate needles 2*a*, and is suspended, by arms 11, from a horizontal shaft 12 with capacity to be swung upward out of the way when necessary during fashioning operations with the usual widening or narrowing combs (not illustrated) said shaft being journaled in the guide brackets 13 for the comb bars which are shown at 14 in Fig. II. The brackets 13 depend in turn from a rod 16 connecting the ends of the arcuate dipper arms 17 of the narrowing mechanism of the machine, said arms being affixed to a longitudinal rock shaft 18 journaled in suitable bearings 19 at the rear of the machine frame. Through the medium of a pair of vertical links 20, the arms 17 are actuated to move the picot bar 9 up and down. The machine is further equipped with end holders 21 for welting bars, which holders are secured in laterally spaced relation to a horizontal rock shaft 23 for upward swinging movement from the normal position shown in Fig. III to the position shown in Fig. XIV incident to automatic welt closing operations. As shown, the shaft 23, is journaled in bearings 24 secured to the longitudinal front top trough rail or beam 25 of the machine frame and adapted to be operated by mechanism partly shown at 26 in Fig. II. Mounted on the frame rail 25 is a pair of laterally-spaced bridge bars 27 which serve as guides for the welt bar (not shown) used to draw off the fabric being knitted.

To adapt a knitting machine such as briefly described to the purposes of my invention, I employ

one of the thread guides for the inelastic yarn. This guide is designated 5*a* and the elastic yarn Y'. I also provide additional mechanism for manipulating the elastic yarn, which is about to be described. Medially fulcrumed at 28 at each side of the machine on a fixed bracket 29 pendant from the corresponding bridge bar 27 is a horizontal lever 30; and pivoted on a stud 31 at the inner end of said lever is a flat vertically-arranged elastic yarn clamping member 32 having a rounded finger 33 at its thinner upper end. Associated with each clamping member 32 is an opposing vertically-arranged clamping member 34 having a reversely curved finger 35 at its upper end, and a cam slot 36 somewhat below said finger through which the shank of a headed stud 37 on the bar 32 extends. Each clamp assemblage is guided for up and down movement between the contiguous end of the needle bar 1 and a retaining plate 38 on the corresponding bridge bar 27, and maintained in vertical position, with capacity for limited in and out play, between a pair of studs 39, 40 on the arm 41 of another pendant bracket 42 on said bridge bar. A coiled spring 43 in tension between the lower end of the clamping member 32 and an anchorage 44 on the bracket 29, serves to keep the rear edge of said clamping member normally in engagement with the stud 39. At its lower end, each clamping member 34 has a pivotal connection 45 with an angular lever 46 which is fulcrumed at 47 on the lever 30. Another spring 48 in tension between the inner horizontal end 46*a* of the lever 46 and an anchorage 49 at the corresponding end of the lever 30, tends to normally maintain the clamping member 34 in the position illustrated in Fig. III with the inner horizontal end portion of said lever 46 bearing against the head of the stud 31, and with the horizontal outer end portion 46*b* thereof normally elevated above a lateral underreaching projection 50 on the lever 30. By another spring 51, the lever 30 is normally held in the position shown in Fig. III with its top edge in engagement with the lower end of the bracket 42 which thus constitutes a stop therefor, and with its beveled front end 30*a* in engagement with a laterally projecting stud 52 on a lug 53 affixed to the rock shaft 23. Another spring 55 in tension between an anchorage 56 on the lever 30 and the clamping member 34 tends to swing the latter clockwise about the pivot 45. Secured to the drop links 20 through which the dipper arms 17 are actuated, are finger projections 57, which, during downward movement of said links, engage the ends 46*b* of the angle levers 46 to actuate the elastic yarn clamping devices in a manner presently explained. As shown in Figs. VI–VIII, the clamping members 32 are formed at their inner edges immediately below the fingers 33 with rounded cam projections 32*a* which are adapted to coact with lateral projections 58 at opposite ends of the sinker head 7. From Figs. II–XIII, it will be observed that the endmost loop transferring points 10 of the picot bar 9 are formed, in accordance with my invention, with lateral inward projections 10*a* for depressing the elastic yarn Y' in a manner also explained presently, said projections being notched at their bottoms as shown.

When the elastic yarn Y' is to be inlaid during normal knitting of the fabric F produced by the machine (as distinguished from inlaying during the formation of a row of picot loops) the operation of my invention is as follows:

In Fig. IX, the guides 5 and 5*a* have been concurrently moved across the needles 2, 2*a* from left to right, the inelastic yarn Y being thereby laid on the nibs of the sinkers and dividers (which latter for simplicity of illustration have been omitted in Fig. IX), and the elastic yarn being run over the tops of the sinkers out of the reach of the needle hooks to the rear of the finger 33 of the clamping device at the right side of the machine, said elastic yarn being wrapped around the finger 33 of the clamping device at the left hand side of the machine as shown in Fig. I. In Fig. IX, moreover, the inelastic yarn Y has already been kinked by the sinkers and dividers just prior to the downward movement of the needles. In Fig. X, a course C of fabric loops has been formed in the usual way from the inelastic yarn Y kinked in Fig. IX as above explained. At this stage, the narrowing mechanism of the machine is brought into action to actuate the picot bar 9, without attendant shogging of the bar in this instance, however to avoid sidewise loop transfer by its points. Upon initiation of the downward movement of the picot bar 9, the projections 57 on the drop links 20 engage the ends 46*b* of the angle levers 46 and depress them as shown in Fig. VI. The angle levers 46 are thereby moved clockwise about their pivots 47, and the clamping members 34 swung about the studs 37 and at the same time lifted bodily so that their curved fingers 35 are moved through the position shown in dot and dash lines at 35*x* in Fig. III to the position shown in full lines as a consequence of incidental coaction between the cam slots 36 of the clamping members 34 and the studs 37 under the influence of the springs 55. The elastic yarn Y' is thus moved laterally against the backs of the points 10 and at the same time clamped between the fingers 33 and 35 of the manipulating devices at the opposite sides of the machine as in Fig. X. As the downward movement of the links 20 continues, the ends 46*b* of the angle levers 46 eventually engage the lateral projections 50 on the levers 30 and cause the latter to be moved counter-clockwise about their pivots 28. Accordingly, the now closed clamping devices are moved downward bodily with the point bar 9, incident to which the elastic yarn Y' is depressed by the projections 10*a* on the endmost points 10 of said bar, to a level below the sinkers 4 positioned to the front (beard side) of the needles 2*a* covered by the points, and in back of the other needles 2 as shown in Fig. VIII, where it is detained upon subsequent advance of the sinkers and dividers over it as shown in Fig. XI. As the picot bar 9 approaches the downward limit of its movement, the clamping members 32 are swung inward through engagement of their curved cam edges 32*a* with the projections 58 at the opposite ends of the sinker head 7 as shown in Fig. VIII. As a consequence, the elastic yarn Y' is released by both clamping devices and stripped from the finger 33 of the left hand clamping device by the knockovers 8. Upon being thus stripped, the elastic yarn will spring up into notches of the projections 10*a* on points 10 of the bar 9, so that in rising the displaced needles 2*a* will pass to one side of said yarn and the other needles 2 to the other side thereof.

Also during rising of the needle and picot bars 1 and 9, the finger 33 of the right hand clamping device will come up on the inside (sinker side) of the elastic yarn Y', with the result that upon reversal of the guide 5*a*, said elastic yarn will loop around said finger and be held by the latter until stripped therefrom by the knockovers at the next inlaying of the elastic yarn in the

same manner as above explained. In Fig. XII, the cycle of picot bar has been completed with restoration of all the parts of the elastic yarn manipulating devices to their normal positions, the elastic yarn Y' being zig-zagged between the needles 2, 2a. Accordingly upon formation of a subsequent fabric course upon the needles from the inelastic yarn Y, the elastic yarn will be engaged between adjacent loops of the preceding fabric courses. In this way, the yarn Y' is not knitted by the needles but inlaid therein as shown in Figs. XIII and XV. In Fig. XV, the yarn Y' is inlaid in every third course, but this illustration is to be considered only as an example of other intervals and frequency of inlaying which may be determined upon in practice. If desired, of course, additional points may be added to the bar 10 so that the elastic yarn is extended to the selvages of the fabric instead of being stopped several wales inward of said edges as in Fig. XV. The present construction has been resorted to to avoid possible difficulties in seaming up the edges of the fabric in the overedge sewing machines ordinarily employed for that purpose. It is also to be understood that, within the scope of my invention, the points 10 of the picot bar 9 may be spaced otherwise than shown if desired.

Upon upward swinging of the transfer bar holders 21 as in Fig. XIV, the pins 52 on the lugs 53 connected to the shaft 23, coact with the beveled ends 36a of the levers 36, thereby causing the members 32 and 34 of the clamping devices to be drawn downward to inactive position out of the way.

By permitting shogging of the picot bar 9 to transfer the fabric loops from the needles 2 to the adjacent needles 2a after concurrent feeding of the elastic yarn Y' and the inelastic yarn Y as hereinbefore described in connection with Fig. IX, and after the first or loop-lifting dip of the regular picot or narrowing motion and also before the loop-delivering and needle-displacing dip as shown in Figs. VIII and XI, the elastic yarn Y' will be inlaid in the picot or run stop band produced as shown at P in Fig. XVI.

From the foregoing it will be apparent that I have provided a simple and reliable auxiliary mechanism for incorporating elastic yarn in knitted fabrics, which can be readily embodied in existing flat knitting machines without entailing structural changes in them or alteration in their normal mode of operation.

Having thus described my invention, I claim:

1. In a flat knitting machine having a bar with a straight series of needles, cooperating sinkers, a reciprocating guide for inelastic yarn, and a bar movable up and down with the needle bar and carrying points for displacing certain needles at intervals along the series from their normal plane; mechanism for incorporating elastic yarn into the fabric at intervals during the knitting including a reciprocating guide for running elastic yarn across the machine above the level of the sinkers beyond the reach of the needles, manipulating devices adjacent opposite ends of the needle bar operative upon retraction of the sinkers, to shift the elastic yarn laterally against the backs of the points and to so hold it during descent of the point bar with the needles, means concurrently operative to depress the elastic yarn for advance of the sinkers over it, so that upon subsequent rise of the needles to take a new supply of inelastic yarn, those needles which have been displaced as aforesaid will pass up to one side of the elastic yarn and the others to the other side of said elastic yarn.

2. Elastic yarn inlaying mechanism for flat knitting machines according to claim 1, wherein the manipulating devices are moved up and down with the point bar; wherein there is a means for actuating said devices at the initiation of their descent to shift the elastic yarn and at the same time clamp it; wherein there is a means for actuating said devices as they reach the limit of their descent to release the elastic yarn; and wherein the yarn depressing means consists of lateral projections on certain of the needle displacing points, said projections being notched at their bottoms to hold the elastic yarn temporarily when it is released by said manipulating devices.

3. Elastic yarn inlaying mechanism for flat knitting machines according to claim 1, wherein the manipulating devices are moved up and down with the point bar, each having the form of a normally open clamp with interpivoted components; wherein there is a means operative at the initiation of the descent of said devices to actuate one component of each for the purpose of shifting the elastic yarn laterally and at the same time clamp it against the other component; wherein there is a means operative as said devices reach the limit of their descent to cause them to open and release the elastic yarn; and wherein the depressing means consists of lateral projections on certain of the needle displacing points, said projections being notched at the bottom to temporarily hold the elastic yarn when released by the manipulating devices.

4. The combination defined in claim 1, including means whereby the clamping devices for the elastic yarn are locked in depressed position out of the way when their use is not required.

5. The combination defined in claim 1, wherein the knitting machine is provided with welt closing means including a holder for welt bars; and including means whereby the elastic yarn manipulating devices are automatically moved to an inactive position during actuation of the welt bar holder.

6. In a flat knitting machine having a straight series of needles, actuating means therefor, a reciprocating guide for feeding inelastic yarn to the needles for the formation of successive fabric courses, mechanism for similarly feeding-in elastic yarn at intervals during the knitting of the fabric courses, and picot mechanism including a picot bar having points corresponding to certain needles at intervals along the series for transferring fabric loops from certain needles to adjacent needles with attendant displacement of the loop receiving needles from their normal plane, said picot mechanism also serving to effect insertion of the elastic yarn between the needles when displaced while the fabric course with displaced loops is held upon the needles so that, upon formation of a succeeding regular fabric course from the inelastic yarn, said elastic yarn will be inlaid in the resulting row of picot stitches.

GEORGE W. RUEDT.