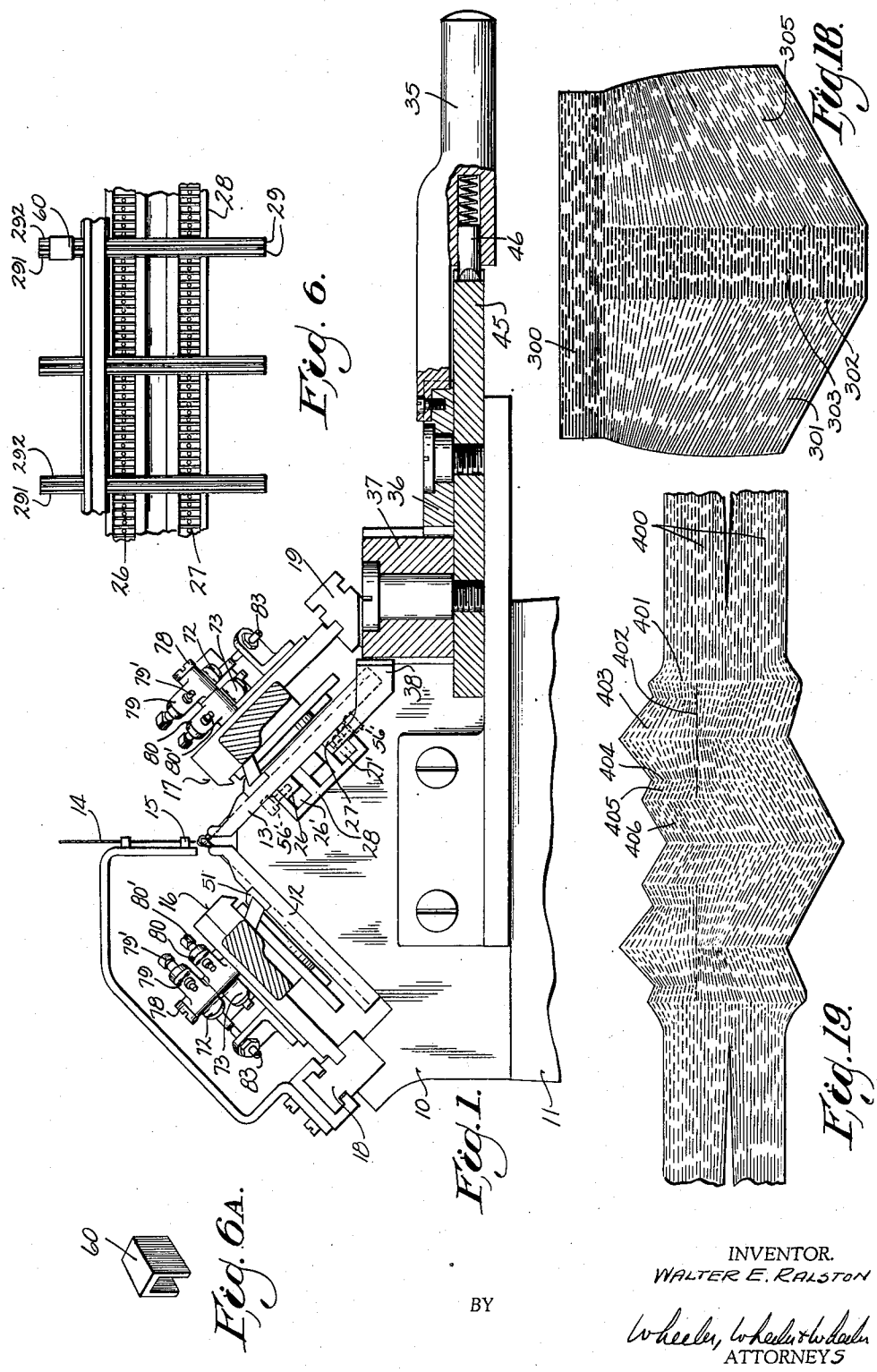
May 26, 1942. W. E. RALSTON 2,284,167

KNITTING MACHINE

Filed Nov. 4, 1938 5 Sheets-Sheet 1



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KNITTING MACHINE

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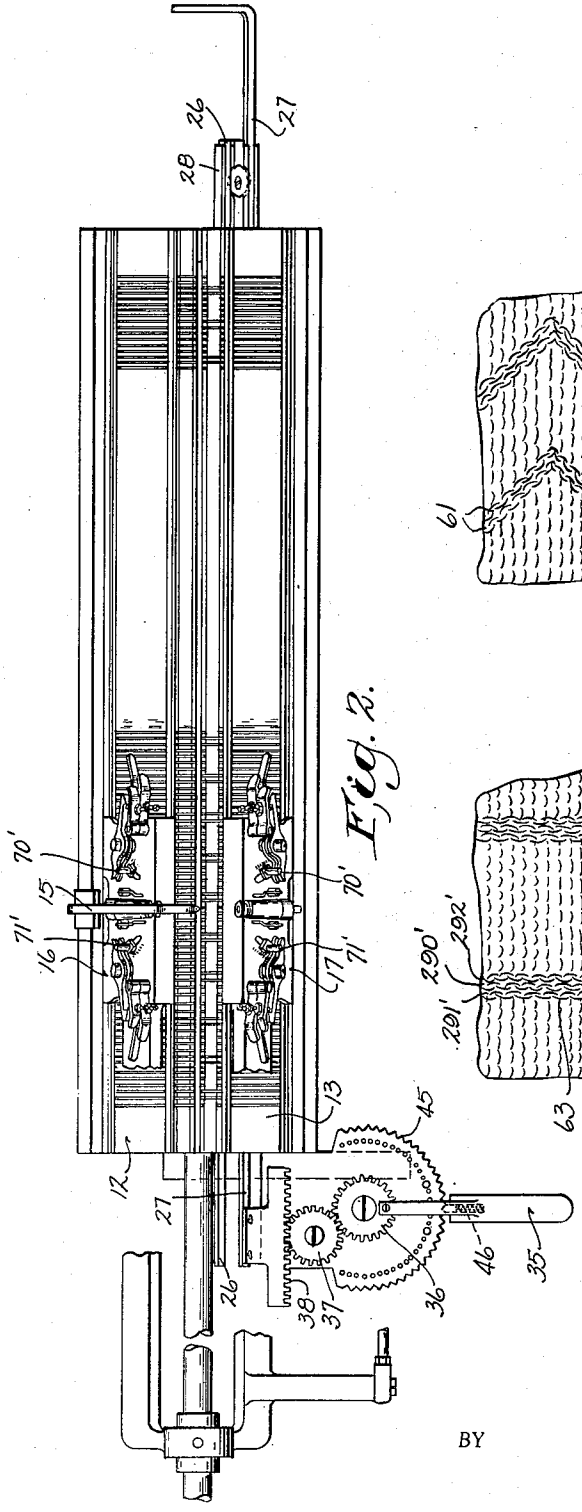


Fig. 12.

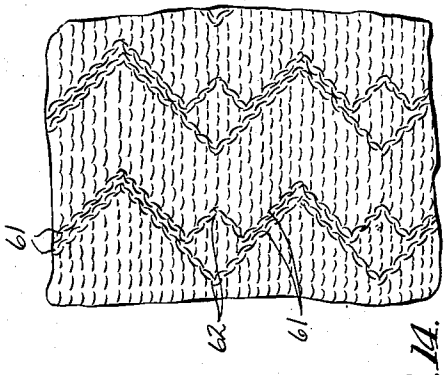


Fig. 14.

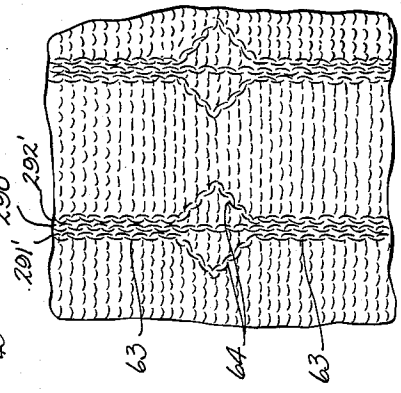


Fig. 13.

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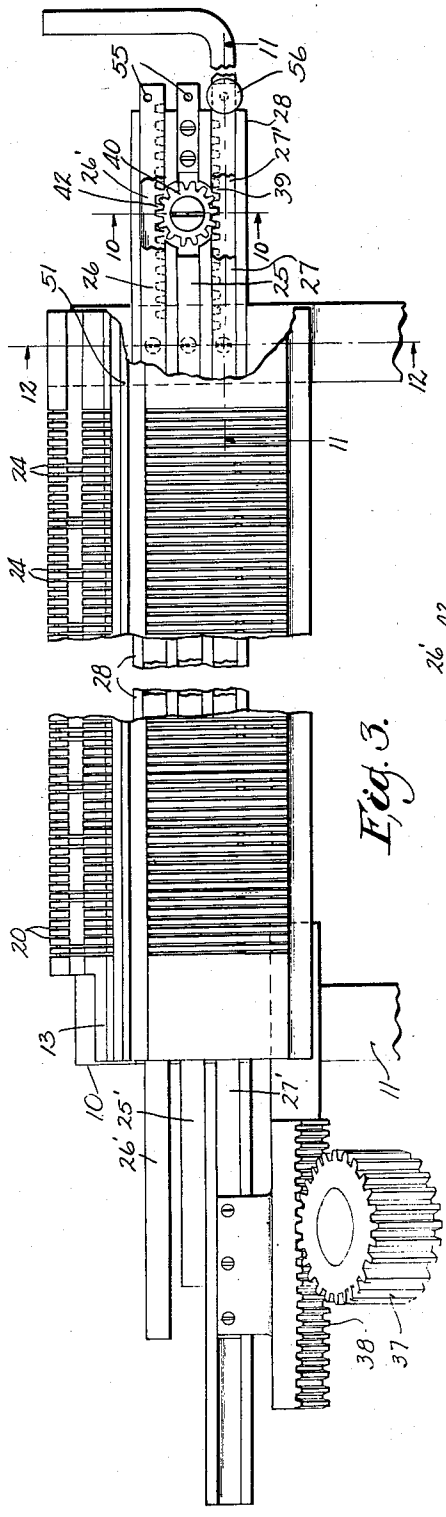


Fig. 3.

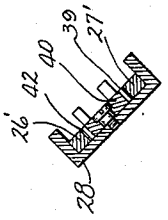


Fig. 10.

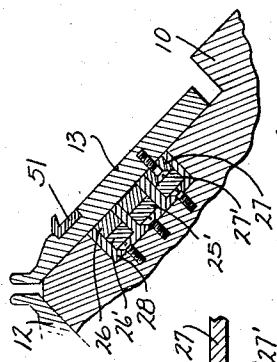


Fig. 12.

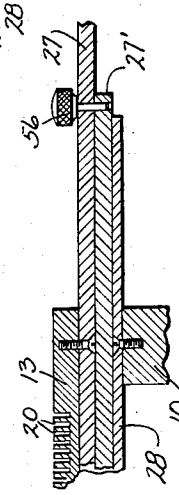


Fig. 11.

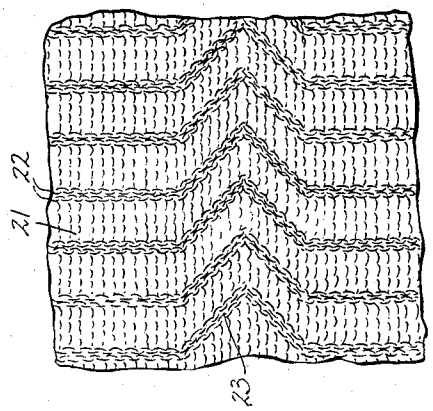


Fig. 15.

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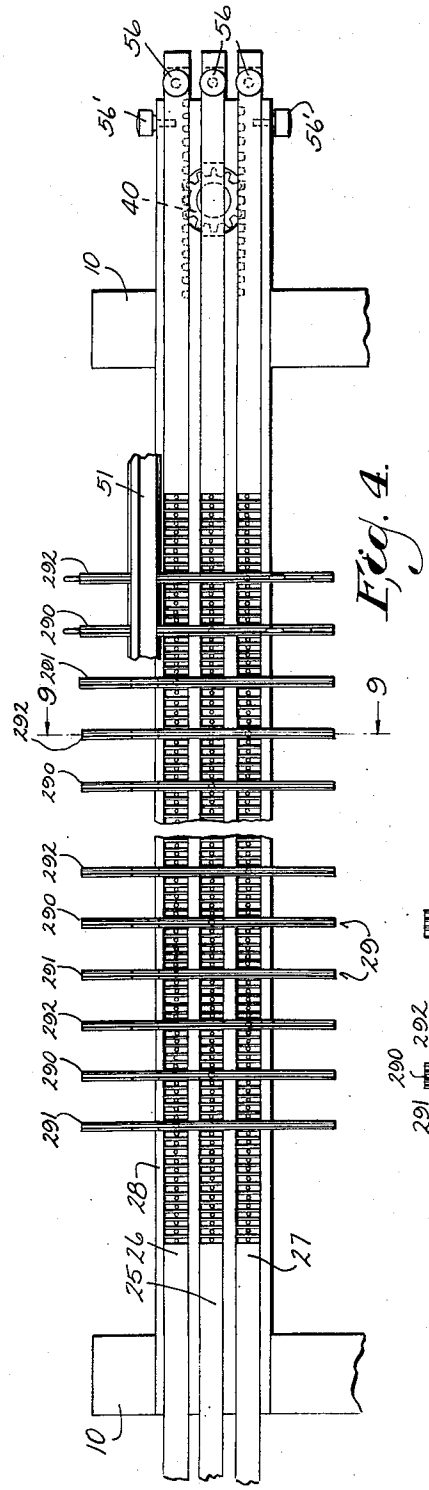


Fig. 4.

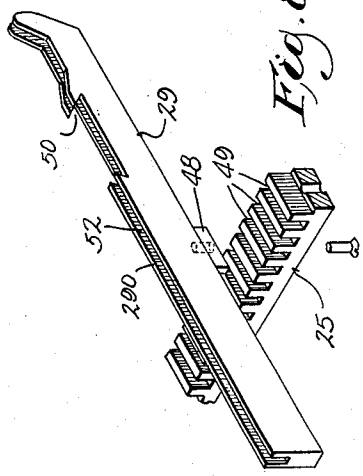


Fig. 8.

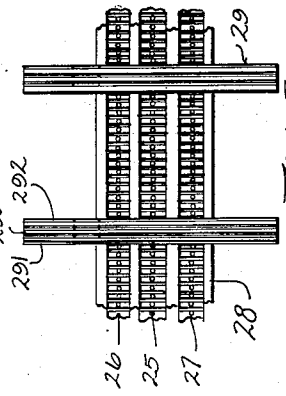


Fig. 7.

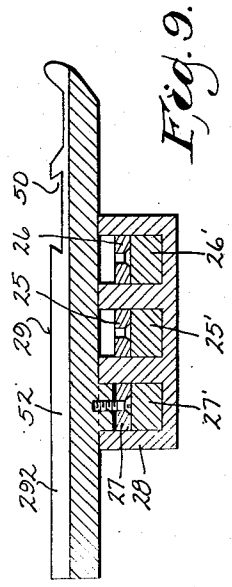


Fig. 9.

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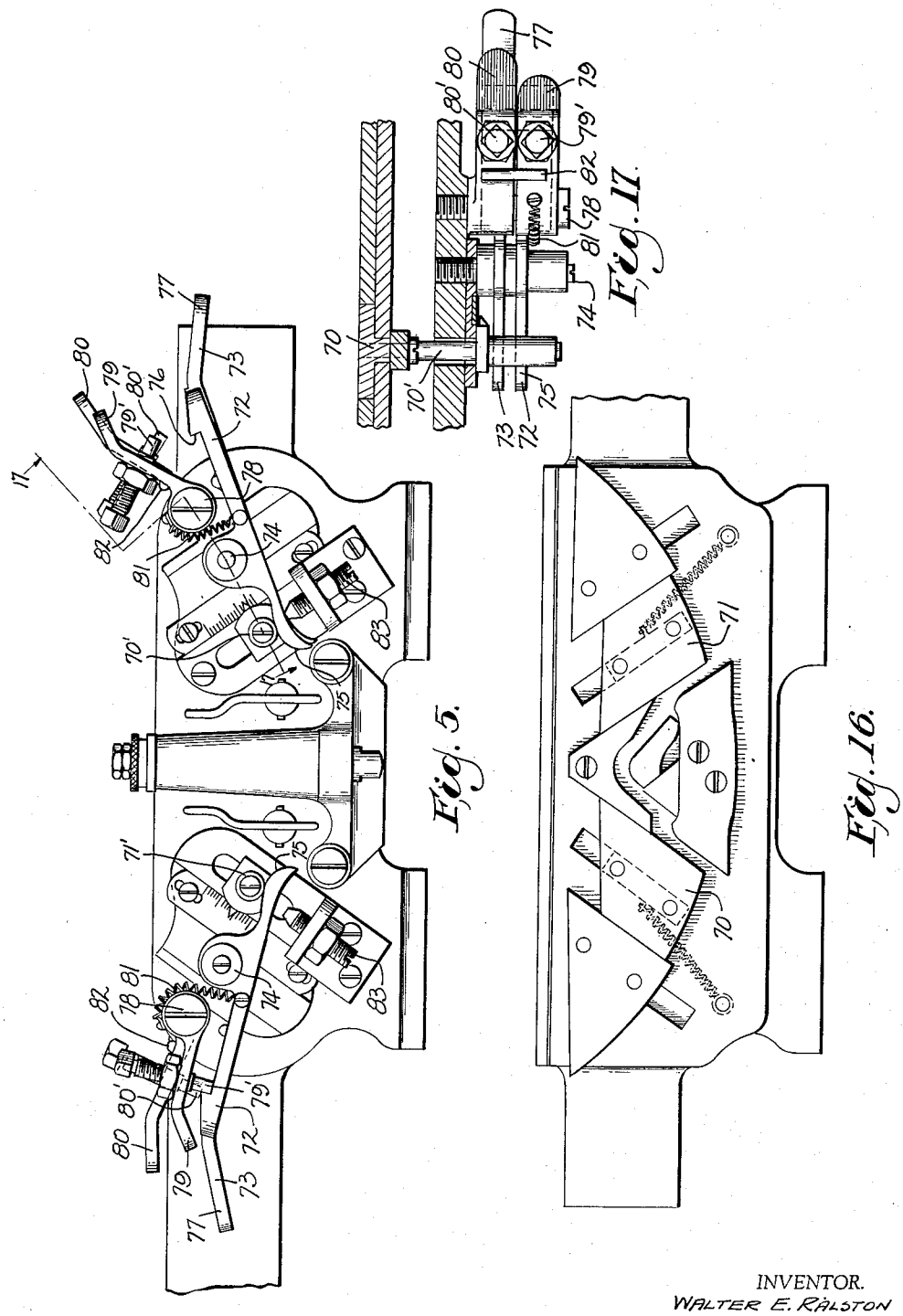


Fig. 17.

Fig. 5.

Fig. 16.

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Patented May 26, 1942 2,284,167

UNITED STATES PATENT OFFICE

2,284,167

KNITTING MACHINE

Walter E. Ralston, Delavan, Wis., assignor to The George W. Borg Corporation, Chicago, Ill., a corporation of Delaware

Application November 4, 1938, Serial No. 238,837

4 Claims. (Cl. 66—69)

My invention relates to improvements in knitting machines.

The object of my invention is to provide a knitting machine wherein at least one of the plates for the needles is "split" or divided into a number of separate sections, and to provide control means for each of said sections or for grouped "banks" of said sections so that individual sections or banks may be moved to the right or left a greater distance than has heretofore been possible with the racking means thus far provided, in fact my object is to make it possible to rack from one side of the machine to the other.

Another object of my invention is to provide a control for a racking mechanism whereby special patterns may be worked out.

A further object of my invention is to provide a special draw cam mechanism whereby to simplify and speed up draw cam control operation thus making it possible to change the draw cam setting in the normal progress of a knitting machine operation and without stopping the machine for the adjustment of the draw cam.

In the drawings:

Figure 1 is an end view of a knitting machine equipped with my improved racking means, split plate, and improved draw cam mechanism.

Figure 2 is a plan view of a knitting machine embodying my invention.

Figure 3 is a view in plan and showing one entire set of plates under the control of my improved racking means.

Figure 4 is a view similar to Figure 3 but showing the needle plate divided into banks of sections which as to one bank the sections are fixed, and as to the two other banks they are oppositely movable to and from the fixed bank.

Figure 5 is a front view from the operator's position of my new draw cam adjusting device.

Figure 6 is a front or operator's view of my split plate with the use of a special clip.

Figure 6A is a perspective of the clip used in the mechanism shown in Figure 6.

Figure 7 is a front or operator's view of a portion of my split plate shown in Figure 4 but with the fixed and movable needle sections racked into juxtaposition.

Figure 8 is an "expanded view" of a rack bar and a needle guide as used in the construction shown in Figure 4.

Figure 9 is a section on line 9—9 of Figure 4.

Figure 10 is a section on line 10—10 of Figure 3.

Figure 11 is a section on line 11—11 of Figure 3.

Figure 12 is a section on line 12—12 of Figure 3.

Figure 13 is a diagrammatic view of a figured fabric, the knitting of which is made possible by portions of the knitting machine shown in Figure 4.

Figure 14 is a diagrammatic view of a knitted fabric, the pattern for which is made possible by the portions of the machine shown in Figure 6.

Figure 15 is a diagrammatic view of a knitted fabric which may be made upon the knitting machine, the portions of which are shown in Figure 3.

Figure 16 is a view of the underside of the cam block shown in Figure 5.

Figure 17 is a section on line 17—17 of Figure 5.

Figure 18 is a plan view of a swimming trunk knit on my split plate machine.

Figure 19 is a plan view of a brassière knitted on my split plate machine.

Like parts are designated by the same reference characters throughout the several views.

The drawings show my invention embodied in a so-called hand knitting machine for the knitting of "flat" fabric and the product of such a knitting machine has heretofore been in the form of either a single weight simple flat web, or a double thickness flat web, or in the form of a single thickness web upon which the simplest forms of pattern have been made either by hand "decking" or by a laboriously operable cam control racking mechanism by means of which one entire needle plate, as for instance the front plate, has been laterally moved to the extent of not more than three or four needles. Obviously, my invention may be incorporated in other types of knitting machines whether hand or power operated as will be clearly seen from the following description.

In a hand knitting machine of the type shown in the drawings, a frame 10 provided with legs 11, or mounted upon a bench, is provided with two needle plates 12 and 13. The needle plate 12, as shown in my drawings, being the rear or back needle plate, and the needle plate 13 being the front needle plate since it is faced toward the operator's position when the device is operated as a hand knitting machine. In this description I shall refer to the needle plate 12 as the rear needle plate upon which a single thickness knitted fabric may be produced and upon which a pattern or the double thickness fabric may be knitted by means of the needles in the

front needle plate 13. It will be understood, of course, that the knitting operation is accomplished by the passage of yarn 14 through guide 15 into the hooks of the needles carried and guided by the needle plates 12 and 13, the guide 15 being reciprocated from end to end of the machine with cam blocks 16 and 17 which are carried and guided by cam block rails 18 and 19 in a manner well known in this art.

Heretofore the front plate 13 has been constructed as shown in Figure 3 with needle guides 20 built into a solid plate extending clear across the machine from left to right, and, as indicated, above, this entire needle plate has heretofore been provided with means for "racking" it laterally to the extent of one to three or possibly four needles. Therefore, it was possible to make a fabric such as that shown in Figure 15 wherein the single thickness fabric 21 produced by the rear plate was given a pattern by the knitting of certain needles in the front plate as shown at 22 and these needles could be racked somewhat to the right and to the left to make a "zig-zag" pattern at 23. To illustrate this I have indicated that certain pairs of needles 24 are positioned in the needle guides of the front plate 13, and the needles in the other guides 20 either are absent or are retracted so as not to operate actively in the knitting of the pattern.

In keeping with my invention involving a split plate, however, I provide mechanism as shown in Figure 4 wherein the usual front plate is broken down into a plurality of needle grooves mounted upon rack bars 25, 26 and 27, each receivable in a separate channel in a rack bar guide 28. The rack bar guide is received in the frame 10 of the knitting machine.

With this construction it is possible to mount separate needle guides 29 in respective rack bars 25, 26 or 27 and arrange them in banks as shown most clearly in Figure 4 where it will be seen that the needle guides 290 are secured to the fixed rack bar 25. The needle guides 291 are secured to the rack bar 26 and the guides 292 are secured to the rack bar 27. Each rack bar has a corresponding sub-rack bar 25', 26' and 27'. The mechanism for the control of these rack bars will now be described.

A handle 35 is connected directly with a pinion 36 which is therefore under the direct control of an operator standing in front of the front plate 13. The pinion 36 is meshed with a reversing pinion 37 which in turn is meshed with a rack 38 attached directly to a sub-rack bar 27'.

The purpose of the reversing pinion 37 is to accomplish coordinating movement between the handle 35 and the sub-rack bar 27', thus making it perfectly natural for an operator to move the handle in the same direction in which he expects the rack bar 27 to move.

Sub-rack bar 27' extends the entire length of the knitting machine and is provided along its inner face with racking teeth 39. These teeth are in mesh with a transfer pinion 40, the axis of which is fixed upon the rack bar guide 28. Sub-rack bar 26' has its inner face provided with rack bar teeth 42 in mesh with the transfer pinion 40 and it is thus apparent that when sub-rack bar 27' is forced to the right, sub-rack bar 26' is forced to the left by the transfer pinion 40.

For easy control and for scheduled formation of patterns, I provide a calibrated ratchet sector 45 and a spring pawl mechanism 46 to engage therewith in the handle 35. The operator of a machine equipped with this control mechanism and the racking means thus far described may, through the control handle 35 and the calibrations shown on the sector 45, ascertain and determine that the bank of needle guides secured to the respective racking bars 26 and 27 are moved one needle position at a time from the position shown in Figure 7 to the position shown in Figure 4 and back again, thus making a pattern as shown in Figure 13, since, as handle 35 is moved one notch on the sector 45, needle guides 291 and 292 will move outwardly or inwardly the distance of one needle spacing.

Various ways may be devised for securing the needle guides 29 to their respective rack bars but I have found that a needle guide may best be secured to a rack bar as shown in Figure 8 since space must be conserved to the utmost in order that the needles in separate rack bars 25, 26 or 27 may be spaced apart at no greater interval than are the needles and their needle guides on the fixed rear plate. In Figure 8 it will be noted that the rack bar is slotted to receive the guide 29 and I therefore provide a boss 48 upon the underside of the guide. The boss 48 is received in one of the slots 49 and a screw fixes the guide in place in one of the slots since the screw is projected upwardly through the bar into the boss 48. The usual dove-tail slot 50 in the upper face of the guide 29 is provided with the usual lock bar 51 (Figure 12) which retains the needle in the usual groove 52.

Obviously, the formation of various types of patterns requires the different adjustment or range of adjustment of the rack bars 26 or 27 and the bank of needles associated with each bar. I therefore have not only provided the structure heretofore described but I have also provided sub-rack bars 25', 26' and 27' which underlie the respective rack bars 25, 26, and 27 to which the needle guides are secured. By providing various bores 55 in the rack bars and sub-rack bars, and by having the transfer pinion 40 engage only with the sub-rack bars, I am able to pin a particular rack bar and a particular sub-rack bar by means of pin 56. If one of the pins 56 is not in position to connect the rack bar and its sub-rack bar, obviously the needle guides will remain stationary even though the handle 35 is moved for the purpose of racking some other bank of needles. To illustrate the method in which this is used I show in Figures 6 and 6A the coupling together of a group of needle guides 29 by means of a clip 60 which prevents the guides from separating and therefore forces rack bar 26 to move with rack bar 27. With the clip 60 in place the pattern to be made by the pairs of needles (one from each bank as shown in Figure 6) will be the pattern shown at 61 in Figure 14, and this pattern in zig-zag form is formed under the control of the handle 35 which is racked in successive movements to the right and then to the left. When the clip 60 is removed and a pin 56 is placed through each of the rack bars and sub-rack bars 26 and 27, the pattern shown at 62 in Figure 14 will be produced; then when the clip is placed in position again the pattern at 61 is again produced, etc.

To illustrate the manner in which the construction shown in Figure 4 operates, the diagrammatic view in Figure 13 shows the stitch at 290', which is stitched by the fixed needles in guides 290 secured to the fixed rack bar 25; the stitch at 291' is knitted by the needles in guides 291 secured to the upper rack bar 26; and the

stitch 292' is knitted by the needles in guides 292 secured to the lower rack bar 27. When the various guides 290, 291, and 292 are side by side as shown in Figure 7, the group of stitches shown at 63 is produced, and when the handle 35 is "racked" to the right, the stitches diverge as shown at 64 as the needles step by step are adjusted to the position shown in Figure 4. Then when the handle 35 is brought back to its original position step by step the stitches produced thereby are parallel again as shown at 63.

To make certain types of patterns and new types of fabric I provide pins 56' which extend through the rack bar guides into the rack bars, but not into the sub-rack bars. With the pin 56 removed and a pin 56' in place the sub-rack bar can "float" under control of the handle 35 and pinion 40 without moving the rack bar which is thus locked to the frame.

I have thus made it possible to quickly change from the conventional solid needle plate to a sectional controlled needle plate by lifting the solid plate from the frame and replacing with a sectional plate mounted on the rack bars for whatever pattern may be desired.

While the solid needle plate is mounted in a knitting position with the needle plate on the opposite side, it is possible to rack it from one end of the machine to the opposite end. Heretofore racking movement to the extent of three or four needles has been the limit in any given direction.

It is also possible to divide a solid needle plate into two parts by pinning one part to the lower rack bar and the other part to the upper rack bar the two sections may be moved in opposite directions. Using this set-up in conjunction with the opposite needle plate a double knee racked fabric can be produced.

By mounting sections of a split plate upon the rack bars in such a way that the sections move in opposite directions, a double knee racked fabric may be made whereby the points created by racking will be made on both sides of the fabric. Or by holding one section with a pin 56' a straight side may be made and a point created on the opposite side of the fabric; also by changing the pins 56 so that both sections rack in the same direction a fabric commonly called a knee-racked fabric may be produced. Heretofore it has only been possible to produce a knee-racked fabric or straight fabric on a conventional machine with solid needle plates.

With my split plate or sectional needle plate machine, a combination of any of the fabrics, namely, the knee-racked, straight side knee-racked, or double knee-racked may be made at the will of the operator or by mechanical controls. It can be seen that caps, brassières, blouses, sweaters, bathing trunks, trimming, pockets, cuffs can be made and formed by the use of any of the three different knee racks either in combination, or singly.

When a single fixed needle section is intermediately placed, I can provide a needle section at either side thereof and mount each of such sections on a rack bar under control of handle 35 thereby producing a symmetrical garment with cupper brassière sections, or other functional patterned garment portions at the other side of a straight central panel.

To illustrate one set-up on a split plate machine whereby a bathing trunk, as shown in Fig. 18, may be made, I use a 400 needle machine, one-half, or 200 needles, being on the back plate and 200 needles on the front plate. By cutting the front needle plate in two pieces, or by building single sections in a bank of 200 needles, I would divide the needles, 87 needles in one section and 23 needles in the other. The section with 87 needles is mounted onto either the upper or lower rack bar. The section with 23 needles is mounted on the center or stationary rack bar. Having done this I position my yarn guides in such a way that one guide carries the yarn the full width of the needle bed or feeds yarn into all needles in operation. The other yarn guide is positioned to feed yarn into the needles the width of the reinforced waist-band 300 which would be knit by the needles on the stationary rack bar. From this point, and with a full cardigan, or half cardigan, I produce a knee rack stitch as shown at 301, racking my machine on the left side to pull my fabric away from the stationary needles. I continue this knitting to a point 302 where the reinforced supporter is knit in. At this point I change my yarn guides so that both guides travel the full width of the needles in operation, and I do not rack the movable rack bar until the supporter or crotch section 303 is completed. I then change back to the knee rack but mis-rack at this point causing my fabric to work back towards the stationary needles thus producing the panel 305 which continues on until the fabric is finished. During the knitting of the panel 305, the yarn guide controlling the reinforcing yarn is positioned to complete the remainder of the waist-band.

Another illustration of the use of my improved split plate is shown in Figure 19 where the fullness necessary to make the cup of a brassière is "built into" the fabric in the following manner. The strap to form the back of the belt of the brassière is shown at 400. This is made by going into a rib stitch brought up to the point 401. The cupped effect 402 is produced on my plate, which is split in the center into two solid sections of needles which are arranged on each side of the center line. I start out with the full or half cardigan stitch and with my locks or cam heads at the extreme right of the machine I rack the two sections away from each other to the extent of one needle. I then go ten rounds of such double knee rack which loosens up an excess of material along the center line of the division between the two sections as indicated at 402. At the end of the 10 rounds the two needle sections are side by side and I then lock them together and continue knee racking both sections of needles in the same direction; I continue for 25 rounds, thus making the portion 403 of the brassière garment. At this point, I mis-rack for 25 rounds to reverse the inclination of the wales to a line 404. From this point, when the head is at the extreme left of the machine, the needle sections are released and the sections are racked away from each other for 10 rounds during which the fabric portion 405 is knit. The two sections are then locked together and racking is continued in the same direction to form the portion 406. The other half portion of the brassière is completed by repeating the foregoing operations.

It will be obvious to any one skilled in this art that the successive racking under the control of the handle 35 would be virtually impossible with any of the types of yarn now used unless the drawing of each stitch by the draw cam in the cam blocks 17 is controlled and adjusted as each type of work produced by the needles of the front

plate is changed, for instance the constant production of a rib stitch as shown in the upper or lower parts of Figure 15 would require a given adjustment of the draw cam while the production of the zig-zag stitching shown at 23 in Figure 15 would require a different setting of the draw cam. I have, therefore, provided a fingertip control for the adjustment of the draw cam in a draw cam control device shown most clearly in Figures 5 and 17.

Each cam block is provided with two draw cams 70 and 71 and each of the draw cams is provided with a post 70' and 71'. These posts extend upwardly through the cam block and are in position to be contacted and controlled by a pair of control levers 72 and 73. The pair of control levers 72 and 73 is mounted upon a single fulcrum pin 74 and each of these control levers is a lever of the first class extending from a cam-like surface 75 which contacts the draw cam post to a latch lip 76, and one of the levers (73) is provided with a fingertip pad 77 comprising an extension of the lever. Upon a separate latch post 78 I provide a pair of latch pin holders 79 and 80, each of which is provided with a latch pin 79' and 80', respectively. These latch pins extend through the latch pin holders 79 and 80 with which they are in threaded engagement, lock nuts being provided as shown. Latch pin holder 79 is provided with a spring 81 tending to withdraw latch pin 79' from engagement with the latch lip 76 of the lever 72 and a clip 82 secured to latch pin holder 80 overlies latch pin holder 79 to compel latch pin holder 80 to move upwardly with latch pin holder 79 but to permit the free downward movement of latch pin holder 79 without affecting latch pin holder 80.

With the draw cam adjusting devices, described above, it will be seen that the post of each draw cam may be adjusted along the slot in which it is mounted to move simply by the fingertip control of the operator for it is possible for the operator to move the draw cam upwardly for a tight draw merely by pressing downwardly upon the latch pin holders 79 and 80 thus causing latch pin 80' to engage the lip on lever 73, then as the knitting work progresses and a slight release of the draw cam is desired, pad 77 may be pressed by the fingertip of the operator whereby to release latch pin holders 79 and 80. The draw of the cam will then be reset by pressure upon holder 79, which in turn, as the work progresses, may be released by a second application of pressure upon pad 77.

Obviously the adjustment of the various positions of the draw cam may be accomplished by setting the adjustment of the latch pins 79' and 80'. Any basic adjustment of the levers 72 and 73 may be accomplished by means of a set screw 83 which positions the limit of "loosening" movement of the draw cam by determining the lowermost position of lever 75.

In the operation of my improved knitting machine in the creation of a pattern involving repeated changes in the racking of stitches produced by the front plate of the machine, the extreme usefulness of my quick draw cam adjustment will be apparent and it has been found in practical commercial operation of my improved knitting machine that the operator soon becomes as proficient in the fingertip control of my draw cam as would a pianist in the fingering of the keys of a piano.

I claim:

1. In a knitting machine of the type known as a flat knitting machine including two needle plates provided with needles to work to and from a knitting zone therebetween, a yarn guide for feeding yarn to said needles, a plurality of needle sections, a rack bar movable with each section, a subrack bar alternatively attachable or detachable to each rack bar and a control device for moving the sub-rack bar.

2. In a knitting machine of the type known as a flat knitting machine including two needle plates provided with needles to work to and from a knitting zone therebetween, and a yarn guide for feeding yarn to said needles, one of said needle plates being divided into a plurality of sections wherein certain of said sections are provided with connections for coordinate movement in opposite right and left direction, said connections including a rack bar for the section moving in one direction and a separate rack bar for the section moving in the other direction.

3. In a knitting machine of the type known as a flat knitting machine including needle plates provided with needles to work to and from a knitting zone therebetween, and a yarn guide for feeding yarn to said needles, one of said needle plates being divided into a plurality of sections, a plurality of rack bars, certain of said sections being secured to said rack bars, a gear rack for each of said rack bars, and a pinion in engagement with two of said gear racks whereby in the movement of one of said racks and its needle section to move the other of said rack bars and its section oppositely.

4. A knitting machine of the type known as a flat knitting machine having a frame and including two plates provided with needles to work to and from a knitting zone therebetween, and a yarn guide for feeding yarn to said needles, one of said needle plates having a section of spaced individual needle guides secured in fixed relation to said frame, and having individual movable sections of needle guides upon either side of said fixed section, a rack bar secured to each of said movable sections and means interconnecting said rack bars whereby to move said movable sections oppositely with reference to said fixed section.

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