April 12, 1955 C. SCHELLER 2,705,879

MECHANISM FOR DRIVING THE THREAD GUIDE OF A FULL-FASHIONED KNITTING MACHINE

Filed Feb. 23, 1954 3 Sheets-Sheet 1

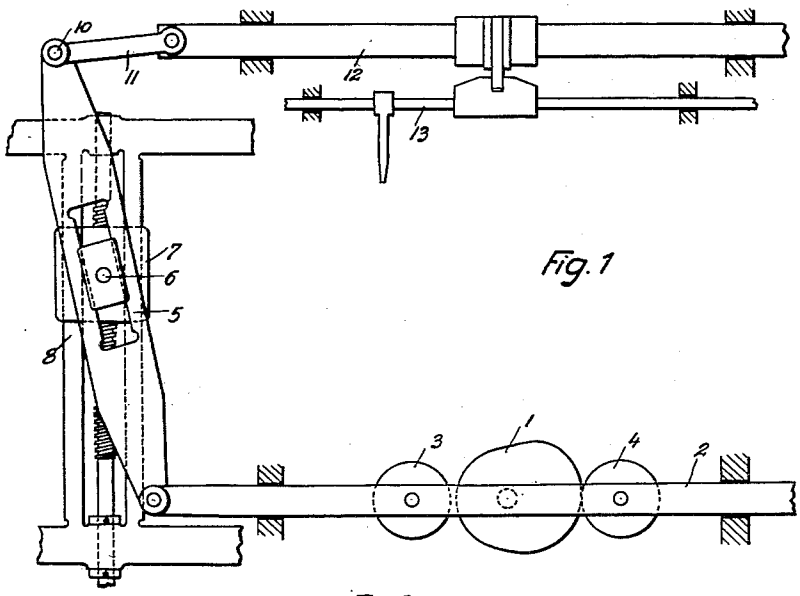


Fig. 1

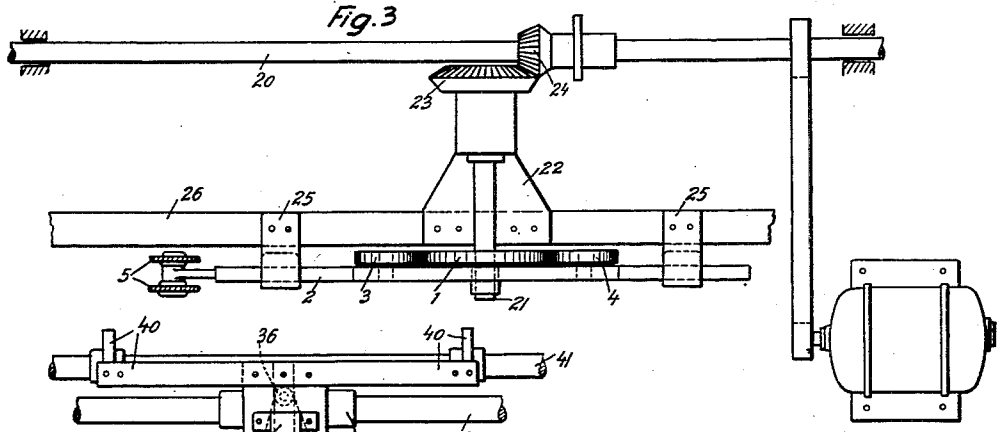


Fig. 3

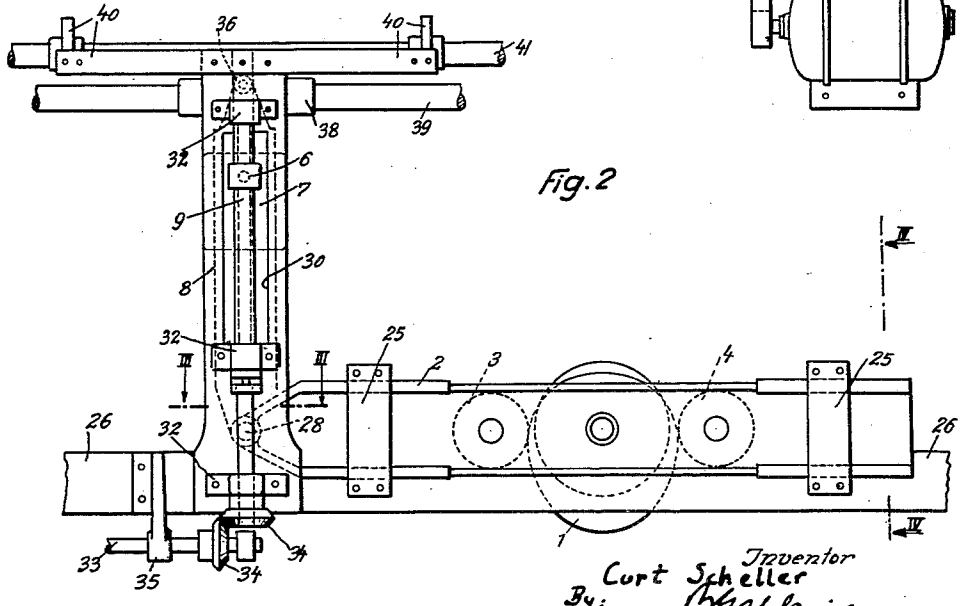


Fig. 2

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April 12, 1955 C. SCHELLER 2,705,879

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Filed Feb. 23, 1954 3 Sheets-Sheet 2

Fig. 4

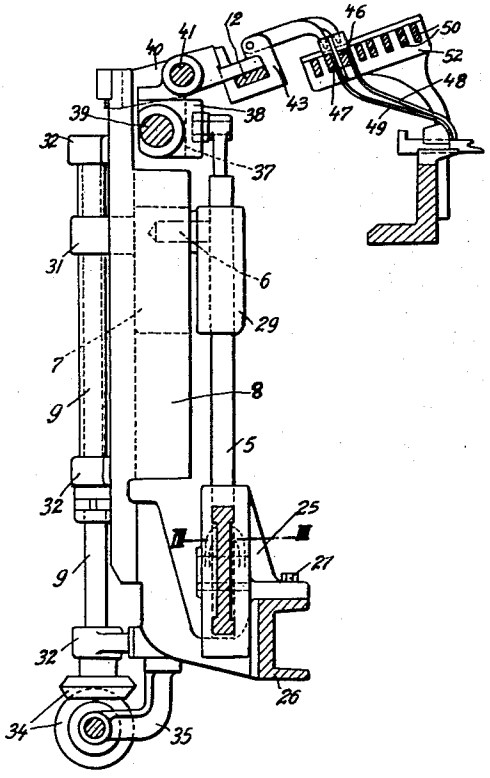
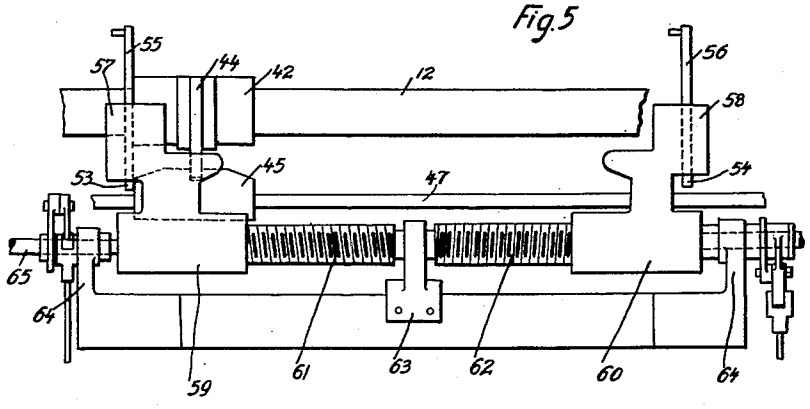


Fig. 5



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MECHANISM FOR DRIVING THE THREAD GUIDE OF A FULL-FASHIONED KNITTING MACHINE

Filed Feb. 23, 1954 3 Sheets-Sheet 3

Fig. 6

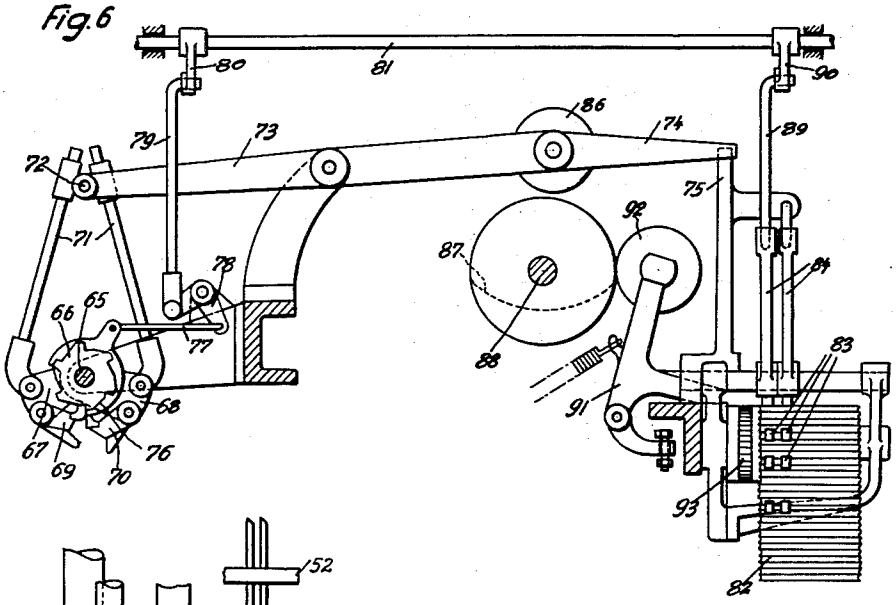
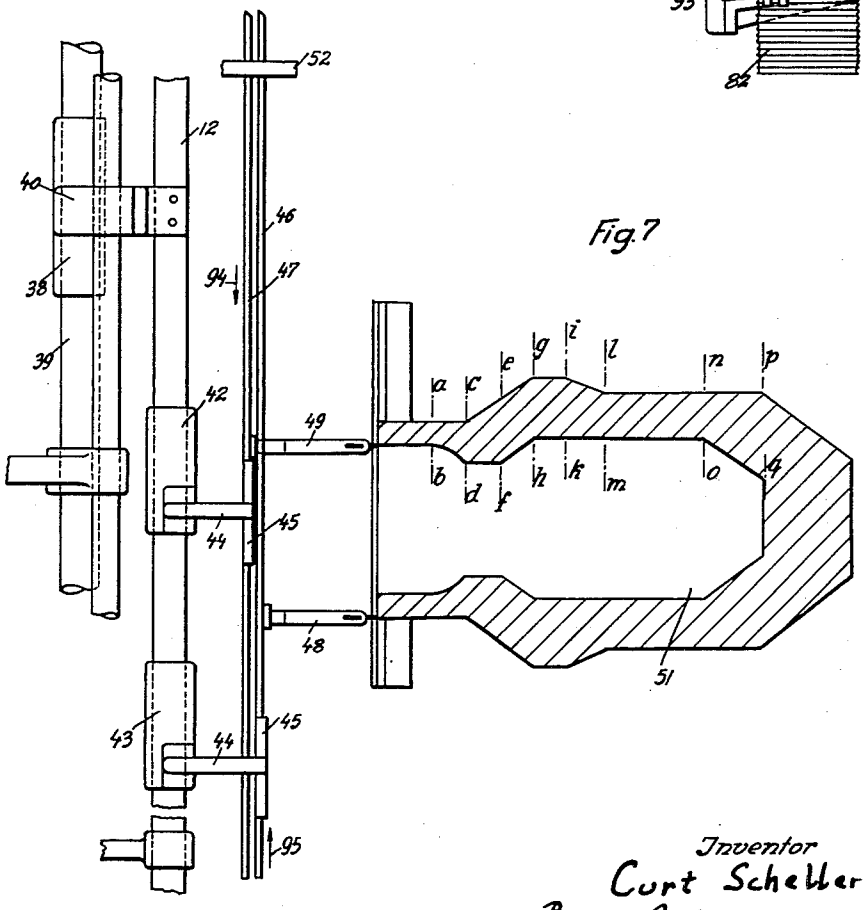


Fig. 7



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MECHANISM FOR DRIVING THE THREAD GUIDE OF A FULL-FASHIONED KNITTING MACHINE

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3 Claims. (Cl. 66—126)

The present invention relates to a mechanism for driving the thread guide of a full-fashioned knitting machine on which goods, such as stockings, are produced which may or may not have reinforcements made by an additional thread guided by a special thread guide.

It is customary to drive such reinforcing thread guide by a mechanism comprising an actuating bar extending parallel to and connected with the slur cock rod and a slide frictionally guided for sliding motion on said actuating bar and adapted to be carried along by the latter. This slide, the so-called brake box, is connected by a releasable cross connector, the so-called braking finger, with the thread guide rod. In operation of this mechanism the thread guide has the same speed as the slur cock. This involves the disadvantage that in operation the thread guide is liable to engage the stops limiting its stroke with a powerful impact liable to damage same and impart oscillations to the thread guide when the sinker advances. Therefore, the speed of operation cannot exceed comparatively low limits.

Moreover, a number of driving mechanisms for thread guides have become known which are operated independently of the means driving the slur cock, such as shown in German Patents No. 434,863 and No. 83,749.

In other driving mechanisms a speed-reducing transmission is interposed between the mechanism driving the slur cock rod and the actuating bar carrying the brake box, such speed-reducing transmission either including levers linked to the sinker driving means or including gearings interposed between the slur cock rod and the actuating bar. In this manner, the thread guide will be imparted a speed smaller than that of the slur cock and, as a result, the knitting machine may be operated at a higher speed than permissible with the first mentioned driving mechanism for the reinforcing thread guide. The relationship of the speed reduction between the slur cock rod and the actuating bar or the thread guide respectively, has reached its limit when the slur cock catches up with or overtakes the thread guide.

The ratio of the speed reduction is constant. It must be so chosen that the slur cock will not catch up or overtake the thread guide at the point of the largest width of the reinforcement to be knitted. This requirement will set an upper limit for the reduced speed of the machine.

It is an object of the present invention to eliminate all of such disadvantages and to render an operation of the machine permissible in which the slur cocks are driven at the same high speed throughout the entire width of the machine sections including the zones in which the material is reinforced to thereby considerably increase the output of the full-fashioned knitting machine.

According to the present invention, a special driving mechanism is provided for the thread guide actuating bar, such special driving mechanism being driven from the shaft of the main eccentric shaft independently of the mechanism driving the slur cock.

The invention will be described hereinafter with reference to a preferred embodiment thereof which is illustrated in the accompanying drawings, it being understood, however, that such detailed disclosure serves the purpose of illustrating rather than restricting the invention which is capable of numerous modifications within the skill of those versed in the art of knitting machines. In the drawings,

Fig. 1 is a diagrammatic elevation of the thread guide, the actuating bar and the mechanism for positively imparting a stroke of variable length to said actuating bar, the actuating bar being shown in its left end position,

Fig. 2 is a similar view of the mechanism showing the details of design and illustrating the actuating bar in its central position,

Fig. 3 is a plan view of the cam and the follower member shown in Fig. 2, the lever being shown in a section taken along the line III—III of Figs. 2 and 4,

Fig. 4 is a view partially in section taken along the line IV—IV of Fig. 2,

Fig. 5 illustrates a pair of thread guide stops and a mechanism for adjusting same,

Fig. 6 is a more or less diagrammatic representation of the means for adjusting the threaded spindle shown in Fig. 5, and

Fig. 7 is a plan view of the pair of thread guides illustrated in Fig. 4 showing a piece of material knitted on the machine and reinforced with the aid of the pair of thread guides.

A cam **1** adapted to be driven by the shaft of the main eccentric imparts a reciprocatory motion to a rod **2** on which two followers **3** and **4** are mounted for engagement with the cam, such reciprocation being in timed relation to that of the slur cock. The reciprocating rod **2** extends lengthwise of the machine frame. The two-armed lever **5** is pivotally connected to the rod **2**, such lever being fulcrumed about a pin **6**. Lever **5** is formed with longitudinal guideways between its ends constituted by a guide slot and is slidably mounted on a member rotatably carried by pin **6** on a support **7**, the latter being guided for vertical adjustment on guideways **8** fixed to the frame of the machine. Such adjustment may be effected by rotation of a threaded spindle **9** engaging a nut fixed to support **7**. The upper end of the two-armed lever **5** is connected by a pin **10** to a link **11** connected with an actuating bar **12**. This actuating bar is adapted in a known manner to carry along the bar **13** carrying the thread guide.

Since this mechanism is entirely independent of the mechanism driving the slur cock, the speed characteristic may be chosen in a suitable manner. Therefore, the cam **1** is so profiled as to accelerate the thread guide over the first half of its travel and to decelerate same over the second half of its travel whereby the speed of the thread guide will be very small, nearly zero, when the thread guide approaches the end of its travel. As a result, the thread guide bar **13** may smoothly engage the stops limiting its movement without a powerful impact. Also, the maximum speed of the thread guide may be made so high, substantially higher than that of the slur cock, that the thread guide will not be caught up with by the slur cock, but will have a sufficient advantage over the same to permit of the desired reduction of speed when approaching the terminal.

While Fig. 1 is a more or less diagrammatic representation in which the actuating bar **12** is shown in its left end position, lever **5** being inclined to be more clearly visible, the details of a satisfactory design will appear from Figs. 2, 3 and 4. In Fig. 2 the same reference numerals which are used in Fig. 1 denote similar elements.

The cam **1** is driven by a horizontal shaft **20** which extends lengthwise of the machine and serves to drive the slur cock cam. For that purpose, cam **1** is fixed to a horizontal shaft **21** extending fore and aft of the machine and journalled in a bracket **22** fixed to the machine frame and provided with a bevel gear **23** which meshes with a bevel pinion **24** fixed to shaft **20**.

The reciprocating rod **2** is slidably guided for horizontal reciprocation in brackets **25**, Figs. 2 and 4, which are fixed to a horizontal frame bar **26** by screws **27**. The lower end of the two-armed lever **5** is bifurcated, as shown in dotted lines in Fig. 4, and straddles the end of the reciprocating rod **2** being pivoted thereto by a pivot pin **28**. In this design the guideways extending lengthwise of the two-armed lever **5** are formed by the side faces thereof rather than by any slot, and the slidable member **29** embraces the lever **5** being slidable on such side faces. The pivot pin **6** is fixed to the member **29** and projects into the support **7**, same being in

form of a block that is slidably mounted in vertical guideways provided by a bracket 8, such bracket being suitably fixed to the frame of the machine frame bar 26. The bracket 8 is provided with a vertical slot 30 at its front. A projection 31 extends from block 7 through slot 30 and has a threaded bore engaging a threaded spindle 9, the latter being rotatably, but non-shiftably mounted in journals 32 fixed to bracket 8. The lower end of spindle 9 is connected to a horizontal shaft 33 by a pair of bevel gears 34 for common rotation. The shaft 33 is journalled in brackets, such as 35, fixed to the frame bar 26. By means to be described later rotation may be imparted to shaft 33 to thereby adjust support 7 within bracket 8 upwardly or downwardly. As a result, the transmisison ratio of lever 5 will be varied.

In this design, the connection between the upper end of lever 5 and the thread guide actuating bar 12 is arranged as follows:

The upper end of lever 5 carries a roller 36 which engages a vertical slot 37 provided in a block 38 slidably mounted on a horizontal bar 39. Therefore, block 38 will be reciprocated by the lever 5, the stroke performed by the block depending on the elevational adjustment of block 7. Block 38 is rigidly connected by a member 40 with the thread guide actuating bar 12, the member 40 being slidably guided on a rod 41. The member 40 may either be constructed as shown in Fig. 7 comprising substantially a transverse finger connecting bar 12 with block 38, or, alternatively, member 40 may be constructed as shown in Fig. 2 comprising a longitudinal rod and a pair of transverse fingers connected therewith. The actuating bar 12 carries brake boxes, such as 42 and 43, each brake box being provided with a transverse finger 44 adapted to releasably engage a block, such as 45, fixed to a thread guide bar 46, or 47 respectively. Bar 46 carries a reinforcing thread guide 48 and bar 47 carries a reinforcing thread guide 49. Thus, it will appear that braking box 42 actuates thread guide 49 and braking box 43 actuates thread guide 48.

As will appear from Fig. 4, there are further and additional thread guide bars, such as 50, which may be used to actuate the main or ground thread guides (not shown) employed to knit the piece 51 of material indicated in Fig. 7, whereas the thread guides 48 and 49 serve to reinforce such material over the areas cross-hatched in Fig. 7 by placing a reinforcing thread in the needles in addition to the ground thread placed therein by the ground thread guides. The various thread guide bars 46, 47, 50 extend lengthwise of the machine in parallel relationship and are slidably guided in brackets 52 suitably fixed to the machine frame.

Each of the thread guide bars, such as 46 and 47, cooperates with a pair of stops to limit its reciprocatory motion. More particularly, such motion is so limited that the thread guides 48 and 49 will travel to and fro over a distance comrresponding to the width of the cross-hatched areas shown in Fig. 7. Such a pair of adjustable stops 53 and 54 limiting the length of travel of the thread guides is shown in Fig. 5. Each of the stops 53 and 54 is formed by the lower end of a slidable member 55, or 56 respectively, which is mounted in vertical guideways of a bracket 57, or 58 respectively. The bracket is formed integral with an internally threaded sleeve 59, or 60 respectively, and is suitably guided in the frame of the machine for lengthwise displacement. The reciprocating actuating bar 12 carries along brake box 42 and the thread guide bar 47 connected thereto by finger 44 until the block 45 fixed to thread guide bar 47 abuts either stop 53 or stop 54. When that happens the thread guide bar 47 and the brake box 42 are stopped and the actuating bar 12 will slide through the brake box.

A spindle 65 having threads 61 and 62 of opposite hand is journalled in suitable brackets 63 and 64 fixed to the frame of the machine and threadingly engages the sleeves 59 and 60. Therefore, rotation of spindle 65 in one direction or the other will adjust stops 53 and 54 towards each other or away from one another. The spindle 65 is connected with shaft 33 (Fig. 2) for common rotation. Therefore, shaft 33 constitutes means to simultaneously adjust the stops 53 and 54 and to vary the transmission ratio of lever 5 and thereby the length of travel of the actuating bar 12.

In Fig. 6 I have shown a well known mechanism that may be used for the purpose of actuating the spindle 65. For that purpose, a pair of ratchet wheels having teeth facing in opposite directions is fixed to spindle 65, one of said ratchet wheels only designated by 66 being shown in Fig. 6. Adjacent to such ratchet wheels, members 67 and 68 each carrying an actuating dog 69, or 70 respectively, are pivotally mounted on spindle 65 and connected by bars 71 and by a pin 72 to one arm 73 of a two-armed lever, the second arm 74 of which normally rests upon a supporting arm 75. Moreover, a shutter member 76 is rotatably mounted on spindle 65 for alternative engagement with one or the other of the two dogs 69 and 70 and is connected by a rod 77, a bell crank 78 and a rod 79 to an arm 80 of a shaft 81. By rotation of this shaft in one or the other direction the shutter member 76 may be caused to disengage one or the other of the two dogs 69 and 70 from the associated ratchet wheel. An endless chain 82 which is stepwise actuated by the driving mechanism of the knitting machine carries cams, such as 83, which may selectively act on levers 84 and 85. Lever 84 when actuated will rock supporting arm 75 thereby disengaging same from lever arm 74, whereupon the latter impelled by a spring not shown will cause a follower roller 86 mounted on arm 74 to engage a cam 87 mounted on a continuously rotating shaft 88. Upon such engagement of follower 86 with cam 87 the lever 73, 74 will be oscillated to thereby oscillate the dogs 69 and 70. The other lever 84 when actuated by a cam 83 of chain 82 will be operative by a connecting rod 89 and a crank 90 of shaft 81 to rock the latter to thereby engage dog 70 disengaging dog 69. As a result, lever 84 will determine the direction of rotation of spindle 65, while lever 84 will effectuate such rotation. The stepwise actuation of chain 82 is effected by a spring-actuated lever 91 having a follower 92 engaging cam 87 and carrying a suitable ratchet pawl not shown adapted to engage a ratchet 93 fixed to a sprocket drum over which chain 82 extends.

From the foregoing it will appear that the mechanism shown in Fig. 6 constitutes a pattern mechanism which may be so set up by insertion of cams or pegs 83 in chain 82 as to effect such an adjustment of stops 53 and 54 as required to knit the reinforcement according to the pattern shown in Fig. 7.

From this pattern it will appear that the left hand stop controlling thread guide bar 47 and the right hand stop controlling thread guide bar 46 must be simultaneously displaced in opposite directions which is done by the threads 61 and 62 of opposite hand. Therefore, stop 53 controls thread guide bar 47, while stop 54 controls thread guide bar 46. An additional pair of stops operable by a mechanism similar to that shown in Fig. 5 is used to limit the travel of bar 47 in the direction of arrow 94 and to limit the travel of bar 46 in the direction of arrow 95.

From the foregoing disclosure it will appear that a variation of the transmission ratio of lever 5 permits of retaining this effect for reinforcements of larger or smaller widths as occur for instance in the knitting of stockings as shown in Fig. 7. The ratio is changed by raising or lowering the fulcrum 6 by operation of spindle 9. When the slide 7 is lowered by rotation of spindle 9, the stroke imparted to the actuating bar 12 and to the thread guides is increased, whereas a lifting of slide 7 results in reduction of such stroke.

Spindle 9 may be rotated by a mechanism which is controlled either by the main controlling chain 82 or by a special controlling chain, controlling disk or the like, running synchronously with the main chain 82 either throughout the cycle of operation or at least during the period in which the reinforcements are knitted. Alternatively, the spindle 9 may be rotated manually or indirectly by the mechanism controlling the thread guide stops through the intermediary of a suitable train of motion-transmitting elements.

Fig. 7 illustrates a reinforced hosiery article, more particularly a stocking, in which the cross-hatched portion is reinforced. It will appear that the limits of the reinforced area are not simple straight lines, but are lines of varying directions whereby the reinforcement has neither constant width nor a symmetrical shape. Thus, the reinforcement has an increasing width from line *a—b* to line *c—d*, said width increasing towards the center line of the stocking. From *c—d* up to *e—f* the width will increase to the out-

side. It will remain constant up to the line *g—h*. The reinforced area has vertical limits and will have a constant width up to *i—k*, whereupon the width decreases at the outside up to *l—m*, then remains constant up to *n—o*, and finally increases towards the center of the stocking up to *p—q*.

As is well known, the reinforcing thread guide has independent stop controlling mechanisms for the two sides. Therefore, the means shown in Fig. 5 are provided which permit of adjusting fulcrum **6**, Fig. 1, in synchronism with each of such controlling mechanisms. Where such control is effected by a special control mechanism, governed either by the main control chain **82** or by another control chain or control disk, the function of the control mechanism is comparatively simple in that suitable cams or pegs **83** or the like are inserted as desired into the control chain **82** or control disk.

Under certain circumstances it may be of advantage to control fulcrum **6** independently of spindle **9** by rotating the spindle nut by means of machine elements not shown. In this event, the nut must be rotatably mounted on slide **7** being secured against relative axial displacement thereon.

While I have described a preferred embodiment of my invention, I wish it to be clearly understood that the same is in no way limited to the details thereof, but is capable of numerous modifications within the scope of the appended claims.

What I claim is:

1. In a full-fashioned knitting machine, the combination comprising a thread guide actuating bar, friction means mounted thereon, a thread guide connected to said friction means, a mechanism imparting a variable stroke to said bar composed of a rotary cam, of a reciprocatory member actuated by said cam, of a motion-transmitting lever connecting said member to said bar, and of means for varying the transmission ratio of said lever, adjustable stops limiting the length of travel of said thread guide, and an adjusting mechanism for adjustment of said stops, said adjusting mechanism being cooperatively connected with said means to simultaneously adjust said stops and vary the length of travel of said bar.

2. In a full-fashioned knitting machine, the combination claimed in claim 1 in which said lever is a two-armed lever formed with longitudinal guideways between its ends, one arm of said lever being connected with said cam-actuated reciprocatory member, the other arm of said lever being connected to said thread guide actuating bar, said combination further comprising a slide mounted on said guideways, a support, and means for pivotally mounting said slide on said support, said means for varying the transmission ratio of said lever being operative to cause relative displacement of said slide and said lever.

3. In a full-fashioned knitting machine, the combination comprising a frame, a reciprocatory thread guide actuating bar slidably mounted in said frame, a thread guide frictionally connected to said bar, a driving shaft journalled in said frame, a cam mounted on said shaft, a reciprocatory follower member actuated by said cam, a two-armed motion-transmitting lever connecting said follower member to said actuating bar and formed with longitudinal guideways between its ends, a support, a slide guided on said guideways and pivotally mounted on said support, guideways being provided in said frame extending substantially lengthwise of said lever and slidably accommodating said support, a threaded spindle non-shiftably journalled in said frame parallel to said last-mentioned guideways and threadingly engaging said support, and means for rotating said spindle to thereby vary the transmission ratio of said lever.

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