

Sept. 10, 1935.

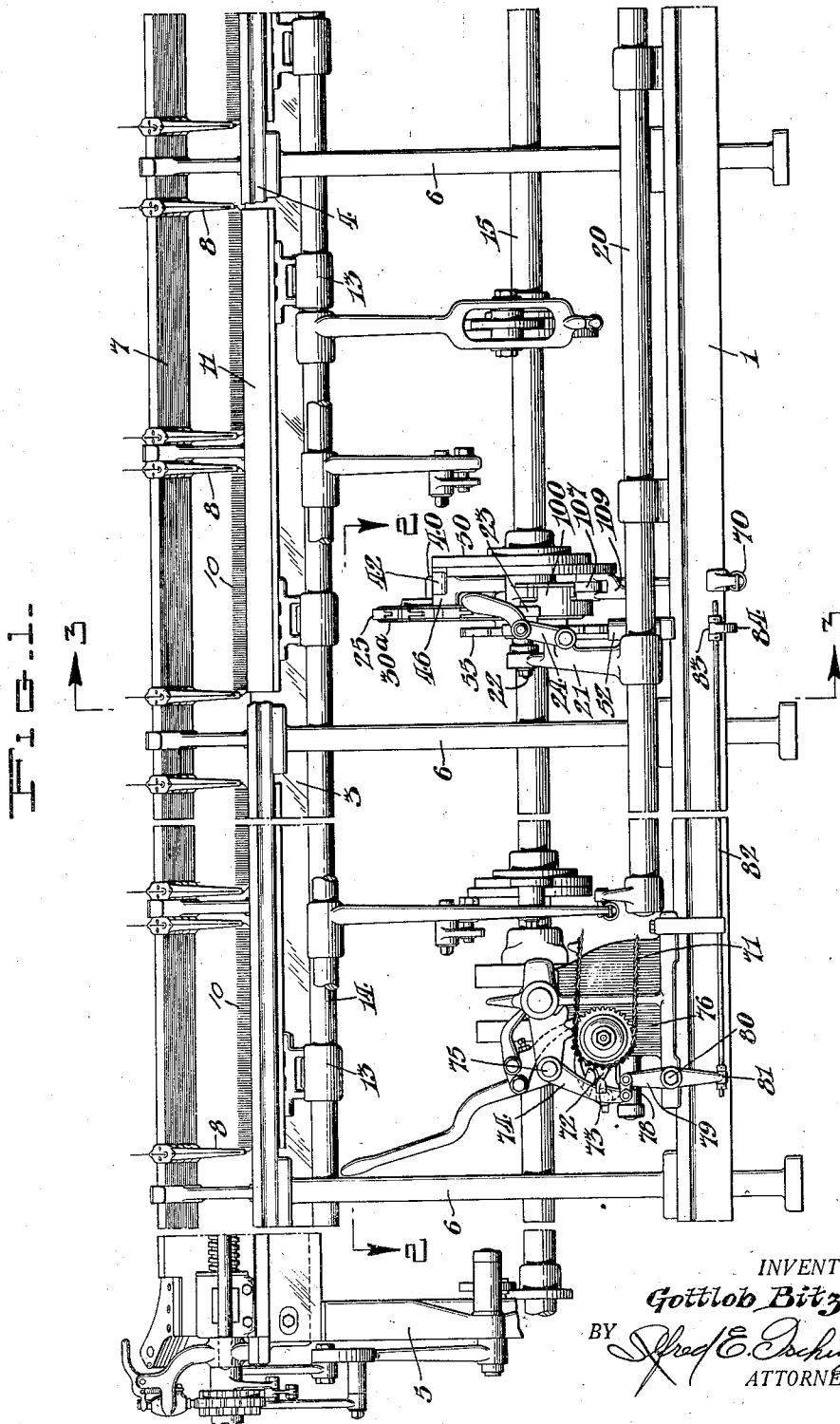
G. BITZER

2,014,100

STITCH REGULATING MECHANISM FOR KNITTING MACHINES

Filed Aug. 16, 1934

10 Sheets-Sheet 1



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STITCH REGULATING MECHANISM FOR KNITTING MACHINES

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10 Sheets-Sheet 2

FIG. 2.

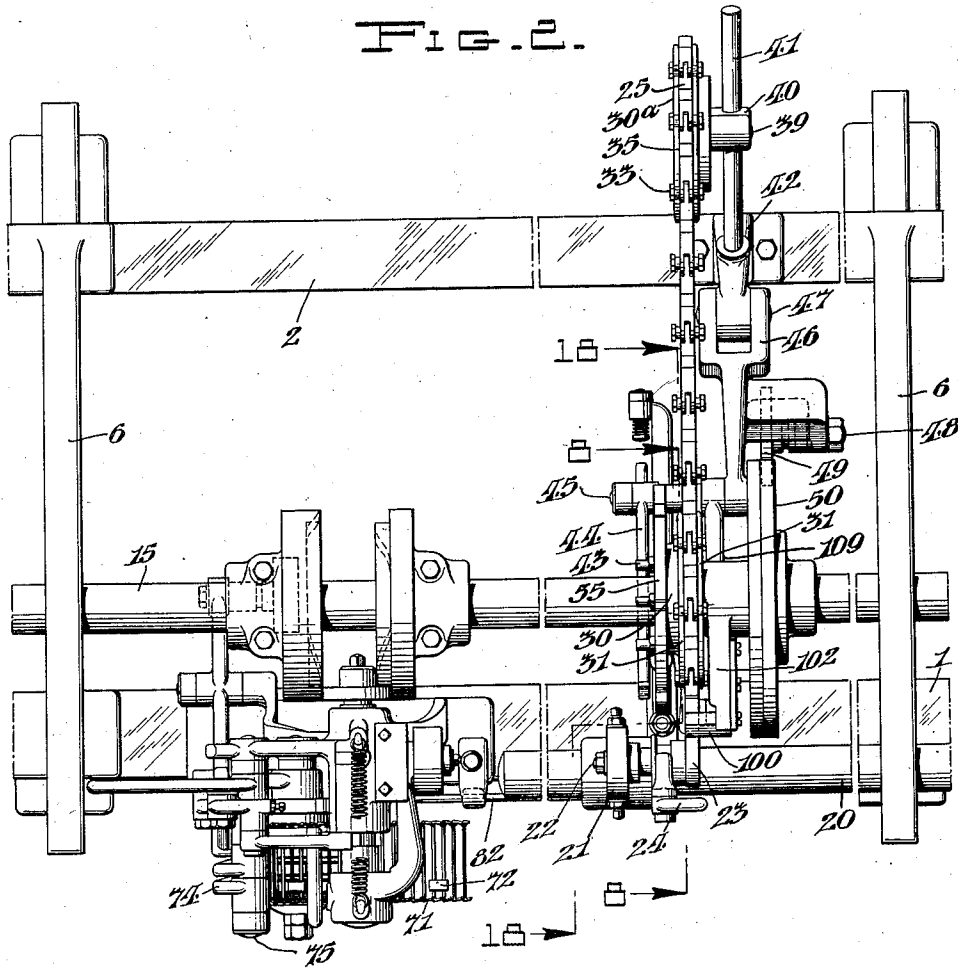


FIG. 3.

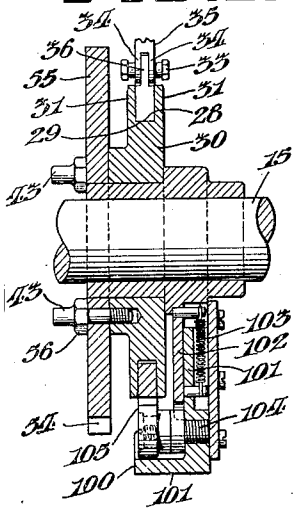


FIG. 4.

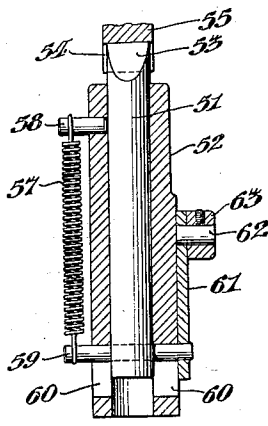
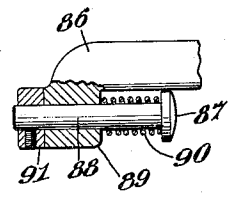


FIG. 5.



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FIG. 3.

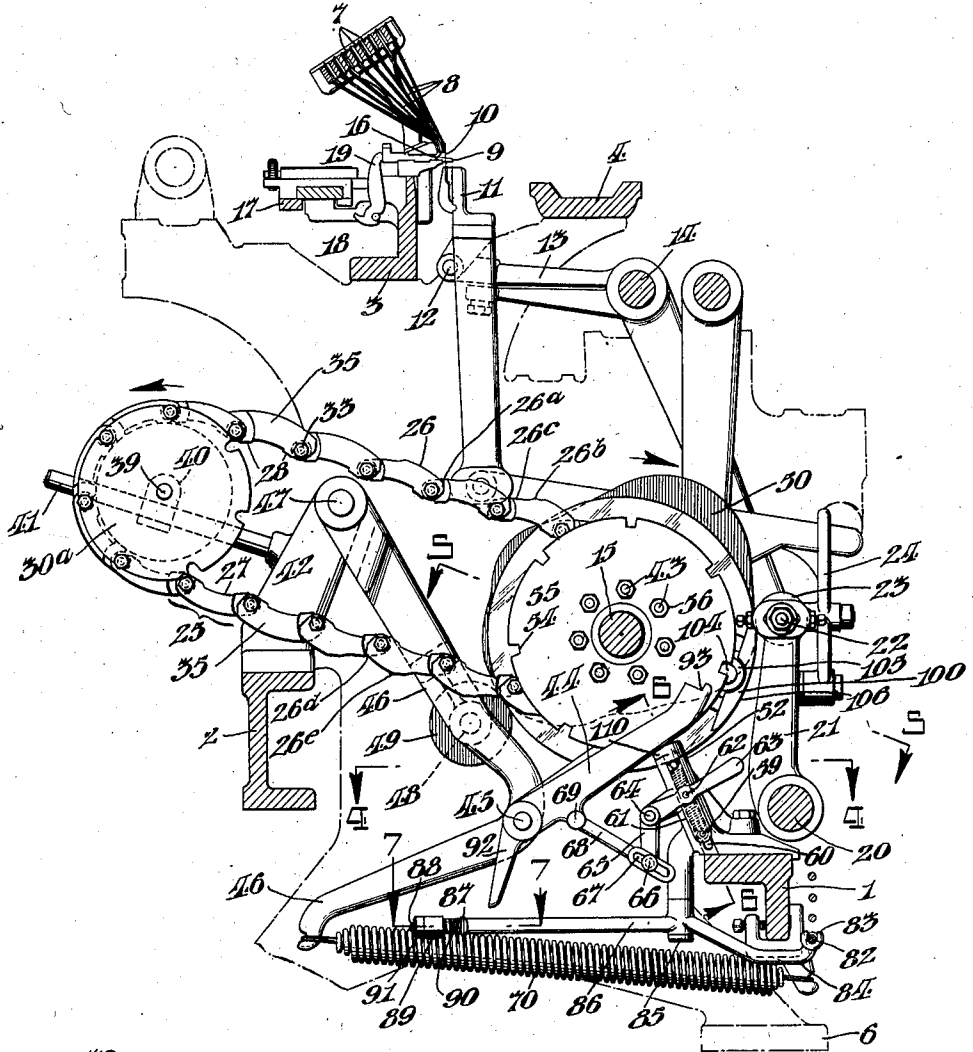
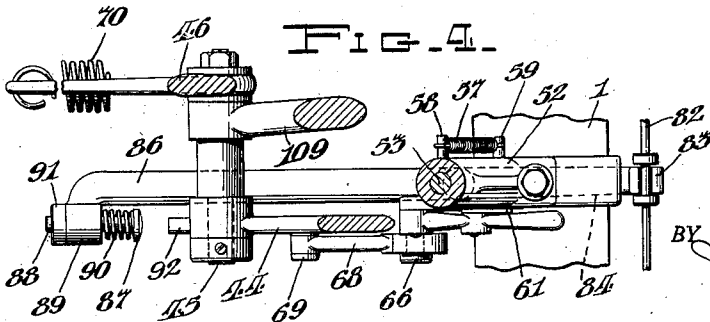


FIG. 4.



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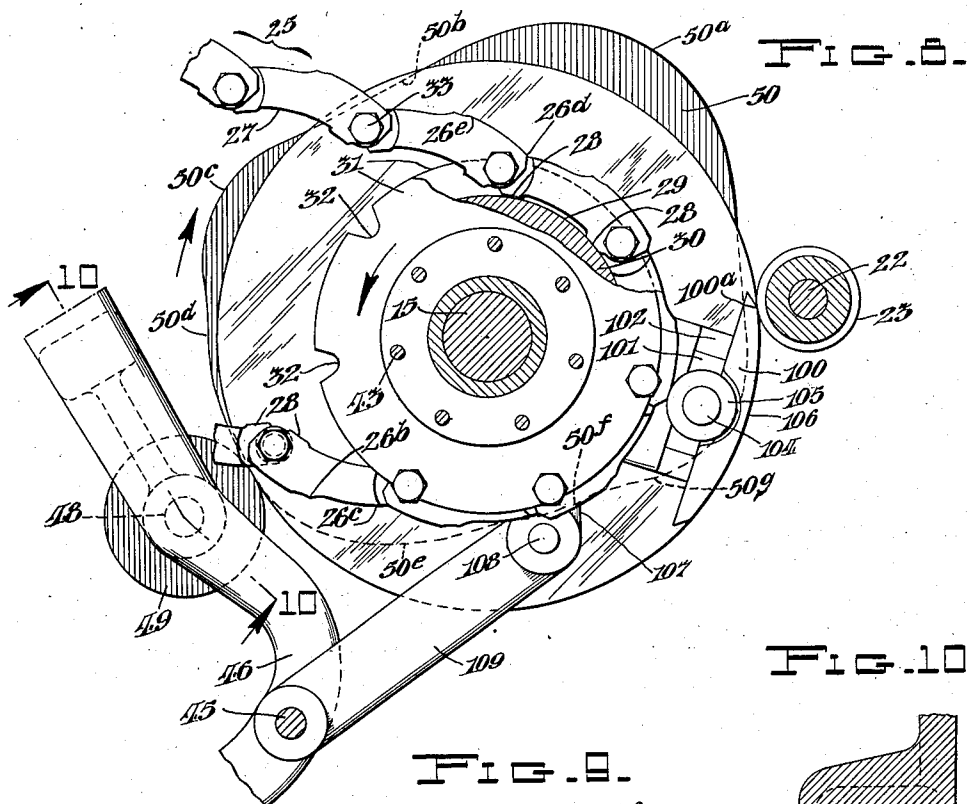


FIG. 8.

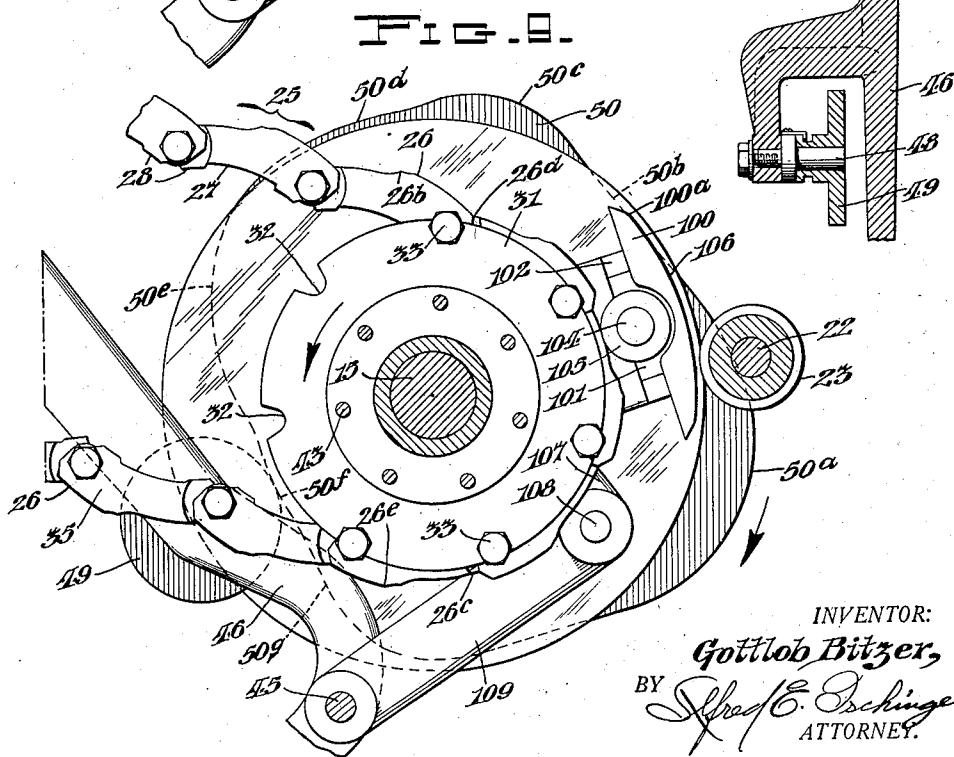


FIG. 9.

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STITCH REGULATING MECHANISM FOR KNITTING MACHINES

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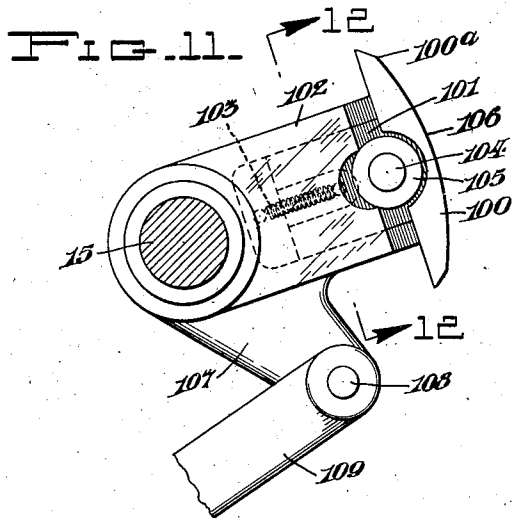


FIG. 12.

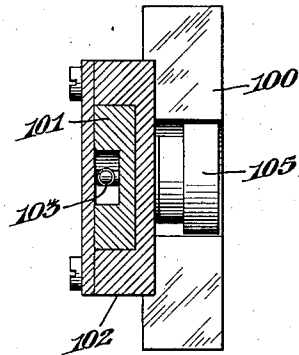
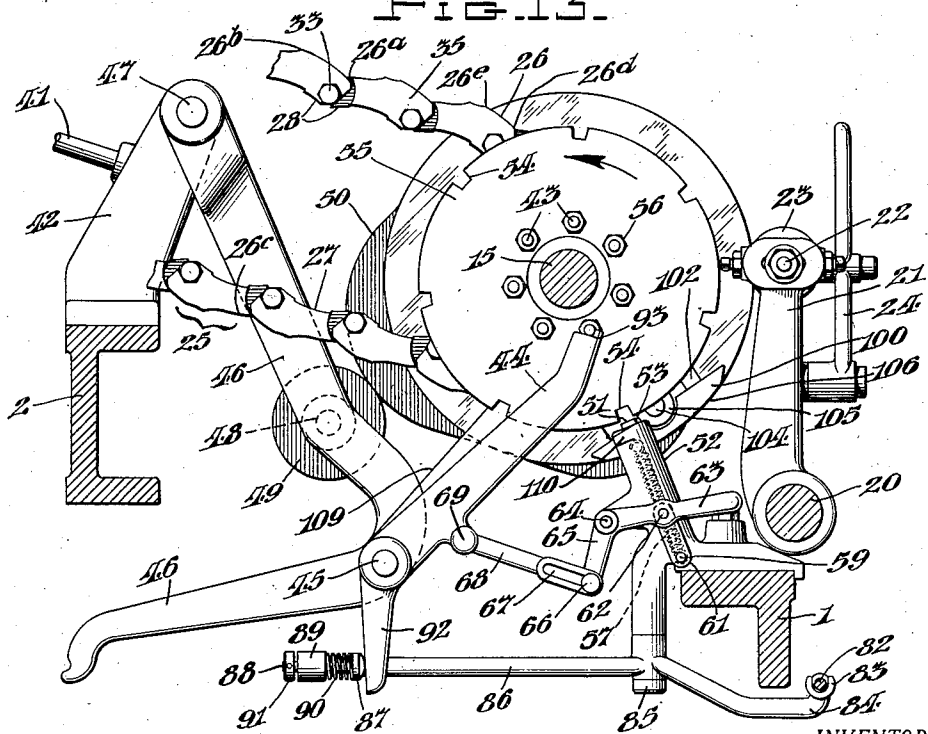


FIG. 13.



INVENTOR:

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BY Alfred E. Ischinger,
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Sept. 10, 1935.

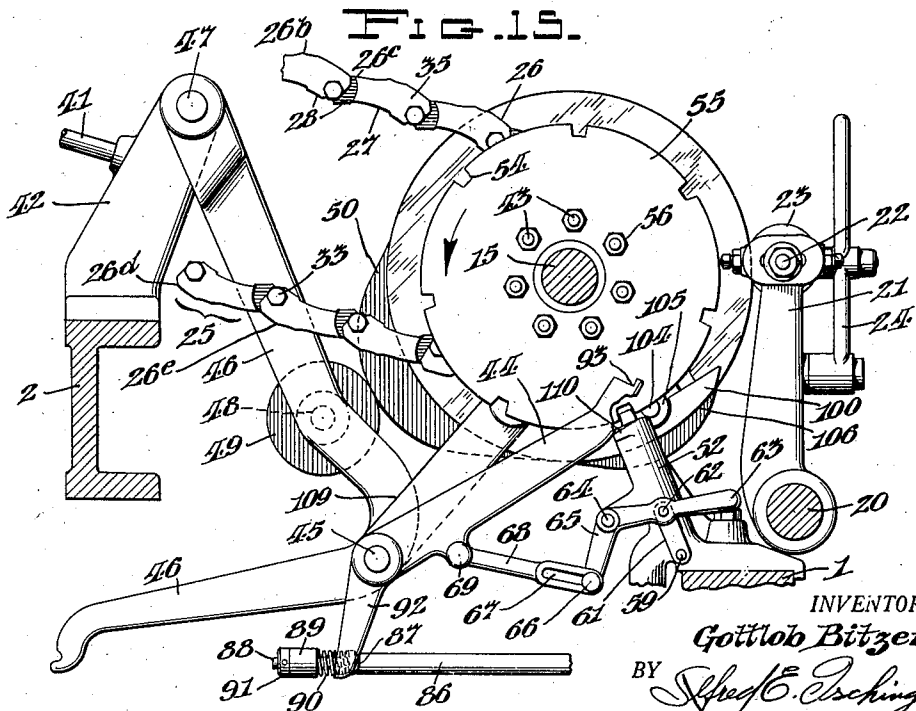
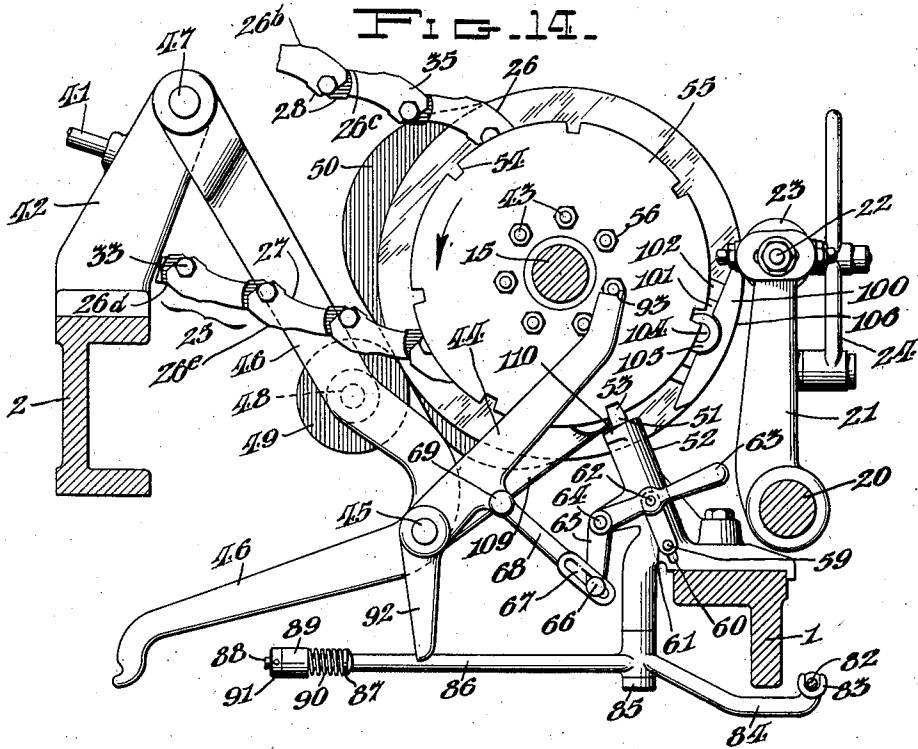
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2,014,100

STITCH REGULATING MECHANISM FOR KNITTING MACHINES

Filed Aug. 16, 1934

10 Sheets-Sheet 6



INVENTOR:
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2,014,100

STITCH REGULATING MECHANISM FOR KNITTING MACHINES

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10 Sheets-Sheet 7

FIG. 16.

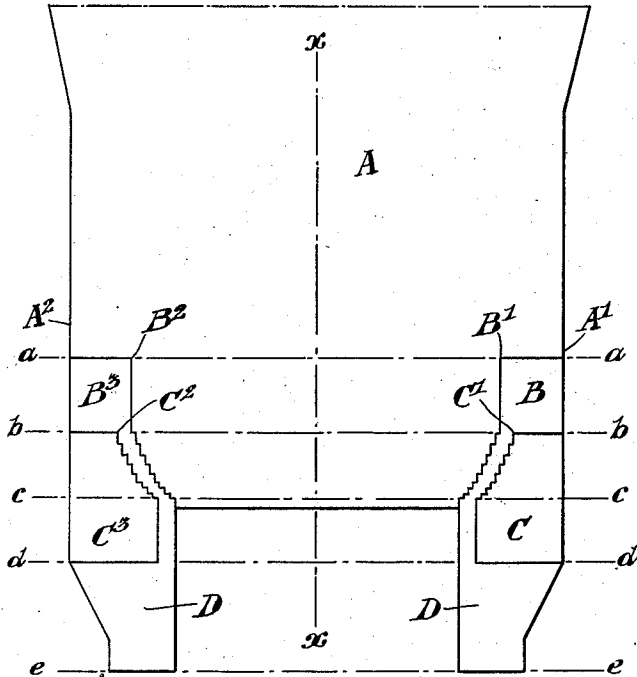


FIG. 17a

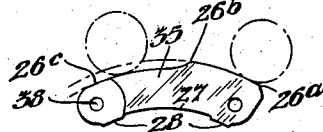


FIG. 17b



FIG. 17c



FIG. 17d

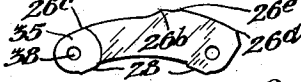


FIG. 17e



FIG. 17f



FIG. 17g



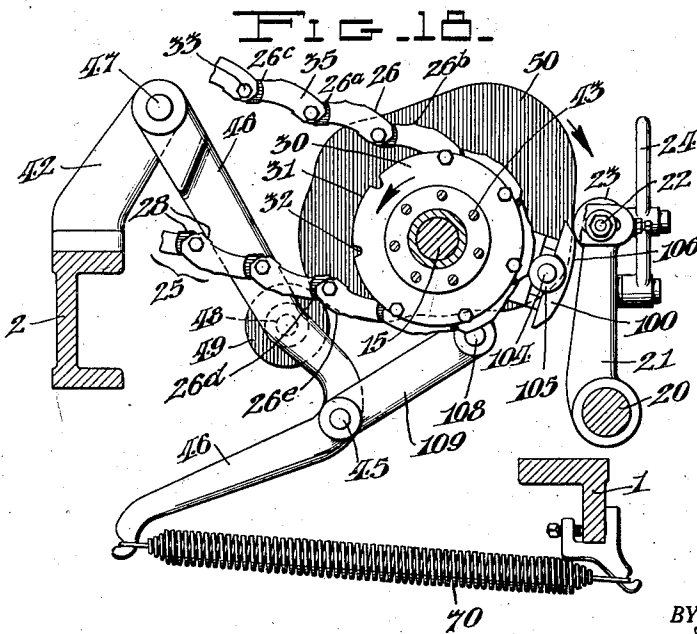
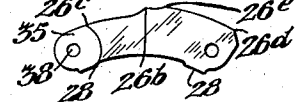
FIG. 17h



FIG. 17i



FIG. 17j



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Fig. 19.

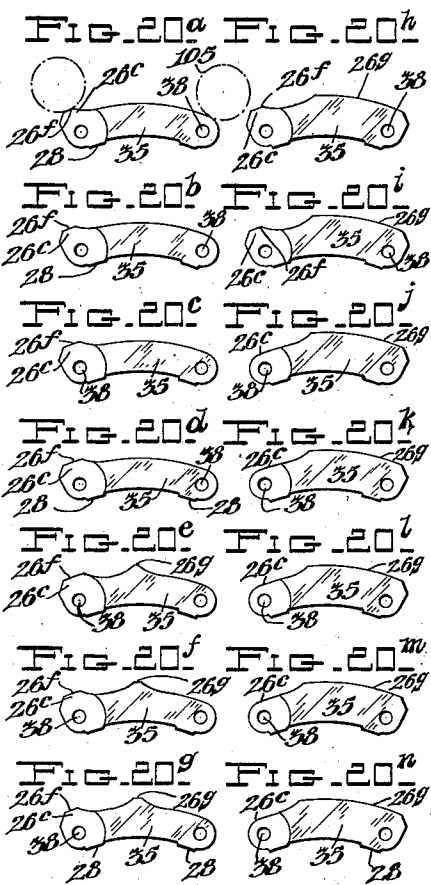
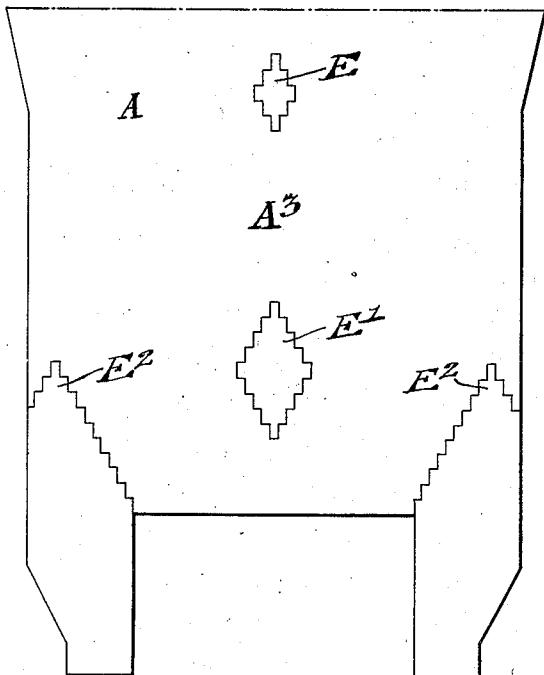


Fig. 22.

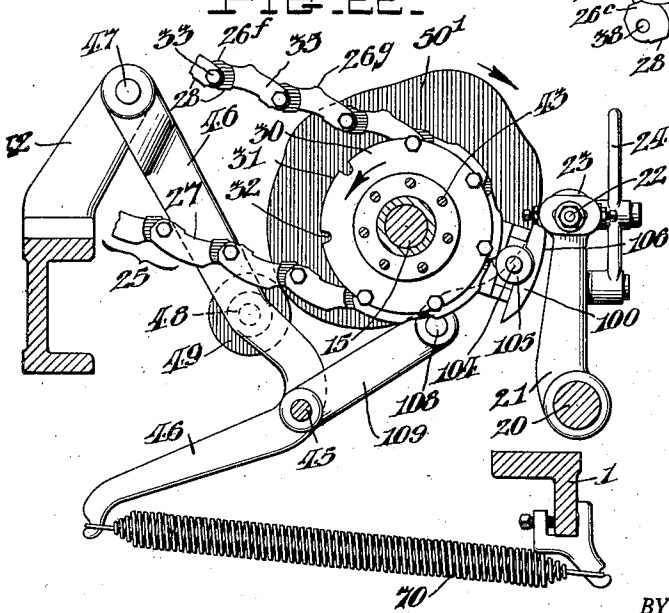
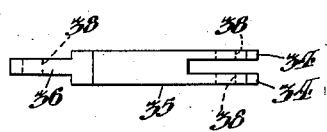


Fig. 21.



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STITCH REGULATING MECHANISM FOR KNITTING MACHINES

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FIG. 23.

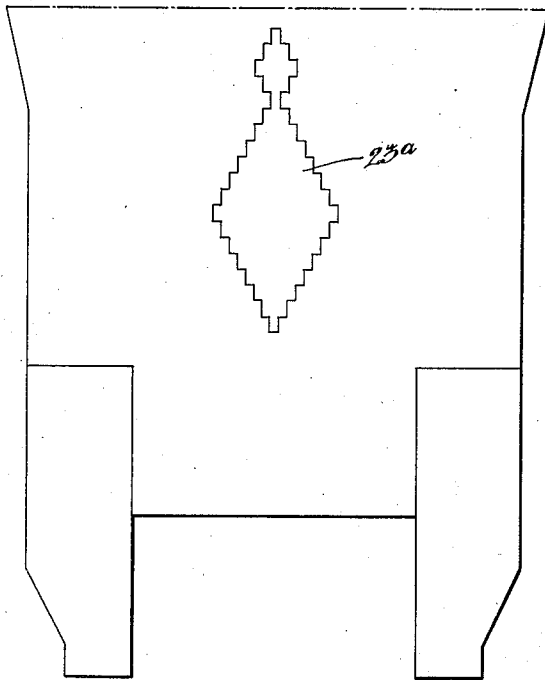


FIG. 24^a

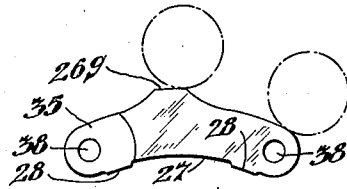


FIG. 24^b

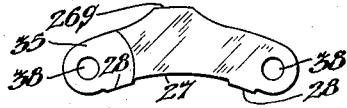


FIG. 24^c

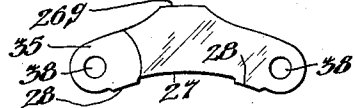


FIG. 24^d

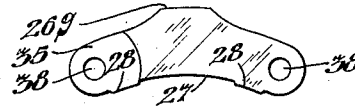


FIG. 24^e

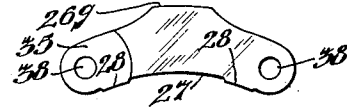


FIG. 24^f



FIG. 24^g

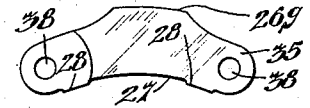
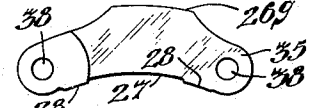


FIG. 24^h

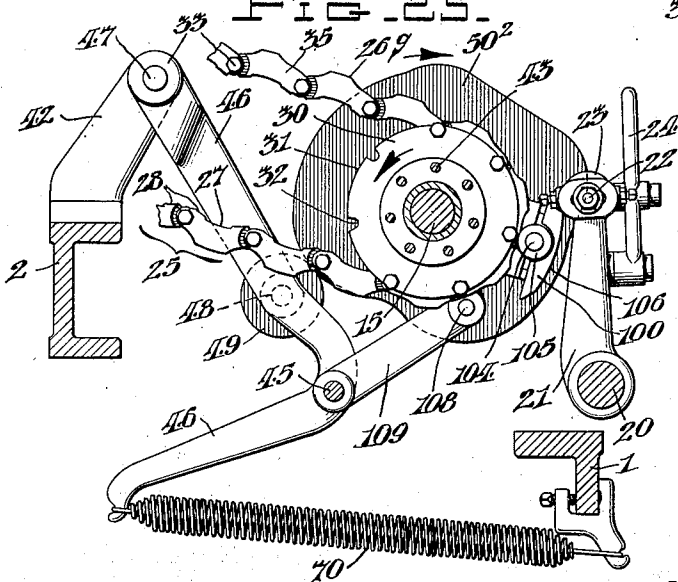


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FIG. 25.



Sept. 10, 1935.

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2,014,100

STITCH REGULATING MECHANISM FOR KNITTING MACHINES

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FIG. 26.

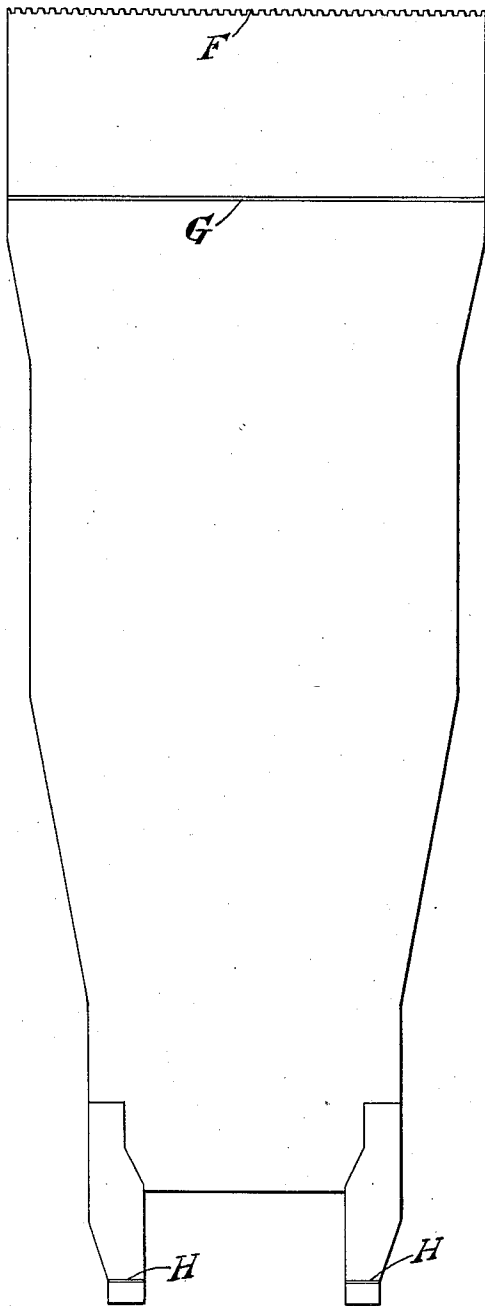


FIG. 27.

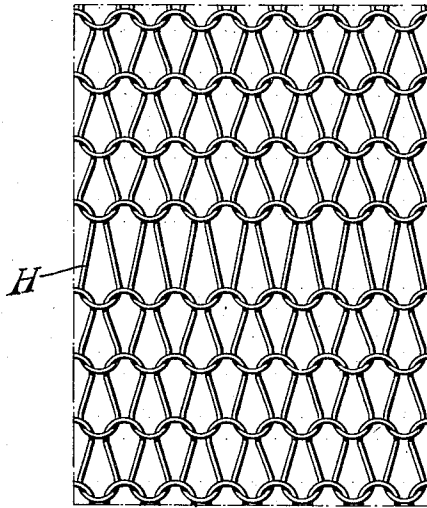


FIG. 28.

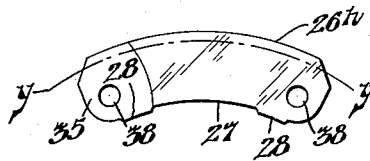


FIG. 29.

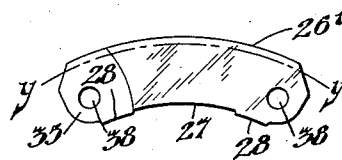
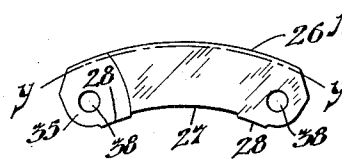


FIG. 30.



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UNITED STATES PATENT OFFICE

2,014,100

STITCH REGULATING MECHANISM FOR KNITTING MACHINES

Gottlob Bitzer, West Reading, Pa., assignor to
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corporation of Pennsylvania

Application August 16, 1934, Serial No. 740,074

30 Claims. (Cl. 66—82)

This invention relates to stitch-regulating mechanism for flat knitting machines such, for example, as those employed in the manufacture of full fashioned hosiery or in any instance where needles are bodily movable to and from a cooperating bank of successively operable sinkers for regulating the length of the stitches produced by the needles.

One object of the invention is to provide a novel stitch regulating mechanism that is flexible and universal in operation, and which permits an infinite variety of pattern effects to be obtained in any part of the stocking fabric.

Another object of the invention is to provide an efficient mechanism for rocking the needles to various positions with respect to the projected position of the sinkers and to maintain such relationship between the needles and sinkers throughout the whole or any part or parts of any single sinker-traversing movement of the slur cock, for lengthening the stitches of a full course or any part or parts of a single course or series of successively knit courses, for producing, for example, a single loose course or plurality of immediately succeeding loose courses at the turning line of a double welt full fashioned stocking, or in forming a picot edge at the turning line of the welt, or in providing topping lines in the heel tabs of a full fashioned leg blank, or for lengthening single stitches or groups of stitches in a single course or succession of courses where a design is being formed by the introduction of an additional thread with the main thread, or lengthening predetermined stitches in the high splice heel to provide for the introduction with the normal main and splicing threads of a third thread adapted to provide additional reinforcement at localized points or areas in the heel of the stocking.

Another object of the invention is the provision of simple and efficient means for controlling the selection of the stitches to be lengthened and the positioning of the lengthened stitches with respect to the selvage edges of the fabric, whereby the outline of the area or areas which include the lengthened stitches will coincide with the marginal edges of design areas produced by the additional thread or threads above noted, wherein the marginal edges of the areas including the additional threads are governed by the thread carrier controlling mechanism of the machine or by a separate attachment applied to the machine. More specifically, this feature of the invention involves the provision of a stitch-regulating chain or drum or a combination of the two composed of or equipped with readily detachable and inter-

changeable links, lugs, lobes, or other variable protuberances or surfaces of varying height or radii arranged and adapted to rock the normal stitch-regulating shaft of the machine to effect selective lengthening of the stitches.

Another object of the invention resides in the provision of novel means whereby the lengthening of stitches may be produced symmetrically at the center of the stocking blank and/or at corresponding points at each side of the longitudinal center line of the blank, and in any desired position.

A further object is to provide a device of the character described which is relatively simple in construction, and which may be made as an attachment readily applicable to straight knitting machines of conventional type, and which makes possible the production on such machines of a variety of products heretofore not producible thereon.

With these and other objects in view, which will become apparent from the following detailed description of the illustrative embodiments of the invention shown in the accompanying drawings, my invention resides in the novel elements of construction, mechanisms and combination of parts in cooperative relationship, as hereinafter more particularly set forth in the claims.

In the drawings:

Figure 1 is a front elevation of sufficient of a full fashioned hosiery knitting machine to illustrate the principles of the invention as applied thereto;

Fig. 2 is a sectional plan view taken on the line 2—2, Fig. 1;

Fig. 3 is a transverse sectional elevation taken on the line 3—3, Fig. 1;

Fig. 4 is a sectional plan view taken on the line 4—4, Fig. 3;

Fig. 5 is a sectional plan view taken on the line 5—5, Fig. 3;

Fig. 6 is a sectional elevation taken on the line 6—6, Fig. 3;

Fig. 7 is a sectional plan view taken on the line 7—7, Fig. 3;

Fig. 8 is an enlarged fragmentary sectional elevation taken on the line 8—8, Fig. 2;

Fig. 9 is a view similar to Fig. 8 showing the mechanism in a different position;

Fig. 10 is a detail sectional elevation taken on the line 10—10, Fig. 8;

Fig. 11 is a detail view of the intermediate rocking mechanism;

Fig. 12 is a sectional view taken on the line 12—12, Fig. 11;

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Figs. 13, 14 and 15 are views similar to Fig. 3, illustrating the operation of the mechanism by which the selector chain is intermittently actuated;

5 Fig. 16 diagrammatically illustrates the lower portion of a stocking leg blank showing the normal high splice heel reinforce with an additionally reinforced area included within the margins of each of the high splice heel areas and
10 appended heel tabs;

Figs. 17a to 17j inclusive illustrate, in detail, those links of the selector chain by which the contours of the high splice heel and supplementary reinforcements, illustrated in Fig. 16, are
15 governed;

Fig. 18 is a view similar to Fig. 3, showing the assembled chain including the links of Figs. 17a to 17j and the particular cam employed for inter-
mittently advancing the selector chain;

20 Fig. 19 is a view similar to Fig. 16, but showing design areas formed in the stocking blank intermediate the longitudinal marginal edges thereof;

25 Figs. 20a to 20n inclusive illustrate, in detail, the links of the selector chain by which the contours of the reinforced areas in Fig. 19 are controlled;

Fig. 21 is a plan view of one of the selector chain links;

30 Fig. 22 is a view similar to Fig. 18, showing the contour of the chain-operating cam peculiar to the formation of the reinforcements illustrated in Fig. 19;

35 Fig. 23 is a view similar to Figs. 16 and 19 but illustrating a design in each side portion of the stocking blank with the high splice heel reinforcements formed in the regular manner by the normal mechanism of the machine provided for such purpose;

40 Figs. 24a to 24h inclusive illustrate, in detail, the links of the selector chain employed in the formation of the design shown in Fig. 23;

Fig. 25 is a view similar to Figs. 18 to 22 showing the cam peculiar to the chain comprising the
45 links illustrating Figs. 24a to 24h inclusive;

Fig. 26 diagrammatically illustrates a full length stocking blank including a picot edge at the turning line of the welt, the juncture line of the double welt with the body of the stocking, and topping lines in the heel tabs, composed of
50 lengthened stitches;

Fig. 27 is an enlarged stitch diagram showing the lengthened stitches of and adjacent a portion of the topping line in one of the heel tabs; and

55 Figs. 28, 29 and 30 illustrate the links in the selector chain by which such full course stitch lengthening is effected.

The figures disclose various parts of a Reading full fashioned knitting machine embodying the invention, in which for clearness, only the parts necessary to an understanding of the invention are illustrated; the other parts, and the operation thereof, being well known in the art as shown and described in the "Reading" Full Fashioned
60 Knitting Machine Catalogue, copyright 1929, and published by the Textile Machine Works, Reading, Pennsylvania.

In Figs. 1, 2 and 3, the machine to which the mechanism of the present invention is applied for the purpose of illustration is illustrated as
70 being of the type employed for producing full fashioned hosiery, which comprises a front beam 1, a back beam 2, a center bed 3 and a front bed 4, extending parallel to each other longitudinally
75 of the machine and rigidly secured to transverse

end frames 5 and center frames 6, 6. Machines of this type include a plurality of parallel longitudinally slidable thread carrier bars 7 which respectively carry thread-controlling fingers 8 for laying individual threads between the sinkers 9
5 and needles 10 of the machine.

The needles are rigidly mounted in a needle bar 11 which is pivotally mounted at 12 in relatively spaced arms 13. The arms 13 are secured to a longitudinally extending needle bar shaft 14
10 which is adapted to be rocked for raising and lowering the needles by the usual cam and lever mechanism from the main cam shaft 15 of the machine.

The position of the needles 10 relative to the 15 throats or shoulders 16 of the sinkers, when the sinkers are in their most forwardly projected position, determines the length of the stitches and is controlled or governed by rocking the needles 10 about the pivots 12, toward the sinkers for
20 lengthening the stitches and away from the sinkers for shortening the stitches.

The position of the needles relative to the foremost position of the sinker shoulders 16 is normally controlled by what is termed the stitch-
25 regulating shaft of the machine, which in the present instance is illustrated at 20 in Fig. 3.

In the present instance, the mechanical connections between the stitch-regulating shaft 20 and the needle bar 11 are of the usual construction, such for example as shown in the patent to C. F. Meyer, No. 1,694,888, dated December 11, 1928, said patent showing continuously rotating cam mechanism whereby the stitch-regulating
30 shaft 20 is normally rocked toward the sinkers for lengthening the stitches in, and during, the formation of the high splice heel reinforce and heel tabs.

The sinkers 9 in the present instance are projected by the usual jacks 19 which are operated
40 by a slur cock 18 arranged to make a complete sinker-traversing movement for each course of stitches produced. The slur cock is, as usual, operated by a bar 17 which is connected to the Coulier motion of the machine in a usual man-
45 ner.

In the present instance, selective rocking of the stitch-regulating shaft 20 is accomplished by the following mechanism:

Secured to the stitch-regulating shaft 20 (see
50 Fig. 3) is a shaft-actuating or stitch-regulating lever 21. The stitch-regulating lever 21 is provided with a laterally extending stud 22 on which is rotatably mounted a roller 23. The roller 23 is adapted to be moved longitudinally of the stud
55 22 into and out of the plane of a selector chain 25, by means of a control lever 24.

The selector chain 25 includes a plurality of readily detachable interchangeable links 35 each having an outer variable cam surface or convex
60 edge 26 shaped in accordance with the selections that the respective links are to make of single stitches or groups of stitches which are to be lengthened in successive individual courses re-
65 spectively.

The inner surfaces 27 of the links are concave and uniform, each link having a pair of relatively spaced lugs or feet 28 arranged to rest on the peripheral surface 29 of a drum 30 which is loose-
70 ly mounted on the cam shaft 15 of the machine.

The drum 30 is provided with side flanges 31, 31 between which the links 35 are disposed and which are notched at 32 to receive laterally extending ends of the pintles 33 by which the links
75

35 of the chain 25 are pivotally connected to each other.

As illustrated in Fig. 21, each link 35 is provided with a tongue 36 of reduced width at one of its ends which projects into a slot formed by and between a pair of parallel ears 34, 34 projecting from the opposite end of the adjacent link, the ears and tongues of the interconnected links being bored at 38, 38 respectively for the reception of the pintles 33.

The length of the chain 25 is determined by the number of courses in which different single or groups of stitches are to be lengthened and the order in which such variations occur.

The outer end of the chain 25 is carried by a drum 30a. The drum 30a is rotatably mounted on a stud 39 which is carried by a bearing or block 40 adjustably mounted on, and for longitudinal movement with respect to, a laterally projecting arm 41, the inner end of which is secured in a bracket 42 which in turn is suitably fixed to the back beam 2 of the machine.

The drum 30 is adapted to be intermittently rotated to bring the links 35 of the chain 25 successively into operating relation to the roller 23 of the stitch-regulating lever 21 and for this purpose the drum 30 is provided with a plurality of teeth, which in the present instance are formed of pins 43, 43, as shown in Fig. 5, which project laterally from one side of the drum, to be engaged by a pawl 44. The pawl 44 is pivotally mounted at 45 on a lever 46 which is pivoted at 47 to the bracket 42.

Rotatably mounted on a stud 48 which extends transversely of the lever 46 is a cam roller 49, as clearly shown in Fig. 10, which is adapted to be engaged by a cam 50 secured to the main cam shaft 15 of the machine.

Normally the drum 30 is held against rotation by a locking bolt 51 (see Fig. 6) which is slidably mounted in a bearing 52 secured to the front beam 1. The outer end 53 of the locking bolt 51 is tapered for entrance into correspondingly shaped notches 54 formed in a locking disc 55 that is secured to the drum by the pins 43 which have integral nut-like heads 56.

The locking bolt 51 is normally held in locking engagement with the disc 55 by means of a spring 57, one end of which is secured to a pin 58 secured in, and projecting laterally from one side of, the bearing bracket 52, while the opposite end of the spring is secured to pin 59 which extends through, and is secured in, the locking bolt 51 and extends through slots 60, 60 formed in the opposite sides of the brackets 52, whereby the bolt 51 is prevented from turning in the said bracket and the tapered end thereof is held in correct relation to the tapered notches 54 in the locking disc 55.

Pivotally connected to one of the projecting ends of the pin 59 is one end of a link 61, the opposite end of which is pivotally connected at 62 to one arm 63 of a bell-crank lever which is pivotally mounted at 64 on the bracket 52. The second arm 65 of the bell-crank lever is provided with a laterally extending stud 66 which is disposed in an elongated slot 67 formed in one end of an operating link 68, the opposite end of said link being pivotally connected at 69 to the pawl 44.

Normally, as the cam 50 revolves with the cam shaft 15 the lever 46 is rocked in one direction by the cam 50 and in the opposite direction by a spring 70, one end of which is secured to the free end of the lever 46 while the opposite end is suit-

ably secured to the front beam 1 of the machine. Normally the pawl 44 assumes the ineffective position shown in Fig. 3, during the rocking of the lever 46 while normal regular courses of stitches are being produced.

As usual in this type of machine, a pattern chain 71 is provided for controlling the narrowing of the blank and other functions of the machine, the pattern chain 71 advancing one link for each course of stitches produced, or one link for each complete revolution of the cam shaft 15.

In the present instance the pattern chain 71 is provided with a series of buttons 72 spaced along the chain in accordance with each single course or with the first course of a group of identical courses which are to be composed wholly or in part of lengthened stitches under control of the mechanism forming the subject matter of the present invention.

In the present instance, the buttons 72 are adapted to engage a lug 73 formed on a lever 74 which is pivoted at 75 to the pattern chain bracket 76, said bracket being rigidly secured to the front beam 1. The lever 74 is connected by a link 78 to one end of a lever 79. The lever 79 is pivoted at 80 to the pattern chain bracket 76.

The second end 81 of the lever 79 is operatively connected to one end of a rod 82 which extends substantially parallel to the front beam 1. The opposite end of the link or rod 82 is operatively connected at 83 to one end of a lever 84. The lever 84 is pivoted at 85 to the drum-locking bracket 52.

The second end 86 of the lever 84 is provided with the spring-pressed stop 87 shown in detail in Fig. 7, the stop 87 being provided with a stem 88 slidably mounted in a bearing 89 formed in the one end 86 of the lever, a spring 90 being confined between the head 87 and the bearing 89 and a collar 91 being secured to the stem 88 at the opposite end of the bearing 89 for limiting the movement of the stop 87 with respect to the lever end 86.

At such time as intermittent movement of the drum 30 is desired one of the buttons 72, by engaging the lug 73 of the lever 74, swings the lever 84 about its pivot 85 to bring the stop 87 into the path of a finger 92, see Fig. 4, formed on the pawl 44, whereby, as the pawling lever 46 is swung outwardly by the cam 50, the finger 92 comes in contact with the stop 87 and swings the pawl 44 about its pivot 45 until a shoulder 93 on the pawl 44 rests against one of the pins 43 of the drum 30.

Swinging of the pawl into engagement with one of the pins 43 effects withdrawal of the locking bolt 51 from the occupied notch 54 of the locking disc 55, through the link 68, bell-crank 65-63 and link 61, such position of the elements being clearly illustrated in Fig. 13.

Further rotation of the cam 50 permits the lever 46 to rock toward the cam shaft 15 under the influence of the spring 70, that is, from the position shown in Fig. 13 to the position shown in Fig. 14, which causes the pawl 44 to effect a single step movement of the drum 30 about the axis of the cam shaft 15.

During such pawling movement of the lever 46, and due to the relation of the pivotal connection 69 of the link 68 to the pawl and to the axis of rotation of the lever 46 and the elongation of the slot 67 in the line 68, the locking plunger 51, under the influence of its spring 57, first engages and then slides on the peripheral surface of the locking disc 55, and, as the pawl 44 attains its max-

imum position, the tapered end 53 of the locking plunger 51 snaps into the then aligned notch 54 of the disc 55 and prevents further rotation of the drum 30.

5 When the spring pressed stop 87 is moved out of operative relation to the finger 92 of lever 44 by means of the pattern chain 71, and the cam roller 49 of lever 46 rides over the high portion of cam 50 the lever 44 assumes the position as shown in Fig. 15. At this time the plunger 51, through the 10 action of link 61, bell crank 65 and 63 and the link 61 will be only slightly withdrawn from the notch 54 of locking disc 55 so as to prevent rotation thereof.

15 Such movement of the drum 30 brings one of the stitch-lengthening links 35 into operative relation to the roller 23 on the stitch-regulating lever 21. The cam surfaces 26 of the links 35 do not function directly with the roller 23. Rocking 20 of the lever 21 is effected by an intermediate mechanism comprising a shoe 100 (see Figs. 8, 9, 11, 12 and 18).

25 The shoe 100 is provided with a foot 101 which is slidably mounted in a lever 102 for movement radially with respect to the axis of the main cam shaft 15 upon which the lever 102 is loosely mounted. A spring 103, having one end attached to the foot 101 and the opposite end attached to the lever 102, tends to move the shoe 100 in- 30 wardly at all times.

35 Rotatably mounted on a stud 104, which projects laterally from the foot 101, is a roller 105 which is adapted to ride the cam surfaces 26 of the links 35 of the selector chain 25, whereby the shoe 100 is moved outwardly and inwardly or vice versa as the lever 102 is rocked about the axis of the shaft 15. During such time the drum 30 with the chain 25 thereon is held in a relatively fixed position.

40 The outer peripheral surface 106 of the shoe 100 is formed on an arc struck from the axis of the shaft 15, and the roller 23 on the stitch-regulating lever 21 bears against the arcuate surface 106 of the shoe 100, and as this surface is moved 45 radially outwardly or inwardly, in accordance with the contour or variable heights of the cam surface 26 of the link 35 which has been positioned in operative relationship to the lever 21, the lever 21 is moved, and consequently the stitch-regulating shaft 20, is correspondingly moved 50 to throw the needles 10 toward or away from the shoulders 16 of the sinkers 9, for lengthening the stitches or for returning the needles to a position for the formation of regular stitches, as the case may be.

55 The rocking of the shoe 100 with respect to the roller 23 is concurrent with the traversing of the jacks 19 by the slur cock 18 and in order that the lengthening of the stitches will be symmetrically governed the shoe 100 rocks in one 60 direction during the first half of the traversing movement of the slur cock 18 and in an opposite direction during the remaining half of the traversing movement of said slur cock, consequently, 65 in cases where the lengthening of the stitches is to be effected at, or immediately adjacent to the center of a course of stitches the cam surface 26 of the link in position will have a rise only at one end of the link. If the lengthened stitches 70 are to be produced adjacent to the selvage edges of the blank the link in position will have a rise at the opposite end of the link. If lengthened stitches are to be produced at the center and at both ends of a course the link in position will be 75 provided with a rise at each end, the length of the

rise circumferentially of the drum 30 determining the number of stitches to be lengthened in each instance. Obviously, where the lengthening of the stitches occurs intermediate the center of the blank and the selvage edges of the 5 blank the rise in the link will accordingly be positioned circumferentially of the drum. The height of the rise determines the extent of rocking of the needles and consequently the extent of the lengthening of the stitches. In cases where 10 the stitches are to be lengthened throughout a full course, the rise of the surface 26 of the link in position, and which corresponds to that particular course, will extend from end to end of the link. In this manner the lengthening of 15 individual stitches or groups of stitches in any place in any course and disposed symmetrically at each of the opposite sides of the center line of the blank may be effected.

20 The rocking of the shoe 100 is effected by the same mechanism which effects the intermittent rotation of the drum 30, the first part of the movement of the lever 46 being adapted to provide the pawling movement while the remainder of the stroke of the lever 46 is adapted to provide 25 the rocking motion of the shoe 100 across the cam surface 26 of the link 35 which has just been moved into operative relation to the stitch-regulating lever 21, the last part of the inward stroke of the lever 46 and the first part of the outward 30 stroke of said lever taking place concurrently with the first and second halves respectively of the full sinker-traversing movement of the slur cock 18.

35 The shoe-carrying lever 102 is provided with an arm 107 to which is pivotally connected at 108 one end of a link 109, the opposite end of which is pivotally connected to the lever 46 by being mounted on the same stud 45 that provides the pivotal connection for the pawl 44 with the 40 lever 46.

45 The peripheral surface of the cam 50 which effects the pawling or intermittent movement of the drum 30 and also the rocking motion of the shoe 100 is so cut that, after the drum 30 has 45 been rotated the necessary distance to permit the locking bolt 51 to enter one of the notches 54 of the disc 55 to hold the drum in position, the lever 46 receives a slight backward movement sufficient to release the pawl 44 from the tooth or 50 pin 43 of the drum 30 by which such movement of the drum has been effected, after which renewed and continued forward movement of the lever 46, for rocking the shoe 100 past the link 55 35 then in position and the roller 23 on the stitch-regulating lever 21 is effected.

60 As soon as the pawl 44 is released from the pin 43 it drops onto and slides over a shoulder 110, formed on the locking bracket 52, throughout the remainder of the forward movement of the lever 60 46 and during return movement of said lever to the position shown in Figs. 3 and 8.

65 In producing a blank, such as that illustrated in Fig. 16, the body portion A of the blank, down to the line *a, a*, is knit in the usual normal manner. 65 The link 35 then in operative relation to the stitch-regulating lever 21 is of such height throughout its entire length as not to effect the normal length of stitches of which the body portion A is composed, the length of said stitches being regulated 70 by the normal stitch-controlling mechanism of the machine.

75 During the last part of the knitting of the course of stitches immediately preceding that represented by the line *a, a* the pattern chain 71 75

will advance to bring one of the buttons 72 thereon under the lug 73 of the lever 74, whereupon the rod 82 will be shifted longitudinally and thereby rock the lever 84 to throw the stop 87 into the path of the finger 92 of the pawl 44. As the shaft 15 continues to rotate, the pawl 44 is swung upwardly into engagement with one of the rack pins 43 on the drum 30 and the locking plunger 51 is simultaneously withdrawn from the occupied notch 54 of the locking disc 55 of said drum. The roller 49 of the lever 46 will then ride on the high portion 50a of the cam 50 with the spring 70 stretched to its maximum extent. As the cam 50 continues to rotate the roller 49 rides down the incline 50b of the cam and the spring 70 at the same time rocks the lever 46 toward the cam shaft 15, from the position shown in Fig. 13 to the position shown in Fig. 14, whereby movement of the drum to the extent of one step is effected and the plain link is replaced by the link shown, for example, in Fig. 17a. The locking plunger 51 at the same time is reseated in one of the locking notches 54 of the disc 55.

Continued rotation of the cam 50 brings a slightly elevated point 50c of the cam in contact with the roller 49 of the lever 46 which moves the lever backwardly a slight extent to release the pawl 44 from the engaged pin 43 on the drum 30. As the cam 50 continues to rotate, the roller 49 rides down the incline 50d thereof and the spring 70 rocks the lever again toward the shaft 15. In so doing the lever 102 is rocked to bring the leading point 100a of the shoe 100 into engagement with the roller 23 of the stitch-regulating lever 21 as clearly shown in Fig. 8.

The roller 105 of the shoe 100 rides onto the high point 26a of the link 35 at substantially the same time as the point 100a of the shoe 100 engages the roller 23 of the stitch-regulating lever 21, whereby the stitch-regulating shaft 20 is rocked and the needles 10 are correspondingly rocked toward the sinkers.

The slur cock 18 then begins its travel across the sinkers, to sink the thread around the needles for the first course of stitches included in the high splice heel reinforce B.

During the travel of the slur cock across the sinkers and during the sinking of the yarn thereby, from the selvage A¹ to the inner line B¹ of the reinforce B, the lever 102 is being rocked and the roller 105 of the shoe 100 is riding on the high part of the link, from the point 26a to the point 26b, whereupon the roller 100 rides onto the normal portion of the link 35, permitting the stitch-regulating shaft 20 to rock back to the normal position as the slur cock travels from the point B¹ to the center of the bank of needles, corresponding to the center line *x, x* of the blank, the needles 10 rocking outwardly from the shoulders 16 of the sinkers 9 and being held in such position during the travel of the slur cock across the sinkers to the center of the bank of needles.

During such movement of the slur cock 18 the lever 102 has continued to rock, in a counter-clockwise direction, as viewed in Fig. 9, by reason of the roller 49 riding down the incline 50e of the cam 50 under the influence of the spring 70, until the roller reaches the low point 50f of said cam, the shoe 100 during such rocking of the lever 46 rocking around the shaft 15, altho at this time not controlling the length of the stitches being produced, the limit of travel of the shoe being determined by the contour of cam 50 and ordinarily being such that the second end 100b thereof is

adjacent to the roller 23 of the stitch-regulating lever 21.

During the travel of the slur cock 18 past the second half of the complement of sinkers, corresponding to a movement from the center line *x, x* of the blank to the selvage A² of the blank, the shoe 100 is rocked in an opposite direction by the roller 49 of the lever 46 riding on an incline 50g of the cam 50. During such rocking of the lever 102 the roller 105 of the shoe 100 again rides up on to the high point 26b of the link 35 then in position, as the slur cock arrives at the position with respect to the jacks 19 which corresponds to the point B² denoting the inner line of the high splice reinforce B³ at the opposite side 15 of the blank, whereupon the stitch-regulating lever 21 is rocked outwardly and held in such position while the slur cock 18 finishes its traversing movement from the inner line B² of the high splice heel B³ until the selvage A² of the blank is attained.

It will here be noted that the movements of the carrier bars 7 by which the threads being laid to the needles are controlled are governed by the usual end stops of the machine in the ordinary manner as the fabric is narrowed to produce the selvages A¹ and A².

During the above noted single traversing movement of the slur cock 18 the pattern chain 71 has advanced one link, to remove the button 72 from under the lug of the lever 74 whereby the rod 82 is shifted in an opposite direction to remove the stop 87 from the path of the finger 92 of the pawl 44, consequently there will be no movement of the drum 30 during the next cycle of rotation of the shaft 15 and the link then in operative relation to the stitch-regulating lever 21 will maintain such position for the knitting of a number of successive courses, for example from line *a, a* to line *b, b*. During the knitting of each of such courses the shoe 100 is moved outwardly and inwardly as the roller 105 thereof is rocked across the cam surface 26 of the link in position, between the end point 26a of said cam surface which corresponds to the selvage edges of the fabric and the end point 26c of the cam surface which corresponds to the center line *x, x* of the blank.

During the knitting of the course preceding that denoted by the line *b, b* another of the buttons 72 becomes effective to move the stop 87 into the path of the finger 92 of the pawl 44, whereupon the drum 30 receives a one step movement in the manner above described which moves the link of Fig. 17a out of operative relation to the stitch-regulating lever 21 and moves another link 35, for example that of Fig. 17b, into operative relation to the stitch-regulating lever 21. This link is similar to the link shown in Fig. 17a, with the exception that it includes a second elevation indicated by numerals 26d and 26e, the cam surface 26 of the link between these points being of higher elevation relative to the axis of the cam shaft 15 than the cam surface between the points 26a and 26b of the link shown in Fig. 17. This higher elevation effects a greater rocking of the needles 10 toward the shoulders 16 of the sinkers 9 to slightly increase the length of the stitches in the courses from the selvage edges A¹ and A² of the blank to the inner lines or edges C¹ and C² of relatively thickened areas C and C³ respectively, in which a third thread is incorporated in addition to the main body thread and the single splicing threads knit into the areas B and B³.

The operation throughout the knitting of the

courses between the lines *b, b* and *c, c* is the same as the operations during the knitting of the courses between the lines *a, a* and *b, b* with the exception that the drum 30 is moved, for example after each fourth course, then after each third course, then after each second course and finally after each course, bringing the links of Figs. 17*c, 17d, 17e, 17f, 17g, 17h, 17i* and 17*j* successively into operative relation to the stitch-regulating lever 21, the difference in each of these links being that the points 26*b* and 26*c* are moved closer to the center point 26*c* in progressively increasing steps, whereby the inner lines B¹ and C¹ and B² and C² of the areas B and B³, C and C³ respectively are caused to extend at an angle or to be curved with respect to the center line of the fabric.

During the knitting of the courses between the lines *c, c* and *d, d* the link shown in Fig. 17*j* remains in operative relation to the stitch-regulating lever 21.

From the knitting of the course corresponding to the line *d—d* to the knitting of the ends of the heel tabs indicated by the line *e, e* the length of the stitches in the heel tabs D, D is controlled by a link having a uniform height from end to end corresponding substantially to the high portion of the link shown in Fig. 17*a*. During the formation of the normal length stitches in the body portion A of the stocking blank, a link having a plain surface of even height from end to end, so as not to interfere with the normal stitch-regulating mechanism, is moved into operation relative to the stitch regulating lever 21.

In producing the blank shown in Fig. 19 the link of Figs. 20*a* and 20*d* having elevated portions 26*f* of different lengths at the end 26*c* of the links are employed in succession and duplicated in reverse order to produce the upper central design area E, then a plain non-elevated link so that the production of the portion A³ of the blank A may be controlled by the normal stitch regulating mechanism. Then the links of the kind shown in Figs. 20*a* to 20*d* are again employed to produce the upper part of the lower central design area E¹, after which links of the character shown in Figs. 20*e* to 20*i*, having variable elevated surfaces 26*g* intermediate their opposite ends in addition to the variable elevated surfaces 26*f* at their ends 26*c*, are provided to produce the lower part of the lower central design area E¹ and the upper tapering parts E², E² of the high splice heel areas, and the links 20*h* to 20*n* are used to produce the lower parts E², E² of the high spliced heel areas.

The links of Figs. 20*a* to 20*n* are shown in cooperative relation to shoe 100 which is rocked by a cam 50¹ as shown in Fig. 22.

In producing such areas the link 35 may be cut to provide a dwell of the roller 105 on the cam surface of the link during the movement of the slur cock past the sinkers corresponding in position to the plain portions of the blank between the side and central design areas and to provide a quickened action of the shoe roller over the portions of the link-elevated surfaces corresponding to the central and side design areas, for more accurately controlling the lengths of the stitches in the more or less rapid changes from long to short stitches and vice versa.

In producing the blank shown in Fig. 23 with design areas of variable widths between each of the side edges of the blank, such as clocks, etc., as indicated at 23*a* in said figure, links of the type shown in Figs. 24*a* to 24*h* are provided in forward and reverse order in the chain 25, each

link having only one elevated surface 26*g* between its ends, and the surfaces of the links being of various lengths circumferentially of the drum 30. The cam 50² is shown slightly redesigned in Fig. 25 for operating the shoe 100 in relation to the links, Figs. 24*a* to 24*h*.

In order to produce full courses of lengthened stitches, as at the picot edge F, welt juncture G, and topping lines H in the blank shown in Figs. 26 and 27, the surfaces 26*h, 26i* and 26*j* of the links in Figs. 28, 29 and 30 respectively are employed. These surfaces extend uniformly from end to end of the links and vary in height only, the surface 26*j* of the link in Fig. 30 being only slightly higher than the normal length stitch height indicated by the broken line *y, y* for producing looping lines such as the lines H, H in the heel tabs. The surface 26*i* of the link shown in Fig. 29, is but slightly higher than the surface 26*j*, for forming the picot edge F, and the surface 26*h* of the link shown in Fig. 28 being slightly higher than the surface 26*i* for forming the welt turning or juncture line G. However when the normal length stitches of the body portion of a stocking blank A are being formed, a link having a lower surface than that of the line Y—Y is provided, for the reason hereinafore stated.

From the above, it will be clear that by producing links having cam surfaces of various heights and various lengths and by placing these 30 elevated cam surfaces at various places throughout the length of the links, or along the whole of the length of the link, stitches at any place in any course throughout the knitting of the stocking blank from end to end thereof may be selectively lengthened to any desired extent in conjunction with the normal operation of the machine.

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 scope of the invention herein disclosed and hereinafter claimed.

I claim:

1. A device, for use with a flat knitting machine equipped with a rockable stitch-regulating lever, comprising an intermittently rotatable element provided with variable surface protuberances movable into operative relation to said lever, and means movable intermediate said protuberances and said lever independently of the lever to rock said lever for regulating the lengths of predetermined stitches produced by the machine.

2. A device, for use with a flat knitting machine equipped with a rockable stitch-regulating lever, comprising an intermittently rotatable element provided with variable surface protuberances movable into operative relation to said lever, and oscillatory means movable intermediate said protuberances and said lever independently of the lever to rock said lever for regulating the lengths of predetermined stitches produced by the machine.

3. A device, for use with a flat knitting machine equipped with a rockable stitch-regulating lever, comprising an intermittently rotatable element provided with variable cam links movable into stationary operative relation to said lever, and means for moving the lever in accordance with the contour of one of the stationary links for regulating the lengths of predetermined stitches produced by the machine.

4. A device, for use with a flat knitting machine equipped with a rockable stitch-regulating lever, comprising an intermittently rotatable ele-

ment and a stitch selector chain extending around said element and including interchangeable links respectively provided with variable surface protuberances movable into operative relation to said lever for regulating the lengths of predetermined stitches produced by the machine.

5 5. A device, for use with a flat knitting machine equipped with a rockable stitch-regulating lever, comprising an intermittently rotatable element provided with variable surface protuberances movable into operative relation to said lever, and oscillatory means pivoted coaxially with said intermittently rotatable element and movable intermediate said protuberances and said lever to rock said lever for regulating the lengths of predetermined stitches produced by the machine.

10 6. A device, for use with a flat knitting machine equipped with a main cam shaft and a rockable stitch-regulating lever adjacent thereto, comprising an intermittently rotatable element adapted to be loosely mounted on said cam shaft and provided with variable surface protuberances movable into operative relation to said lever, and oscillatory means pivoted coaxially with said intermittently rotatable element and movable intermediate said protuberances and said lever to rock said lever for regulating the lengths of predetermined stitches produced by the machine.

15 7. A device, for use with a flat knitting machine equipped with a main cam shaft and a rockable stitch-regulating lever adjacent thereto, comprising an intermittently rotatable element adapted to be loosely mounted on said cam shaft and provided with variable surface protuberances movable into operative relation to said lever, oscillatory means pivoted coaxially with said intermittently rotatable element and movable intermediate said protuberances and said lever to rock said lever for regulating the lengths of predetermined stitches produced by the machine, and means adapted to be secured to said cam shaft for effecting oscillation of said intermediate operable means.

20 8. A device, for use with a flat knitting machine equipped with a main cam shaft and a rockable stitch-regulating lever adjacent thereto, comprising an intermittently rotatable element adapted to be loosely mounted on said cam shaft and provided with variable surface protuberances movable into operative relation to said lever, oscillatory means pivoted coaxially with said intermittently rotatable element and movable intermediate said protuberances and said lever to rock said lever for regulating the lengths of predetermined stitches produced by the machine, and means adapted to be secured to said cam shaft for intermittently rotating said element.

25 9. A device, for use with a flat knitting machine equipped with a main cam shaft and a rockable stitch-regulating lever adjacent thereto, comprising an intermittently rotatable element adapted to be loosely mounted on said cam shaft and provided with variable surface protuberances movable into operative relation to said lever, oscillatory means pivoted coaxially with said intermittently rotatable element and movable intermediate said protuberances and said lever to rock said lever for regulating the lengths of predetermined stitches produced by the machine, means adapted to be actuated by said cam shaft for constantly oscillating said intermediate operable means, and means carried by the last

said means for intermittently rotating said element.

10 10. A device, for use with a flat knitting machine equipped with a stitch-regulating lever, comprising an intermittently rotatable element, a stitch selector chain extending around said element and including interchangeable links respectively provided with variable surface protuberances movable into operative relation to said lever, and oscillating means pivoted coaxially with said intermittently rotatable element and movable intermediate said protuberances and said lever to rock said lever for regulating the lengths of predetermined stitches produced by the machine.

15 11. A device, for use with a flat knitting machine equipped with a stitch-regulating lever, comprising an intermittently rotatable element, a chain extending around said element and including interchangeable links having cam surfaces of respectively varying heights with respect to the axis of said element, and means operable between said cam surfaces and said lever for rocking said lever to vary the lengths of predetermined stitches in accordance with the variations in the height of said cam surfaces respectively.

20 12. A device, for use with a flat knitting machine equipped with a stitch-regulating lever, comprising an intermittently rotatable element, a chain extending around said element and including interchangeable links having cam surfaces of respectively varying heights with respect to the axis of said element and varying lengths with respect to the circumference of said element, and means operable between said cam surfaces and said lever for rocking said lever to vary the lengths of predetermined stitches and groups thereof in accordance with the variations in the height and length of said cam surfaces respectively.

25 13. A device, for use with a flat knitting machine equipped with a stitch-regulating lever, comprising an intermittently rotatable element provided with radial protuberances of varying height relative to the axis of said element, an arm coaxially pivoted with respect to said element, means for oscillating said arm about said axis, a shoe slidably mounted in said oscillatory arm for radial movement with respect to said axis and adapted to engage said lever, and means on said shoe adapted to ride on said protuberances during oscillation of said arm for rocking said stitch-regulating lever in accordance with the varying height of said protuberances.

30 14. A device, for use with a flat knitting machine equipped with a stitch-regulating lever, comprising an intermittently rotatable element provided with radial protuberances of varying height relative to the axis of said element, an arm coaxially pivoted with respect to said element, means for oscillating said arm about said axis, a shoe slidably mounted in said oscillatory arm for radial movement with respect to said axis and provided with a circumferentially extended convex surface adapted to engage said lever and being formed on an arc having its center substantially coincident with said axis, and means on said shoe adapted to ride on said protuberances during oscillation of said arm for rocking said stitch-regulating lever in accordance with the varying height of said protuberances.

35 15. In a full-fashioned knitting machine, the combination with a cam shaft and loop-forming means, of an intermittently rotatable element mounted on the cam shaft movable relative thereto, a locking and ratchet wheel construction rig-

idly connected to said element, a locking member and a pawl member cooperating with said locking and ratchet wheel constructions respectively, an oscillatory lever carrying said pawl member, fixed means carrying said locking member, and means operatively connecting said members for effecting application of the one, and release of the other, of said members.

16. In a full-fashioned knitting machine, the combination with a cam shaft and loop-forming means, of an intermittently rotatable element mounted on the cam shaft movable relative thereto, a locking and ratchet wheel construction rigidly connected to said element, a locking member and a pawl member for cooperation with said locking and ratchet wheel constructions respectively, an oscillating lever carrying said pawl member, fixed means carrying said locking member, means operatively connecting said members for effecting application of the one, and release of the other, of said members, and means for effecting said operations of said members during predetermined oscillations of said lever.

17. In a full-fashioned knitting machine, the combination with a cam shaft and loop-forming means, of an intermittently rotatable element mounted on the cam shaft movable relative thereto, a locking disc and ratchet wheel construction rigidly connected to said element, a fixed bearing adjacent to said element, a locking bolt slidably mounted in the fixed bearing and projecting into a recess in the disc, a lever for constant oscillation pivoted adjacent to said element, a pawl pivotally mounted on said lever, a release lever for the bolt pivoted to said fixed bearing, and a link connecting the pawl and said release lever for simultaneous actuation of said pawl and bolt.

18. A device, for use with a flat knitting machine equipped with a series of sinkers, a bank of needles, a lever for tilting the needles relative to the sinkers, and traversing means for projecting the sinkers between the needles successively from side to side of the needle bank; said device comprising an intermittently rotatable element, a chain extending around said element and comprising a series of links respectively provided with cam surfaces of varying height relative to the axis of said element; an element for oscillation about, and movement radially with respect to, the axis of the first said element intermediate said links and said lever for tilting the needles relative to the sinkers in accordance with said link cam surfaces, and means for synchronizing the oscillations of said intermediate element with the sinker-traversing movements of said projecting means.

19. A device, for use with a flat knitting machine equipped with a main cam shaft and a rockable stitch-regulating lever adjacent thereto, comprising an intermittently rotatable element adapted to be loosely mounted on said cam shaft and provided with variable surface protuberances movable into operative relation to said lever, oscillatory means pivoted coaxially with said intermittently rotatable element and movable intermediate said protuberances and said lever to rock said lever for regulating the lengths of predetermined stitches produced by the machine, means adapted to be actuated by said cam shaft for constantly oscillating said intermediately operable means, normally ineffective means carried by the last said means for intermittently rotating said element, and selectively operable means for rendering said element rotating means effective.

20. A device, for use with a flat knitting ma-

chine equipped with a main cam shaft, a rockable stitch-regulating lever adjacent thereto and a pattern chain, comprising an intermittently rotatable element adapted to be loosely mounted on said cam shaft and provided with variable surface protuberances movable into operative relation to said lever, oscillatory means pivoted coaxially with said intermittently rotatable element and movable intermediate said protuberances and said lever to rock said lever for regulating the lengths of predetermined stitches produced by the machine, means adapted to be actuated by said cam shaft for constantly oscillating said intermediately operable means, means normally intermediately operable by the last said means for intermittently rotating said element, and selectively operable means actuated by said pattern chain for rendering said element-rotating means effective.

21. A device, for use with a flat knitting machine equipped with a main cam shaft, a rockable stitch-regulating lever adjacent thereto and a pattern chain, comprising an intermittently rotatable element adapted to be loosely mounted on said cam shaft and provided with variable surface protuberances movable into operative relation to said lever, oscillatory means pivoted coaxially with said intermittently rotatable element and movable intermediate said protuberances and said lever to rock said lever for regulating the lengths of predetermined stitches produced by the machine, means adapted to be actuated by said cam shaft for constantly oscillating said intermediately operable means, a stitch selector chain passing around said element and composed of interchangeable links respectively, means normally ineffectively carried by the last said means for intermittently rotating said element, and selectively operable means actuated by said pattern chain for rendering said element-rotating means effective.

22. In a full-fashioned knitting machine, the combination with a cam shaft and loop-forming means, of an intermittently rotatable element mounted on the cam shaft movable relative thereto, a locking disc and ratchet wheel construction rigidly connected to said element, a fixed bearing adjacent to said element, a locking bolt slidably mounted in the fixed bearing and projecting into a recess in the disc, a constantly oscillating lever pivoted adjacent to said element, a pawl pivotally mounted on said lever, a release lever for the bolt pivoted to said fixed bearing, a link connecting the pawl and said release lever for simultaneous actuation of said pawl and bolt, means for slidably supporting said pawl in an inoperative position during the oscillations of said lever, a finger on the pawl, and a stop movable into the path of said finger for raising said pawl from said support into operative relation to said ratchet construction and for releasing the bolt from the locking disc.

23. A device, for use with a flat knitting machine equipped with a series of sinkers, a bank of needles, a lever for tilting the needles relative to the sinkers, and traversing means for projecting the sinkers between the needles successively from side to side of the needle bank; said device comprising an intermittently rotatable element, a chain extending around said element and comprising a series of links respectively provided with cam surfaces of varying height relative to the axis of said element, an element for oscillation about, and movement radially with respect to, the axis of the first said element intermediate said links

and said lever for tilting the needles relative to the sinkers in accordance with said link cam surfaces, the length of the cam surface of each link traversed by said intermediate oscillatory element being proportionate to substantially one-half the total traverse of the sinker-projecting means across the series of sinkers whereby oscillation of said element in one direction longitudinally of the links effects lengthening of predetermined stitches in one-half of a course thereof and movement of said element in the opposite direction effects lengthening of predetermined stitches in the second half of the course symmetrically to the first half course.

24. A device, for use with a flat knitting machine equipped with a series of sinkers, a bank of needles, a lever for tilting the needles relative to the sinkers, said device comprising an intermittently rotatable element, a chain extending around said element and comprising a series of links respectively provided with cam surfaces of varying height relative to the axis of said element, an element for oscillation about, and movement radially with respect to, the axis of the first said element intermediate said links and said lever for tilting the needles relative to the sinkers in accordance with said link cam surfaces, oscillatory means for intermittently rotating said chain-supporting element to bring said links successively into operative relation to said lever, and means for effecting oscillation of said elements in predetermined relation to each other.

25. A device, for use with a flat knitting machine equipped with a series of sinkers, a bank of needles, a lever for tilting the needles relative to the sinkers, said device comprising an intermittently rotatable element, a chain extending around said element and comprising a series of links respectively provided with cam surfaces of varying height relative to the axis of said element, an element for oscillation about, and movement radially with respect to, the axis of the first said element intermediate said links and said lever for tilting the needles relative to the sinkers in accordance with said link cam surfaces, oscillatory means for intermittently rotating said chain-supporting element to bring said links successively into operative relation to said lever, means for effecting oscillation of said elements in predetermined relation to each other including a rocking lever common to both oscillating elements, and a cam for actuating said rocking lever.

26. A device, for use with a flat knitting machine equipped with a series of sinkers, a bank of needles, a lever for tilting the needles relative to the sinkers, said device comprising an intermittently rotatable element, a chain extending around said element and comprising a series of links respectively provided with cam surfaces of varying height relative to the axis of said element, an element for oscillation about, and movement radially with respect to, the axis of the first said element intermediate said links and said lever for tilting the needles relative to the sinkers in accordance with said link cam surfaces, oscillatory means for intermittently rotating said chain-supporting element to bring said links successively into operative relation to said lever, means for effecting oscillation of said elements in predetermined relation to each other including a rocking lever common to both oscillating elements, a cam for actuating said rocking lever in one direction, and a spring for actuating said rocking lever in the opposite direction.

27. A device, for use with a flat knitting machine equipped with a series of sinkers, a bank of needles, a lever for tilting the needles relative to the sinkers, said device comprising an intermittently rotatable element, a chain extending around said element and comprising a series of links respectively provided with cam surfaces of varying height relative to the axis of said element, an element for oscillation about, and movement radially with respect to, the axis of the first said element intermediate said links and said lever for tilting the needles relative to the sinkers in accordance with said link cam surfaces, a rotary cam coaxially aligned with said chain-carrying element, a lever actuated by said cam, a pawl pivotally connected to said cam actuated lever, a ratchet fixedly connected to said chain-carrying element for engagement by said pawl, and means for selectively effecting engagement of the pawl with the ratchet for intermittently rotating the chain-carrying element to position said chain links successively in operative relation to said stitch-regulating lever.

28. A device, for use with a flat knitting machine equipped with a series of sinkers, a bank of needles, a lever for tilting the needles relative to the sinkers, said device comprising an intermittently rotatable element, a chain extending around said element and comprising a series of links respectively provided with cam surfaces of varying height relative to the axis of said element, an element for oscillation about, and movement radially with respect to, the axis of the first said element intermediate said links and said lever for tilting the needles relative to the sinkers in accordance with said link cam surfaces, a rotary cam coaxially aligned with said chain-carrying element, a lever actuated by said cam, means operatively connecting said oscillatory element to said cam-actuated lever, a pawl pivotally connected to said cam actuated lever, a ratchet fixedly connected to said chain-carrying element for engagement by said pawl, and means for selectively effecting engagement of the pawl with the ratchet for intermittently rotating the chain-carrying element to position said chain links successively in operative relation to said stitch-regulating lever, said cam having a lever-actuating surface adapted to rock the lever in a manner to effect pawling of said chain-carrying element in advance of effective oscillation of said intermediate element between the link cam surface and the stitch-regulating lever.

29. A device, for use with a flat knitting machine equipped with a series of sinkers, a bank of needles, a lever for tilting the needles relative to the sinkers, said device comprising an intermittently rotatable element, a chain extending around said element and comprising a series of links respectively provided with cam surfaces of varying height relative to the axis of said element, means for locking the chain-carrying element against rotation, an element for oscillation about, and movement radially with respect to, the axis of the first said element intermediate said links and said lever for tilting the needles relative to the sinkers in accordance with said link cam surfaces, a rotary cam coaxially aligned with said chain-carrying element, a lever actuated by said cam, means operatively connecting said oscillatory element to said cam-actuated lever, a pawl pivotally connected to said cam-actuated lever, a ratchet fixedly connected to said chain-carrying element for engagement by said pawl, means operatively connected to said pawl

for releasing said locking means, and means for selectively effecting engagement of the pawl with the ratchet and substantially simultaneously releasing said locking means for intermittently rotating the chain-carrying element to position said chain links successively in operative relation to said stitch-regulating lever, said cam having a lever-actuating surface adapted to rock the lever in a manner to effect pawling of said chain-carrying element relocking of said chain-carrying element and releasing the pawl from the ratchet in advance of effective oscillation of said inter-

mediate element between the link cam surface and the stitch-regulating lever.

30. A flat knitting machine equipped with stitch-regulating means comprising a movable element, intermittently operable means having a plurality of various surface contours for successive presentation to said element for cooperation therewith, and means movable intermediate a presented contour and said element, which intermediate means moves independently of, and actuates, said element.

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