July 4, 1961 M. BIALOSTOK 2,990,703

GLOVE KNITTING APPARATUS

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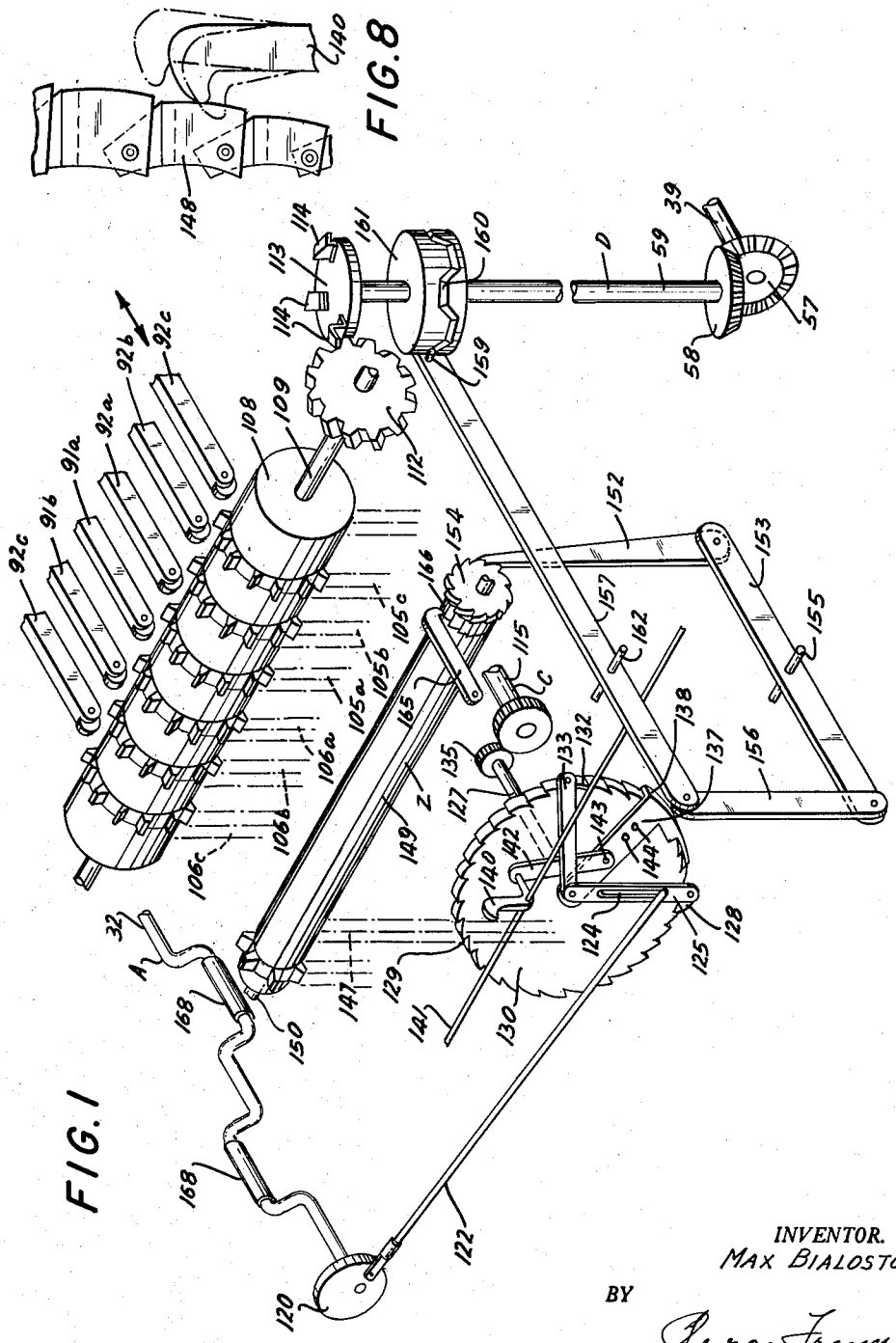


FIG. 8

FIG. 1

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GLOVE KNITTING APPARATUS

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FIG. 2

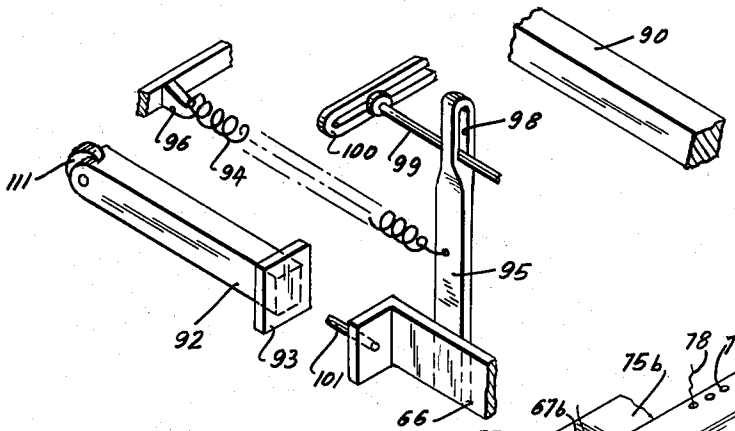


FIG. 3

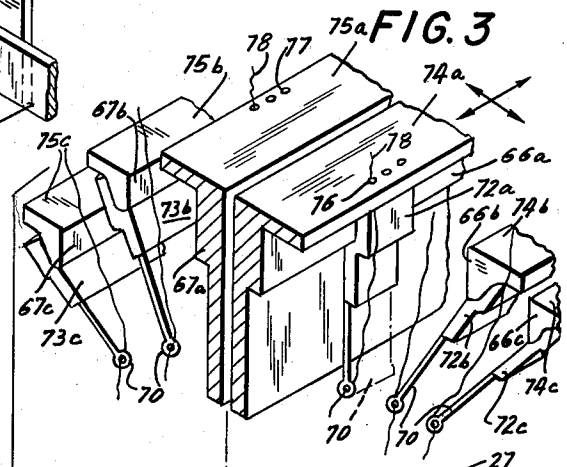
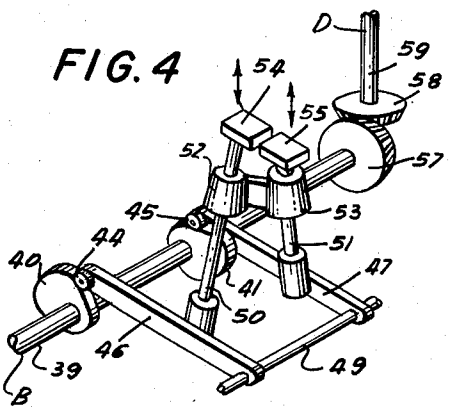
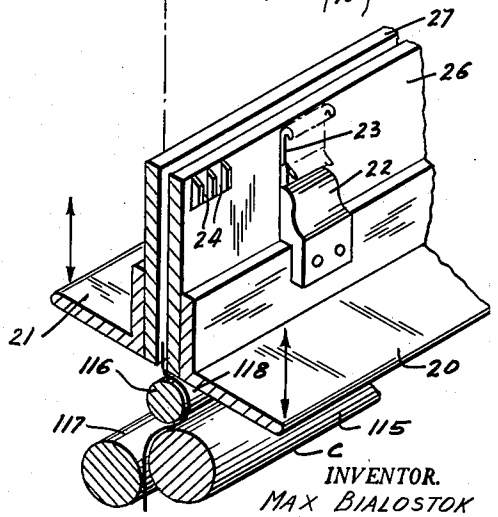


FIG. 4





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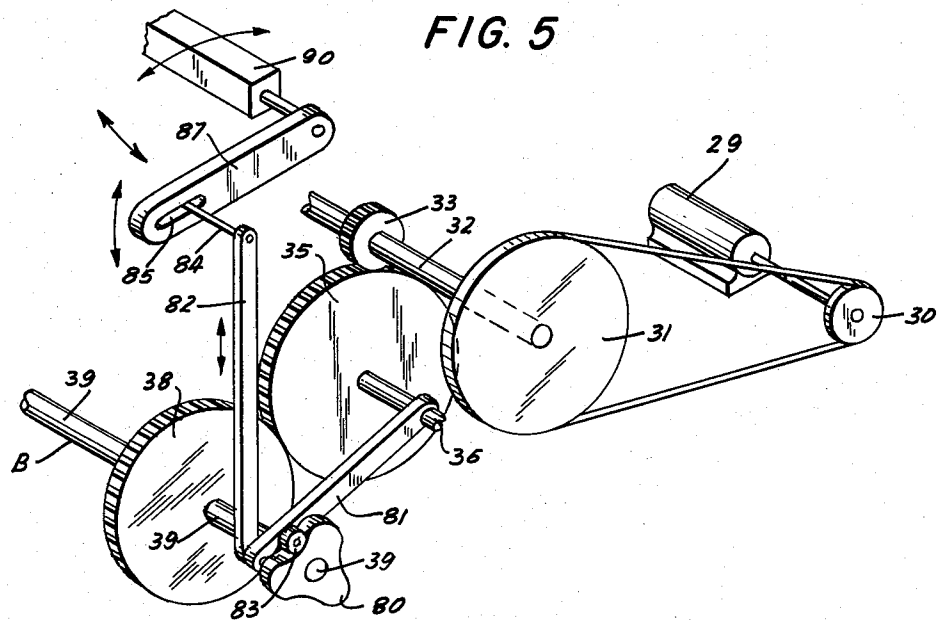
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FIG. 5



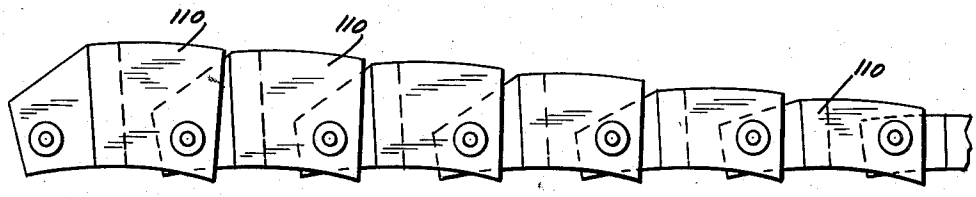


FIG. 6

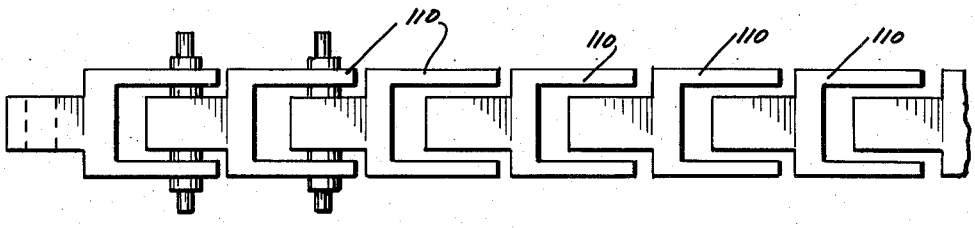


FIG. 7

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GLOVE KNITTING APPARATUS

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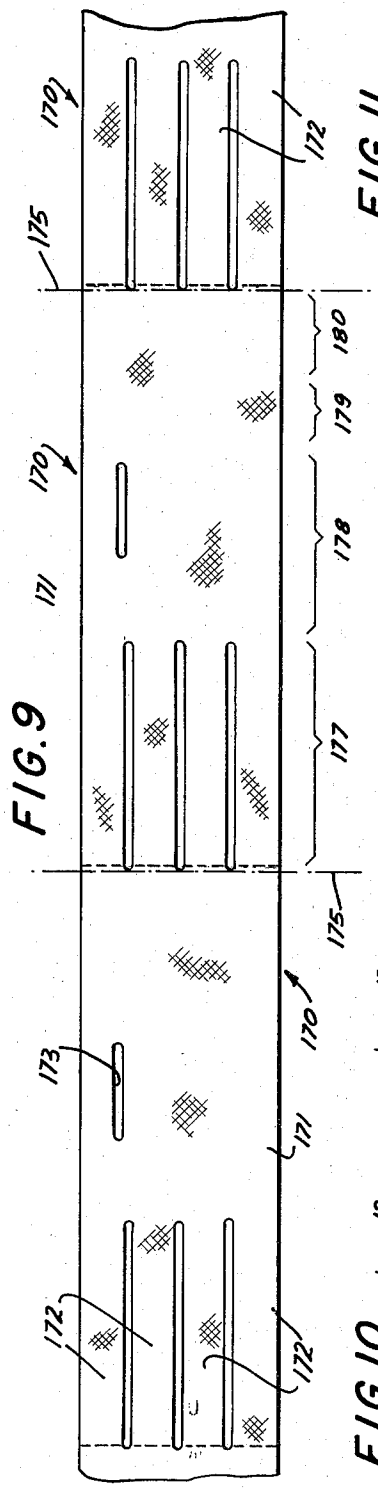


FIG. 9

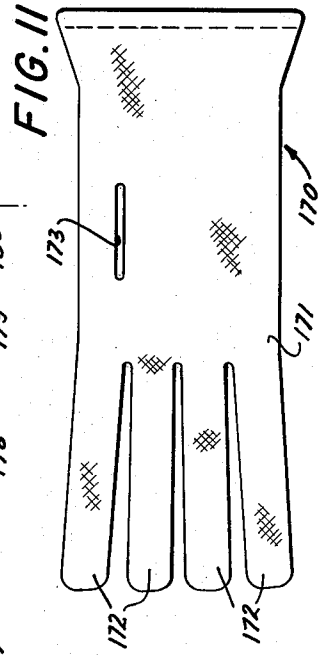


FIG. 11

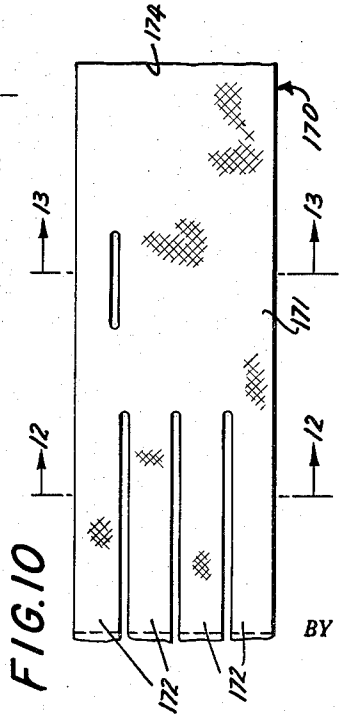


FIG. 10

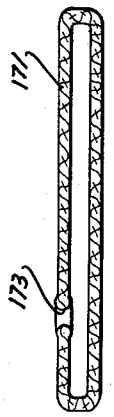


FIG. 13

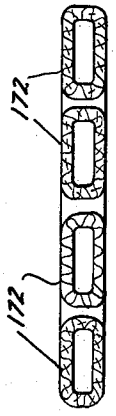


FIG. 12

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GLOVE KNITTING APPARATUS

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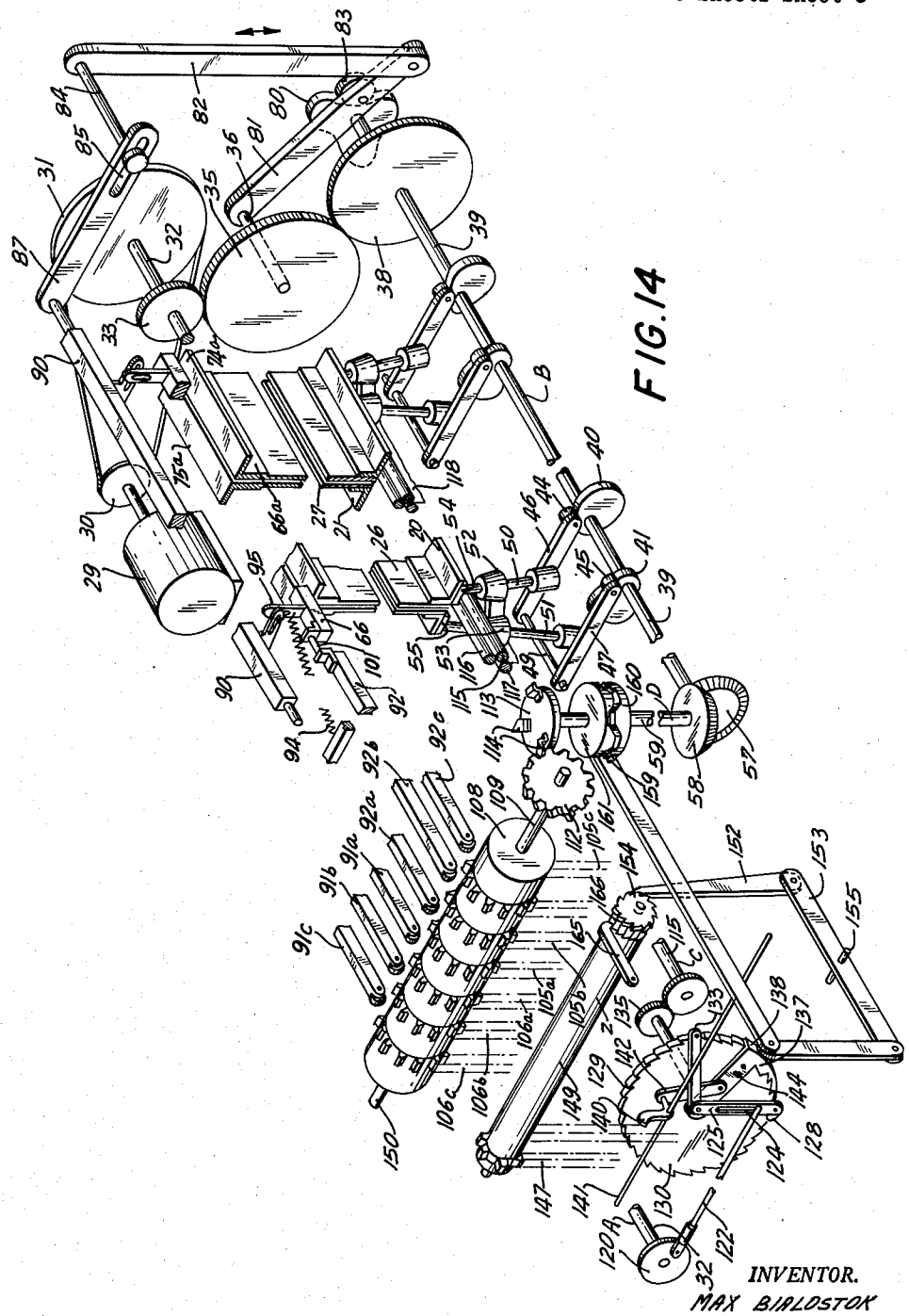


FIG. 14

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United States Patent Office 2,990,703 Patented July 4, 1961

2,990,703

GLOVE KNITTING APPARATUS

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Filed May 28, 1956, Ser. No. 587,716
4 Claims. (Cl. 66—87)

This invention relates to knitting apparatus and, more particularly, to apparatus used to control the operation of latch needle warp knitting machines so as to produce a knitted garment with a minimum of operations.

As is generally known by those skilled in the art, Raschel type, latch needle, warp knitting machines are provided with two needle beds and multiple guide bars. When both needle beds are used at the same time, warp knitted, rib, fabrics may be produced, as well as double-faced structures which are suitable for all types of outer wear and dress goods, since such can be knitted in the form of a tube. By varying the movements of the needle beds and guide bars, a great number of various designs and stitches can be produced in the fabric so as to particularly adapt the fabric for specific purposes. An object of this invention, therefore, is to provide novel controls and apparatus for use with latch needle warp knitting machines that are simple in construction, efficient in operation, and which may be used to produce fabrics of novel utility.

Another object of this invention is to provide a series of related control elements for directing the cyclic operation of latch needle warp knitting machines to produce a fabric in which the tautness of each course of stitches may be automatically varied.

A further object of this invention is to provide apparatus for automatically controlling the operation of latch needle warp knitting machines so as to provide a continuously knitted fabric having a predetermined sequence of loosely and tightly knitted courses of stitches.

Still a further object of this invention is to provide apparatus for latch needle type warp knitting machines for automatically knitting a series of blanks for gloves, each blank of which includes a tubular hand portion, tubular finger portions and a thumb cot receiving opening.

A more specific object of this invention is to provide apparatus for automatically knitting a continuous series of glove blanks, each of which is constructed of a plurality of courses of stitches of varying tautness so as to readily conform to the hand-shape of the wearer and which has finished tubular finger portions of varied predetermined lengths.

All of the foregoing and still further objects and advantages of this invention will become apparent from a study of the following specification, taken in connection with the accompanying drawing, wherein:

FIG. 1 is an exploded view, in perspective, of related sub-assemblies of a machine made in accordance with this invention.

FIG. 2 is an exploded view in perspective, and partly in section, elements of the yarn guide bar, lateral shifting, actuating mechanism.

FIG. 3 is a an exploded view in perspective, and partly in section, showing the relative disposition of certain of the associated elements.

FIG. 4 is a perspective view of the needle bed actuating mechanism.

FIG. 5 is a perspective view, showing the associated elements of the yarn guide bar rocking mechanism.

FIG. 6 is a side elevational view of a pattern chain used for automatically controlling certain of the knitting apparatus.

FIG. 7 is a top elevational view of the pattern chain shown in FIG. 6.

FIG. 8 is an enlarged view showing the engagement of a follower with a pattern chain that automatically controls the tautness of each course of stitches.

FIG. 9 is a plan view showing a continuously produced series of knitted glove blanks made in accordance with the present invention.

FIG. 10 is a plan view showing a single blank severed from the series of blanks shown in FIG. 9.

FIG. 11 is a plan view showing the single blank of FIG. 10 turned right side out, or inverted.

FIG. 12 is a transverse sectional view taken along the line 12—12 of FIG. 10.

FIG. 13 is a transverse sectional view taken along line 13—13 of FIG. 10.

FIG. 14 is a diagrammatic perspective view showing the various parts in their assembled, combination, relationship.

Referring now to FIG. 3 of the drawing, the component knitting parts of a two-bed Raschel wrap knitter are shown to include the front and back latch needle beds **20, 21.** Each needle bed carries at least one needle lead **22** into which a plurality of latch needles **23** are cast and which are adapted to be vertically reciprocated through associated tricks **24** of trick plates **26, 27** that are fixed relative to the respective front and back needle beds.

The power for actuating the needle beds, as more clearly shown in FIG. 5, is supplied by a motor **29** having a driving pulley wheel **30** that drives a pulley belt which is connected to a reduction pulley wheel **31** mounted on a rotatable shaft **32.** Also fixed to the shaft **32** is a spur gear **33** that is in meshing engagement with an idler gear **35** rotatably carried on an idler shaft **36.** The idler gear **35** is in meshing engagement with a spur gear **38** that is keyed to one end of and drives a longitudinal shaft **39** having a pair of identical cams **40, 41** keyed to the opposite end thereof. The cams are disposed on the shaft **39** with their respective high points 180 degrees apart so that rotatable follower elements **44, 45,** respectively, each carried by one end of the levers **46, 47** associated therewith, are adapted to rock the levers about the axis of the pivot shaft **49** to which the opposite ends of the levers are rotatably connected. Each lever **46, 47** pivotally supports a push rod **50, 51,** respectively, that is slidably received within and guided by fixed bearings **52, 53** which bring the pads **54, 55** at the upper ends of the rods **50, 51** into operative engagement with the back **21** and front **20** needle beds, respectively, so as to alternately raise and lower the associated latch needles carried thereby the motion being such that the front and back beds are each raised once during each longitudinal shaft revolution. A bevel gear **57** is secured to the shaft **39** at the opposite extremity of the shaft on which the spur gear **38** is secured. This bevel gear **57** is in meshing engagement with a corresponding bevel gear **58** which is secured to and drives a take-off shaft **59** to automatically advance a series of pattern chains, for the purposes hereinafter described.

The yarn guide bars are disposed above the needle beds **20, 21.** As shown in FIG. 3, three guide bars **66***a*, **66***b*, **66***c*, are shown disposed above the front needle bed **20** and three guide bars **67***a*, **67***b*, **67***c*, are shown disposed above the back needle bed **21.** The guide bars are carried by a guide bar bracket (not shown) in fixed spaced position and are adapted to carry the yarn guides **70.** Each set of yarn guides is spaced identically with the latch needles **23** and are cast in the front leads (**72***a*, **72***b*, **72***c*) and the back leads (**73***a*, **73***b*, **73***c*) which are secured to the respective guide bars. Each guide bar has, just above the leaded guides, a narrow, horizontal metal plate **74, 75** with lines of holes **76, 77.** There is such a hole for each yarn guide so that the yarn **78** passes through these holes before passing through the guides so as to keep the yarn parallel and in proper place.

The yarn guides **70** act in conjunction with the needles **23** to produce the knitting action. As each set of needles rises to their highest position by the movement of one of the needle beds, **20**, **21**, the respective guide bars **66**, **67** swing through the needles from the back to the front. Then the guides move longitudinally either to the right or left for the space of one or more needles and pass through the needles again to the back thereof. The needle beds are then lowered whereby each needle descends and draws its loop. As the guide moves from, across, and back, it passes around one needle and lays a strand of yarn in the hook. The first formed loop is around the shank of the latch needle. When the needle descends, the prior loop closes the latch and is pushed off over the top of the needle by the associated trick plate and, at the same time, pulls the next strand of yarn into a loop through the prior one. In the event that this cycle is carried on with one needle, a single chain would be formed. When two or more needles are used, the chain made by one yarn is looped in with that of another, forming a piece of cloth.

Referring to FIG. 5 of the drawing, the swinging or oscillating motions of the guide bars are shown to be obtained through the longitudinal shaft **39** which has a three-crested cam **80** secured at one end thereof. A lever **81** rotatably fulcrumed at one end on the idler shaft **36** and pivotally secured to one end of a vertical link **82** at its other end, has a follower element **83** intermediate its length in engagement with the cam **80**. The opposite end of the vertical link has a transverse actuating shaft **84** secured thereto in slidable engagement with a longitudinal slot **85** of a rocking lever **87**. This lever is rigidly connected to a rocking shaft **90** to which the entire guide bar assembly is secured. Rotation of the longitudinal shaft **39** thus sets up a vertical motion in the vertical link **82**, that results in a rocking movement of the shaft **90**, the movement being such that three such vertical and rocking reciprocations are made during each longitudinal shaft revolution.

Referring to FIG. 2, the separate longitudinal movement or shogging of each of the guide bars to the right and the left is shown to be effected by means of a push bar **92** having a metal plate **93** fastened to the inner end against which one extremity of the guide bar **66** is held by spring **94** that is secured at one end to the riser **95** of the guide bar and at the other end to a hook **96** on a stationary part of the frame. The upward extremity of the riser **95** has a vertically disposed slot **98** that is adapted to slidably receive a guide pin **99** carried by a guide element **100** that is also fixed to the frame so that the adjustment pin **101** projecting from the end of the guide bar is adapted to rub across the face of the pusher bar plate **93** as the rocking shaft **90** swings the push bar back and forth across the needle beds. The extent of longitudinal movement of each push bar **92** controls the extent of longitudinal movement of the respective guide bar to control the type of knitting stitch.

As is more clearly shown in FIG. 1, the longitudinal movement of each push bar **91***a*, *b*, *c*; **92***a*, *b*, *c* is controlled by a separate pattern chain **105***a*, *b*, *c*; **106***a*, *b*, *c* that is carried by a pattern drum **108** rigidly secured to a rotatable shaft **109**. As is well known to those skilled in the art, each pattern chain consists of a series of links **110** pivotally secured together. The links may all be of the same size or of various sizes, as shown in FIGS. 6 and 7, depending upon the extent of movement of the guide bars desired, which movement determines the number of latch needles, the respective guide needles carried by the guide bars will pass during the longitudinal movement thereof; as the size of the links increases, so will the movement of the respective push bars and guide bars be increased. The return springs **94** exert a pressure through the push bar to insure that the rollers **111** carried by each push bar will follow the exact profile of the links. As the drum **108** is rotated, the pattern chains are also rotated, whereupon the push bars will control the knitting operation in accordance with the predetermined pattern desired as set up by the arrangement of the various sizes of links of the pattern chain. The intermittent rotation of the drum **108**, is effected through a worm wheel **112** that is secured to the end of the shaft **109** and is driven by a cam wheel **113** that has four inclined cams **114** equally spaced around the circumference thereof. As each cam **114** passes through the associated slot of the worm wheel, the drum is rotated a sufficient amount to bring the next succeeding link **110** of each chain into engagement with the roller **111** of the respective push bar to move the associated guide bar. During each complete revolution of the shaft **59**, the worm wheel is given four intermittent movements. Thus, as the rollers pass from one link to the next, lateral motion is imparted to the guide bars. The movement of the barrel which takes place four times during each machine cycle and is timed with respect to the swinging motions of the guide bars to take place at exactly the right moments to give the proper underlaps and overlaps. Since the longitudinal shaft **39** provides the power for effecting the rise and fall of the needle beds, the oscillating movement of the guide needle bars and the rotation of the pattern chain drum, the timing in readily coordinated.

The stitch length and the fabric texture may be controlled by setting the fabric take-up mechanism, whereby increasing the rate of fabric take-up is adapted to provide a stitch of greater length and fewer courses of stitches per inch of fabric. As shown in FIG. 3, the take-up roll **115** is disposed beneath and in close association with the needle beds **20**, **21** and cooperates with a pair of idler rolls **116**, **117** to draw the fabric **118** as the yarn is knitted. Referring to FIG. 1, the power for driving the take-up roll **115** is received from the rotatable shaft **32** that is driven with the spur gear **33** (see FIG. 5) which is in the gear train of power from the motor **29**. The shaft **32** drives an eccentric on which one end of a pull rod **122** is eccentrically pivotally secured. The other end of the rod **122** is adjustably received within the slot **124** to a draw link **125** that is rotatably mounted on one end of a stud shaft **127**. The outer end of the draw link **125** has a draw pawl **128** pivotally secured thereto, which is spring biased into engagement with the detents **129** of the ratchet wheel **130** that is rigidly secured to the outer end of the stud shaft **127**. A locking pawl **132**, carried by a lock link **133**, is pivotally secured to link **133** and is spring biased into engagement with the detents **129** of the ratchet wheel and, since the link **133** is held in a fixed non-rotatable position relative to the shaft **127**, prevents rotation of the ratchet wheel in one direction while permitting rotation in the other direction. It will be recognized, therefore, that as the power shaft **32** is rotated, the eccentrically mounted pull rod reciprocatingly pulls and returns for each rotation of the shaft. As it returns, the draw pawl **128** runs freely over a plurality of detents before coming to rest in engagement with one detent, while the ratchet wheel is held stationary by the locking pawl **132**. As the pull rod is pulled back, the pawl **128** draws or rotates the sprocket wheel to the extent of the length of draw travel of the pull rod. The rotation of the sprocket wheel is transmitted through the stud shaft **127** and the spur gear **135** secured at the inner end thereof, to the take-up roll **115** to draw the fabric through the machine. The length of travel of the pull rod may be manually adjusted by adjusting the point of securement thereof with the longitudinal slot **124** of the draw link **125**.

An automatic adjustment mechanism is provided to vary the extent of rotation of the ratchet wheel **130** and thus the amount of rotation of the take-up roll **115** for each course of stitches knitted to control the stitch length and fabric texture. An adjustment link **137** is rotatably mounted on the outer end of the stud shaft **127** and has a shoe **138** in overlapping and shielding engagement with

a certain number of detents **129** of the ratchet wheel. When properly positioned, the shoe is adapted to prevent the engagement of the draw pawl **128** with the detents **129** positioned adjacent to the outward extremity of the return movement thereof, whereby the pawl, on the draw part of its cycle, rides freely over the top of the shoe until it reaches the first detent not covered by the shoe which it engages and draws through the remaining portion of the draw movement. The draw pawl is thus caused to skip several detents whereby the ratchet wheel **130** is rotated only a fraction of the amount which would otherwise result. The position of the shoe **138** is controlled by an indexing finger **140** that is in the form of a bell-crank pivotally mounted on a fixed shaft **141** adjacent to the ratchet wheel assembly. One end of the finger is pivotally engaged with one extremity of an extension length **142**, the other extremity of which has a pin **143** in fixed and adjustable position in engagement with one of a series of openings **144** along the length of the adjustment link **137**. The other end of the finger **140** is adapted to engage a take-up pattern chain **147** that is carried by a rotatable drum **149** mounted on a fixed shaft **150**. The drum is rotated by a pawl **152** that is pivotally secured to one end of a rocker link **153** and spring biased into engagement with the detents of a ratchet wheel **154** secured to one end thereof. A rotatable shaft **155** supports the link **153** for its rocking movement and the other end of the rocker link is pivotally secured to one extremity of a connecting link **156**, the opposite extremity of the connecting link being pivotally secured to the outer end of a second longitudinal rocker link **157**. The inner end of the longitudinal rocker link **157** has a follower stud element **159** that is adapted to follow a patterned cam slot **160** in a cam wheel **161** that is rigidly secured to and driven by the take-off shaft **59**, so as to rock the link **157** about its fixed pivot shaft **162**. The position of the cam wheel **161**, while being adjustable, is set to rock the link **157** four times for each rotation of the take-off shaft in sequence with the engagement of the cams **114** with the worm wheel **112** of the push bar control mechanism. Each rocking movement of the shaft is adapted to cause the pawl **152** to rotate the drum **149** sufficiently to move the next subsequent link **148** in the pattern chain **147** into engagement with the index finger **140** of the adjustment mechanism. If the subsequent link is higher than the previous link, it will rock the finger about its shaft to move the shoe **138** to cover additional detents on the ratchet wheel, whereby the take-up roll will rotate to a lesser extent to provide a tighter stitch for the next course of stitches. A locking pawl **165** is pivotally secured at one end and spring biased at its other end into engagement with corresponding detents **166** on the drum **149** to hold the same against rotation between rotating movements of the actuating pawl **152**. The shaft **32** is provided with offset hand-holds **168** to provide for a manual adjustment of the pattern chain **147** at any time so as to set the starting point thereof.

Referring now to FIGS. 9 through 13, by way of example, a series of glove blanks are shown that are knitted by means of the present invention. Each blank **170** includes a hand portion **171**, finger portions **172**, a thumb cot receiving opening **173**, and a wrist portion **174**. The blanks are knitted in the series shown in FIG. 9 and need only be severed along the parting line **175** to obtain the separate blanks as shown in FIG. 10. In order to provide a form fit, the various parts of the glove are knitted in zones at different degrees of tightness or looseness. More particularly, as seen in FIG. 9, the finger zone **177**

is knitted relatively loosely, the hand portion zone **178** is knitted a bit tighter, the lower wrist portion zone **179** is more tightly knitted, and the terminal wrist portion zone **180** is knitted very loosely. As a result, the finished glove may be blocked to a form-fitting shape, as shown in FIG. 11. This variation of stitch tautness is obtained by arranging the proper size links **148** of the pattern chain **147** associated with the take-up control so as to knit the desired number of respective loose and tight courses. It will be recognized that the apparatus may be arranged to knit various other types of form-fit articles merely by setting up the proper sequence of pattern chain links.

While this invention has been described with particular reference to the specific form shown in the drawing, it is to be understood that such is not to be construed as imparting limitations upon the invention, which is best defined by the claims appended hereto.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a latch needle warp knitting machine of the type having a source of operating power and pattern cams mounted upon a pattern cam drum rotated by said power source controlling the knitting of each course of stitches, variable take-up means drivenly connected to said source of operating power for drawing the knitted fabric from the machine at a variable rate and degree of tension to control the degree of tightness of each course of stitches, said variable take-up means comprising a drive wheel actuating said take-up means, a drive element driven by said source of operating power to effect intermittent partial rotation of said drive wheel, motive power means imparting to said drive element a substantially constant repetitious driving motion, index means limiting the magnitude of said driving motion transmitted by said drive element to said drive wheel, and a pattern link chain intermittently driven by said pattern cam drum controlling the setting of said index means for the knitting of each course of stitches.

2. Apparatus as set forth in claim 1, wherein said drive wheel comprises a ratchet wheel, and said drive element comprises a pawl for driving said ratchet wheel in a single direction.

3. Apparatus as set forth in claim 2, wherein said motive power means comprises a reciprocating rod, said pawl being supported at one end of said rod for continuous reciprocating movement therewith along a path of fixed length, said limiting means comprising a shield associated with said ratchet wheel for preventing the engagement of said pawl with said ratchet wheel during a part of said reciprocating movement of said pawl relative to said ratchet wheel.

4. Apparatus as set forth in claim 3, wherein said index means is adapted to prevent said engagement of said pawl with said ratchet wheel to an extent determined by the relative sizes of said pattern chain links.

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