Feb. 2, 1926. 1,571,766

W. FELS

CAM MECHANISM FOR KNITTING MACHINES

Original Filed July 8, 1920 8 Sheets-Sheet 1

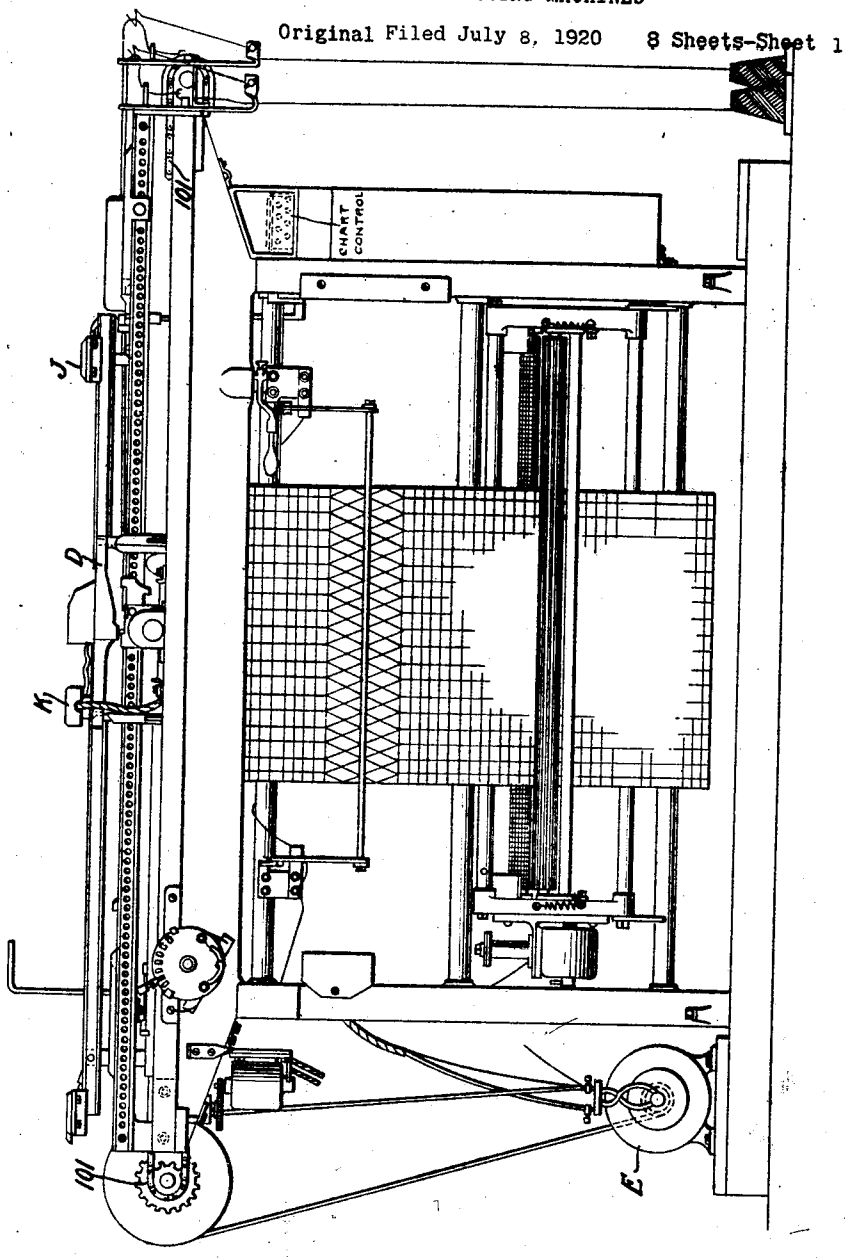


Fig. 1

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CAM MECHANISM FOR KNITTING MACHINES

Original Filed July 8, 1920 8 Sheets-Sheet 2

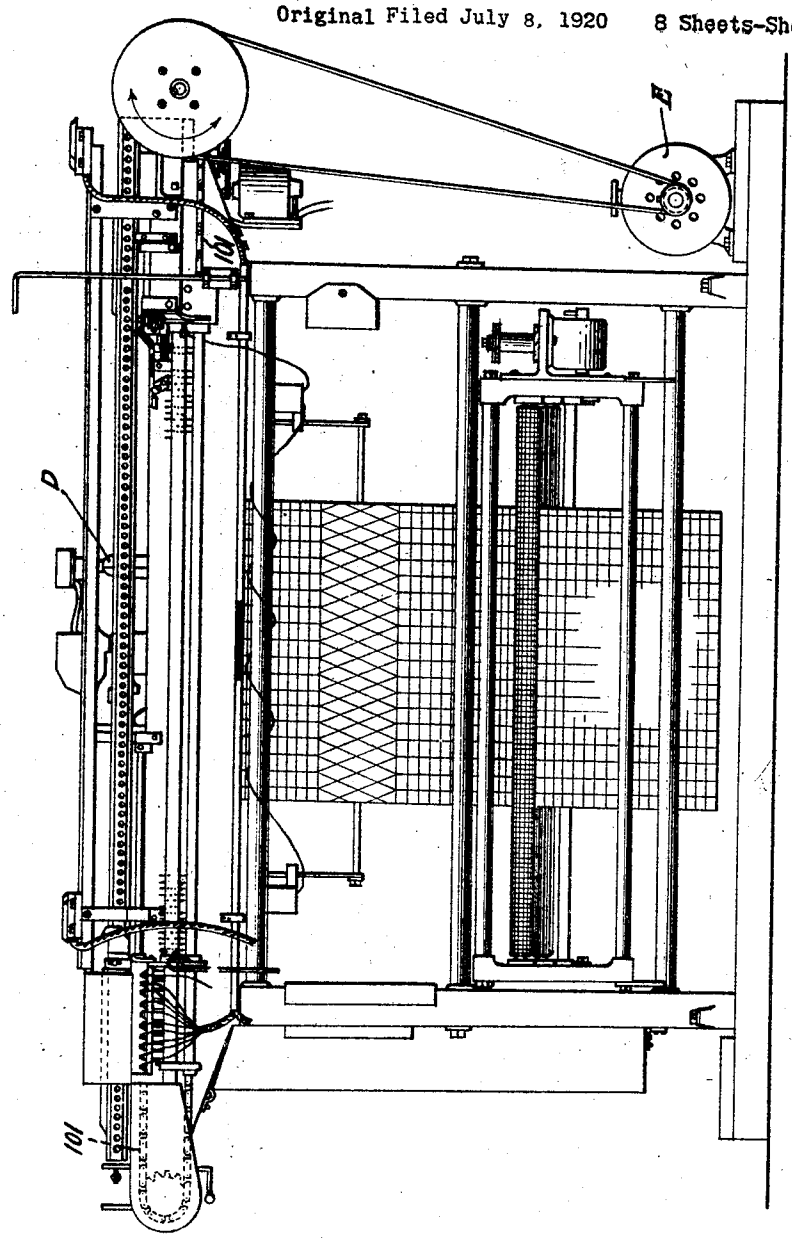


Fig. 2

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CAM MECHANISM FOR KNITTING MACHINES

Original Filed July 8, 1920 8 Sheets-Sheet 3

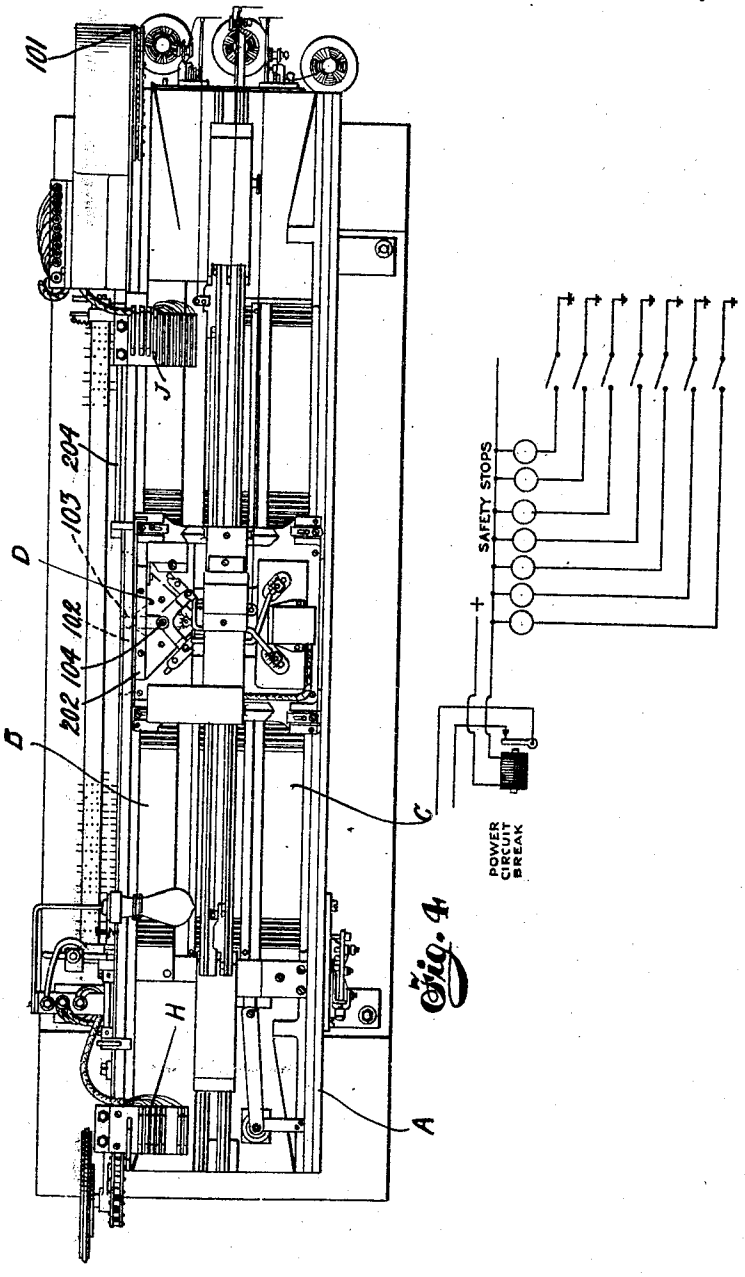


Fig. 3

Fig. 4

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CAM MECHANISM FOR KNITTING MACHINES.

Original Filed July 8, 1920 8 Sheets-Sheet 4

Fig. 6

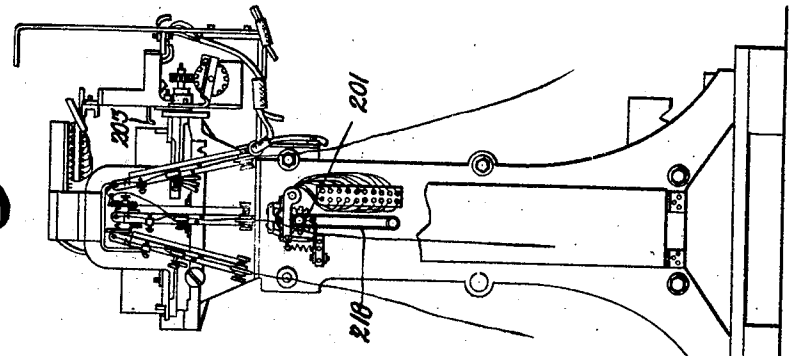
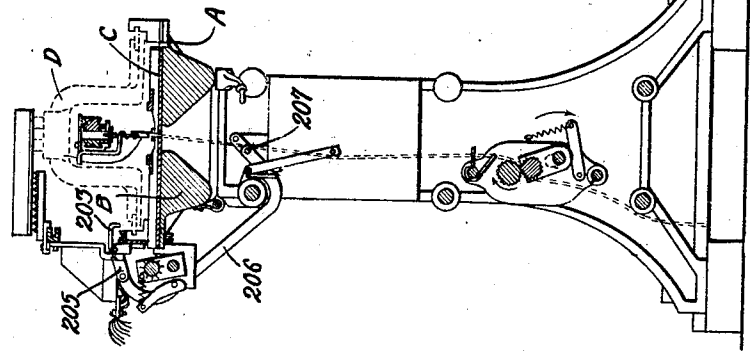


Fig. 5



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CAM MECHANISM FOR KNITTING MACHINES

Original Filed July 8, 1920 8 Sheets-Sheet 5

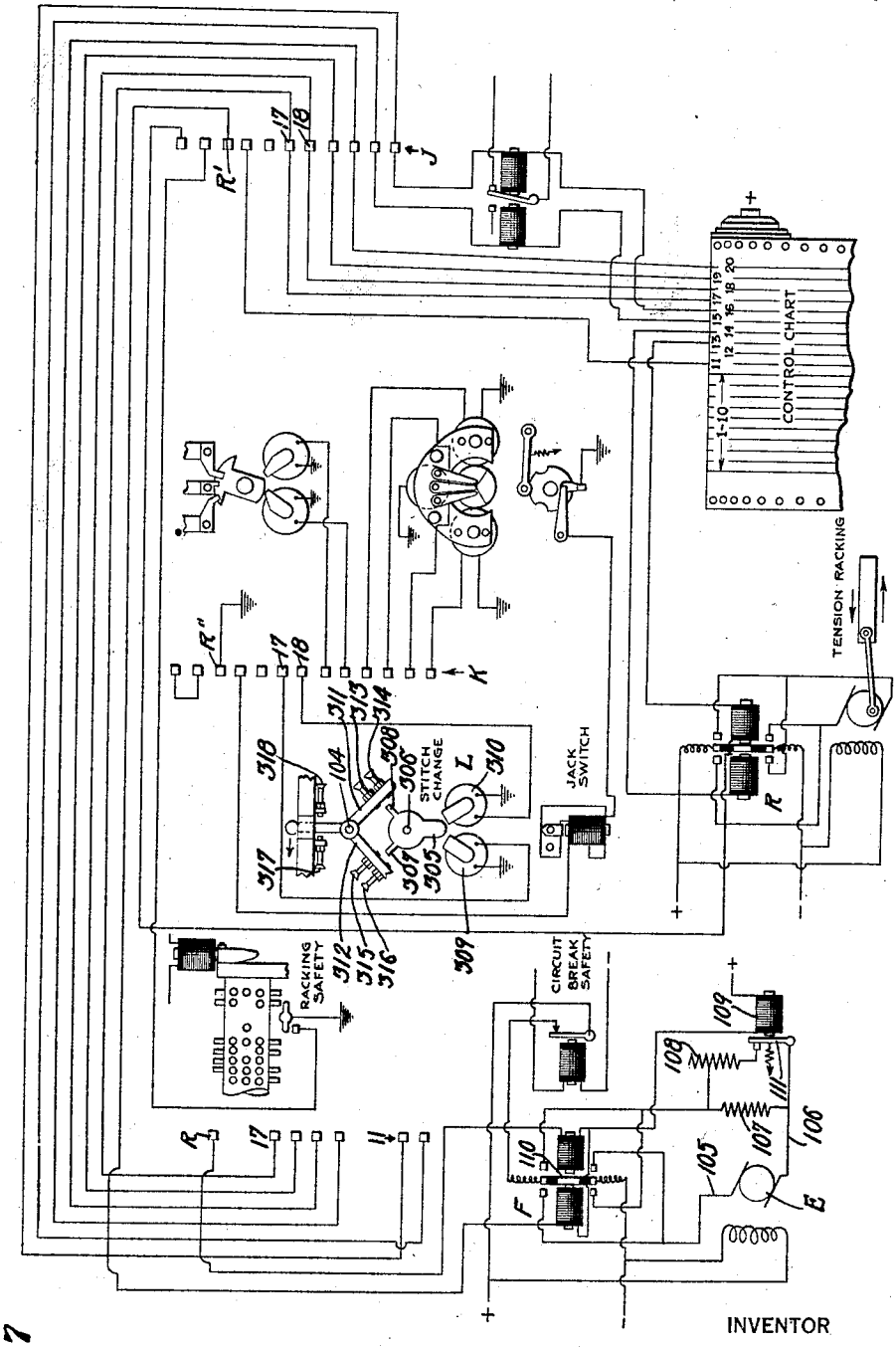


Fig. 7

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CAM MECHANISM FOR KNITTING MACHINES

Original Filed July 8, 1920 8 Sheets-Sheet 6

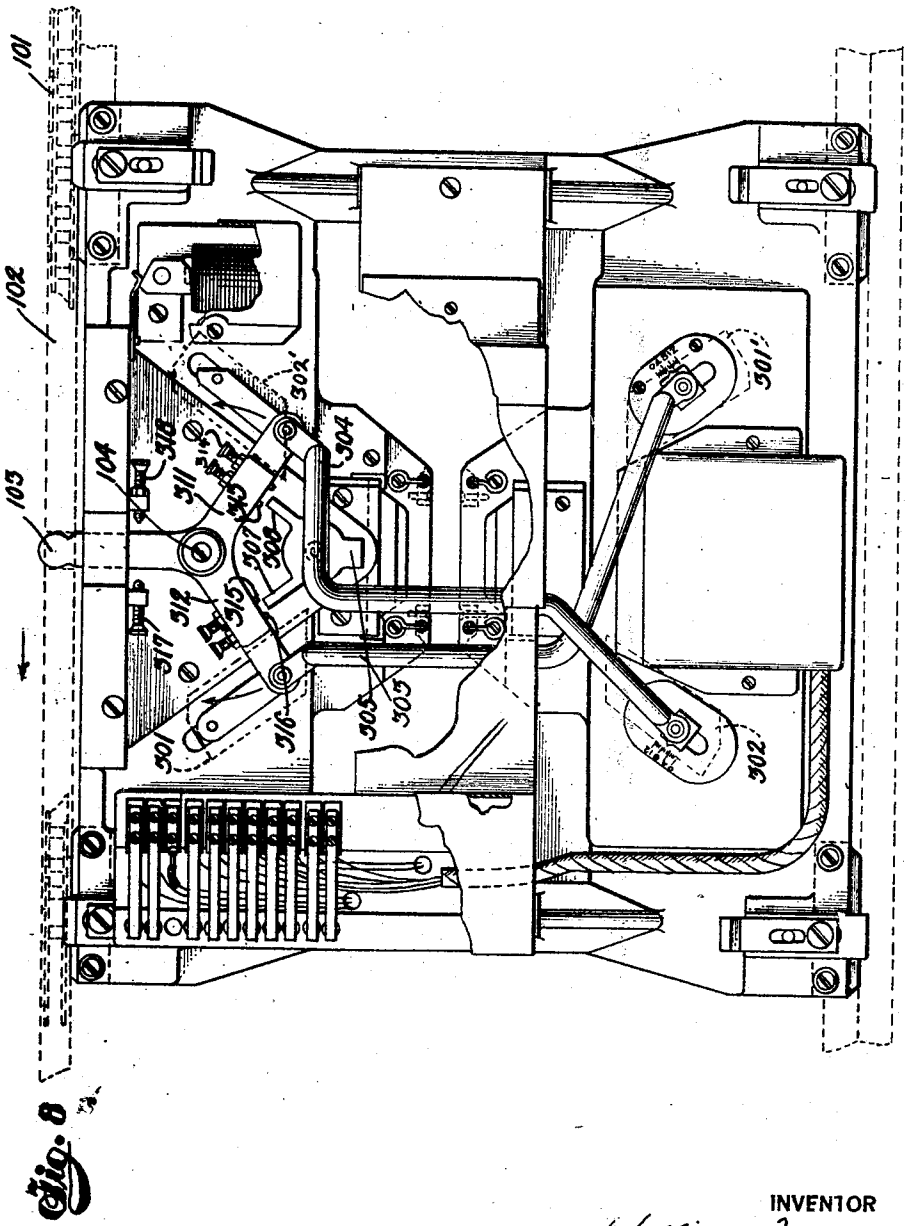


Fig. 8

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CAM MECHANISM FOR KNITTING MACHINES

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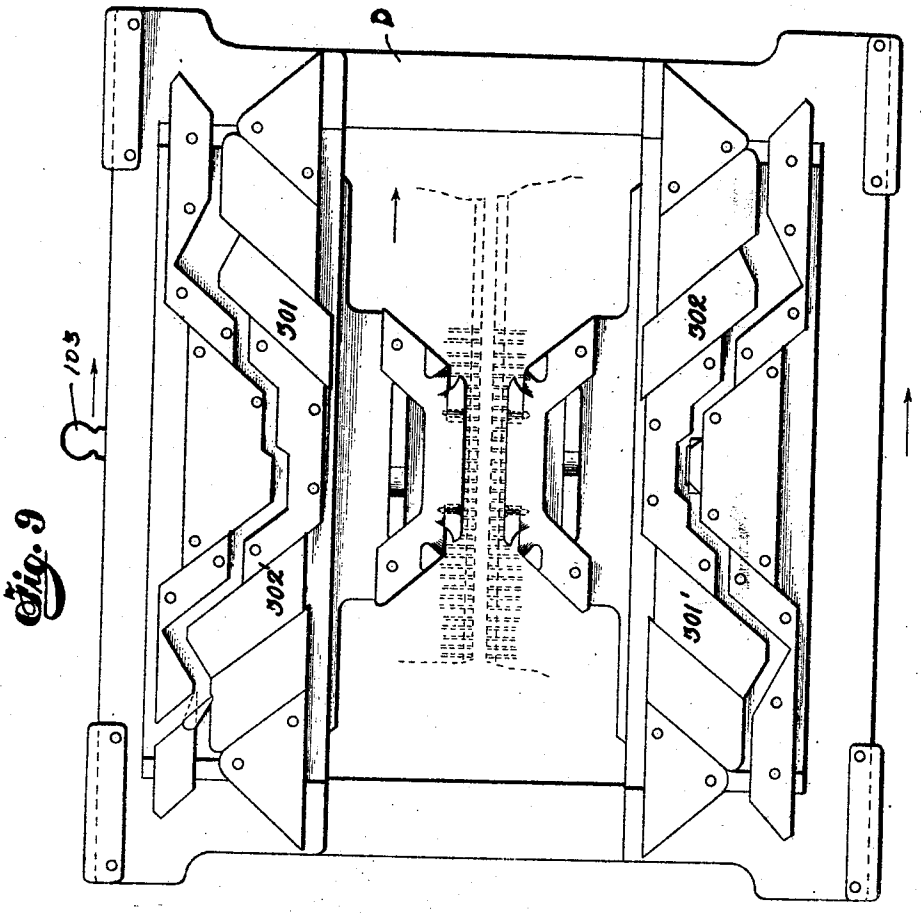


Fig. 9

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CAM MECHANISM FOR KNITTING MACHINES

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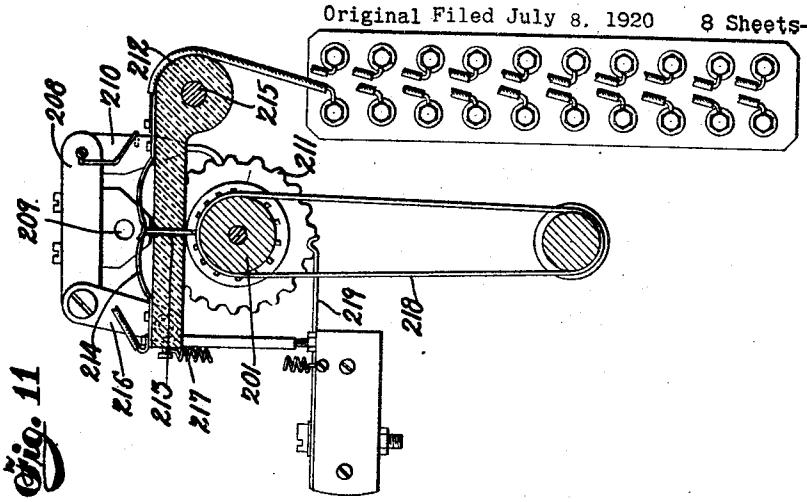


Fig. 11

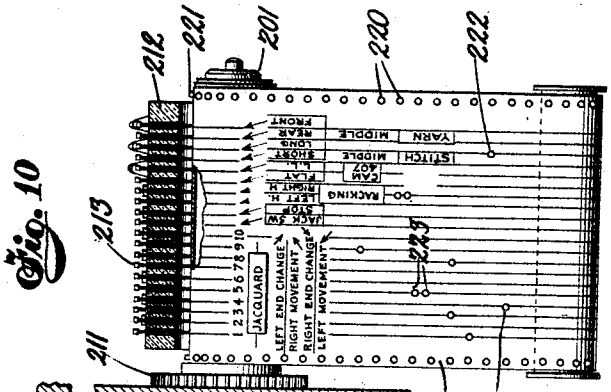


Fig. 10

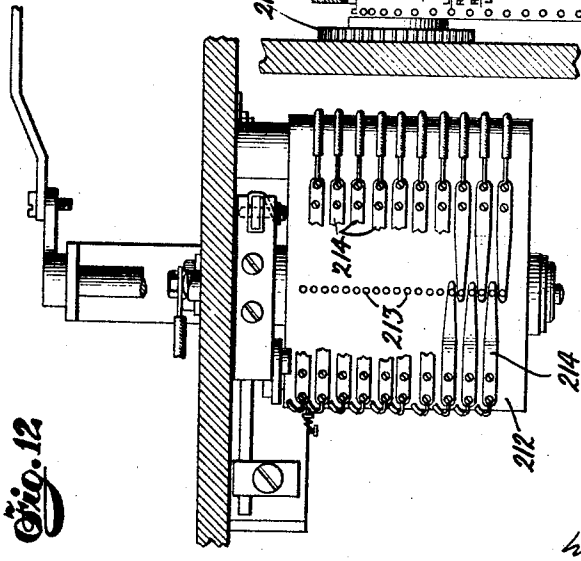


Fig. 12

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Patented Feb. 2, 1926. 1,571,766

UNITED STATES PATENT OFFICE.

WILLIAM FELS, OF ELBERTA, ALABAMA, ASSIGNOR TO MAX NYDEGGER, OF ELIZABETH, NEW JERSEY.

CAM MECHANISM FOR KNITTING MACHINES.

Orginal application filed July 8, 1920, Serial No. 394,678. Divided and this application filed August 31, 1921, Serial No. 497,233. Renewed July 11, 1925.

To all whom it may concern:

Be it known that I, WILLIAM FELS, a citizen of Austria, residing in Elberta, county of Baldwin, and State of Alabama, have invented an Improvement in Cam Mechanism for Knitting Machines, of which the following is a specification.

The present invention relates to an improvement in knitting machines, and more particularly to mechanism for controlling the stitch length. One object has been to provide a machine which shall be fully or partly automatic and at the same time of relatively simple construction with a minimum of mechanically controlled and actuated parts. A further object has been to provide relatively simple means for preventing injury to the machine in case of careless or erroneous operation.

It is known that knitting machines, automatic in varying degrees, have been devised but these machines are usually of complicated design and involve a multiplicity of mechanical movements which not only make the machine expensive to manufacture, but also cause frequent breakdowns and make it necessary for the operator to devote considerable attention to repairs and adjustments.

According to the present invention, I utilize substantially the well known framework and opposed front and rear needle beds of a flat links links machine, although I do not intend to limit the application of the present invention to machines of this type, it being contemplated that the same or similar principles of operation may be applied to other types of knitting machines with suitable modifications. In connection with the flat double bed machine, I use a reciprocating carriage preferably automatically reversible in direction and which carries with it suitable means for effecting changes in the positions of the jack actuating cams to produce corresponding changes in the stitch length. A complete operative knitting machine will also preferably include cam positioning means for controlling the action of the needle jacks to produce either flat or links links operation according to a predetermined order, and means for engaging and disengaging a plurality of thread carriers to vary the color scheme of the fabric according to a predetermined arrangement, although the device forming the subject matter of the present application will perform its functions independently of the operation of the aforesaid cam positioning means and thread carriers.

It is contemplated that stitch length change may be controlled automatically with other pattern changes if desired, and by electrical means through the instrumentality of a suitable pattern chart having perforations arranged in the path of contacts, said contacts forming part of electrical circuits connected with and controlling the operation of corresponding change mechanisms of the machine. Thus, the chart may be rotated around the periphery of a drum in such a way that perforations will occur in predetermined relative positions in the path of the contacts and at the proper time to effect corresponding changes in the operation of the machine and thus in the pattern of the fabric. The claims of the present application will, however, be limited to the invention embodied in the stitch length change mechanism as described and disclosed in my co-pending application, Serial No. 394,678 filed July 8, 1920, of which the present application is a division.

One embodiment of my invention is illustrated in the drawings accompanying the present specification, and in which

Figure 1 is a front elevation,

Figure 2, a rear elevation,

Figure 3, a top plan view,

Figure 4, a diagrammatic representation of a portion of the power circuit including circuit breaking stop means,

Figure 5, a transverse vertical section on the line 5—5 of Figure 3,

Figure 6, an end elevation showing the arrangement of the electrical pattern control chart,

Figure 7, a diagrammatic representation of a portion of the electrical pattern control system,

Figure 8, a top plan view of the reciprocating carriage with portions broken away to disclose details of construction,

Figure 9, a bottom plan view of the reciprocating carriage,

Figure 10, a detail fragmentary view of the pattern control chart and co-operating contacts,

Figure 11, a detail view partly in vertical

section of the pattern control chart and contact making and breaking mechanism associated therewith, and

Figure 12, a top view of the contact making and breaking mechanism associated with the pattern control chart.

Referring to the drawings, a machine embodying my invention may conveniently comprise a framework A supporting a fixed rear needle bed B and a front needle bed C preferably slidable both longitudinally and laterally (Figure 3). A reciprocating carriage or carrier D is arranged above the needle beds B and C, said carriage being driven by any suitable means such as a motor E operatively connected to a drive chain 101, said chain having a slotted member 102 adapted to receive and engage the free end 103 of a lever pivotally mounted on the carriage at 104 (Figures 3 and 8). As shown more clearly in Figures 1 and 2, the chain 101 is mounted on sprockets arranged at opposite ends of the machine, said sprockets being driven by a belt or other connection with the motor E. Means are provided for periodically reversing the direction of the current through the armature of the motor thus reversing the direction of the chain 101 which is in effect a reciprocating carrier or carriage actuating means. To accomplish this reversing operation automatically, a reversing switch indicated at F in Figure 7 of the drawings, is interposed in the power circuit, said switch being controlled by a double relay, the opposed magnets of which are alternately energized at the end of each run of the carriage, the circuit being closed through suitable contacts mounted on the framework of the machine and on the carriage respectively. However, before reversing the current in the armature of the motor, it is desirable to reduce the current or otherwise impede the movement of the carriage so as to avoid harmful impact thereof at the ends of its course. As shown in Figure 7, the motor circuit includes the conductors 105 and 106, the latter of which contains a resistance 107 and also a parallel resistance or rheostat 108. Thus, to increase the resistance in the conductor 106, the rheostat 108 may be periodically cut out. This is conveniently accomplished by means of a relay including a magnet 109, said magnet being in circuit with both magnets of the double relay F and also with the fixed contact R at one end of the machine, an adjustable contact R′ at the opposite end of the machine, and a movable circuit closing contact R″ mounted on the carriage D. For practical purposes, the magnet 109 and the double relay may operate substantially simultaneously. However, the action of the double relay may be effectively delayed by making the bar 110 thereof heavier than the bar 111. Thus, the current in the motor E will be reduced either simultaneously with or just before the change of direction of the current therein. Obviously, although I have described an automatically reciprocating drive for the carriage, any other suitable means for oscillating the carriage may be employed.

In addition to the automatic features associated with the reversing mechanism, I have also provided automatic means for controlling and actuating in predetermined succession those parts of the device which operate more particularly to form the fabric and to govern the character of the pattern thereof. This automatic control is effected through a combination of electrical and mechanical arrangements which are measurably simpler than those commonly untilized for a similar purpose in the knitting art and, at the same time effect a highly desirable uniformity and certainty of operation. The control apparatus, according to my invention, co-operates with the driving mechanism in such a manner that the necessary changes of certain parts are effected at the proper time to secure the desired design of fabric and also to prevent injury to the machine, the latter result being accomplished through the instrumentality of suitable safety devices. The general scheme of control includes a system of circuits each having one set of contacts which engage according to a predetermined arrangement, so that no change is effected unless both sets of contacts are in engagement simultaneously. Referring to Figures 3 and 7 of the drawings, the periodically operating contacts are represented at H, J and K, the contacts H being fixed at one end of the machine, the contacts J being slidably mounted at the other end of the machine, so that the length of stroke of the carriage may be varied, and the contacts K being mounted on the carriage to reciprocate therewith. Thus, some of the contacts K engage all of the contacts H at each stroke toward the left end of the machine, while some of the contacts K engage all of the contacts J at each stroke toward the right end of the machine. All of the contacts H and J are in circuit with a rotating drum 201, the details of which are more clearly disclosed in Figures 10 to 12 inclusive. Intermittent movement is imparted to the drum 201 by suitable means connected with the reciprocating carriage and operated thereby. Thus, the carriage is provided with an upwardly projecting cam shaped member 202 (Figure 3) which moves in the path of a lever 203 (Figures 5 and 6) and deflects one end of said lever upwardly. The lever 203 is securely fastened to a rod 204 (Figure 3) journaled in the framework of the machine and having a lever arm 205 secured at one end. A link 206 pivoted at 207 imparts a rocking motion to a pawl carrier 208 pivotally mounted at 209 (Figure 11). A spring

pressed pawl 210 engages a ratchet 211 which is operatively connected to the drum 201 and imparts intermittent movement to said drum to the extent of one step during each stroke of the carriage. A contact carrier 212 is mounted adjacent to the drum 201 and is provided with a plurality of perforations adapted to accommodate plunger contacts 213 normally pressed toward the drum by means of springs 214. The carrier 212 is pivotally mounted at 215 and is connected to the pawl carrier 208 by means of a link 216. A spring 217 may be provided to hold the contact carrier normally in position to permit the plunger contacts 213 to engage the peripheral surface of the drum 201 or, when in operation, the surface of a pattern chart 218 arranged to cover the surface of said drum. A yielding detent 219 engages the ratchet 211 to prevent lost motion. As indicated in Figure 10, the pattern chart 218 is provided with perforations 220 which receive corresponding sprocket projections 221 extending from the peripheral surface of the drum 201. The surface of the chart may be provided with transverse and longitudinal markings by which the pattern controlling perforations 222 and 223 may be more readily located and identified as to function. In the embodiment of my invention illustrated in the drawings, the pattern chart will move twice between each two of the perforations 220. In other words, the pattern chart will travel a distance equal to the distance between two perforations 220 during a complete oscillation of the carriage D, but the movement will take place in two increments. Thus, a change perforation 222 occurring on the same transverse line with the perforations 220 will indicate a change to be effected at the end of a run of the carriage in one direction while a change perforation 223 indicates a change to be effected at the end of a run of the carriage in the opposite direction.

In operation, the plunger contacts 213 bear yieldingly against the surface of the pattern chart 218 and, as the perforations 222 and 223 come into register with said plunger contacts, the latter are permitted to extend through said perforations, thus, in each case, closing a circuit. This operation takes place intermediate the ends of the carriage runs so that, when the carriage reaches one end or the other of its course, one or more changes will take effect, depending upon the number of perforations through which the plungers 213 are properly projecting into contact with the drum 201. Referring to Figure 7, circuits 17 and 18 include magnets which cooperate with the stitch change mechanism to control the length of the stitch. The three positions herein provided for result in long, medium and short stitches, respectively.

The stitch change mechanism will be more clearly understood from an examination of Figures 8 and 9 taken in connection with Figure 7. As shown in Figures 8 and 9, two pairs of stitch forming cams 301 and 302′ and 301′ and 302 respectively are slidably mounted in the carriage D, the first mentioned or rear pair operating the needles in the rear bed and the other or front pair operating those in the front bed, the rear cam 301 and the diagonally opposed front cam 301′ being connected by means of a suitable connecting rod 303, and the rear cam 302′ and the diagonally opposed front cam 302 being connected by a suitable connecting rod 304 so that cam positioning mechanism operating for example on the rear cams may also simultaneously position the front cams. In Figure 9, the cams 301′ and 302′ are shown in stitch forming position and normally move to this position simultaneously when the carriage is traveling in the direction indicated by the arrow. At the same time, the then forward cams 301 and 302 are withdrawn out of the path of the jack butts. The purpose of the stitch change control mechanism is to determine the extent to which the stitch forming cams in each movement of the carriage will extend away from the median line between the needle beds. In other words, the farther the operative end of the cams is extended from said median line, the greater will be the extent of displacement of the needle actuating jacks and therefore the longer the stitch made thereby. Ordinarily, a variation of three steps will be sufficient corresponding to long, short and medium stitches. In accordance with the present invention, the electrical control system hereinabove referred to operates to automatically select a position for a stop member which serves to limit the movement of cam moving means. Thus, as shown in Figure 7, said selecting apparatus is illustrated at L and may include an armature having a projecting lug 305, said armature being pivotally mounted at 306 and being also provided with detents 307 and 308. The lug 305 lies adjacent to the ends of the cores of magnets 309 and 310. The lever which is pivoted at 104 and engages the drive chain 101 to move the carriage back and forth is also provided with arms 311 and 312 which are in turn pivotally connected with the cams 302′ and 301, respectively, as shown in Figure 8. The arm 311 is provided with adjustable stops 313 and 314. The arm 312 is similarly provided with adjustable stops 315 and 316. Another pair of adjustable stops 317 and 318 may be mounted in suitable brackets on the carriage one at either side of the lever 103. Thus, if the magnet 309 is energized just prior to a movement of the carriage in the direction of the arrow (Figure 7) by closing the circuit 17, Figure 7, through a suitable perforation

in the chart 218, Figure 10, the armature will be rotated and the detent 307 will be moved into position opposite the inner end of the adjustable stop 315. At about the same time, the direction of the drive chain has been reversed and, as it moves in the direction of the arrow, it will carry with it the end 103 of the lever pivoted at 104 and the lever will thus be deflected a certain extent before it picks up the carriage to move it across the needle beds. However, the extent of deflection is limited by the interposition of the detent 307 in the path of adjustable stops provided for the purpose.

In the illustrative case under consideration, when the lever is deflected, the inner end of stop 315 will engage the end of detent 307. In moving to this position the arms 311 and 312 actuate cam connecting rods 304 and 303, respectively, by which cams 302 and 301 will have been withdrawn from operative jack engaging position, while cams 301′ and 302′ will have been moved to stitch forming position. By energizing the same magnet prior to movement of the carriage in the opposite direction, detent 308 will be positioned to intercept stop 314 when the lever arm is deflected and the cams will therefore be positioned to form a stitch of different length from that previously made. Where both magnets are energized simultaneously, the detents 307 and 308 will take a position to engage the lever arms 311 and 312 between the stops on said arms and the extent of movement of the cams will then depend upon the positioning of the adjustable stops 317 and 318. These will preferably be adjusted to move the cams sufficiently to form a stitch of maxium length for both directions of movement of the carriage. In the diagrammatic representation of the circuits controlling the stitch change mechanism hereinabove referred to, the circuits and contacts are identified by the numbers 17 and 18, both of which occur in all of the contact groups H, K and J.

The stitch change mechanism hereinabove described, considered in its relationship to the knitting machine, is believed to mark a distinct advance in the knitting machine art. One important advantage residing in this construction is the displacing of the inoperative or forward cams out of the path of the needle engaging jacks, thus eliminating the commonly experienced drag of the forward cams on the knitted fabric which has heretofore caused considerable difficulty in breakage of the yarn, particularly where the machines are operating on a very fine or relatively weak material.

I claim as my invention:

1. Cam mechanism for knitting machines having a cam carrier and reciprocating carrier actuating means, comprising cams slidably mounted on said carrier, and cam moving means including a rocking member secured to said cams and actuated by the reciprocating carrier actuating means.

2. Cam mechanism for knitting machines having a cam carrier and a reciprocating carrier actuating member, including cams slidably mounted on the carrier and a rocking connector between the carrier actuating member and cams on the carrier for moving said cams into operative stitch forming position.

3. Cam mechanism for knitting machines having a cam carrier and a reciprocating carrier actuating member, including stitch forming cams slidably mounted on the carrier, a lever pivotally mounted on the carrier and pivotally connected to the cams, and operatively connected with the carrier actuating member to move the cams into operative stitch forming position.

4. Cam mechanism for knitting machines comprising a cam carrier, cams slidably arranged thereon, a plurality of stops for determining different relative effective operating positions of said cams, means for selectively moving said stops to different predetermined positions on said carrier, and means for moving the cams simultaneously to the predetermined relative positions fixed by said stops.

5. Cam mechanism for knitting machines comprising a cam carrier, cams slidably arranged thereon, stop means for determining different relative effective operating positions of said cams, including a pivotally mounted detent, means for selectively moving the detent to different predetermined stop positions, and means for moving the cams simultaneously to the predetermined relative positions fixed by said detent.

6. Cam mechanism for knitting machines comprising a cam carrier, cams slidably arranged thereon, stop means for determining different relative effective operating positions of said cams including an armature having a detent, magnetically controlled means for moving said armature to present the detent in different effective cam arresting positions, and means for moving the cams simultaneously to the predetermined positions fixed by the detent on the armature.

7. Cam mechanism for knitting machines having a cam carrier and reciprocating carrier actuating means, comprising cams slidably mounted on said carrier, and cam moving means including a rocking member secured to said cams and actuated by the reciprocating carrier actuating means, and manually adjustable stop means for limiting the extent of deflecting of the rocking member.

8. Cam mechanism for knitting machines having a cam carrier and reciprocating carrier actuating means, comprising cams slid-

ably mounted on said carrier, and cam moving means including a rocking member secured to said cams and actuated by the reciprocating carrier actuating means, and manually adjustable stop means comprising a movable member mounted on the carrier in the path of the rocking member to limit the extent of deflection of said rocking member.

9. Cam mechanism for knitting machines having a cam carrier and reciprocating carrier actuating means, comprising cams slidably mounted on said carrier, and cam moving means including a rocking member secured to said cams and actuated by the reciprocating carrier actuating means, and adjustable stop means interposed in the path of said rocking member to determine the extent of deflection thereof.

10. Cam mechanism for knitting machines comprising a cam carrier, cams slidably arranged thereon, a plurality of stops for determining different relative effective operating positions of said cams, means for selectively moving said stops to different predetermined positions on said carrier, and means for moving the cams simultaneously to the predetermined relative positions fixed by said stops, and manually adjustable members operative between the cam moving means and the stops and cooperating with said stops to permit more accurate adjustment of the extent of movement of said cam moving means.

11. Cam mechanism for knitting machines comprising a cam carrier, cams slidably mounted thereon, a rotatable armature having a plurality of spaced stops, means for moving said armature to effectively present the stops in predetermined relative positions and means interposed between said cams and said stops to engage the stops and retain the cams in predetermined relative positions.

12. Cam mechanism for knitting machines comprising a cam carrier, reciprocating carrier actuating means, cams slidably mounted on the carrier, a rotatable stop member having spaced stop portions, means for rotating said stop member to present the stop portions in different effective cam arresting positions and means actuated by the reciprocating carrier for moving said cams and cooperating with said stop portions to retain the cams in different predetermined positions.

13. In a knitting machine, the combination of a cam carrier, stitch forming cams slidably mounted thereon, a cam actuating lever pivoted on the carrier, and stop means adapted to engage different portions of the lever, said means comprising a rotatable armature having spaced lever engaging portions, magnetic armature moving means in operative relation thereto and means for energizing said magnetic means including an electrical circuit and means on the carrier for automatically closing said circuit.

14. In a knitting machine, the combination of a cam carrier, stitch forming cams slidably mounted thereon, a cam actuating lever operatively connected to the cams, a plurality of cam positioning stops operatively arranged with respect to the lever, and electrically actuated means on the carrier for selectively positioning the stops.

15. In a knitting machine, the combination of a cam carrier, stitch forming cams slidably mounted thereon, a cam actuating lever operatively connected to the cams, a plurality of cam positioning stops operatively arranged with respect to the lever, and electrically actuated means operatively connected with the carrier for selectively positioning the stops.

In testimony whereof, I have signed my name to this specification this 13th day of July 1921.

WILLIAM FELS.