Aug. 20, 1935. A. GEE 2,011,577

LACE MECHANISM FOR FLAT KNITTING MACHINES

Filed March 25, 1931 3 Sheets-Sheet 1

FIG. I.

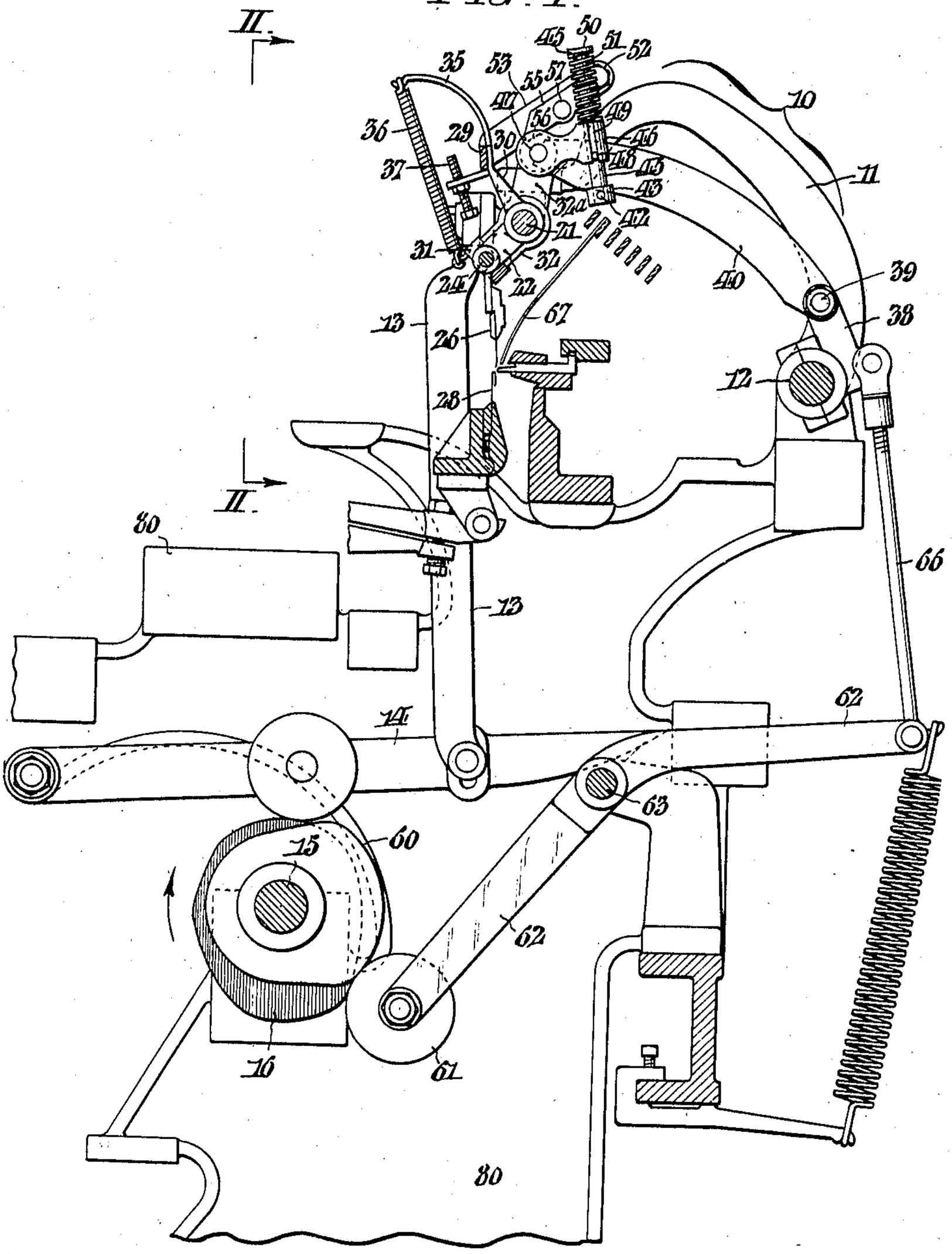

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FIG. II.

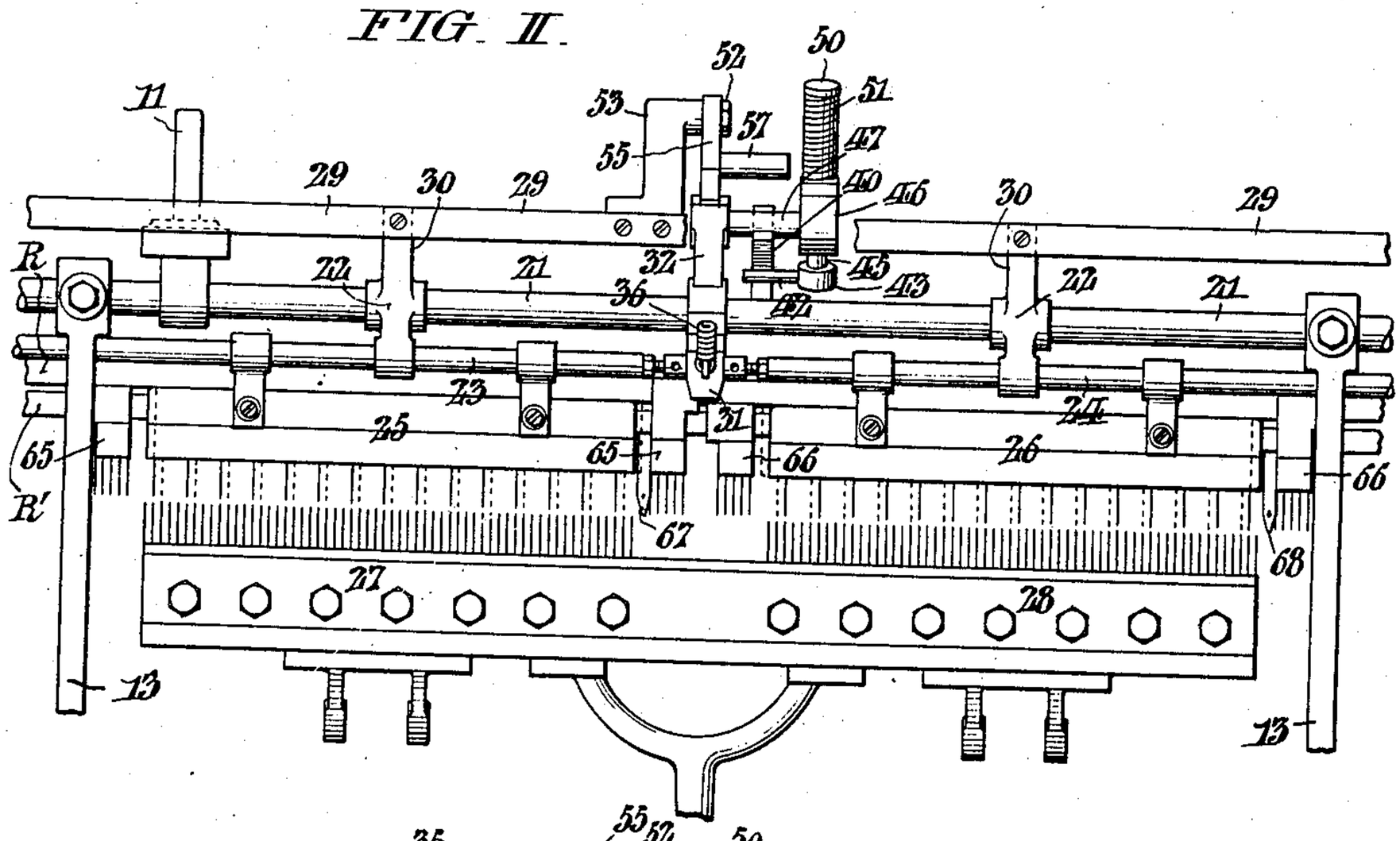

FIG. III.

FIG. VII.

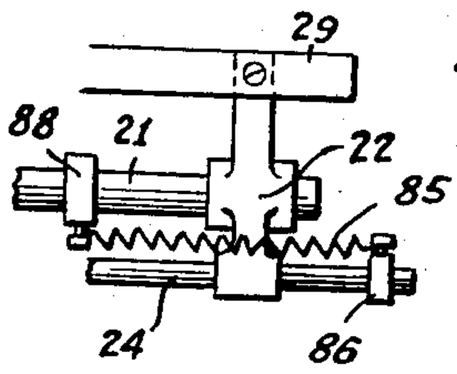

FIG. IV.

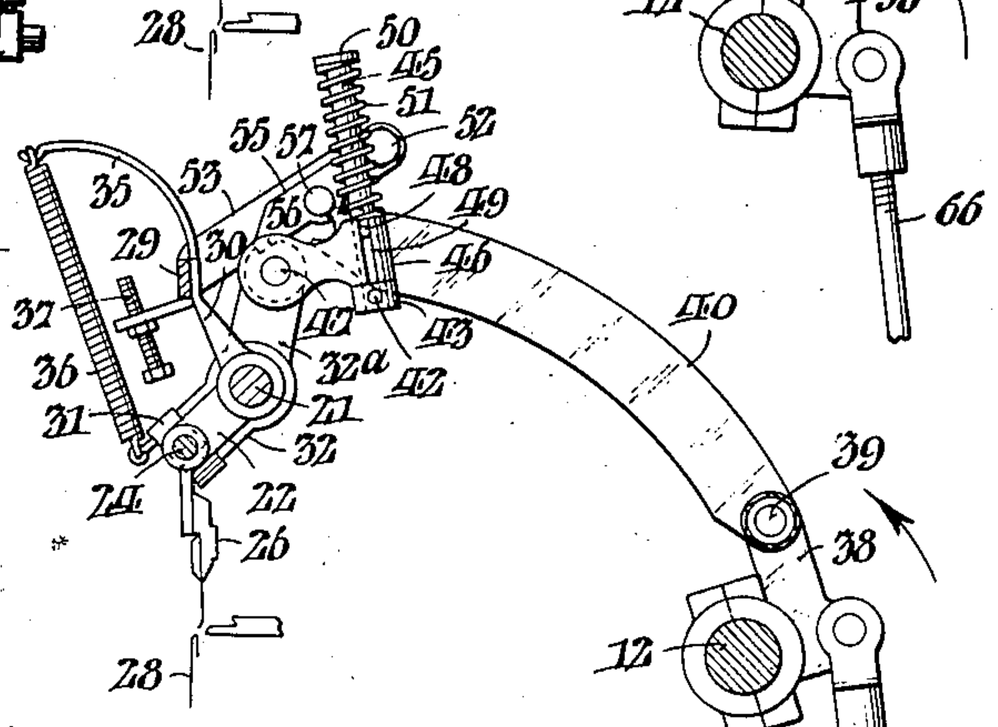

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FIG. V.

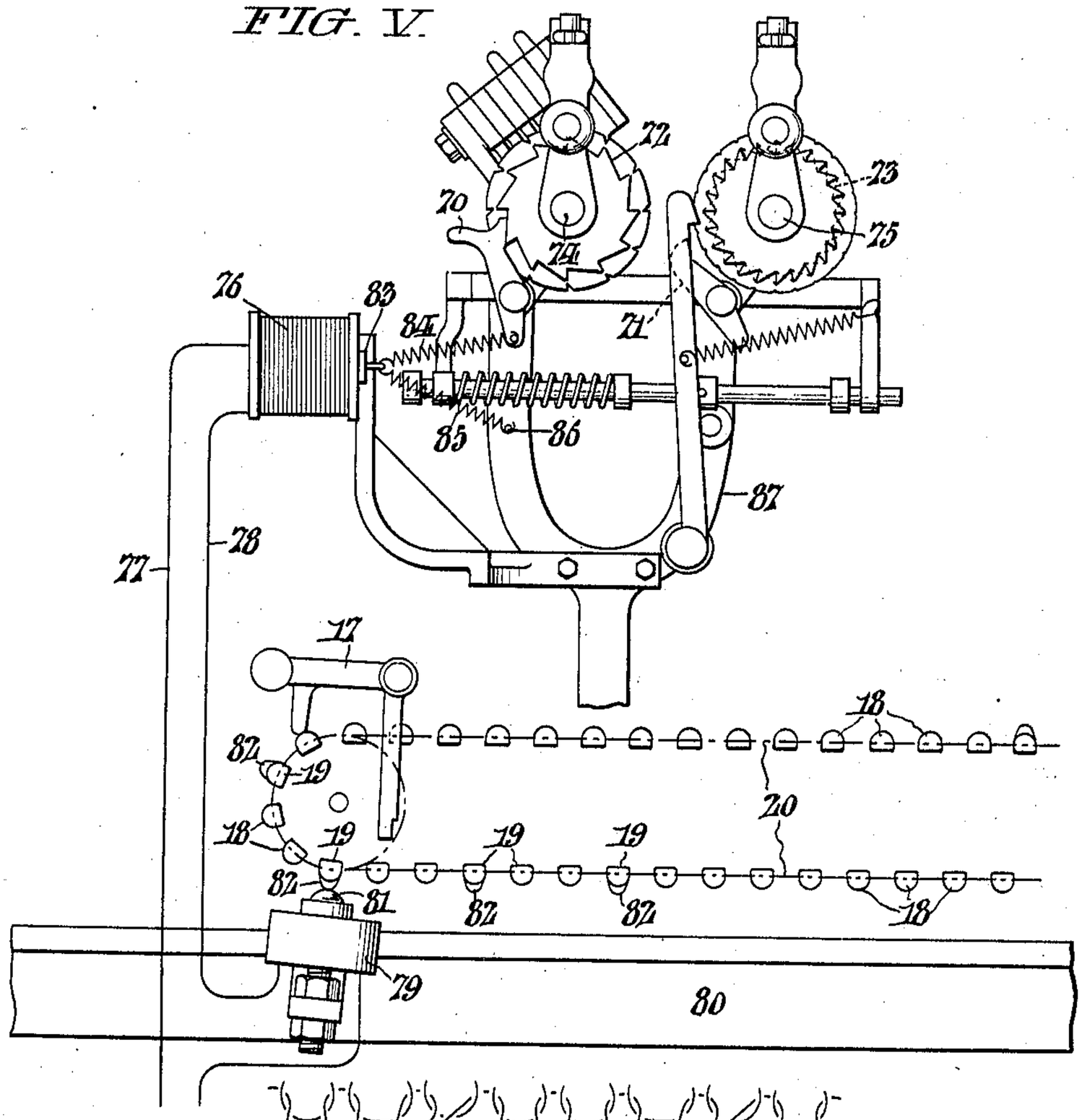
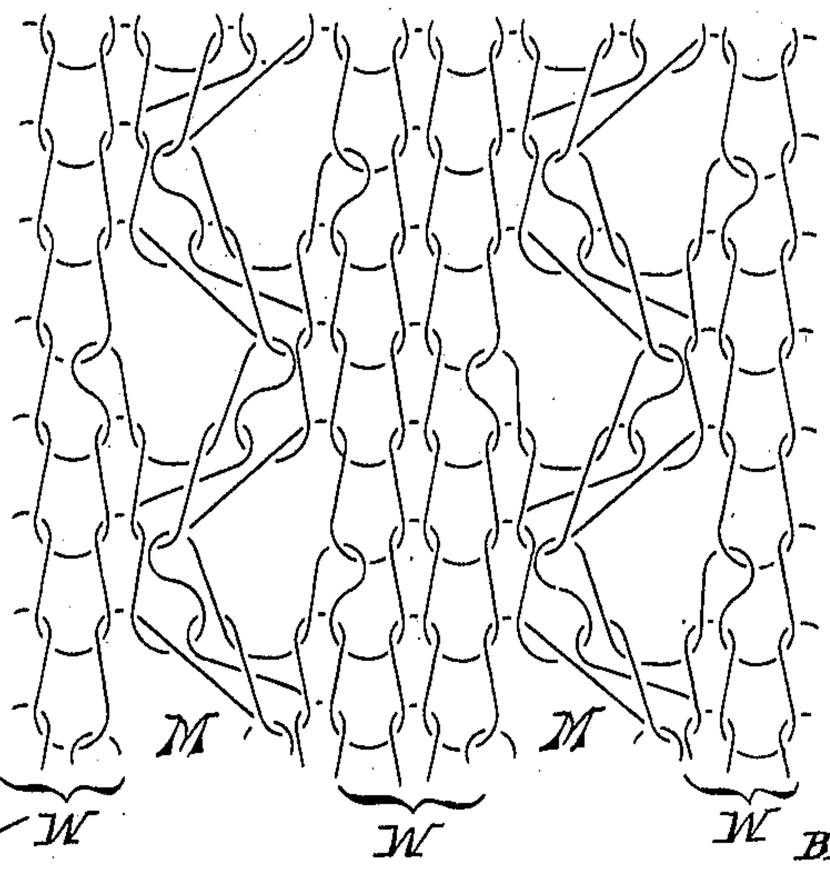


FIG. VI.



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UNITED STATES PATENT OFFICE

2,011,577

LACE MECHANISM FOR FLAT KNITTING MACHINES

Albert Gee, Elkins Park, Pa.

Application March 25, 1931, Serial No. 525,147

7 Claims. (Cl. 66—96)

This invention relates to flat knitting machines; and it has reference more particularly to flat knitting machines of the "cotton" type employed in the manufacture of full fashioned stockings.

The main object of my invention is to enable production of open mesh or lace effects of various designs incident to the knitting of stocking blanks on full fashioned knitting machines, more rapidly and economically than possible with the special complicated mechanisms heretofore designed for the purpose.

The foregoing desiderata I attain as hereinafter fully set forth through provision of simple and inexpensive means whereby the picot or ravel stop mechanism, with which modern full fashioned knitting machines are ordinarily equipped, is converted into mechanism suitable to the formation of lace effects of different designs or patterns; and through provisions, likewise simple and inexpensive, in connection with the narrowing heads of the knitting machines, whereby the said heads are actuated to predetermine concurrent shaping or fashioning of the stocking blanks with use of the yarn carriers alone.

Other objects and attendant advantages of this invention will be manifest from the detailed description following in coordination with the attached drawings, wherein Fig. I shows a cross section of a full fashioned knitting machine conveniently embodying my invention.

Fig. II is a fragmentary front elevation of the machine viewed as indicated by the arrows II—II in Fig. I.

Figs. III and IV are detail views illustrating the action of certain parts provided for modifying the operation of the picot attachment of the machine to determine production of lace effects in accordance with my invention.

Fig. V is a fragmentary diagrammatic view showing one of the narrowing heads of the machine and the special provisions whereby the functioning of the head is governed from the measuring chain.

Fig. VI is a conventional representation of one form of open mesh or lace work which may be economically produced through my invention; and

Fig. VII is a view of a detail of the machine, in plan.

With reference more particularly to Figs. I and II of these illustrations, the narrowing mechanism of the machine is comprehensively designated by the numeral 10. As usual, the curved arms 11 of this narrowing mechanism reach forwardly from a horizontal rock shaft 12 at the rear of the machine, to which they are secured; and said arms are coupled, by means of vertical links 13, with roller arms 14 which are subject to rotary cams on the cam shaft 15 of the machine, one of said cams being indicated at 16 in Fig. I. Through the medium of the parts just described, dipping and lifting motion is imparted to the narrowing mechanism 10 in a well known manner when the cam shaft 15 is shifted endwise to bring the cams 16 into the planes of the rollers on the arms 14. The means for shifting the cam shaft 15 is not illustrated except for the controlling bell crank member 17 shown in Fig. V, which member is actuated by lugs or buttons 18 and 19 on the measuring chain 20, also in a manner well understood in the art.

The numeral 21 (Figs. I and II) indicates the usual longitudinally extending rod which is supported from the ends of the curved arms 11 and whereto are secured suspension bearing members 22 that afford sliding support to a pair of axially aligned rods 23, 24. To these rods 23, 24 are respectively attached the picot combs 25 and 26 associated with the two needle sets 27, 28 in each knitting section of the machine. When not in use, the combs are swung upward about the rods 23, 24 so that their points rest against a flat horizontal bar 29 which overlies the rod 21 and which is secured by screws to upward extremities 30 of the bearing members 22. The usual wedge cam for shifting the rods 23, 24 concurrently in opposite directions against the action of springs 85 (see Fig. VII) is shown at 31 in Figs. I and II, it being secured to the end of a lever 32 fulcrumed for free rocking movement on the rod 21. The details of an illustrative form of the spring mounting is shown in Fig. VII, in which springs 85 are shown as tending to bring together collars 86 and 88 carried respectively by rods 21 and 24 at or near the ends thereof.

Ordinarily, incident to the formation of a picot edge or a ravel stop course in the fabric, the wedge cam is moved into action but once to effect shifting of the combs 25, 26 for transfer of fabric loops from alternate needles to adjacent needles of the two groups 27, 28 as required. To determine periodic shifting of the combs and resultant formation of open mesh or lace work as the stocking blanks are being knit on the machine, I make provisions for intermittently actuating the wedge cam as follows: Secured to the horizontal bar 29, is a bracket member 35 having an upwardly curved extremity which affords anchorage for one end of a tension spring

36 whereof the opposite end is attached to the lever 32 carrying the wedge cam 31. The spring 36 just referred to tends to draw the cam lever 32 into contact with a screw stop 37 adjustable in a horizontal extremity of the bracket member 35. Mounted with capacity for oscillatory movement on the horizontal shaft 12, is a motion translating element 38 whereto is pivotally connected at 39, a curved thrust arm 40 having a notch 41 in its outer end. Adjacent its outer end, the thrust arm 40 rests on a stud 42 projecting laterally from a collar 43 at the lower end of a vertical bolt 45. As shown, this bolt 45 is slidable in a guide 46 secured to a pin 47 that reaches horizontally from the upward extremity 32*a* of the wedge cam lever 32. The bolt 45 is prevented from turning in the guide 46 through engagement of a lug 48 thereon with a slot 49 in the said guide. At its upper end the bolt 45 has a collar 50 for abutment of a spring 51 which is compressed between the said collar and the top of the guide. Pivoted at 52 to a bracket arm 53 reaching rearwardly from the horizontal bar 29, is a gravity latch 55 which is adapted to engage a notch 56 in the upward extremity 32*a* of the wedge cam lever 32, and which has a pin 57 projecting from one side thereof. Oscillatory movement may be induced in the motion translating element 38 by any suitable means; but for convenience, I prefer to utilize other parts of the picot mechanism, to wit: the usual rotary cam 60 on the cam shaft 15 of the machine, which acts upon a roller 61 on the downward extremity of a spring influenced bell crank lever 62 fulcrumed on a fixed center 63, see Fig. I, the horizontal arm of the said bell crank lever being coupled, by means of an adjustable link rod 66', with the motion translating element 38.

In operation, as each of the buttons or lugs 18 or 19 of the measuring chain 20 actuates the bell crank element 17 (Fig. V), the cam shaft 15 of the machine is shifted endwise in the known manner so that the cams 16 and 60 thereon are moved into the plane of the rollers respectively on the levers 14 and 62. The cam 16 is the first to become active and causes dipping of the narrowing mechanism 10 so that the points of the combs 25 and 26 are brought into engagement with aligned needles of the groups 27, 28 to take the fabric loops from them. Then, as the narrowing mechanism 10 is lifted, through continued rotation of the cam 16, with the loops on the comb points, the cam 60 becomes active in causing forward movement of the thrust arm 40 through the interposed bell crank lever 62, the link 66, and the motion translating member 38, with attendant engagement of the notch at the end of said thrust arm with the stud 47 on the wedge cam lever 32. As a consequence, the lever 32 is swung counterclockwise about the rod 21, and the wedge cam 31 thereby moved downward from the position of Fig. III to spread the rods 23, 24 and the combs supported by them compressing and storing energy in the springs driving the rods to normal position. The points of the combs are brought into alignment with individual needles of the groups 27, 28 adjacent those needles from which the loops were previously taken. As the lever 32 is swung in the manner just explained, the gravity latch 55 drops into the notch in the lever 32 as in Fig. I, thereby to lock the same temporarily against movement. This action is followed immediately by a second dip of the narrowing mechanism 10 under the influence of the cam 16, so that the loops suspended on the points of the bars are placed on the above referred to adjacent needles of the groups 27, 28. Due to interlocking of the notched end of the thrust arm 40 with the stud 47 at the initiation of the forward stroke of the said arm, the spring 51 is compressed through lifting of the arm by the wedge cam lever 32 as the concerted movement continues. However, upon retirement of the thrust arm 40 from the lever 32 (now locked) and with completion of the current rotation of the cam shaft 15 to lift the narrowing mechanism 10, the spring 51, in relaxing, causes the notched end of the thrust arm to be lifted to the position shown in Fig. IV above the plane now occupied by the pin 47. During the succeeding actuation of the narrowing mechanism 10 brought about by the next in the series of buttons 18, 19 on the measuring chain 20, the combs 25, 26 (still spread as in Fig. II) are caused to descend so that their points take the loops from the needles to which the transfer was made during the first described operation. Just as the comb points clear the needles 27, 28, the thrust arm 40 is advanced by the action of the rotary cam 60, and, this time, engages the lug 57 on the latch 55, thereby dislodging the latter from the notch 56 in the lever 32. As a consequence, the lever 32 is swung clockwise by the spring 36 until it engages the stop 37, with attendant withdrawal of the wedge cam 31 from between the contiguous ends of the slide rods 23 which carry the point combs 25, 26. Through the energized springs (not shown) influencing the slide rods 23, 24, the combs 25, 26 are instantly moved toward each other to the positions shown in dotted lines in Fig. II. Then, during the succeeding dip of the narrowing mechanism 10, the fabric loops suspended from the comb points are transferred to the needles now in line with them. Thus by intermittent actuations of the narrowing mechanism in the manner explained, as the knitting proceeds, fabric loops are transferred first in one direction, and then in the other between adjacent needles of the groups 27, 28 with resultant formation of lace effects which may obviously be varied by differently spacing the points in the combs. The fabric shown for the purposes of exemplification in Fig. VI, is contingent upon use of a comb point for every fourth needle, with determination of open meshes M in alternation with double wales W of plain fabric loops. Further variations in the design may be had by increasing the spacing of the buttons 18, 19 on the measuring chain so that multiple courses of plain loops intervene open mesh fabric areas along the length of the fabric; or again by manipulation of the parts shown in Figs. III and IV as by throwing the pawl 55 out of action—all in a manner which will be readily understood by skilled knitters.

Due to employment of the picot combs 25, 26, it is impracticable to fashion the fabric with the usual narrowing combs 65, 66 which are shown in Fig. II as being shifted to inactive position beyond opposite ends of the needle banks. I therefore accomplish the fashioning of the calf portions of the stockings solely by gradually decreasing the throw of the carriers 67, 68 which serve the yarns to the needles 27, 28. This obviously necessitates a change in the operation of the narrowing heads whereof one is shown in end elevation in Fig. V. Accordingly, I dispense with the rod with which the machine is ordinarily equipped to connect the pawls 70, 71 that respectively cooperate with the ratchet wheels 72, 73 of the narrowing screws 74, 75 for the usual yarn

carrier stops, and the stops for controlling the throw of the narrowing comb rods R, R' (Fig. II). By reason of the omission just referred to, the pawl 71 for racking the stop screw 75 for the narrowing comb rods may be manually thrown to inactive position as in Fig. V, while the pawl 70 for racking the screw 74 for the yarn carrier rods may be maintained active. A further departure from usual practice will be noted in that I have provided a magnetic device in the form of a solenoid 76 for controlling the activity of the pawl 70, the said solenoid being in circuit with a suitable source of electric current (not shown) through conductors 77, 78. The solenoid 76 is controlled, in turn, by a switch 79 secured to the frame 80 of the machine and having its actuating plunger 81 projecting into the path of cam lugs 82 on the buttons 19 of the measuring chain 20. The operating connection between the pawl 70 and the armature 83 of the solenoid 76 may consist of a spring 84; and said armature is normally held retracted by another spring 85 engaged at one end with a fixed anchorage 86 on the pawl yoke 87 of the narrowing head. Normally, when relaxed, the spring 84 functions as a rigid link to withhold the pawl 70 from the ratchet wheel 72; but when expanded through pull of the armature 83 by the solenoid 76, the spring 84 serves to maintain the pawl 70 yieldingly engaged with the said ratchet wheel. With the described arrangement, it is evident that as each of the buttons 19 on the measuring chain 20 actuates the switch 79, the pawl 70 is moved into action by the solenoid 76 to rack the ratchet wheel 72 one tooth, the throw of the yarn carrier bars being thereby progressively reduced and the fabric correspondingly narrowed concurrently with the formation of lace work as hereinbefore explained. Preferably, I knit a length of plain fabric immediately below the welt of the stocking blank incident to which the initial narrowings may be made in the usual manner with both the screws 74, 75 of the narrowing head operating. Under this condition all that is required is to swing the picot combs 25, 26 up out of the way and to place the pawl 71 into active position for use of the usual narrowing combs 65, 66.

Having thus described my invention, I claim:

1. In a full fashioned knitting machine embodying a straight series of needles, narrowing mechanism, a point comb supported by the narrowing mechanism with capacity for endwise shifting to transfer fabric loops between adjacent needles incident to dipping and lifting of the narrowing mechanism, and a cam for so shifting the point comb in opposition to spring pressure, the said cam being secured to a rock lever; means for periodically actuating the rock lever to determine the formation of lace work in the fabric produced by the machine, including a spring effective to draw the lever aforesaid against a fixed stop with the cam retracted from the point comb, a latch to lock the lever against the action of the spring when the lever is swung to active position to effect shifting of the point comb, and a member for alternately swinging the lever and for tripping the latch.

2. In a full fashioned knitting machine embodying a straight series of needles, narrowing mechanism, a point comb supported by the narrowing mechanism with capacity for endwise shifting to transfer fabric loops between adjacent needles incident to dipping and lifting of the narrowing mechanism, and a cam for so shifting the point comb in opposition to spring pressure, the said cam being secured to a rock lever; means for periodically actuating the rock lever to determine the formation of lace work in the fabric produced by the machine, including a spring effective to draw the lever against a fixed stop with the cam retracted from the point comb, latch means to lock the lever against the action of its spring when swung into active position to effect shifting of the point comb, and a reciprocating thrust arm actuated by a rotary cam on the cam shaft of the machine to alternately swing the finger as aforesaid and trip the latch.

3. In a full fashioned knitting machine embodying a straight series of needles, narrowing mechanism, a point comb supported by the said mechanism with capacity for endwise shifting to transfer fabric loops between adjacent needles incident to dipping and lifting of the narrowing mechanism, a rock lever with a cam for so shifting the point comb in opposition to spring pressure, and a measuring chain for governing the various phases of the knitting; means for periodically actuating the rock lever to determine the formation of lace work in the fabric produced by the machine, including a spring effective to draw a lever against the fixed stop with the cam retracted from the point comb, a latch to lock the lever against the action of its spring when swung into active position to effect shifting of the point comb, and means governed by the measuring chain of the machine to alternately swing the lever as aforesaid and trip the latch.

4. In a full-fashioned knitting machine embodying a straight series of needles, narrowing mechanism, a point-comb supported by the narrowing mechanism with capacity for endwise shifting to transfer fabric loops between adjacent needles incident to dipping and lifting of the narrowing mechanism, and a cam for so shifting and retaining the point-comb in opposition to spring pressure, said cam being secured to a rock lever; means for actuating the rock lever to make the cam active at alternate intervals between sets of dipping-and-lifting movements of the point-comb to shift the comb and retain it shifted, and means to release the point-comb in the other intervals between the sets of dipping-and-lifting movements to make the spring pressure effect the transferring movement, thereby to determine the formation of lace-work in the fabric produced by the machine.

5. In flat-bed knitting machinery for the production of flat, knitted fabrics having laterally displaced loops therein, including a bank of needles for forming and interlocking yarn-loops in the formation of ordinary knitted fabric, a plurality of transfer points, a bar movable axially and carrying the points, means for effecting dipping-and-lifting movement of the bar, means for effecting movement of the bar to position the points normally in relation to predetermined needles, and a cam for movement into and out of engagement with the bar, said cam effecting movement of the bar to position the points against the action of the normal-positioning means; the machinery having means for latching the cam after it has been effective to move the bar against the action of the normal-positioning means, and means for releasing the latching means after the next actuation of the dipping-and-lifting means has brought the points into and out of engagement with the needles at which the latching means has located the points and

to which the points immediately previously transferred loops.

6. In flat-bed knitting machinery for the production of flat, knitted fabrics having laterally displaced loops therein, including a bank of needles for forming and interlocking yarn-loops in the formation of ordinary knitted fabric, a plurality of transfer points, a bar movable axially and carrying the points, means for effecting dipping-and-lifting movement of the bar, means for effecting movement of the bar to position the points normally in relation to predetermined needles, and a cam for movement into and out of engagement with the bar, said cam, when moved into engagement with the bar, effecting movement of the bar to position the points against the action of the normal-positioning means; the machinery having means for latching the cam after it has been moved into engagement with the bar to retain the bar in the position to which it has been moved, and means for releasing the latching means after the next actuation of the dipping-and-lifting means has brought the points into and out of engagement with the needles at which the latching means has located the points and to which the points immediately previously transferred loops.

7. In flat-bed knitting machinery for the production of flat, knitted fabrics having laterally displaced loops therein, including a bank of needles for forming and interlocking yarn-loops in the formation of ordinary knitted fabric, a pair of bars movable axially, a plurality of transfer points carried by each bar, the ends of the bars being positioned adjacent each other, means for effecting dipping-and-lifting movement of the bars, means for effecting movement of the bars to position the points normally in relation to predetermined needles, and a cam for movement into and out of engagement with the ends of the bars, said cam, when moved into engagement with the bar ends, effecting movement of the bar to position the points against the action of the normal-positioning means; the machinery having means for latching the cam after it has been moved into engagement with the bar ends to retain the bars in the position to which they have been moved, and means for releasing the latching means after the next actuation of the dipping-and-lifting means has brought the points into and out of engagement with the needles at which the latching means has located the points and to which the points immediately previously transferred loops.

ALBERT GEE.