

Oct. 21, 1930.

H. E. HOUSEMAN

1,779,237

MECHANISM FOR KNITTING PLATED FABRIC

Filed July 29, 1927

4 Sheets-Sheet 1

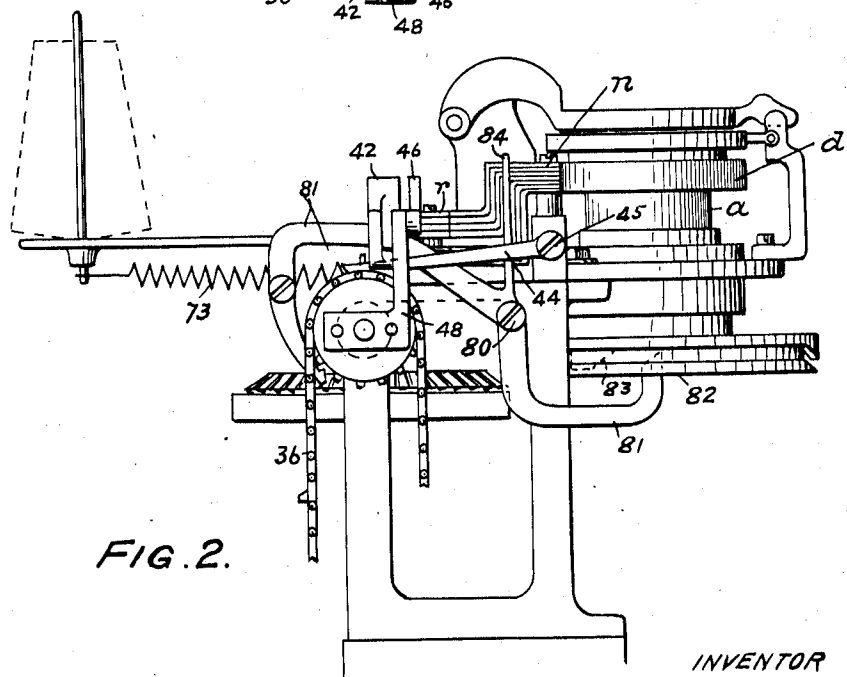
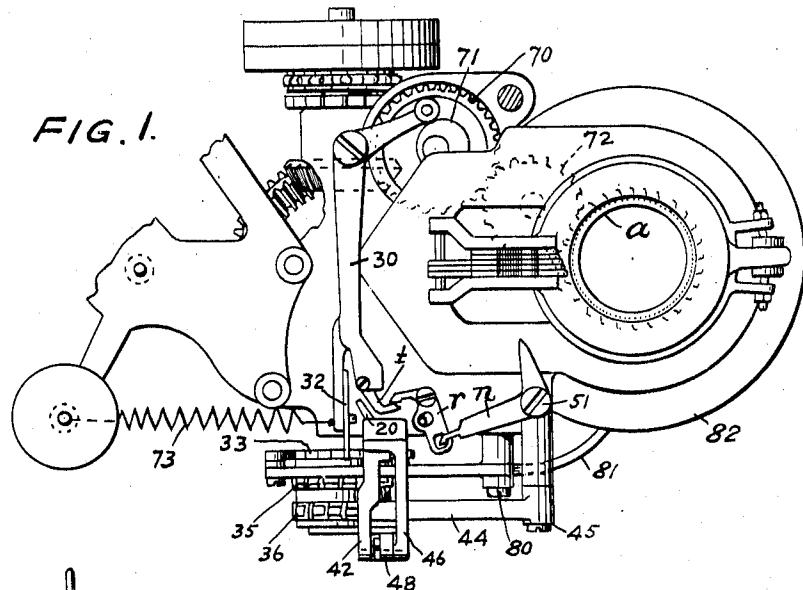


FIG. 2.

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WITNESS:

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Oct. 21, 1930.

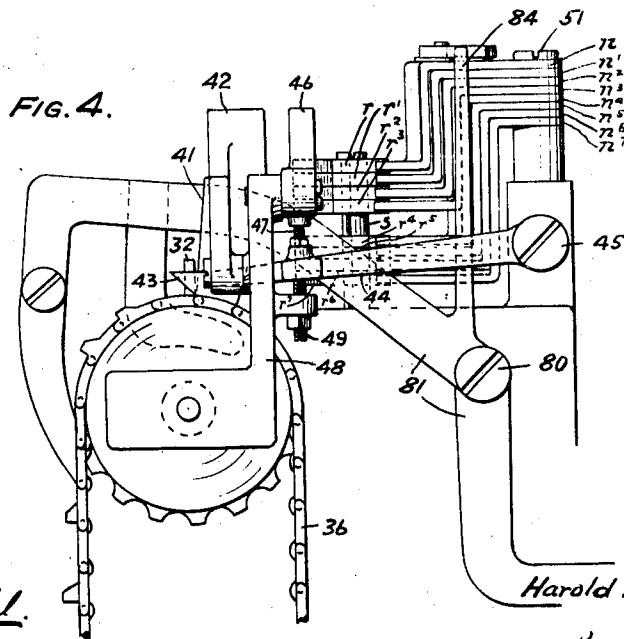
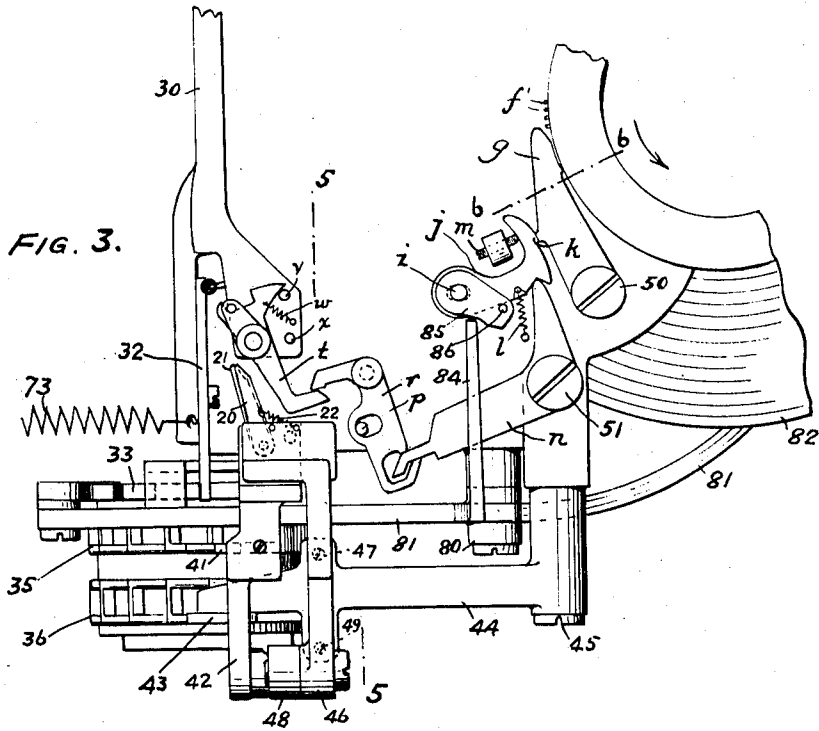
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MECHANISM FOR KNITTING PLATED FABRIC

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4 Sheets-Sheet 2



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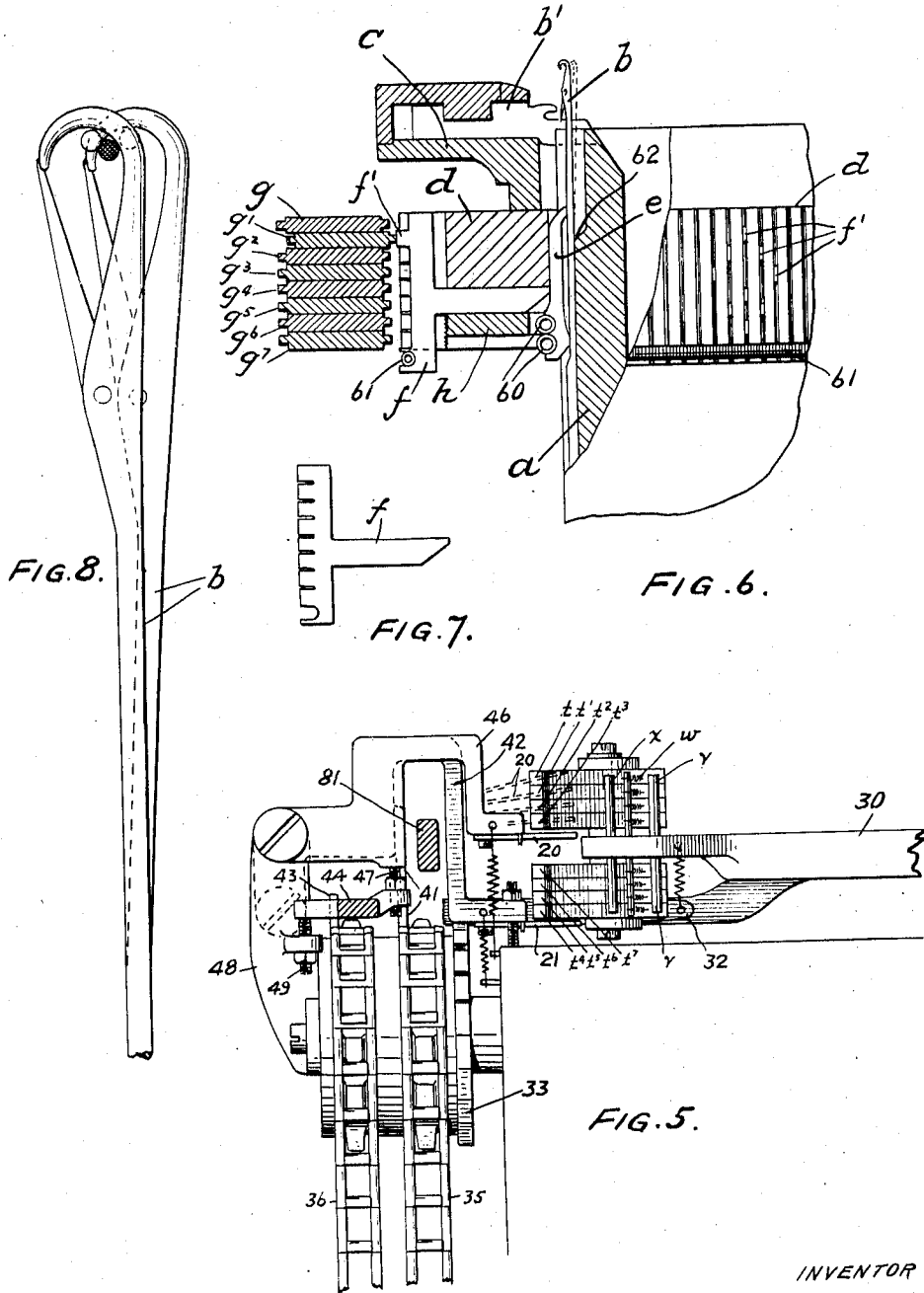
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MECHANISM FOR KNITTING PLATED FABRIC

Filed July 29, 1927

4 Sheets-Sheet 3



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1,779,237

MECHANISM FOR KNITTING PLATED FABRIC

Filed July 29, 1927

4 Sheets-Sheet 4

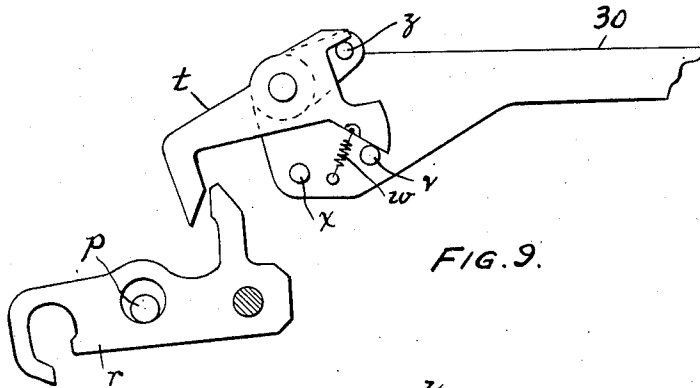


FIG. 9.

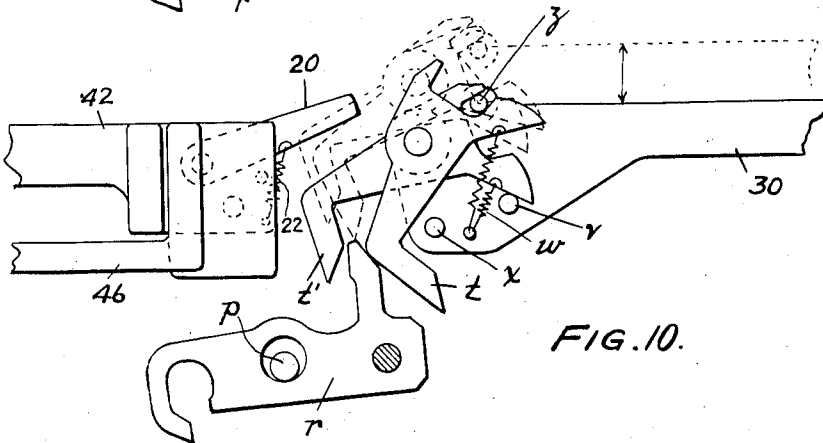


FIG. 10.

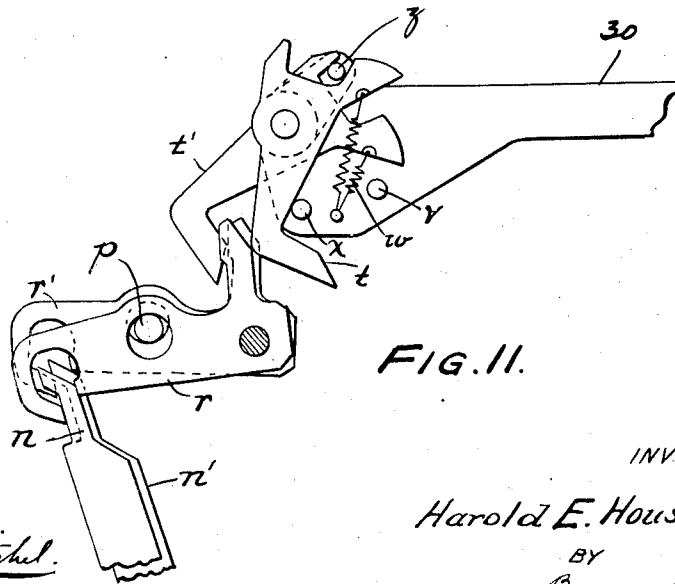


FIG. 11.

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UNITED STATES PATENT OFFICE

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MECHANISM FOR KNITTING PLATED FABRIC

Application filed July 29, 1927. Serial No. 209,382.

In an application filed by Wilbur L. Houseman, Serial No. 209,383, filed July 29, 1927, means are provided whereby certain needles may be selectively pushed back to effect the production of continuous or intermittent stripes or figured effects. Yarn is fed to a circle of needles in such relation as will cause the needles, when in normal position, to knit regular plated fabric. When selected needles are pushed back, the needles will knit the yarn in a reversed relationship and thus produce reverse plated fabric in the wales knit by such needles while they are pushed back.

The present invention comprises automatic pattern-controlled mechanism particularly adapted for actuating the mechanism set forth in the Wilbur L. Houseman application.

A preferred embodiment of my invention is shown in the accompanying drawings, in which—

Fig. 1 is a plan view of a knitting machine to which the invention has been applied, the figure embodying also a general view of some of the elements of my invention.

Fig. 2 is a side elevation of the parts shown in Fig. 1.

Fig. 3 is a plan view of that part of the machine that embodies my invention.

Fig. 4 is an end view of the mechanism shown in Fig. 3.

Fig. 5 is a section through Fig. 3 on the line 5—5.

Fig. 6 is a section on the line 6—6 of Fig. 3, showing a part of the needle cylinder and of the means for selectively pressing back needles, said means being set forth in said Wilbur L. Houseman application.

Fig. 7 is a detail view of one of the needle presser actuating jacks of Fig. 6.

Fig. 8 is a detail view of the upper ends of two needles, one in normal position to knit regular plated fabric and the other pressed back into position to knit reverse plated fabric.

Figs. 9, 10 and 11 are detail views, in different positions, of the lever mechanism constituting part of my invention.

I shall first describe the mechanism for

selectively pressing back needles devised by Wilbur L. Houseman and illustrated in Figs. 6, 7 and 8, and shall then describe the pattern-controlled means that I have devised for actuating said mechanism automatically.

Vertically slidable in slots of the revolving needle cylinder *a* are the needles *b* which are movable up and down in a normal knitting wave by cams not shown. Fastened to the needle cylinder is the sinker dial *c*, which carries the sinkers or web holders *b'*, which cooperate with the needles in the usual manner to form the stitches.

Below the sinker dial *c* is a slotted jack dial *d*, which is attached to the sinker dial. Pressers *e* are placed in the needle cylinder slots after the needles have been inserted and are held in place by the two spring bands 60. These pressers are so shaped that they bear against the needles at the extreme upper ends of the pressers and also at points opposite the spring bands 60. The needle cylinder slots are of greater than normal depth at their upper ends, forming shoulders 62. The needles are unsupported above these shoulders, which act as fulcrums when needles are pushed back by the upper ends of pressers *e*. The jack dial *d* has slots corresponding in number with the slots in the needle cylinder. At intervals and in groups in accordance with a pattern which is to be formed in the knitted fabric, jacks *f* are inserted in the dial slots. These jacks are held lightly in contact with their corresponding needle pressers *e* by a spring band 61.

A threaded clamp ring *h* holds the jacks in their proper vertical position. The jacks are formed with slots on their rear ends so that sections may be broken out in different places leaving butts *f'* which may be in any one of eight different vertical positions. If desired, there may be two or more butts on a jack. The one illustrated in Fig. 7 has butts in all eight positions, whereas the one shown in Fig. 6 has a butt in the second highest position.

The eight cams *g*, *g*¹, *g*², *g*³, *g*⁴, *g*⁵, *g*⁶, *g*⁷, do not revolve and may be moved into or out of the path of the butts of the jacks *f*, each of the eight cams being in alignment with one

of the corresponding eight butt locations on the jacks.

When one or more of the eight cams $g, g^1, g^2, g^3, g^4, g^5, g^6, g^7$, are moved and held in the path of the jacks having butts corresponding to the vertical positions of such cams, these jacks will be pushed inward and will in turn rock the corresponding pushers e , thereby springing the corresponding needles at the fulcrum point 62, causing their hooked ends to be set back out of line with the adjacent unpushed needles.

I shall now describe the mechanism which I have devised to selectively render the jack cams g, g^1 , etc., active or inactive to produce figured reverse plated effects.

In Fig. 3, these cams are shown pivoted on a stud 50. Pivoted on a stud i , which is on a bracket attached to the machine frame, are eight levers j , one for each of the cams g, g^1 , etc., and in vertical alignment with said cams. Springs l , one for each lever, tend to rock them in a clockwise direction, so that extensions k on these levers will ride upon similar extensions on the jack cams, rendering said cams active by pushing them toward the jack dial and thus in the path of butts on the jacks. Adjusting screws m , one for each lever, enable a fine adjustment of the pushing cams to be made so that needles will be sprung back just the proper distance. Levers j have slotted holes where they pivot on stud i so that they will move toward or from the jack cams when screws m are adjusted. The sides of these levers where they bear against screws m are curved so as to follow a true radius from stud i .

Pivoted on stud 51 in alignment with the eight levers j are eight stepped levers n, n^1 , etc., one for each lever j . When these levers n, n^1 , etc., are rocked in a clockwise direction, their corresponding levers j are moved in a counter-clockwise direction, whereby shoulders k disengage the projections on the corresponding jack cams g, g^1 , etc., thereby rendering said cams inoperative. When, however, levers n, n^1 , etc., are rocked in the opposite direction, the ends of levers n, n^1 , etc., fall into recesses in their corresponding levers j , thereby permitting springs l to function to render said levers j active to push corresponding jack cams into operative position.

From the foregoing, it will be seen that the swinging of levers n, n^1 , etc., in one direction or the other will determine whether corresponding levers j and jack cams shall be inoperative or operative. I shall now describe the means employed for positively moving the levers n, n^1 , etc.

Pivoted on a stud fastened to the frame of the machine are eight bell crank levers r, r^1 , etc., (see Figs. 3, 4, 9, 10, and 11). These levers are in two groups of four each, being spaced apart by a sleeve s (see Fig. 4), and

their long ends are curved to embrace each of the stepped levers n, n^1 , etc. As the ends of the levers n, n^1 , etc., are formed with upper and lower cam faces, levers r, r^1 , etc., when moved forward will slide up and beyond the upper cam faces and rock levers n, n^1 , etc., in a counter-clockwise direction and hold them in this position. When levers r, r^1 , etc., are moved in the opposite direction, levers n, n^1 , etc., will be moved in a clockwise direction, through the action of said levers r, r^1 , sliding along the lower cam surfaces of levers n, n^1 , etc.

The movement of the levers r, r^1 , etc., back and forth is limited by a pin p extending through aligning holes in the levers. Levers r, r^1 , etc., which, as before mentioned, consist of an upper set of four and a lower set of four, are operable respectively by eight levers t, t^1 , etc., which are also grouped in upper and lower sets of four each. These levers t, t^1 , etc., are pivoted between their ends on a lever 30, which is reciprocated back and forth, by means to be hereinafter described, as indicated by the double arrow, Fig. 10. Each lever t, t^1 , etc., is held, normally, in the inactive position shown in Fig. 9 against a stop v on lever 30 by means of a spring w . In Figs. 10 and 11, to avoid confusion, only two sets of levers n, n^1, r, r^1 , and t, t^1 are shown. In Figs. 4 and 5 the groups of these levers are illustrated.

Each of the levers t, t^1, t^2 and t^3 of the top group is operated by a selector 20, which is movable laterally, by means to be hereinafter described, and vertically as shown in dotted lines, Fig. 5, to selectively actuate any of said levers. A similar selector 21 operates in identically the same manner to selectively operate each of the levers t^4, t^5, t^6 and t^7 of the lower group.

Let it be assumed that all of the eight jack cams g, g^1 , etc., are inactive and that it is desired to render the top cam g active and that levers t, r, n and j are adapted to effect this shift. Selector 20 is moved into alignment with lever t while lever 30 is moved forward (that is, in a downward direction in Figs. 9, 10 and 11). In the backward or upward movement of lever 30, lever t contacts with selector 20 before lever 30 completes its movement, and during the completion of the upward movement of lever 30, selector 20 presses lever t down from its normal position (the upper dotted line position in Fig. 10) to a somewhat lower position (the other dotted line position in Fig. 10), during which limited downward movement of lever t , it contacts with the extreme tip of lever r and thereafter snaps over it; the selector 20 (which is held in operative position by a spring 22 that is stronger than spring w) yielding slightly to allow lever t to yield sufficiently to enable it to clear the tip of lever r . Lever 30 now starts to move down,

thereby carrying lever t out of contact with the selector. Thereupon, as lever 30 continues to move down, lever r has a cam action on lever t and swings it against the pull of its spring w and, before the downward movement of lever 30 is completed, lever t is forced against a stop x on lever 30. During the completion of the downward movement of lever 30, lever t is confined between lever r and stop x , and exerts a positive cam action on lever r and tilts it down on its axis, as shown in Fig. 11, thereby swinging lever n into position to release lever j , which is swung by its spring l to render jack cam g active.

In the upward movement of lever 30, lever t will release lever r , and if selector 20, in the meanwhile, has been shifted, lever t will be retracted, by its spring w , to the position shown in Fig. 9; but lever r will not be retracted because its end has moved beyond the upper cam angle on lever n . It is desired that lever r shall maintain its advanced position until another chain of levers shall be actuated by the selector 20, and that lever r shall be retracted at the same time that another lever r^1, r^2 or r^3 is advancing. This is accomplished by causing any of the levers t, t^1, t^2 or t^3 in the movement by which it advances its corresponding lever r, r^1, r^2 or r^3 to swing the other levers t, t^1, t^2, t^3 in the group, into position to retract any of the levers r, r^1, r^2, r^3 that may be in advanced position.

To make this operation clear, let it be assumed that lever r^1 has been advanced, that lever 30 is in the down position (Fig. 10), that lever t is in the position shown in Fig. 9, that selector 20 is shifted to align with lever t , that lever 30 moves up, that lever t contacts with the selector and is thereby moved a short distance, that lever 30 starts to move down, that lever t snaps over lever r , and that as lever 30 completes its down movement, lever r is advanced—all as hereinbefore explained. It will be observed, by reference to Fig. 9, that each lever t, t^1, t^2 and t^3 is forked at one end thereof, that stop v acts to limit the movement in one direction of levers t, t^1, t^2 and t^3 by contacting with the lower fork, and that on the shaft carrying levers t, t^1, t^2 and t^3 is pivoted an arm provided with a pin z , which engages the upper fork of any of the levers t, t^1, t^2 and t^3 that is in its normal position. Assuming that, as above described, lever 30 is completing its downward movement and that lever t is swinging from the position shown in Fig. 10 to that shown in Fig. 11. In Fig. 10 it will be observed that the lower fork of lever t has contacted with pin z . Therefore, as lever t swings from the position shown in Fig. 10 to the position shown in Fig. 11, its lower fork actuates pin z . Pin z contacts with the upper forks of the other levers t^1, t^2 and t^3 and swings them into the

position in which lever t^1 is shown in Fig. 11. If, as above assumed, lever r^1 is in its advanced position, lever t^1 will contact with lever r^1 and swing it into the position occupied by lever r^1 in Fig. 11, thereby causing the far end of lever r^1 to slide onto the under cam face of lever n^1 at the same time that the near end of lever r is riding down below the upper cam face of lever n . The retraction of lever r^1 will thus, through lever n^1 and the corresponding lever j render jack cam g^1 inoperative, whereas the simultaneous advancement of lever r will, through lever n and the corresponding lever j through the action of the corresponding spring l , render jack cam g operative.

As above mentioned, levers t, t^1, t^2 and t^3 are spaced above the lower group t^4, t^5, t^6 and t^7 , the upper group being controlled by selector 20 and the lower group by selector 21.

These selectors are operated by separate pattern mechanisms to be hereinafter described, so that a selection may be made in either the upper or lower groups independently or, if desired, simultaneously. It is therefore possible to render any one of the upper four cams g, g^1 , etc., active by the operation of the upper selector 20, or any one of the lower four of said cams active by the operation of the lower selector 21, or one of the upper four and one of the lower four of said cams simultaneously active by the simultaneous action of both selectors.

Pin z extends downward between the forked ends of all the levers t, t^1 , etc., of both groups so that when any one of said levers is selectively operated, all of the other levers will be rocked by said pin for the purpose described.

Lever 30 is actually the long arm of a bell crank lever pivotally mounted on the machine frame (see Fig. 1). The other arm of this lever has a pin which rides on a cam 71 on gear wheel 70, thereby, in cooperation with a spring 73, giving lever 30 the reciprocatory movement hereinbefore described. Gear wheel 70 is geared one to one with the needle cylinder through an intermediate gear 72.

Reciprocating lever 30 carries a pawl 32 (see Figs. 1, 3 and 5) that imparts an intermittent progressive movement to a ratchet wheel 33 on a shaft carrying two pattern chains 35 and 36. The pattern chains are provided with removable lugs of four different heights.

Selections of the lower group of levers t^4, t^5, t^6 and t^7 are made in the following manner (see Figs. 3, 4 and 5): Lugs on the pattern chain 35 are adapted to engage a cam member 41 carried on a yoke-shaped lever 42 (see Fig. 5) on the end of which is mounted the selector 21. This lever 42 is pivoted to a bracket 48. The lever 42 is normally down in a position where the selector 21 is inactive, but is movable into four different positions,

thereby causing the selector to align with any one of the four levers t^4 , t^5 , t^6 and t^7 by the action of the different height lugs on the pattern chain 35 on cam 41.

5 Selections of the upper group of levers t , t^1 , t^2 , t^3 are made as follows: Lugs on the pattern chain 36 are adapted to engage a cam 43 carried on a lever 44 which is pivoted at 45 to a bracket on the machine frame. A
10 yoke-shaped lever 46, which carries the selector 20, is pivoted to the bracket 48. This lever 46 rests upon an adjusting screw 47 in lever 44, which in turn rests upon an adjusting screw 49 carried by bracket 48. Lever 46
15 is normally down so that selector 20 is inactive, but the selector may be caused to align with any one of the levers t , t^1 , t^2 and t^3 by the action of the different height lugs on the pattern chain 36 on cam 43 of lever 44.

20 It is obvious that by positioning the lugs on the pattern chains, the selectors may be shifted to actuate any predetermined chains of levers at each course of knitting, and that thereby jack cams g , g^1 , etc., may be moved
25 into and out of action in such manner as to produce any desired pattern.

I have not herein described the means for arresting the movement of the pattern chain during the knitting of the heel and toe. Such
30 means, forming no part of the present invention, are described in a copending application Serial No. 110,311, Patent No. 1,769,580.

As hereinbefore mentioned, it is decidedly
35 advantageous to have all of the needles in perfect alignment during heel and toe knitting and also when a transfer ring is to be placed on the needles for the purpose of transferring a rib top. I have therefore provided additional mechanism which will insure
40 all of the cams g , g^1 , etc., being inactive at these desired periods irrespective of whether the pattern mechanism would normally render certain of these cams active at such times or not. This desired result I accomplish in the following manner. Pivoted
45 between its ends on the machine frame, at 80, is a lever 81 (see Figs. 2, 3 and 4), one arm of which is bent down and extends under the main pattern disc 82 in the path of a cam 83 fastened to the underside of said disc. This
50 disc is intermittently ratcheted and controls the knitting of the various parts of the stocking, including the knitting of the heel and toe portion and the leveling of the needles for transferring, in a manner which is well known in the art. Extending upward from
55 lever 81 is a bent arm 84 which passes over and above levers n , n^1 , etc. When lever 81 is rocked by cam 83, the arm 84 pushes against a lever 85 which is pivoted at i , and by means of a depending pin 86, which passes in front of the eight levers j , swings any of
60 such levers which at the time may be in the active position to the inactive position and

holds all the levers j inactive notwithstanding any operation of any lever n which would normally operate its corresponding lever j to move its corresponding cam into operative position. When cam 83 passes from under
70 lever 81, lever 85 is released from arm 82 and levers j again come under control of the pattern mechanism described.

It is obvious that by placing cams 83 in various positions on the pattern disc 82, the
75 pattern mechanism may be, whenever desired, rendered inoperative to press needles out of line.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:

1. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently
85 positioned non-rotatable cams movable into and out of operative position, contrivances for different needles respectively adapted to rotate with the needles and to be actuated by different operatively positioned cams to deflect the hook ends of their respective
90 needles out of their normal knitting plane, chains of levers adapted to control the operation of the respective cams, a reciprocatory member adapted to operate said chains of levers, means to actuate the needle cylinder
95 and synchronously therewith operate the reciprocatory member, and pattern mechanism adapted to selectively bring the several chains of levers into operative relationship with the reciprocatory member.

2. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently positioned non-rotatable cams movable into and
105 out of operative position, different contrivances, one for each of a number of needles, adapted to rotate with the needles and to be actuated by different operatively positioned cams to deflect the hook ends of their respective needles out of their normal knitting
110 plane, chains of levers adapted to control the operation of the respective cams, means to actuate the needle cylinder and synchronously therewith actuate any of the chains of levers, and a selector movable into
115 different positions to render any of said chains of levers effectively operable by its actuating means.

3. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently positioned non-rotatable cams movable into and
120 out of operative position, different contrivances, one for each of a number of needles, adapted to rotate with the needles and to be actuated by different operatively positioned
125 cams to deflect the hook ends of their respective needles out of their normal knitting plane, mechanisms adapted to control the operation of the respective cams, means to
130

actuate the needle cylinder and synchronously therewith actuate any of said mechanisms, pattern-controlled means adapted to selectively render any of said mechanisms effectively operable by its actuating means, and means, operable by one of said mechanisms while moving into cam-controlling position, to control the movement out of cam-controlling position of any other mechanism that is in cam-controlling position.

4. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently positioned non-rotatable cams movable into and out of operative position, different contrivances, one for each of a number of needles, adapted to rotate with the needles and to be actuated by different operatively positioned cams to deflect the hook ends of their respective needles out of their normal knitting plane, chains of levers adapted to control the operation of the respective cams, means to actuate the needle cylinder and synchronously therewith actuate any of the chains of levers, and pattern-controlled mechanism adapted to selectively place none or all of the several chains of levers into operative relation with its actuating means.

5. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently positioned non-rotatable cams movable into and out of operative position, different contrivances, one for each of a number of needles, adapted to rotate with the needles and to be actuated by different operatively positioned cams to deflect the hook ends of their respective needles out of their normal knitting plane, chains of levers adapted to control the operation of the respective cams, a reciprocatory member carrying the lever of each chain that is adapted to actuate another lever of the same chain, a selector adapted to move the first lever of any chain into actuating position, means to actuate the needle cylinder and synchronously therewith said reciprocatory member, and pattern mechanism adapted to position the selector.

6. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently positioned non-rotatable cams movable into and out of operative position, different contrivances, one for each of a number of needles, adapted to rotate with the needles and to be actuated by different operatively positioned cams to deflect the hook ends of their respective needles out of their normal knitting plane, shifting levers adapted to effect the movement of the respective cams into operative position, operating levers one for each shifting lever, and a connecting means operable, when any operating lever is rendered operative, to synchronously put into action its shifting lever and render inopera-

tive any other shifting lever that had been previously operative.

7. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently positioned non-rotatable cams movable into and out of operative position, different contrivances, one for each of a number of needles, adapted to rotate with the needles and to be actuated by different operatively positioned cams to deflect the hook ends of their respective needles out of their normal knitting plane, chains of levers adapted to control the operating of the respective cams, a reciprocatory member carrying the lever of each chain that is adapted to advance a second lever of the same chain, means to actuate the needle cylinder and synchronously therewith said reciprocatory member, pattern-controlled mechanism adapted to selectively render operable the first lever of a chain, and means, operable by each of said first levers, in its movement to actuate a second lever of the same chain, to so actuate the first levers of the other chains that any of the second levers that is in cam-controlling position will be retracted by its actuating first lever from such position.

8. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently positioned non-rotatable cams movable into and out of operative position, different contrivances, one for each of a number of needles, adapted to rotate with the needles and to be actuated by different operatively positioned cams to deflect the hook ends of their respective needles out of their normal knitting plane, chains of levers adapted to control the operation of the respective cams, a reciprocatory member adapted to operate the sets of levers, means to actuate the needle cylinder and synchronously therewith operate the reciprocatory member, pattern mechanism adapted to selectively bring the several chains of levers into operative relationship with the reciprocatory member, and other pattern mechanism adapted to render all the chains of levers inoperative to move or maintain their respective cams in operative position.

9. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently positioned non-rotatable cams movable into and out of operative position, different contrivances, one for each of a number of needles, adapted to rotate with the needles and to be actuated by different operatively positioned cams to deflect the hook ends of their respective needles out of their normal knitting plane, chains of levers adapted to control the operation of the respective cams, means to actuate the needle cylinder and synchronously therewith actuate any of the chains of levers, a selector movable into different

positions to render any of said chains of levers effectively operable by its actuating means, and pattern mechanism adapted to render all the chains of levers, even when operated by the selector, inoperative to move or maintain their respective cams in operative position.

10. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of cams movable into and out of operative position, different contrivances, one for each of a number of needles, adapted to rotate with the needle cylinder and to be actuated by different operatively positioned cams to deflect the hook ends of their respective needles out of their normal knitting plane, mechanisms adapted to control the operation of the respective cams, means to actuate the needle cylinder and synchronously therewith any of said mechanisms, and two selectors one movable into position to render any of a plurality of said mechanisms operable by its actuating means and the other movable into position to render any of another plurality of said mechanisms operable by its actuating means.

11. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently positioned non-rotatable cams movable into and out of position to be engaged by the hereinafter specified contrivances, contrivances for different needles respectively, adapted to rotate with the needles and to be actuated by different operatively positioned cams to deflect the hook ends of needles out of their normal knitting plane, said contrivances being also adapted to return said cams to inoperative position, and pattern controlled means adapted at intervals to selectively move different cams into, and hold them in, operative position and to subsequently release said cams and allow them to be returned to inoperative position by said contrivances.

12. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently positioned non-rotatable cams movable into and out of position to be engaged by the hereinafter specified contrivances, contrivances for different needles respectively, adapted to rotate with the needles and to be actuated by different operatively positioned cams to deflect the hook ends of the needles out of their normal knitting plane, spring-actuated levers tending to move the cams into position to be engaged by said contrivances and adapted to hold said cams from being displaced from operative position by said contrivances, and pattern-controlled means adapted at intervals to selectively release the different levers and allow them to be so spring-actuated.

13. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently

positioned non-rotatable cams movable into and out of position to be engaged by the hereinafter specified contrivances, contrivances for different needles respectively adapted to rotate with the needles and to be actuated by different operatively positioned cams to deflect the hook ends of needles out of their normal knitting plane, levers, one for each cam, springs adapted to move said levers in one direction to render their respective cams operative, means adapted to positively move said levers in the opposite direction and restrain them from being operated by their springs, and pattern controlled means adapted to release each lever restraining means and allow the corresponding cam to be sprung into operative position at a point in the rotation of the needle cylinder at which no corresponding contrivance is opposite such cam.

14. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently position non-rotatable cams movable into and out of position to be engaged by the hereinafter specified contrivances, contrivances for different needles respectively, adapted to rotate with the needles and to be actuated by different operatively positioned cams to deflect the hook ends of needles out of their normal knitting plane, levers, one for each cam, adapted to move the cams into operative position, and a device which is adjustable to variably determine the extent of movement of each lever and its corresponding cam and thereby determine the amount of deflection that is imparted to the corresponding needle.

15. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently positioned non-rotatable cams movable into and out of position to be engaged by the hereinafter specified contrivances, contrivances for different needles respectively, adapted to rotate with the needles and to be actuated by different operatively positioned cams to deflect the hook ends of needles out of their normal knitting plane, slotted levers, one for each cam, adapted to operate said cams, pivots which the slots of said levers engage, and a device between which and each cam the corresponding lever is adapted to swing and which is adjustable to vary the extent to which such cam is moved by its lever.

16. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently positioned non-rotatable cams movable into and out of position to be engaged by the hereinafter specified contrivances, contrivances for different needles respectively, adapted to rotate with the needles and to be actuated by different operatively positioned

cams to deflect the hook ends of needles out of their normal knitting plane, levers, one for each cam, adapted to render the respective cams operative, pattern controlled means adapted to selectively render said levers operable or inoperable to render the respective cams operative, and another pattern controlled means adapted to render all of said levers inoperable to render the respective cams operative regardless of the operation of the first named pattern controlled means.

17. In a circular knitting machine, the combination with a rotatable needle cylinder and needles carried thereby, of differently positioned non-rotatable cams movable into and out of position to be engaged by the hereinafter specified contrivances, contrivances for different needles respectively, adapted to rotate with the needles and to be actuated by different operatively positioned cams to deflect the hook ends of needles out of their normal knitting plane, and levers, one for each cam, adapted to operate said cams, each lever being adjustable to predetermine the position to which the corresponding cam shall be moved to operate its corresponding needle deflecting contrivance and each lever being movable to so move its corresponding cam into operative position.

In testimony of which invention, I have hereunto set my hand at Philadelphia, Pennsylvania, on this 19th day of July, 1927.

HAROLD E. HOUSEMAN.