Oct. 25, 1938. H. E. HOUSEMAN 2,134,480

KNITTING METHOD AND MACHINE

Filed Jan. 25, 1935 4 Sheets-Sheet 1

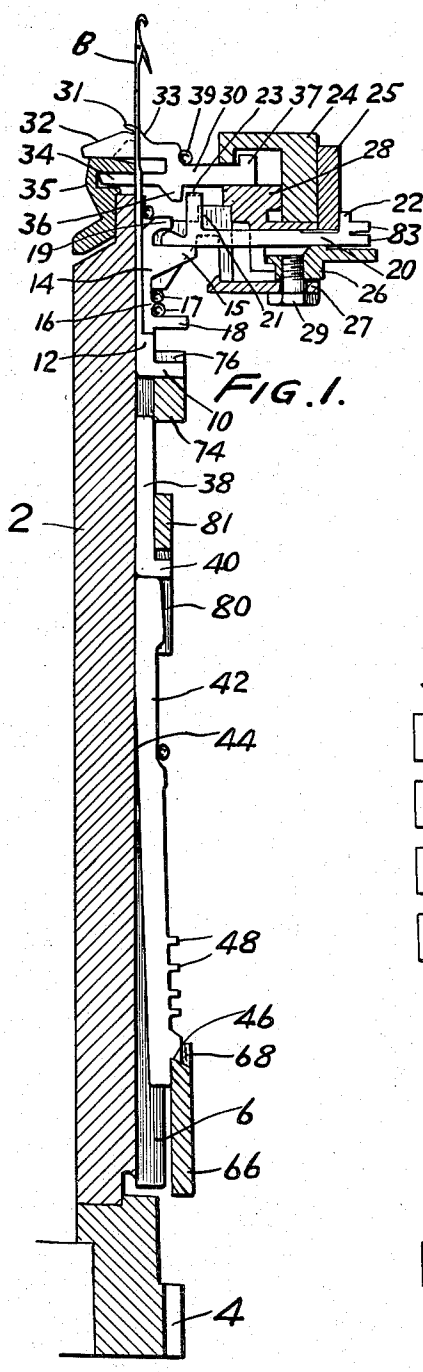


FIG. 1.

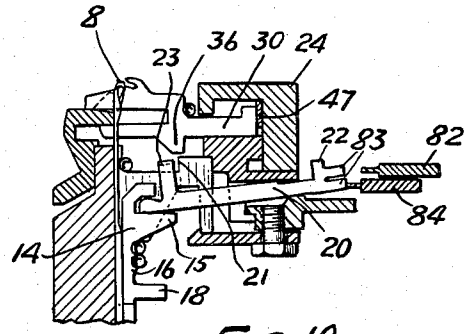


FIG. 10.

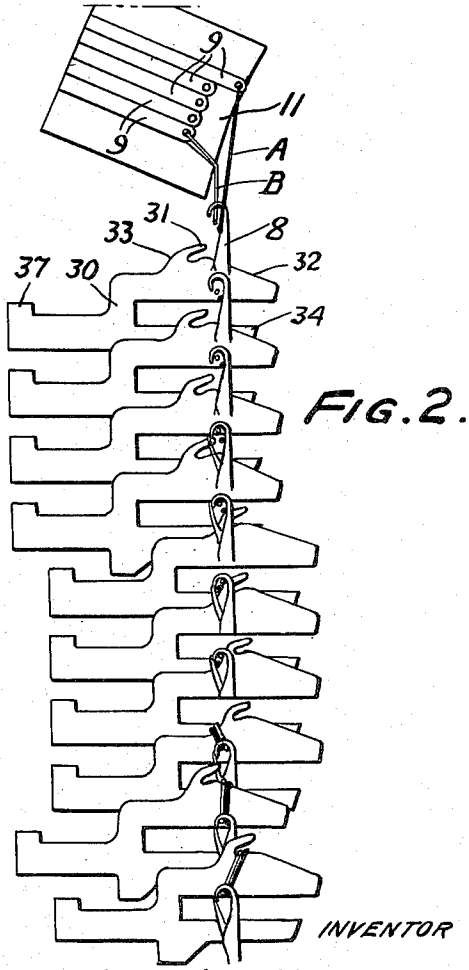


FIG. 2.

WITNESS:

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Oct. 25, 1938. H. E. HOUSEMAN 2,134,480

KNITTING METHOD AND MACHINE

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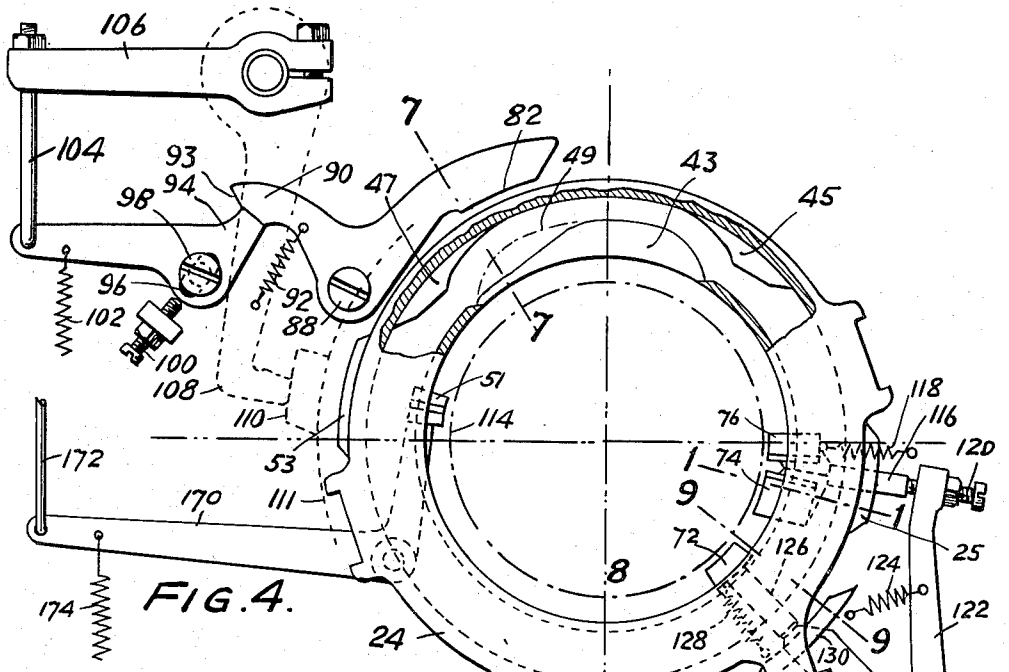


FIG. 4.

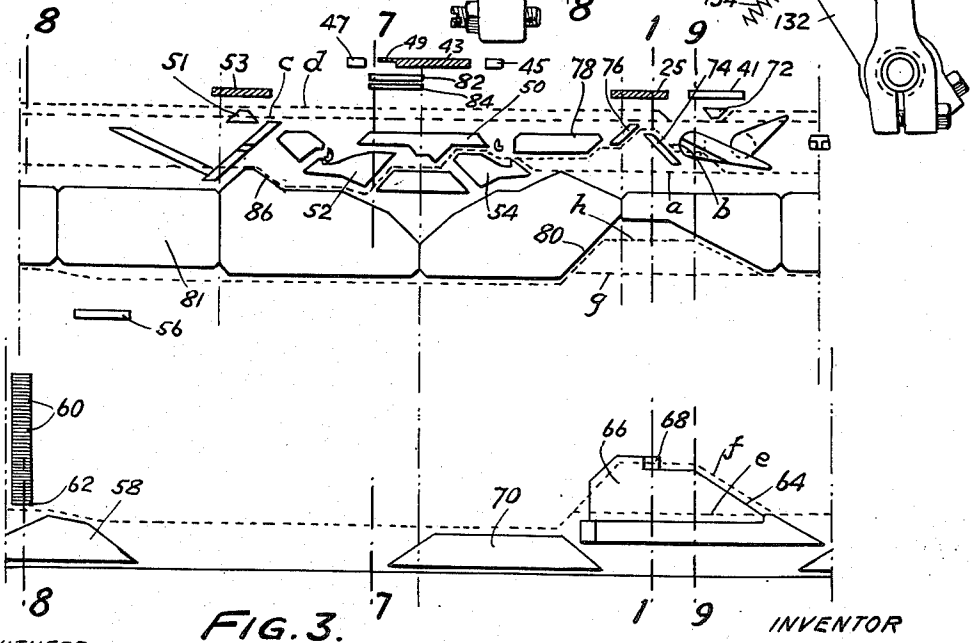


FIG. 3.

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KNITTING METHOD AND MACHINE

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FIG. 5.

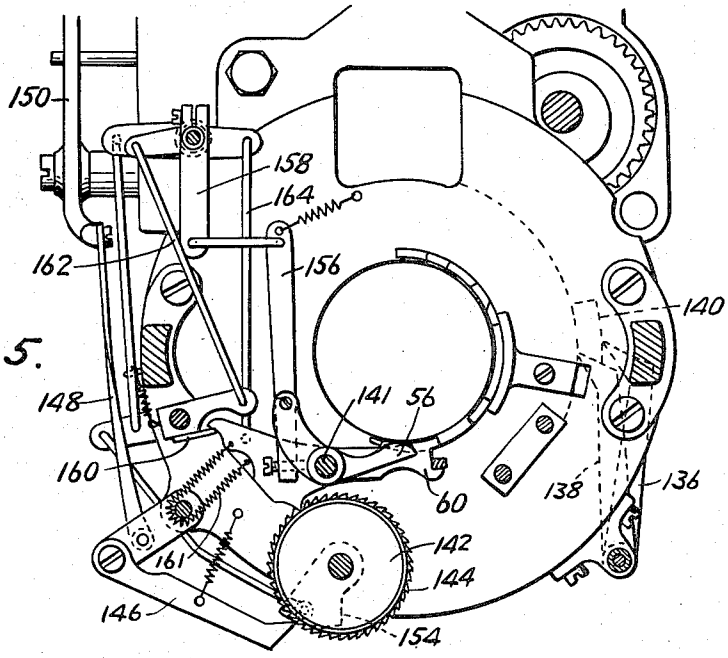
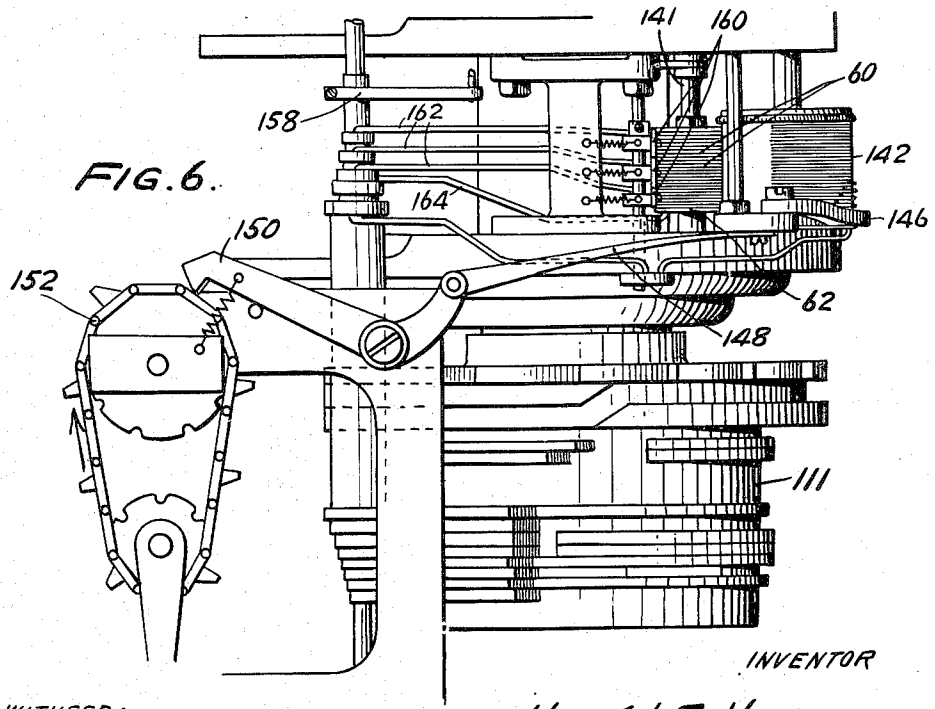


FIG. 6.



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KNITTING METHOD AND MACHINE

Filed Jan. 25, 1935 4 Sheets-Sheet 4

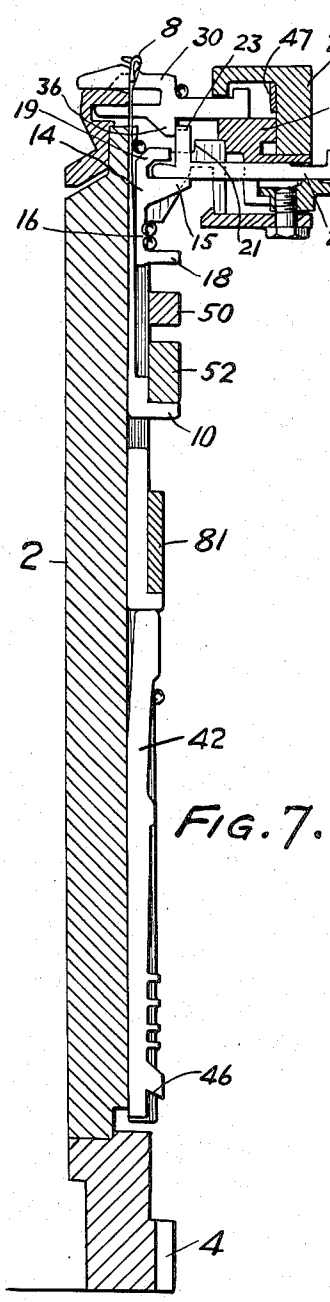


FIG. 7.

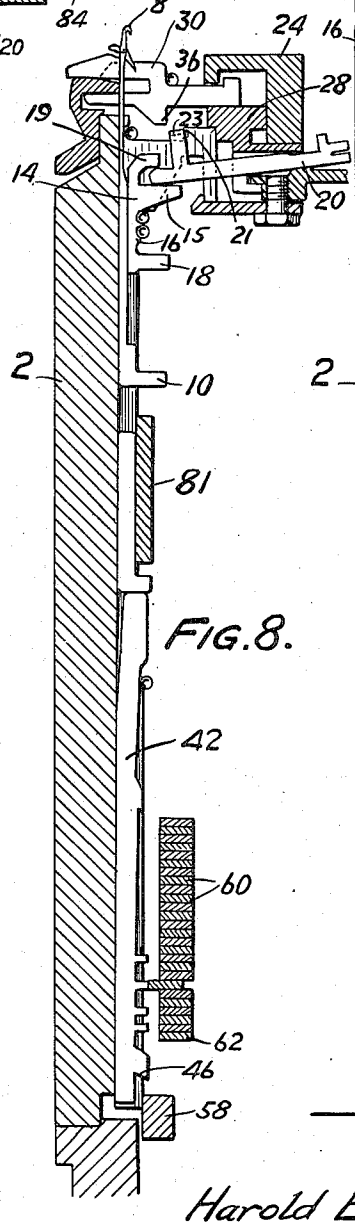


FIG. 8.

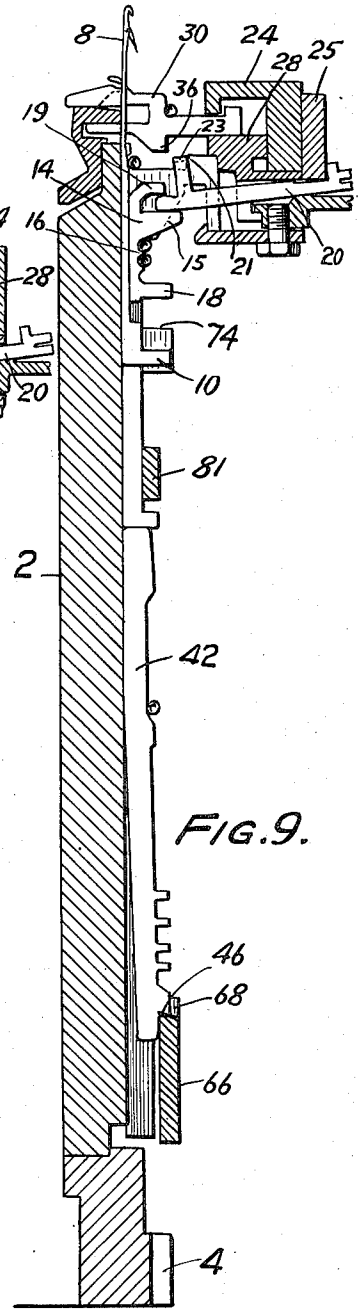


FIG. 9.

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Patented Oct. 25, 1938 2,134,480

UNITED STATES PATENT OFFICE

2,134,480

KNITTING METHOD AND MACHINE

Harold E. Houseman, Laconia, N. H., assignor to Standard-Trump Bros. Machine Company, Laconia, N. H., a corporation of Delaware

Application January 25, 1935, Serial No. 3,376

27 Claims. (Cl. 66—50)

This invention relates to a knitting method and machine and has particular reference to the production of selective normal and reverse plating by selective manipulation of special sinkers or elements associated therewith.

As is well known at the present time, the character of plating produced in loops of a knitted fabric when two yarns are fed in predetermined relationship to needles may be varied by selective manipulations of specially designed sinkers or elements associated therewith as the stitches are being drawn. The character of action of the sinkers or other elements upon the yarns may vary depending upon the character of the associated elements, the feed of the yarns, etc., but in all cases of such reverse plating there is involved some variation in movement of the sinkers or associated elements, the variations being attained through suitable controlling mechanism.

The present invention is not concerned with the particular manner of cooperation between the needles, sinkers or other elements, and yarns, but is concerned primarily with improved controlling mechanism whereby elaborate patterning may be secured through selective plating and reverse plating, although the mechanism involved is of a quite simple character. In this application the controlling elements are shown as applied to a sinker reverse plating mechanism in which specially formed sinkers are provided and means associated therewith are used to project the sinkers inwardly prematurely at predetermined times to cause the loops to be drawn either in front of or behind the nibs of the sinkers to thereby effect either normal or reverse plating. It will be understood that while the controlling mechanism is shown in its application to this type of operation, it is applicable for the manipulation of sinkers or other elements associated with the sinkers for producing selective normal and reverse plating in any of the known conventional fashions.

In most mechanisms heretofore used for producing sinker reverse plating, the sinkers or elements associated individually therewith are provided with a number of butts. Unless such number of butts is objectionably increased, however, to an extent taking up an undue amount of space and giving rise to objectionable lateral thrusts, there is a definite limit to the character of patterns which may be produced. It is the broad object of the present invention to provide a selecting method and means for securing the varying operations of sinkers or the like at desired times, which method and means are adapted for the production of elaborate patterns involving numerous variations in selection.

Other objects of the invention, particularly relating to details of construction and manipulations, will be apparent from the following description read in conjunction with the accompanying drawings, in which:

Fig. 1 is a diagrammatic vertical section taken on the plane indicated at 1—1 in Figs. 3 and 4 through a needle cylinder and associated parts illustrating certain elements used in accordance with the invention;

Fig. 2 is a diagrammatic perspective view indicating the production of normal and reverse plating by normal and premature movements of sinkers in accordance with known methods;

Fig. 3 is an inside development of various needle, jack, sinker and other associated cams;

Fig. 4 is a diagrammatic plan view partly in section showing certain cams and cam controlling means;

Fig. 5 is a horizontal section showing controlling devices for effecting selection;

Fig. 6 is a fragmentary elevation showing the same subject matter as Fig. 5;

Fig. 7 is a section similar to Fig. 1 but taken on the plane indicated at 7—7 in Figs. 3 and 4 showing the premature projection of a sinker to effect reverse plating;

Figs. 8 and 9 are sections similar to Fig. 1 but taken on planes indicated at 8—8 and 9—9, respectively, in Figs. 3 and 4; and

Fig. 10 is a partial section corresponding to Fig. 7 but showing a sinker which is being projected at a normal time to effect normal plating.

The knitting machine which is specifically illustrated for the purpose of showing the invention is, in general, of conventional character and only so much of the machine is illustrated as is necessary for a clear understanding of the invention. The machine comprises an elongated rotary needle cylinder 2 rotated through the medium of a ring gear 4, which cylinder is provided with the usual slots 6 for the reception of needles and other associated parts. The needles are of the usual latch type and are provided with butts 10 and shoulders 12 located, as illustrated, above the butts.

Located in the needle slots above the shoulders 12 are jack guides 14 held normally in an upper position by spring bands 17 above and below small projections indicated at 16. The projections 16 are so formed as to tend to latch the jack guides in upper position, but when sufficient force is

applied, tend to cam the lower of the spring bands outwardly to permit the jack guides to move down. Each of the jack guides is provided with a butt 18 designed to be acted upon by suitable cams as described hereafter. In order to provide for the proper guidance of jacks 20, each of the jack guides is provided with upper and lower arms, respectively designated at 19 and 15, designed to embrace the inner end of a jack 20 which is guided within a slot in sinker dial 28 aligned with a corresponding needle slot. Each of the jacks 20 is provided with an upwardly extending arm 23 having a laterally turned upper end designed to engage a downward projection 36 formed on an adjacent sinker. The corresponding sinkers are, of course, slightly displaced circumferentially from their operating jacks inasmuch as they must pass between the needles, and the turned ends of the arms 23 insure proper cooperation between the jacks and sinkers. Each of the jacks is, furthermore, provided with an upwardly extending butt 22 and one or more removable butts 83 at different heights. The butts 22 are arranged to be acted upon by cams at proper times to effect outward and inward movements of the jacks, while the butts 83 may be selectively acted upon to effect additional inward movements thereof. While two positions are illustrated for butts 83, only a single butt, consisting merely of the outward edge of butt 22, may be used if only certain manipulations are desired, or, alternatively, if more elaborate control is wished, more than two butts 83 may be provided.

The sinker dial 28 is surmounted by the usual sinker cap 24 which carries sinker operating cams, described below, and is arranged for limited circumferential movement in the usual fashion. Besides the cams designed to operate on the butts 37 of the sinkers, this sinker cap also carries cams 25, 53 and 41 arranged to operate at suitable times upon the butts 22 of the jacks 20.

The sinker dial 28, which is slotted on its top for the sinkers and on its bottom for the jacks, rests on the cylinder walls at 51. Four segmental clamp rings 26 pull the dial down against the cylinder walls and also form a fulcrum for the rocking of the jacks. The rings 26 are drawn downwardly by the clamps 27, two of which are provided for each segmental ring 26, the clamps being connected to the rings by screw 29 and engaging ledges formed on the cylinder walls.

Each sinker 30 is provided with an upper arm 32 having a sloping upper surface providing a ledge over which stitches are drawn and also a lower arm 34 guided in the cylinder top 35. Each of the sinkers is provided with a nose or nib 31 behind which there is a sloping edge 33 on which stitches are drawn to effect reverse plating. The sinkers are provided with the usual butts 37 acted upon by cams designed to impart to them their usual movements. The premature movements to effect reverse plating in the present instance are imparted by cams acting upon the butts 83 of jacks 20. Cams 43, 45 and 47 are provided to act upon the sinkers. Cams 43 and 47 effect the proper sinker movements during rotary knitting and reciprocation in a forward direction, while cams 43 and 45 effect corresponding movements during knitting in a reverse direction. A cam 41 is provided secured to the sinker cap to act upon the jack butts 22 and holds the jacks 20 inwardly at proper times to insure against their being thrown outward by centrifugal force.

Inasmuch as the usual cam 43 is cut away at its trailing end, considering the case of rotary knitting, in order to permit premature sinker movements, the spring band 39 would normally tend to move the sinkers inwardly even though they were not acted upon by the jacks 20 and were not intended to move inwardly until acted upon by cam 47. In order to avoid such premature inward movement under spring band action, there are preferably inserted in the sinker slots special band holding bits, one for each sinker, which are adapted to be acted on by a cam indicated at 49 to hold the spring bands outwardly until such time as the sinkers which are to produce normal plating are moved inwardly by cam 47. Such band holding bits are well known and are not described herein, since they form no essential part of the present controlling means. They are shown, for example, in the patent to Pons No. 1,821,848, dated September 1, 1931. The cam 49 which controls them is located above the cam 43 and acts upon their butts, which are longer than the butts of the jacks 30.

Located in the needle slots below the needles are intermediate needle jacks 38 provided with butts 40, while below these intermediate jacks are located lower tilting jacks 42 whose inner edges are so formed as to provide pivots 44 about which as horizontal axes the jacks may rock. At their lower ends the jacks 42 are provided with shoulders 46 adapted to engage cams, as will be hereafter more fully pointed out. The jacks are also provided below their pivots with butts 48 which may be selectively arranged for the purpose of producing patterns. The jacks may be supplied, for example, containing a full complement of butts which may be selectively broken out in order to provide the necessary setup for a desired pattern.

Referring to Fig. 3, there is disclosed therein the layout of cams arranged to act upon the needles, jacks 20, sinkers 30 and the butts of jack guides 14, and the intermediate and lower jacks 38 and 42. The needle stitch cams are of the usual variety and comprise the upper center cam 50 and the usual stitch drawing cams 52 and 54, the former of which serves to draw the needles downwardly during rotary knitting.

Cooperating with the lower jacks there are an upper cam 56 designed to rock the lower ends of the jacks outwardly and a series of lower cams 60 and 62 designed to rock the lower ends of the jacks inwardly. All of these cams are formed as levers and will be referred to hereafter. The lowermost of the cams designed to rock the jacks inwardly is designated differently from the others, since it performs a somewhat different function. In advance of the cams 60 there is located a fixed cam 58 which is designed to engage the shoulders 46 on the lower jacks and cause them to rise to a predetermined level before they reach the location of the cams 60. This action insures a proper vertical alignment between the butts on the jacks and the various corresponding cams 60. There is also provided, in a position following the cams 60, a cam 66 having an upward slope 64 on which the shoulder 46 of such of the jacks 42 as have their lower ends extending outwardly may ride, whereby such jacks will be raised. A slope 68 provided on the cam 66 serves to rock the lower ends of the jacks inwardly and thus disengage them from the top level of the cam 66. A guard cam 70 is provided to prevent possibility of damage to the jacks

during reciprocation and limit their downward movements.

A cam 72 is provided designed to engage the butts 18 of raised jack guides 14 so as to depress all of the jack guides at its position. This is to prepare the jack guides for a subsequent selection.

Cams 74 and 76 are respectively designed to raise and lower needles by engagement with their butts 10 for purposes which will hereafter become apparent. The lowering action of cam 76 is continued by the usual guard cam 78. A ring of cams indicated at 81 serves to maintain the intermediate jacks within the needle slots. A cam face 80 on the lower portion of this series is adapted to engage the butts 40 of the intermediate jacks to lower them and with them the lower jacks 42. Levers 82 and 84 are provided to act upon the butts 83 of the horizontal sliding jacks 20. A cam 86 is provided to raise the needles to a desired level. It may be noted that the loops on needles which may be raised due to selection clear the latches as jacks pass up cam 64, while the loops on needles which are not raised clear the latches thereof at cam 54.

Besides the cams mentioned above, there are provided a cam 51 arranged to raise jack guides 14 and a cam 53 carried by the sinker cap and arranged to engage butts 22 and move jacks outwardly. Both of these cams are used to avoid improper actions of the elements during reciprocation, and their functions will be brought out hereafter. Other cams are provided for the purpose of producing, for example, gusset toes, but need not be described since they have no direct relationship to the present invention.

The layout of cams having been described, reference will now be made to their controlling means. The cams 82 and 84 are associated with duplicate operating devices indicated in Fig. 4. Each cam is formed on the end of a lever which is pivoted at 88 and which is provided with a tail 90 having a cam surface 93 held in engagement with the actuating end of a lever 94. Each lever 94 is provided with an elongated slot 96 receiving a vertical pin 98 and is urged by a spring 102 into engagement with an adjustable fixed stop screw 100. By this arrangement, as will be obvious, there is provided a fine adjustment of the position of each lever 94 and hence of the position of the cam 82. Fine adjustment is desirable to insure the proper movement of a prematurely actuated sinker. Each lever 94 is connected by a link 104 to a lever 106. The levers 106 are secured to individual ones of a series of nested vertically extended shafts which carry at their lower ends cam following levers 108 engageable under the action of springs 102 with suitable controlling cams 110 on the main cam drum 111 which is stepped about under chain control during the operation of the machine in the usual fashion.

The needle circle is approximately indicated at 114 in Fig. 4. The cams 74 and 76 are moved radially together and are carried by a sliding plunger 116 guided in a fixed portion of the machine and urged outwardly by a spring 118 into engagement with an adjustable stop screw 120 carried by the end of a lever 122 which is urged counterclockwise as viewed in plan by a spring 124 stronger than the spring 118.

The cam 72 is carried by a similar plunger 126 urged outwardly by a spring 128. The plunger 126 is moved inwardly at the proper time by a clockwise movement of a cam 130 on a lever 132. The levers 122 and 132 are mounted upon vertically extending nested shafts which, at their lower ends, carry cam following levers 136 and 138 engageable with suitable cams 140 carried by the pattern drum 111.

Control of the cams 60, which are formed as levers pivoted at 141, is effected by the action upon tails thereof of tricks carried by a trick wheel 142. These tricks, which are receivable in slots in the trick wheel in the usual fashion, are provided with butts which may be selectively arranged to produce the desired control of the cams 60. The trick wheel 144 is stepped about intermittently by the action of a pawl 146 which is oscillated through the medium of a link 148 by the lever 150 which rides upon lugs carried by the links of a pattern chain 152 which is advanced one step upon each revolution of the needle cylinder. By a suitable setup of the lugs on the pattern chain, the trick wheel may be advanced upon each revolution of the needle cylinder or at less frequent intervals. A guard 154 is provided for interrupting the advance of the trick wheel and for securing a setup thereof at the completion of a stocking, this being effected as described in the application of Stanley R. Shelmire, Ser. No. 623,057, filed July 18, 1932.

The cam 56 is formed on a lever which has a functionally integral, adjustable extension 156 connected by a link to a lever 158 which is secured to one of a series of vertical nested shafts whose lower ends carry cams acted upon by cams on the pattern drum 111.

If desired, the series of cams 60 may operate in a plurality of sets. In the machine illustrated, for example, there are three such sets. By reason of such arrangement, there is made a convenient provision for the formation in a single stocking of three quite different independent patterns in different portions thereof. For example, besides the usual normal and reverse plated pattern extending throughout the stocking, provision may be made for the formation of a clock or the like extending through only a portion of the design. The groups of levers may be selectively rendered operative or inoperative by control of levers 160 which engage their rear ends and pull them away from the tricks on the trick wheel 142 against the action of the springs 161. The levers 160 are independently controlled by links 162 connected to arms on three of the nested shafts hereafter referred to.

The lowermost cam 62, which is also pivoted at 141, is controlled by a connection through a link 164 to an arm carried by still another of the nested shafts.

Cam 51 is carried by a lever 170 connected by a link 172 to one of the set of nested shafts heretofore referred to as controlled by the main pattern drums. Normally this cam 51 is out of action under the influence of spring 174.

The yarns A and B, which are to be selectively normal and reverse plated, are fed to the needles in conventional fashion, for example, by being fed from yarn fingers 9 located in the throat 11 of the usual latch ring. If yarn changes are to be made, yarns carried by the different fingers may be selectively brought into operation at predetermined times by the usual yarn changing mechanism, involving conventional clamping and cutting devices.

The operations involved in producing normal and reverse plating by the mechanism just described will be readily understood from a consideration primarily of Figs. 3 and 4, showing

the cam arrangements, and Figs. 1, 7, 8, 9 and 10, showing the details of operation of the sinker controlling elements.

In Fig. 3 there are indicated, in dotted lines, the paths of characteristic parts of the various elements associated with the needles in the needle slots and the needles themselves. For example, at *a* and *b* there are indicated the alternative paths of the needle butts, at *c* and *d* there are indicated the alternative paths of the butts **18** of the jack guides **14**, at *e* and *f* there are indicated the alternative paths of the shoulders **46** of the lower jacks **42**, and at *g* and *h* there are indicated alternative paths of the butts **40** of the intermediate jacks **38**. It will be noted that through the greater part of a revolution the butts of the needles and intermediate jacks and the shoulders of the lower jacks follow constant paths. The elements associated with the needle cylinder move to the left in Fig. 3 during rotary knitting.

Initially, let it be assumed that a particular set of elements associated with one needle and an adjacent sinker are in such position that the upper end of the lower jack is at the position of cam **56**. At such time the jack guide **14** of this set of elements may be in either upper or lower position with its butt **18** following either path *c* or *d*, depending upon the selection made prior to the previous stitch drawing operation. The intermediate jack **38** will have been lowered and will in turn have lowered the lower jack **42**, the lower end of which will have been projected outwardly by cam **56** if it had not previously been in such position. The sinker will be in its inner position. Jack **20** will be in an outer position depending upon whether or not it is raised or lowered. If it is raised, then it may be in an extreme outer position to which it would have been thrown by centrifugal action if unrestrained by friction. If it is in lower position, the turned end of its arm **23** will have been engaged, either centrifugally or due to the action of cam **53**, with the annular shoulder **21** of the upper portion of the cylinder wall. The needle will have been somewhat raised by cam **86** from its lowest stitch drawing position, but the loop thereon will not have cleared the latch.

As the rotation proceeds, the lower jack will ride upwardly over leveling cam **58** and its butts may or may not be engaged by one of the cams **60**. This event is illustrated in Fig. 8, which figure shows the lower end of the lower jack **42** pressed inwardly by the engagement with one of its butts of one of the cams **60**. A jack, the lower end of which is rocked inwardly, will, in the next stitch drawing operation, determine the formation of the normal loop. Assuming that the lower jack under consideration was not acted upon by any of cams **60**, its shoulder **46** will remain out in a position to ride up the slope **64** of cam **66** along the upper path *f*. The butt of the intermediate jack will then follow path *h* and as the end of the rise is reached, the corresponding needle will be pushed upwardly so that its butt follows path *b* in position to later engage cam **74**.

If, on the other hand, a lower jack is pressed inwardly by the action of one or more of cams **60**, its shoulder **46** will fail to engage the slope **64** of cam **66** and will follow path *e*. The butt of the intermediate jack will then remain at the same level and move along path *g*, and the needle butt will move along path *a* underneath the cam **74**, so that it will not be raised by that cam.

In the meantime, the jack **20** will be pushed inwardly by the action of cam **41** and while this jack is held inwardly the butt of jack guide **14** will reach the position of cam **72**. If the jack guide is held lowered, it will pass below cam **72** without being acted upon thereby. On the other hand, if it is in raised position, it will be lowered by cam **72** with the result that any jack passing this point will occupy the same lower position in which it will be yieldingly retained by the location of the lower of the spring bands **17** above projection **16**. The preliminary inward movement imparted to the jack **20** is for the purpose of insuring that the turned end of its arm **23** is inwardly of the shoulder **21** of the needle cylinder so that, if it is associated with a jack guide which is lowered, the turned end will pass downwardly inside the shoulder. If the jack **20** was held in its lower position, it will already have been restrained from outward movement by the engagement of the turned end of its arm **23** with shoulder **21** and will be moved only slightly inwardly by cam **41**. Fig. 9 illustrates the parts in the position occupied immediately after passing cam **72**.

If the needle has been raised as indicated above, it will ride up cam **74** and the loop which it carries will pass below its latch. When it moves along the upper portion of the slope of cam **74**, its shoulder will engage and move upwardly the jack guide **14**, raising the butt of this guide to the level *d*. Just prior to such rise, the cam **25** insures that the jack **20** is sufficiently far out that if it rises, its arm **23** will not jam against the projection **36** on the bottom of the sinker. In general, centrifugal action upon the jacks insures that they occupy outer positions engaging the ledges of the segmental clamps. Fig. 1 shows the parts in the positions attained as the needle reaches the upper end of cam **74**.

Following the selective rise of its jack guide **14**, a raised needle will be lowered by cams **76** and **78**, whereby it is brought to a level with the needles which were not previously raised to pass with the latter over cam **54**, which serves to raise the last named needles to a latch clearing height. Simultaneously, the raised intermediate and lower jacks are moved downwardly by cam **80**, any raised lower jack being previously forced off the cam surface **64** by the action of the face **68**. Downward overrun of any lower jack is prevented by the cam **70**.

Upon reaching cam **45**, which only acts during reciprocation, the sinker will already occupy an inner position and consequently will be withdrawn by cam **43** together with its jack **20** if the latter is in upper position and has not already been thrown out centrifugally to the greater extent. Any yarns which may at such time lie behind the nose **31** of a sinker will be caused to clear the same and drop upon the sloping ledge **32**. Thus, as yarns are taken for the formation of new loops, the yarns of the last formed course will lie upon the sloping ledges **32** of the sinkers.

As the position of cams **82** and **84** is reached, the needle will have taken yarns from the feeding fingers. Cam **82**, or **84**, or both, will project the jack **20** inwardly irrespective or whether it is in upper or lower position if it is supplied with a corresponding butt **83**. If it is in upper position, its arm **23** will engage projection **36** of the sinker and impart to the sinker a premature inward movement so that the yarns are drawn over the edge **33** of the sinker behind its nose **31**, thus effecting reverse plating in the usual fashion. On the other hand, if the jack **20** were in lower position, inward movement imparted to it by cam

82 or 84 would not be transferred to the sinker and consequently the yarns would be drawn over the edge 32 of the sinker in front of nose 31 to produce normal plating. Fig. 7 indicates the conditions at this time for the production of reverse plating, while Fig. 10 indicates the conditions for the production of normal plating.

It is at this time that the band-holding bits function to hold out the spring band 39 to prevent the premature inward movement of sinkers which are not to be moved inwardly in spite of the fact that the operative edge of cam 43 is cut away. As indicated above, a portion 49 of cam 43 acts on the longer butts of the band-holding bits to prevent the action of band 39 upon the sinkers which will be centrifugally urged outwardly.

If the sinker was not prematurely moved inwardly, it will be moved inwardly by the action of the usual cam 47, which serves to produce the inward movement to knock over the old loops. The needle is then raised by cam 86 and the initial condition again attained.

From the above it will be obvious that the proper preselection of elements insures the production of either normal or reverse plating in the next stitch drawing operation. It is to be noted that the action of the cams 60 is somewhat negative in the sense that reverse plating is effected when none of the cams engages a lower jack.

It is frequently desirable to interrupt the formation of patterns in order to knit what is known as a plain sole, although the patterns are to be continued in the instep, by the association of the proper needles with jacks provided with butts in alignment with the cam 62. Then, if this cam is caused to be continuously in operative position during the formation of the foot portion of the stocking, normal plated knitting will be effected on the sole needles. Simultaneously, however, selective actuation of the jacks controlling the formation of loops on the instep needles may proceed as in the knitting of the leg, such jacks having the butts capable of cooperating with the cam 62 removed.

The provision of butts 83, which may be selectively removed from the jacks, may have a somewhat similar purpose. For example, suppose that the upper butts 83 are removed from those jacks 20 which are designed to effect reverse plating on the instep needles while those jacks which are designed to produce reverse plating on sole needles have lower butts 83 removed, then during the formation of the leg portions of a stocking both cams 82 and 84 may be in action to effect reverse plating on any needles throughout the circle, as may be determined by the control of cams 60. If, however, cam 82 is withdrawn during the formation of the foot portion of the stocking, then the first mentioned jacks will not be moved inwardly despite their selective upper or lower positioning under the action of lower jacks 42. As a result, reverse plating will only be produced in the instep portion of the stocking.

It will be obvious, however, that the provision of two or more butts such as 83 associated with selectively operating cams such as 82 and 84 may be used for the production of modified patterns in various ways in association with the control produced by the trick wheel through cams 60. For example, a rather elaborate pattern may be reduced to a somewhat skeleton form through various portions of the design merely by producing a selective ability or inability of certain jacks 20 to control the premature sinker movements. It is desirable, however, that the number of butts 83 provided should not be large in number, inasmuch as the action thereon by controlling cams tends to produce transverse thrusts upwardly and downwardly. Furthermore, it may be noted that the control at this point is by no means so flexible as that produced by pattern control of jacks 42, and control of jacks 20 is therefore desirable only as an adjunct to the major patterning means provided by the jacks 42 and their controlling elements.

The purpose of cams 51 and 53 is to insure against jamming during heel and toe knitting. The possibility that jamming might occur without the provision of such cams arises from the fact that when the needles are raised to inactive position by the pickers, they rise to such height as to engage the jack guides 14 and thus raise the arms 23 of jacks 20 to such height as, without such cams, to possibly cause them to engage the projections 36 on sinkers at a time when the sinkers are being retracted. To avoid any action of this nature, the cam 53 is designed to act upon the jacks 20 to move them outwardly to such position that the arm 23 will clear any associated projection 36 of a sinker. While the jacks are thus held outwardly, the jack guides are raised by the cam 51. The cam 51 is moved into action before the needle cylinder reverses to begin heel or toe knitting and at the same time cam 72 is withdrawn so that the jack guides will not be depressed as they pass its position. When rotary knitting is again resumed, cam 51 is taken out of action and cam 72 is again moved into action. In order that both of these cams may go into action even though all the jack guides happen to be riding at the same level when such action is to occur, the butts 18 of the jack guides are made of different lengths so that either of these cams may possibly first move in almost to the short butts and then, as subsequent long butts approach, act as cams thereon moving further inwardly to position to thereafter cam short butts. Cam 51 is made movable to avoid unnecessary wear on the spring bands.

Cams 74, 76, 82 and 84 are designed to be withdrawn when leveling occurs. The cams 82 and 84 are preferably out of action during heel and toe knitting.

What I claim and desire to protect by Letters Patent is:

1. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, elements individually associated with at least certain of said needles and movable into alternative positions, means cooperating with the elements adjacent the stitch drawing position to variously move the members to effect the production of normal or reverse plating depending upon the positions of elements, and means for positioning said elements at a prior location, said last means including means for selectively variously moving needles associated with said elements.

2. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, elements individually associated with at least certain of said needles and movable

into alternative positions, means cooperating with the elements adjacent the stitch drawing position to variously move the members to effect the production of normal or reverse plating depending upon the positions of elements, and means for positioning said elements at a prior location, said last means including means for selectively variously moving needles associated with said elements, the needles being arranged to engage and move said elements during certain needle movements.

3. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, means for selectively positioning needles prior to the stitch drawing position, and means controlled by such selective positioning of the needles for variously moving the members adjacent the stitch drawing position to effect the production of normal or reverse plating.

4. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, means for selectively positioning needles prior to the stitch drawing position, and means controlled by such selective positioning of the needles for variously moving the members adjacent the stitch drawing position to effect the production of normal or reverse plating, said needles serving to control such movements of adjacent members.

5. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, means for selectively positioning needles prior to the stitch drawing position, radially movable jacks positioned by said selective positioning of needles, and means acting on the jacks adjacent the stitch drawing position whereby movements are imparted to the members to effect normal or reverse plating depending upon the selective positioning of needles.

6. A circular knitting machine including a slotted needle cylinder, needles slidable in the slots of said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, elements individually associated with at least certain of said needles within their slots and movable into alternative positions by certain movements of the corresponding needles, means cooperating with the elements adjacent the stitch drawing position to variously move the members to effect the production of normal or reverse plating depending upon the positions of the elements, and means for positioning said elements at a prior location, said last means including jacks movable in the needle slots below the needles and means for selectively actuating the jacks.

7. A circular knitting machine including a slotted needle cylinder, needles slidable in the slots of said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, means for selectively positioning needles prior to the stitch drawing position, said last means including jacks movable in the needle slots below the needles and means for selectively actuating the jacks, and means controlled by such selective positioning of the needles for variously moving the members adjacent the stitch drawing position to effect the production of normal or reverse plating.

8. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, radially movable jacks individually associated with the members, means for moving the jacks radially in one direction adjacent the stitch drawing position, and means for positioning the jacks prior to such position, so that those in one position fail to engage their corresponding members when moved radially in said direction and those in another position engage their corresponding members when moved radially in said direction, to thereby effect the selective production of normal or reverse plating.

9. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, elements individually associated with at least certain of said needles and movable into alternative positions, means cooperating with the elements adjacent the stitch drawing position to variously move the members to effect the production of normal or reverse plating depending upon the positions of elements, means at a prior location for causing all of said elements to assume a predetermined position, means for selectively raising needles at an intermediate location to thereby selectively position said elements, and means for thereafter causing said needles to pass through their usual knitting wave.

10. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, jacks carried by the needle cylinder associated with at least certain of said members, means for similarly continuously operating relatively to the needle cylinder at least certain of said jacks, jack controlling means, and pattern means for selectively positioning said controlling means so that said jacks are rendered either effective or ineffective to actuate said members when they are operated by said operating means.

11. The method of producing selective reverse plating by the selective actuation of members movable between the needles and arranged to engage yarns when stitches are being drawn, including feeding a plurality of yarns to a circular series of needles and moving said needles to produce stitches, acting near the stitch forming point in the same fashion in the formation of every course upon elements individually associated and rotatable with said members and selectively positioning said elements at a prior location, so that they may actuate their respective members when acted upon as aforesaid.

12. The method of producing selective reverse plating by the selective actuation of members movable between the needles and arranged to engage yarns when stitches are being drawn, including feeding a plurality of yarns to a circular series of needles and moving said needles to pro-

duce stitches, acting upon elements individually associated with said members to cause them to move said members to effect the selective production of normal or reverse plating, and selectively positioning said elements at a prior location by causing selective movements of needles associated with said elements.

13. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, jacks individually associated with at least some of said members and rotatable therewith, means for moving said jacks in the same fashion at every course of knitting adjacent the stitch drawing position, and selective positioning means for said jacks adapted to render them active upon their respective members to effect selective reverse plating when so moved.

14. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, sinkers or like instrumentalities movable between the needles and adapted according to their position to so engage the yarns when stitches are being drawn as to effect either normal or reverse plating, jacks individually associated with at least some of said sinkers and rotatable therewith, means for moving said jacks in the same fashion in the formation of every course adjacent the stitch drawing position and selective positioning means for said jacks to render them active to move their respective sinkers to effect reverse plating when so moved.

15. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, elements individually associated with at least certain of said needles and movable axially of the needle cylinder into alternative positions, means moving radially, adjacent the stitch drawing position, elements located in one position to cause the elements to engage and move corresponding members to effect reverse plating, and means for selectively positioning said elements axially of the needle cylinder at a prior location while they are out of engagement with said members.

16. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, elements individually associated with at least certain of said needles and movable axially of the needle cylinder into alternative positions, means moving radially, adjacent the stitch drawing position, elements located in one position to cause the elements to move corresponding members to effect reverse plating, and means also individually associated with the needles for selectively positioning said elements axially of the needle cylinder at a prior location.

17. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, jacks associated individually with said members, means for selectively positioning jacks in alternative positions axially of the cylinder by axial movements only at a location prior to the point where stitches are drawn, and means for moving said jacks radially adjacent the stitch drawing position so that, dependent upon the selective positions of the jacks previously assumed, they may affect the movements of the members to effect the production of normal or reverse plating.

18. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, jack guides individually associated with at least certain of said needles and movable into alternative positions, jacks associated with said jack guides and located in alternative positions thereby, means for so alternatively positioning said jack guides, at a location prior to the point where stitches are drawn, to alternatively position the jacks, and means for thereafter, adjacent the stitch drawing position, moving relatively to the needle cylinder the jacks thus alternatively positioned so that, depending upon their positions, they may affect the movements of the members to effect the production of normal or reverse plating.

19. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, jack guides individually associated with at least certain of said needles and movable into alternative positions, jacks associated with said jack guides and located in alternative positions thereby, means for so alternatively positioning said jack guides, at a location prior to the point where stitches are drawn, to alternatively position the jacks, and means for thereafter, adjacent the stitch drawing position, moving relatively to the needle cylinder the jacks thus alternatively positioned so that, if they are in one position they fail to engage said members and normal plating results, and if they are in an alternative position they engage and move the members and reverse plating results.

20. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, elements carried by the needle cylinder individually associated with at least certain of said needles and movable axially thereby into alternative positions, means for so alternatively positioning said elements at a location prior to the point where stitches are drawn, means cooperating with said elements in one alternative position for thereafter, adjacent the stitch drawing position, prematurely moving members relatively to the needle cylinder to effect the production of reverse plating, and means for moving other members relatively to the needle cylinder to effect the production of normal plating.

21. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, jack guides individually associated with at least certain of said needles and movable into alternative positions,

jacks associated with said jack guides and located thereby in active or inactive positions, means for so alternatively positioning said jack guides, at a location prior to the point where stitches are drawn, to alternatively position the jacks in active or inactive positions, and means for thereafter, adjacent the stitch drawing position, moving relatively to the needle cylinder the jacks thus alternatively positioned so that those which have been located in active position will move corresponding members to effect reverse plating.

22. A circular knitting machine including a needle cylinder, needles slidable in said cylinder, means for feeding a plurality of yarns to the needles, members movable between the needles and arranged to engage the yarns when stitches are being drawn, elements carried by the needle cylinder individually associated with at least certain of said needles and movable axially into alternative positions, means for so alternatively positioning said elements, by axial movements only, at a location prior to the point where stitches are drawn, means cooperating with said elements in one alternative position for thereafter, adjacent the stitch drawing position, prematurely moving members relatively to the needle cylinder to effect the production of reverse plating, and means for moving other members relatively to the needle cylinder to effect the production of normal plating.

23. Knitting mechanism comprising a bed and actuator means, said bed and said actuator means being relatively movable, a series of needles carried by said bed, a series of auxiliary knitting elements extending at a substantial angle to said bed and individual to at least certain of said needles, means to selectively operate said needles, and means to effect a selective operation of individual auxiliary knitting elements in response to the operation of the individual needles with which they are associated but subsequent thereto, said effecting means including means adapted to be set in accordance with the selective operation of the needles and also including means forming part of said actuator means.

24. Knitting mechanism comprising a bed and actuator means, said bed and said actuator means being relatively movable on said bed, means forming part of the actuator means to selectively control the operation of the needles, a series of auxiliary knitting elements extending at a substantial angle to said needle bed, and a series of control elements individual to at least certain of said needles and individually responsive to the movement thereof, said control elements being adapted to control the actuation of said auxiliary knitting elements in response to the operation of another part of the actuator means.

25. Knitting mechanism comprising a bed and actuator means, said bed and actuator means being relatively movable, a series of slots in said bed, a plurality of knitting elements movable longitudinally in said slots, a series of auxiliary knitting elements and a series of control elements for said auxiliary knitting elements, said control elements being individual to at least certain of said knitting elements and being movable to operative position therewith, means to selectively impart longitudinal movement to said knitting elements, and means to selectively operate said auxiliary knitting elments in accordance with the positioning of said control elements.

26. Knitting mechanism comprising a bed and actuator means, said bed and said actuator means being relatively movable, a series of needles carried by said bed, means forming part of the actuator means to selectively control the operation of the needles, a series of auxiliary knitting elements extending at a substantial angle to said needle bed, a series of controlled elements individually responsive to the operation of at least certain of said needles and adapted to have a setting imparted thereto by the needle operation, and means operative in accordance with the setting thereof to cause the selective operation of said auxiliary knitting elements in accordance with the setting of said control elements.

27. Knitting mechanism comprising a bed and actuator means, said bed and actuator means being relatively movable, a series of slots in said bed, a plurality of needles movable longitudinally in said slots, a series of sinkers, a series of control elements for said sinkers, said control elements being individual to at last certain of said needles and being movable to operative position therewith, means to selectively impart longitudinal movement to said needles, and means to selectively operate said sinkers in accordance with the positioning of said control elements.

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