Jan. 15, 1929.

1,699,320

E. WILDT ET AL

KNITTING MACHINE

Filed June 7, 1928

2 Sheets-Sheet 1

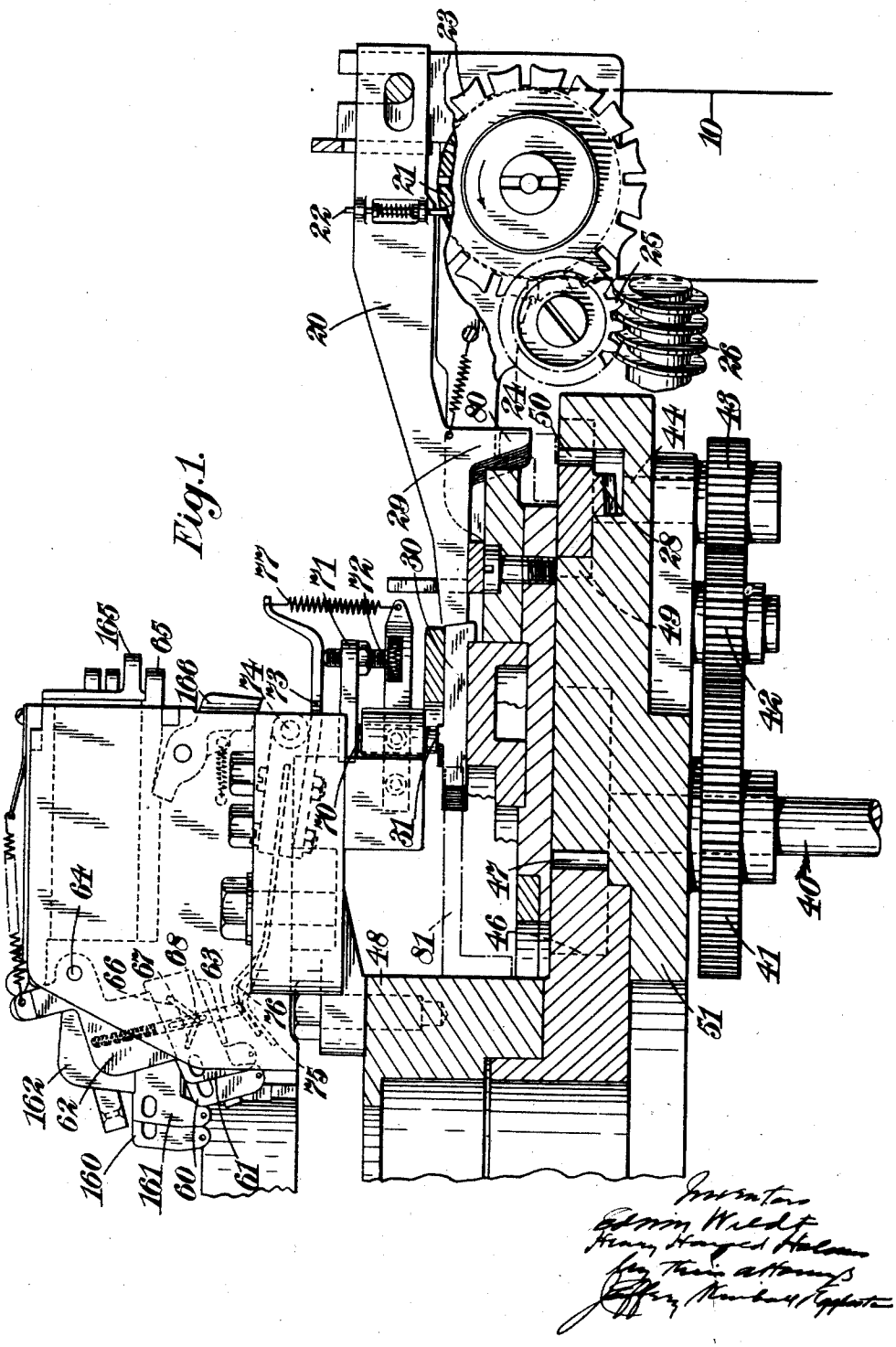

Fig. 1.

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2 Sheets-Sheet 2

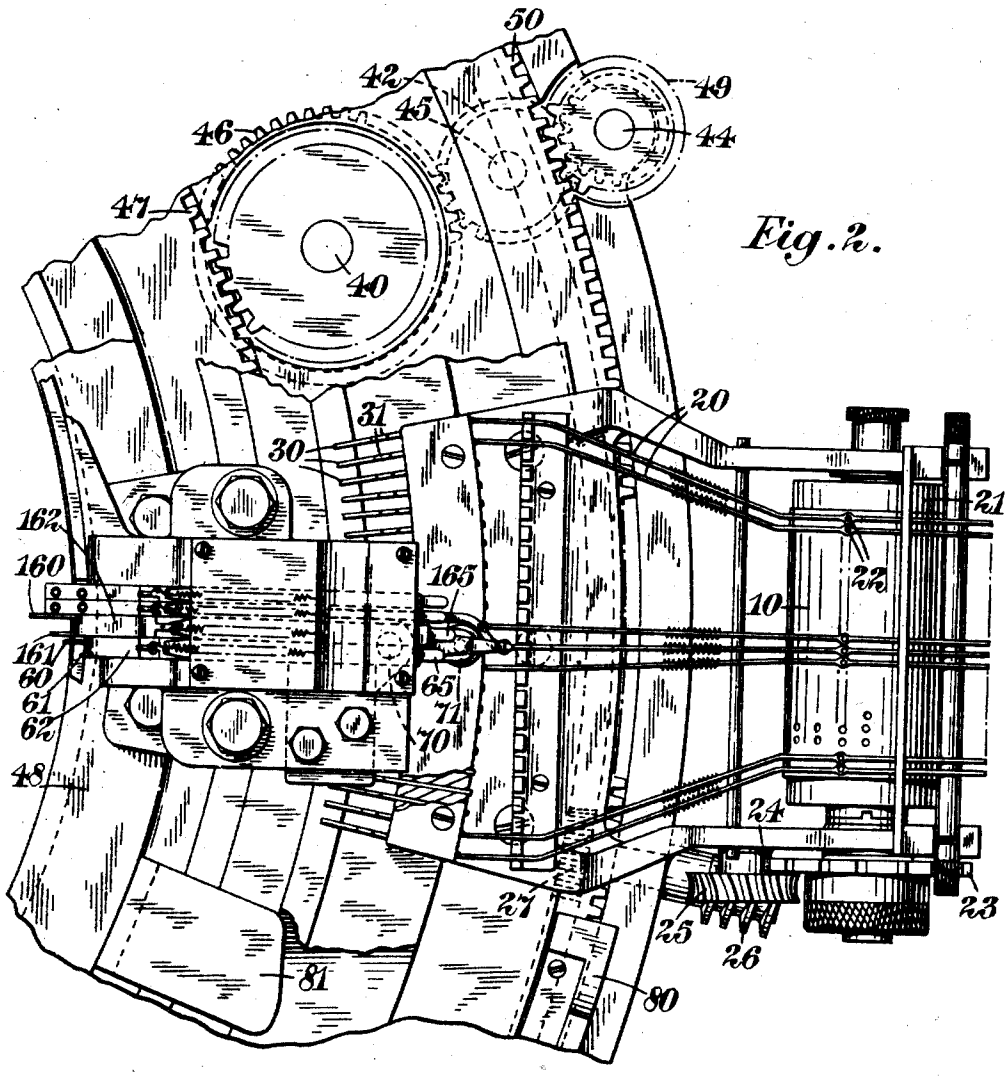

Fig. 2.

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UNITED STATES PATENT OFFICE.

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KNITTING MACHINE.

Application filed June 7, 1928, Serial No. 283,507, and in Great Britain January 3, 1927.

This invention consists in improvements in or relating to knitting machines, and while it has particular application to circular knitting machines, it is not limited thereto.

An object of the present invention is to provide an improved means for producing a pattern in the knitted fabric by a method or yarn-reversal or reverse-plating. The known method of reverse-plating entails feeding simultaneously to the needles two yarns which differ from one another in colour, appearance or character. The yarns are fed at different angles and/or heights so that one is brought to the front of the fabric and the other to the back. When their relative positions are reversed, that yarn which, up to the time of reversal, appeared on the front of the fabric, will be thrown to the back and vice versa. Patterns are produced by repeated reversals in this manner and an advantage of producing a pattern by reverse-plating lies in the fact that as both yarns are knitted simultaneously, no loose or floating threads appear at the back of the knitted fabric.

The invention is equally applicable, however, to a method in which only one of the yarns is knitted, while the other remains as a floating thread at the back. In a similar manner the pattern is produced by reversing the relative positions of the yarns.

The term "reverse-plating mechanism" or "reverse-plating" where it occurs hereinafter and in the appended claims is therefore to be understood as including not only a yarn-reversing mechanism or method in which both yarns are knitted simultaneously but also a mechanism or method in which only one yarn is knitted.

The invention consists broadly in the combination of means for reversing the relative positions at which two yarns are to be fed to the needles, a jacquard device, and an operative connection between it and said reversing means, said operative connection comprising a plurality of selectors which are individually selectable by the jacquard device and are allocated respectively to specific needles whereby each selector always co-operates only with its own needle. By "allocated respectively to specific needles", we mean that a selector is provided for each needle whereat a reversal of the relative positions of the yarns may be desired, and that each selector is so located that when it acts to make a reversal, it causes the reversal to occur at some certain specific needle; it will be obvious that a single selector may serve a small group of adjacent needles that are always to take the yarns in a like relation.

Other features of the invention will be apparent from the following description of a preferred example of reverse-plating mechanism, illustrated in the accompanying drawings, in which

Figure 1 is an elevation, partly in section, of one form of the invention applicable to a circular knitting machine having a fixed needle cylinder and a rotatable cam-box, the plane of the section being radial with respect to the needle cylinder, and

Figure 2 is a plan of the parts shown in Figure 1, parts being broken away to show other parts situated beneath.

Like reference numerals indicate like parts in both figures of the drawings.

In both figures of the drawings, only portions of the needle cylinder, cam-box and associated mechanism are illustrated, and a pattern-control mechanism for a relatively small group of needles only is shown. It will be appreciated that the pattern-controlling mechanism illustrated and now to be described can be duplicated at intervals around the machine wherever it is desired to be used so that, if necessary, every single needle in the whole cylinder can be associated with a selector.

In the mechanism illustrated each needle has appropriated to it a selector for controlling the reverse-plating mechanism, and all the selectors of a group are under the influence of a perforated jacquard band, pattern, or pattern-element 10.

The selectors, in the form of sliders are indicated at 20 and are allocated one to each needle that is to be influenced by the pattern-controlling (yarn-reversing) mechanism. All these selectors illustrated are controlled by the jacquard band 10 so as to be moved forwardly when selected thereby. That is to say, the jacquard band 10 passes over the slotted roller 21 into which spring-pressed pins 22, mounted one in each selector, can enter when selected to do so by a perforation in the jacquard band. As shown in the drawings, these perforations or pattern-calling agencies, for individual rows of stitches are arranged in a row crosswise of the pattern and the direction of movement of the pattern. The roller 21 as a plurality of longitudinal slots which will register in turn with succes-

sive lines of perforations in the jacquard band. The roller is moved round step by step by Geneva stop mechanism comprising a toothed wheel 23, pin 24, worm-wheel 25, and worm 26. The worm is rotated by engagement between a bevel wheel 27 (Figure 2) fast on the worm spindle and a gearing 28 which is rotated, in a manner to be described later, in company with the cam-box. As the roller is turned a step after a pin 22 is passed into a slot, the roller acts on that pin to slide the corresponding selector 20 inwardly.

For each of the sliders 20, there is an intermediate sliding selector 30, there being, therefore, as many elements 30 as there are sliders 20. Each of the intermediate selectors 30 has an upwardly-directed projection 31 for a purpose to be described more fully hereinafter.

The means by which the several rotating parts are driven are as follows:—

A main driving shaft 40 carries a gear 41. An idler gear 42 intermeshes with the gear 41 and another gear 43 carried on a shaft 44, bearings being provided for the shafts 40 and 44 and for the spindle 45 of the gear 42 in a fixed part of the machine. The shaft 40 also carries a second gear 46 which meshes with a gear 47 secured to and rotatable with the cam-box, part of which is indicated at 48. The shaft 44 also carries a second gear 49 which meshes with a ring of gear teeth 50 formed on the gear ring 28. The latter receives a bearing in a fixed part 51 of the machine so that it can revolve around the axis of the needle cylinder.

Thus, from the main drive shaft 40 motion is transmitted, on the one hand, to the cam-box 48, and on the other hand, to the gear ring 28 which drives the worm 25, and through it to the roller 21 and jacquard card 10. The gear ratios are so chosen that the gear ring 28 and the cam-box both revolve round the cylinder axis at the same angular velocity.

The reverse-plating mechanism actuated or controlled by the sliders 20, comprises one or more sets of yarn feeders, each set comprising two relatively movable feeders, such as 60 and 61, which, in their normal positions, deliver their respective yarns at different heights to the needles. These yarn feeders are mounted on a carrier 62 and are movable in opposite directions radially of the needle cylinder by endwise movement of a spring-controlled plunger 63. In the example illustrated, two sets of such yarn-changing devices are shown, the second set having its yarn feeders indicated by the reference numerals 160 and 161, and the mount is indicated by the reference numeral 162. The respective yarn enters each feeder through the large oval opening shown and passes to the needles from the feeder through the lower circular opening shown in each feeder.

The yarn feeders 60 and 61 are shown in an operative position for delivering their yarns to the needles, whereas the feeders 160 and 161 are shown in their inoperative positions. The movement from the operative to the inoperative positions is obtained by swinging the mount about its axis of pivoting 64 by means of sliders 65 and 165. Those sliders which are moved forwardly (towards the left in Figure 1) to hold their respective mounts in operative position, are held forwardly by means of a trigger device 166. It will be seen that the yarn feeders 60 and 61 have been moved to the operative position and are retained therein by the trigger 166, whereas the feeders 160 and 161 are in the inoperative position.

The yarn-changing mechanism that is in the operative position is caused to produce a reversal of the yarns by endwise movement of the plunger 63, and this plunger has a projecting pin 68 which is engaged in oppositely inclined slots 66 and 67 respectively in the feeders 60 and 61. It will be understood that when the plunger 63 is moved in one direction, the feeder 60 will be moved forwardly towards the needles, and the feeder 61 will be withdrawn therefrom. Conversely, when the plunger 63 is moved in the reverse direction, the movements and relative positions of the feeders 60 and 61 will be reversed.

A sliding plunger 70, adapted to be engaged at one end by the projections 31 on the intermediate sliders 30, carries at its other end an arm 71 having at its outer end an adjustable set-screw 72. The end of the latter engages with a lever 73 on one side of a pivot 74 about which the lever turns. The pivot 74 is received in the casing which carries the yarn feeders. On the opposite side of the pivot 74 the lever 73 is bifurcated to provide two portions 75 and 76. These two portions lie respectively under pins 63 of two adjacent sets of interchangeable yarn feeders. One lever 73 therefore serves two such sets. When one of the sets of feeders is held out of operation its pin 63 will be unaffected by movements of the lever 73 whereas the pin 63 of the other set will be in a position to be influenced by the appropriate bifurcation at the end of the lever 73. It will be obviously possible, if both sets of interchangeable yarn feeders were simultaneously in the operative position, for the lever 73 to actuate the pins 63 of both sets simultaneously. In the normal operation of the machine, however, only one set of the yarn feeders will generally be in operation at any one time.

It will be appreciated that with the mechanism described and illustrated, each needle to which the pattern control (by yarn-reversal) is to apply is individually under the influence of a selector 20. Thus, if a selector 20 has been moved forwardly, as in the ex-

ample illustrated, it will have pushed its co-operating intermediate slider 30 forwardly so that the projection 31 is beneath the plunger 70 whereby the pin 63 of the reverse-plating mechanism that is in operation is allowed to move to the bottom of its stroke. On the other hand, if the selector 20 has not been moved forwardly (by reason of there being no perforation in the jacquard band 10 presented to the pin 22) the intermediate slider 30 will not have been moved forwardly, and consequently the plunger 70 will remain in or move to its lowermost position and the pin 63 will then have been raised to the top of its stroke by the spring 77 attached to lever 73. It will be observed that the yarn guides are biased in one direction; that is to say, the spring 77 tends to cause the yarns to be fed in one certain relation to each other. The selectors then act to cause the yarns to be fed in another relation to each other. This is the preferred arrangement.

By reason of the inclined slots 66 and 67 in the yarn feeders which are engaged by a transverse pin 68 extending from the pin 63, the relative positions of the two yarn feeders, such as 60 and 61, will be interchanged by the endwise movement of the pin 63. In the same manner the yarn feeders 160 and 161 will be influenced by a pin similar to 63 which is engaged by a portion 76 of the bifurcation of lever 73. That is to say, if the feeder 60 is projected more forwardly than is the feeder 61 when the pin 63 is at the bottom of its stroke, the position of the two feeders will be interchanged when the pin 63 is moved to the top of its stroke. Consequently, as the relative positions of the feeders 60 and 61 (or 160 and 161) are dependent upon the position of the plunger 70 and this position is regulated by the position of the projections 31 in relation to the plunger, it follows that the reversal of the relative positions of the yarns is determined by the lay-out of the perforations in the jacquard card. Moreover, as for each patterning needle there is a separate selector 20 and intermediate selector 30, reversal can be effected and caused to occur at any predetermined individual needle with which selector mechanism is associated.

It will be understood that the mechanism is so timed that the jacquard card is first stepped round so as to present a line of perforations to the set of pins 22 when the sliders 20 are in their most retracted positions. The completion of the stepped movements of the jacquard roller then moves those sliders which have been selected by the jacquard card (i. e. whose pins have passed through perforations therein and have entered a groove in the jacquard roller) towards the needle cylinder with the effect above described.

In order to enable all the selectors 20 and the intermediate selectors 30 to be reset between successive control operations of the jacquard card 10, cams 80 and 81 are provided. These cams come into operation with respect to the individual selectors after the yarn has passed the needles controlled by the selectors. The cam 80 is a lifting cam and by engagement with a projection 29 on the selector 20 the latter is lifted so that its pin 22 is raised clear of the jacquard card. The spring 120 then moves the selector away from the needle cylinder into a position for selection by the jacquard card. The cam 81 engages with the inner ends of the intermediate selectors and pushes them outwardly to follow up the selectors 20.

The invention as to its details of construction, arrangement and application is capable of many modifications.

For instance, although the invention has been described as applied to a machine having a revolving cam-box, it can, with modifications readily understood to those conversant with the manufacture and design of knitting machines, be applied to a machine having a revolving needle cylinder.

In the examples illustrated herein, the jacquard-controlled mechanisms have been shown as applied to needles disposed in a sector only of the machine. Similar mechanism may be positioned around the periphery of the machine so that all the needles, or predetermined groups of them, are controlled in the manner described. It is not essential that every individual needle in the cylinder should be subject to the pattern control, as the latter may be applied only to those needles or groups of needles where such control is desirable. Where, therefore, it has been stated hereinabove that a plurality of selectors are employed and are allocated respectively one to each needle or group thereof, it is to be understood that such a statement is intended to include the arrangement in which a certain number only of the needles in the machine are to be subject to the pattern control and not the whole number thereof; but where needles occur that are to be subject to the control, then there will be a plurality of selectors for those needles allocated in the manner above-mentioned.

The invention is not limited in its application to circular knitting machines, as equivalent mechanism can be applied to knitting machines other than those of the circular type.

The invention has been described only in regard to the particular mechanism for actuating and controlling the reverse-plating devices. It is to be understood that other control means, which are customary or requisite and are known in the industry, may or will be employed in accordance with the type and purpose of the machine to which the present invention is applied.

It is to be understood that in combination

with the reverse-plating mechanism described herein there can be employed any preferred mechanism for changing the stitching, for example for producing tuck designs simultaneously with the yarn reversal. One such mechanism has been described in co-pending application, Serial No. 205,181, and our British Patent No. 283,609, and as this mechanism has been set out in great detail in the said co-pending application and patent, it is unnecessary to describe it again herein. Other known forms of tucking control, however, can be employed, if preferred.

We claim:—

1. In a knitting machine, the combination of a bank of needles, a plurality of reverse-plating yarn guides, at least one of which is movable with respect to another, a plurality of selectors allocated respectively to specific needles and movable substantially independently of each other for controlling the relative positions of the yarn guide to each other, and a pattern mechanism including a pattern in which the pattern-calling agencies for individual rows of stitches are arranged in a row or rows substantially crosswise of the pattern and the direction of movement of the pattern for controlling the positioning of the selectors.

2. In a knitting machine, the combination of a bank of needles, a plurality of reverse-plating yarn guides, at least one of which is movable with respect to another to reverse the relative positions, one with respect to another, at which the yarns are guided to the needles, a plurality of selectors allocated respectively to specific needles and movable substantially independently of each other, for controlling the relative positions of the yarn guides to each other, a pattern mechanism including a pattern in which the pattern-calling agencies for individual rows of stitches are arranged in a row or rows substantially crosswise of the pattern, and the direction of movement of the pattern, for controlling the positioning of the selectors, and means for moving the selectors selected by the pattern for movement.

3. In a circular knitting machine, the combination of a circular bank of needles, a plurality of reverse-plating yarn guides revolving relative to said bank, around the axis of said bank, and at least one of which guides is movable with respect to another to reverse the relative positions, one with respect to another, at which the yarns are guided to the needles, a bank of selectors allocated respectively to specific needles, substantially independently selectable, and movable substantially successively around the axis of the bank of needles in individual revolutions of the yarn guides, for controlling the relative positions of the yarn guides to each other, said bank of selectors being held in a fixed position relative to the bank of needles, and a pattern mechanism including a pattern in which the pattern-calling agencies for individual rows of stitches are arranged in a row or rows substantially crosswise of the pattern and the direction of movement of the pattern, for controlling the positioning of the selectors.

4. In a circular knitting machine, the combination of a circular bank of needles, a plurality of reverse-plating yarn guides revolving relative to said bank, around the axis of said bank, and at least one of which guides is movable with respect to another to reverse the relative positions, one with respect to another, at which the yarns are guided to the needles, a bank of selectors allocated respectively to specific needles, substantially independently selectable, and moving substantially successively around the axis of the bank of needles in individual revolutions of the yarn guides, for controlling the relative positions of the yarn guides to each other, said bank of selectors being held in a fixed position relative to the bank of needles, a pattern mechanism including a pattern in which the pattern-calling agencies for individual rows of stitches are arranged in a row or rows substantially crosswise of the pattern and the direction of movement of the pattern, for controlling the positioning of the selectors, and means for moving the selectors selected by the pattern for movement.

5. The subject-matter of claim 4 characterized by the fact that said means for moving the selectors includes a rotating roller supporting the pattern and having openings in its surface, and that the pattern-calling agencies are perforations in the pattern through which abutments on selectors fall into said openings in the roller so that the roller, in rotating, can engage such abutments and therethrough move the corresponding selectors.

6. In a knitting machine, the combination of a bank of needles, a structure including a plurality of reverse-plating yarn guides which, relative to said bank, moves along said bank, a plurality of selectors allocated respectively to specific needles and movable substantially independently of each other to and from points in the path of said structure where they may engage said structure to change the relative positions of the yarn guides, and a pattern mechanism including a pattern in which the pattern-calling agencies for individual rows of stitches are arranged in a row or rows substantially crosswise of the pattern and the direction of movement of the pattern, for controlling the positioning of said selectors at said points in the path of the yarn guide structure.

7. In a circular knitting machine, the combination of a circular bank of needles, a yarn guide structure rotating relatively thereto and including a plurality of reverse-plating

yarn guides, an arcuate bank of selectors coaxial with and retained fixed in position with respect to the bank of needles, said selectors being allocated respectively to specific needles and movable substantially independently of each other to and from points in the path of said structure where they may engage said structure to change the relative positions of the yarn guides, a pattern mechanism including a pattern in which the pattern-calling agencies for individual rows of stitches are arranged in a row or rows substantially crosswise of the pattern and the direction of movement of the pattern, for controlling the positioning of the selectors at said points in the path of the structure, and means for moving successively, in individual revolutions of the yarn guide structure, the selectors selected by the pattern.

8. The subject matter of claim 1 characterized by the fact that the selectors are sliding members.

9. In a knitting machine, the combination of a bank of needles, a plurality of reverse-plating yarn guides, at least one of which is movable in respect to another and which are biased to feed the yarns in some certain relation to each other, a plurality of selectors allocated respectively to specific needles and movable substantially independently of each other to and from positions in which they change the relative positions of the yarn guides to cause the yarn to be fed in another relation to each other, and a pattern mechanism including a pattern in which the pattern-calling agencies for individual rows of stitches are arranged in a row or rows substantially crosswise of the pattern and the direction of movement of the pattern, for controlling the positioning of the selectors.

10. In a circular knitting machine, the combination of a circular bank of needles, a yarn guide structure revolving with respect thereto and including a pair of reverse-plating yarn guides, means to normally return said guides to relative positions wherein they feed the yarns to the needles in a certain relation to each other, a substantially arcuate bank of selectors substantially coaxial with the bank of needles, said selectors being allocated respectively to specific needles and movable substantially independently of each other to and from positions in which they stand in the path of said structure to engage the same to reverse the positions of said yarn guides from normal, a pattern mechanism including a pattern in which the pattern-calling agencies for individual rows of stitches are arranged in a row or rows substantially crosswise of the pattern and the direction of movement of the pattern, for controlling the positioning of the selectors in the path of the structure, and means for moving the selectors as selected by said pattern.

11. The subject matter of claim 4, characterized by the fact that in addition to the means for moving the selector selected by the pattern for movement, there is cam means, revolving around the axis of the needle bank, for returning the selectors substantially to the positions from which they were moved by the first mentioned means.

12. The subject matter of claim 1, characterized by the fact that there are two or more sets of reverse-plating yarn guides, each set including a plurality of reverse-plating yarn guides, and independently adjustable to and from control by the selectors.

13. In a knitting machine, the combination of a bank of needles, a plurality of reverse-plating yarn guides, a pattern in which the pattern-calling agencies for individual rows of stitches are arranged in a row or rows substantially crosswise of the pattern and the direction of movement of the pattern, an operative connection comprising a plurality of selectors which are individually selectable by the pattern mechanism and are allocated respectively to specific needles, intermediate selectors allocated respectively to and movable with each said selector, a plunger actuated by said intermediate selectors and operatively connected to said yarn guides, means controlled by the pattern to move said selectors and their associated intermediate selectors in one direction, and means to return the selectors in the reverse direction.

14. In a knitting machine, the combination of a bank of needles, a yarn guide movable to change its relation to the bank of needles, a plurality of selectors allocated respectively to specific needles and movable substantially independently of each other, for controlling the relation of the yarn guide to the bank of needles, and a pattern mechanism including a pattern in which the pattern-calling agencies for individual rows of stitches are arranged in a row or rows substantially crosswise of the pattern and the direction of movement of the pattern, for controlling the positioning of the selectors.

15. The subject matter of claim 14, characterized by the fact that the yarn guide is biased to a certain relation to the bank of needles, and that the selectors, as selected by the pattern mechanism, engage the yarn guide structure to move the yarn guide to another position.

In testimony whereof we have signed our names to this specification.

EDWIN WILDT.
HENRY HAROLD HOLMES.