

July 25, 1950

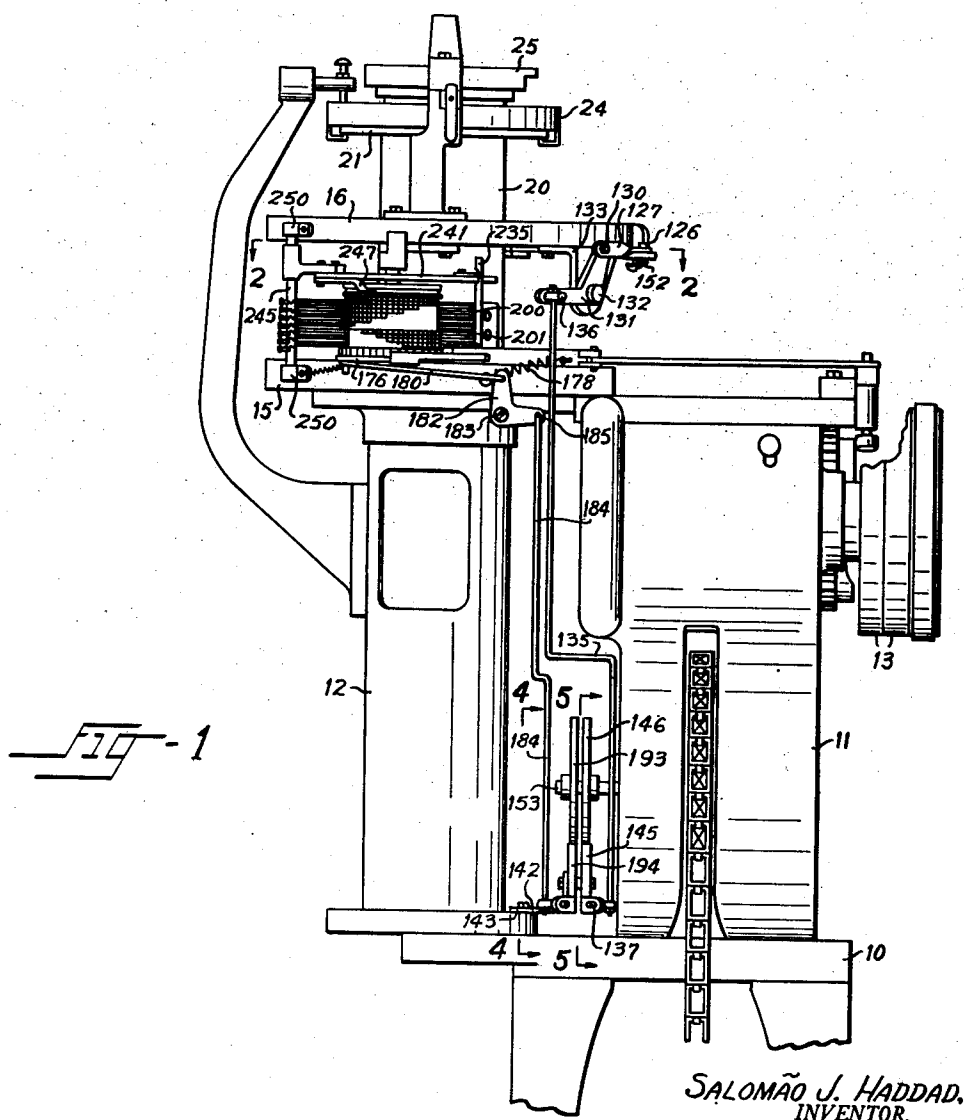
S. J. HADDAD

2,516,697

APPARATUS FOR KNITTING FLOAT PATTERNS

Filed March 8, 1949

11 Sheets-Sheet 1



SALOMÃO J. HADDAD,
INVENTOR.

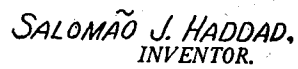
BY

Paul H. Kohn

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2,516,697

11 Sheets-Sheet 2



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July 25, 1950

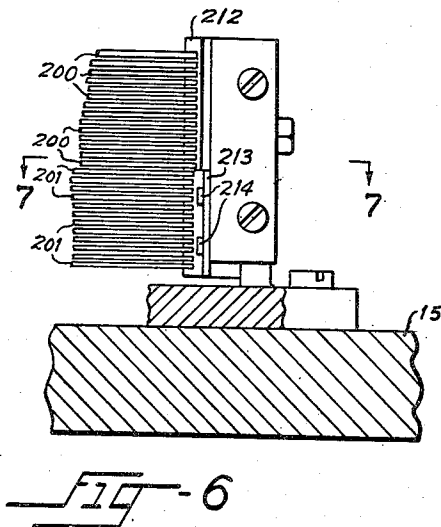
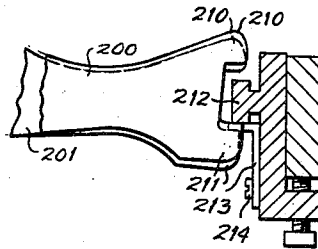
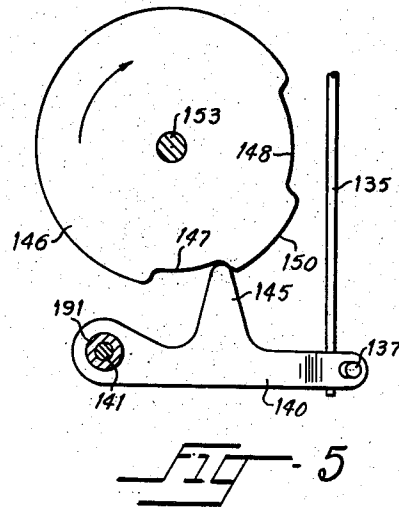
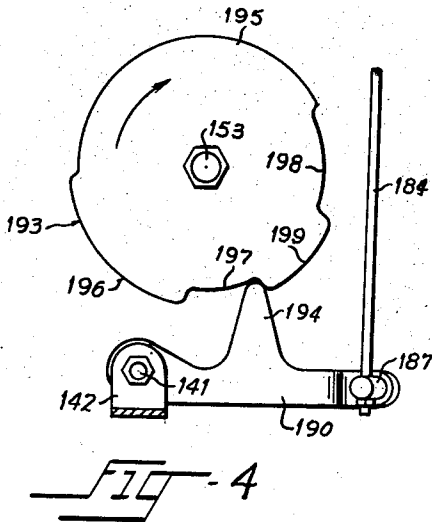
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2,516,697

APPARATUS FOR KNITTING FLOAT PATTERNS

Filed March 8, 1949

11 Sheets-Sheet 3



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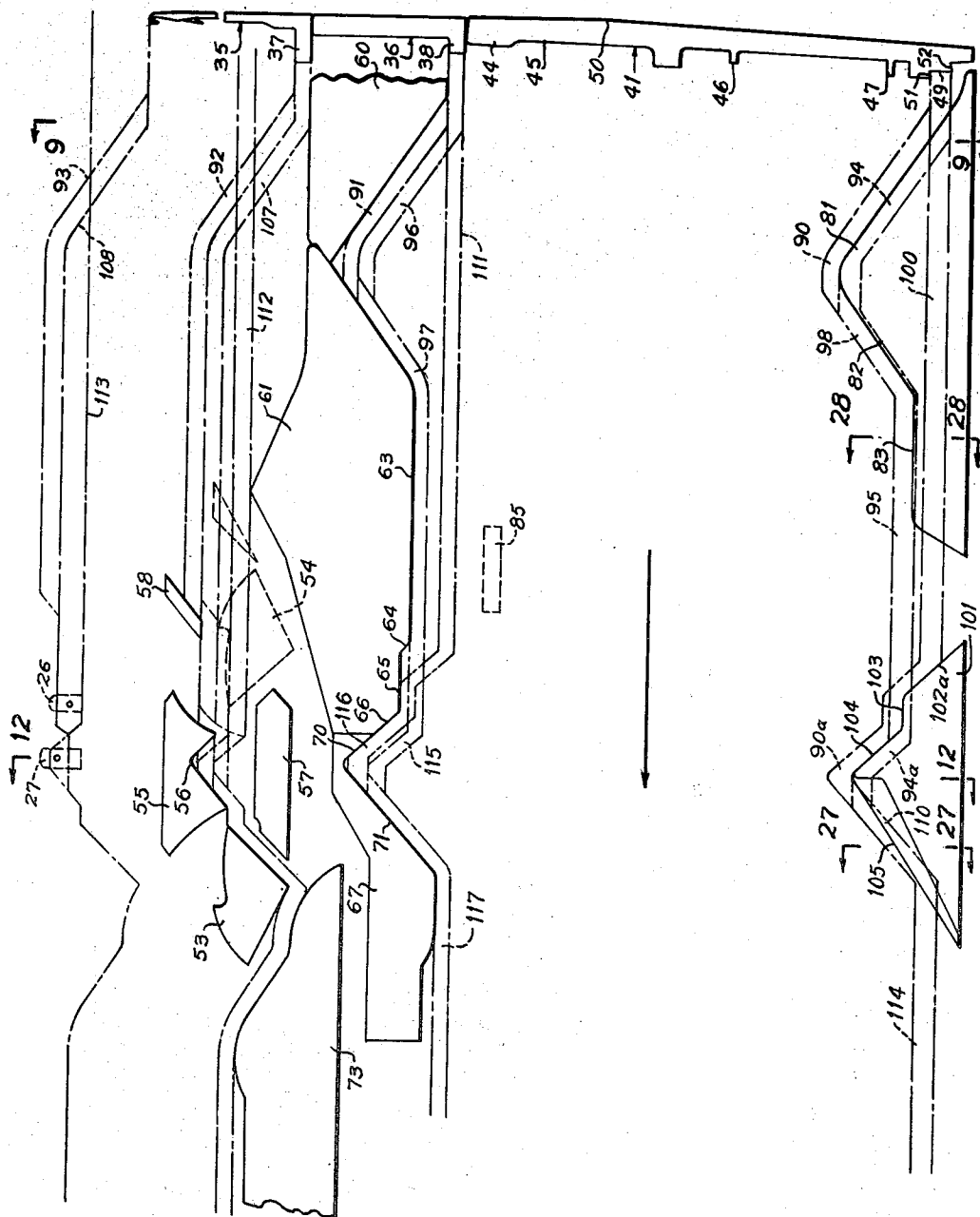
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APPARATUS FOR KNITTING FLOAT PATTERNS

Filed March 8, 1949

11 Sheets-Sheet 4



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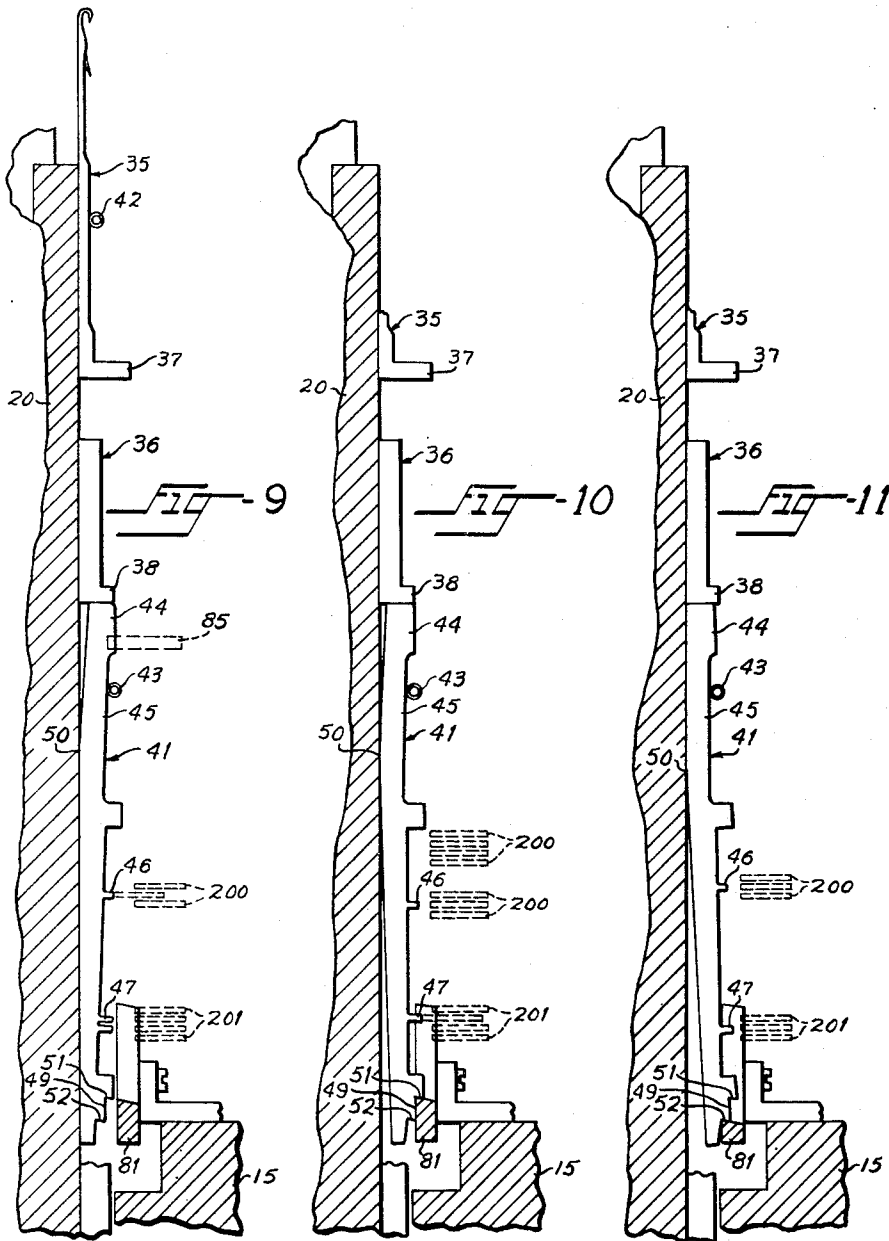
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APPARATUS FOR KNITTING FLOAT PATTERNS

Filed March 8, 1949

11 Sheets-Sheet 5



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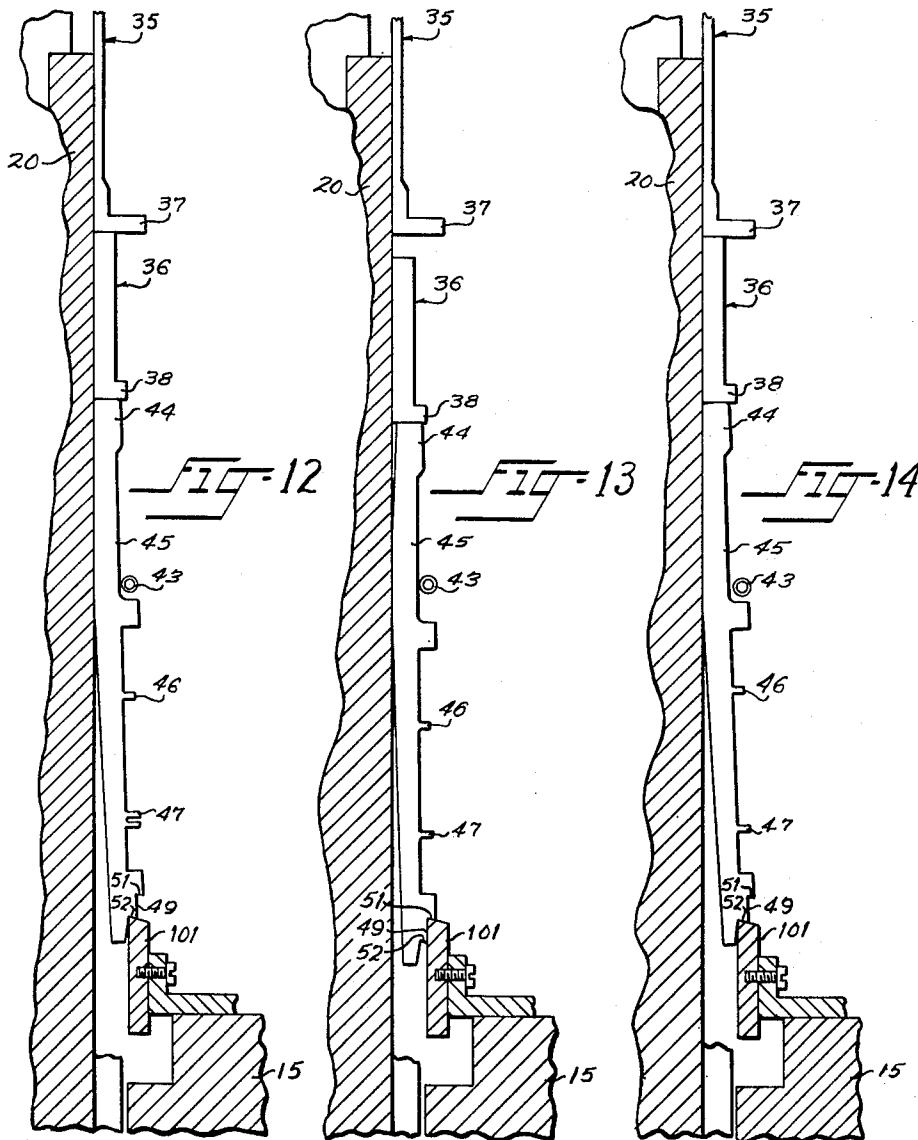
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APPARATUS FOR KNITTING FLOAT PATTERNS

Filed March 8, 1949

11 Sheets-Sheet 6



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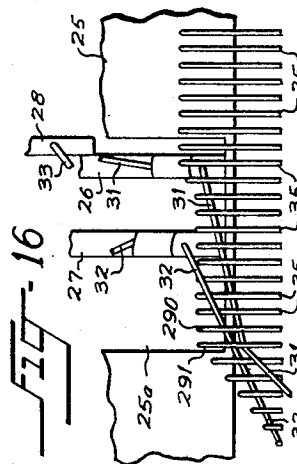
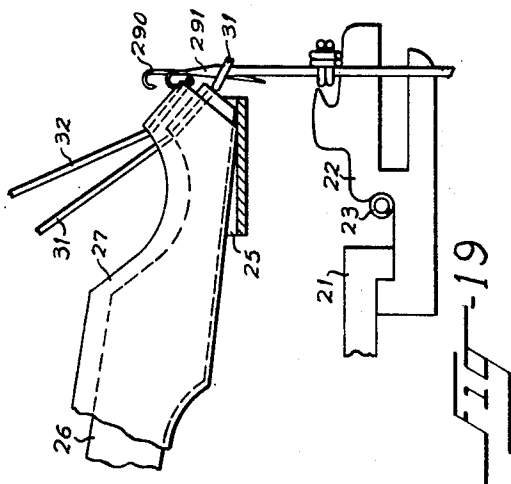
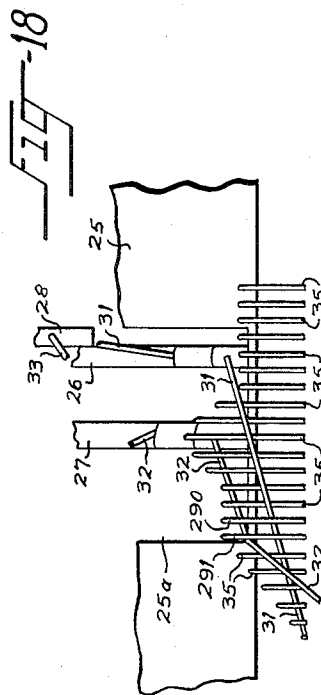
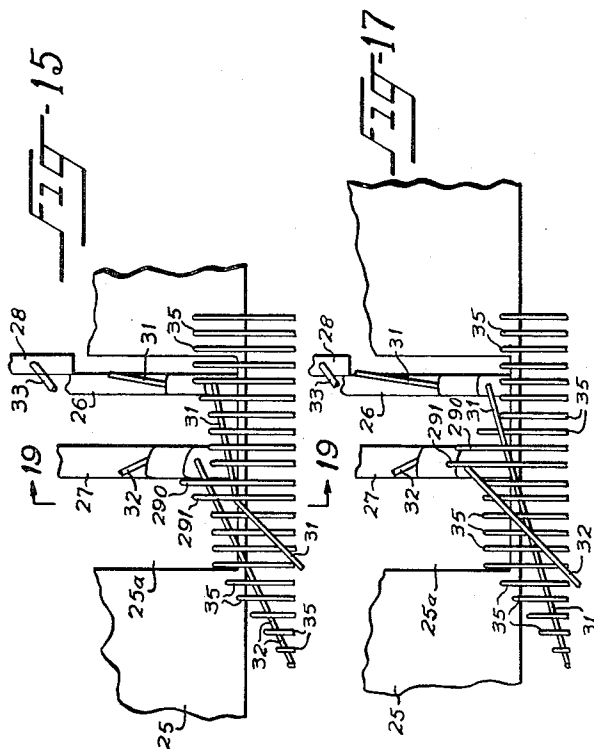
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2,516,697

APPARATUS FOR KNITTING FLOAT PATTERNS

Filed March 8, 1949

11 Sheets-Sheet 7



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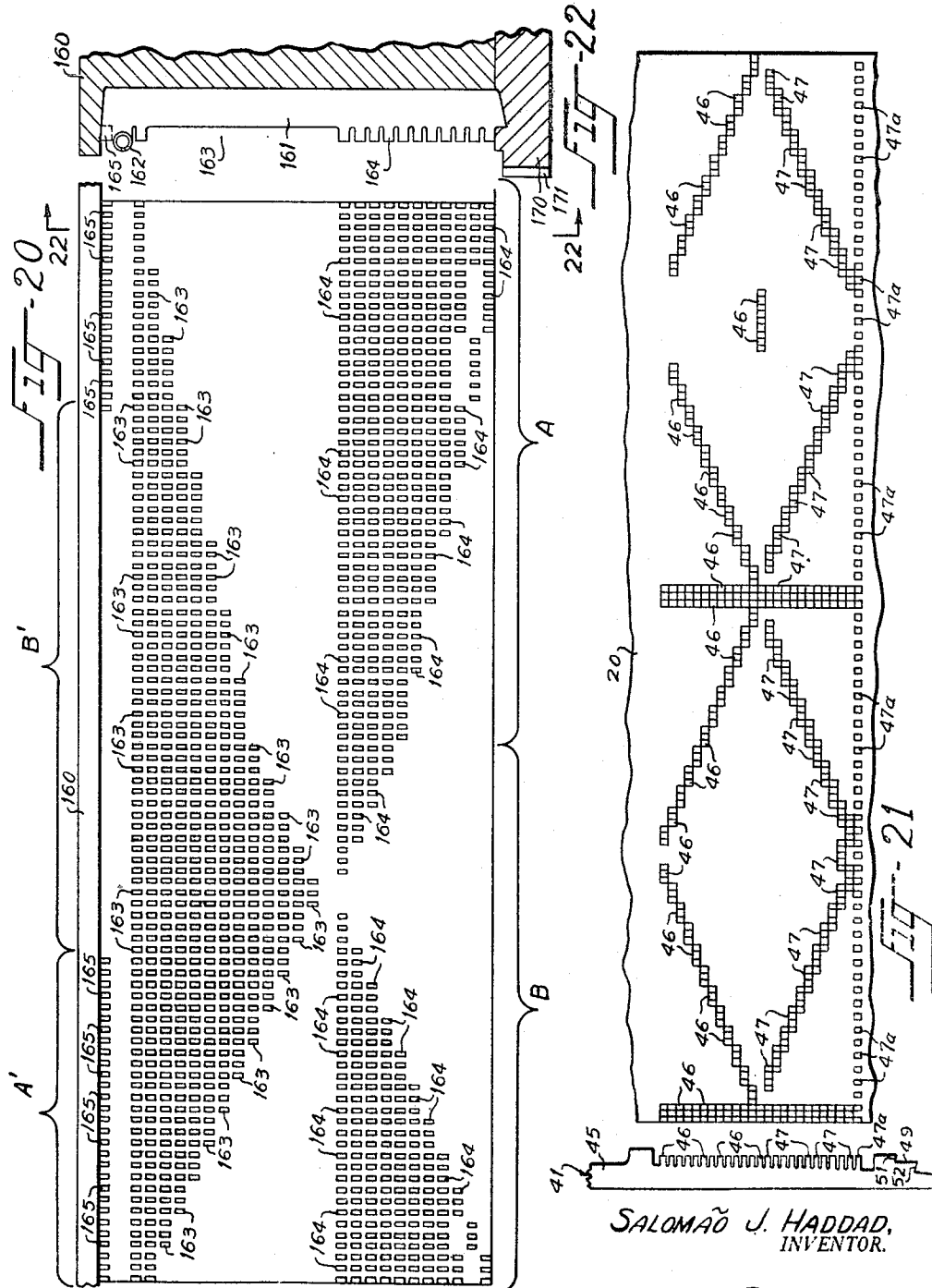
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2,516,697

APPARATUS FOR KNITTING FLOAT PATTERNS

Filed March 8, 1949

11 Sheets-Sheet 8



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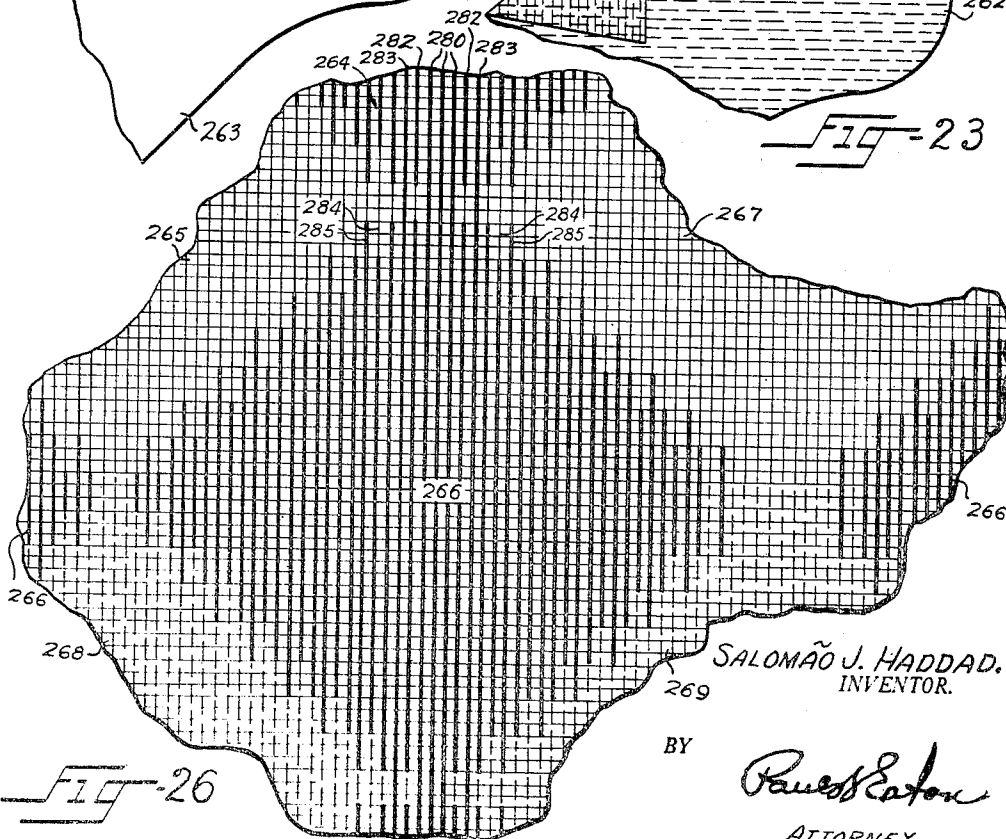
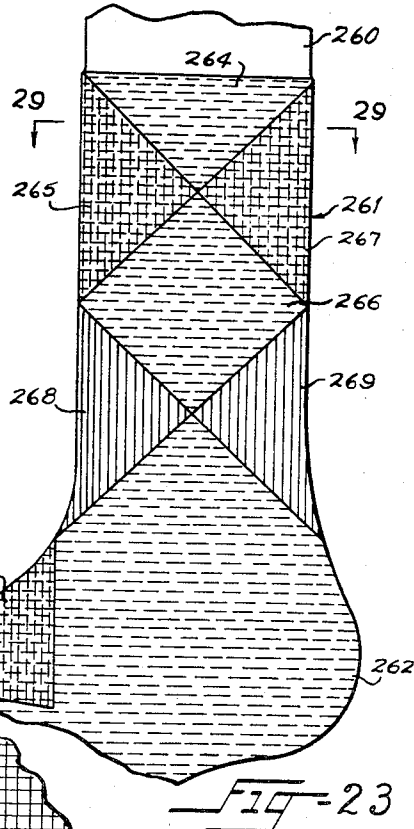
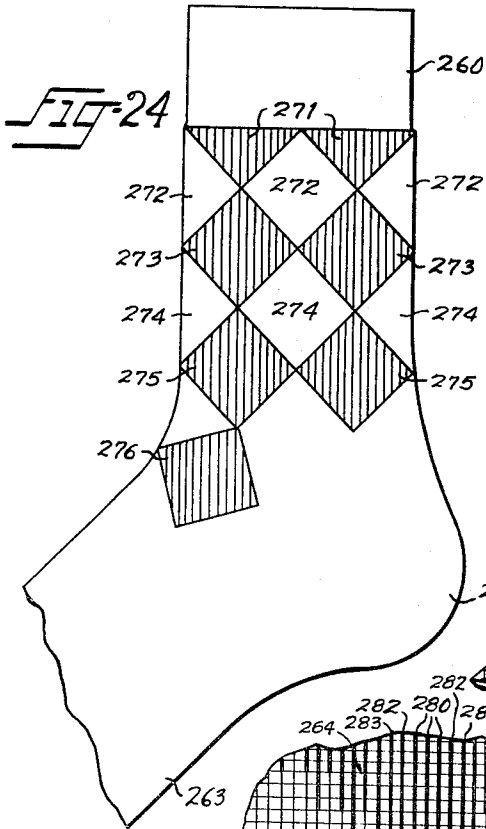
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APPARATUS FOR KNITTING FLOAT PATTERNS

Filed March 8, 1949

11 Sheets-Sheet 9



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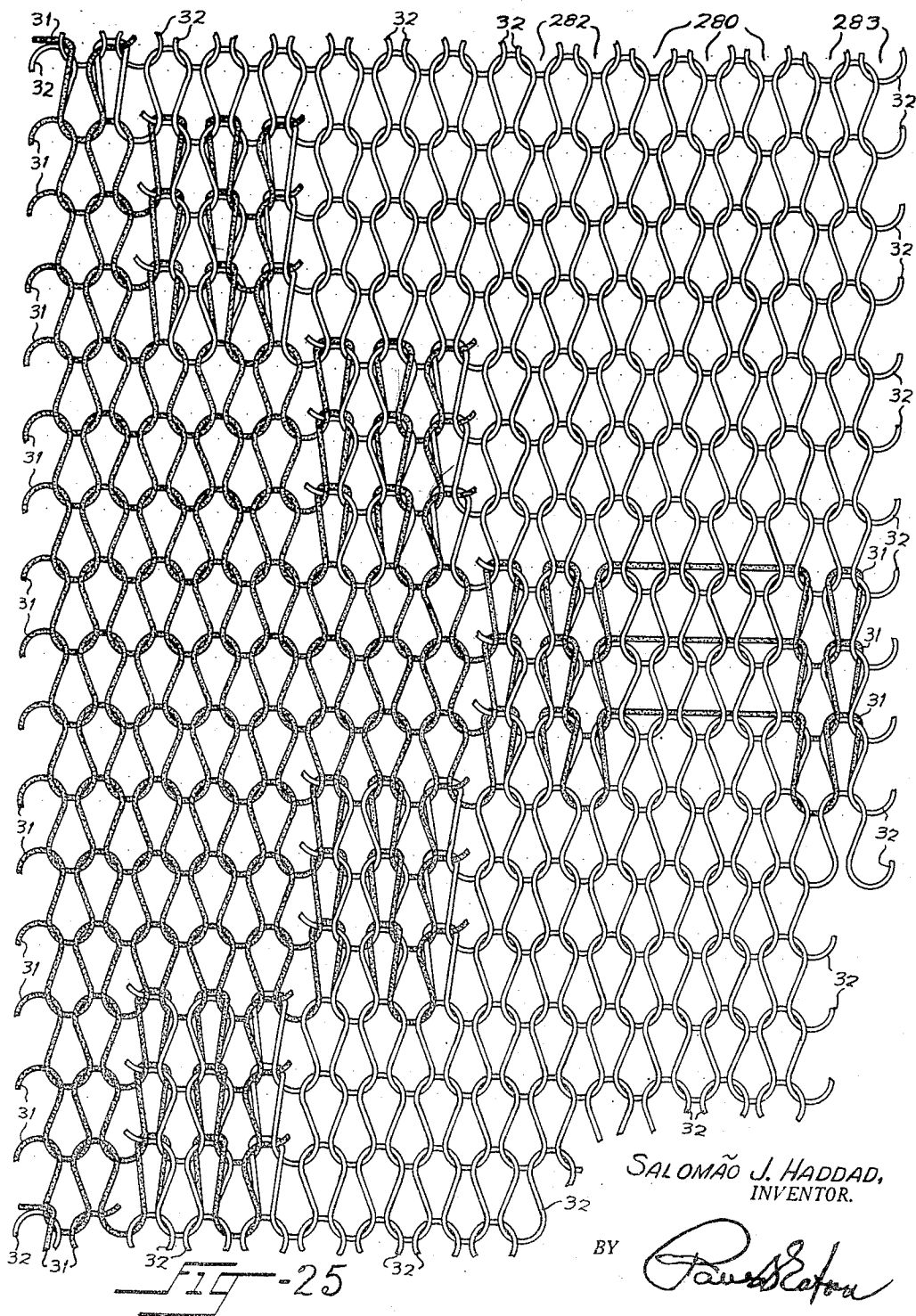
S. J. HADDAD

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APPARATUS FOR KNITTING FLOAT PATTERNS

Filed March 8, 1949

11 Sheets-Sheet 10



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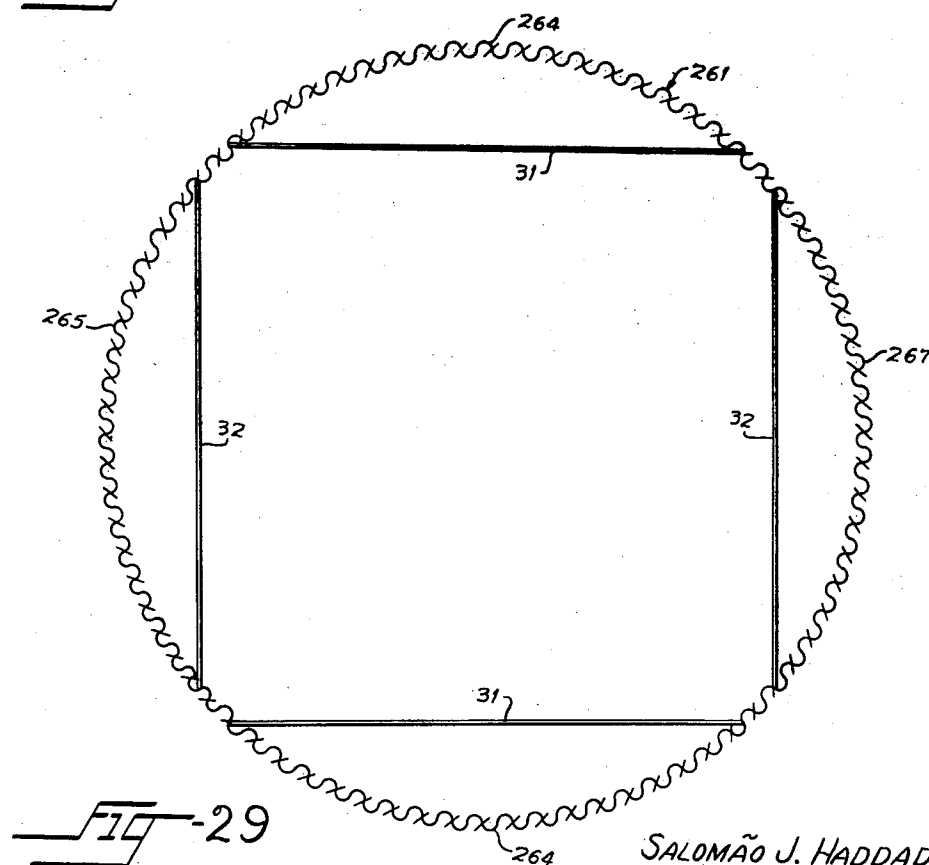
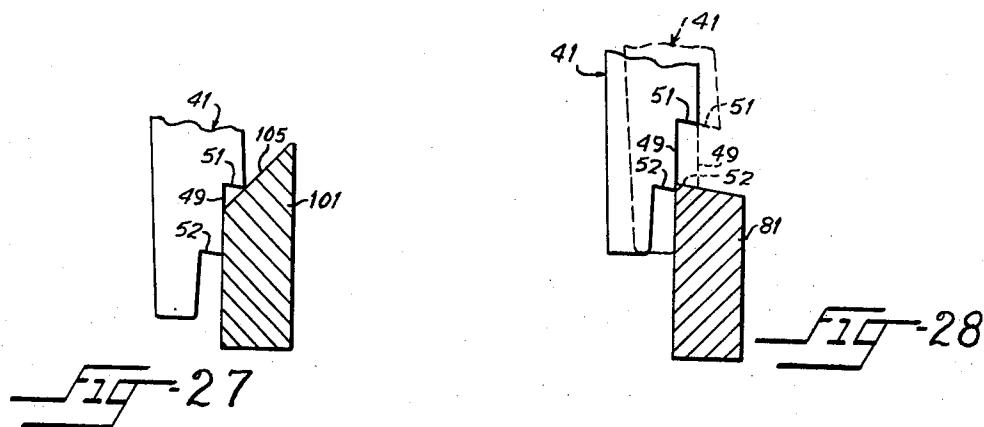
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2,516,697

APPARATUS FOR KNITTING FLOAT PATTERNS

Filed March 8, 1949

11 Sheets-Sheet 11



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UNITED STATES PATENT OFFICE

2,516,697

APPARATUS FOR KNITTING FLOAT PATTERNS

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Application March 8, 1949, Serial No. 80,273

18 Claims. (Cl. 66—50)

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This invention relates to improvements in circular knitting machines and more especially to circular knitting machines for making patterns in fabrics by introducing yarns of two or more different colors at points immediately adjacent each other to the needle circle whereby these yarns may be introduced to the needle circle separately or together according to the desired pattern.

The introduction of knitting yarns in the manner heretofore stated is particularly important in the forming of the so-called "Argyle diamond" type of pattern in which vertical rows of diamonds of different colors are arranged adjacent each other. By way of description, each of the yarn feed fingers introduces a different color which may be referred to as maroon and gray. The maroon and gray yarns are fed simultaneously to the needle circle to form a pattern in which one yarn is knitted on selected needles while the other yarn is floated behind the needles and whereby one section of the fabric will be knitted from one yarn while the other yarn is floated behind the needles and then the other yarn will be knitted by a plurality of needles to form another section of fabric while the first yarn is floated behind the second set of needles, in any given course, independently of each other except at the junctures of the two sections where both yarns are knitted in the same needles for a few needles to tie the adjacent sections together, this being necessary due to the fact that while one of the yarns is being knitted into the fabric, the other yarn is floated on the inner side of the needles and these floated yarns are cut away after the fabric is knitted. It will be obvious from the apparatus to be herein described that many types of patterns may be formed by the use of this apparatus, these patterns including squares or plaids, vertical stripes, chevrons, angles, diamonds, diagonals, etc.

Yarn feed fingers can be provided for as many differently colored yarns as desired so that two yarns of different colors may be introduced for a plurality of courses, and then a new combination of two colors can be fed to the needles. These combinations can be changed throughout the knitting of the stocking.

This invention is not limited to but is shown in association with the type of machine commonly known as Scott and Williams Model HH Spiral circular knitting machine employing main cylinder jacks, auxiliary jacks and needles similar to those shown in the patent to Marshall et al. No. 2,040,946 of May 19, 1936.

It is another object of this invention to provide main cylinder jacks similar to those described with two stepped notches adjacent their lower ends and to further provide selective means for

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positioning the lower portions of selected main jacks in any one of three different positions inwardly and outwardly with respect to the needle cylinder. When the lower portions of these certain selected jacks are in an intermediate position, the uppermost of said notches will be engaged by and will cause the jacks to be elevated in riding over a first and a second cam to present the corresponding needle at such an elevation as to pick up the yarn from the first of the yarn feed fingers, there being other cam means to lower the needle so as to pass adjacent the second of the yarn feed fingers but in so doing will not pick up the yarn from the second yarn feed finger.

When the lower end of others of the certain selected jacks are in an innermost position; that is, with the lower portion of the jack against the needle cylinder, the jack will then miss the first of the said cams but will be caused to be elevated by the second of said cams and, in so doing, will cause the corresponding needle to pass adjacent the first feed finger but will not pick up the yarn from the first feed finger, after which the needle will be elevated to pick up the yarn from the second feed finger.

When the lower portions of still others of the certain selected jacks are in their outermost positions, the lowermost of said notches in the lower portions of the jacks will engage the first and second cams successively and will be elevated to the highest position as the corresponding needles pass adjacent the first and second feed fingers and in so doing the corresponding needles will pick up the yarns from both the first and second yarn feed fingers to thus knit both yarns into the fabric simultaneously.

It is still another object of this invention to provide means for varying the number of steps the trick wheel or selector drum moves to complete a revolution as well as to provide means for varying the length of these steps during each revolution to thereby provide means for knitting any desired number of courses proportionate to a given number of wales in forming a single pattern.

It is another object of the invention to provide in a circular knitting machine means for feeding simultaneously two yarns of different colors during continuous rotation of the needle cylinder and knitting one of the yarns on a plurality of adjacent needles while floating the other yarn behind the needles, then causing both yarns to be knitted by one or more needles, and then causing the other yarn to be knitted on a plurality of adjacent needles while said one yarn is floated behind the second section of needles, together with pattern means for varying the number of needles taking the respective yarns from course to course.

Some of the objects of the invention having

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been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which

Figure 1 is a front elevation of a portion of a Scott and Williams circular knitting machine and showing only those parts which are pertinent to the invention and showing parts of the invention applied thereto;

Figure 2 is an enlarged sectional plan view showing the selector drum or trick wheel and the needle cylinder and associated parts and is taken substantially along the line 2—2 in Figure 1 with parts not pertinent to the invention omitted therefrom;

Figure 3 is an enlarged sectional plan view of the lower left-hand portion of Figure 2 but being taken at a point closely adjacent the ratchet wheel and at a lower point than that shown in Figure 2;

Figure 4 is an enlarged elevation with parts in section and being taken substantially along the line 4—4 in Figure 1 and showing the cam means for rendering the means which transmits rotation to the selector drum inoperative during the knitting of the cuff, heel, foot, and toe portions of a stocking;

Figure 5 is an enlarged elevation with parts in section and being taken substantially along the line 5—5 in Figure 1 showing the cam means for moving the lower portion of the cylinder selector jacks outwardly after they have passed over the first cam and before being brought into engagement with the second cam at the needle cylinder during the knitting of the leg portion and the instep portion of the hose;

Figure 6 is an enlarged elevation with parts in section, taken substantially along the line 6—6 in Figure 2 and showing the working ends of the selector fingers and the associated means for restricting their inward movement relative to the needle cylinder;

Figure 7 is a sectional plan view taken substantially along the line 7—7 in Figure 6 and showing the upper group of selector fingers in one position and showing the lower group of selector fingers in another position;

Figure 8 is a schematic development illustrating one arrangement of cam devices for operating the needle, needle or auxiliary jacks and selector jacks and looking at the inner sides of the circularly arranged cam devices relative to the needle cylinder;

Figure 9 is a vertical sectional view of a portion of the needle cylinder and is taken at a point substantially along the line 9—9 in Figure 8 relative to the cam devices and also showing one of the selector jacks and corresponding auxiliary or needle jacks and one of the corresponding needles and also showing the lower portion of the selector jacks in its innermost position;

Figure 10 is a vertical sectional view similar to Figure 9 and is taken at the same point relative to the cam devices in Figure 8 as Figure 9 but showing the lower portion of the selector jack in an intermediate position;

Figure 11 is a view similar to Figure 9 but being taken slightly to the right or in advance of the line 9—9 relative to the cam devices shown in Figure 8 and showing the lower portion of one of the selecting jacks in its outermost position relative to the needle cylinder;

Figures 12, 13 and 14 are vertical sectional views through a portion of the needle cylinder similar to Figure 9 and all of these views are taken substantially along the line 12—12 relative to the

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cam devices shown in Figure 8. Figures 12, 13 and 14 correspond to Figures 9, 10 and 11, respectively, and show the selector jacks and associated parts in a position they will have attained after having moved from the point in which Figures 9, 10 and 11 are taken to a point at which Figures 12, 13 and 14 are taken in Figure 8;

Figure 15 is an elevation showing some of the needles of the needle cylinder as they are passing adjacent the ends of the yarn feed fingers wherein the needles passing adjacent the first feed finger are picking up the yarn from the same while the needles passing adjacent the second feed finger are not picking up the yarn from the second feed finger and immediately following the knitting of the yarn from both of the feed fingers simultaneously;

Figure 16 is a view similar to Figure 15 and shows the needles having advanced to a slightly different position relative to the yarn feed fingers from that shown in Figure 15;

Figure 17 is a view similar to Figure 16 but showing the needles as though the needle cylinder had rotated a partial revolution to where certain of the needles will pick up the yarn from the second of the feed fingers and will merely pass by the first of the feed fingers without picking up the yarn from the first of the feed fingers;

Figure 18 is a view similar to Figure 17 but shows the needles as though the needle cylinder had advanced a short distance beyond the point shown in Figure 17;

Figure 19 is an elevation taken substantially along the line 19—19 of Figure 15 and also showing the yarn feed fingers and associated parts adjacent the needles;

Figure 20 is a schematic diagram showing the arrangement of the butts on the selector bits associated with the selector drum for producing an "Argyle diamond" type of pattern such as that shown in Figure 23;

Figure 21 is a schematic diagram showing an arrangement of the butts on the selector jacks on the needle cylinder, this arrangement being incidental to produce a pattern such as that shown in Figure 23 in cooperation with the arrangement of the butts on the selector bits shown in Figure 20;

Figure 22 is a vertical sectional view through a portion of the selector drum and is taken substantially along the line 22—22 in Figure 20 showing one of the selector bits associated therewith;

Figure 23 is a diagrammatic side elevation of a stocking showing the "Argyle diamond" type of pattern which is one of many which may be produced with this apparatus;

Figure 24 is another diagrammatic side elevation illustrating another pattern which may be produced with this apparatus by merely changing the arrangements of the butts shown in Figures 20 and 21;

Figure 25 is a greatly enlarged elevation showing a portion of the fabric at the central portion of Figure 23 and showing some of the floated yarns cut away and some of the floated yarns remaining as an integral part of the fabric;

Figure 26 is a schematic diagram of a portion of the fabric as illustrated in Figure 23;

Figure 27 is an enlarged vertical sectional view, being taken substantially along the line 27—27 in Figure 8, showing how the lower portion of a selector jack 41 engages the cam 161 as the jack is moved downwardly;

Figure 28 is an enlarged vertical sectional view, being taken substantially along the line 28—28

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in Figure 8, showing how the lower portions of selector jacks in intermediate and outermost positions engage the cam 31;

Figure 29 is an enlarged schematic sectional plan view being taken along the line 29—29 in Figure 23 and showing the floated yarns inside the stocking, the knitted yarns being represented symbolically.

Referring more specifically to the drawings, the knitting machine generally comprises a main base or frame 10 which supports an upstanding housing 11 and a vertically disposed sock horn 12, there being conventional gearing, not shown, disposed within the housing 11 to which motion is imparted through pulleys 13 which are suitably driven by means not shown. The conventional gearing disposed within the housing 11 is clearly shown in the patent to A. E. Page, Number 1,969,853 of August 14, 1934 and a further description of this gearing is thus deemed unnecessary. The needles cylinder is also rotated by conventional means as shown in said patent.

The housing 11 and tubular member 12 support a circular bed plate 15 which provides a mounting for selector device operating means and may in turn support a second annular bed plate or cam plate 16 by means of posts 17 (Figure 2) and this cam plate 16 carries the usual needle controlling cams, cam-ring, picker mechanism, web-holder mechanism, weft guard ring, instrument dial, if any, and yarn-feeding devices, not shown, which may be pertinent to the particular kind of holsey or machine to which this invention may be applied. This cam plate 16 as well as bed plate 15 also support cam devices and other attachments which are the improved features of the present invention and which will be later enumerated and described in detail.

The knitting machine also has a conventionally driven needle cylinder 20, as by the means shown in said patent, and a sinker head 21 (Figure 1) and conventional sinkers 22 such as shown in Patent Number 1,467,691, one of which is shown in Figure 19, a portion of a continuous coiled spring 23 being shown in Figure 19 which normally urges the sinker 22 towards the needle cylinder 20. The sinker head 21 has the conventional sinker cap or ring 24 thereon and disposed thereabove is a conventional latch ring 25 which is pivotally swung in the conventional manner and carries a plurality of conventional yarn feed fingers, a first, a second and a third of which are shown in Figures 15 to 19, inclusive, and which are indicated at 26, 27 and 28, respectively. The latch ring 25 is provided with a throat gap 25a through which these yarn feed fingers 26, 27 and 28 extend. This gap is cut wider than normal at the side remote from the knitting point to accommodate the fingers 26 and 28, which are provided in addition to the yarn fingers usually carried by the latch ring. These yarn feed fingers 26, 27 and 28 usually carry body yarns, plating yarns, reinforcing yarns, and others, to the needles in a conventional manner. However, in the knitting of stockings, such as shown in Figures 23 and 24, the necessity of separate body yarns, plating yarns and reinforcing yarns is eliminated and, depending upon the number of colors that are to be included in the pattern of a stocking, there is merely a separate yarn feed finger for each color of yarn and all of the yarns serve as body yarns in the structure of the stocking. However, although not shown in the drawings, by the use of con-

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ventional plating means, certain portions of the stocking could be plated at the same time that other portions are knitted by floating one or more of the yarns following the principle of this invention.

In the drawings there is shown yarns 31, 32 and 33 which are fed through the yarn feed fingers 26, 27 and 28, respectively, and, for purposes of illustration, we will assume that the yarns 31, 32 and 33 are gray, maroon and red, respectively. The free ends of the yarn feed fingers 26, 27 and 28 are adapted to be lowered or raised selectively, the raising and lowering of the yarn feed fingers being controlled by conventional means, not shown, which usually comprise a main cam drum having cam means thereon and since this cam drum and the intervening connections are well known and are not materially different from those in the usual types of Scott & Williams machine, they have been omitted from the drawings for purposes of clarity. This control means for the yarn feed fingers 26, 27 and 28 is clearly shown in the patent to Page No. 1,627,337 of May 21, 1927, and also the patent to Scott 1,152,850 of September 7, 1915.

It might be stated that although a Scott and Williams model HH Spiral machine is generally referred to in this specification, it is equally possible for the principles of this invention to be applied to various other machines wherein similar jacks and needles are used, it being evident to those skilled in the art that some modifications may be required if it is desired to apply such principles to another type of machine.

Referring to Figures 8 to 14, inclusive, the cylinder 20 has conventional latch needles 35 working in the usual needle slots, beneath which are individual auxiliary or needle jacks 36. The needles 35 have butts 37 and are usually divided into long and short butt groups for the well known purpose of separating instep and heel needles during the knitting of a heel and toe. Each of the auxiliary jacks also has a butt 38 integral therewith, the purpose of which will be later described.

Disposed in alinement with each of the needles 35 and below each of the auxiliary jacks 36 is a conventional cylinder selector jack or pattern jack broadly designated at 41. The auxiliary jacks 36 and the selector jacks 41 are the same as those shown in the patent to Grothey, No. 2,411,422 of November 19, 1946. It will be noted that the needles 35 and the selector jacks 41 are retained in the slots of the needle cylinder 20 by conventional continuous coiled springs 42 and 43, respectively, which encircle the needle cylinder 20. It might be stated that the jacks 41 are bent laterally slightly so that when they are installed in the conventional grooves of the needle cylinder 20, the frictional contact between the jacks and the walls of the grooves in the needle cylinder 20 will cause the selector jacks 41 to remain in their inner or outer position, as the case may be and at the elevation to which they are directed by cams to be later described, after having moved out of engagement with the same.

Each of the selector jacks 41 has an outwardly projecting portion or butt 44 at its upper end and immediately below this portion 44 is a recessed portion 45 and below this recessed portion 45 is a plurality of butts which may be broken away for pattern purposes. These removable butts are divided into groups of upper butts 46 and lower butts 47, the upper and lower groups of butts extending in opposite directions from a

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point midway of all the butts. The purpose of dividing these butts into upper and lower butts 46 and 47, respectively, is to be later described.

It will be noted in Figure 21 that every other one of the selector jacks has a butt 47a on its lower end. This has nothing to do with the present invention but these butts are left thereon in the event that it should be desired to knit a stocking with a ribbed welt in which case they would be used. However, they have nothing whatever to do with the formation of the different designs in the main part of the stocking.

The jacks 41 preferably have a rocking point at 50 on their backs and it is thus seen that by moving either the upper or lower end of the jacks 41 inwardly the opposite end of the jacks will be caused to move outwardly. The jacks 41 thus described are conventional in all respects and the lower ends of these jacks 41 are provided with staggered or stepped shoulders 51 and 52 which are caused to engage or not to engage cams, to be presently described, according to the pattern arranged in the selector drum to be later described. The shoulders 51 and 52 and a portion 49 are used in a slightly different manner from that described in the said Patent No. 2,411,422. The portion 49 extends between the notches 51 and 52 of the jacks 41 and its function will be later described.

Mounted on the upper surface of the cam plate 16 in the usual manner (Figure 1) are conventional cams which are shown in the central portion of Figure 8 and which are instrumental in raising and lowering the needle jacks and the corresponding needles. The machine may comprise the usual stitch cams 53 and 54 with a conventional top center cam 55. In this instance, the top center cam 55 is modified to include an inverted V-shaped notch 56 in its lower portion to accommodate the butts 37 on certain selected needles 35 which may be elevated for picking up the yarn from the second of the yarn feed fingers 27. This inverted V-shaped notch 56 in the cam 55 is an important feature and necessary to the operation of the improved apparatus.

Also disposed between the stitch cams 53 and 54 and immediately below the top center cam 55 (Figure 8) is a conventional bottom center cam 57 which, although it is shown in the drawings, is not used in this particular operation. A lowering cam 58 is disposed to the right of the top center cam 55 in Figure 8 and is provided for engagement by the butts 37 on certain selected needles 35 to direct these needles downwardly prior to their engaging the right-hand surface of the cam 55 and in taking the yarn from the first of the yarn feed fingers 26. The lower ends of the needles 35 are slidably supported prior to their passing through the stitch cams 54 and 53, successively, by right auxiliary side cam 60 and left auxiliary side cam 61 and these cams 60 and 61 are conventional. The left auxiliary side cam 61 has a lower horizontal surface 63 and an angular rising surface 64 and another lower horizontal surface 65 extending from the angular surface 64. Cam 61 also has an upwardly and angularly extending surface 66. These surfaces 63, 64, 65 and 66 are changes made in the configuration of this left auxiliary side cam 61 inasmuch as the lower surface of this cam normally extends a substantial distance downwardly, more than that shown in the drawings, and does not have the irregular

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configuration such as the surfaces 64, 65 and 66.

Disposed in cooperating engagement with the left-hand end of the left auxiliary side cam 61 in Figure 8 is a new cam 67 whose leading end conforms to and fits snugly against the trailing end of the cam 61. Cam 67 has upwardly and downwardly inclined surfaces 70 and 71 on its lower edge which cooperate with the angularly extending surface 66 of the cam 61. The lower surfaces of the cams 60, 61 and 67 are arranged to permit the auxiliary jacks 36 to be raised by the corresponding selector jacks 41 in a manner to be later described and to then move the auxiliary jacks 36 downwardly which will, in turn, cause the corresponding selector jacks 41 to move downwardly prior to and during the knitting operation, as the needles 35, the auxiliary jacks 36 and the selector jacks 41 move from right to left as indicated by the arrow in Figure 8.

The paths followed by the needles 35, the needle jacks 36 and the selector jacks 41 are, of course, initially determined by the patterning in the selector drum, to be later described, as well as the arrangement of the upper and lower butts 46 and 47 on the selector jacks 41.

It will be noted that immediately following the movement of the needles 35 past the stitch cam 53 in Figure 8, the butts 37 will engage a cam 73 to move the needles 35 upwardly. This completes the description of the cams which are arranged and fixedly mounted on the cam plate 16 in the usual manner. It might be stated that the stitch cam 54 is, in this instance, moved radially out of contact with the butts 37 on the needles 35 during the knitting of a stocking while using this apparatus, with the exception that this cam 54 and other operating cams, not shown, are provided to cause the needles to be directed downwardly before passing through the stitch cams and related cams upon the knitting of a stocking being completed and preparatory to starting the knitting of another stocking.

Secured as by screws 80 to the upper surface of the circular base 15 (Figure 2) is a first selector jack elevating cam 81. This cam 81 is disposed below and in cooperating alignment in a vertical plane with the cams 60 and 61 in Figure 8 and is similar to a conventional cam which is usually mounted at this point, but the cam 81 differs from the conventional cam in that it is provided with a downwardly sloping surface 82 and a horizontal upper surface 83, the left-hand end of which terminates at a point in substantial vertical alignment with a push-out cam 85 (Figure 8) which is disposed a substantial distance above the horizontal plane of the cam 81 and immediately below the lower surface of the cam plate 16 and which will be later described in detail.

It might be stated that the distance from the downwardly sloping surface 82 to the corresponding surface on the lower portion of the cam 61 disposed thereabove and also the distance from the surface 83 on the cam 81 to the lower surface 63 of cam 61 is very accurate so as to equal the vertical height of the butts 38 on the auxiliary jacks 36 plus the distance from the shoulder 52 to the upper end of the selector jacks 41 for purposes to be later described.

Referring to Figures 9, 10 and 11 it may be observed that the shoulders 51 and 52 on the lower ends of the selector jacks 41 are undercut at a slight angle so that their outermost portions are disposed in a slightly lower horizontal plane than their innermost portions and that the surfaces 82 and 83 on the cam 81 are cut at a slight angle

extending outwardly and downwardly relative to the needle cylinder 20, this angle conforming to the angle of the lower edges of the shoulders 51 and 52.

Upon the lower portion of the jack 41 being moved radially outward to the position shown in Figure 11, the shoulder 52 will, upon rotation of the needle cylinder 20, ride on the cam 81 and the portion 49 between the shoulders 51 and 52 and will follow the path indicated at 90 in Figure 8. This will cause the butt 38 and the corresponding auxiliary jack 36 to follow the path indicated at 91 in Figure 8 and will also cause the butt 37 of the corresponding needle 35 to follow the path indicated at 92 in Figure 8. When the butt 37 of the latch needle 35 follows the path 92 in Figure 8 the upper end of the needle 35 will follow the path indicated by the dot-dash line 93 in Figure 8 which will position the needle 35 for picking up both of the yarns 31 and 32 from the yarn fingers 26 and 27 respectively.

Now, when the lower ends of the selector jacks 41 are moved to the intermediate position shown in Figure 10 through the medium of the pattern drum, to be later described, and the butts 46 and 47 on the jacks 41, as will be later described, the shoulder 51 will engage the cam 81, at its right-hand portion in Figure 8, and will be caused to move upwardly as a result of which the portion 49 between the shoulders 51 and 52 will move along the path indicated at 94 in Figure 8. It will be noted that the paths 90 and 94 are merged, as at 98, into a single path which is the path in a horizontal radial plane that the portion 49 between the shoulders 51 and 52 will follow after the jacks 41 have been elevated to their highest position by the cam 81. Now, the butts 38 on the corresponding auxiliary jacks 36 will also be caused to move along a path 96 when the shoulder 51 is in engagement with the elevating cam 81 and the paths 91 and 96 of butts 38 merge into a single path 97, which the butts 38 of the jacks 36 follow after having moved up the paths 91 and 96. The butts 38 are then engaged by the right-hand angular surface of the left auxiliary side cam 61. The left auxiliary side cam 61 and the lower jack elevating cam 81 are spaced an accurate distance apart from each other corresponding to the vertical width of the butts 38 on the jacks 36 plus the distance from the upper end of the jacks 41 to the lower edge of the shoulder 52 as heretofore stated, thus causing the portion 49 between the shoulders 51 and 52 to follow the path 95 in Figure 8.

Now, in the first instance, that is; when the cam 81 is in engagement with the lower shoulder 52 of the selector jacks 41, the lower surface of the shoulder 52 will remain in engagement with the angular surface 82 and the horizontal surface 83, as shown in dotted lines in Figure 28. However, in the second instance, that is; when the shoulder 51 is in engagement with the cam 81 as the jacks 41 are elevated, these particular jacks are moved downwardly to follow the same path as the jacks that had been raised by the shoulder 52 engaging the cam 81 and due to the corresponding beveled or angular surfaces on the shoulder 52 and the surfaces 82 and 83 radially of the needle circle, the shoulder 52 will be prevented from engaging the surfaces 82 and 83 and will, instead, engage the inner surface of the cam 81 as the portion 49 disposed between the shoulders 51 and 52 moves along the path 95 as shown in solid lines in Figure 28.

The reason for the length of the selector jacks

41 from their upper ends to the lower surface of the shoulder 52 plus the vertical width of the corresponding butts 38 on the needle jacks 36 being held to an accurate tolerance is to prevent the lower ends of certain selected jacks 41 from being moved outwardly as they are being moved downwardly by the butts 38 on the auxiliary jacks 36 engaging the lower angular surface at the right-hand side of the left auxiliary side cam 61 in Figure 8 when the jacks 41 are in the solid line position in Figure 28. The reason that the portion 49 is provided integral with the cam 81 is to insure that the lower ends of the jacks 41 will not be urged outwardly upon the butts 38 of the corresponding jacks 36 moving into engagement with the lower surface 63 of the cam 61 as they move from right to left in Figure 8. The reason that these jacks 41 may be urged outwardly at their lower ends, in the event that the portion 49 does not engage the inner surface of the cam 81, in the manner stated and as shown in Figure 28, as they are being moved downwardly by the corresponding needle jacks 36, is the extra pressure of the lower ends of the auxiliary jacks 36 against the upper ends of selector jacks 41 may have a tendency to move the upper ends of the jacks inwardly, which would, of course, project the lower ends outwardly and would thus move them out of position for being properly aligned for the next succeeding cam 101.

When the lower portions of the selector jacks 41 are in their innermost positions, or in the position shown in Figure 9, the portion 49 between the shoulders 51 and 52 will be caused to move along the path indicated at 100 in Figure 8 and will not engage the cam 81 at all due to the cam 81 being spaced far enough away from the periphery of the needle cylinder 20 as to be out of the path of the inwardly moved lower end of such jacks 41.

After the jacks 41 have moved from right to left in Figure 8 beyond the cam 81 they are caused to engage a new elevating cam 101. Referring to Figure 2 it may be observed that this new elevating cam 101 is secured, as by screws, 102 to the circular base plate 15. The cam 101 in Figure 8 has a lower elevating surface 102a, an intermediate horizontal surface 103 and an upper elevating surface 104. This will cause the jacks 41 to be moved upwardly an amount equal to the vertical height of inclined surface 102a and some of the jacks 41 will then be moved upwardly by inclined surface 104 according to the desired pattern. The cam 101 is also provided with a downwardly inclined lowering surface 105 which is beveled inwardly (Figure 27) to thus permit the jacks 41 to be pushed inwardly by the auxiliary jacks 36 as they are moved downwardly in engagement with the surface 71 of the new cam 67. The surface 105 of the cam 101 is beveled inwardly so the cam 101 may be adjusted back and forth as desired and so the surfaces 102a, 103 and 104 may be properly aligned in a vertical plane with the surfaces 70 and 71 of the new cam 67 and the surfaces 64, 65 and 66 of the left auxiliary side cam 61 without defeating the purpose of the surface 105, which is to assist in supporting the lower ends of the selector jacks 41 and to project them inwardly to align them with succeeding cams, not shown. This completes the description of the cams mounted on the circular base 15.

Now, as heretofore stated, upon the lower ends of the jacks 41 being moved to their outermost position as shown in Figure 11 the shoulder 52

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will ride up the elevating cam 81 and the portion 49 between the shoulders 51 and 52 will follow the path indicated at 90 in Figure 8 thus resulting in the butts 38 of the corresponding auxiliary jacks 36 following the path 91 and the butts 37 and the upper ends of the needles 35 following the paths indicated at 92 and 93 in Figure 8. Now, upon the lower ends of the jacks being moved to the intermediate position shown in Figure 10 the shoulder 51 will be caused to engage the cam 81 and will be elevated by the same and in so doing the portion 49 will follow the path indicated at 94 as heretofore stated. In so doing, the butts 38 of the corresponding auxiliary jacks 36 will follow the path indicated at 96 while the butts 37 of the needle 35 will follow a path indicated at 107 in Figure 8 and while the upper ends of the needles will follow a path indicated by the dash-dot line 108.

When the lower portion of a jack 41 is in its innermost position as shown in Figure 9 the portion 49 between the shoulders 51 and 52 will follow the path indicated at 100 in Figure 8 thus causing the butts 38 of the corresponding jacks 36 to follow a path indicated at 111 in Figure 8. However, the butts 37 on the corresponding needles will follow a path indicated at 112, inasmuch as these particular needles are partially elevated at the time they are moved into vertical alignment with the cam 81. Thus the upper ends of the needles will be caused to move along a path indicated by the dot-dash line 113. When either of the shoulders 51 or 52 are engaged by the cam 81, that is, when the lower ends of the jacks 41 are positioned in either the the outermost or intermediate positions shown in Figures 11 and 10 respectively, the narrow portions 45 of the jacks 41 will pass adjacent the cam 85 and thus the upper portions 44 of the jacks 41 will not be engaged by the push-out cam 85 and therefore the lower ends of the jacks 41 will retain their original positions radially of the needle cylinder 20.

Now, in the instance of the shoulder 52 having engaged the cam 81, as shown in Figure 11, when the jack 41 has moved to where the shoulder 52 will engage the elevating surface 102a of the cam 101, as shown in Figure 14, the portion 49 between the shoulders 51 and 52 will follow a path indicated at 90a which corresponds to the path 90 that this same portion follows in being elevated on the cam 81. On the other hand, after the shoulder 51 of a jack 41 has moved out of engagement with the cam 81, or from the position shown in Figure 10, and the jacks have moved to where the shoulder 51 will engage the elevating surface 102a of the cam 101, as shown in Figure 13, the portion 49 between the shoulders 51 and 52 will follow a path indicated at 94a in Figure 8 and this path 94a corresponds to the path 94 that this same portion had previously followed in being elevated by the cam 81.

When the lower portion of a jack 41 is in its innermost position as shown in Figure 9, resulting in the same moving along the path indicated at 100 in Figure 8, and immediately after it has passed by the cam 81 in its movement from right to left in Figure 8, the lower portion of the jack 41 will then be projected outwardly inasmuch as the widened or outwardly projecting portions 44 of this particular jack will be engaged by the push-out cam 85 inasmuch as these particular jacks 41 will not have been raised sufficiently to permit the portion 44 to pass there-

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by without being engaged by the push-out cam 85, it being obvious that the jacks 41 will be caused to rock on the rocking point 50.

As a result of these latter jacks 41 being moved outwardly at their lower ends, after having moved past the cam 81, the shoulder 52 will be caused to engage the elevating surface 102a of the cam 101, in the manner shown in Figure 12, as the jack 41 moves from right to left in Figure 8 thereby causing the same to move upwardly along the same path 90a that others of the jacks have formerly been stated as having followed. The paths 90a and 94a, followed by the portion 49 of the selector jacks 41, merge into a single path 110 along which the portion 49 follows after the jacks have been elevated by the cam 101 and in which attitude they remain until they are again selected by the patterning means to be later described.

It is manifest that when the jacks 41 are raised by the shoulders 51 and 52 engaging the cam 101, the butts 38 of the corresponding auxiliary jacks 36 will also be elevated along paths 115 and 116, respectively, and these paths 115 and 116 merge into a single path 117 which the butts 38 travel as they are moved downwardly by engagement with the lower angular surface 71 of the new cam 67, and, in so doing, cause the corresponding jacks 41 to move downwardly along the path 114 in the lower portion of Figure 8. It will be noted that the butts 38 of the auxiliary jacks 36, after traversing the path 111 are raised by the corresponding jacks 41 when neither of the shoulders 51 and 52 have previously been in engagement with the cam 81. In this instance, the butts 38 of the auxiliary jacks 36 will follow the same path 116 previously followed by the butts 38 on the auxiliary jacks 36 because the shoulder 52 again engages the elevating cam 101, as shown in Figure 12.

It may be observed in Figure 8 that when the butts 37 of the needles 35 are caused to move along the path 107 by the shoulder 51 of the corresponding selector jacks engaging the cam 81, the upper ends of the needles 35 are caused to move along the path 108 in Figure 8 and these butts 37 engage the right-hand surface of the top center cam 55 and the needles 35 are thus moved downwardly, simultaneously picking up the yarn 31 from the first of the yarn feed fingers 26.

Inasmuch as the shoulder 51 is caused to engage the cam 101, the corresponding selecting jacks 41 and the corresponding auxiliary jacks 36 are not raised sufficiently to move the corresponding needles 35 upwardly into the inverted V-shaped notch 56 after having been moved downwardly and, consequently, the butts 37 remain at the same elevation after having been moved downwardly by the cam 55 until they engage the left-hand surface of the inverted V-shaped notch 56 in the cam 55, at which time they are caused to move downwardly after which they are engaged by the stitch cam 53 and directed downwardly against the left-hand side cam 73 which again raises these needles 35 to a position where they are engaged by other cam means, not shown, for again directing them to the position shown at the right-hand side of Figure 8, the knitting of this yarn 31 having taken place between the cam 55 and the stitch cam 53. The action of the sinkers 22 in this instance is entirely conventional and a description of the operation of the sinkers is deemed unnecessary.

It has already been stated how the butts 37 of the needles 35 are caused to follow the path 112 when neither of the shoulders 51 or 52 is caused to engage the cam 81. It may be noted in Figure 8 that, in this instance, the butts 37 of the needles 35 will travel in a horizontal plane until they have moved adjacent the juncture of the inverted V-shaped notch 56 and the right-hand surface of the cam 55. Now, at this time the corresponding selector jacks 41 will have been moved outwardly at their lower ends by the push-out cam 85 as heretofore described, thus resulting in the shoulder 52 engaging the cam 101 to thus elevate the selector jacks 41 and the corresponding auxiliary jacks 36, as a result of which the upper ends of the auxiliary jacks 36 will engage the lower ends of the needles 35 thus moving them upwardly to where they will pick up the yarn 32 from the second of the yarn feed fingers 27. However, the needles 35 will have passed by the first of the feed fingers 26 without picking up the yarn 31 therefrom.

The butts 38 of the jacks 36 will then engage the lower angular surface 71 on the new cam 67 as heretofore stated and will cause the corresponding selector jacks 41 to move downwardly and simultaneously corresponding needles 35 will have picked up the yarn 32 from the second of the yarn feed fingers, and their butts 37 will engage the left-hand surface of the inverted V-shaped notch 56 and will thus be urged downwardly to follow the same path heretofore stated for the butts 37 which had previously followed the path 107.

Now, when the butts 37 are caused to move along the path 92 by virtue of the shoulder 52 having engaged the cam 81 to be elevated by the same, the upper end of the corresponding needles 35 will follow the path 93 and it is thus seen that these needles will be directed downwardly by the cam 58 so that the paths 92 and 93 of the butts 37 and the upper ends of these needles, respectively, will merge into the paths 107 and 108, respectively. Consequently, these latter needles will pick up the yarn 31 from the first yarn feed finger 26 and will again be caused to move downwardly by the butts 37 engaging the right-hand surface of the top center cam 55.

In this instance, the shoulder 52 will again engage the cam 101 thus raising the jacks 41 and the corresponding auxiliary jacks 36 to thereby cause the butts 37 of the corresponding needles 35 to move upwardly into the inverted V-shaped notch 56 in the cam 55 and, in so doing, will cause the hooks of the needles 35 to take the yarn from the second yarn feed finger 27 in the manner heretofore described, and then the needles 35 will be caused to follow along the path followed by the previous needles to where yarns 31 and 32 will be knitted into the stocking by the stitch cam 53. It might be here stated that in the instance of forming a pattern such as that shown in Figure 23, only two needles in each course would knit simultaneously at each edge of the diamond and a maximum of eight needles would knit simultaneously with two yarns as in the latter case in the event of there being portions of four diamonds around the stocking in the same horizontal plane as shown in Figure 23.

It has already been stated how the cam member 85 pushes the upper portions of the selector jacks 41 inwardly thus causing the lower portions to move outwardly. Now, there is provided a cam member 149 (Figure 2) which is provided to restrict the outward movement of the lower portion

of the selector jacks 41 as they are urged outwardly by the spring 43 and cam 85. This cam member 149 is secured, as by screws 151, to the circular base member 15. The cam 149 is provided to insure that the lower end of the selector jacks 41 will be properly aligned for engagement with the elevator cam 101 in the manner heretofore stated.

Referring to Figures 1, 2, 5 and 8 it may be observed that the push-out cam 85 is secured, as by screws 120, to bell crank 121 oscillatably mounted as at 123 on the lower surface of the cam plate 16. This bell crank 121 has secured to the end remote from the cam 85, as by screws 124, an arm 125 which extends outwardly and is pivotally connected as at 126 to a link 127 pivotally connected at its other end, as at 130, to the upper end of a bell crank 131 oscillatably mounted, as at 132, on a bracket 133 secured, as by screws 134, to the lower surface of the cam plate 16.

A vertically disposed connecting rod 135 is pivotally connected, as at 136, to the lower free end of the bell crank 131 and extends downwardly and at its lower end it is pivotally connected, as at 137 (Figure 5), to an actuating lever 140, the left-hand end of which in Figure 5 is oscillatably mounted on a stud 141 projecting from a bracket 142 secured, as by a screw 143, to the frame 10 (Figure 1). This actuating lever 140 has a projection 145 extending upwardly therefrom which is adapted to engage the periphery of a cam wheel 146 having spaced recesses 147 and 148 therein between which a raised portion 150 is disposed, the radius of the raised portion 150 being the same as the main portion of the cam 146 with the exception of the notches or recesses 147 and 148. The projection 145 of the actuating lever 140 is normally urged against the periphery of the cam wheel 146 by a tension spring 152 (Figures 1 and 2) which is connected at the junction point of the arm 125 and the link 127, thus normally urging the bell crank 121 (Figure 2) in a counter-clockwise direction.

In order to limit the inward movement of the cam 85, an angle plate 154 is secured, as by screws 154a, to the edge of the cam plate 16 (Figure 2) and an adjustment screw 155 is threadably mounted in the angle plate 154 and engages the arm 125, there being a lock nut 156 threadably mounted on the screw 155 to secure the adjustment screw 155 in adjusted position.

The cam wheel 146 is fixedly mounted on a shaft 153 extending from and driven by the gearing disposed within the housing 11 and being driven in timed relation to the rotation or oscillation of the needle cylinder 20. In a cycle of the operation of this cam wheel 146, the projection 145 of the actuating lever 140 rides against the main portion of the cam wheel 146 during the knitting of the welt and then the cam wheel 146 rotates to where the projection 145 moves into the recess 147 during the knitting of the leg portion of a hose and then engages the raised portion 150 during the knitting of the heel.

The cam follower or projection 145 then engages the recessed portion 148 during the knitting of the instep and then engages the main peripheral portion of the cam wheel 146 during the knitting of the foot and toe portions of a stocking and during the changing from one stocking to another. When the projection 145 is in engagement with the recessed portions 147 and 148

of the cam wheel 146 the cam 85 is urged inwardly into operative position and the cam 85 is moved to inoperative position when the projection 145 in Figure 5 is in engagement with the raised portion 150 and the main portion of the cam wheel 146 having the same radius as the cam portion 150.

It might be stated that the cam 85 and the means for operating the same are a usual part of a model PW Scott and Williams machine and are applicable to the model HH machine without modifying the same.

Selector mechanism

The selection of the jacks 41 for the operation of the needles is accomplished as in Patent Number 1,906,204, by means of a trick wheel 160 or pattern drum (Figure 2) which is provided with a plurality of spaced selector bits arranged around the periphery of the trick wheel 160 (Figures 20 and 22) and being held in engagement therewith by a continuous coiled spring 162 surrounding the trick wheel 160. Each of the selector bits 161 is divided at its outer edge into upper and lower butts 163 and 164, respectively, these butts being disposed below the coiled spring 162 and there being an additional removable butt 165 disposed above the coiled spring 162. The selector drum or trick wheel 160 has a ratchet wheel 170 fixed to its lower end, the same having long teeth 171 around its periphery, there being two shorter teeth 172 in Figure 3 adjacent each other at one point around the periphery of the ratchet wheel 170 for the purpose of properly aligning the butts 163 and 164 on the pattern drum 160 with selector fingers 200 and 201, to be later described, after knitting one pattern preparatory to knitting another pattern.

The selector drum or trick wheel 160 is mounted for rotation on the usual selector drum post 174 and is racked around the post 174 by virtue of a conventional pawl 175 reciprocated in the usual manner, and being normally urged from right to left in Figures 1 and 2 by a tension spring 178. This racking mechanism is substantially as shown in the patent to F. R. Page, Number 2,005,632 of June 18, 1935. Oscillatably mounted on the post 174 and disposed beneath the ratchet wheel 170 is an idling plate 176 which, during the operation of the selector drum 160, is disposed in the dotted line position shown in Figure 2. Pivotaly connected to the plate 176 as at 177 (Figures 1 and 2) is a link 180 which is pivotaly connected as at 181 (Figures 1 and 2) to the upper end of a bell crank 182. The bell crank 182 is oscillatably mounted as at 183 on a bracket 183a extending outwardly from the base plate 15 in Figure 2 and has pivotaly connected to the free end thereof, as at 185, the upper end of a connecting rod 184.

This connecting rod 184 extends downwardly and is connected, as at 187, to an actuating lever 190 (Figure 4) which is also oscillatably mounted on the stud 141, there being a spacer 191 between the actuating levers 140 and 190 so the actuating lever 140 may be disposed in the same vertical plane as the cam wheel 146 and the actuating lever 190 may be disposed in the same vertical plane as a cam wheel 193. The actuating lever 190 has a projection 194 extending upwardly therefrom which is adapted to engage the periphery of the cam wheel 193, the cam wheel 193 being provided with spaced recesses 197 and 198 and a raised portion 199 and an intermediate arcuate portion 195. The projection 194 engages

the recessed portions 197 and 198 during the knitting of the leg and instep portions, respectively, of a stocking and engages the raised portion 199 during the knitting of the heel.

The intermediate arcuate portion 195 on the cam wheel 193 in Figure 4 is provided to cause the idler plate 176 to assume the position shown in Figure 3 during the knitting of the toe portions of the stocking prior to going into knitting of the welt of the next stocking. It may be seen in Figure 4 that the cam wheel 193 also has a raised portion 196 which is of the same radius as the portion 199 and during the knitting of the welt and the heel, the idler plate 176 is thus moved a substantial distance further to the right than that shown in Figure 3 to cause the pawl 175 to be moved entirely out of engagement with any of the teeth 171 in the ratchet wheel 170.

It is thus seen that the selector drum or trick wheel 160 is rendered inoperative at all times with the exception of during the knitting of the leg and instep portions of a stocking, when the short teeth 172 are aligned for engagement by the ratchet pawl 175, inasmuch as the idler plate 176 will prevent the ratchet pawl 175 from engaging the short teeth 172 until the idler plate 176 is moved by the cam 193 from the position shown in Figure 3 to the position shown in Figure 2. It will be noted that the cam wheel 193 is fixedly mounted on the shaft 153 adjacent the cam wheel 146 and in spaced relation thereto and the recessed portions 197 and 198 coincide with the recessed portions 147 and 148 in the cam wheel 146 thus rendering the trick wheel 160 inoperative simultaneously with the cam 85 being rendered inoperative during the knitting of the cuff, heel and toe and changing from one stocking to another.

Now referring to Figures 2, 6 and 7, there may be observed a plurality of conventional selector fingers or reader cams, there being a plurality of upper reader cams 200 and a plurality of lower reader cams 201. These selector fingers or cams 200 and 201 are identical, the upper selector fingers or cams 200 being disposed in coinciding relation to the upper butts 163 on the selector bits 161 in Figure 22 and the lower selector fingers or cams 201 being disposed in coinciding relation to the lower butts 164 on the selector bits 161. The selector fingers or cams are oscillatably mounted on a vertical post 204 (Figure 2) and each of the selector cams 200 and 201 has a tail 205 adapted to read its own particular level of the butts 163 and 164 on the selector drum or trick wheel 160. Where the butts 163 or 164 have been broken off the bits 161 of the selector drum 160, the tail 205 engages the surface of the trick wheel or selector drum 160 by virtue of a tension spring 206 on one end of each of the selector fingers. Each of the selector fingers 200 and 201 has spaced ears 210 and 211 integral therewith and disposed at their right-hand ends in Figures 2 and 7 and these ears 210 and 211 straddle a conventional selector finger stop 212 adjustably mounted in the usual manner on the circular bed plate 15.

It will be noted in Figures 6 and 7 that the selector finger stop 212 has an angle plate 213 secured thereto, as by screws 214, this angle plate 213 being a usual part of a Model PW Scott & Williams circular knitting machine and being adaptable to the present invention. When the tails 205 on the upper selector fingers 200 and 201 are engaged by any one of the butts 163 or 164 on the selector bits 161, the selector fingers 200

and 201 assume the position shown in Figure 2, that is, with the ears 210 in engagement with the stop 212.

On the other hand, when there is no butt 163 engaging the tails 205 on the upper selector fingers 200, the associated ear 211 is urged against the stop 212 to thus move the lower ends of any of the selector jacks 41 having coinciding butts 46 thereon inwardly relative to the needle cylinder 20 to the innermost position as shown in Figure 9, the relative positions of each of the fingers 200 and 201 being shown in dotted lines, which will result in the yarn 32 being picked up from the second finger 27 in the manner heretofore described. In the event that the tail 205 of any of the lower selector fingers 201 is not engaged by one of the lower butts 164 on the selector drum 160, the ear 211 of the lower selector finger 201 is also urged inwardly against the outer surface of the angle plate 213 as shown in Figure 7 and the lower fingers 201 do not move inwardly as far as the upper fingers 200.

Now, assuming that there is a butt 46 as well as a butt 47 on one of the jacks 41 and there is a corresponding upper butt 163 on the selector drum 160 while a butt 164 corresponding to the butt 47 on the jack 41 is broken off, then the upper corresponding selector finger 200 will be moved outwardly at its right-hand end in Figures 1 and 7 so it will not engage the corresponding butt 46 on the selector jack 41. Thus the free ends of the fingers 200 will assume the dotted line position in Figure 10. Now, assuming there is not any lower butt 164 on the selector drum 160, the spring 206 will urge the ear 211 of the lower selector finger 201 inwardly to the position shown in Figure 7 and, there being a corresponding butt 47 on the lower portion of the selector jack 46, the lower end of the selector jack 41 will be moved inwardly to the intermediate position shown in Figure 10. The relative positions of the free ends of the selector fingers 200 and 201 are shown in dotted lines in Figure 10. It might be stated that the lower ends of the selector jacks are all in their outermost positions, as shown in Figure 11, prior to their moving past the working ends of the selector fingers 200 and 201 and are thus in position for being moved inwardly or, in the event that both the lower and upper selector fingers 200 and 201 are engaged by corresponding butts 163 and 164 on the selector drum 160, the fingers 200 and 201 will assume the dotted line position in Figure 11 and the selector jacks 41 will remain in the position shown in Figure 11 to ride up the cam 81 in the manner heretofore stated, although these may be coinciding butts 46 and 47 on the jacks 41.

In some instances, although there may be corresponding butts 46 or 47 on the selector jacks 41, if there are corresponding butts 163 and 164 on the selector drum 160, the corresponding selector fingers 200 and 201 would not engage these corresponding butts 46 and 47 on the selector jack 41, and, consequently, these selector jacks 41 would still remain in the outermost position shown in Figure 11 after having passed by the working ends of the selector fingers 200 and 201.

The selector fingers 200 and 201 (Figure 2) are arranged to be held in inactive or inoperative position, in which they are not operated in accordance with the patterning of the trick wheel or selector drum 160 by means of a conventional contact 220 (Figure 2) of sufficient width to span all of the selector fingers 200 and 201 carried by a lever 221 pivotally mounted on a post 222 fixed

to the circular bed plate 15. A suitable link 223 connects the lever 221 to conventional mechanism controlled by and operated in accordance with the fabric or other requirements of the fabric knit.

In order to insure engagement of the jacks by the selector fingers 200 and 201, in the manner heretofore stated, there is placed in advance of the selector fingers a cam member 225 which is conventional and is clearly shown in Patent Number 2,050,946 of August 11, 1936. The cam member 225 is pivotally mounted, in a conventional manner, on the upper portion of the post 204 in a position to engage the projection 44 on the cylinder selector jacks 41 as shown in said patent to move the upper portions of said jacks inwardly and the lower portions outwardly, rocking the jacks 41 on the pivot point 50, to substantially the position shown in Figure 11.

The cam member 225 is provided with a conventional operating arm 226 which is operated by conventional intervening connections, not shown, extending from the main pattern drum, not shown.

Although the present invention does not include the push-out cam 85 and the cam 225, it is believed that a summary of their function will provide for a clearer understanding of the present invention. The cam 85 engages the upper portions 44 of the selector jacks 41 which have not been raised by the first cam 81 whereas the selector jacks 41 which have been raised by the first cam 81 are raised high enough so that the push-out cam 85 does not engage their upper ends to thus move their lower ends outwardly. The selector jacks 41 raised by the second cam 101 are then, further on the revolution of the cylinder 20, engaged by the cam 225 (Figure 2) at their upper ends to move their lower ends to outermost position. It is to be noted that the cam 85 is withdrawn from the path of the upper ends of the selector jacks 41 at all times when a pattern is not being knitted by the herein described method and apparatus. During the knitting of the body portion of the stocking both of the cams 85 and 225 ride against or closely adjacent the periphery of the needle cylinder 20.

During the knitting of the heel pocket both of the cams 85 and 225 are moved out of engagement with the upper portions of the selector jacks 41 so that the lower ends of the jacks 41 will remain in the position shown in Figure 9 and thus will not be affected by the patterning on the pattern drum 160. It is to be understood that during the knitting of the heel pocket, the needle cylinder reciprocates as a result of which neither of the cams 85 and 225, nor the selector fingers 200 and 201, could act satisfactorily on the jacks 41, the selector fingers 200 and 201 being rendered inactive due to the action of contact 220 in Figure 2, as heretofore described.

During the knitting of the instep pattern portion of the hose the cams 85 and 225 are in the same position in which they repose during the knitting of the body portion of the hose, that is, they are both in engagement with or closely adjacent the periphery of the needle cylinder 20 during the knitting of the instep portion of the hose.

In order to stop the patterning at any time during the knitting of a stocking, such as in that portion of the stocking disposed between the instep and the toe of the stocking, the cam member 85 reposes against the periphery of the needle cylinder 20 and conventional means, not shown,

cause the cam member 225 to be moved outwardly, away from engagement with the periphery of the needle cylinder 20 as a result of which the upper ends of the jacks 41 are engaged by the cam 85 after having passed by the cam 81 and before engaging the cam 101 and this cam 85 causes the selector jacks 41 to be moved outwardly at their lower ends relative to the needle cylinder 20 for engaging the beveled portion 102a of the cam 101 and the beveled portion 105 pushes the lower ends of the selector jacks 41 inwardly a substantial distance and other cam means, not shown, are then engaged by the selector jacks 41 and further assist in moving the lower ends of the selector jacks 41 inwardly to substantially the position shown in Figure 9. Now, assuming that the cam 225 is not in engagement with the periphery of the needle cylinder 20, the jacks 41 remain in the position shown in Figure 9 and are not affected by the patterning in the pattern drum 160. It is thus seen that the needles thus affected by the latter selector jacks 41 will only take the yarn from the second yarn feed finger 27 which carries the maroon yarn 32.

In order to determine the number of teeth 171 in the ratchet wheel 170 of the selector drum 160 which are racked by the pawl 175 during the knitting of a stocking, I have provided a stop 235 (Figure 2) which extends upwardly from the pawl 175 and is adapted to be selectively engaged by a projection 236 on a plate 237 secured, as by screws 240, to an arm 241. This plate 237 also has a recess 242 therein disposed immediately adjacent the projection 236 and into which the pin 235 is adapted to pass when the arm 241 is in an outer position, that is, turned slightly in a clockwise direction from the position shown in Figure 2, by means to be presently described. The arm 241 is pivotally mounted on a conventional post 245, to which the springs 206 are connected at one end thereof, and this post 245 is fixedly secured in blocks 250 projecting from the circular base 15 and the cam plate 16 (Figure 1.)

Secured to the arm 241 intermediate its ends is a hook member 247 as by screws 248. This hook member 247 in Figure 1 extends downwardly and is then hooked inwardly and is adapted to engage that portion of the selector bits 161 which is disposed above the coiled spring 162 in Figures 20 and 22, or, in the event that there is a butt 165 on the bit 161 with which it is in engagement, this butt 165 will of course urge the hook member 247 and the arm 241 outwardly to where the notch 242 will be disposed in alignment with the pin 235. The selector drum 160 on a Scott & Williams Model HH spiral knitting machine and on other similar machines is usually provided with ninety-six bits 161 therein spaced equally apart from each other around the periphery of the same and the ratchet wheel 170 usually has a like number of teeth thereon. Now, the ratchet pawl 175 (Figure 2) may be caused to rack the selector drum 160 once with every revolution of the needle cylinder 20 in a manner similar to the mechanism shown in the said patent to F. R. Page Number 2,005,632.

However, the pawl actuating mechanism shown in said Patent Number 2,005,632 is such that only the same number of teeth may be racked by the pawl 175 (Figure 2) each time the pawl 175 transmits a step in rotation to the selector drum 160. Now, assuming that conventional means have been provided whereby the pawl 175 will rack a single tooth with each revolution of the needle

cylinder 20, as is usually the case with machines of this type, this would indicate that the machine would knit 96 courses in completing the cycle in the forming of a design such as the forming of a diamond in a stocking. On the other hand, if the conventional means are provided whereby the pawl 175 will rack two teeth 171 in the selector drum 160 with each revolution of the needle cylinder 20, then, it is manifest that the knitting machine could knit 48 courses in a stocking forming a single pattern in the cycle of operation of this knitting machine.

It is thus seen, that heretofore it has been impossible to provide means whereby a number of courses may be knitted in a stocking which would be other than an even divisor or multiplier of the number of teeth 171 in the selector drum 160, and, in the instance of a stocking having 160 wales therein, and, in the case of a stocking being divided into two vertical rows of diamonds, such as that shown in Figure 23, the diamonds thus formed could not possibly be of the same number of courses in height as they are the number of wales in width. For example: one single tooth 171 is racked by the pawl 175 with each revolution of the needle cylinder 20; then the diamond would be 80 wales wide and 96 courses high, while if the pawl 175 (Figure 2) were permitted to move far enough to engage two teeth 171 with each revolution of the needle cylinder 20, the diamond thus formed in the stocking would be 80 wales wide and 48 courses high and it is thus seen that the diamond would have a greater width than height.

In order to produce a pattern such as that shown in Figure 23 and where the diamond is symmetrical, it has been found preferable to use a total of 71 needles and to rack the selector drum 72 times in forming a symmetrical diamond similar to that shown in Figure 26 and wherein the yarn from one diamond to another of like color is floated across in back of the portion of another diamond disposed therebetween (Figures 25 and 29) and at the widest part of one diamond in one row there are provided approximately four wales for interconnecting the upper and lower diamonds in a single vertical row and in back of which the yarns are floated from one diamond to another in a horizontal row as shown in Figure 25. Those floated yarns which extend for more than four wales are usually cut away after the stocking is removed from the machine.

By referring to Figure 20, it may be observed how a complete revolution is imparted to the selector drum in a number of steps which is not an even divisor or multiplier of the number of bits in the selector drum 160. Due to the fact that the tails 205 of the selector fingers 200 and 201 are disposed at approximately right angles from the point at which the hook portion 247 engages the selector drum 160, the first of the butts 165 in the group indicated at A' in the left-hand portion of Figure 20 coincides with the first butts 163 and 164 at the extreme right-hand side of Figure 20 in the group indicated at A, that is, when any of the butts 163 and 164 in the vertical row of the extreme right-hand side of Figure 20 is in engagement with the corresponding selector fingers 200 and 201, the first butt 165 at the right-hand side the second group A' in the left-hand portion of Figure 20 is in engagement with the hook portion 247 extending from the arm 241 in Figure 2.

Now, it is obvious that when one of the butts 165 is in engagement with the hook 247, the arm 241 will be moved outwardly in such a manner

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as to aline the recess 242 with the pin 235 and this will permit the pawl 175 to complete its maximum stroke to thus move the selector drum 160 the equivalent of two selector bits 161 with each movement of the pawl 175. Thus, due to the arrangement of the butts 163 on the selector drum 160, every other one of the vertical rows of the butts 163 and 164 in the group designated at A in Figure 20, as the selector drum 160 moves from left to right, would engage the tails 205 of any of the selector fingers 200, 201 which may be disposed at the same level as the butts 163 and 164, with each revolution of the needle cylinder 20. It might be stated that the depth of the recess 242 (Figure 2) may be increased if desired to permit the pawl 175 to rack more than two teeth with each movement thereof if required in some pattern division.

Due to the fact that there are no corresponding butts 165 as indicated by the bracket lines B', for the vertical rows of butts 163 and 164 appearing in the group designated at B in Figure 20, the arm 241 would then be permitted to move inwardly to the position shown in Figure 2, to where the projection 236 would be in alinement with the pin 235 and would thus prevent the pawl 175 from moving as far to the left as it would if the recess 242 were in alinement with the pin 235 and thus the pawl 175 would merely engage and move the selector drum 160 the distance from one bit to the next in each stroke thus resulting in the tails 205 of the selector fingers 200 and 201 engaging corresponding butts 163 and 164 in each and every vertical row of the selector bits 161 appearing in the group designated at B in Figure 20 as the selector drum 160 moves from left to right in Figure 20 and with each revolution of the needle cylinder 20. The rotating mechanism is shown in patents to Page Numbers 1,906,204 and 2,005,632.

Figures 23 and 24 show two types of patterns which may be knitted with this apparatus, although, as already stated, there are many other types of patterns which may be knitted with this apparatus. Figure 23 shows a stocking comprising a welt portion 260, a leg portion 261, a heel portion 262 and a foot portion 263.

In the form of the invention shown in Figure 23, with the selector drum being set up as shown in Figures 20 to 22 inclusive, there would first be knitted the lower half of the diamond shaped portions 264 on each side of the stocking and while the portions 264 were knitted, the upper halves of diamonds 265 and 267 would be knitted, and then while the lower halves of diamonds 265 and 267 are being knitted, the upper half of diamonds 266 would be knitted on opposite sides of the stocking, only one of which is shown in Figure 23. While the lower half of diamonds 265 are being knitted with one color the upper halves of additional diamonds 268 and 269 would be knitted. When the diamonds 268 and 269 shall have been completed, the heel pocket will then be knitted after which an additional diamond 270 would be knitted in the instep from any color of yarn desired but in this instance would be of the same color as diamonds 265 and 267.

When the colored diamonds 265 and 267 are knitted into the stocking, the yarn feed finger 26 is moved upwardly in the usual manner and the yarn feed finger 28 is moved downwardly to the elevation that the yarn feed finger 26 previously held and then the red yarn 33 is fed to the needles 35 to thus form the colored diamonds 268 and 269 in Figure 23. In this instance, a sepa-

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rate yarn is knitted into the heel 262 by means of a conventional finger, not shown, and the foot portions 263, being subject to the same process involving the pattern selection as described for the leg portion of the stocking.

The "Argyle diamond" pattern substantially as shown in Figure 23 is formed by the arrangement of the butts 47 on the cylinder jacks 41 as shown in Figure 21 in cooperation with the arrangement of the butts 163 and 164 on the selector bits 161 as shown in Figure 20. And it has already been described how the butts on the selector jacks 41 and the butts on the selector bits 161 cooperate with one another through the medium of the selector fingers 200 and 201 and therefore a further description is thus deemed unnecessary.

Figure 24 shows another type of pattern on a stocking, the various parts of the stocking being identical to the stocking shown in Figure 23 with the exception of the pattern appearing thereon and like reference characters will apply to the stocking shown in Figure 24 as those applying to the stocking shown in Figure 23. In the case of knitting a pattern such as that shown in Figure 24, only two colors of yarns would be used, in which instance one or the other of the yarn feed fingers 26 or 28 would remain in a raised position throughout the knitting of the entire stocking. All of this is well known to those familiar with the art and it is also a well known fact that in order to form the pattern shown in Figure 24 it would be necessary to change the arrangement of the butts 46 and 47 on the cylinder selector jacks 41 as well as the arrangement of the butts 163 and 164 on the selector drum 160.

In the form shown in Figure 24, the same style of knitting would be carried out as in Figure 23 except, as above stated, only two yarns would be used and the number of diamonds would be doubled from that shown in Figure 23, that is, after the welt 260 is knitted, the lower halves of four diamonds 271 would be knitted while the upper halves of four diamonds would be knitted, which are indicated at 272. Then, while the lower halves of diamonds 272 are knitted, the upper halves of diamonds 273 are knitted and while the lower portions of diamonds 273 are knitted, the upper halves of diamonds 274 would be knitted and simultaneously with the knitting of the lower halves of diamonds 274, the upper halves of diamonds 275 would be knitted. When the diamonds 275 shall have been completed knitting will proceed until the heel pocket is reached, or if the diamonds shall extend down to the heel pocket, the heel pocket could be knitted immediately below the diamonds 275. After the heel pocket has been knitted, additional diamonds 276 could be knitted on the side portions of the instep portion of the stocking to thus complete the design portion of the stocking.

These two examples are shown as illustrating the many different designs which could be knitted by the apparatus herein set forth as it is only necessary to change the bits 161 in the selector drum and the butts on the selector jacks 41 in order to vary the pattern to produce any desired type of pattern wherein one of the yarns is floated behind a substantial number of needles while the other yarn is being knitted to form the design.

Figure 26 is shown schematically, and is representative of the diamond 266 in Figure 23. Let us assume that the diamonds 265 and 267 are

being knitted with a gray yarn and the pattern drum is about ready for production of the diamonds 266. And, let us assume that the color of diamonds 266 would be maroon. The maroon thread is knitted at the three wales designated at 280 (Figures 25 and 26) and both the gray and maroon threads would be knitted on the two wales 282 and 283 on each side of the wales 280 to interlock the gray and maroon threads prior to the gray threads being knitted in the diamonds 265 and 267 and the maroon threads being floated. It so happens that even though there is no plating control at the two needles, the wale adjacent each side of the wales 280 will usually throw the gray yarn on the outside of the wale 282 while the maroon yarn appears on the outside of the wales 283.

After about three courses are knitted, then three additional needles are placed in operation on each side of the needles knitting the wales 280 and three additional courses are knitted. It will be noted that the next to the outermost of the tie-in needles also thrown into operation with the three additional needles, on each side of the diamonds, will have the gray thread appearing on the outside of wale 284, while the maroon thread will be appearing on the outside wale 285 of the outermost ones of the two tie-in needles which are thrown in to produce the effect which is shown in Figures 25 and 26, and this continues, that is, the throwing in of additional needles and tie-in needles, to fill out the upper half of the diamond 266 at which time the junction points between the diamonds 266 and the diamonds 268 and 269 are knitted in the same manner as above described for the beginning of diamond 266 and then the reverse action appears in the lower half of the diamond 266 as described for the upper half of the diamond.

These illustrations are merely given in order to show how the knitting takes place and why it is that the sets of tie-in needles thrown in every three courses will have the gray yarn appearing on the outside of the fabric at one of these needles adjacent the edge of the diamond, due to the fact that a yarn upon starting to float behind the needles will assume a lower position relative to the next yarn. This displacement is accentuated at the edge of each float, in which particular needle the reverse plating effect is usually more visible. It might be stated that this plating effect, at interknitted edges, has not been purposely provided for, due to its secondary importance, and it only takes place by the nature of the floating principle referred to.

It will be noted in Figures 15 to 19, inclusive, how certain needles 290 and 291, which are identical to needles 35, at times are raised higher than the other needles to engage both yarns 31 and 32 being knitted. In this instance, the needles 290 and 291 are raised by action of the shoulders 52 of the jacks 41 engaging cam 81. The position of the jacks 41 as shown in Figures 11 and 14, will always permit the shoulder 52, under any circumstances to engage both of the cams 81 and 101, thus causing the needles 291 and 290 to be raised twice in a single course and to take the yarns 31 and 32 from the fingers 25 and 27 successively. It will be noted in Figure 15 that all needles to the left of needles 290 and 291 are knitting, let us say, a maroon section and it is to be noted that the needles to the right of needles 290 and 291 are taking the gray yarn

31 to knit another section adjacent to the maroon section. Now, it has already been described as to how a gray yarn is floated back of a maroon section and how a maroon yarn is floated back of a gray section, and by raising two additional needles 290 and 291 a first and a second time in a single revolution of the needle cylinder to take and knit both yarns, these yarns are, therefore, anchored in the fabric to prevent their pulling out of the same after the float portions have been cut away. It is also clear as to how these additional needles 290 and 291 change every three courses in knitting the pattern outlined in the drawings; that is, every time additional needles are raised up on each side of the section to take additional wales, the two additional needles will be raised to pick up not only the first yarn 31 but also to immediately rise again and pick up the second yarn 32 as is clearly illustrated in Figure 17. Therefore, as the pattern is changed to throw in more needles or to cause a lesser number of needles to take the yarn, these additional needles 290 and 291 which change around the needle circle with each change of pattern, will be thrown up at both yarn feed fingers 26 and 27 to interknit the float yarns at the intersection of one color pattern area with another color pattern area.

It is to be understood that the needles 35, let us say to the left of needles 290 and 291, which will take the strand 32, will rise to the same height as the needles 290 and 291, whereas the needles which do not take specific yarns, such as the needles to the right of needles 290 and 291, will not rise to as great a height and this will cause the yarn 31 to be floated or, in other words, to pass over the top of the needles which are not raised to as great height, and be deposited on the back of these needles as a float yarn.

It is thus seen that I have provided means whereby a number of different colored yarns equivalent to the number of conventional yarn feed fingers appearing in the conventional latch ring 25 may be knitted and whereby a single thickness of yarn may be employed as each color is used, the necessity of reverse plating being eliminated by merely floating the yarns which are not on the face of the stocking across the inside of the stocking and then, after the knitting of the stocking has been completed, cutting away the floated yarns appearing on the inside of the stocking.

In the drawings and specification there has been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only, and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. In a circular knitting machine, apparatus for producing knitted fabric comprising means for knitting at least two different yarns into a single course, means for knitting one of the yarns into the fabric, means for knitting both of the yarns into the fabric simultaneously, means for knitting one of the other yarns into the fabric while the remaining yarns are floated behind the needles, said circular knitting machine having a circular series of needles and also having normal selecting means for the needles for selectively raising certain of the needles and also having means for presenting the yarns to the needles at different elevations, other selecting means for raising needles immediately following action of the normal selecting means for the needles for

introducing the first and the second of the yarns to the needles thus raised, a third selecting means for holding the needles in a lowered position as they pass the first of the yarns and for moving them to a raised position as they pass the second of the yarns to thus knit the second of the yarns into the fabric independently of the first of the yarns and a fourth selecting means for raising the needles as they pass the first of the yarns and for lowering the needles as they pass the second of the yarns to thus knit the first of the yarns into the fabric independently of the second of the yarns while the second of the yarns floats thereby.

2. In a circular knitting machine having a needle cylinder in which vertically movable needles are mounted and a plurality of selector jacks disposed one beneath each of said vertically movable needles, and also having a plurality of fingers for presenting body yarns to the needles as they are raised to a given height above the needle circle, said machine also having normal means for raising and lowering some of the selector jacks and corresponding needles for picking up a first of the body yarns, and also having selecting means for the selector jacks, means engageable by the selector jacks upon action thereon by the selecting means for again raising some of the needles after they have been lowered by the normal means and after they have picked up the first of the yarns for picking up another of the yarns to thus knit both of the yarns into a fabric simultaneously in a single course.

3. In a structure according to claim 2, actuating means for the jack selecting means to cause certain of the jacks to be acted upon by the normal means to cause corresponding needles to pick up the first of said yarns and to cause the latter jacks to miss the yarns presented thereafter whereby only the first of said yarns are knitted into the fabric selectively.

4. In a structure according to claim 2, means engageable by the selector means for said jacks for moving certain others of the jacks to a third position whereby, upon rotation of the needle cylinder, the jacks and corresponding needles will remain in a lowered position as the needles pass the first of said yarns and means for rendering said jacks thus positioned engageable by the said engageable means for said jacks and corresponding needles after having passed by the first of said yarns and to thus cause the needles to pick up the second of the yarns only for knitting the second of the yarns into the fabric independently of the first of the yarns selectively.

5. In a circular knitting machine having a needle cylinder in which a plurality of vertically movable independent needles are mounted and also having a vertically movable selector jack disposed below each of said vertically movable needles and also having a series of elevating and lowering cams arranged adjacent the needle cylinder, means for positioning the lower ends of said jacks radially of the needle cylinder in three different positions, a pair of yarn feed fingers spaced from each other and disposed adjacent the path of travel of the needles and being adapted to feed body yarns to the needles at different elevations upon the needles being raised, one of said positions of the jacks causing the jacks to engage the cams adjacent the needle cylinder for elevating and lowering and again elevating and lowering the corresponding needles successively as they pass by each of the yarn feed fingers for taking the yarn therefrom, the second of the positions causing said selector jacks to remain lowered

as the corresponding needles pass the first of said fingers and causing said selector jacks to be elevated in passing the second of said yarn feed fingers for taking yarn from the second of the yarn feed fingers only and said third position of the lower ends of the selector jacks causing the selector jacks and the corresponding needles to be in an elevated position as they pass the first of said yarn feed fingers and to be in a lowered position as they pass the second of the yarn feed fingers to thus take the yarn from the first of the yarn feed fingers only whereby the yarns from either one of the yarn feed fingers are selectively knitted into the fabric while the yarn from the other of the yarn feed fingers is floated across in back of the yarn that is being knitted into the fabric and whereby the yarn from both of the yarn feed fingers may be knitted into the fabric simultaneously in splicing the two yarns together at the junction point of the change in knitting from one yarn to the other.

6. In a circular knitting machine having a needle cylinder in which vertically movable needles are mounted and having selecting means for raising selected needles to a given height, and also having selector jacks cooperating with said needles, spaced means disposed at different levels for presenting two or more yarns to spaced needles which are raised to a given height simultaneously and independently of each other in forming a plurality of designs in a knitted fabric wherein a variety of designs are disposed in the same courses and wherein single yarns are knitted into each of the designs and wherein the fabric simultaneously with each other at their junction points, means for varying the number of courses appearing in a particular design according to the number of wales appearing in the design for producing a symmetrical pattern as knitted by the yarns thus presented.

7. In a structure according to claim 6, said means for varying the number of courses knitted in forming a single pattern according to the number of wales knitted into the pattern comprising a selector drum and selector fingers controlled by the selector drum for selectively positioning the selector jacks radially of the needle cylinder at their lower ends, said selector drum having a ratchet wheel thereon and being engageable by a reciprocating pawl for normally racking the selector drum one tooth in the ratchet wheel with each stroke of the pawl, means controlled by the patterning in the selector drum for selectively increasing movement of the pawl to cause said pawl to occasionally rack the selector drum two teeth in the ratchet wheel according to the desired pattern to thereby vary the number of strokes of the ratchet pawl required to complete a revolution of the selector drum.

8. In a circular knitting machine having a plurality of vertically reciprocable needles and a throat and a plurality of yarn feed fingers disposed in the throat and spaced apart from each other for feeding a plurality of yarns to the needles and having pattern means for selecting certain of the needles for elevation, means for elevating a plurality of needles adjacent the throat to take one yarn and to float another yarn back of the elevated needles during continuous knitting, the pattern means serving to gradually increase the number of needles elevated to take one yarn and to float the other yarn back of the elevated needles after a predetermined number of courses have been knitted, said pattern

means also having means for elevating one or more needles to a higher elevation than the level of the other elevated needles and at each edge of the group of elevated needles to take both yarns at the outer edges of the elevated needles to interknit both yarns into the fabric, said pattern means also having means for elevating an additional group of needles adjacent the first group of elevated needles to take the other yarn while the first yarn is floated behind the second group of needles and whereby pattern effects can be produced during continuous knitting in different portions of the courses being knitted.

9. In a circular knitting machine having pattern means for selectively raising the needles and comprising means for raising a plurality of adjacent needles to a predetermined elevation and increasing or decreasing the number of needles elevated in a group after a plurality of courses have been knitted, a plurality of means for feeding a plurality of yarns to the needles at different elevations and whereby the elevated needles will take one yarn while the remaining yarns are floated back of the elevated needles, said pattern means also comprising means for elevating a plurality of separated groups of needles in a given course to cause one group of needles to knit one yarn while the other yarns are floated therebehind and the other groups of needles to knit one of the other yarns which have been floated behind an adjacent group of needles to knit the same while floating the first yarn which has been knitted by an adjacent group of needles back of the second group of needles, said machine having means for elevating one or more needles at each edge of said two groups of needles to cause them to interknit the yarns which are being knitted on adjacent groups of needles.

10. In a circular knitting machine having a plurality of vertically reciprocable needles and a throat and a plurality of yarn feed fingers disposed in the throat and spaced apart from each other and having their points of feed disposed at different elevations for feeding a plurality of yarns to the needles and having pattern means for selecting certain of the needles for elevation, means for elevating a plurality of needles adjacent the throat and at a point after they have passed the first feed finger to take one yarn and to float another yarn from another feed finger back of the elevated needles during continuous knitting, the pattern means serving to gradually increase the number of needles elevated to take one yarn and to float the other yarn back of the elevated needles after a predetermined number of courses have been knitted, said pattern means also having means for elevating one or more needles to a higher elevation than the level of the other elevated needles and at each edge of the group of elevated needles in order to rise again and also take the second yarn after having taken the first yarn and to interknit both yarns into the fabric at the outer edge of the elevated needles, said pattern means also having means for elevating an additional group of needles adjacent the first group of elevated needles to take the other yarn while the first yarn is floated behind the second group of needles and whereby pattern effects can be produced during continuous knitting in different portions of the courses being knitted.

11. In a circular knitting machine having pattern means for selectively raising the needles and comprising means for raising a plurality of adjacent needles to a predetermined elevation and

increasing or decreasing the number of needles elevated in a bunch after a plurality of courses have been knitted, a plurality of means for feeding a plurality of yarns to the needles at different elevations and at points spaced from each other and whereby the elevated needles will take one yarn while the remaining yarns are floated back of the elevated needles, said pattern means also comprising means for elevating a plurality of separated groups of needles in a given course to cause one group of needles to knit one yarn while the other yarns are floated therebehind and the other groups of needles will knit one of the other yarns which have been floated behind an adjacent group of needles to knit the same while floating the first yarn which has been knitted by an adjacent group of needles back of the second group of needles, said machine having means for elevating one or more needles at each of the edges of said two groups of needles to interknit the yarns which have been knitted and floated respectively in the adjacent groups of needles, the groups of needles which are elevated being elevated after one of the feeding means has been passed.

12. In a knitting machine having a rotary needle cylinder provided with spaced vertical grooves around its periphery and having a vertically movable needle in each of the grooves and having a vertically movable needle jack disposed immediately below each of said needles and also having a vertically movable selector jack disposed immediately below each of said needle jacks, and also having yarn feed fingers thereon, said yarn feed fingers being spaced apart from each other, one finger having its feed eye disposed at a lower elevation than the feed eye in the other fingers, said knitting machine also having circularly arranged selector cams disposed around the needle cylinder for selectively raising and lowering the needles and picking up the yarn from a first of the yarn feed fingers, additional cam means for raising the needles a second time in a single revolution of the needle cylinder adjacent a second of the yarn feed fingers for picking up the yarn therefrom, other cam means for lowering certain others of the needles after having picked up the yarn from the first of the yarn feed fingers and before moving past the second of the yarn feed fingers to thus cause some of the needles to pick up yarns from one of the feed fingers while not picking up yarns from the other of the feed fingers although the feed fingers may remain at the same elevation during a single revolution of the needle cylinder, and whereby the yarn or yarns not taken by the needles will be floated behind the needles taking a yarn.

13. In an independent needle circular knitting machine having a plurality of vertically movable needles, means for selecting a group of adjacent needles to take and knit one yarn, while floating a second yarn behind the group of needles, and for selecting a second group of needles for taking and knitting the said one yarn while floating the second yarn behind the second group of needles and for selecting third and fourth groups of needles disposed between the first and second groups of needles and the second and first groups of needles respectively to take the second yarn while the said one yarn is floated behind the third and fourth groups of needles, said selecting means also varying from course to course the number of needles in the various groups which take the respective yarns, and means for causing needles in one group which are disposed adjacent the

needles of the other groups to take and knit both of the yarns.

14. In a circular independent needle knitting machine having a first body yarn feeding finger and a second body yarn feeding finger and also having a single set of stitch cams, pattern controlled means to cause the yarn from the first body yarn feeding finger to be taken by a first set including certain of the needles, said pattern controlled means also being operable to cause the yarn from the second body yarn feeding finger to be taken by a second set including certain of the needles so as to cause the body yarn taken by the first set of needles to be deposited on the back of the second set of needles and resulting in both yarns being knitted independently in a single course, said pattern controlled means also being operable to cause both yarns to be taken by certain of both sets of needles at their juncture so as to cause both body yarns on one or more needles to be knitted simultaneously and said pattern controlled means having means for varying from course to course the needles which take the two respective yarns to form a desired pattern.

15. In a circular independent needle knitting machine having a first body yarn feeding finger and a second body yarn feeding finger and also having a single set of stitch cams, pattern controlled means for elevating a first set including certain of the needles in advance of the first body yarn feeding finger to pick up the body yarn therefrom and to lower said needles before reaching the second body yarn feeding finger so as to fail to pick up the body yarn from the second body yarn feeding finger, said pattern controlled means also being operable to elevate a second set including certain of the needles after they have passed the first body yarn feeding finger and before they reach the second body yarn feeding finger so as to cause the body yarn taken by the preceding or first set of needles to be deposited on the back of the said second set of needles and whereby said second set of needles will take the body yarn from the second body yarn feeding finger, said two sets of needles taking the two body yarns being overlapped at their junction point so as to cause both body yarns on one or more needles in both sets to be knitted on the overlapped needles simultaneously and said pattern controlled means having means for varying from course to course the needles which take the two respective yarns to form a desired pattern.

16. In a circular knitting machine having a rotary needle cylinder and also having a plurality of vertically movable needles spaced about the needle cylinder and also having a single set of stitch cams, a first and a second body yarn feeding fingers spaced substantially apart from each other adjacent the upper end of the needle cylinder, pattern controlled means for elevating a first plurality of the needles prior to their passing the first body yarn feeding finger so as to cause them to take the body yarn therefrom but to lower said first plurality of the needles before they pass the second body yarn feeding finger so as to fail to take the yarn from the second body yarn feeding finger, said pattern controlled means serving to elevate a second plurality of the needles after they have passed the first body yarn feeding finger and before passing the second body yarn feeding finger so as to take the yarn from the second body yarn feeding finger and to fail

to take the yarn from the first body yarn feeding finger to thus knit the body yarns from both of the body yarn feeding fingers in separate portions of a single course and said pattern controlled means also serving to elevate certain of the needles before they pass the first body yarn feeding finger and to cause them to remain in elevated position as they pass both of the body yarn feeding fingers so as to take the yarn from both of the yarn feeding fingers and to thus knit both of the body yarns simultaneously with certain of the needles and said pattern controlled means being arranged to vary from course to course the needles raised to take the body yarns and also varying the needles which simultaneously knit both body yarns.

17. In a circular knitting machine having a rotary needle cylinder provided with a plurality of circularly spaced vertically movable needles and having a single set of stitch cams, a first and a second body yarn feeding fingers spaced substantially apart from each other adjacent the upper ends of the needles, means for selectively elevating certain of the needles so as to cause them to take the body yarn from either of the yarn feeding fingers without taking the yarn from the other yarn feeding finger, selectively operable means for elevating certain other of the needles so as to take and knit the yarns from both of the yarn feeding fingers simultaneously in a single course and pattern controlled means for varying the needles from course to course which take the body yarns from the yarn feed fingers.

18. In a circular knitting machine having a rotary needle cylinder and a single set of stitch cams and also having a plurality of vertically movable needles positioned around the needle cylinder and also having two spaced yarn feed fingers for feeding at least two body yarns to the needles, means for elevating certain of the needles so as to take only the yarn from the first yarn feed finger, means for elevating others of the needles for taking only the yarn from the second yarn feed finger while failing to take the yarn from the first yarn feed finger, means for elevating some of the needles which had independently taken the yarn from each of the yarn feed fingers so as to cause these last-named needles to take the yarn from both of the yarn feed fingers to thus interknit the yarns from each of the yarn feed fingers on the same needles in a single course and pattern controlled means for increasing the number of adjacent needles from course to course which take one yarn and consequently decreasing the number of the other needles which take the other yarn.

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