Dec. 13, 1955 S. J. HADDAD 2,726,525

APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

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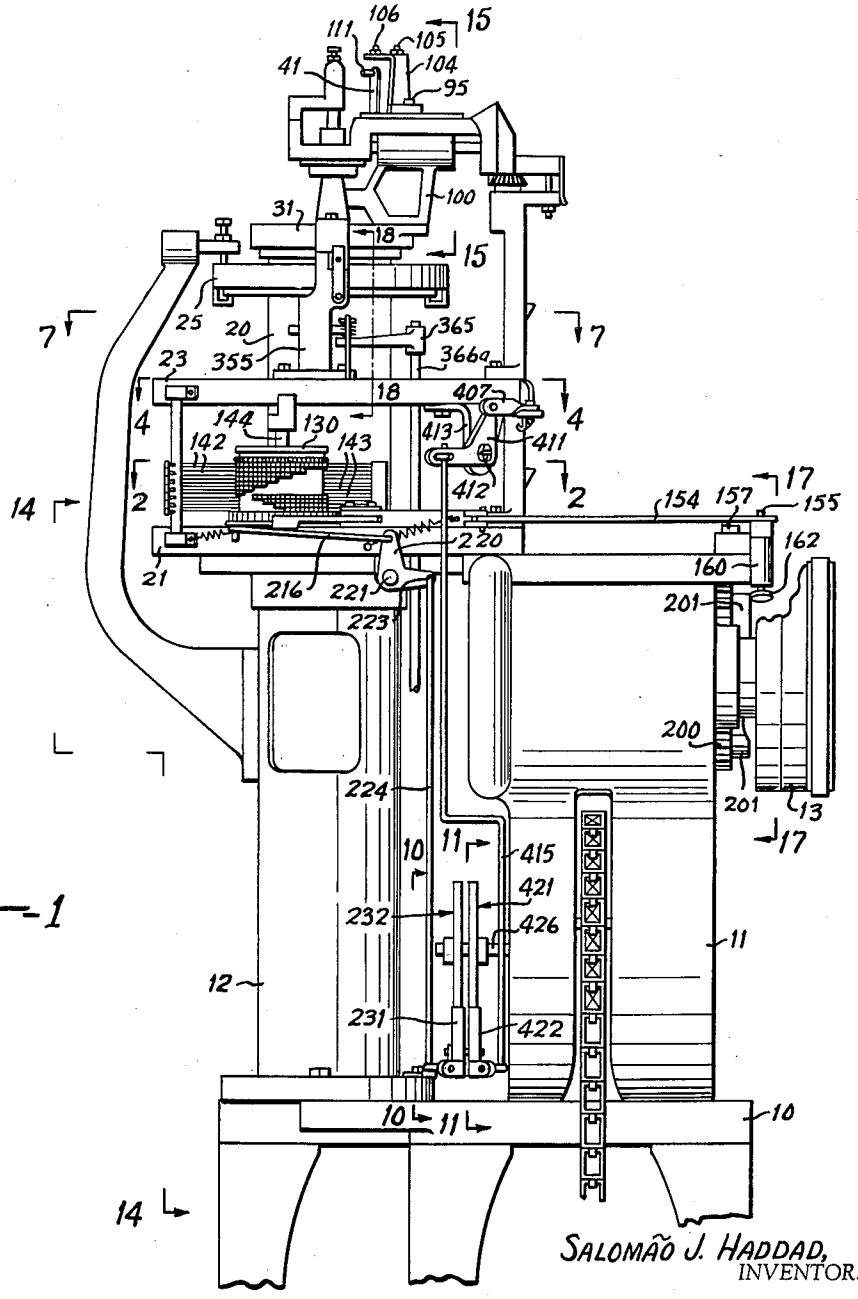


Fig-1

SALOMÃO J. HADDAD,
INVENTOR.

BY

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APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

Filed Jan. 23, 1950 18 Sheets-Sheet 2

Fig - 2

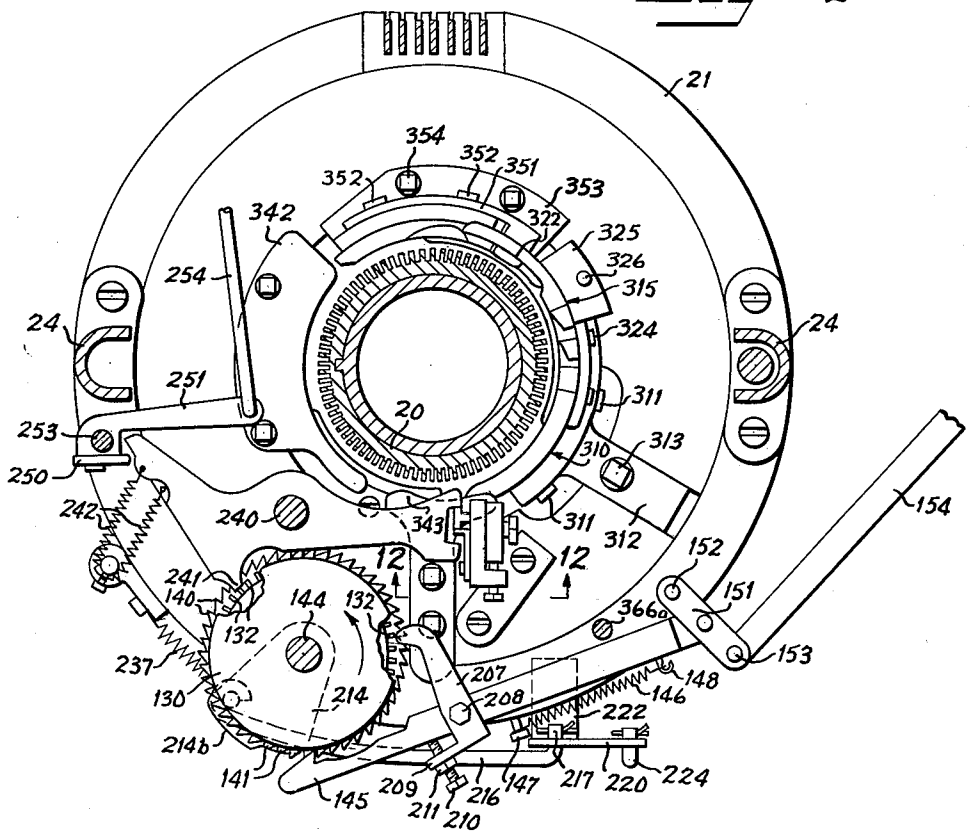
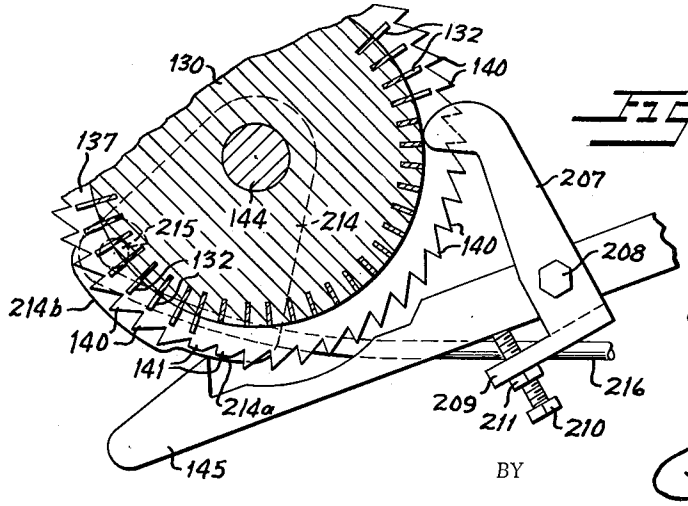


Fig - 3



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INVENTOR.

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APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

Filed Jan. 23, 1950 18 Sheets-Sheet 3

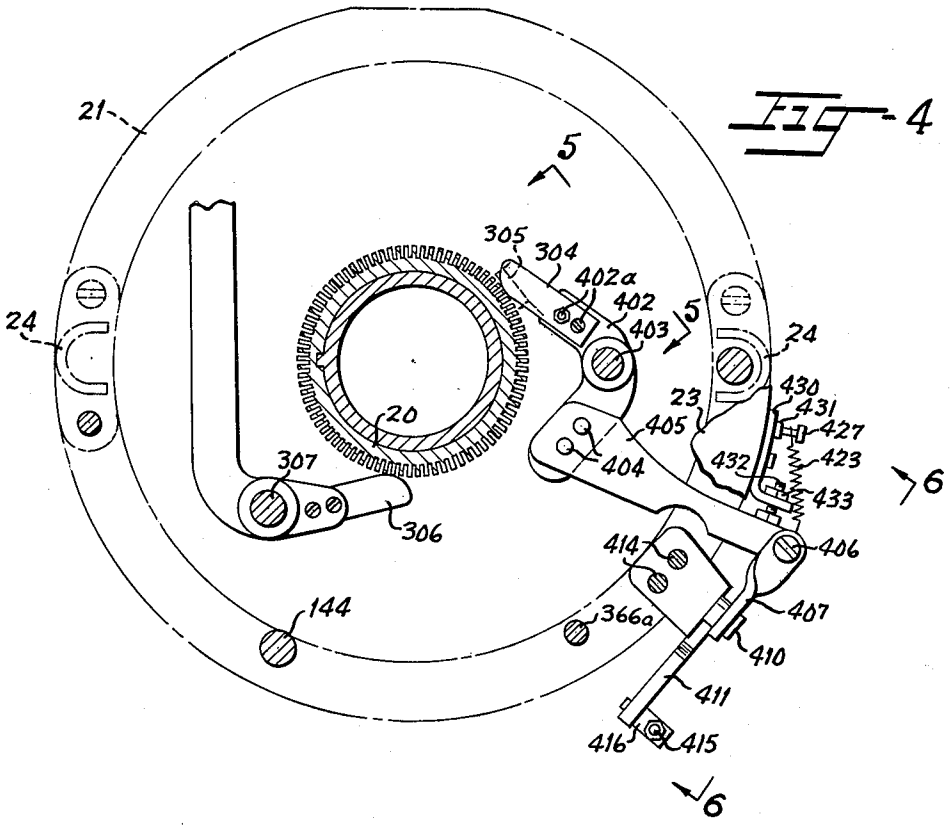


Fig. 4

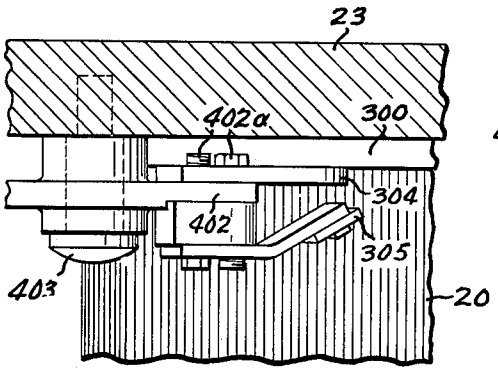


Fig. 5

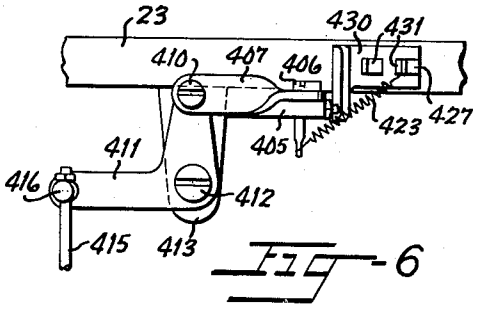


Fig. 6

SALOMÃO J. HADDAD,
INVENTOR.

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APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

Filed Jan. 23, 1950 18 Sheets-Sheet 4

Fig-7

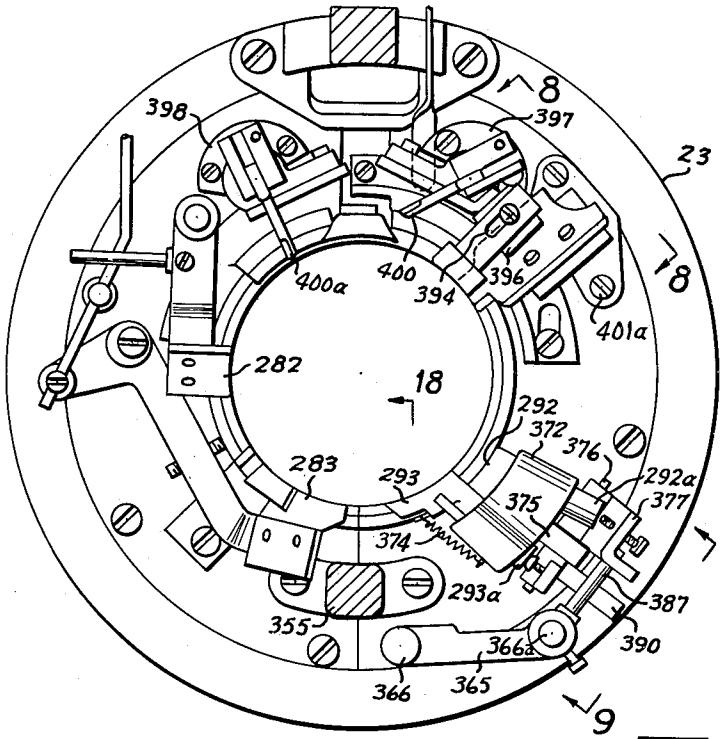


Fig-9

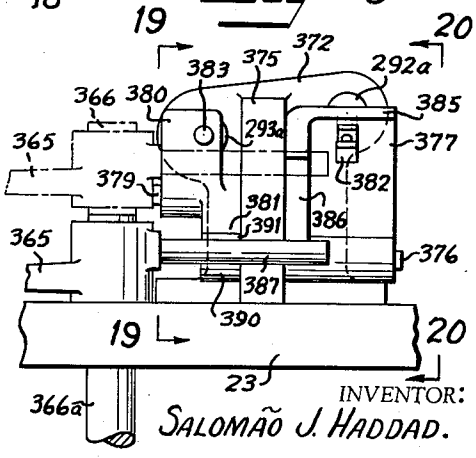
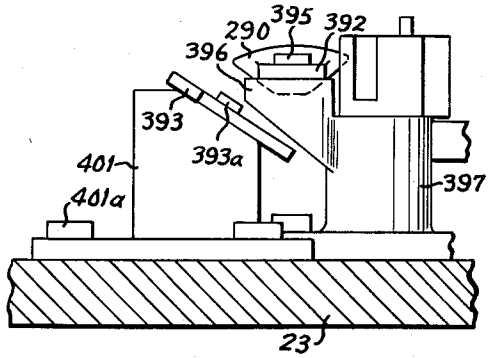


Fig-8



INVENTOR:
SALOMÃO J. HADDAD.

BY

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APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

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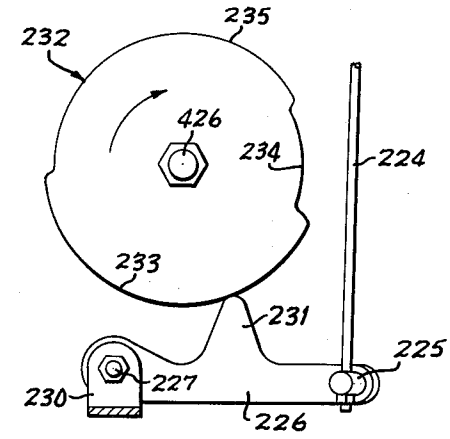


Fig-10

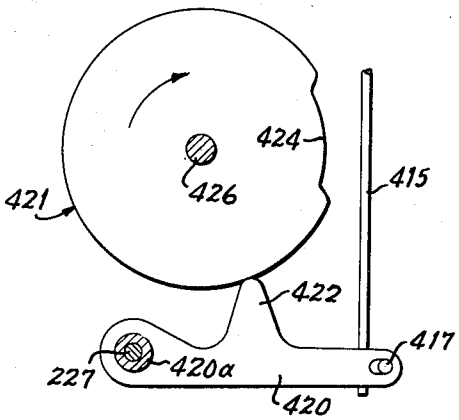


Fig-11

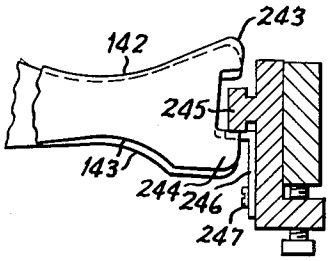


Fig-13

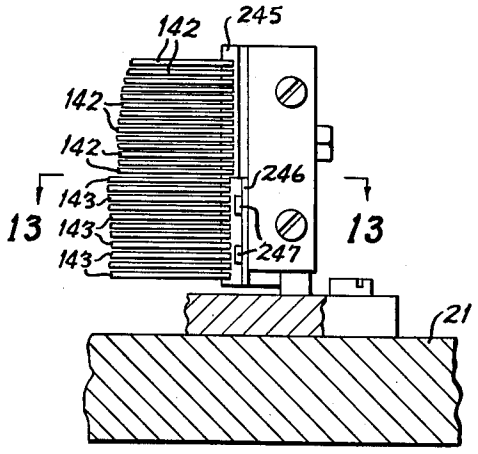


Fig-12

SALOMÃO J. HADDAD,
INVENTOR.

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APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

Filed Jan. 23, 1950 18 Sheets-Sheet 6

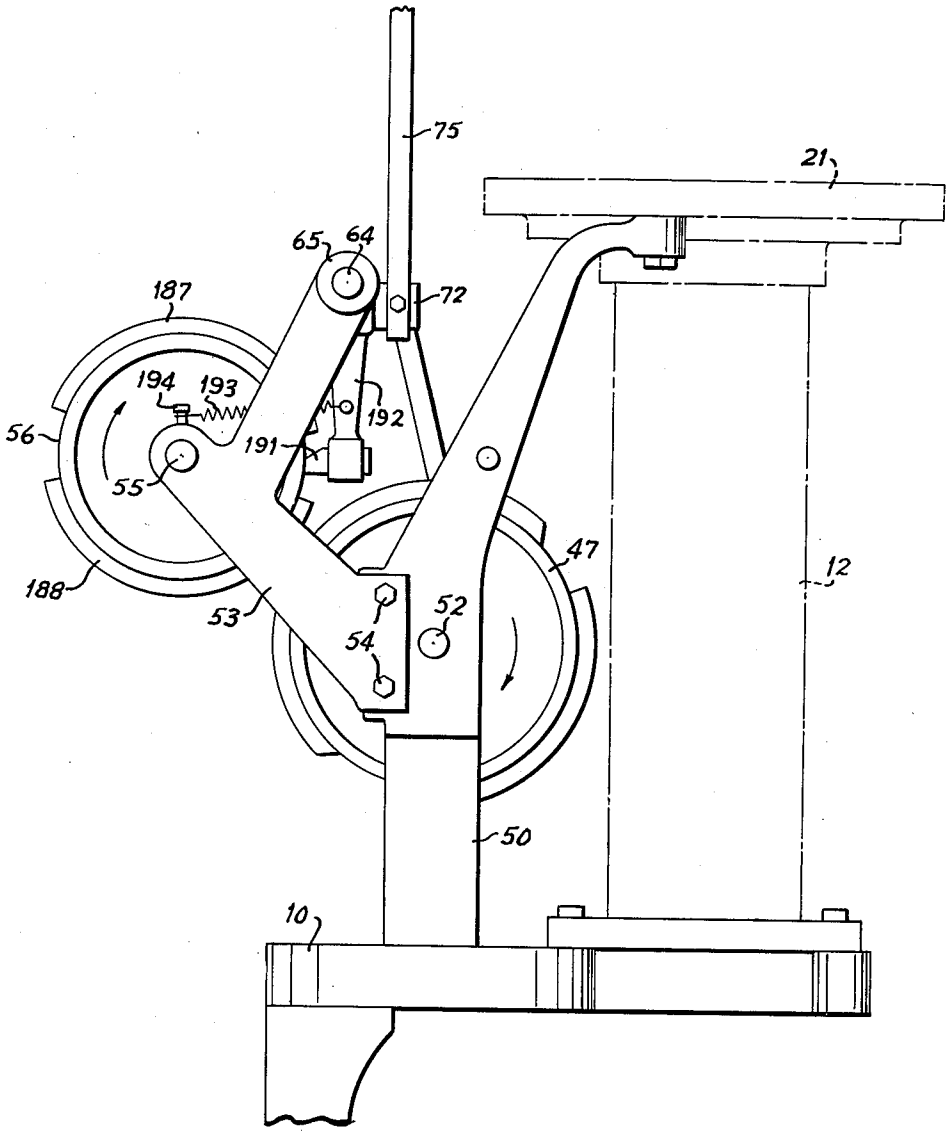


Fig - 14

SALOMÃO J. HADDAD,
INVENTOR.

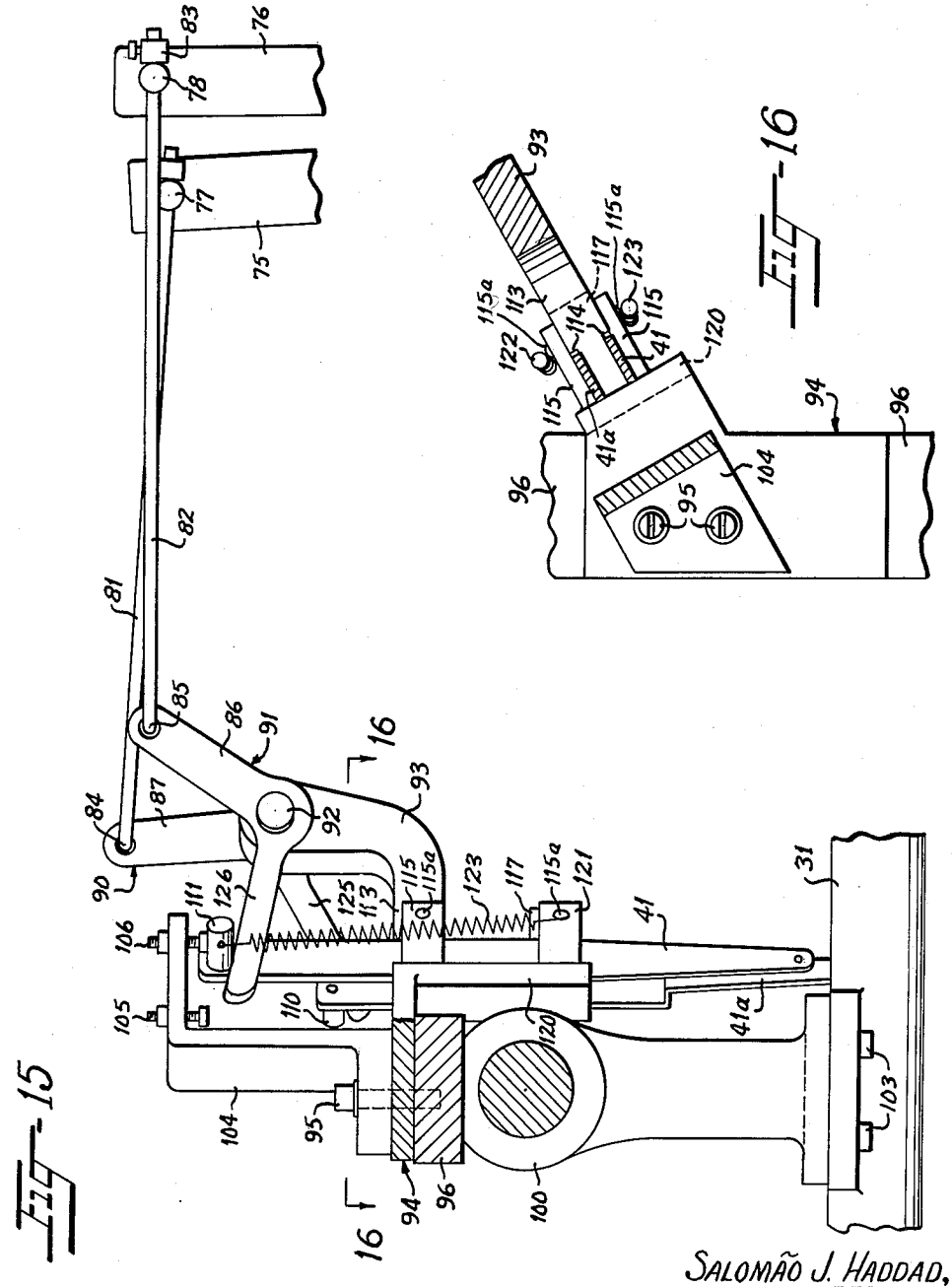
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Filed Jan. 23, 1950 18 Sheets-Sheet 7



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INVENTOR.

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APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

Filed Jan. 23, 1950 18 Sheets-Sheet 8

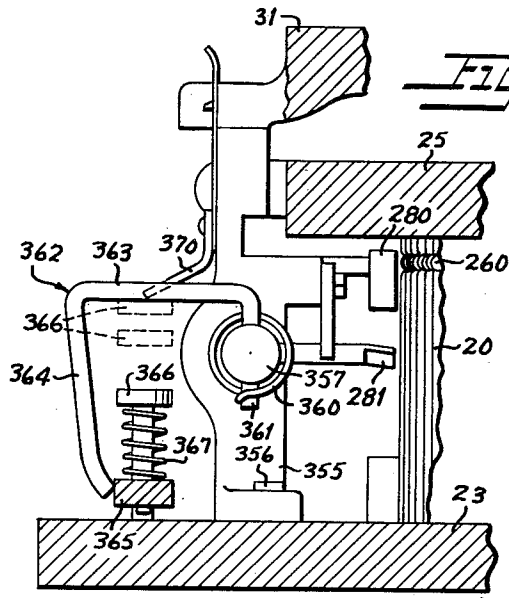


Fig-18

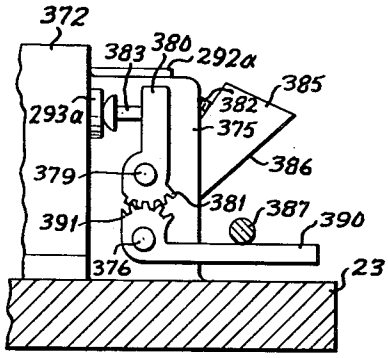


Fig-19

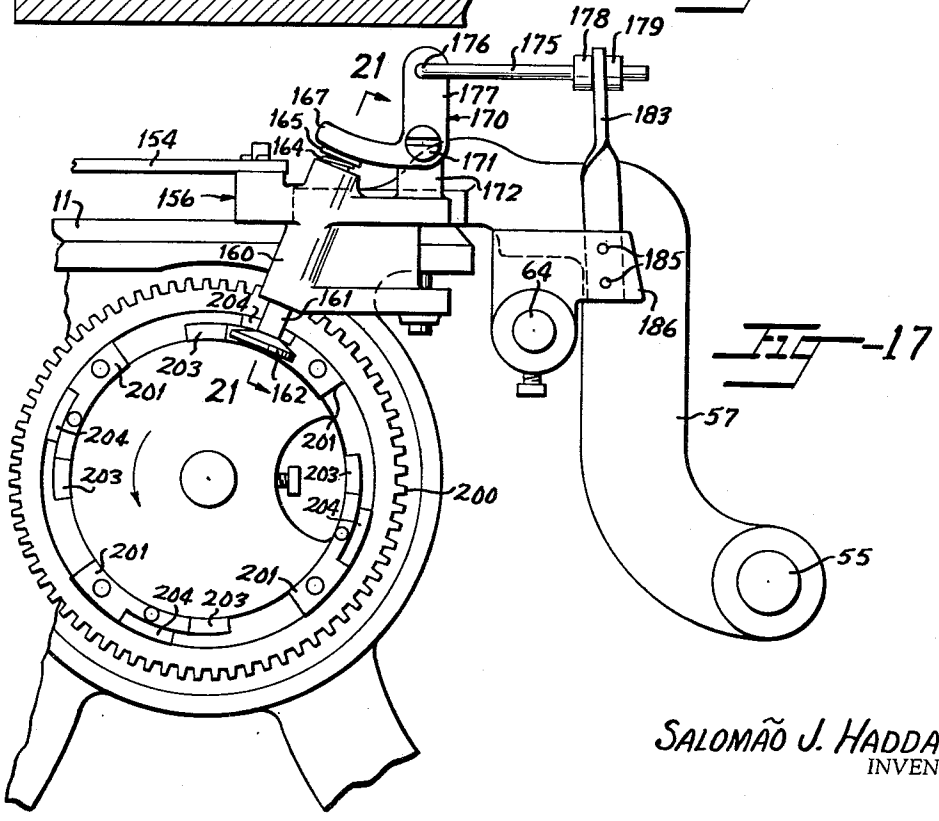


Fig-17

SALOMÃO J. HADDAD.
INVENTOR.

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APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

Filed Jan. 23, 1950 18 Sheets-Sheet 9

FIG-22

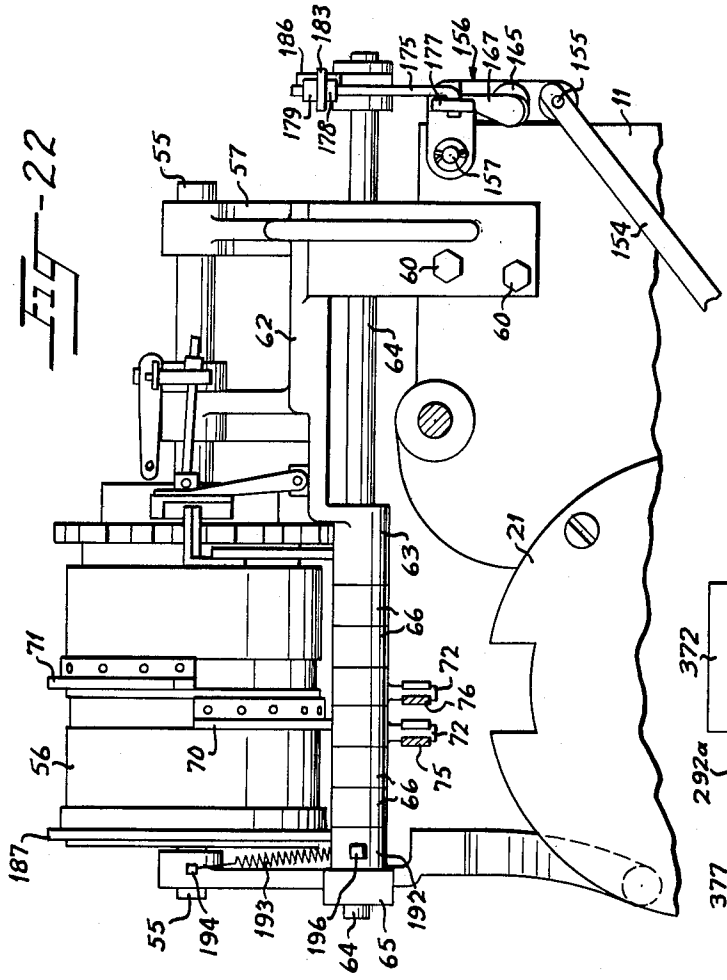


FIG-20

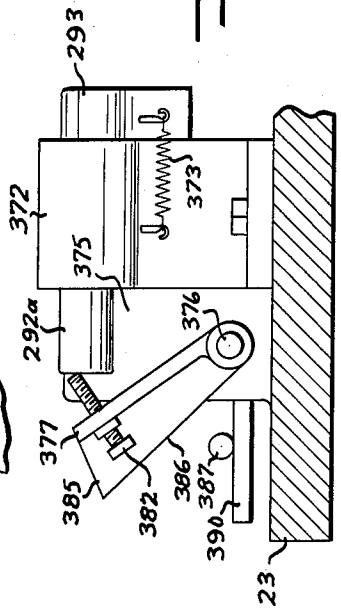
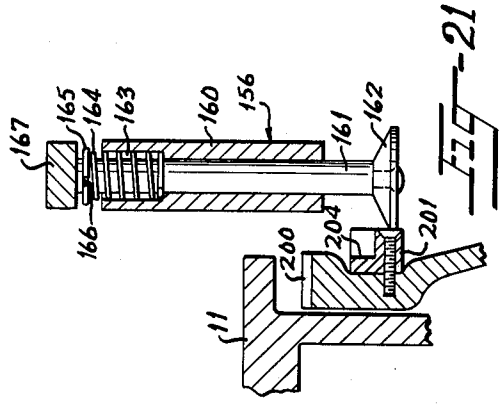


FIG-21



SALOMÃO J. HADDAD,
INVENTOR.

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APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

Filed Jan. 23, 1950 18 Sheets-Sheet 10

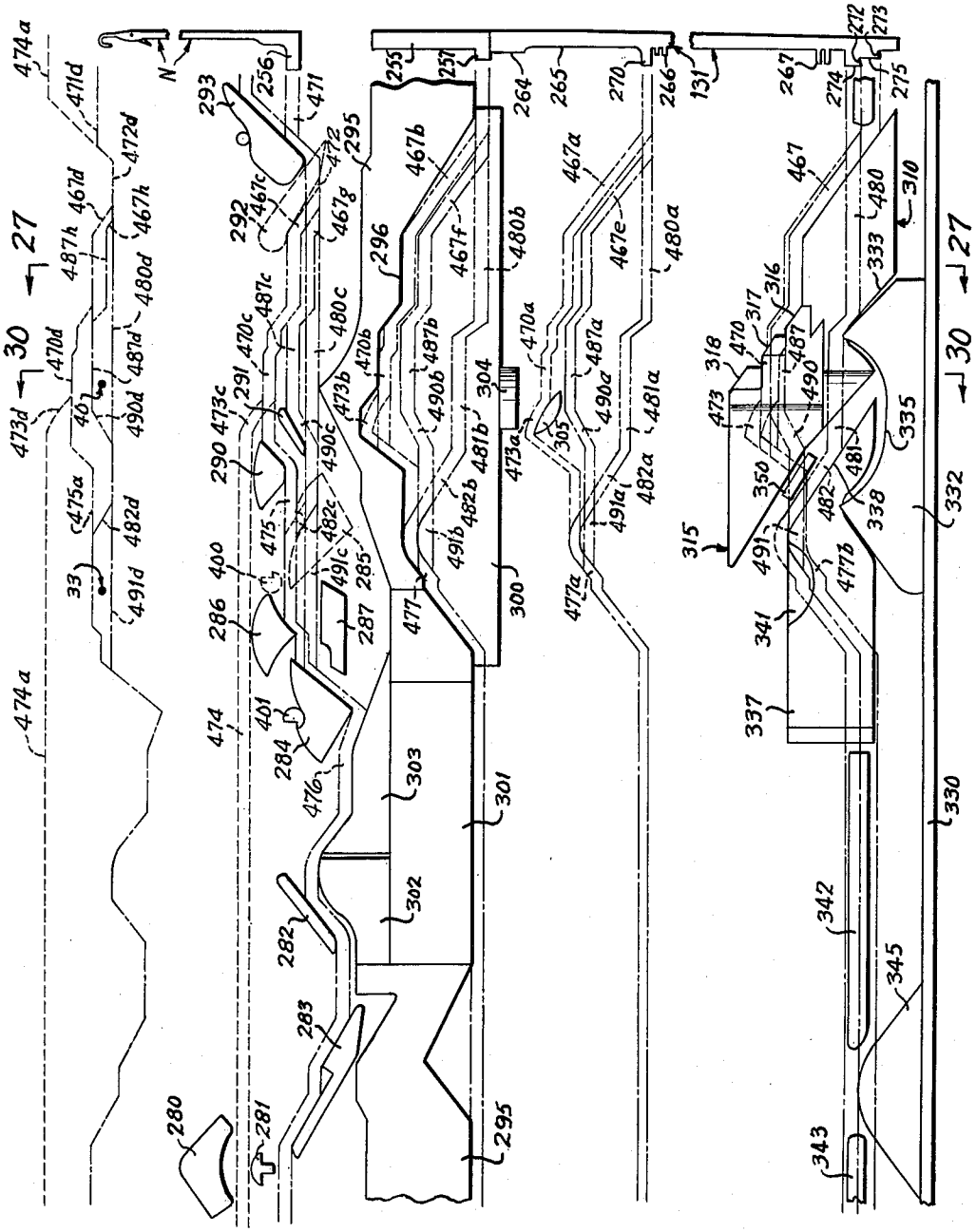


Fig. 23

SALOMÃO J. HADDAD,
INVENTOR.

BY

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Dec. 13, 1955 S. J. HADDAD 2,726,525

APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

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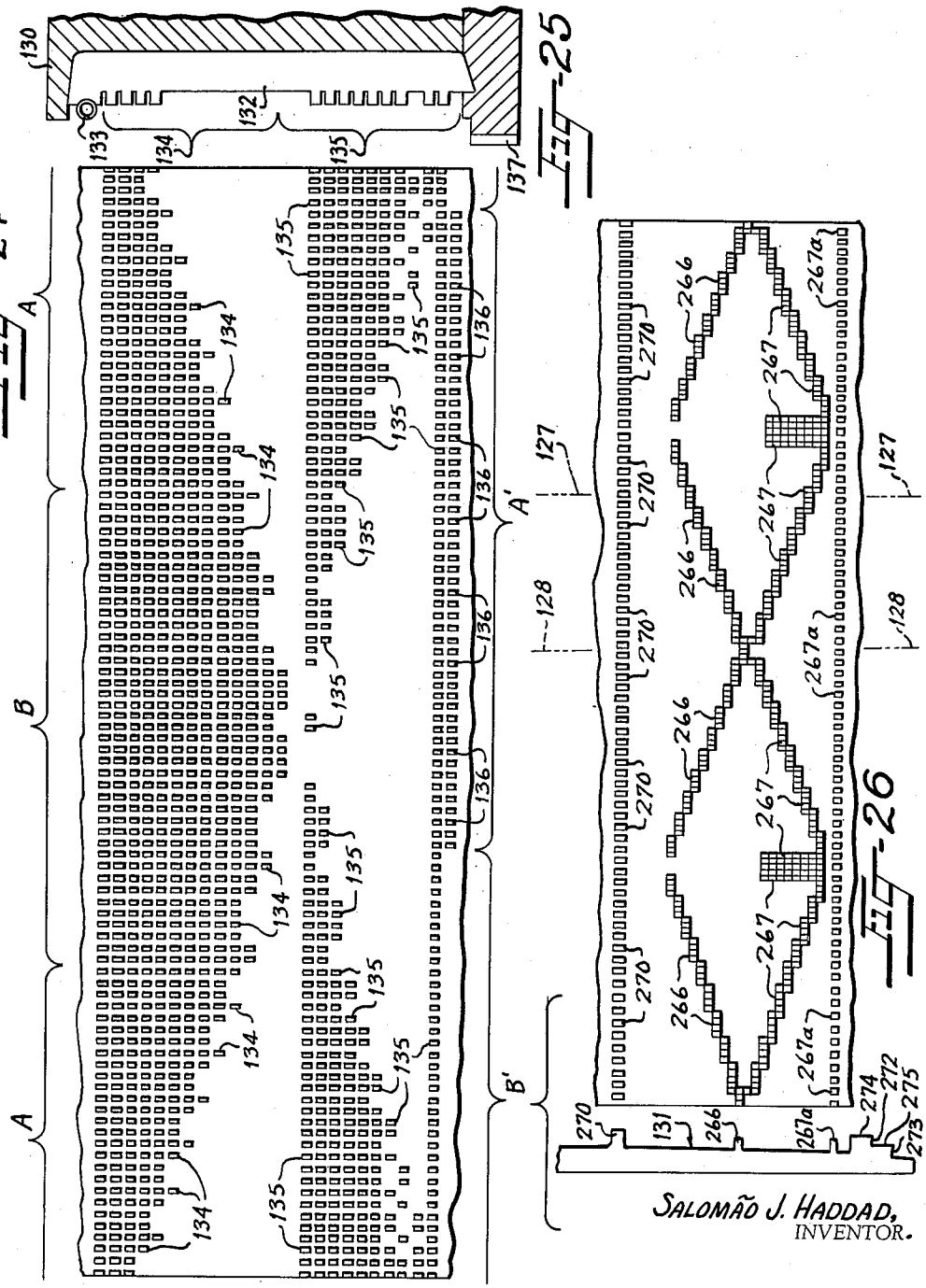


Fig-24

Fig-25

Fig-26

SALOMÃO J. HADDAD,
INVENTOR.

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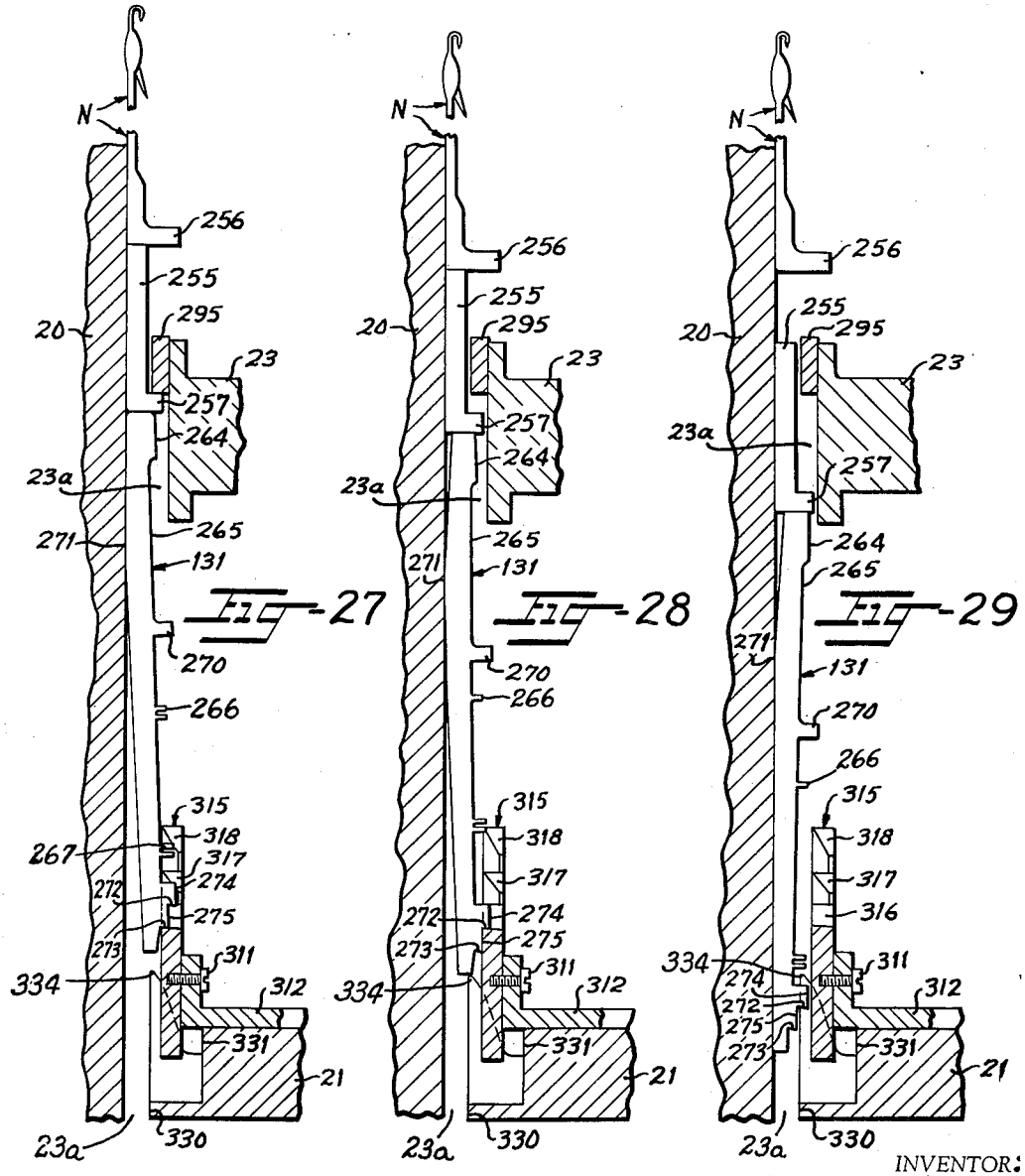


Fig-27

Fig-28

Fig-29

INVENTOR:
SALOMÃO J. HADDAD.

BY

ATTORNEY

Dec. 13, 1955 S. J. HADDAD 2,726,525

APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

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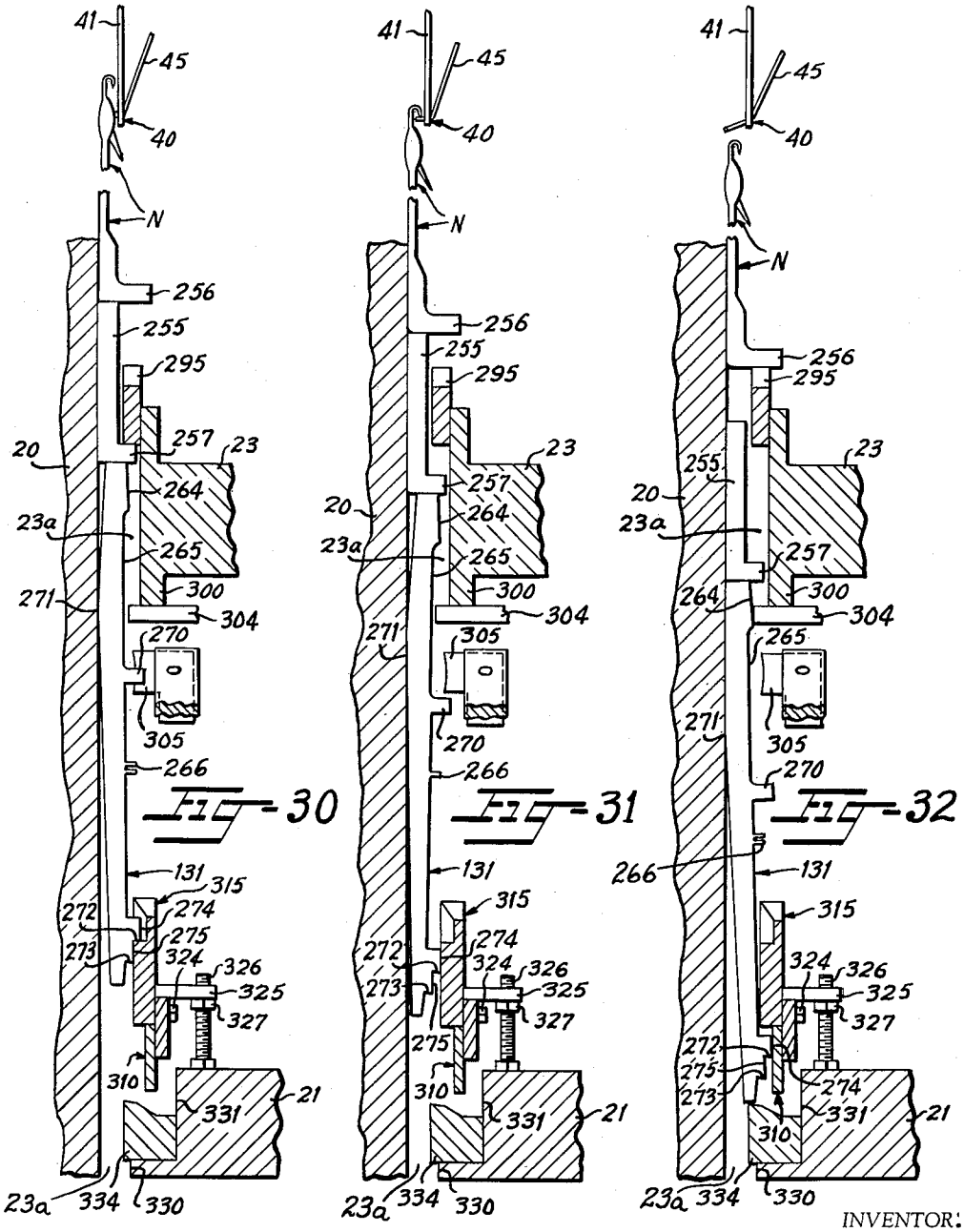


Fig-30 Fig-31 Fig-32

INVENTOR:
SALOMÃO J. HADDAD.

BY

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Dec. 13, 1955 S. J. HADDAD 2,726,525

APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

Filed Jan. 23, 1950 18 Sheets-Sheet 14

Fig. 33

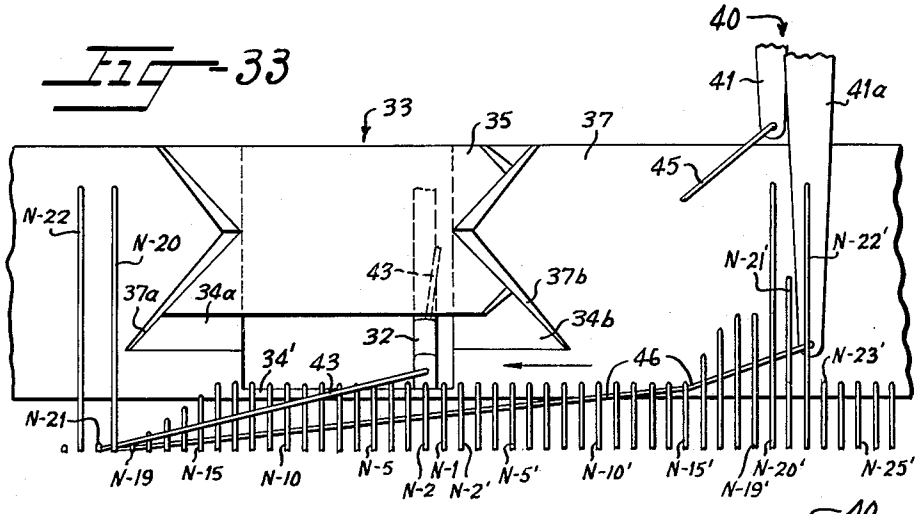


Fig. 34

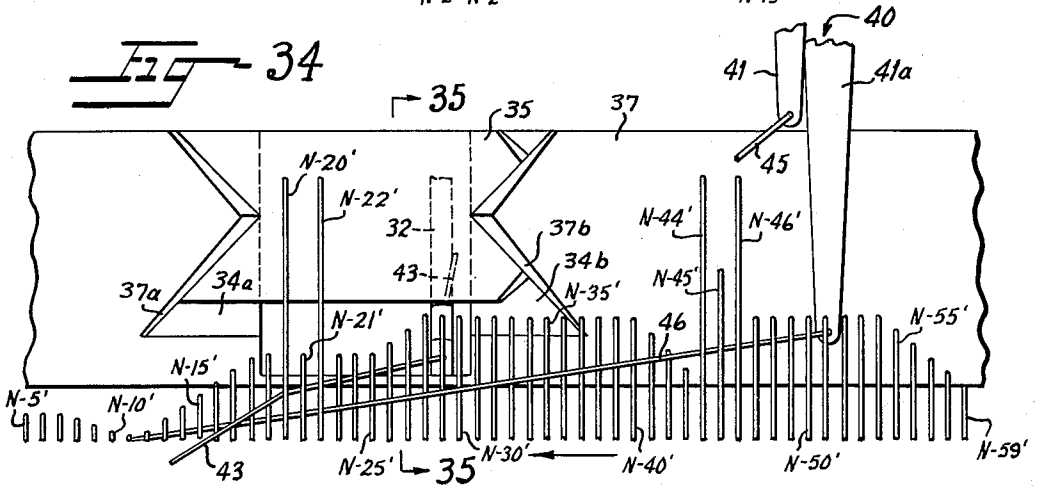
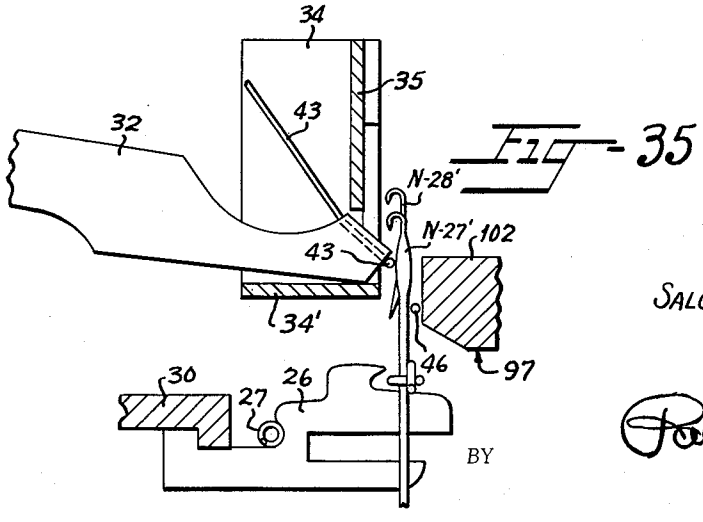


Fig. 35



SALOMÃO J. HADDAD,
INVENTOR.

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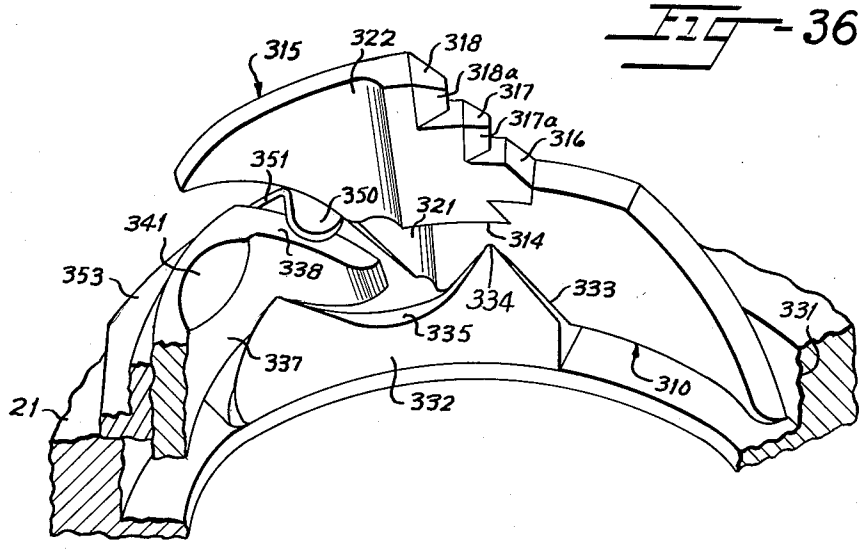
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APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

Filed Jan. 23, 1950 18 Sheets-Sheet 15

Fig-36



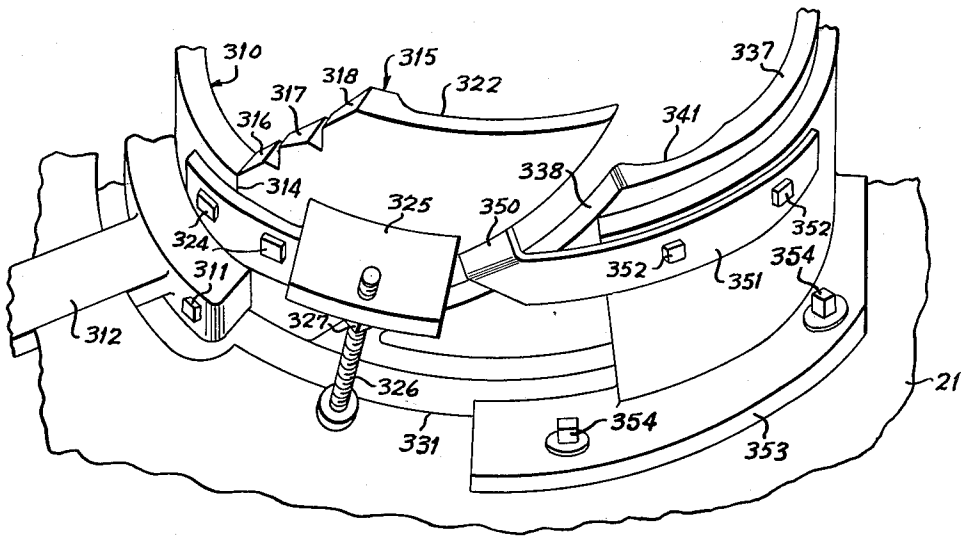


Fig-37

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INVENTOR.

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APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

Filed Jan. 23, 1950 18 Sheets-Sheet 16

Fig-39

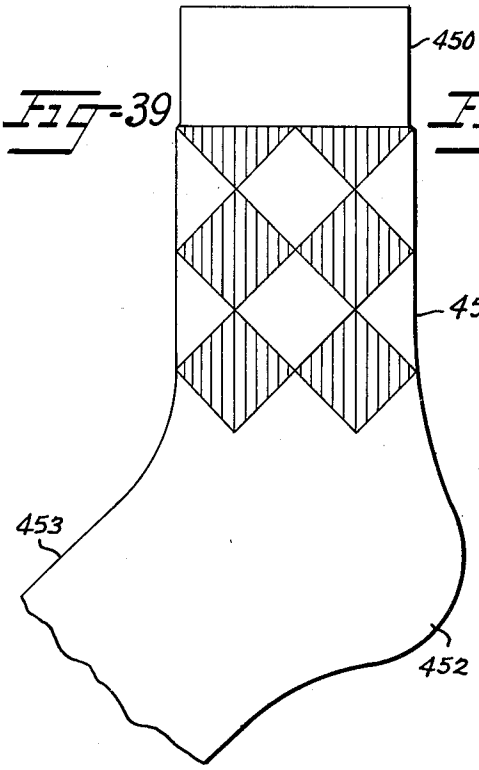


Fig-38

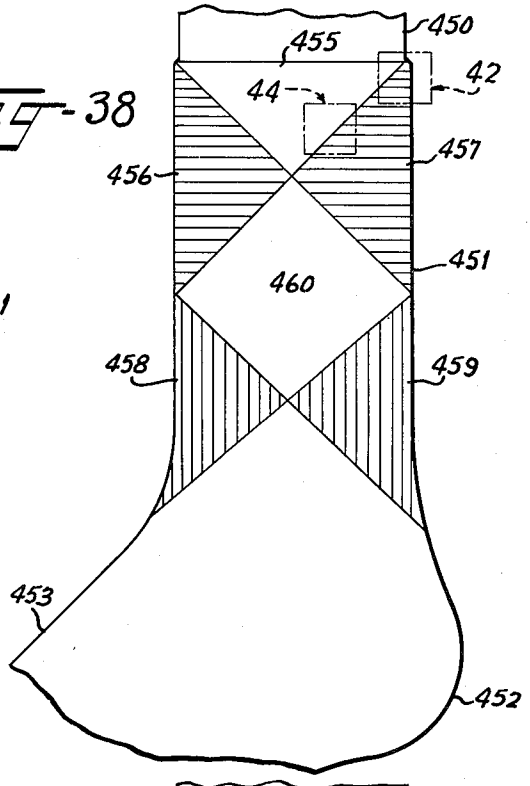


Fig-41

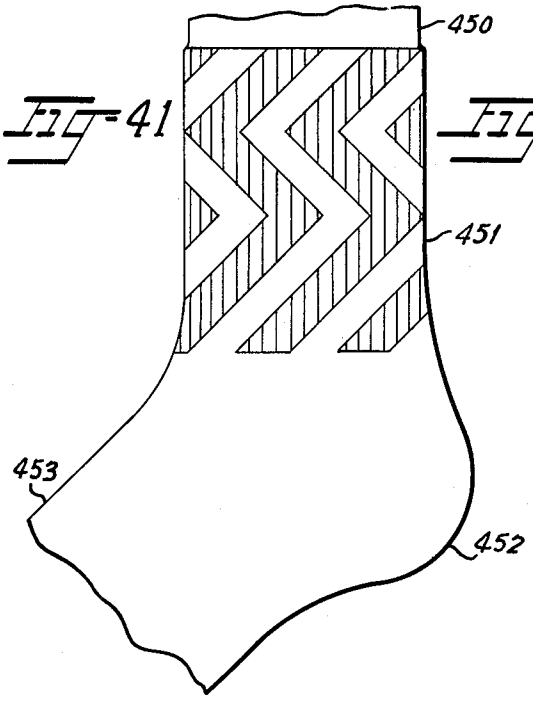
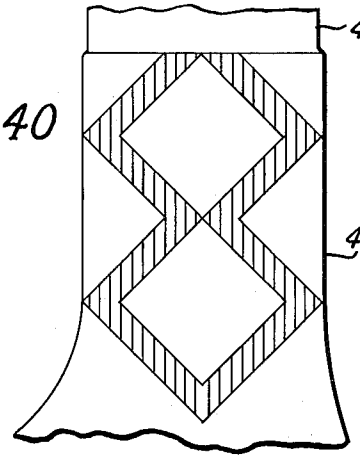


Fig-40



SALOMÃO J. HADDAD,
INVENTOR.

BY

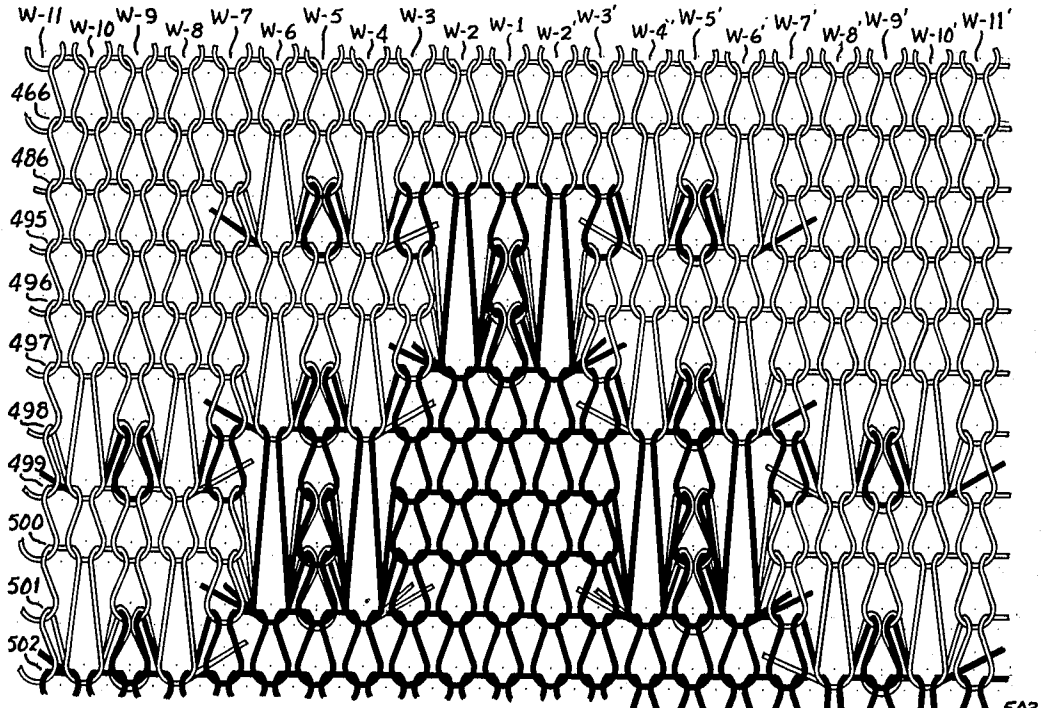
ATTORNEY

Dec. 13, 1955 S. J. HADDAD 2,726,525

APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

Filed Jan. 23, 1950 18 Sheets-Sheet 17

Fig. 42



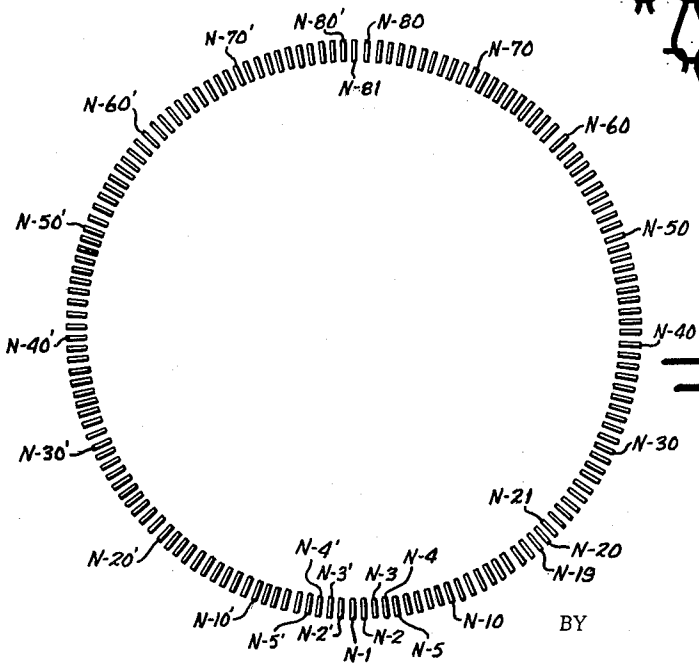


Fig. 43

SALOMÃO J. HADDAD,
INVENTOR.

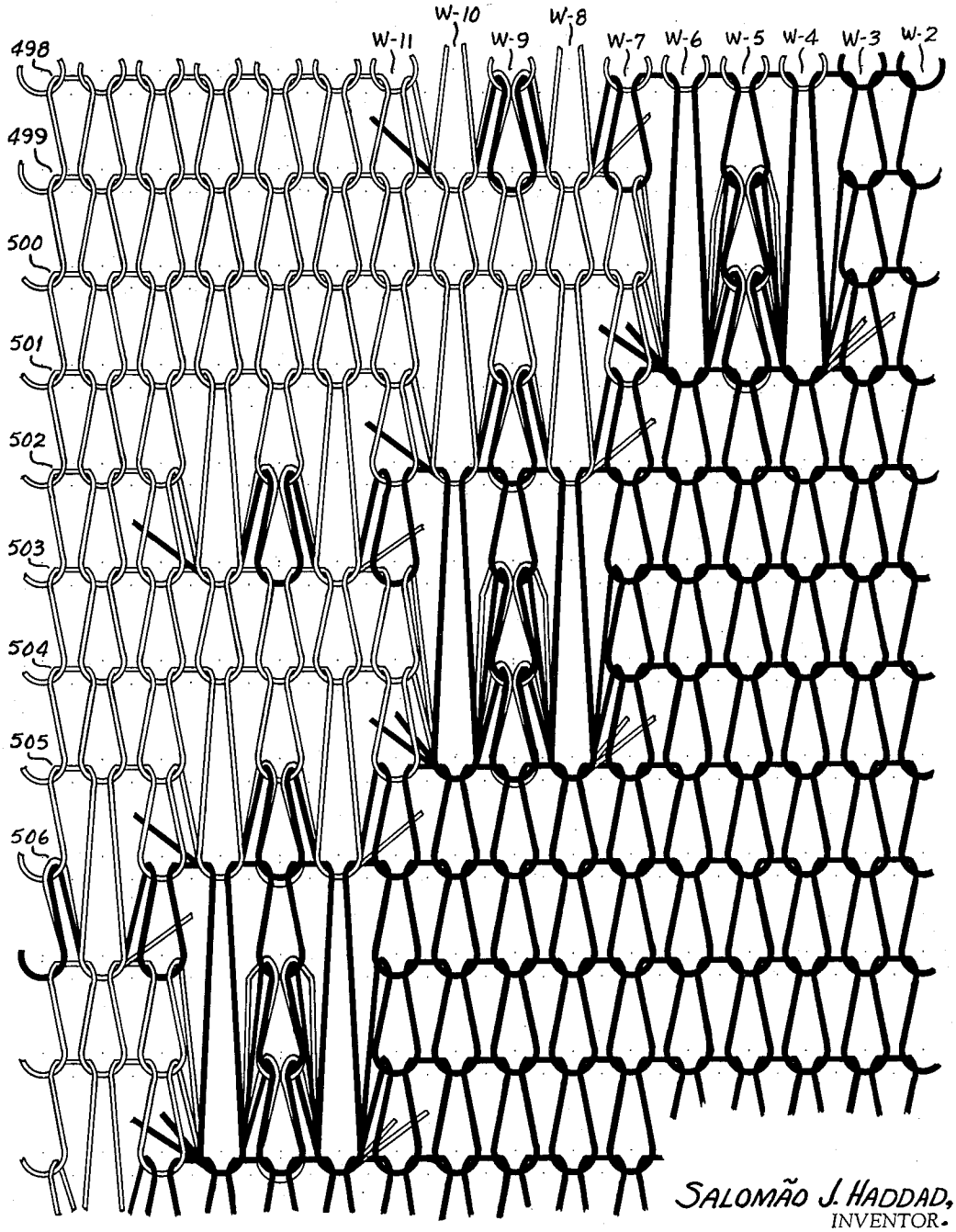
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APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

Filed Jan. 23, 1950 18 Sheets-Sheet 18



SALOMÃO J. HADDAD,
INVENTOR.

Fig. 44

BY

ATTORNEY

United States Patent Office 2,726,525 Patented Dec. 13, 1955

2,726,525

APPARATUS FOR KNITTING DESIGNS IN TUBULAR FABRICS AND METHOD

Salomão J. Haddad, Shrewsbury, Mass., assignor, by mesne assignments, to Standard Hosiery Mills, Burlington, N. C., a corporation of North Carolina

Application January 23, 1950, Serial No. 139,996

33 Claims. (Cl. 66—50)

This invention relates to improvements in circular knitting machines and more especially to circular knitting machines of the type employed in making patterns in fabrics by introducing yarns of two or more different colors at points immediately adjacent each other to the needle circle and whereby these yarns may be introduced to the needles in such a manner as to be knitted on some of the needles simultaneously while being knitted on other of the needles independently, according to a desired pattern.

This invention is a continuation in part of my copending application, Serial No. 80,273, filed March 8, 1949, and entitled "Apparatus for Knitting Float Patterns, now Patent No. 2,516,697 of July 25, 1950.

The primary object of this invention is to provide improvements in a knitting machine of a type having a needle cylinder in the periphery of which vertically movable pattern jacks are mounted and each of the pattern jacks having coinciding needle jacks and latch needles associated therewith, the pattern jacks being controlled by the usual pattern means such as the trick wheel.

These improvements are also employed in conjunction with an auxiliary yarn feed station disposed in advance of a main yarn feed station adjacent the needle circle and include means for selectively positioning the needles at four different elevations at the auxiliary yarn feed station, namely, a lower elevation, first and second intermediate elevations, and a higher elevation and providing other means for either lowering or elevating the needles to a lower or an upper elevation, after moving past the auxiliary yarn feed station and upon passing the main yarn feed station, so as to selectively take the yarn from the auxiliary yarn feed station as well as to selectively take the yarn from the main yarn feed station while, at other times, moving other of the needles to such an elevation as to cause the needles to pass above the stitch cams retaining the previous loops thereon. This makes possible, in one instance, the taking of the yarn from the first yarn feed station but not taking the yarn from the second yarn feed station and thus knitting the yarn from only the first yarn feed station, which is the hereinbefore described auxiliary yarn feed station. This also makes possible in a second instance, the taking of the yarn from both of the yarn feed stations and knitting both of the yarns simultaneously and, in a third instance, this makes possible the taking of the yarn from only the second or main yarn feed station thus resulting in only the yarn from the main yarn feed station being knitted into the fabric.

It is another object of this invention to provide a fabric structure wherein two or more different colors of yarn may be knitted in the forming of patterns of a type wherein the suture formed by the juncture of two colors of yarn extends at an angle relative to the plane of the wales and the courses being knitted and wherein, for example, a first needle will take both colors of yarn, knitting the two colors simultaneously while another

needle disposed on each side of the first needle may fail to take the yarn according to a desired pattern for a predetermined number of courses, the yarns being floated between the first needle and the needles disposed adjacent remote sides of the needle disposed to each side of the first needle. The needle disposed each side of the first needle remains inactive, during the knitting of several courses, merely retaining the loops and all additional yarn thereon.

It is still another object of this invention to provide pattern controlled means for varying the number of steps the trick wheel or selector drum moves to complete a revolution and to vary the time at which a step in movement is imparted to the trick wheel relative to a predetermined point on the periphery of the needle cylinder, upon rotation thereof, so as to insure that a proper patterning may be transmitted from the selector drum to those pattern jacks whose butts which are responsive to the patterning on the trick wheel and normally disposed in the vertical plane of the needle cylinder at which the usual step in rotation is transmitted to the selector drum, may be positioned to one side of this point when these particular butts are to be acted upon through the conventional selector fingers associated with the selector drum.

Some of the objects of the invention having 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 wherein many of the parts are shown schematically and showing parts of the present invention applied thereto;

Figure 2 is an enlarged sectional plan view taken substantially along the line 2—2 in Figure 1 and showing the pattern jack control cams encircling the needle cylinder and showing the selector drum or trick wheel and associated parts but omitting those parts which are not pertinent to the present invention;

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

Figure 4 is an enlarged schematic sectional plan view taken substantially along the line 4—4 in Figure 1 and showing other pattern jack control cams not appearing in Figure 2, the lower circular bed or cam plate being shown in dot-dash lines and the upper circular bed or cam plate being broken away for purposes of clarity;

Figure 5 is an enlarged fragmentary elevation showing a portion of the upper bed plate in cross section and showing two of the cams for controlling the pattern jacks and being taken substantially along the line 5—5 in Figure 4;

Figure 6 is a fragmentary elevation looking substantially along the line 6—6 in Figure 4 and showing a part of the control mechanism for the pattern jack control cams shown in Figure 5;

Figure 7 is an enlarged top plan view, with parts in section, taken substantially along the line 7—7 in Figure 1 showing the needle control cams, which surround the needle cylinder, mounted on the upper bed plate;

Figure 8 is an enlarged elevation, with parts in section, looking substantially along the line 8—8 in Figure 7 and showing two of the stationary needle cams of the present invention which are employed in lowering certain of the needles which may have been elevated to operating position adjacent the auxiliary yarn feed station;

Figure 9 is an enlarged fragmentary elevation looking substantially along the line 9—9 in Figure 7 and show-

ing a pair of conventional alternately movable needle lowering and elevating cams;

Figure 10 is an enlarged elevation, with parts in section, looking substantially along the line **10—10** in Figure 1 and showing the cam means for rendering the means which transmit rotation to the selector drum inoperative during the knitting of the top, heel, foot and toe portions of a stocking;

Figure 11 is an enlarged elevation, with parts in section, looking substantially along the line **11—11** in Figure 1 and showing the cam means for controlling a push-out cam and a pattern jack elevating cam shown in Figures 4 and 5;

Figure 12 is an enlarged fragmentary elevation, with parts in section, looking substantially along the line **12—12** in Figure 2 and showing the working ends of the selector fingers and associated means for restricting their inward movement relative to the needle cylinder;

Figure 13 is a sectional plan view taken substantially along the line **13—13** in Figure 12 and showing the upper group of selector fingers in one position and the lower group of selected fingers in another position;

Figure 14 is an enlarged fragmentary elevation looking substantially along the line **14—14** in Figure 1 but showing only the rearmost portion of the knitting machine and also showing the sock horn and the associated lower bed plate in dash-dot lines;

Figure 15 is an enlarged elevation, with parts in section, looking substantially along the line **15—15** in Figure 1 and showing the manner in which the auxiliary yarn feed fingers are mounted and the linkage connected thereto;

Figure 16 is a fragmentary sectional plan view taken substantially along the line **16—16** in Figure 15;

Figure 17 is an enlarged elevation looking substantially along the line **17—17** in Figure 1 but showing only the rear portions of the knitting machine and showing an improved mechanism for transmitting reciprocation to the pawl arm associated with the trick wheel in Figures 2 and 3;

Figure 18 is an enlarged fragmentary elevation, with parts in section, looking substantially along the lines **18—18** in Figures 1 and 7 but showing the widening pick mechanism disposed above the plane of the structure shown in Figure 7;

Figure 19 is a fragmentary elevation looking substantially along the line **19—19** in Figure 9;

Figure 20 is an elevation, with parts in section, looking substantially along the line **20—20** in Figure 9 and also showing the structure at the opposite side of the cam block shown in Figure 19;

Figure 21 is an enlarged vertical sectional view taken substantially along the line **21—21** in Figure 17;

Figure 22 is a fragmentary top plan view of the rear portion of the knitting machine looking from a point immediately above the lower bed plate **21** in Figure 1 and looking down at the structure shown in Figures 14 and 17;

Figure 23 is a schematic development illustrating one arrangement of cam devices for operating the needles, the needle jacks and the pattern jacks, and looking at the inner surfaces of the circularly arranged cam devices relative to the needle cylinder;

Figure 24 is a schematic diagram showing the arrangement of the butts on the selector bits associated with the selector drum or trick wheel for producing an "Argyle diamond" type of pattern such as that shown in Figure 38;

Figure 25 is an elevation looking at the right-hand end of Figure 24;

Figure 26 is a schematic diagram showing the arrangement of the butts on the pattern jacks of the needle cylinder, this arrangement being incidental to produce a pattern such as that shown in Figure 38 in cooperation with the arrangement of the butts on the selector drum as shown in Figure 24;

Figures 27, 28 and 29 are enlarged vertical sectional views of a portion of the needle cylinder and are taken at a point substantially along the line **27—27** in Figure 23 relative to the cam devices and also showing one of the pattern jacks and a corresponding auxiliary jack and a corresponding needle, the lower ends of the pattern jacks being shown in a different position relative to the needle cylinder in each of the Figures 27, 28 and 29;

Figures 30, 31 and 32 are enlarged vertical sectional views through a portion of the needle cylinder, similar to Figures 27, 28 and 29. These Figures 30, 31 and 32 are taken substantially along the line **30—30** relative to the cam devices shown in Figure 23. Figures 30, 31 and 32 correspond to the Figures 27, 28 and 29, respectively, and show the pattern jacks and associated parts in a position they will have attained after having moved from the point at which Figures 27, 28 and 29 are taken to the point at which Figures 30, 31 and 32 are taken in Figure 23;

Figure 33 is a fragmentary elevation looking from the inside of the needle cylinder toward the latch ring and showing some of the needles in the needle cylinder as they are passing adjacent the main and auxiliary yarn feed stations and wherein certain of the needles at the auxiliary yarn feed station are taking the yarn from the same while the yarn from the yarn feed finger at the main yarn feed is being floated back of the needles;

Figure 34 is a view similar to Figure 33 but showing the needles as though the needle cylinder had rotated a partial revolution to where certain needles will pass above both of the yarn feed stations while certain other of the needles will take up the yarn from both of the yarn feed stations;

Figure 35 is a vertical sectional view taken substantially along the line **35—35** in Figure 34 and showing the manner in which the yarn is fed to the needles at the main yarn feed station;

Figure 36 is a fragmentary perspective view of the pattern jack elevating cams shown in the lower portion of Figure 23 with parts in section;

Figure 37 is a fragmentary perspective view looking at the outside of the cams shown in Figure 36;

Figure 38 is a diagrammatic side elevation of a stocking showing one form of an "Argyle diamond" type of ornamental pattern which may be produced with the present invention and which is the particular stocking for which the patterning is arranged throughout the machine as described in the course of this specification;

Figures 39, 40 and 41 are diagrammatic side elevations of a stocking similar to Figure 38 but showing other forms of ornamental patterns which may be knitted into the leg of a stocking with the present apparatus;

Figure 42 is a greatly enlarged schematic elevation showing the structure of the fabric at the point of a diamond and being an area defined by dotted lines indicated by the arrow **42** in Figure 38;

Figure 43 is a diagram showing the upper ends of the needles in the needle circle;

Figure 44 is a greatly enlarged schematic elevation of a portion of the knitted fabric produced with this machine and showing the structure at the juncture of two adjacent triangular or diamond-shaped areas of the knitted fabric, this area being defined by dotted lines indicated by the arrow **44** in Figure 38.

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 from 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 R. W. Scott, No. 1,152,850 of September 7, 1913, and a further description of this gearing is deemed unnecessary. The knitting machine also has a conventional needle

cylinder **20** which is driven, by means not shown but appearing in said Patent No. 1,152,850, to, at times, reciprocate and to, at other times, rotate in a conventional manner.

The housing **11** and the tubular member **12** support a circular lower bed or cam plate **21** (Figures 1 and 2) which provides a mounting for a series for pattern jack control cams and selector devices for controlling the pattern jacks. This lower bed plate **21** also supports an upper annular bed or cam plate **23** by means of posts **24**. This cam plate **23** has an opening **23***a* therein (Figures 27 to 32, inclusive) to the vertical wall of which some of the stationary needle cams are secured and the needle cylinder **20** extends through this opening **23***a*. The cam plate **23** also carries the usual needle controlling cams besides other needle controlling cams which are a part of the present invention and which will be later described. This cam plate **23** also carries the usual cam ring, picker mechanism and other devices which may be pertinent to the particular kind of hosiery or machine to which the present invention may be applied.

The knitting machine also has a conventional sinker head **25** (Figure 1) and conventional sinkers **26**, such as are shown in U. S. Patent No. 1,467,691, one of which is shown in Figure 35. A portion of an endless coiled spring **27** is shown in Figure 35 which normally urges the sinkers **26** towards the needle cylinder **20**.

The sinker head **25** has a conventional sinker cap or ring **30** thereon and disposed thereabove is a conventional latch ring **31** which is pivotally swung in the conventional manner and usually carries a plurality of conventional yarn feed fingers **32** only one of which is shown in Figures 33, 34 and 35. The yarn feed finger **32** is located at the usual main yarn feed station indicated at **33** in Figures 23, 33, 34 and 35.

Although only one conventional yarn feed finger **32** is shown in Figures 33, 34 and 35, it is to be understood that any desired number of yarn feed fingers may be employed according to the desired number of colors to be knitted into a stocking and also wherein a heavier type of yarn may be required as in the heel and toe portions of a stocking.

Referring to Figures 33, 34 and 35, the latch ring **31** is provided with the usual throat gap **34** which is closed at its bottom by a throat plate **34'** and the upper inner portion of which is adapted to be closed, at times, by a conventional gap closer **35** which may be of the identical structure of that shown in U. S. Patent No. 1,859,137 of May 17, 1932.

Due to the fact that the needles are provided with latches which are longer than those usually on the needles of this type knitting machine, the side walls of the throat gap **34** are cut away to form openings **34***a* and **34***b* and the lower beveled proximate edges **37***a* and **37***b* of a conventional latch ring liner **37** are cut back further than normal so the longer needle latches may engage and slide along these edges **37***a* or **37***b*, depending upon the direction in which the needle cylinder is moving, and the latches will thus be fully opened by the time they reach the side walls of the openings **34***a* and **34***b* for the well known purpose of preventing these latches from breaking or becoming damaged in any way.

As heretofore stated, more than one yarn feed finger **32** may be employed in association with the present invention for the purpose of not only carrying the usual body yarns but to also carry plating yarns, reinforcing yarns, and others to the needles in a conventional manner. As described in said co-pending application, in the knitting of stockings such as that shown in Figures 38 to 41, inclusive, the necessity of separate body yarns, plating yarns, and re-inforcing yarns and the like is eliminated and, depending upon the number of colors that are to be included in the pattern of this stocking, there is merely a separate yarn feed finger employed for each color of yarn that is to be directed to the needles at the main yarn feed station **33**. However, other colors of yarn may be directed to the needles from auxiliary yarn feed fingers, to be later described, associated with an auxiliary yarn feed station broadly designated at **40**. It might be stated that, although not shown in the drawings, by the use of conventional plating means, portions of the stocking could be plated at the same time that other portions of the stocking are knitted by floating one or more of the yarns following the principle of this invention.

An important feature of the present invention, and which is not embodied in said co-pending application, is the auxiliary yarn feed station **40** and which may include any number of especially adapted yarn feed fingers but in the present invention includes first and second auxiliary yarn feed fingers **41** and **41***a*, respectively (Figures 15, 16, 33 and 34). There has been a form of auxiliary station employed in other machines for feeding a rubber yarn to the needles, which is similar to the auxiliary station of the present invention, this being shown in U. S. Patent No. 2,062,208 of November 24, 1936.

In the drawings there are shown yarns **43**, **45** and **46** which are fed through the yarn feed fingers **32**, **41** and **41***a*, respectively, and, for purposes of illustration, we will assume that the yarns **43**, **45** and **46** are white, blue and red respectively. The free end of the yarn feed finger **32** at the main yarn feed station **33** is adapted to be selectively raised or lowered along with any other yarn feed fingers which may be employed at the main yarn feed station **33**. This raising and lowering of the yarn feed finger **32** is controlled by conventional means, not shown, which usually comprises main drum having cam means thereon, only the main drum being shown in Figure 14 and being indicated at **47**. Since this main drum **47** and the intervening connections are well known and are not materially different from those in the usual types of Scott and Williams machines, the intervening connections have been omitted from the drawings for purposes of clarity. This control means for the yarn feed finger **32** is clearly shown in United States Patent No. 1,627,337, of May 21, 1927, and also in said United States Patent No. 1,152,850 of September 7, 1915.

It might be stated that, although a Scott & 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 knitting machine.

Referring to Figure 14, there will be observed a conventional bearing stand **50** supported at its lower end on the main frame **10** and at its upper end by the lower bed plate **21**, and which has one end of a conventional main drum shaft **52**, mounted therein. This conventional main drum shaft **52** has the main drum **47** mounted thereon and a complete revolution is imparted to the main drum **47**, through said conventional gearing within the housing **11** (Figure 1) and the conventional chain, during the knitting of each complete stocking. The end of the main drum shaft **52**, remote from that shown in Figure 14, is supported in a conventional manner, not shown, but which is clearly shown in said Patent No. 1,152,850.

This bearing stand **50** (Figure 14) has an auxiliary bearing stand **53** secured thereto, as by screws **54**, which extend upwardly and rearwardly at an angle therefrom. A striper drum shaft **55** is rotatably mounted in the upper end of the stand **53** and has a conventional striper pattern drum **56** mounted thereon. The end of the striper pattern drum shaft **55** remote from the auxiliary bearing stand **53**, is rotatably mounted in a conventional bearing bracket **57** (Figures 17 and 22) which extends upwardly and forwardly, in Figure 17, and is secured, as by screws **60**, to the upper surface of the housing **11**.

Referring to Figure 22, it will be observed that the bearing bracket **57** has an inwardly projecting portion **62**

which forms a bearing member 63 for rotatably supporting an actuating lever shaft 64 which is supported at the left hand side of the machine, in Figure 22, in a bearing portion 65 projecting from the auxiliary bearing stand 53 in Figure 14. This actuating lever shaft has a plurality of actuating levers 66, oscillatably mounted thereon, only one of which is shown in detail in Figure 14, and which will be presently described. It mght be stated that the actuating lever shaft 64 normally extends between the bearing members 63 and 65, in Figure 22, and is usually employed only in supporting the actuating levers 66. However, in the present instance, the shaft 64 extends a substantial distance to the right beyond the bearing portion 63, in Figure 22, and has apparatus mounted on the right hand end thereof, which is part of the present invention and which will be later described in detail.

Step-by-step rotation is imparted, according to a desired pattern, to the striper pattern drum 56 through said conventional gearing disposed in the housing 11. This striper pattern drum 56 rotates a complete revolution, in a step-by-step manner, during the knitting of the pattern portion of a stocking and has suitable spaced cam members 70 and 71 (Figure 22), secured thereto for controlling the first and second auxiliary yarn feed fingers 41 and 41*a* respectively.

According to a desired pattern, the cam members 70 and 71 are adapted to, at times, engage the lower ends of corresponding actuating levers 66 (Figures 14 and 22), in a conventional manner, and these particular actuating levers have inwardly projecting portions 72 integral therewith to which the lower ends of links 75 and 76 are connected, the link 75 corresponding to the cam member 70 and the link 76 corresponding to the cam member 71. The links 75 and 76 have pins 77 and 78, (Figure 15) mounted thereon which are slidably penetrated by connecting rods 81 and 82, each of which has a collar 83 fixedly mounted thereon and which collars are adapted to engage the corresponding pins 77 and 78, in the manner shown in Figure 15.

The connecting rods 81 and 82 extend forwardly and are connected as at 84 and 85, respectively, to the upper ends of bell cranks designated at 90 and 91, respectively, and both of which are oscillatably mounted on opposed ends of a stub shaft 92 which is fixedly mounted, as by a pressed fit, in the upper end of an upwardly extending bearing portion 93 of an auxiliary yarn feed finger support broadly designated at 94. The auxiliary yarn feed finger support 94 (Figure 15) is secured, as by screws 95, to the upper surface of a conventional gear housing 96, which houses some of the gears for driving the usual type of needle dial mechanism, broadly designated at 97 (Figure 35). The gear housing 96 (Figure 15) is suitably secured to the upper surface of a conventional needle dial bracket 100 and this needle dial bracket, along with the needle dial and other associated parts, is clearly shown and described in United States Patent No. 1,641,101 of August 30, 1927, and, therefore, only those parts which are pertinent to the present invention and also relate to the dial mechanism 97 will be further described.

The dial mechanism 97 includes a disk-shaped dial plate 102 which is driven to rotate in a conventional manner at the same rate as the needle cylinder 20 and which is usually provided with conventional dial needles but which needles are not employed in combination with the present invention and so are omitted, the purpose of the disk-shaped dial plate 102 of the dial mechanism 97 being to provide means for engaging any floated yarns which extend back of a substantial number of needles (Figure 35) so as to pull a substantially greater length of yarn from the corresponding yarn feed finger than would normally be taken by a corresponding needle and so that the the floated yarn will not extend in a straight line between the points at which the floated yarn is knitted into the fabric. This simplifies the operation of severing the floated yarns from the inside of the knitted stocking after the stocking is removed from the knitting machine.

If so desired, the dial mechanism 97 may include all of the parts shown in said Patent No. 1,641,101 so as to knit a rib top on a stocking. However, in this instance, the dial would be raised in a conventional manner, to a position higher than its normal position during knitting of the top, and above the sinker head so as to not interfere with the floated yarns during the knitting of the ornamental pattern portion of a stocking.

Referring again to Figure 15, it will be observed that the needle dial bracket 100 is secured, as by screws 103 to the latch ring 31. The screws 95, which secure the auxiliary yarn feed finger support 94 to the upper surface of the gear housing 96, also secure a substantially Z-shaped bracket 104 to the upper surface of the auxiliary yarn feed finger support 94. The upper horizontal leg of the substantially Z-shaped bracket 104 has a pair of vertical adjustment bolts 105 and 106 threadably mounted therein which are adapted to be engaged by pins 110 and 111, respectively, projecting laterally from the upper ends of the auxiliary yarn feed fingers 41 and 41*a*, respectively.

It will be observed, in Figure 16, that the upwardly extended bearing portion 93 of the auxiliary yarn feed finger support 94 has a lateral portion 113 integral therewith which connects the same with the main portion of the support 94 and which has a pair of notches 114 therein in which are slidably penetrated by the auxiliary yarn feed fingers 41*a* and 41. These notches 114 are closed by suitable plates 115 secured, as by screws 115*a*, to opposed sides of the lateral portion 113. Now, referring to Figure 15, it will be noted that the auxiliary yarn feed fingers 41 and 41*a* are also guided for vertical sliding movement in a guide block 117 which is similar to the lateral portion 113 of the support 94 and which guide block is integral with a downwardly extending flat portion 120 of the auxiliary yarn feed finger support 94.

Both sides of the guide block 117 are closed by suitable plates 121 which are identical to the plates 115, in Figure 16, and only one of which is shown in Figure 15. Tension springs 122 and 123 are suitably connected at their lower ends to the remote surfaces of the plates 121 and their upper ends are connected to the pins 110 and 111, which extend from the auxiliary yarn feed fingers 41 and 41*a* respectively. These tension springs 122 and 123 normally urge the auxiliary yarn feed fingers 41 and 41*a* downwardly and also urge their respective pins 110 and 111 downwardly against forwardly projecting legs 125 and 126 of the bell cranks 90 and 91 respectively. It is thus seen, that upon either one of the cam members 70 and 71, in Figure 22, moving into engagement with the actuating levers 66, the respective links 75 and 76, since they are fixed at their lower ends to the forwardly projecting portions 72 of the actuating levers 66, will move rearwardly or from left to right at their upper ends in Figure 15 and which will, in turn, transmit partial clockwise rotation to the respective bell cranks 90 and 91. This will, of course, cause the respective auxiliary yarn feed fingers 41 or 41*a* to be moved from a lowered or operative position to a raised or inoperative position.

Selector mechanism

In Figures 2 and 3, there is shown details of a conventional trick wheel or selector drum 130 and this selector drum is identical in its construction to the selector drum referred to in said co-pending application. However, pattern controlled means are provided in association with the means for transmitting step-by-step rotation to the selector drum as to vary, according to a desired pattern, the time at which the selector fingers associated with the selector drum are actuated relative to rotation of the needle cylinder 20 so as to operate upon the butts of certain selector or pattern jacks to be presently described. For example, a step in rotation is normally transmitted

to the selector drum shown in Figures 24 and 25 at precisely the time that the portion of the needle cylinder **20** indicated by the dash-dot line **127** moves past the selector fingers, which are controlled by the patterning on the selector drum and, of course, as is well known to those familiar with the art, as this step in rotation is transmitted to the selector drum, the corresponding selector fingers change their positions according to the patterning on the selector drum.

Now, a variation in the timing of transmitting a step in rotation to the selector drum relative to the rotation of the needle cylinder **20** is necessary because, as may be observed in Figure 26, those butts, on the pattern jacks associated with the needle cylinder **20**, which are disposed in the vertical plane of or adjacent the dash-dot line **127** may fail to respond to the patterning of the selector drum if a step in rotation is transmitted thereto at precisely the time that these particular butts move past the same.

Therefore, said pattern controlled means are provided to, at times, transmit a step in rotation to the selector drum, upon certain revolutions of the needle cylinder **20**, at precisely the time that the butts disposed in the vertical plane of the dash-dot line **127**, in Figure 26, move past the same. At other times, a step in rotation may be transmitted to the selector drum slightly later than the time that the butts disposed in the vertical plane of the dash-dot line **127**, in Figure 26, move past the corresponding selector fingers or, in other words, a step in rotation may be imparted to the selector drum when a point on the needle cylinder approximately 90 degrees following the dot-dash line **127**, this point being indicated by a dash-dot line **128** in Figure 26.

It is thus seen that plenty of time will transpire between the time that the point on the needle cylinder defined by the line **127** moves past the selector fingers associated with the selector drum and the time that the butts disposed in the vertical plane of the dash-dot line **128** move past the selector fingers of the selector drum, so as to insure that a proper patterning may be transmitted from the selector drum to those pattern jacks which are disposed at or adjacent the dot-dash line **128** in Figure 26.

The trick wheel is shown in **130** and Figures 1, 2 and 3 and, as is well known to those familiar with the art, the trick wheel **130** is instrumental in the selection of the pattern jacks, broadly designated at **131** and to be later described, for the operation of the needles N substantially as shown in United States Patent No. 1,906,204. This trick wheel or selector drum (Figures 2, 3, 24 and 25) is provided with a plurality of radially spaced selector bits **132** mounted in the usual slots provided therefor in the periphery of the trick wheel **130** and being held in engagement therewith by an endless coiled spring **133** surrounding the trick wheel **130**.

Each of the selector bits **132** is divided at its outer edge into upper and lower butts **134** and **135**, respectively, these butts being disposed below the coiled spring **133**, substantially as shown in said co-pending application, and there being special removable butts **136** disposed on the lower ends of the selector bits **132**, which butts **136** are not employed in the selection of the pattern jacks **131** but are employed in determining the number of teeth that the selector drum **130** is racked in a manner to be presently described.

The selector drum or trick wheel **130** has a ratchet wheel **137** fixed to its lower end, the same having long teeth **140** around its periphery and there being two shorter teeth **141** in Figure 3, adjacent each other at one point around the periphery of the ratchet wheel **137** for the purpose of properly aligning the butts **134** and **135** on the selector drum **130** with selector fingers **142** and **143**, to be later described, after knitting one ornamental pattern and while knitting the conventional parts of a stocking other than the ornamental pattern portion thereof, preparatory to knitting another pattern.

The selector drum or trick wheel **130** is mounted for rotation on the usual selector drum post **144** and is racked around the post **144** by virtue of a conventional pawl **145** which is reciprocated in the usual manner but the length of stroke of which is controlled by the pattern controlled means, heretofore referred to and to be presently described, said pattern controlled means being a part of the present invention.

With the exception of the pattern controlled means for controlling the length of stroke of the pawl **145**, this racking mechanism is substantially as shown in United States Patent No. 2,005,632 of June 18, 1935.

Also, the time at which the pawl **145** is caused to transmit step-by-step rotation to the selector drum **130**, it is controlled by an improved pattern means which is a part of the present invention and which is provided so as to cause the various selector fingers **142** and **143**, which are responsive to the butts **134** and **135** on the selector drum **130**, to be moved into operating position at varying periods relative to the needle cylinder **20** upon each revolution thereof. This will be more fully described later in the specification.

The conventional pawl **145** is normally urged from right to left, in Figures 1, 2 and 3, by a tension spring **146** connected to a suitable anchor **147** projecting from the lower bed plate **21** and being connected at its right end to a suitable spring anchor **148** projecting from the pawl **145**. The right hand end of the pawl **145** is pivotally connected intermediate the ends of a link **151** pivoted at one end, as at **152**, on the upper surface of the lower bed plate **21** and being pivoted at its other end, as at **153**, to the front end of a link **154**.

The link **154** extends from the link **151**, in Figure 2, and is pivotally connected, as at **155**, to a substantially L-shaped dog **156** in Figure 22. This L-shaped dog **156** is oscillatably mounted, as at **157**, on the upper end of the gear housing **11**. It will be observed in Figure 17, that the L-shaped dog **156** has an angularly disposed tubular portion **160** integral therewith in which a follower pin **161** is mounted for vertical sliding movement and which pin has an enlarged disk-shaped follower portion **162** integral with the lower end thereof.

The upper portion of the tubular portion **160** is counterbored, as at **163** (Figure 21), and has a compression spring **164** therein, which bears against a suitable snap-ring **165** mounted in a groove **166** provided therefor in the upper end of the follower pin **161**. It is thus seen that the compression spring **164** normally urges the pin **161** upwardly into engagement with the lower surface of a substantially horizontally disposed arm **167** of a bell crank **170**. The bell crank **170** is oscillatably mounted, as at **171**, on an upwardly projecting portion **172** (Figure 17) of the L-shaped dog **156**. The bell crank **170** and the compression spring **164** associated with the follower pin **161** are parts of the present invention comprising the pattern controlled means for determining the time at which the pawl **145**, in Figures 2 and 3, will transmit a step in rotation to the selector drum **130**.

This pattern controlled means also includes a connecting rod **175** which is pivotally connected, as at **176** (Figure 17), to the upper end of an arm **177** of the bell crank **170**. This connecting rod **175** extends rearwardly and has a pair of collars **178** and **179** fixedly mounted thereon between which the upper end of an arm **183** is disposed, this arm **183** also being slidably penetrated by the connecting rod **175**. The arm **183** extends downwardly from the connecting rod **175** and is fixedly secured, as by screws **185**, on a block **186** fixedly secured on the right hand end of the actuating lever shaft in Figure 22. It is thus seen that upon oscillation being transmitted to the shaft **64**, by means to be presently described, the block **186** will oscillate with the shaft **64** and will thus transmit movement to the bell crank **170** about its axis **171**.

Oscillation is transmitted to the shaft **64**, according

to a desired pattern, by spaced circularly arranged cam members 187 and 188 (Figures 14 and 22) suitably secured to the striper pattern drum 56. The reading end 191 of an actuating lever 192 (Figure 14), which is similar to the conventional actuating levers 66, is urged against the periphery of the striper pattern drum 56 or the cam members 187 or 188, as the case may be, by a tension spring 193 connected at its right-hand end, in Figure 14, intermediate the ends of the actuating lever 192 and connected at its left-hand end to a suitable spring anchor 194 projecting from the upper end of the auxiliary bearing stand 53. The actuating levers 66 and 192 (Figures 14 and 22) are substantially the same as actuating levers 24 shown in Figure 3 of United States Patent No. 2,062,208 of November 24, 1936.

The actuating lever 192 is fixedly mounted on the actuating lever shaft 64, as by a set screw 196 (Figure 22), and it is thus seen that upon either of the cam members 187 or 188 engaging the reading end 191 of the actuating lever 192, partial counterclockwise rotation will be imparted to the shaft 64, in Figure 14, causing the same to move in a clockwise direction, in Figure 17, to partially rotate the bell crank 170 in a clockwise direction and permitting the disk-shaped follower 162 to move upwardly to a slightly higher plane than that shown in Figure 17.

It will be observed in Figures 1 and 17 that the disk-shaped follower 162 normally rides against the outer side of a conventional driven gear 200 which is of a type substantially as shown in Figure 3 of United States Patent No. 2,040,946 of May 19, 1936, and which is driven in the manner shown in said patent to turn one revolution to four revolutions of the needle cylinder 20. Secured to the outer surface of the gear 200 is a plurality of compound cam members 201 each of which projects outwardly from the gear 200 and has inclined surfaces 203, 204 thereon. These inclined surfaces 203, 204 are staggered relative to each other so that the inclined surfaces 203, 204 will cause the disk-shaped follower 162 to move toward the observer, in Figure 17, at predetermined periods during rotation of the gear 200.

Upon the follower portion 162 being elevated slightly by the compression spring 164 (Figure 21), and through the pattern means heretofore described, the follower portion 162 will move into engagement with the inclined surfaces 204 at a time slightly later than it would if the portion 162 had been disposed in the path of travel of the inclined surfaces 203. It is thus seen that the inclined surface 203 on each of the cam members 201 will cause the pawl 145 to operate in advance of the normal period at which it would operate if the follower portion 162 were in the path of travel of the inclined surface 204 upon rotation of the gear 200. As the cam member 201 (Figure 17) moves into engagement with the follower portion 162, the L-shaped dog 156 will be caused to move toward the observer in Figure 17, or in a partial counterclockwise direction in Figure 22, and will thereby cause the pawl 145 to move from left to right in Figures 2 and 3 by virtue of the links 154 and 151. This will impart a normal length step in rotation to the selector drum 130 which is the equivalent of two teeth in the ratchet wheel 137.

Now, in order to increase the range of the pattern drum 130, it is necessary to, at times, impart a step in rotation to the selector drum 130 the equivalent of but a single tooth of the ratchet wheel 137. Therefore, there is provided a reading finger 207 which is secured intermediate the ends of the pawl 145, as by a screw 208, and the reading end of which is adapted to engage the periphery of the selector drum 130 in the horizontal plane of special butts 136 on the selector bits 132 (Figures 24 and 25). The reading finger 207 (Figure 3) has a transversely extending portion 209, integral therewith, which is penetrated by an adjustment screw 210 held in adjusted position by a lock nut 211.

It has already been stated that upon normal operation of the pawl 145, a step in rotation is imparted to the selector drum 130 the equivalent of two teeth in the ratchet wheel 137. This would occur in the event the reading end of the reading finger 207 (Figures 2 and 3) did not engage one of the butts 136 upon the pawl 145 being moved from right to left in Figures 2 and 3 by the tension spring 146. However, upon a special butt 136 being disposed in the path of the reading end of the reading finger 207, movement of the pawl 145 from right to left is restricted and, upon the cam member 201 (Figure 17) again moving into engagement with the follower portion 162 of the follower pin 161, a shorter stroke will thus be imparted to the pawl 145 and a step in rotation will be imparted to the selector drum 130 the equivalent of but a single tooth 140 in the ratchet wheel 137.

Upon going into the knitting of an ornamental pattern portion of a stocking, it is necessary to again initiate step-by-step rotation of the selector drum 130 (Figures 2 and 3). Now, the means for selectively rendering the pawl 145 operative or inoperative, as the case may be, in association with the present invention is substantially the same as that described in said co-pending application. However, it is believed that a description of the same is in order so the present invention may be clearly understood.

Oscillatably mounted on the post 144 and disposed beneath the ratchet wheel 137, is an idling plate 214 having a notch 214a and, during the operation of the selector drum 130, the plate 214 is disposed in the position shown in Figure 2. Pivotally connected to the plate 214, as at 215 (Figures 1 and 2), is a link 216, which is pivotally connected, as at 217, to the upper end of a bell crank 220. The bell crank 220 is oscillatably mounted, as at 221, on a bracket 222 extending outwardly from the lower bed plate 21, in Figures 1 and 2, and which has pivotally connected to the free end thereof, as at 223, the upper end of a connecting rod 224.

This connecting rod 224 extends downwardly and is connected, as at 225, to an actuating lever 226 (Figure 10) oscillatably mounted on a stud 227 mounted in a bracket 230 secured to the frame 10. The actuating lever 226 has a reading projection 231 thereon which is adapted to engage the periphery of a cam wheel 232 having a high level 233, a low level 234 and an intermediate level 235. It might be stated that one of the so-called recesses in the corresponding cam 195 of said co-pending application is omitted from the cam wheel 232 in Figure 10 since an ornamental pattern portion is not knitted into the foot portion of the stocking shown in Figure 38. The reading projection 231 of the actuating lever 226 is normally urged against the periphery of the cam wheel 232 by a tension spring 237 (Figures 1 and 2), one end of which is connected at the juncture of the link 216 and the plate 214 and the other end thereof is connected to the lower bed plate 21.

The reading projection 231, on the actuating lever 226, engages the high level 233 of the cam wheel 232 during the knitting of the heel, foot, toe, loopers round and welt of a stocking. Now, when the reading projection 231 is in engagement with high level 233 of the actuating lever 226, the connecting rod 224 will have moved downwardly to where the high point of the idling plate 214 will have moved into engagement with the pawl 145 and, although continuous reciprocation is transmitted to the pawl 145, the idling plate 214 will prevent the pawl 145 from engaging any of the teeth 140 or 141 in the ratchet wheel 137 (Figures 2 and 3).

Now, upon the lower level 234 of the cam wheel 232 (Figure 10) moving into engagement with the projection 231, the tension spring 237 will move the idling plate 214 in a partial clockwise direction in Figures 2 and 3 to where it will be entirely out of the path of travel of the pawl 145 and will thus permit the pawl 145 to engage

all of the teeth, including the teeth **141**, in the ratchet wheel **137**.

The knitting machine then goes into the knitting of the ornamental portion of a stocking such as that appearing in the leg portion of the stocking shown in Figure 38, during which time the cam wheel **232** moves so the intermediate level **235** will engage the reading projection **231** on the actuating arm **226**. This will cause the plate **214**, in Figures 2 and 3, to partially rotate in a counterclockwise direction from the position shown in Figure 2 to the position shown in Figure 3 and, upon completion of the knitting of an ornamental pattern portion of the stocking, the pawl **145** will continue to engage the teeth **140** in the ratchet wheel **137**, for transmitting step-by-step rotation to the selector drum **130**, until the pawl **145** has moved the ratchet wheel **137** to the position shown in Figure 3. At this time the teeth **141** will then be positioned adjacent the pawl **145**, as it is moved from right to left in Figure 2 and the notch **214***a* of the plate **214** will then be in position adjacent the teeth **141** and will prevent the pawl **145** from transmitting further step-by-step rotation to the selector drum **130** until the high level **233** of the cam wheel **232** again moved into engagement with the reading projection **231** on the actuating arm **226**. The location of the shorter teeth **141** on the ratchet wheel **137** relative to the selector drum **130** insures that the selector drum **130** will be properly positioned for going into the knitting of each succeeding ornamental pattern portion of a stocking.

Now, referring to Figures 2, 12 and 13, there may be observed a plurality of conventional selector fingers or reader cams, there being a plurality of upper selector fingers **142** and a plurality of lower selector fingers **143**. These selector fingers or cams **142** and **143** are identical, the upper selector fingers **142** being disposed in coinciding relation to the upper butts **134** on the selector bits **132** (Figure 25) and the lower selector fingers **143** being disposed in coinciding relation to the lower butts **135** on the selector bits **132**. The selector fingers **142**, **143** are oscillatably mounted on a vertically disposed post **240** (Figure 2) and each of the selector fingers **142** and **143** has a tail **241** adapted to read its own particular level of the butts **134** and **135** on the selector drum or trick wheel **130**.

Where the butts **134** or **135** have been broken off of the bits **132** on the selector drum **130**, the corresponding tail **241** engages the surface of the trick wheel or selector drum **130** by virtue of a tension spring **242** on one end of each of the selector fingers **142** and **143**. Each of the selector fingers **142** and **143** has spaced ears **243** and **244** integral therewith and disposed at their right-hand ends in Figures 2 and 13, and these ears **243** and **244** straddle a conventional selector finger stop **245** adjustably mounted in the usual manner on the circular bed plate **21**.

As in said co-pending application, it will be noted, in Figures 12 and 13, that the selector finger stop **245** has an angle plate **246** secured thereto, as by screws **247**, this angle plate **246** being a usual part of a Model PW, Scott & Williams circular knitting machine and being especially adapted to the present invention. When the tails **241** on the selector fingers **142** and **143** are engaged by any one of the corresponding butts **134** or **135** on the selector bits **132**, the selector fingers **142** and **143** assume the position shown in Figure 2, that is, with the ears **243** in engagement with the inner surface of the stop **245**.

On the other hand, when there are no butts **134** engaging the tails **241** on the corresponding upper selector fingers **142**, the associated ear **244** is urged against the outer surface of the stop **245** (Figure 13) and thus moves the lower ends of any of the pattern jacks **131**, having coinciding butts thereon, inwardly relative to the needle cylinder **20** to the innermost position as shown in Figure 29. This will result in the corresponding needles picking up the yarn **43** from the conventional main yarn feed finger **32** in a manner to be later described. In the event that the tails **241** of any of the lower selector fingers **143** (Figure 12) is not engaged by one of the lower butts **135** on the selector drum **130** (Figures 24 and 25) the ear **244** of the corresponding lower selector finger **143** is urged inwardly against the outer surface of the angle plate **246**, as shown in Figure 13, and thus the lower selector fingers **143** do not move inwardly as far as the upper selector fingers **142**.

In order to render the patterning on the selector drum **130** ineffective, such as in knitting the foot portion of a stocking, a conventional contact **250** (Figure 2), of sufficient width to span all of the selector fingers **142** and **143**, carried by a lever **251** is provided. The lever **251** is oscillatably mounted on a post **253** fixed to the bed plate **21**. A suitable link **254** connects the lever **251** to conventional mechanism, not shown, controlled and operated in accordance with the fabric or other requirements of the fabric being knitted.

Referring to Figures 23 and 27 to 35, inclusive, the needle cylinder **20** has a plurality of conventional latch needles, generally designated at N, working in the usual needle slots and beneath which are individual auxiliary or needle jacks **255**. The needles each have a needle butt **256**. The needles N are usually divided into long and short butt groups for the well known purpose of separating instep and heel needles during the knitting of the heel and toe portions of the stocking. Each of the auxiliary jacks **255** has a butt **257** integral therewith, the purpose of which will be later described (Figures 27 to 32). A conventional cylinder selector jack or pattern jack, broadly designated at **131**, is disposed below each of the auxiliary jacks **255** in vertical alignment with each of the needles N.

The auxiliary jacks **255** and the pattern jacks **131** are substantially the same as those shown in United States Patent No. 2,411,422 of November 19, 1946. It will be observed that the needles N and the pattern jacks **131** are retained in the slots of the needle cylinder **20** by conventional endless coiled springs such as **260** (Figure 18) which encircle the needle cylinder **20**.

Each of the selector or pattern jacks **131** has an outwardly projecting portion or shallow butt **264** at its upper end and immediately below this butt **264**, is a recessed portion **265** and below this recessed portion **265** is a plurality of butts which may be broken away for pattern purposes. These butts, which are commonly referred to as removable butts, are divided into groups of upper butts **266** and lower butts **267**, the upper and lower groups of butts extending in opposite directions from a point midway of all the removable butts. The purpose of dividing these butts into upper and lower groups will be later described.

In Figure 26 there is shown a schematic arrangement of the butts on the lower portion of the various pattern jacks **131** which are mounted in the needle cylinder **20**, this arrangement being specifically for knitting the ornamental pattern portion of a stocking such as that shown in Figure 38. It will be noted, in Figure 26, that every other one of the selector or pattern jacks has a butt **267***a* on its lower end. As in said co-pending application, these butts **267***a* have 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 and in which case they would be used. However, they have nothing whatever to do with the formation of the different ornamental designs on the leg of the stocking.

It will also be observed, in Figure 26, that alternate ones of the pattern jacks **131** are provided with the usual main butt **270**, the main butts **270** being modified somewhat from the conventional main butts in that the upper portion thereof is cut away so that the vertical height of the butt **270** will be approximately one-half of its usual vertical height so as to permit the butts **270** to, at

times, pass beneath a tear-shaped elevating cam **305** to be later described (Figures 4, 5 and 23).

Each of the jacks **131** also, preferably, has a rocking point **271** on the back thereof and it is thus seen that by moving either the upper or lower ends of the jacks **131** inwardly, the opposite end of the jacks **131** would be caused to move outwardly with respect to the needle cylinder **20**. The jacks **131** just described are substantially conventional and the lower ends of the jacks **131** are provided with staggered or stepped first and second shoulders **272** and **273**, respectively, which are caused to engage or not to engage cams, to be presently described, according to the desired pattern as shown in Figures 24 and 26. The shoulders **272** and **273** define outwardly projecting portions **274** and **275**, respectively, the projections **274** and **275** being described so as to clarify the pathways of these portions as they traverse the various pattern jack cams to be later described (Figure 23).

Needle and pattern jack cams

Mounted on the upper surface of the upper bed or cam plate **23**, in the usual manner (Figure 1) are many conventional cams which are shown in the central portion of Figure 23 and which are instrumental in raising and lowering the auxiliary jacks and the corresponding needles. Reading from left to right in the central portion of Figure 23, there is shown a conventional stationary guiding and leveling cam **280** beneath which is the usual widening pick **281**, the structure of the needle cam **280** and the widening pick **281** being substantially as shown in Figures 13 and 15 of said Patent No. 1,152,850. However, the widening pick **281** is controlled in a slightly different manner than has heretofore been the case and the structure relating to this control means for the widening pick **281** will be later described.

Disposed to the right and below the widening pick **281**, in Figure 23, is a conventional lowering cam **282** and a conventional elevating cam **283** which are usual parts of knitting machines of this type but are not pertinent to the present invention and therefore a further description thereof is deemed unnecessary since it is evident that the needle butts **256** may travel in the horizontal plane in which they leave the upper surface of the cam **302**, if so desired, as they move from right to left in Figure 23.

The machine may also comprise the usual stitch cams **284** and **285** with a conventional top center cam **286** and a conventional bottom center cam **287**. It will be noted that although the top center cam **286** is provided, this top center cam is not cut away at the lower portion thereof as was necessary in said co-pending application since many of the cams have been spaced slightly further apart from each other than in said co-pending application.

Disposed to the right of the stitch cam **285** is an auxiliary needle leveling cam **290** which is a part of the present invention and which is used in lowering and leveling certain needles which are projected upwardly for taking the yarn from the auxiliary yarn feed fingers **41** and **41***a* preparatory to the butts of these particular needles passing through the stitch cams, or for leveling certain other needles which are projected upwardly, in a manner to be later described, to a higher plane than the previously described needles to where the butts thereof will pass above the stitch cams and will thus fail to take the yarn from either of the yarn feed stations **33** or **40**. Disposed below and to the right of the auxiliary needle leveling cam **290** is a stationary auxiliary needle lowering cam **291** which is also a part of the present invention and is also provided to project certain needles downwardly which may have picked up the yarn from the auxiliary yarn feed fingers **41** or **41***a*.

Disposed to the right of the auxiliary needle lowering cam **291**, in Figure 23, is a pair of alternately movable elevating and lowering cams **292** and **293**. These cams **292** and **293** are normally used in the widening and narrowing operations at the heel and toe of a stocking. In the present instance they are not only used for this purpose but the alternate lowering cam **293** is employed in lowering any needles which had previously passed above the top center cam **286** during knitting of the ornamental pattern portion of a stocking and, in the event the cam **293** is used, this cam **293** levels all needles prior to the needles moving past the yarn feed stations **40** and **33**. The alternate elevating and lowering cams **292** and **293** are conventional in structure, with the exception of their manner of operation which is modified somewhat from that of conventional machines so as to cooperate with movement of the widening pick **281**, in a manner to be later described.

One end of an auxiliary side cam **295** is disposed beneath the conventional needle cams **282** and **283** and extends a substantial distance around the needle cylinder **20** and its other end terminates below the stitch cam **285** in Figure 23. The lower surface of this side cam **295** is usually substantially regular, however, this cam **295** has been modified to include an irregular lower surface at **296** which is provided to accommodate the butts **257** on the auxiliary jacks **255** which may, at times, be caused to traverse a pathway conforming substantially to the configuration of the lower surface **296** of the cam **295**.

Disposed below but in off-set relation to the lower surface **296** of the cam **295** is a shield cam **300** which is actually a part of the bed plate **23** (Figures 27 to 32, inclusive) and which defines a part of the opening **23***a*, to the wall of which the cam **295** is secured in a conventional manner. The purpose of the shield cam **300** is to prevent any of the auxiliary jacks **255**, whose butts do not traverse the pathway immediately adjacent the lower surface **296** of the cam **295** from being thrown out of the needle cylinder due to centrifugal force. An intermediate shield member **301**, which is conventional, is provided in the opening between opposed ends of the auxiliary side cam **295** and has a pair of conventional elevating cams **302** and **303** mounted on the upper surface thereof which are provided to direct the butts of all needles passing through the stitch cams, from right to left in Figure 23, to the lowering needle cam **282**.

Disposed immediately below and substantially midway of the shield cam **300** is an upper push-out cam **304** which is constructed and operated in a manner substantially as shown and described in said co-pending application but which has associated therewith a substantially tear-shaped elevating cam **305** which is a part of the present invention and will be later described.

Referring to Figure 4, it will be noted that a conventional cam member **306** of a type shown in United States Patent No. 2,050,946 of August 11, 1936, is provided to insure engagement of the pattern jacks **131** by the selector fingers **142** and **143**. As is well known, this cam member **306** is disposed below and closely adjacent the upper bed plate **23** and is oscillatably mounted, as at **307**, and is controlled in the manner shown in said patent to engage the shallow butts **264** on the upper ends of the pattern jacks **131** so as to move the upper portions thereof inwardly and the lower portions thereof outwardly, rocking the jacks **131** on their pivot points **271** to substantially the position shown in Figure 27.

Referring again to Figure 23, there is shown, a substantial distance below the push-out cam **304**, a cluster of pattern jack elevating cams all of which are parts of the present invention and which comprise a first pattern jack elevating cam **310** which, as shown in Figures 2, 27, 36 and 37, is secured, as by screws **311**, to a bracket **312** which, is secured, by any suitable means such as a screw **313**, to the lower bed or cam plate **21**. It will be observed, in Figures 23 and 36, that the upper portion of the first pattern jack elevating cam **310** is cut away, as at **314**, for reception of the lower por-

tion of a stepped pattern jack cam 315 which has an inclined elevating surface 316 which is cut away to provide inwardly beveled steps 317 and 318 the purpose of which will be later described.

The portions of the first pattern jack elevating cam 310 and the stepped pattern jack cam 315 remote from the elevating surfaces thereof having recesses 321 and 322, respectively (Figures 23 and 36), to thus provide a greater area between the inner surfaces of the cams 310 and 315 in the horizontal plane of the recesses 321 and 322 and the needle cylinder 20 than the space between the adjacent portions of the cams 310 and 315 and the needle cylinder 20 for purposes to be later described. The stepped pattern jack cam 315 is secured, as by screws 324 (Figures 2, 30 and 37), to the extended vertical leg of an inverted L-shaped bracket 325, the vertical leg of which is also secured to the outer surface of the first pattern jack elevating cam 310, by one of the screws 324, to assist in holding the pattern jack cams 310 and 315 in radial alignment.

The horizontal leg of the inverted L-shaped bracket 325 is threadably penetrated by a set screw 326 which extends downwardly and the head of which bears against the upper surface of the lower bed plate 21 (Figures 30 to 32 and 37 inclusive) and which screw 326 has a lock nut 327 thereon which bears against the lower surface of the horizontal leg of the inverted L-shaped bracket 325 to hold the bracket in adjusted position. The set screw 326, when adjusted, retains the stepped pattern jack cam 315 in proper relation to the first pattern jack elevating cam 310.

It will be noted that the push-out cam 304, in Figure 23, is disposed in a vertical plane above the recesses 321 and 322 in the pattern jack cams 310 and 315. As is well known to those familiar with the art, this push-out cam 304 causes the lower ends of the pattern jacks 131 to move outwardly to substantially as shown in Figure 32 so the outwardly projecting portion 274 at the lower ends of the jacks 131 may be moved outwardly beyond the radial plane of the inner surfaces of the thickened portions of the pattern jack cams 310 and 315.

Referring to Figures 27 to 32 inclusive, it is well known that the lower bed plate 21 has an opening 330 through which the needle cylinder 20 extends. The wall of the opening 330 is grooved in a conventional manner, as at 331, in Figures 27 to 32, inclusive, and many of the pattern jack cams mounted on the lower bed plate 21 extend downwardly into the groove 331, other of these cams being supported on the shoulder formed by the annular groove 331 in the bed plate 21 around the opening 330. Mounted on the shoulder formed by the groove is an improved pattern jack leveling cam 332, which fits beneath the first pattern jack elevating cam 310, this cam 310 being cut away, as at 333, to accommodate an inwardly and upwardly projecting pointed portion 334 of the pattern jack leveling cam 332 (Figures 23, 27, 28, 29 and 36).

The pattern jack leveling cam 332 is cut away, as at 335 in Figures 23 and 36, so as to provide clearance for the lower ends of the pattern jacks 131 when they are projected inwardly at their upper ends by virtue of the push-out cam 304 disposed thereabove in Figure 23. Disposed to the left of the first pattern jack elevating cam, in Figure 23, is a second pattern jack elevating cam 337 having an inclined leading surface 338 for moving certain of the pattern jacks upwardly. The second pattern jack elevating cam 337 also has a recess 341 therein which is disposed adjacent the upper end of the inclined surface 338 and the bottom of the recess 341 being slanted downwardly and inwardly, as shown in Figure 36, so as to engage the outwardly projecting portions 274 of any of the pattern jacks 131 which may have been projected outwardly to such a position as to engage the same as they pass thereby, and to thereby move the lower ends of the corresponding pattern jacks 131 inwardly so that the lower ends of all the jacks will be disposed in the same radial plane relative to the needle cylinder upon moving out of the radial plane of the second pattern jack elevating cam 337.

After the pattern jacks 131 have moved from right to left, in Figure 23, passing the second pattern jack elevating cam 337, they then move past a pair of pattern jack cam ring segments 342 and 343 which are spaced slightly apart from each other and are secured, in a conventional manner, to the lower bed plate 21. A conventional leveling cam 345 is secured on the shoulder formed by the annular groove 331 in the bed plate 21, in a conventional manner, and is disposed in a vertical plane between the proximate ends of the cam ring segments 342 and 343. However, the leveling cam 345 is not pertinent to the present invention and a further description thereof is deemed unnecessary.

It will be noted, in Figures 27 to 32 and 36 and 37, that the inner surfaces of the first and second pattern jack elevating cams 310 and 337 and the stepped cam 315 are spaced substantially the same distance apart from the periphery of the needle cylinder 20 with the exception of the recesses 321 and 322 in the pattern jack cams 310 and 315 which provide a slightly greater space between the periphery of the needle cylinder 20 and the inner surfaces of the recesses 321 and 322. Also, the pattern jack leveling cam 332 is disposed in substantially closer relation, at the inner surface thereof, to the needle cylinder 20 than the inner surfaces of the first and second pattern jack elevating cams 310 and 337.

Now, it will be observed, in Figures 23, 36 and 37 that there is disposed between the proximate edges of the first and second pattern jack elevating cams 310 and 337 a stationary lower push-out cam 350. This lower push-out cam 350 extends outwardly relative to needle cylinder and it will be observed in Figures 2 and 37 that this cam 350 has integral with the outer end thereof a curved plate portion 351 which is secured, as by screws 352, to the outer surface of the second pattern jack elevating cam 357. The second pattern jack elevating cam 337 is flanged as at 353, this flange 353 being secured to the lower bed plate 21 by any suitable means such as screws 354. This completes the general description of the various needle and pattern jack raising and lowering cams arranged around the needle cylinder on the lower and upper bed plates 21 and 23 respectively.

It has already been stated how most of the needle and pattern jack cams are conventional and some of the needle cams are controlled in a manner peculiar to the present invention and that certain of the needle and pattern jack cams are a part of the present invention. A description will now be given of the structure associated with those conventional cams which are operated in an improved manner as well as the structure associated with the needle cams which are a part of the present invention.

It has further been stated that the guiding and leveling cam 280 and its associated widening pick 281 (Figures 23) are conventional and are mounted and controlled in substantially the manner shown in said United States Patent No. 1,152,850. Now, by referring to Figure 18, there will be observed the upper portion of the needle cylinder 20 and also portions of the sinker head 25, the latch ring 31 and the upper bed plate 23. The latch ring 31 and the sinker head 25 are, of course, mounted at their front ends on the upper end of a conventional standard or post 355 secured, as by screws 356, only one of which is shown, to the upper surface of the upper bed plate 23. The conventional control means for the widening pick 281 comprises the usual shaft 357 which is oscillatably mounted in the standard 355 and in which the outer end of the widening pick 281 is mounted, there being the usual longitudinally extending slot, not shown in the present drawings but clearly shown in said Patent No. 1,152,850, to permit horizontal as well as vertical movement by the widening pick 281.

As is well known, the widening pick **281**, upon being engaged by the butts **256** on any of the needles N, is moved downwardly and outwardly and thus transmits partial clockwise rotation to the shaft **357** (Figure 18) to thereby move the free end of the widening pick **281** from a slightly higher plane than that shown in Figure 18 to a slightly lower plane than that shown in Figure 18. Now, the free end of the widening pick **281** is normally urged to a raised position by a conventional torsion spring **360** connected to the standard **355** at one end thereof and to a normally vertically disposed portion **361** of a control finger **362** which also has a substantially horizontal leg **363**, having a downwardly and inwardly bent extended portion **364** at the rear end thereof.

Many knitting machines heretofore in use have been provided with the control finger **362** in association with the widening pick **281**, however, the downwardly and inwardly extended portion **364** is peculiar to the present invention and the lower end thereof is adapted to engage the inner end of a substantially horizontal arm **365** (Figures 1 and 18) the outer end of which is fixedly mounted on the upper end of a vertically movable shaft **366***a*. The shaft **366***a* is controlled in a conventional manner by a suitable cam, not shown, on the main drum **47**, this cam controlled shaft **366***a* being clearly shown in Figures 1 and 2 of said Patent No. 1,152,850.

Referring again to Figure 18, it will be observed that this arm **365** has a conventional spring loaded pin mounted for vertical sliding movement in the arm **365** and the head of which bears against the upper end of the compression spring **367**. Heretofore, the head of the pin **366** has only affected the control finger **362** when in the intermediate and upper dotted line positions shown in Figure 18. While in the uppermost position, the head of the pin **366** retains the widening pick **281** in an intermediate inoperative position or in substantially the position shown in Figure 23, there being a suitable stop member **370** secured to the front surface of the post **355** which restricts upward movement of the head of the pin **366** so the free or working end of the widening pick **281** will not be projected downwardly below the position shown in Figure 23. The head of the pin **366** assumes the uppermost dotted line position during narrowing in the heel and toe of a stocking.

When the head of the pin **366** is in the intermediate dotted line position shown in Figure 18, the widening pick **281** is then permitted to move upwardly under pressure of the torsion spring **360** to thus be disposed in the path of the butts of any of the needles N which may have previously passed above the stitch cams so as to perform the usual widening operations in knitting the heel and toe of a stocking. Now, in the present instance, it is necessary, upon movement of the arm **365** and the associated pin **366** to the solid line or lowered position, shown in Figure 18, to again render the widening pick **281** inoperative and due to the fact that the alternate elevating and lowering cams **292** and **293** are also controlled by vertical movement of the arm **365**, in a manner to be presently described, so as to cause the lowering cam **293** to move to operative position while the elevating cam **292** moves to inoperative position. This arm **365** is also employed in rendering the widening pick inoperative during the knitting of an ornamental pattern portion and during all other rotary knitting.

Now, during the knitting of the ornamental pattern portion of a stocking, if the widening pick **281** were not rendered inoperative upon the cam **292** being moved into operative position, the widening pick **281** would engage the butt of the leading one of any needle that may have been elevated to its horizontal plane while in an operative position and will thus be lowered and upon the butt of the corresponding needle moving away from the widening pick **281**, the widening pick **281** will return to its operative position and, since many of the needles whose butts pass above the stitch cams a substantial distance apart from each other, this would cause another needle and, at times several other needles, to be lowered by the widening pick **281** during a single revolution of the needle cylinder and which is not conducive to smooth operation of the knitting machine. Of course, it is not necessary that the widening pick be lowered to inoperative position during rotary knitting other than the ornamental pattern portion of a stocking because all needle butts then pass through the stitch cams and beneath the widening pick **281**.

Referring to Figures 7, 9 and 19, there is shown an alternate cam block **372** which is suitably secured to the upper bed plate **23** and in which stem portions **292***a* and **293***a* of the elevating and lowering cams **292** and **293**, respectively, have radial sliding movement. Suitable tension springs **373** and **374** normally urge the respective elevating and lowering cams **292** and **293** outwardly with respect to the needle cylinder **20** (Figures 7 and 20). The cam block **372** has an outwardly projecting fin portion **375** integral therewith which has a transverse pin **376** (Figure 9) fixedly mounted therein, and projecting from opposed sides thereof, and on one end of which a lever **377** is oscillatably mounted. The other end of the shaft **376** has an outwardly extending portion **390** of a segmental gear **391** oscillatably mounted thereon which is adapted to be engaged by a segmental gear **381** oscillatably mounted on a stub shaft **379** fixedly mounted in the outwardly projecting fin portion **375**. The segmental gear **381** has an upwardly extending portion **380** which has a suitable screw **383** threadably embedded therein which is adapted to engage the outer end of the stem portion **293***a* of the alternate cam **293**. The lever **377** has a suitable screw threadably embedded therein which is adapted to engage the outer end of the stem portion **292***a* of the alternating cam **292**.

The lever **377** has an outwardly projecting flange **385** integral therewith provided with a cam surface **386** which is adapted to, at times, be slidably engaged by an actuating rod **387**. This rod **387** projects outwardly from the hub of the arm **395** (Figure 9) and, upon being moved downwardly, through downward movement of the associated control rod **366**, the tension spring **373** will urge the alternate elevating cam **292** outwardly to inoperative position and, as the arm **365** moves to the position shown in Figure 18, the actuating rod **387** moves into engagement with the upper surface of the outwardly projecting arm **390** integral with the segmental gear **391** which meshes with the segmental gear **381** heretofore described.

Now, the alternate elevating and lowering needle cams **292** and **293**, their manner of being mounted and the control means therefor, is conventional on many machines of this type and are not to be considered as parts of the present invention. However, heretofore, the alternate lowering cam **293** has moved into operative position upon the head of the pin **366**, in Figure 18, being disposed in the uppermost dotted line position and, at this time, the alternate elevating cam **292** has been moved to inoperative position, by virtue of the associated tension spring **373**, while the widening pick **281** has been held in an inoperative position.

Now, upon movement of the head of the pin **366** to the intermediate dotted line position in Figure 18, the widening pick **281** has been enabled to move to operative position and since the actuating arm **387** has moved out of engagement with the surface **386** on the lever **377**, both the tension springs **373** and **374** will have urged the corresponding alternating elevating and lowering needle cams **292** and **293** to inoperative position.

The widening pick **281** and the needle cams **292** and **293** are still controlled in the above manner in the present instance. However, heretofore, upon further downward movement of the arm **365** to the solid line position shown in Figure 18, the actuating rod **387** has engaged the arm **390** of the segmental gear **391**, in Figure 19, to thus move the lowering needle cam **293** into operative position and, at the same time, the widening pick **281** has also remained in an operative position. Therefore, I have provided the

downwardly and inwardly bent portion 364 at the front end of the control finger 362, in Figure 18, which will be engaged by the arm 365 as it moves the head of the pin 366 downwardly from the intermediate or uppermost dotted line position to the solid line position to thus render the widening pick inoperative while the alternate lowering needle cam 293 is in an operative position.

This completes the description of the conventional cams disposed above the upper bed plate 23 and a description of the auxiliary needle leveling cam 290 and the auxiliary needle lowering cam 291, both of which are a part of the present invention, will now be given. The auxiliary needle leveling cam 290 and the auxiliary needle lowering cam 291 have stems 392 and 393, respectively, extending outwardly therefrom (Figure 8) and the stem 392 has an adjustment slot 394 therein (Figure 7) which is slidably penetrated by a screw 395 for securing the auxiliary leveling cam 290 to the upper surface of a projection 396 on a conventional narrowing pick support block 397 secured to the bed plate 23. A similar support block 398 is secured to the bed plate 23 and these blocks 397 and 398 support conventional narrowing picks 400 and 400*a*, respectively, in a conventional manner (Figures 7 and 23). The stem 393 of the auxiliary needle lowering cam 291 is secured, as by screws 393*a*, to an auxiliary needle lowering cam block 401 secured, as by screws 401*a*, to the upper bed plate 23. The push-out cam 304 is conventional and is controlled in a manner identical to that described in said co-pending application. However, the tear-shaped elevating cam 305, disposed immediately beneath the cam 304 is a part of the present invention and as in said co-pending application, the upper push-out cam 304 (Figures 2 and 4) is secured, as by screws 402*a*, to a bell crank 402 oscillatably mounted, as at 403, on the lower surface of the upper bed plate 23. The screws 402*a*, which secure the upper push-out cam 304 to the upper surface of the bell crank 402, also secure the tear-shaped elevating cam 305 to the lower surface of the bell crank (Figure 5).

The bell crank 402 has secured to its end remote from the cam 304, as by screws 404, an arm 405 which extends outwardly and is pivotally connected, as at 406, to a link 407. The link 407 is pivotally connected at its other end, as at 410, to the upper end of the second bell crank 411 oscillatably mounted, as at 412, on a bracket 413 secured, as by screws 414, to the lower surface of the cam plate 23.

The upper end of a connecting rod 415 is pivotally connected, as at 416 (Figures 1, 4 and 6), to the lower free end of the bell crank 411 and extends downwardly. The lower end of the connecting rod 415 is pivotally connected, as at 417 (Figures 1 and 11), to an actuating lever 420, the lefthand end of which, in Figure 11, is oscillatably mounted on the stud 227 heretofore described. A suitable spacing washer 420*a* is disposed between the actuating levers 226 and 420 so the actuating lever 420 may be disposed in the same vertical plane as a cam wheel 421, the actuating lever 420 having a suitable reading projection 422 projecting upwardly therefrom which is normally held in engagement therewith by a tension spring 423 to be presently described (Figures 4 and 6).

The cam wheel 421, in Figure 11, has a single recess 424 in the periphery thereof which coincides with the low level 234 of the cam wheel 232 in Figure 10. Both of the cam wheels 232 and 421 are fixedly mounted on a shaft 426 extending from and driven by the gearing disposed within the housing 11, in Figure 1, and being driven in timed relation to rotation or oscillation of the needle cylinder 20.

The tension spring 423 (Figures 4 and 6) is connected at the junction point of the arm 405 and the link 407 at one end thereof and at the other end is connected to a suitable spring anchor 427 projecting from the upper bed plate 23 to thus normally urge the bell crank 402 in a counterclockwise direction in Figure 4.

In order to limit inward movement of the push-out cam 304 and the tear-shaped elevating cam 305, an angle plate 430 is secured, as by screws 431, to the edge of the upper bed or cam plate 23 (Figure 4) and an adjustment screw 432 is threadably mounted in the angle plate 430 and engages the arm 405, there being a suitable lock nut 433 mounted on the screw 432 to secure the adjustment screw 432 in adjusted position.

Method of operation and stocking structure

Now, referring to Figures 38 to 44, inclusive, there is shown a few of the variegated ornamental pattern portions which may be knitted into a tubular fabric, such as the leg portion of a stocking, on a knitting machine embodying the many features of the present invention heretofore described. The butts 134, 135 and 136 on the selector drum 130, in Figure 24, and the butts 266, 267, 267*a* and 270 on the pattern jacks 131, in Figure 26, are especially arranged for knitting the stocking shown in Figure 38. However, it is well known to those familiar with the art that the patterning on the selector drum 130 (Figure 24) and of the pattern jacks 131 (Figure 26) may be arranged so as to knit many other types of ornamental pattern portions in a stocking, a few of these other forms of ornamental portions being shown in Figures 39, 40 and 41.

In any event, the structure of the knitted fabric at the juncture of two adjacent diamonds or two adjacent portions of different yarn, wherein the juncture extends at an angle relative to the wales and courses of the knitted stocking, will always be substantially as shown in Figures 42 and 44.

All of the stockings shown in Figures 38 to 41 inclusive, have the same characteristic parts typical of a half-hose and comprising a plain, rib or elastic top 450, a leg or ornamental pattern portion 451, a heel pocket 452 and a foot 453. The toe has been omitted from the drawings and the heel and toe portions have both been omitted from the stocking shown in Figure 40 since the present invention relates specifically to the leg portion 451 of the stocking, the top 450, the heel pocket 452 and the foot 453 being knitted in a conventional manner. It is to be understood, however, that the ornamental pattern portion of the stockings shown in Figures 38 to 40, inclusive, may be extended through the foot portion of the stocking, if so desired, in a manner similar to that referred to in said co-pending application. The top 450, the ornamental pattern portion or leg 451 and the foot 453 are knitted with rotary movement of the needle cylinder 20 and the heel pocket 452 is, of course, knitted through the usual widening and narrowing operations during reciprocatory movement of the needle cylinder 20.

Now, it will be observed in Figure 38 that opposed sides of the ornamental pattern portion 451 of the stocking, which are identical, have a gusset 455 knitted of, we will say, a white yarn which is joined to front and rear diamond-shaped areas 456 and 457, respectively, of a blue yarn and the lower points of which are connected to the upper points of front and rear diamond shaped areas 458 and 459 which are knitted of a red yarn. Disposed between the diamonds 456, 457 and 458, 459, are white diamonds 460 disposed on opposed sides of the stocking and only one of which is shown in Figure 38. The remainder of the stocking is, of course, knitted of a white yarn and, thus, is commonly termed a body yarn.

Now, referring to Figures 42 and 44, there is shown the manner in which the juncture of two adjacent triangular portions are interknitted, the showing in Figures 42 and 44 being typical of the manner in which all of the junction points of adjacent areas are interknitted but being, specifically, greatly enlarged views of respective areas 42 and 44 defined by dotted lines in Figure 38. As heretofore stated, the top for the stocking is knitted in the conventional manner of rotary knitting and the final course in the knitting of the top is indicated at 466 in

Figure 42. A first course indicated at **486** (Figure 42) is then knitted in the ornamental pattern portion **451** of the stocking.

By referring to Figure 43, there will be observed a schematic plan view of the needle circle and, since the needles bear the general reference character N, numerals will be affixed to the letter N to designate certain needles in the needle circle. The reference character N–1 will apply to the needle appearing at the lowermost point in the needle circle, in Figure 43, and those needles to the left of the needle N–1 will bear the same reference characters as those to the right of the needle N–1 with the prime notation added.

For purposes of description we will assume the needle N–1 to be disposed at the center of the rear of the stocking shown in Figure 38 and which needle is employed in the knitting of the wale extending from the uppermost to the lowermost points in the diamond-shaped area **457**. Only those needles which are brought into play in the present description will have said affixed numeral applied to the general reference character N to avoid a congestion of reference characters in Figure 43.

Now, in order to further clarify the structure of the stocking shown in Figures 42 and 44 as well as the operation of the various knitting instrumentalities, the wales knitted by the various needles will bear corresponding reference characters. For example, the wale knitted by needle N–1 will bear the reference character W–1 and the wale knitted by the needle N–2 will bear the reference character W–2, etc. It might be stated that, conforming to the usual practice, the stocking structure shown in Figures 42 and 44 is inverted, since it is well known that the toe portion is the last portion of a stocking to be knitted. Therefore, the reference characters bearing the prime notation will appear on the right-hand side of the wale W–1, in Figure 42, although the reference characters bearing the prime notation associated with the needles, in Figure 43, are disposed to the left of the needle N–1.

The needles which knit the diamond **456** at the front of the stocking and their corresponding pattern jacks **131** are operated in an identical manner to the needles employed in knitting the rear half of the stocking, which includes the diamond-shaped area **457**, and, therefore, only the needles which knit the rear half of the stocking will be described as to their function, it being understood that a similar operation will take place with respect to the needles disposed at the opposite side of the needle circle or employed in knitting the front half of the stocking and including the diamond-shaped area **456** in Figure 38.

In knitting all of the courses in the top **450** (Figure 38) down to, but not including, the course **466** (Figure 42), all of the needles in the needle circle move from right to left, in Figure 23, in such a manner as to engage the alternate lowering cam **293** and then move in a horizontal plane from the lower edge of the cam **293** and ride up the right-hand stitch cam **285**, which is then in an operative position, after which the needles pass through the stitch cams and so on around with the needle cylinder.

Now, during the knitting of this final course **466** in the top **450** of the stocking shown in Figure 38, the right hand stitch cam **285** moves to inoperative position in a conventional manner and the contact **250** in Figure 2 is moved about the post **253** in a conventional manner to relieve the selector fingers **142** and **143** so their reading tails **241** may impinge upon the periphery of the selector drum **130**. Also, since the plate **214** has been disposed in the position shown in Figure 3, during the knitting of the top **450**, the high surface **233** on the cam wheel **232** (Figure 10) moves out of engagement with the reading projection **231** whereby the same moves into engagement with the low surface **234** on the cam wheel **232**. This will, in turn, move the plate **214** from the position shown in Figure 30 to the position shown in Figure 2 to thereby permit the conventional pawl **145** to engage the short teeth **141** on the ratchet wheel **137** associated with the selector drum **130** and to thus initiate step-by-step rotation of the selector drum **130**.

Also, both of the auxiliary yarn feed fingers **41** and **41***a* having been in a raised or inoperative position during the knitting of the top **450**, by means of cams on the main drum, not shown, the cam member **71**, in Figure 22, will move out of engagement with the corresponding actuating lever **66** to transmit partial counterclockwise rotation to the bell crank **91** in Figure 15. This will permit the tension spring **123** to move the auxiliary yarn feed finger **41** into an operative position, or so that the lower end thereof is disposed in substantially the same horizontal plane as that of the auxiliary yarn feed finger **41***a* in Figures 33 and 34, the auxiliary yarn feed finger **41***a* remaining in an inoperative position at this time.

In knitting the first course **486** in the ornamental pattern portion **451** of the stocking shown in Figure 38, the structure of which is shown in Figure 42, the patterning shown in Figures 24 and 26, and relating to the selector drum **130** and the butts on the pattern jacks **131**, is such that the pattern jacks **131** disposed below the needles N–4, N–5, N–6, N–4′, N–5′ and N–6′ (Figure 43) will not be engaged by the selector fingers **142**, **143** (Figure 12) and, therefore, their lower ends will remain in an outermost position, substantially as shown in Figure 27. Therefore, the shoulder **273** on the lower end of each of these pattern jacks **131** will engage and ride up the first pattern jack elevating cam **310**, in Figure 23, the projection **275** traversing a pathway **467**, which pathway extends along the upper horizontal surface of the pattern jack cam **310** (Figure 23) and then extends upwardly along the inclined surface **316** which is also engaged by the shoulder **273**. Now, as these pattern jacks **131** continue to move from right to left in Figure 23, the shoulder **272** engages a portion of the inclined surface **317** of the stepped pattern jack cam **315** to where the projection **275** will traverse a pathway **470**. At this moment the projection **275** will also engage the inwardly beveled surface **317***a* to move the lower end of the corresponding pattern jacks **131** inwardly to pass the pattern jack cam **315**.

As these particular pattern jacks **131** traverse the pathways **467** and **470** heretofore described, the main butt **270** on these particular pattern jacks **131** will traverse pathways **467***a* and **470***a* while the corresponding butts **257** on the auxiliary jacks **255** will traverse corresponding pathways **467***b* and **470***b* and while the butts **256** of the corresponding needles N–4, N–5, N–6, N–4′, N–5′ and N–6′ will traverse a pathway **471** until they engage and are moved downwardly by the alternate lowering cam **293** and will traverse a pathway **472** until they enter a pathway **467***c* which corresponds to the pathway **467** of the projection **275** on the corresponding pattern jacks **131**.

The butts **256** of the needles N–4, N–5, N–6, N–4′, N–5′ and N–6′ will then move upwardly from the pathway **467***c* to a pathway **470***c* which corresponds with the pathways **470**, **470***a* and **470***b* therebelow in Figure 23. During this time, the upper ends of the needles will successively traverse pathways **471***d*, **472***d*, **467***d* and **470***d* which corresponds to the pathways traversed by the corresponding needle butts **256**.

It has already been stated how alternate ones of the pattern jacks **131** are provided with the main butt **270** and, for purposes of description, we will assume that all needles bearing the even reference characters, such as N–2, N–2′, N–4, etc., are provided with the main butt **270** and, therefore, the pattern jacks **131** associated with the needles N–5 and N–5′ will continue to move at the same elevation from right to left in Figure 23, as they pass the tear-shaped cam **305**, while the butts **270** of the jacks **131** associated with the needles N–4, N–6, N–4′ and N–6′ will engage the tear-shaped elevating cam **305** and will be elevated to traverse a pathway **473***a*, the projection **274** at the lower end of these last-named jacks **131** traversing a pathway **473** while the butts **257** of the auxiliary

needle jacks 255 associated with the needles N–4, N–6, N–4′ and N–6′ will traverse a pathway 473*b*.

As these jacks 131 are elevated, upon their butts 270 traversing the pathway 473*a*, the needle butts 256 and the upper ends of the needles N–4, N–6, N–4′ and N–6′ will be elevated, traversing respective pathways 473*c* and 473*d*.

This will cause these needle butts 256 and the upper ends of these needles to then traverse respective pathways 474 and 474*a* to where the needle butts 256 will pass above the auxiliary needle leveling cam 290 as well as the stitch cams including the top center cam 286.

It might be stated that the arm 365, in Figure 18, is controlled by said conventional pattern means, not shown, so as to remain in the solid line or lower position during the knitting of the top 450, the ornamental pattern portion 451, the foot portion 453 and the usual loopers rounds. Therefore, upon the butts 256 traversing the pathway 474, in Figure 23, the widening pick 281 will be in the position shown and thus these butts will pass above the same. Now, upon the upper ends of the needles N–4, N–6, N–4′ and N–6′ being elevated to traverse the pathway 474*a*, we will assume the latches and hooks thereof will be disposed above the plane of the feeding end of the yarn feed finger 41 at the auxiliary station 40 as well as the yarn feed finger 32 at the main station 33 in Figure 33. Thus, these needles will fail to draw stitches in the wales W–4, W–6, W–4′ and W–6′ during the knitting of the first course 486 in Figure 42. However, the stems of these needles engage and cause the yarns from both stations to pass outside these needles as the loops carried thereby from the course 466 are retained inside of the needles relative to the needle circle.

On the other hand, the upper ends of the needles N–5 and N–5′ will continue along the pathway 470*d* (Figure 23) and the butts 256 thereof will engage the auxiliary needle leveling cam 290 to be projected downwardly to traverse a pathway 475, the upper ends of these needles traversing a corresponding pathway 475*a*. Now, as these needles N–5 and N–5′ move past the auxiliary yarn feed finger 41 at the station 40, the blue yarn 45 will be fed to these needles between the latch and hook portions thereof and, upon these needles being projected downwardly by the auxiliary needle leveling cam 290, to the pathway 475, the needles N–5 and N–5′ will still be disposed at a high enough elevation to take the white yarn 43 from the yarn feed finger 32, at the main yarn feed station 33, as a result of which both the white yarn 43 and the blue yarn 45 will be knitted, upon the needle butts 256 of the needles N–5 and N–5′ then passing through the stitch cams to traverse a pathway 476 (Figure 23).

Due to the fact that the upper ends of the odd needles N–1, N–3, N–3′, etc., which do not have the main butts 270, are selectively elevated to traverse the pathways 470*d* and 475*a*, successively, the needle latches should be longer than those which are a usual part of a knitting machine of this type. In other words, whereas the usual distance from the top of each needle to the lower end of each latch, when open, is 0.430 inch, the recommended distance is 0.535 inch. The elevation at which the upper ends of needles traversing the pathway 470*d* are disposed relative to the latch ring and the yarn feed fingers 32 and 41*a* may be observed in Figures 33 and 34 with particular reference to the needle indicated at N–21′ in Figure 33. The elevation at which even needles are selectively elevated to traverse the pathway 474*a* is also shown in Figures 33 and 34 with particular reference to the needles N–20, N–22, N–20′ and N–22′ in Figure 33.

In knitting the first course 486 (Figure 42), the blue yarn 45 is also taken from the yarn feed station 40 and knitted by the needles N–1, N–2, N–3, N–2′ and N–3′. It has already been stated how both the white yarn and the blue yarns are knitted simultaneously in the wales W–5 and W–5′. In this first course 486, stitches are formed of the white yarn, in a manner to be later described, in all the remaining wales extending in opposite directions from opposed sides of the wales W–6 and W–6′ except the wales at the opposite side of the stocking which correspond to the wales W–1 to W–6, inclusive, and W–2′ to W–6′ inclusive.

All the needles N–1 to N–19 and N–2′ to N–19′ are shown in Figure 33 as traversing pathways 487*d*, 490*d* and 491*d* of Figure 23. The needle N–21 is shown in Figure 33 after having traversed the pathways 470*d* and 475*a*. Figure 34 shows the needles N–20′ and N–22′ advanced a partial revolution from the position in which they are shown in Figure 33, the rest of the needles being advanced accordingly.

In Figure 34 the needles N–44′ and N–46′ are shown traversing the pathway 474*a* previously traversed by the needles N–20′ and N–22′. The needles N–23′ to N–43′, between the high needles N–22′ and N–44′, in Figure 34, are shown traversing pathways 482*d* and 475*a* after having traversed the pathway 480*d* (Figure 23). The needle N–45′ (Figure 34) is shown traversing the pathway 470*d* previously traversed by needle N–21′.

The needles N–47′ to N–59′ (Figure 34) are shown as though traversing the pathways 467*h* and 487*d* preparatory to traversing the pathways 490*d* and 491*d* previously traversed by the needles N–1 to N–19 and N–2′ to N–19′. The position of the knitting instrumentalities shown in Figures 33 and 34 takes place during knitting of the diamond-shaped areas 458, 459 and 460 in Figure 38. However, the same operations take place during knitting of the gussets 455 and the diamond-shaped areas 456 and 457, except the auixiliary yarn feed fingers 41 and 41*a* reverse their positions.

As the butts 256 on the needles N–4, N–5, N–6, N–4′, N–5′ and N–6′ follow their corresponding pathways 475 and 474 in the knitting of the course 486, the butts 257 on the needle jacks 255 move downwardly to traverse a pathway 477, the main butts 270 on the corresponding pattern jacks 131 traversing a pathway 477*a* and the projection 275 between the shoulders 272 and 273 traversing a corresponding pathway 477*b*. By referring to Figure 42, it is evident that those needles other than the needles N–1 to N–6 and N–2′ to N–6′, inclusive, and the corresponding needles at the opposite side of the needle circle, will draw the usual type of stitches of white yarn. However, due to the fact that the conventional right-hand stitch cam 285 is withdrawn from operating position during the knitting of an ornamental pattern portion of the stocking, these particular needles, which draw conventional stitches, are operated in a manner peculiar to the present invention.

The patterning means shown in Figures 24 and 26 is so arranged as to cause the lower ends of the jacks 131 associated with those needles other than the needles N–1 to N–6 and N–2′ to N–6′, to be moved inwardly against the periphery of the needle cylinder 20 to substantially the position shown in Figure 29 by virtue of certain selector fingers 142 engaging corresponding butts 266 on these pattern jacks 131.

As the selected pattern jacks 131 move from right to left, in Figure 23, upon their lower ends being moved to the position shown in Figure 29, the projection 274 will traverse a pathway 480 and the shoulder 272 will engage and be elevated slightly by the leveling cam 332 traversing a substantially horizontal pathway 481, the shoulder 272 then engaging the inclined surface 338 of the second pattern jack elevating cam 337, causing the projection 274 to be elevated traversing a pathway 482. This cam 337 is disposed inwardly of the cam 310, as is the cam 332, so as to permit these jacks 131 to move past the cam 310 without engaging the same.

Now, as the projection 274 on the end of each of these particular pattern jacks 131 traverses the pathways 480, 481 and 482, the main butts 270 on the jacks 131 beneath the even (alternate) needles traverse pathways 480*a*, 481*a* and 482*a* corresponding to the pathways 480,

481 and 482. The jacks 131 beneath the particular odd needles heretofore referred to traverse the same pathways as the even needles but are not provided with main butts 270 and, thus, have no main butts 270 to traverse the pathways 480*a*, 481*a* and 482*a*.

Those pattern jacks 131, corresponding to the needles N–4, N–6 N–4', and N–6', whose main butts 270 are projected upwardly during this first course 486 to traverse the pathways 467*a*, 470*a* and 473*a*, are elevated to such a level that the shallow butts 264 thereon would pass above the push-out cam 304. However, the shallow butts 264 of those pattern jacks 131 whose main butts 270 traverse the pathways 480*a*, 481*a* and 482*a* are disposed in a lower horizontal plane upon passing the push-out cam 304 so as to permit the push-out cam 304 to move these particular pattern jacks 131 inwardly at their upper ends and outwardly at their lower ends to cause the projections 274 and 275 to move into the recesses 321 and 322 in the pattern jack elevating cams 310 and 315. This will permit the shoulder 272 on these last-named pattern jacks 131 to engage the inclined surface 338 of the second pattern jack elevating cam 337 while, on the other hand, those pattern jacks 131 whose main butt 270 had been elevated to the plane of the pathway 470*a* will move past the second pattern jack elevating cam 337 without either of the shoulders 272 and 273 on these pattern jacks 131 engaging the inclined surface 338 of the second elevating cam 337.

It might be stated, however, that in the event that vibration of the various working parts may have caused these projections 274 and 275 on the last-named pattern jacks to be moved outwardly relative to the needle cylinder 20 upon moving past the recess 322 in the stepped pattern jack elevating cam 315 as the projection 274 moves along the pathways 470 and 490, the lower push-out cam 350 is so shaped as to engage the projection 274 to move the same inwardly relative to the needle cylinder 20 so as to be disposed inwardly of the inner surface of the second pattern jack elevating cam 337.

As the projections 274, on the pattern jacks 131 which have moved along the pathway 482, move downwardly to enter the pathway 477*b*, by virtue of the butts 257 on the corresponding auxiliary pattern needle jacks 255 moving along the pathway 477 heretofore described, these projections 274 will be engaged by the inclined inner surface formed by the recess 341 in the second pattern jack elevating cam 337 and will thus be projected inwardly, as will any other pattern jacks whose projections 274 may have been elevated to such a position as to be engageable by this slanted surface of the recess 341 in the second elevating cam 337, to thus level the lower ends of the pattern jacks 131 preparatory to the shallow butts 264 of all of these particular pattern jacks 131 being engaged and moved inwardly by the cam member 306 (Figure 4), conditioning these pattern jacks 131 for proper response to the patterning on the selector drum 130 (Figure 24).

Upon the projection 274 on certain of the pattern jacks 131 traversing the pathways 480, 481 and 482, successively, the butts 257 on the corresponding needle jacks 255 would traverse pathways 480*b*, 481*b* and 482*b*, while the butts and hooks of the corresponding needles would traverse pathways 480*c* and 480*d*, respectively, as they move from right to left in Figure 23, until the upper ends of the needle jacks 255 were elevated to a high enough plane to engage the lower surfaces of the corresponding needle butts 256 to thus move these needle butts 256 along a pathway 482*c* to enter the pathway 475 and to then pass through the stitch cams.

The upper ends of these particular needles would, of course, be elevated traversing a pathway 482*d*. It is thus seen that the upper ends of these last-named needles would remain in a lowered position upon passing the auxiliary yarn feed station 40 and would fail to take the yarn from the corresponding yarn feed finger 41 but would be elevated so as to take the yarn from the main yarn feed finger 32 at the main yarn feed station 33 to thus draw stitches of the white yarn 43 in the gussets 455 (Figure 38) at opposed sides of the stocking.

It will be noted in Figure 42 that no stitches are knitted into the fabric by the needles N–4, N–6, N–4' and N–6' in the first course 486 and, since the upper ends of these needles traverse the pathway 474*a*, in Figure 23, they will retain the loops of the course 466 thereon throughout the knitting of the course 486, and the blue yarn 45 from the auxiliary yarn feed finger 41 (Figures 33 and 34) will be floated inside the stocking all the way around except in forming the first stitches in top of the diamond-shaped area 456 (Figure 38).

Also, in knitting the first course 486, the blue yarn 45 is singularly taken from the yarn feed station 40 and knitted by the needles N–1, N–2, N–3, N–2' and N–3'. Now, in order to feed a blue yarn only to the needles and to also prevent the butts 270 on pattern jacks 131 corresponding to the alternate needles which are to take the blue yarn from engaging and riding up the tear-shaped elevating cam 305, at least one of the lower selector fingers 143 (Figures 12 and 13) engages butts 267 on the corresponding pattern jacks 131, projecting them inwardly relative to the needle cylinder to the intermediate position shown in Figure 28. This will cause the shoulder 272 to engage and be elevated by the first pattern jack elevating cam 310 and the projection 274 will then traverse the pathway 467 previously described as being followed by the projection 275. However, since the shoulder 272 is in engagement with the top surface of the first pattern jack elevating cam 310, these particular pattern jacks 131 will continue to move in the same horizontal plane after moving past the inwardly beveled step 317 to traverse a pathway 487.

These particular pattern jacks 131 are then projected downwardly along a pathway 490, by means to be presently described, to where the projection 274 will traverse a pathway 491 to the pathway 477*b* which is traversed by the projection 275. These particular pattern jacks 131 will still move in a high enough plane to where their shallow butts 264 will miss the push-out cam 304 as the jacks 131 pass thereby. However, in the event any of the butts 274 may have been projected inwardly upon moving past the recessed portion 322 of the stepped cam 315, the lower push-out cam 350 will engage these projections 274 so as to permit the projection 274 to continue in the same horizontal plane after being moved downwardly along the pathway 490 and so that the projection 275 of these particular pattern jacks 131 may traverse the pathway 477*b* as they are lowered by the corresponding needle jacks 255.

Now, as the projection 274 traverses the pathways 467, 487, 490 and 491, the main butts 270 move along pathways 467*e*, 487*a*, 490*a* and 491*a*, the corresponding needle jack butts 257 traversing pathways 467*f*, 487*b*, 490*b* and 491*b* in Figure 23. The needle butts 256 of any corresponding needles, after being projected downwardly by the needle cam 293, will traverse pathways 467*g*, 487*c*, 490*c* and 491*c* and on through the stitch cams.

It will be noted that the butts 256 of these particular needles are raised to the elevation of the pathway 487*c* by virtue of the shoulder 272 having engaged the cam 310 and the projection 274 having moved along the pathway 487. Thus, the auxiliary needle lowering cam 291 will be engaged by these particular needle butts 256 to thus cause these needle butts 256 to traverse the pathways 490*c* and 491*c* ase they move from right to left in Figure 23. This downward movement of the needle butts 256, caused by the auxiliary needle lowering cam 291, will move the needle jacks 255 and the pattern jacks 131 downwardly causing the butts 257 and 270 thereof to move downwardly along the pathways 490*b* and 490*a*, respectively, the projection 274 moving along the pathway 490.

The upper ends of the needles whose butts 256 have traversed the pathways 467*g*, 487*c*, 490*c* and 491*c* will

traverse pathways **467***h*, **487***h*, **487***d*, **490***d* and **491***d*. It is thus seen that the upper ends of the needles N–1, N–2, N–3, N–2′ and N–3′ would be elevated, in knitting the first course **486**, to take the blue yarn **45** from the auxiliary yarn feed finger **41** at the auxiliary yarn feed station **40** and would then be projected downwardly by the auxiliary needle lowering cam **291** so as to pass below the main yarn feed finger **32** at the main yarn feed station **33**. However, these last-named needles will draw stitches of the blue yarn since they pass through the stitch cams.

It is thus seen that in the knitting of the first course **486** at the apex of a diamond, the needles affected by the patterning on the pattern drum **131** and the butts of the selector jacks **131** perform all four functions in the series of different operations through which the various needles may pass in knitting a stocking. These functions may be listed as follows:

1. Selected needles take the yarn from the first or auxiliary yarn feed station **40** and do not take the yarns from the second or main yarn feed station **33**.

2. Selected needles fail to take the yarn from the first or auxiliary yarn feed station **40** but do take the yarn from the second or main yarn feed station **33**.

3. Selected needles take the yarn from the first yarn feed station **40**, are lowered slightly and take the yarn from the second or main yarn feed station **33**.

4. Selected needles are elevated to assume a position of such height, as they pass the first or auxiliary yarn feed station and the second or main yarn feed station, that they fail to take the yarn between their hooks and latches but will retain the loops of a previously knitted course thereon as the butts thereof pass above the stitch cams, the yarn from both the yarn feed stations being caused to bear against the outer surfaces of these needles with respect to the center of the needle cylinder.

It is evident that any desired combination of the above functions with respect to adjacent needles in sequence in knitting a single course is possible.

Following the knitting of the first course **486** in the diamond shown in Figure 42, a second course **495** is knitted wherein loops or stitches are formed of the white yarn by all of the needles except the needles N–2 and N–2′. Also, stitches are formed of the blue yarn by the needle N–1 simultaneously with the stitch on this needle N–1 being formed of the white yarn and the stitches on the needles N–2 and N–2′ are retained thereon during the knitting of this second course **495**. The operations with respect to the needles N–1, N–2 and N–2′ during the knitting of the second course **495** are identical to the operations of the respective needles N–5, N–6 and N–4 in knitting the first course **486**.

Following the knitting of the second course **495**, a third course **496** is knitted in exactly the same manner in which the second course **495** was knitted and then a fourth course **497** is knitted, this fourth course **497** being knitted in the identical manner in which the first course **486** was knitted.

It is thus seen that elongated loops are formed in two alternate wales which loops extend for two or more courses and then elongated loops are formed in at least two alternate wales the first of which is spaced one wale apart from the remote sides of the two first-named elongated loops, and the last-named elongated loops extending from a course intermediate the ends of the first-named elongated loops and terminating in a course succeeding the course in which the first-named elongated loops were knitted to thus stagger the elongated loops in alternate wales along the interknitted portions of adjacent diamond-shaped areas.

In Figure 42 the floated portions of the blue and white yarns involved in the knitting of the various courses shown are cut away. However, since there are only a few wales past which the floats of white yarn extend in the first few courses in knitting a blue diamond, namely, the courses **594** to **501**, inclusive, it is preferred that these floated yarns remain a part of the finished fabric for all practical purposes.

By referring to Figure 44 it will be observed that the structure of the stocking is enlarged somewhat from the showing in Figure 42 and although the various needles function in the manner identical to that heretofore described, it is more clearly shown in Figure 44 how both colors of the yarns **45** and **43** are, at times, knitted on the same needles simultaneously while, at other times, some of the needles knit with the white yarn **43** while other of the needles knit with the blue yarn **45** in the knitting of a single course.

It is thus seen that in the knitting of diamond-shaped patterns wherein two or more different colors of yarn are employed, the junction points in each wale, wherein the two different colors of yarn are interknitted, may be constructed so as to knit a single color of yarn on alternate needles while knitting another color of yarn on some of the needles between the alternate needles and while also knitting both colors of yarn on others of the needles between the alternate needles. Also, by retaining both colors of yarn on alternate needles and, at the same time, by knitting the same two yarns on those needles between the alternate needles, the yarn of one color is floated to, say, the outside of the needles while the yarn of the other color is floated on the other or inside of the needles, this resulting in the two floating yarns being interlocked at their bases in such a manner as to prevent their opposed ends from being pulled apart unintentionally, as in laundering, after the floated portions have been cut away, that is, the floated portions between opposed diamond-shaped areas, such as the diamond-shaped areas **458** and **457** in Figure 38.

To further exemplify the function of the various needles in the needle circle, it will be noted that the loops at the juncture of wales W–8, W–9 and W–10 with the fourth, and fifth courses in Figure 42, which courses are indicated by the reference characters **497** and **498** are identical to the loops formed in the wales W–4, W–5 and W–6 in the courses **466** and **486** and the elongated or stretched loops at the juncture of wales W–4, W–5 and W–6 with the fifth, sixth and seventh courses, indicated at **498**, **499**, and **500**, respectively, are similar to the loops formed in the same wales thereabove in the courses **496** and **497** except being longer and of a blue yarn. Of course, the needles follow different pathways in knitting. In all instances where the needles fail to knit the yarn, as in the course **501** at the wales W–8 and W–10, the upper ends of the needles, in Figure 23, passed above the eyes of the auxiliary and main yarn feed fingers **41** and **32**, respectively, transversing the pathway **474***a*.

The upper ends of all needles which take and knit both colors of yarn simultaneously, which, incidently, are the needles which knit between adjacent long loops such as the needle knitting in the wale W–1 in the courses **495** and **496**, or the needle knitting in the wale W–9 in courses **499** and **502**, will be elevated at both of yarn feed stations **40** and **33**, successively, traversing the pathways **470***d* and **475***a* in Figure 23.

The upper ends of those needles which knit only the white yarn, such as in knitting the central portions of the gussets **455** at opposed sides of the stocking in Figure 38, or the central portions of the diamond-shaped areas **460** at opposed sides of the stocking shown in Figure 38, will traverse the pathways **480***d* and **482***d* to then enter the pathway **475***a* to thus take the white yarn **43** from the main yarn feed finger **32** at the main yarn feed station **33** prior to passing through the stitch cams.

On the other hand, those needles which are employed in knitting only the blue yarn, such as the central portions of the diamond-shaped areas **456** and **457**, will traverse the pathways **467***h*, **487***d*, **490***d* and **491***d*. This will elevate the upper ends of the needles to where they will take the blue yarn **45** from the auxiliary yarn feed finger **41** and will then move downwardly to where they

will miss the white yarn 43 from the main yarn feed finger 32 and will then pass through the stitch cams knitting only with the blue yarn 45.

Although certain of the loops in the wales shown in Figures 42 and 44 have an elongated shape, such elongation extending for several courses, the fabric does not actually have this appearance but is illustrated in this manner for purposes of clarity. In fact, it might be stated that such "locking" stitches will form in practically the same size and shape of the adjacent conventional type of stitches, thus causing the floated yarns, which are held tightly within their own immediate structure, to be safely secured on the inside of the fabric. The appearance of the fabric at the points wherein the long loops and the short loops are knitted is hardly noticeable as being any different from other knitted fabrics wherein the loops are all of the same length, these longer loops only being noticeable upon very close inspection such as with the use of a magnifying glass or other type of optical instrument or by stretching the fabric.

After the initial few courses, say, the four courses 485, 495, 496 and 497, have been knitted, a widening of the area knitted by the blue yarn and a narrowing of the adjacent areas knitted by the white yarn is effected due to the arrangement of the butts of the jacks 131 and on the pattern drum 130. At this point, the successive widening and narrowing operations are performed in such a sequence that, taking the wales W–4, W–5 and W–6 and the courses 496 to 502 for example, normal stitches are formed of the white yarn in the courses 496 in the wales W–4, W–5 and W–6. In the subsequent course 497, no stitches are formed in the wales W–4 and W–6 while a double stitch, that is, a stitch of both yarns is formed simultaneously in which event the blue yarn extends across the wales W–4 and W–6 without being knitted in the course 497.

In the course 498, normal stitches are formed, but in this instance, the blue yarn instead of the white yarn is fed to the needles N–4 and N–6 and only a blue yarn is fed to the needle N–5 resulting in normal loops being formed in the wales W–4, W–5 and W–6 in the course 498. It will be noted that the course 498 at the juncture of the two different colored yarns in the wales W–4 to W–6, inclusive, bisects the courses between which the loops extend in the wales W–8 and W–10 of the white yarn and the blue yarn is extended beyond the wale W–6 for an additional four wales but is not knitted in the course 498 and wales W–8 and W–10.

The courses 499 and 500 are then knitted during which no stitches are formed in the wales W–4 and W–6 of courses 499 and 500 and stitches are formed of both colors of yarn in the wale W–5. In the course 501, loops are formed in the wales W–4 and W–6 of the blue yarn and this causes the loops formed in these last-named wales in the course 498 to be stretched across the courses 499 and 500 to be interknitted and, in so doing, to tuck both yarns which had extended across the wales W–4 and W–6 of courses 499 and 500 into the course 501.

The sequence of operations with respect to the courses 497 to 502 is then repeated in a step-by-step manner, the tuck stitch loops in the subsequent courses being off-set with respect to the last-named courses in accordance with the degree of angle required in the suture formed at the juncture of two adjacent areas relative to the wales and courses thereof.

The showing in Figure 44 is merely provided to exemplify the suture structure at the juncture of two adjacent rectilinear areas intermediate the apex of a diamond and the widest portion of a diamond so as to avoid confusion as to the manner in which the steps are knitted as the knitting progresses following the knitting of the apex of a diamond, the apex thereof being shown in Figure 42. Figure 44 shows two complete progressive steps in the widening of the area knitted by one of the yarns and the corresponding narrowing of the area knitted by the other of the yarns.

It might be stated that during the knitting of a fabric, such as that shown in Figures 42 and 44, the loops or stitches in the immediate area surrounding the elongated loops are shortened considerably due to the yarn for the elongated loops being "borrowed" from the adjacent conventional loops. Thus, after the fabric is knitted, the conventional loops partially regain their length and substantially shorten the so-called elongated loops. Thus the elongated loops are drawn tightly around the yarn floated thereby to assist in locking the ends of the yarns when their floated portions are cut away. For this reason the elongated loops may be properly termed as forming lock stitches.

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 having a rotary needle cylinder and a plurality of vertically movable needles mounted around the periphery of the needle cylinder and having selector means for controlling the needles and having at least two yarn feed fingers, namely a first and a second yarn feed finger, spaced a substantial distance apart from each other adjacent the path of rotation of the needles, the combination of a first means for positioning certain selected needles to take the yarn from the second yarn feed finger only, a second means for positioning other selected needles for taking the yarn from the first yarn feed finger only during the same course in which the first means was operable, a third means for positioning certain other selected needles to take the yarn from both the yarn feed fingers in the same course in which the first and second means were operable and a fourth means for positioning certain other selected needles so they retain the loops of a previously knitted course thereon but are withheld from knitting, and said fourth means also being operable during the knitting of the same course in which the first, second and third means are operated.

2. In a circular knitting machine having a rotary needle cylinder in which vertically movable needles are mounted and also having a plurality of pattern jacks disposed one beneath each of said needles and also having a main yarn feed station disposed adjacent the needles provided with a plurality of yarn feed fingers for presenting yarns to the needles as they are raised to a given height and also having means for raising and lowering some of the pattern jacks and the corresponding needles for taking a first yarn from at least one of the yarn feed fingers at the main yarn feed station and said knitting machine also having selector means for selecting the pattern jacks, the combination of an auxiliary yarn feed station having at least one yarn feed finger disposed in advance of the main yarn feed station, means engageable by the pattern jacks upon action thereon by the selector means for raising a first group of needles in advance of the auxiliary yarn feed station to take the yarn therefrom, means for successively lowering said first group of needles after passing the auxiliary station and at a point in advance of the main yarn feed station to a level below the level of the yarn feed fingers at the main yarn feed station so as to cause them to fail to take the yarn from the yarn feed finger at the main yarn feed station, a second means engageable by the pattern jacks upon action thereon by the selector means for raising a second group of needles to cause their hooks to pass a substantial distance above the yarn feed finger of the auxiliary yarn feed station so as to miss the means for lowering the first group of needles so the second group of needles may remain at a high enough elevation to take the yarn from the main yarn

feed station after having taken the yarn from the auxiliary feed station.

3. In a circular knitting machine having a rotary needle cylinder in which vertically movable needles are mounted and a plurality of pattern jacks disposed one beneath each of said needles and also having a main yarn feed station disposed adjacent the needles and having a plurality of yarn feed fingers for presenting yarns to the needles as they are raised to a given height and also having means for raising and lowering some of the pattern jacks and the corresponding needles for taking a first yarn from at least one of the yarn feed fingers at the main yarn feed station and said knitting machine also having selector means for selecting the pattern jacks, and said knitting machine also having stitch cams through which the needles normally pass in drawing stitches, the combination of an auxiliary yarn feed station having at least one yarn feed finger disposed in advance of the main yarn feed station, means engageable by the pattern jacks upon action thereon by the selector means for raising a first group of needles in advance of the auxiliary yarn feed station to take the yarn therefrom, means for successively lowering said first group of needles after passing the auxiliary station but at a point in advance of the main yarn feed station to a level below the level of the yarn feed finger at the main yarn feed station so as to cause them to fail to take the yarn from the yarn feed finger at the main yarn feed station, a second means engageable by the pattern jacks upon action thereon by the selector means for raising a second group of needles to cause their hooks to pass a substantial distance above the yarn feed finger of the auxiliary yarn feed station so as to miss the means for lowering said first group of needles so the second group of needles may remain at a high enough elevation to take the yarn from the main yarn feed station after having taken the yarn from the auxiliary yarn feed station, a third means engageable by the pattern jacks upon action thereon by the selector means for elevating certain alternate needles to a higher level than the levels to which the first and second groups of needles are raised to cause the latches of said alternate needles to pass above the yarn feed fingers at both of the stations and to where these alternate needles will pass above the stitch cams but will retain the loops of a previously knitted course thereon.

4. In a circular knitting machine having a rotary needle cylinder in which vertically movable needles are mounted and a plurality of pattern jacks disposed one beneath each of said needles and also having a main yarn feed station disposed adjacent the needles and having a plurality of yarn feed fingers for presenting yarns to the needles as they are raised to a given height and also having means for raising and lowering some of the pattern jacks and a corresponding first group of needles for taking a first yarn from at least one of the yarn feed fingers at the main yarn feed station and said knitting machine also having selector means for selecting the pattern jacks, and said knitting machine also having stitch cams through which the needles normally pass in drawing stitches, the combination of means engageable by the pattern jacks upon action thereon by the selector means for raising a second group of needles in advance of the auxiliary yarn feed station to take the yarn therefrom, means for lowering the last-named needles after passing the auxiliary station but at a point in advance of the main yarn feed station to a level below the level of the yarn feed finger at the main yarn feed station so as to cause them to fail take the yarn from the yarn feed finger at the main yarn feed station but to take a second yarn from the auxiliary yarn feed station, a second means engageable by the pattern jacks upon action thereon by the selector means for raising a third group of needles to cause their hooks to occupy a position substantially above the yarn feed finger of the auxiliary yarn feed station so as to miss the means for lowering the second group of needles and so the third group of needles may remain at a high enough elevation to take the first yarn from the main yarn feed station after having taken the second yarn from the auxiliary yarn feed station, a third means engageable by the pattern jacks upon action thereon by the selector means for elevating alternate needles forming a fourth group to a higher elevation than the yarn feed fingers at either of the stations, to where these alternate needles will pass above the stitch cams and their latches will pass above all of the yarn feed fingers but these needles will retain the loops thereon of a previously knitted course and selector controlled means for causing certain of said alternate needles to pass through the stitch cams while other of said alternate needles may pass above the stitch cams.

5. In a circular knitting machine having a rotary needle cylinder in which vertically movable needles are mounted and a plurality of pattern jacks disposed one beneath each of said needles and also having a main yarn feed station disposed adjacent the needles and having a plurality of yarn feed fingers for presenting yarns to the needles as they are raised to a given height and also having means for raising and lowering some of the pattern jacks and a corresponding first group of needles for taking a first yarn from at least one of the yarn feed fingers at the main yarn feed station and said knitting machine also having selector means for selecting the pattern jacks and said knitting machine also having stitch cams through which the needles normally pass in drawing stitches, the combination of an auxiliary yarn feed station having at least one yarn feed finger disposed in advance of the main yarn feed station, means engageable by the pattern jacks upon action thereon by the selector means for raising a second group of needles in advance of the auxiliary yarn feed station to take the yarn therefrom, means for lowering the last-named needles after passing the auxiliary station but at a point in advance of the main yarn feed station to a level below the level of the yarn feed finger at the main yarn feed station so as to cause them to fail to take the yarn from the yarn feed finger at the main yarn feed station, a second means engageable by the selector jacks upon action thereon by the selector means for raising a third group of needles to cause their hooks to occupy a position substantially above the yarn feed finger of the auxiliary yarn feed station so as to miss the means for lowering the second group of needles so the third group of needles may remain at a high enough elevation to take the yarn from the main yarn feed station after having taken the yarn from the auxiliary yarn feed station, a third means engageable by the pattern jacks upon action thereon by the selecting means for elevating alternate needles forming a fourth group to a higher elevation than the yarn feed fingers at either of the stations, to where these alternate needles will pass above the stitch cams and their latches will pass above all of the yarn feed fingers but these needles will retain the loops of a previously knitted course thereon.

6. In a circular knitting machine having a rotary needle cylinder in which a plurality of vertically movable independent needles are mounted and also having pattern means thereon and also having means for directing a first and a second yarn to the needles and also having stitch cams for acting upon the needles in drawing stitches, the combination of pattern controlled means for causing all of the needles in the needle circle pass through the stitch cams knitting a first yarn into a first course, other pattern controlled means for knitting a succeeding or second course and wherein a second yarn is knitted on at least one of the needles simultaneously with the first yarn being knitted on this particular needle and also wherein a needle disposed immediately adjacent opposed sides of the last-named needle will be withheld from knitting either of the yarns but will retain the

loops from the previously knitted first course thereon.

7. In a circular knitting machine having a rotary needle cylinder provided with a plurality of vertically movable needles and also having a pattern jack disposed beneath each of the needles and also having a plurality of needle cams arranged in a circle around the needle cylinder and said machine also having a plurality of pattern jack elevating and leveling cams arranged in a circle around the needle cylinder below the needle cams and also having a plurality of selector fingers for acting upon the lower portions of the pattern jacks and a selector drum having pattern means thereon for controlling movement of the selector fingers, the combination of a first and a second yarn feed station spaced from each other adjacent the needle cylinder, means for elevating and then lowering at least one selected needle for taking and knitting two yarns in a single course, one from each of the yarn feed stations, means for elevating at least one given needle adjacent opposed sides of the first-named needle so as to cause their latches to pass above the plane of both yarn feed stations and to retain the loops of a previously knitted course thereon, other means for successively elevating and lowering groups of needles adjacent opposite sides of said given needles to where they will take and knit the yarn from either of the yarn feed stations independently of the other, means for transmitting step-by-step rotation to the selector drum in timed relation to rotation of the needle cylinder so as to effect a change in the position of the selector fingers for engaging the pattern jacks, and pattern controlled means for varying the time at which a step in rotation is imparted to the selector drum relative to a revolution of the needle cylinder so as to permit a change in patterning during a single course and so that pattern jacks immediately adjacent one another may be varied as to the positions of the lower ends thereof inwardly and outwardly with respect to the needle cylinder.

8. In a circular knitting machine having a rotary needle cylinder in which vertically movable needles are mounted and having selecting means for selecting needles for raising to a given height, and also having pattern jacks cooperating with said needles, the combination of spaced means 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 also wherein the yarns from the designs are knitted into 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 yarn thus presented, and means for actuating the jacks, according to selection by the selecting means, for elevating alternate needles so their hooks and latches pass above said spaced means and so the stems of the alternate needles engage the yarn while retaining the yarn of a previously knitted course thereon.

9. In a circular knitting machine having a rotary needle cylinder in which vertically movable needles are mounted and having selecting means for selecting needles for raising to a given height, and also having pattern jacks cooperating with said needles, the combination of spaced means 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 also wherein the yarns from the designs are knitted into 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 yarn thus presented, means for actuating the jacks, according to selection by the selecting means, for elevating alternate needles so their hooks and latches pass above said spaced means and so the stems of said alternate needles engage the yarn while retaining the yarn of a previously knitted course thereon, 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 having selector fingers controlled by the drum for selectively positioning the pattern jacks radially of the needle cylinder at their lower ends, said selector drum having a ratchet wheel thereon, a reciprocating pawl for engaging the ratchet wheel for normally racking the selector drum one tooth in the ratchet wheel with each stroke of the pawl, and 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.

10. In a circular knitting machine having a rotary needle cylinder provided with a plurality of vertically movable needles and also having a pattern jack disposed beneath each of the needles and also having a plurality of needle cams arranged in a circle around the needle cylinder and said machine also having a plurality of pattern jack elevating and leveling cams arranged in a circle around the needle cylinder below the needle cams and also having a plurality of selector fingers for acting upon the lower portions of the pattern jacks and a selector drum having pattern means thereon for controlling movement of the selector fingers, the combination of a first and a second yarn feed station spaced from each other adjacent the needle cylinder, means for successively elevating and lowering at least one selected needle for taking two yarns one from each of the yarn feed stations and drawing overlapping stitches therewith, means for elevating at least one given needle adjacent opposed sides of the first-named needle so as to cause their latches to pass above the planes of both yarn feed stations and to retain the loops of a previously knitted course thereon, other means for successively elevating and lowering groups of needles adjacent opposite sides of said given needles to where they will take and knit the yarn from either of the yarn feed stations independently of the other, means for transmitting step-by-step rotation to the selector drum in timed relation to rotation of the needle cylinder so as to effect a change in the position of the selector fingers for engaging the pattern jacks, and pattern controlled means for varying the time at which a step in rotation is imparted to the selector drum relative to a revolution of the needle cylinder so as to permit a change in patterning during a single course and so that pattern jacks immediately adjacent one another may be varied as to the positions of the lower ends thereof inwardly and outwardly with respect to the needle cylinder.

11. In a knitting machine having a rotary needles cylinder provided with a plurality of vertically movable needles mounted around the periphery of the needle cylinder and said machine also having at least two yarn feed fingers disposed adjacent the path of rotation of the needles and said machine also having stitch cams adjacent the needle cylinder for acting upon needles directed thereto, means for moving some of the needles past the first of said feed fingers to take the yarn therefrom, means for lowering the needles immediately after having passed the first of the yarn feed fingers so as to pass below and thus fail to take the yarn from the second of the yarn feed fingers, means for moving others of said needles past the first of the yarn feed fingers

but with their hooks at a lower level to prevent the taking of the yarn by the needles from the first of the yarn feed fingers, means for immediately raising the latter needles to cause their hooks to pick up the yarn from the second of the yarn feed fingers as they pass thereby, means for raising still others of the needles as they pass by both the first and second of the yarn feed fingers to an elevation to cause their hooks to take the yarn from both of the yarn feed fingers and means for raising certain alternate needles to where their latches will pass above both yarn feed fingers and their butts will pass above the stitch cams whereby the yarn from either one or both of the yarn feed fingers may be knitted into the fabric independently of each other or simultaneously and the said alternate needles will fail to draw stitches but will retain the loops of a previously knitted course thereon according to a desired pattern.

12. In a 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 yarns to the needles at different elevations, apparatus for producing knitted fabric comprising means for knitting at least two different yarns into a single course, means for knitting a first of the yarns into the fabric, means for knitting both of the yarns into the fabric simultaneously, means for knitting a second of the yarns into the fabric while the remaining first yarn is floated behind the needles and within the needle circle, 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, 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 and a fifth selecting means for raising alternate needles to where their hooks and latches will pass substantially above both yarns to where they will fail to draw stitches thus retaining the loops of a previously knitted course thereon.

13. In a circular knitting machine having a rotary needle cylinder in which vertically movable needles are mounted and a plurality of pattern 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, said machine also having means for raising and lowering some of the pattern jacks and corresponding needles for taking a first of the body yarns and also having selecting means for selecting the pattern jacks, means engageable by the pattern jacks upon action thereon by the selecting means for moving the pattern jacks to a second position radially of the needle cylinder to again raise some of the needles after they have been lowered by the conventional means, and after they have taken the first of the yarns, for taking another of the yarns to thus knit both of the yarns into a fabric simultaneously in a single course, and means for varying the time of action of the selecting means relative to the rotation of the needle cylinder so as to cause intermittent movement to be imparted to the selecting means as different spaced points on the needle cylinder pass the selecting means to thereby cause a change in sequential patterning to be effective upon pattern jacks immediately adjacent each other in varying their positions relative to the needle cylinder.

14. In a circular knitting machine having a rotary needle cylinder in which vertically movable needles are mounted and a plurality of pattern 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, said machine also having means for raising and lowering some of the pattern jacks and corresponding needles for taking a first of the body yarns and also having selecting means for selecting the pattern jacks, means engageable by the pattern jacks upon action thereon by the selecting means for moving the pattern jacks to a second position radially of the needle cylinder to again raise some of the needles after they have been lowered by the conventional means, and after they have taken the first of the yarns, for taking another of the yarns to thus knit both of the yarns into a fabric simultaneously in a single course, means for controlling the time of action of the selector means relative to the rotation of the needle cylinder so as to permit a positive reaction of the pattern jacks to the selecting means although a variable patterning may be effected by the selecting means to cause pattern jacks immediately adjacent each other to vary as to their position relative to the needle cylinder, 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 take the second of the yarns only for knitting the second of the yarns into the fabric independently of the first of the yarns selectively and means engageable by alternate jacks which have moved to said third position to thus elevate corresponding alternate needles so as to retain the loops of a previously knitted course thereon.

15. In a circular knitting machine having a rotary needle cylinder in which a plurality of vertically movable independent needles are mounted and also having a vertically movable pattern jack disposed below each of said vertically movable needles and also having a series of elevating and lowering cams arranged adjacent the needle cylinder, a plurality of 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 yarns to the needles passing thereby at a given elevation, the first of said positions of the jacks causing the jacks to engage cams adjacent the needle cylinder for elevating and lowering them in successive steps 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 pattern jacks to remain lowered as the corresponding needles pass the first of said fingers and causing said pattern 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, the third of said positions of the lower ends of the pattern jacks causing the pattern 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 fingers to thus take the yarn from the first of the yarn feed fingers only, a main butt on alternate jacks, and an elevating cam engageable by said main butt upon said jacks being moved to said first position to thus elevate corresponding alternate needles to where their latches will pass above both yarn feed fingers thus retaining a previously knitted loop thereon whereby the yarn from either one of the yarn feed fingers is 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.

16. 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 and knit the respective yarns, 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, means for selecting alternate needles at the proximate edges of adjacent groups of needles to retain the loops of a previously knitted course thereon for a predetermined number of courses and other means for selecting these same alternate needles to draw stitches therewith in succeeding courses to form loops extending between several courses in single alternate wales,

17. In a circular knitting machine having a plurality of vertically reciprocable needles and also having a throat provided with a plurality of main yarn feed fingers disposed in the throat and said machine also having a plurality of auxiliary yarn feed fingers spaced apart from the main yarn feed fingers for feeding a plurality of yarns to the needles and said machine having pattern means for selecting certain of the needles for elevation, a first means for actuating needles, according to selection by the pattern means, for elevating a plurality of needles adjacent the throat to take a first yarn and to float a second yarn back of the elevated needles during continuous knitting, the pattern means serving to gradually increase the number of needles elevated to take said first yarn and to float the second yarn back of the elevated needles after a predetermined number of courses have been knitted from the first yarn, a second means for actuating needles, according to selection by the pattern means, and disposed in advance of the auxiliary and the main yarn feed fingers for elevating one or more needles to a higher elevation than the level of the needles elevated by the first means and at each edge of the group of needles elevated by the first means so as to take the first and second yarns at the outer edges of the needles elevated by the first means to interknit both yarns into the fabric, a third means for actuating needles, according to selection by the pattern means, for elevating an additional group of needles adjacent the needles elevated by the first means to take the second yarn while the first yarn is floated behind the second group of needles and whereby pattern effects can be produced during continuous rotary knitting in different portions of the courses being knitted, a fourth means for actuating needles, according to selection by the pattern means, for elevating certain alternate needles, included in and at the juncture of the needles elevated by the first and third means in a previously knitted course, to a higher elevation than the needles elevated by the first, second and third means so as to pass the latches of the needles elevated by the fourth means above all the yarn feed fingers and to cause them to be withheld from knitting while retaining the loops of a previously knitted course thereon, and a fifth means for actuating needles, according to selection by the pattern means, for elevating these same alternate needles in a subsequent course to substantially the same level as that of those needles elevated by either of the first and second means and to then lower said alternate needles so as to draw stitches therewith in a formation of stretched loops extending between several courses.

18. In a circular knitting machine having a plurality of vertically reciprocable needles and also having a throat provided with a plurality of main yarn feed fingers disposed in the throat and said machine also having a plurality of auxiliary yarn feed fingers spaced apart from the main yarn feed fingers for feeding a plurality of yarns to the needles and said machine having pattern means for selecting certain of the needles for elevation, a first means for actuating needles, according to selection by the pattern means, for elevating a plurality of needles adjacent the throat and at a point after they have passed a first auxiliary feed finger to take a first yarn and to float a second yarn from a second main yarn feed finger back of the elevated needles during continuous knitting, the pattern means serving to gradually increase the number of needles elevated to take said first yarn and to float the second yarn back of the elevated needles after a predetermined number of courses have been knitted from the first yarn, a second means for actuating needles, according to selection by the pattern means, and disposed in advance of the auxiliary and the main yarn feed fingers for elevating one or more needles to a higher elevation than the level of the needles elevated by the first means and at each edge of the group of needles elevated by the first means so as to take the first and second yarns at the outer edges of the needles elevated by the first means to interknit both yarns into the fabric, a third means for actuating needles, according to selection by the pattern means, for elevating an additional group of needles adjacent the needles elevated by the first means to take the second yarn while the first yarn is floated behind the second group of needles and whereby pattern effects can be produced during continuous rotary knitting in different portions of the courses being knitted, a fourth means for actuating needles, according to selection by the pattern means, for elevating certain alternate needles, included in and at the juncture of the needles elevated by the first and third means in a previously knitted course, to a higher elevation than the needles elevated by the first, second and third means so as to pass the latches of the needles elevated by the fourth means above all the yarn feed fingers and to cause them to be withheld from knitting while retaining the loops of a previously knitted course thereon, and a fifth means for actuating needles, according to selection by the pattern means, for elevating these same alternate needles to a lower elevation than their level during the course in which the fourth means operated so as to take yarn from either of the yarn feed fingers and to then lower the same in one or more succeeding courses so as to draw stitches therewith in a formation of stretched loops extending between several courses.

19. In a circular knitting machine having a rotary needle cylinder and having a plurality of vertically movable needles and coinciding pattern jacks both mounted in the periphery of the needle cylinder and also having selector means for positioning the jacks radially of the needle cylinder, a main yarn feed station and an auxiliary yarn feed station spaced from each other, each yarn feed station having at least one yarn feed finger normally disposed in a lowered operative position adjacent the path of travel of the needles, the combination of cam means for actuating the jacks, according to selection by the selector means, so as to cause a first segment of the needles to pass above the yarn feed finger in the auxiliary yarn feed station and below the yarn feed finger in the main yarn feed station and to selectively cause a second segment of the needles to pass below the yarn feed finger in the auxiliary yarn feed station and above the yarn feed finger in the main yarn feed station, and cam means for actuating some of the jacks, according to selection by the selector means, so as to elevate alternate needles in either segment to a plane a substantial distance above both the yarn feed fingers so these alternate needles will fail to take the yarn in

their hooks from either of the yarn feed fingers but will retain the loops of a previously knitted course thereon throughout the knitting of a given course.

20. In a circular knitting machine having a rotary needle cylinder in which a plurality of vertically movable independent needles are mounted and having pattern means thereon and also having means for directing a first and a second yarn to the needles and also having stitch cams for acting upon the needles in drawing stitches, the combination of pattern controlled means for knitting courses wherein all of the needles in the needle circle pass through the stitch cams to thereby knit a first course from a first yarn, other pattern controlled means for knitting a succeeding second course wherein a second yarn is knit independently of the first yarn on a first needle and on a second and third needle disposed adjacent opposite sides of the first needle and on fourth and fifth needles disposed adjacent opposite sides of the second and third needles, means to render inactive sixth and seventh needles disposed adjacent opposite sides of the fourth and fifth needles while retaining the loops of the previous first course thereon during the formation of the second course, means to cause eighth and ninth needles disposed adjacent opposite sides of the sixth and seventh needles to knit both yarns in the second course, means for knitting a third course in sequence to the first and second courses wherein the first and second yarns are knit simultaneously on the first needle, means rendering the second and third needles inactive in the third course while retaining the loops of the second course thereon, means to cause the remaining needles in the third course including said sixth and seventh needles to take and knit the first yarn only, means for knitting a fourth course in sequence to the first, second and third courses identical to said third course, and means for knitting a fifth course identical to said second course wherein the second and third needles which were inactive during formation of the third and fourth courses will take and knit the second yarn to thus form the apex of a triangularly-shaped area from the second yarn while interknitting the first yarn with some of the loops formed from the second yarn to thereby tie the triangularly-shaped area to the portion of the fabric knit from the first yarn.

21. In a circular knitting machine having a rotary needle cylinder provided with a plurality of vertcially movable latch needles and also having a pattern jack disposed beneath each of the needles and also having a plurality of needle cams arranged in a circle around the needle cylinder and said machine also having a plurality of pattern jack elevating and leveling cams arranged in a circle around the needle cylinder below the needle cams and also having a plurality of selector fingers for acting upon the lower portions of the pattern jacks, said machine also having a selector drum provided with pattern means thereon for controlling movement of the selector fingers, the combination of a first and a second yarn feed station spaced apart from each other adjacent the needle cylinder, means for elevating and then lowering at least one selected needle for causing its hook to take two yarns one from each of the yarn feed stations and to draw overlapping stitches therewith, means for elevating at least one given needle adjacent opposed sides of the first-named needle so as to cause their latches to pass above the planes of both yarn feed stations to thereby retain the loops of a previously knitted course thereon and other means for successively elevating and lowering at least some of the needles adjacent opposite sides of said given needles to where said some of the needles will take and knit the yarn from but one of the yarn feed stations.

22. In a circular knitting machine having a rotary needle cylinder provided with a plurality of vertically movable needles and also having a pattern jack disposed beneath each of the needles and also having a plurality of needle cams arranged in a circle around the needle cylinder, said needle cams including a set of stitch cams, said machine also having a plurality of pattern jack elevating and leveling cams arranged in a circle around the needle cylinder below the needle cams and also having a plurality of selector fingers for acting upon the lower portions of the pattern jacks and a selector drum having pattern means thereon for controlling movement of the selector fingers, the combination of a first and a second yarn feed station spaced from each other adjacent the needle cylinder, means for elevating and then lowering at least one selected needle for taking two yarns in a single course, one from each of the yarn feed stations and forming overlapping stitches therewith, means for elevating at least one given needle adjacent opposed sides of the first-named needle so as to cause their latches to pass above the planes of both yarn feed stations and so the given needles pass above the set of stitch cams thus retaining the loops of a previously knitted course thereon, other means for successively elevating and lowering groups of needles adjacent opposite sides of said given needles to where they will take and knit the yarn from either of the yarn feed stations independently of the other, means for transmitting step-by-step rotation to the selector drum in timed relation to rotation of the needle cylinder so as to effect a change in the position of the selector fingers for engaging the pattern jacks, and pattern controlled means for varying the time at which a step in rotation is imparted to the selector drum relative to a revolution of the needle cylinder so as to permit a change in patterning during a single course and so that pattern jacks immediately adjacent one another may be varied as to the positions of the lower ends thereof inwardly and outwardly with respect to the needle cylinder.

23. In a knitting machine having a circular series of independent vertically movable needles, a vertically movable needle jack disposed beneath each of said needles, a vertically movable selector jack disposed beneath each of said needle jacks, a plurality of yarn feed fingers and a set of stitch cams disposed in the path of the needles which take the yarn from said yarn feed fingers, the combination of circularly arranged selector cams disposed around the needle cylinder for controlling the needles, said yarn feed fingers including a first and a second yarn feed finger spaced from each other adjacent the needle cylinder, said circularly arranged selector cams including a first cam means for successively raising all the needles after they have passed the first yarn feed finger and in advance of passing the second yarn feed finger for taking the yarn from the second yarn feed finger and to then cause all the needles to successively pass through the stitch cams in knitting a first plurality of courses, said selector cams also including a second cam means for selectively raising a first segment of the needles in a course subsequent to said plurality of courses to successively raise said first segment of the needles for taking the yarn from the first yarn feed finger, a third cam means operable upon the needles in said first segment of needles for successively lowering the first segment of needles after they have taken the yarn from the first yarn feed finger and before they have passed the second yarn feed finger to thus cause the first segment of needles to draw stitches from the first yarn feed finger, a fourth cam means also operable in said subsequent course for raising a second contiguous segment of the needles after they have passed the first yarn feed finger and before they pass the second yarn feed finger to cause said second segment of needles to take and knit the yarn from the second yarn feed finger, a fifth cam means for raising certain selected needles at the juncture of said first and second segments in advance of the first yarn feed finger and for maintaining said certain selected needles at a high enough elevation to also take the yarn from the second yarn feed finger in advance of the said certain selected needles passing through the stitch cams to simultaneously form stitches from both of the yarns at the juncture of the first and second segments of needles, whereby the yarn from the first yarn feed finger will be floated past the area

formed from the yarn from the second yarn feed finger and the yarn from the second yarn feed finger will be floated past the area knitted from the yarn from the first yarn feed finger, and a sixth cam means for raising other selected needles at the juncture of the first and second segments of the needles to where their latches will pass above both yarn feed fingers and their butts will pass above the circularly arranged selector cams and the stitch cams and whereby the last-named needles are rendered inactive but will retain the loops of the previously knitted course thereon.

24. That method of knitting a stocking on a circular independent needle knitting machine which comprises continuously rotating the needle cylinder to knit a first plurality of courses by continuous rotary knitting and feeding one or more yarns to the needle circle at two spaced feeding points adjacent the needle circle, knitting a second plurality of courses by elevating certain needles to take yarn from one of the points and then forming normal loops therewith, elevating certain other needles to take yarn from the other of the feeding points and then forming normal loops therewith, elevating some of the needles in both of these last-named groups to take the yarn from both feeding points and then forming normal loops therewith so as to interknit the yarns at the juncture of the groups of needles, passing the latches on alternate ones of the needles above both of the feeding points at which the yarn is taken so as to cause the yarn to bear against the stems of said alternate needles, then again elevating said alternate needles in a subsequent course following said second plurality of courses to take yarn from either of the feeding points and then forming loops therewith so as to form recurrent loops which skip said second plurality of courses between their anchorage points while normal loops immediately adjacent the recurrent loops are formed in each of the second plurality of courses.

25. That method of knitting on a circular knitting machine which comprises elevating a portion of the needles to take one yarn and then lowering the portion of the needles to draw stitches therewith while floating a second yarn back of said portion of the needles, elevating additional groups of needles to take the second yarn and then lowering said additional groups of needles to also draw stitches therewith while floating the first yarn back of the needles, varying the number of elevated needles in said portion and said additional groups in different courses to determine the pattern, interknitting both yarns between said portion of the needles and contiguous groups of needles by a relatively few needles, and elevating certain alternate needles at the wales at which both yarns are interknitted during the knitting of several courses to where they will fail to knit but will retain the loops of previously knitted courses thereon, and then successively elevating and lowering these alternate needles in a course following said several courses to take and knit one of the yarns therewith in forming loops in spaced wales which skip several courses and are interknitted in the last-named course to thereby draw said several courses together at said spaced wales.

26. That method of knitting a seamless stocking on a circular independent needle knitting machine which comprises continuously rotating the cylinder to knit a plurality of courses by continuous rotary knitting, feeding a plurality of yarns to the needles simultaneously, elevating spaced groups of needles so as to cause the needles in said spaced groups to take and knit a first yarn while floating a second yarn back of the needles which take said first yarn, causing the groups of needles between the spaced groups of needles to take and knit the second yarn and to float the first yarn back of the groups of needles which take the second yarn during continuous knitting, varying the number of needles during continuous knitting which take and knit the various yarns from course to course, also withholding certain alternate needles at the juncture of adjacent groups of needles from knitting one or more succeeding courses while retaining the loops of a previously knitted course thereon, and then restoring these same alternate needles to action in still another succeeding course to form stretched loops which skip one or more courses in alternate wales.

27. That method of knitting a seamless stocking on a circular independent needle knitting machine which comprises continuously rotating the cylinder to knit a plurality of courses by continuous rotary knitting, feeding a plurality of yarns to the needles simultaneously at spaced points, elevating spaced groups of needles so as to cause the needles in at least one first group to take a first yarn from a first feeding point and then successively lowering the first group so as to miss a second feeding point and then forming stitches with the first group while floating a second yarn back of the needles which take said first yarn, causing second groups of needles adjacent the first group to remain at a lower elevation so as to miss the yarn from the first feeding point and then successively raising the second groups of needles to take the second yarn from the second feeding point and then successively lowering the second groups of needles and forming stitches therewith while floating the first yarn back of the second groups of needles during continuous knitting, varying the number of needles which take the various yarns from course to course during knitting, elevating certain needles at the junctures of the first and second groups to take the yarns from both feeding points and then lowering said certain needles and forming overlapping stitches therewith in the fabric at each edge of each group of needles, also withholding certain other alternate needles at the edges of adjacent groups of needles from knitting for one or more succeeding courses while retaining the loops of a previously knitted course thereon, and then knitting with these same alternate needles in still another succeeding course to form stretched loops which skip several courses in certain alternate wales.

28. That method of knitting a seamless stocking on a circular independent needle knitting machine which comprises continuously rotating the cylinder to knit a plurality of courses by continuous rotary knitting and feeding a plurality of yarns to the needles simultaneously at spaced points and successively elevating and lowering spaced groups of needles so as to cause the needles in a first group to take and knit a first yarn while floating a second yarn back of the needles which take said first yarn, causing the first group of needles to remain at a lower elevation so as to miss the first yarn from the first feeding point and then successively raising and lowering the first group of needles to take and knit the second yarn from a second feeding point, successively raising and lowering a second group of needles adjacent the first group to take and knit at least one yarn from the first feeding point and to float the second yarn back of the second group of needles during continuous knitting, interknitting both yarns in the fabric at each edge of each group of needles, varying the number of adjacent needles in each group which take and knit each yarn in different courses, also withholding from knitting certain alternate needles at the edges of adjacent groups of needles for one or more succeeding courses while retaining the loops of a previously knitted course thereon, and then knitting with these same alternate needles in still another succeeding caurse to form loops which skip several courses in certain alternate wales.

29. In a circular knitting machine having a rotary needle cylinder provided with a plurality of vertically movable latch needles, and also having spaced means adjacent the needle cylinder for feeding at least two yarns to needles passing the same at a given height, means for presenting one of the yarns to selected needles spaced a substantial distance apart from each other during knitting of a particular course for knitting the yarn therewith and floating the other yarn back of these needles, means for knitting at least one succeeding course wherein certain

of the spaced needles are withheld from knitting but retain the loops of said particular course thereon, means for knitting a course subsequent to said succeeding course or courses wherein said certain of the spaced needles again take and knit the same yarn to form tuck-stiches which skip more than one course between the points at which they are knitted into the fabric, and means for repeatedly varying said certain of the spaced needles on each side of a given needle from one group of courses as defined by the last-named tuck-stitches to succeeding similar groups of courses to thereby form designs having marginal areas defined by angularly extending rows of tuck-stitches.

30. In a circular knitting machine having a rotary needle cylinder provided with a plurality of vertically movable needles and also having means for feeding a plurality of yarns to the needles, means for knitting a first group of successive courses wherein certain alternate needles retain the loops of a previously knitted course thereon but are withheld from knitting in the first group of courses, means for knitting a succeeding second group of courses wherein the certain alternate needles draw stitches, means for causing certain other alternate needles adjacent the first-named alternate needles to be withheld from knitting during the knitting of at least the first course of the second group of courses while retaining the loops of a previously knitted course of the first group of courses thereon, and means for causing said certain other alternate needles to draw stitches during the knitting of one of the courses in the second group of courses to thus form loops which skip more than one course in overlapping relation to adjacent loops which skip at least one course between the points at which they are knitted into the fabric.

31. In a circular knitting machine having a rotary needle cylinder provided with a plurality of vertically movable needles, a pattern jack disposed beneath each of the needles, a plurality of selector fingers for acting upon the lower portions of the pattern jacks and a selector drum having pattern means thereon for controlling movement of the selector fingers; the combination of a first and a second yarn feed station spaced apart from each other adjacent the needle cylinder, cam means for actuating jacks, according to selection by the selector fingers, for successively elevating and lowering at least one selected needle for taking two yarns one from each of the yarn feed stations and drawing overlapping stitches therewith, cam means for actuating jacks, according to selection by the selector fingers, for elevating at least one given needle adjacent opposed sides of the first-named needle so as to cause their latches to pass above the planes of both yarn feed stations and to retain the loops of a previously knitted course thereon, other cam means for actuating jacks, according to selection by the selector fingers, for successively elevating and lowering groups of needles adjacent opposite sides of said given needles to where they will take and knit the yarn from either of the yarn feed stations independently of the other, means for transmitting step-by-step rotation to the selector drum in timed relation to rotation of the needle cylinder so as to effect a change in the position of the selector fingers for engaging the pattern jacks, and pattern controlled means for varying the time at which a step in rotation is imparted to the selector drum relative to a revolution of the needle cylinder so as to permit a change in patterning during a single course and so that pattern jacks immediately adjacent one another may be varied as to the positions of the lower ends thereof inwardly and outwardly with respect to the needle cylinder.

32. In a circular knitting machine having a rotary needle cylinder provided with a plurality of vertically movable needles, a pattern jack disposed beneath each of the needles, a plurality of selector fingers for acting upon the lower portions of the pattern jacks and a selector drum having pattern means thereon for controlling movement of the selector fingers; the combination of a first and a second yarn feed station spaced apart from each other adjacent the needle cylinder, cam means for actuating jacks, according to selection by the selector fingers, for elevating and then lowering at least one selected needle for taking two yarns one from each of the yarn feed stations and to draw overlapping stitches therewith, cam means for actuating jacks, according to selection by the selector fingers, for elevating at least one given needle adjacent opposed sides of the first-named needle so as to cause their latches to pass above the planes of both yarn feed stations to thereby retain the loops of a previously knitted course thereon, and other cam means for actuating jacks, according to selection by the selector fingers, for successively elevating and lowering at least some of the needles adjacent opposite sides of said given needles to where said some of the needles will take and knit the yarn from either of the yarn feed stations independent of the other.

33. That method of knitting a stocking on a circular knitting machine having stitch cams which comprises elevating certain needles to a predetermined position for taking one yarn and passing the needles through the stitch cams to form stitches therewith while floating another yarn back of the elevated needles in knitting a given course, elevating alternate needles to such an elevation as to cause the alternate needles to pass above the stitch cams during the knitting of at least one subsequent course and elevating these same alternate needles to said predetermined position on a course succeeding said subsequent course and passing these needles through the stitch cams so as to interknit the loops carried by these needles, which were formed in said given course, with the loops formed in the course succeeding said subsequent course.

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