Dec. 31, 1935. W. N. TAGGART 2,025,913

PATTERN YARN FEEDING MECHANISM FOR KNITTING MACHINES AND METHOD OF OPERATING SAME

Original Filed Nov. 1, 1929 3 Sheets-Sheet 1

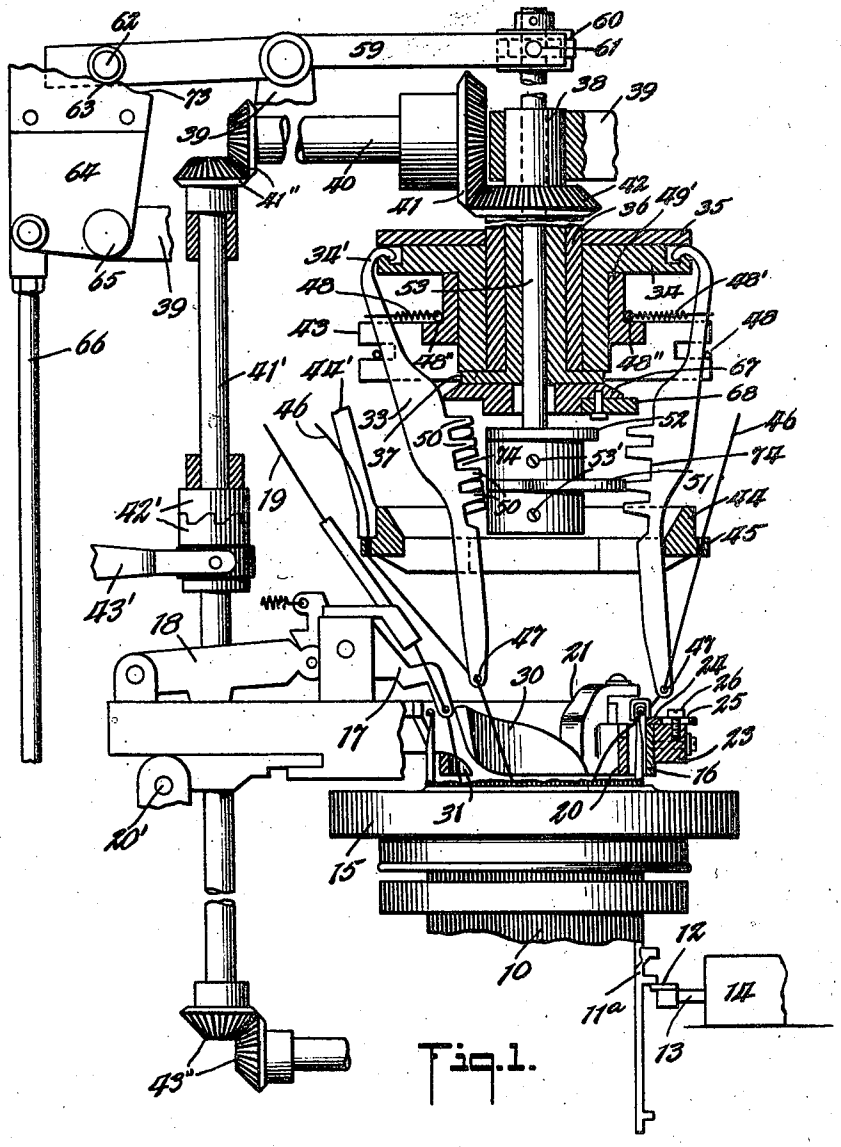


Fig. 1.

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Fig. 2.

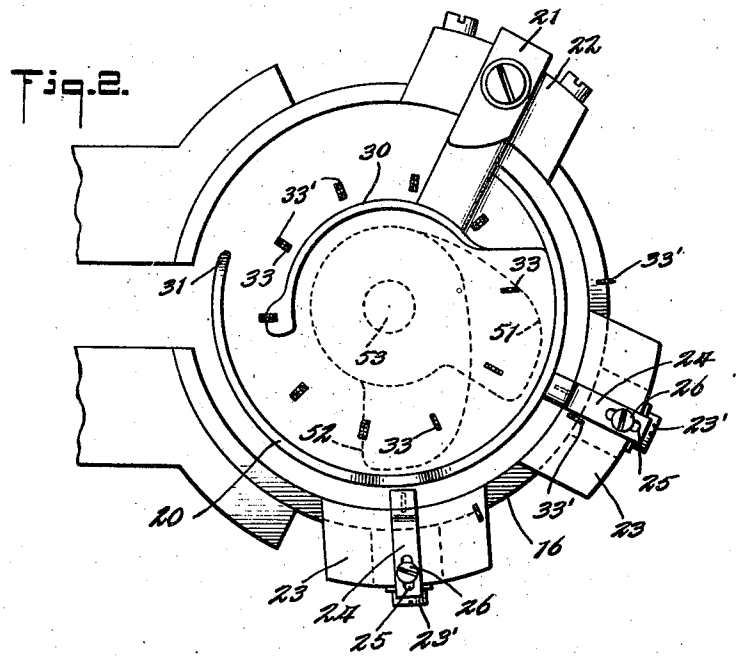
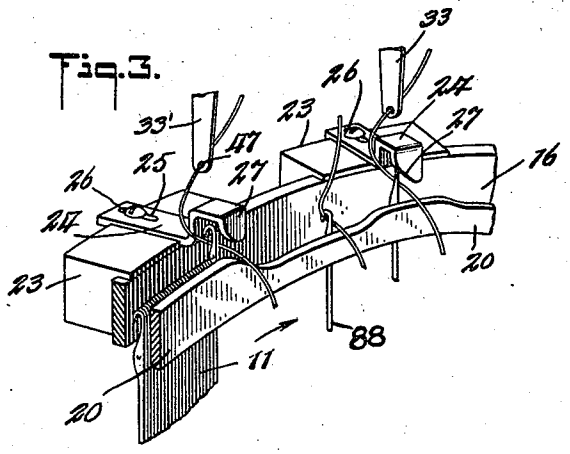


Fig. 3.



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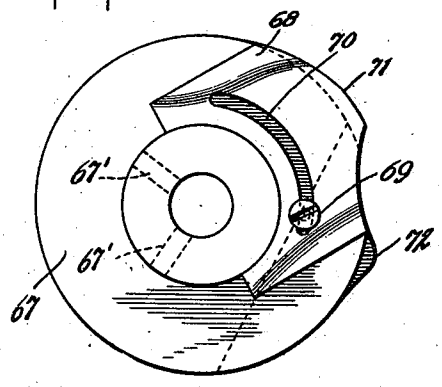
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Fig. 4.



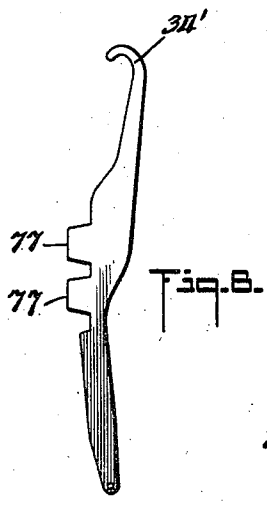


Fig. 8.

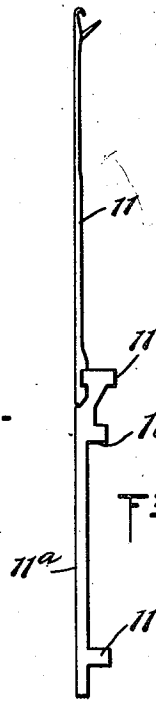


Fig. 7.

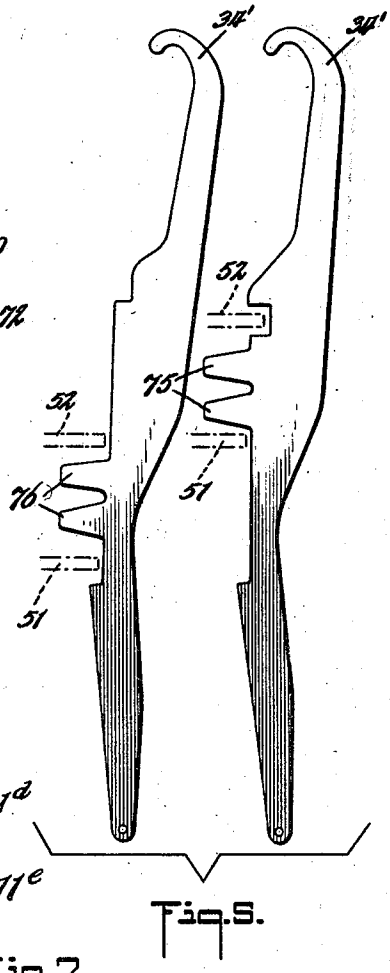


Fig. 5.

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UNITED STATES PATENT OFFICE

2,025,913

PATTERN YARN FEEDING MECHANISM FOR KNITTING MACHINES AND METHOD OF OPERATING SAME

William N. Taggart, Manoa, Pa., assignor, by mesne assignments, to Standard Trump Bros. Machine Co. Inc., a corporation of Delaware

Original application November 1, 1929, Serial No. 404,024. Divided and this application August 29, 1931, Serial No. 560,153

28 Claims. (Cl. 66—135)

My invention relates to pattern yarn feeding mechanism for circular knitting machines and it is an object thereof to provide improved means for making vertical stripes in the fabric produced thereon, as well as other patterns and embroidery effects. This machine is of the type in which the patterning is produced by introduction of a separate extra yarn at each point where the pattern is desired. The selection of the needles around which the pattern yarns are to be laid can be accomplished by raising the selected needles to a higher level than the others. The patterning yarns are supplied by yarn guides which pass the yarns across the needle circle from inside to out and back again.

This is a division of my application Serial Number 404,024, filed November 1, 1929. This application relates to the abutment broadly. Combination claims including the abutment and also other features shown herein are found in said parent application Ser. No. 404,024.

Referring to the drawings, which are made a part of this application and in which similar reference characters indicate similar parts:

Fig. 1 is an elevation, partly in section, showing part of a circular knitting machine with my invention applied thereto;

Fig. 2, a plan of the same with parts omitted;

Fig. 3, a detail illustrating the method of supplying the pattern yarn to the needles;

Fig. 4, a detail showing a plan of a cam;

Figs. 5 and 6, detail elevations of modified forms of yarn fingers; and

Fig. 7, an elevation of a needle and jack.

In the drawings, reference character **10** indicates a needle cylinder rotating in a clockwise direction as the machine is shown in Fig. 2, and having needles **11** in its slots as usual, which needles are elevated and depressed by conventional needle knitting cams (not shown). In addition to such needle cams I provide special cams **12**, one for each point where needles are to be specially elevated, these cams being mounted on stems **13** movable radially in bearings **14** by suitable pattern mechanism. Jacks **11***a* are located in the needle slots underneath all the needles, or only below certain ones if preferred. The jacks have butts **11***b* coacting with the abovementioned conventional needle raising and lowering cams of any desirable or conventional character for causing the knitting. The jacks also have patterning butts **11***c* and **11***d* at different levels for coacting with the special elevating cams **12**. As indicated the patterning butts are of different lengths and they may vary widely in each series, so as to raise needles in varying numbers and in varying sequences according to the positions of the special lifting cams **12** (only one of which is shown in the drawings). In practice it has been found that jacks with upper butts of six different lengths and lower butts of six different lengths can be used with two of the special raising cams **12** described and that such jacks work in satisfactory manner. Obviously this enables me to make a great variety of patterns in the fabric. For example, a long butt jack can be aranged at the middle of a group of several jacks with shorter butts whereby in one position of cam **12** only that needle is raised which is above the long butt jack and in another position both the long butt jack and the medium butt jacks raise their needles into yarn taking position. Many other arrangements will suggest themselves to those skilled in the art.

The machine is supplied with a sinker ring **15**, a latch ring **16**, one or more main yarn guides **17** and operating means for said guides including levers **18**, all of which may be of any conventional or desirable character. By the term main yarn as here used I intend to designate any yarn which may be used in the body of a stocking or in any part thereof, e. g., one of several yarns for making horizontal stripes, splicing yarns or some other yarn or yarns not intended for my special yarn fingers hereinafter described, one such main yarn being indicated at **19**.

For the purpose of permitting the striping or patterning yarn to enter the selected needles only and to prevent it entering the needles not selected, a guard **20** is mounted inside the needle circle. This guard is shown as a segmental ring or apron beginning shortly after the knocking over point and ending at point **31** just prior to the knocking over point. The upper edge of this ring is formed as a cam of which certain parts are high to lift a pattern yarn or yarns above the needles not specially elevated at that point to take such pattern yarn or yarns. This ring or apron is supported by a bracket **21** (Fig. 1) secured to a block **22** mounted on the latch ring or other suitable support.

A specially formed separator **30** is secured to or formed integral with block **21** and extends around past the ending point **31** of the segmental ring or apron **20** thereby preventing interference between the pattern yarns and the main yarns or the guides therefor at the point where the main yarns are fed to the needles (see Fig. 1). A main yarn such as that indicated at **19**, when put out of action, is cut off by a yarn trap (not shown) which is located at the left hand side of

bracket 21 (shown in Fig. 2) and which forms no part of my invention herein claimed. The leading end of the separator 30 is spaced some distance radially inward from the end 31 of the segmental ring 20. The pattern yarns slide inside the lower inclined edge of the separator after they pass the point where they are taken by the needles and are held in idle position within the circle of needles.

One of the principal features of my invention is an element or abutment 24 extending across the needle circle at a distance from the main yarn feeding means and adapted to carry a pattern yarn into contact with the selected needles as the relative rotation between the needles and the abutment 24 takes place. Specifically the abutments 24 are shown as stationary and a pair of circumferentially adjustable blocks 23 held by screws 23' engaging horizontal slots in said blocks serve to support abutments 24 extending radially above and across the needle circle from their mounting outside the needle circle. Each abutment has a hook at its end providing a space through which specially elevated needles move as indicated in Figs. 1 and 3, in taking a pattern yarn. The other needles remain approximately at the level indicated at the left hand side of Fig. 3. The abutments 24 have slots at 25 to receive screws 26 whereby the abutments are attached to the blocks 23 with capacity for radial adjustment so that the recess or gateway for the hooks of the needles will be properly positioned to permit the needles to pass midway of the width of the recess and to prevent it from striking the abutment if it should be bent slightly at its upper end. The downwardly bent outer ends of the hook shaped portions of abutments 24 have inclined faces as indicated at 27 to cause the yarn to slide down past the abutments without being hung up or broken thereby. Preferably the blocks 22 and 23 are supported on the latch-ring so that the blocks and the parts carried thereby will be out of the way when the latch ring is swung back about its pivot 20'.

The means for laying the pattern yarns in the path of the abutments and the specially elevated needles comprises one or more yarn fingers here shown as arranged in closely-adjacent pairs 33, 33' having at their upper ends hooks by means of which they are held between two rotating plates 34 and 35 fixed to a hollow spindle 36 which is supported on a flange 37 of a sleeve 38 carried by a bracket 39 secured to the fixed framework of the machine in any suitable manner. A horizontal driven shaft 40 of the machine drives sleeve 36 through bevel gears 41 and 42. The shaft 40 is driven from a shaft 41' through bevel gearing 41''. The shaft 41' is in two sections adapted to be connected by a clutch 42' through the medium of a lever 43' operated by any suitable pattern mechanism to throw out the clutch at the time when the needle cylinder starts to reciprocate for making heels and toes, at which time the pattern yarn fingers are not operated but are held in idle position by springs hereinafter described. The shaft 41' is driven from a constantly rotating shaft of the machine through suitable connections indicated at 43'' (Fig. 1).

The pattern yarn fingers are guided for radial movement by means of a slotted ring forming guides and supported on said sleeve 36, the guides being indicated at 43. An open ring 44 having inwardly facing guiding slots for the lower ends of the fingers has passages at 45 for the pattern yarns 46 which are led through these passages and then to the eyes 47 at the lower ends of the yarn fingers. The ring 44 is supported by arms 44' depending from a bobbin stand (not shown) arranged between the plate 35 and the gear 42, it being understood that the gear 42 is at a considerable distance above plate 35. Each pattern yarn finger is drawn toward idle position by means of an individual coil spring 48', such coil spring being connected to its finger in any suitable manner, as by means of a hook encircling the pattern yarn finger and being connected at its inner end to a suitable part such as a ring 48'' surrounding a collar 49' which forms part of the fixed frame of the machine. A precautionary spring ring 48 serves to hold the yarn fingers away from abutments 24 in case of failure of one of the springs 48'. It is to be noted that these yarn fingers have a radial movement only relatively to the needles, i. e., they do not move about a needle or group of needles in laying a pattern yarn around the same, their action being supplemented by abutments 24 for this purpose. Circumferentially the yarn fingers are just in advance of the group of needles around which their yarns can be wrapped.

The pattern yarn fingers are provided near the middle of their length with butts or projections 50 which serve as followers for cams 51 and 52, such cams being arranged in any suitable number on a shaft 53 passing upward through sleeve 38 and being secured thereto by set-screws 53' or the like to permit adjustment of the cams about the shaft. The shaft 53 is pivotally connected at its upper end to a lever 59 by means of a collar 60 and a yoke indicated at 61. This lever 59 is pivoted intermediate its ends to the fixed bracket 39. The lever 59 has a follower 62 at the opposite end of the lever from the collar 60 resting on a cam surface 63 on a pattern element 64 pivoted at 65 to the bracket 39 and having pivotally connected thereto a rod 66 operated by a pattern chain or pattern drum to move the cam 64 about its axis and so cause the lever 59 to swing on its pivot, thereby raising or lowering shaft 53 and its cams 51 and 52 so as to vary the operation of the pattern yarn fingers due to the fact that different followers on the yarn fingers will be engaged by the cams at their various elevations.

It is desirable to move the special yarn fingers outward into the neighborhood of the needle circle before they are actually caused to cross the needle circle by their respective cams 51 and 52. For this purpose I have provided at a point above the cam 52 a support 67 (Figs. 1 and 4). This support comprises a cylindrical portion with threaded holes at 67' for set-screws to hold it on shaft 53 and an overhanging flange, as shown in Fig. 1. A plate 68 is secured to the support 67 by means of a clamping screw 69 passing through a slot 70, said plate having an outwardly projecting cam portion 71 (Fig. 4). This plate is so arranged as to give a preliminary outward movement to a pattern yarn finger which is to be engaged and moved fully out by plate 51. If the plate were not provided the finger would be thrown out with undue speed and suddenness from which damage to the mechanism or an imperfect pattern in the fabric might result. Another cam plate having a cam 72 is secured to the support 67 in proper relation for pre-advancing pattern yarn fingers which are to be engaged and operated by cam 52. After the fingers have passed the respective pre-advancing and main actuating cams they are pulled back suddenly to idle position by individual springs 48'.

The butts or followers **50** on each pattern finger are shown in the drawings as spaced from each other a distance at least equal to the width of a follower and in Fig. 1 each follower on one finger of the pair is staggered with relation to the same follower of the other finger. In addition the followers are shown with a gap **74** between each such staggered pair of followers. In Fig. 1 each pattern yarn finger is shown as having two pairs of followers and the other finger of the pair has followers lying opposite the spaces in that first named finger, so that according to the up and down adjustment of the cams **51** and **52** such cams will either engage followers on one of the pattern yarn fingers of a pair or on the other according to the desired pattern, unless the shaft **53** is elevated or depressed to such an extent as to bring the upper cam above the plane of all the followers or to bring the lower cam below the plane of all the followers and the other cam opposite gap **74**.

In Fig. 2 there are shown ten pairs of pattern yarn fingers and by means of these fingers patterns can be made at ten or more intervals about a stocking or the like, which patterns may of course be interrupted as desired so as to form interrupted stripes or mere spots or any other desired designs. The width of a figure may be varied by circumferential adjustments of blocks **23** or cams **51** and **52**, by changing the arrangement of the various sized butts on the jacks or by moving the special jack cams inward to a greater or less extent according to their pattern control, thereby changing the number of needles to be specially elevated according to the pattern desired. By having the fingers arranged in pairs a finger **33** may for example control a white yarn and a finger **33'** may control a red yarn. If now the body of the stocking be of some other color, a pattern may be produced consisting alternately of red yarn and white yarn. As the pattern yarns supplied to specially elevated needles can be changed at any rotation of the machine such changes may take place as often as desired, and the number of colors following each other in the same wales can also be increased by increasing the number of closely-adjacent pattern yarn fingers. It is not desirable that the patterns should continue through the heel or toe of a stocking and usually they are not desired in the sole of the foot. In knitting heels and toes by reciprocation, as usual, or in plain knitting where no patterns are desired, the pattern mechanism moves the cam plate **64** counter-clockwise to a point where the roller **62** engages the low part at **73** of the cam surface **63**, whereby cam **52** will pass above the uppermost follower **50** on each pattern yarn finger and cam **51** will pass through the space between the upper and lower pairs of said followers, which is widened for this purpose as indicated at **74** in Fig. 1. For the reason set forth none of the pattern yarn fingers will be oscillated radially and no patterns will be made thereby. It should be noted that the oscillating cam plate **64** has five positions for roller **62**, corresponding to the necessary number of positions of cams **51** and **52** for operating or idling the pattern yarn fingers. It is within the bounds of my invention to group more than two pattern yarn fingers at each pattern position. Also a larger number of steps may be provided on oscillating cam plate **64** and the arrangement of followers on the pattern yarn fingers may be correspondingly varied, e. g., by providing three pairs of followers on each finger, etc.

For knitting a stocking with patterns in the leg and instep but not in the heel, toe or sole, pattern yarn fingers such as shown in Fig. 5 are used in the section of the needle circle corresponding to the heel, toe and sole. It will be seen that the upper pair of followers **75** is the same as the upper pair of followers on the corresponding fingers of the pairs shown in Fig. 1, while the followers **76** are the same as the lower pair on corresponding fingers of the pairs shown in Fig. 1. The cams **51** and **52** being positioned either at a low point as indicated at the left hand of Fig. 5 or at a high point as indicated at the right of said figure, the two pattern yarn fingers as shown in Fig. 5 and all similar pattern yarn fingers in the heel section will not be operated by the cams **51** and **52** but the operation of the instep pattern yarn finger like those in Fig. 1 may be continued. This makes a sole without pattern, but patterns may be placed in the sole if desired, leaving the heel and toe plain, merely by unclutching the clutch **42'** during the heel and toe.

In Fig. 6 I have shown a pattern yarn finger having only two followers **77** instead of two pairs of followers with a space between them as shown in Fig. 1. Such a pattern yarn finger may be used where a one-color pattern is to be made throughout the length of the stocking, the advantage of this finger being that it is cheaper to make and the single follower wears longer and is less liable to be bent or damaged than the narrower followers of a pair on the fingers in other figures.

In the operation of forming a pattern according to the disclosure of Figs. 1 to 4 it will be seen that as the needles, the pattern yarn fingers and the bobbin stand rotate, a selected pattern yarn finger will first be moved radially by its preadvancing cam and then by either one of cams **51** and **52** so as to lay its yarn between a specially elevated needle or needles and the hooked end of abutment **24**. A needle or a group of needles being elevated into position to pass through the recess in said hook portion of abutment **24**, the first of such needles will strike against the yarn which is held in proper position by the hook, and the pattern yarn is carried on through said hook by such needles. Immediately thereafter the cam **51** or **52** releases the pattern yarn finger **33** which returns to its position near the center of the needle circle and the rearmost portion of the bight of yarn laid about the needle or needles will slide over the abutment **24** and down the incline **27** and be held by the retracted needle in the position indicated in connection with the needle **88** in Fig. 3. It will be observed that the abutment not only serves to hold or sweep the yarn against the selected needle or needles and past them, but also holds the yarn behind the selected needle or needles while the yarn finger is bringing the yarn back across the circle to the inside. The abutment also serves to guide the portions of yarn projecting inwardly from the needle to the yarn finger down the shank of the needle by virtue of portion **27**.

It will be obvious to those skilled in the art that various modifications may be made in my device without departing from the spirit of the invention and therefore I do not limit myself to what is shown in the drawings and described in the specification but only as indicated in the appended claims. It will be obvious also that patterns of many varieties may be made. As one example of such pattern a stripe may be

made in one color said stripe being interrupted at intervals by wider spots of a different color, the yarns for said spots being provided by one of two juxtaposed pattern yarn fingers and the yarn for the balance of the stripe by the other. This is merely one illustration of a possible pattern as it will be obvious to those skilled in the art that many other patterns may be made by varying the position of the cams 51, 52, the lengths of jack butts, the position of cams 12, etc. Thus, for example, by juxtaposing three or more pattern yarn fingers a narrow stripe may show several colors in succession.

Where in the claims I speak of a yarn behind the selected needles, I refer to a position at the following side of the needle considered in the direction of movement of the moving element. Similarly where in the claims I speak of laying a yarn in front of a selected needle, I refer to the leading side.

It will also be obvious that the invention is applicable to circular knitting machines, whether it is the needle cylinder or the cam cylinder which revolves. It is immaterial whether the relative movement of the needles and abutment be caused by the rotation of the needles or of the abutment.

What I claim is:

1. A circular knitting machine having a circle of independent needles, means for raising needles selectively, and radially movable means for laying a pattern yarn in front of a needle or needles thus raised, in combination with an element having circumferential movement relatively to the needles and adapted temporarily to hold against said raised needles the pattern yarn laid in front of the latter, while the radially movable means keeps its circumferential relation to the needles unchanged.

2. A circular knitting machine having a circle of independent needles, means for raising needles selectively, and radially movable means for laying a pattern yarn in front of a needle or needles thus raised, in combination with an element having circumferential movement relatively to the needles and adapted to contact with and wrap under the hooks of said raised needles the pattern yarn laid in front of the latter.

3. A circular knitting machine having a rotary circle of independent needles, means for raising needles selectively, and a radially movable yarn finger for laying a pattern yarn in front of a needle or needles thus raised, in combination with an element having circumferential movement relatively to the needles adapted to contact with the pattern yarn laid in front of the latter, bring it into contact with said needles and wrap same under the hooks of said needles when the yarn finger is retracted.

4. In a circular knitting machine a rotary circle of independent needles, a main yarn finger, means for raising needles selectively at a point on the needle circle different from said main yarn finger and a plurality of pattern yarn fingers adapted to rotate with said needles and lay yarns in front of needles thus raised, in combination with a stationary element adjacent the needle circle adapted to contact with and arrest temporarily the rotation of the yarn laid in front of the selected needles until caught under the hooks of said needles.

5. The combination in a circular knitting machine, of a rotary circle of independent needles, means for selectively raising the needles, an abutment for contacting with the yarn extending across the needle circle and providing a recess for passage of elevated needles, and radially movable means for laying a pattern yarn between an elevated needle and said abutment and retracting same, said abutment and radially movable means cooperating to wrap said wrap yarn around selected elevated needles.

6. In a circular independent needle knitting machine having a rotary needle cylinder and main yarn guiding means, a special needle cam for raising needles selectively at a distance from said main yarn feeding means, a stationary abutment extending across the needle circle and lying at least partly outside the circle, a plurality of juxtaposed pattern yarn fingers revolving with the needle cylinder, means for oscillating said pattern yarn fingers in planes radially of the machine whereby a yarn is laid across said abutment in position to be taken by a selectively raised needle, and pattern means for predetermining the order of action of said pattern yarn fingers, said pattern means including followers at different elevations on said pattern yarn fingers.

7. In a circular independent needle knitting machine having needle-operating cams, a rotary needle cylinder and a main yarn guiding means, one or more stationary abutments extending across the needle circle at a distance from said main yarn guiding means and lying at least partly outside the circle, means for elevating selected needles before they pass said abutments, a pattern yarn finger adjacent the needle circle revolving with the needle cylinder, means for moving said pattern yarn finger in a plane extending radially of the machine so as to lay its yarn across an abutment between it and an elevated needle, and means for returning the finger to a position inside the needle circle after the yarn is engaged by such needle, substantially as set forth.

8. In a circular knitting machine a rotary circle of independent needles, a main yarn finger, means for raising needles selectively at a point on the needle circle different from said main yarn finger and a plurality of pattern yarn fingers adapted to rotate with said needles and lay yarns in front of needles thus raised, in combination with a stationary element adjacent the needle circle and lying at least partly outside the circle, adapted to arrest temporarily the rotation of the yarn laid in front of the selected needles until caught under the hooks of said needles, and means adapted to operate said pattern fingers selectively to cause the laying of different yarns in front of the same needles in successive courses.

9. In a circular knitting machine, a circle of independent needles, a main yarn finger, means for raising at a point on the needle circle different from said main yarn finger needles selected from a segment of the circle of needles, and means for raising at another point a different selection of needles from the same segment, in combination with a plurality of pattern yarn fingers adapted to lay different yarns across the needle circle at the two points selectively for engagement in the same course by needles selected from the same segment, and a plurality of stationary elements lying at least partly outside the needle circle adapted to arrest the movements of the pattern yarns temporarily until engaged by the selected needles.

10. In a circular knitting machine having a rotary needle cylinder, needle cams and main yarn feeding means, a pattern-controlled jack elevating cam for selectively raising needles at a dis-

tance from said main yarn feeding means, one or more abutments for contacting with the yarn mounted outside and extending across the needle circle, having such movement relative to the needles as will cause each to pass all the needles, pattern yarn fingers pivotally supported above said needles, means for moving said pattern yarn fingers selectively outward to lay pattern yarns between said abutments and needles elevated by said pattern controlled cam, and pattern means for controlling the action of said pattern yarn finger moving means.

11. In a circular knitting machine a rotary circle of independent needles, means for raising needles selectively at a point on the needle circle and a plurality of pattern yarn fingers adapted to rotate with said needles and lay yarns in front of needles thus raised, in combination with a stationary element adjacent the needle circle adapted to arrest temporarily the rotation of the yarn laid in front of the selected needles until caught under the hooks of said needles, and means adapted to operate said pattern fingers selectively to cause the laying of different yarns in front of the same needles in successive courses.

12. A method of forming designs in fabric knit on a circular independent needle knitting machine comprising the steps of leading a wrap yarn from one element across the needle circle in front of an elevated needle and holding the yarn temporarily against said elevated needle by contact of the yarn with a second element having movement past the entire circle of needles while the first element maintains its circumferential relation with the needles unchanged, causing the two elements to cooperate in finishing the wrapping of the pattern yarn by leading the wrap yarn back across the needle circle.

13. In a circular knitting machine, a circle of independent needles, means for raising needles selectively and a yarn finger movable radially for laying a pattern yarn in front of a selected needle, in combination with an element having circumferential movement relatively to the needle and adapted to guide the pattern yarn across the circle behind the selected needles when the yarn finger moves back across the needle circle.

14. In a circular knitting machine, a circle of independent needles, means for raising needles for wrapping, and a yarn finger adapted to lay a pattern yarn across the needle circle and return, it having no circumferential movement relative to the needles, in combination with an element lying across the needle circle having circumferential movement past the entire circle of needles and adapted to sweep a pattern yarn laid across the circle, against and past a selected needle or needles, and hold it there until the yarn finger has returned it across the needle circle.

15. In a circular knitting machine, a circle of independent needles, means for raising needles at a point on the needle circle and a plurality of pattern yarn fingers adapted to rotate with said needles and lay yarns across the circle in front of a needle or needles thus raised, in combination with an element adjacent the needle circle having movement relatively to the needles adapted to arrest temporarily the rotation of the yarn laid in front of the selected needles until caught under the hooks of the latter and to guide the yarn behind the selected needles when the yarn finger brings it back across the circle.

16. A method of forming designs in fabric made on a knitting machine having a rotary circle of independent needles, comprising the steps of feeding a main yarn to said needles, leading a pattern yarn from a first element across the needle circle in front of an elevated needle, holding the pattern yarn temporarily against said elevated needle by contact of the yarn with a stationary second element while the first element continues to travel with the needles, and leading the pattern yarn back across the needle circle.

17. A method of forming designs in fabric made on a knitting machine having a rotary circle of independent needles, comprising the steps of feeding a main yarn to said needles, leading a pattern yarn across the needle circle in front of an elevated needle, said yarn being fed from a yarn finger rotating with the needles, holding the yarn temporarily against movement with said elevated needle without altering the movement of the yarn finger by contacting said yarn with an element passed by all the needles and leading said pattern yarn back across the needle circle after passage of said elevated needle.

18. In a circular independent needle knitting machine having needle operating cams, a revolving needle cylinder, a circle of independent needles in said cylinder, circumferentially stationary main yarn guiding means, means for selecting needles vertically, one or more pattern yarn fingers having butts directed radially inward, a support for said pattern yarn fingers, means for rotating said support in timed relation with the needle cylinder, and non-revoluble cams for the butts on said fingers adapted to move said fingers radially outward to lay their yarns across the needle circle, in combination with non-revoluble means acting directly on yarns laid across the needle circle to wrap said yarns about selected needles.

19. In a circular independent needle knitting machine having needle operating cams, a revolving needle cylinder, a circle of independent needles in said cylinder, a circumferentially stationary main yarn guide, means for elevating selected needles to be wrapped, one or more pattern yarn fingers and a support for said pattern yarn fingers, in combination with means for rotating said support in timed relation with the needle cylinder, non-rotary cams for causing the pattern yarn fingers to lay their yarns radially across the needle circle, stationary means contacting with the yarns from the pattern yarn fingers to lay them about selected needles, and means for adjusting said cams up and down to vary the action thereof on said fingers.

20. A method of forming designs in fabric knit on a circular independent needle machine, comprising the steps of leading a plurality of wrap yarns each fed from its own element across the needle circle each in front of its own group of one or more elevated needles in succession, and subsequently leading the yarns back across the needle circle in contact with a second element acting on all the yarns in succession, which latter pushes the yarns behind the elevated needle or needles associated with that particular yarn.

21. A method of forming designs in fabrics knit on a circular rotating independent needle machine, comprising raising a needle selectively for wrapping, causing a yarn finger rotating with the needle circle to lay a pattern yarn across the needle circle in front of the selected needle, then arresting the yarn till it has passed a plurality of needle positions and caught in the selected needle without arresting the yarn finger, and selecting a different needle to be raised and wrapped by the same yarn on a subsequent course.

22. In a circular knitting machine, the combi-

nation of a rotary circle of independent needles, means for raising needles selectively for wrapping, a plurality of pattern yarn fingers pivotally supported above the needles, and means for rotating said fingers with the needles, in combination with one or more abutments mounted radially outside the needle circle for contacting with the wrap yarns, there being relative movement between the abutment on the one hand and the needles and pattern yarn fingers on the other hand, and means for oscillating the fingers selectively to lay pattern yarns between an abutment and an elevated needle for the purpose of wrapping.

23. A circular knitting machine having a rotary circle of independent needles, means for selectively raising the needles for wrapping, a plurality of yarn fingers pivotally supported above the needles, and a plurality of pattern yarn guides pivotally supported above the needles, said fingers rotating with said needles, in combination with an abutment for contacting with the pattern yarns mounted on an element radially outside the needle circle, there being relative movement between the abutment and a plurality of pattern yarn guides, in combination with means for selecting the pattern yarn fingers to lay pattern yarns in front of the abutment whereby the latter will contact the yarn and arrest its movement until it is caught in a selected needle or needles.

24. A circular knitting machine having a rotary circle of independent needles, means for selectively raising the needles for wrapping, a plurality of yarn fingers pivotally supported above the needles, and a plurality of pattern yarn guides pivotally supported above the needles, said fingers rotating with said needles, in combination with an abutment for contacting with the pattern yarns mounted on an element radially outside the needle circle, there being relative movement between the abutment on the one hand and a plurality of needle positions and pattern yarn guides on the other hand, in combination with means for selecting the pattern yarn fingers to lay pattern yarns in front of the abutment whereby the latter will contact the yarn and arrest its movement until it is caught in a selected needle or needles.

25. In a circular knitting machine, a circle of independent needles, means for raising needles selectively and a yarn finger movable radially for laying a pattern yarn ahead of selected needles and back across the needle circle, in combination with an element adapted to contact with the yarn on the hook side of the needles selected and bring the yarn into contact with the needles for wrapping, said element having a portion inside the needle circle adapted to guide the yarn downwardly on the needles in back of the hooks, said yarn-contacting element and said circle of independent needles having relative movement past each other for causing the wrapping.

26. A method of forming designs in fabrics knit on a circular independent needle machine, comprising the steps of leading a wrap yarn fed from one element across the needle circle in front of an elevated needle or needles and causing the yarn to engage under the hooks of the needles by contact of the yarn with a second element, said second element and entire circle of needles passing each other on each revolution of the machine, and causing the first element to lead the yarn back across the needle circle, completing the wrapping, and then causing another needle or needles to be elevated and wrapped on the same revolution of the machine by another yarn and the same second element.

27. A method of forming designs in fabrics knit on a circular independent needle machine, comprising the steps of raising a plurality of needles selectively for wrapping, causing a yarn finger rotating with the needle circle to lay a pattern yarn in front of the raised needles, causing the yarn to contact with a second element and be wrapped around the raised needles by moving the raised needles past the said second element and then leading the yarn back across the needle circle.

28. In a circular knitting machine, a circle of independent needles, means for raising needles for wrapping, and an element lying across the needle circle, all the needles in the circle moving past said last-mentioned element on each revolution of the machine by virtue of movement of the needle circle, in combination with a yarn finger adapted to lay a pattern yarn between a raised needle or needles and said element lying across the needle circle, the yarn finger having no circumferential movement relatively to the needle circle, said element lying across the circle being adapted to hold a pattern yarn laid across the circle until the latter is engaged by the raised needles and returned across the needle circle by the yarn finger.

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