June 20, 1961 O. C. BRUCE 2,988,907

YARN GUIDING APPARATUS FOR CIRCULAR KNITTING MACHINES

Filed Sept. 16, 1960

FIG. 1

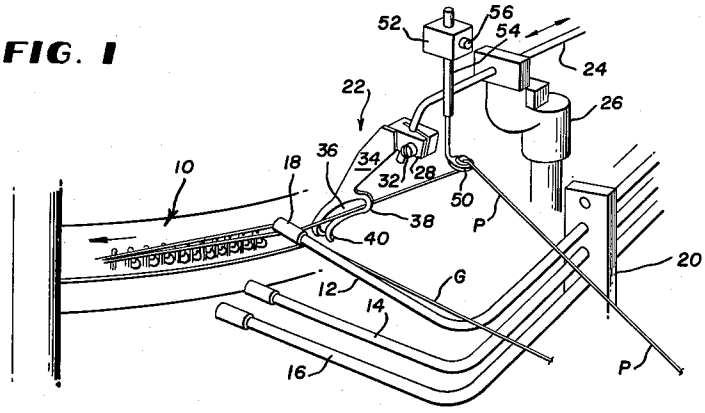


FIG. 2

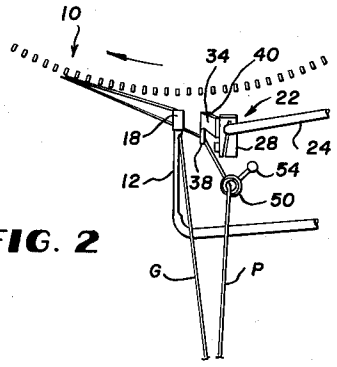


FIG. 3

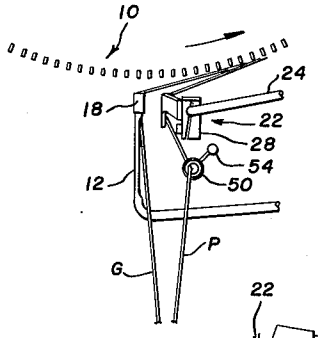


FIG. 4

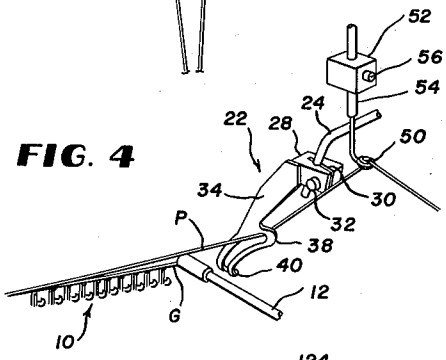


FIG. 5

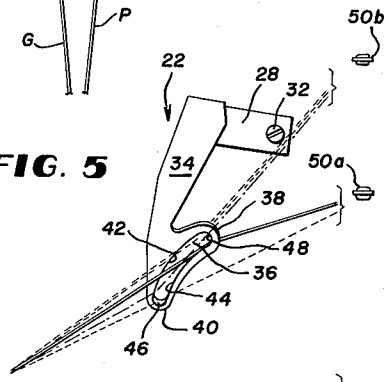


FIG. 6

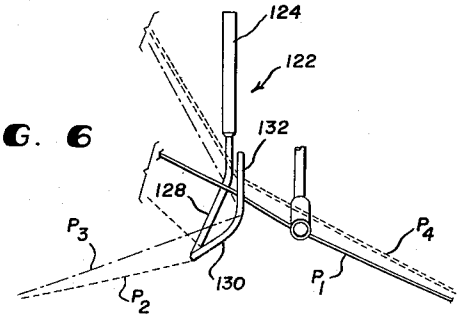
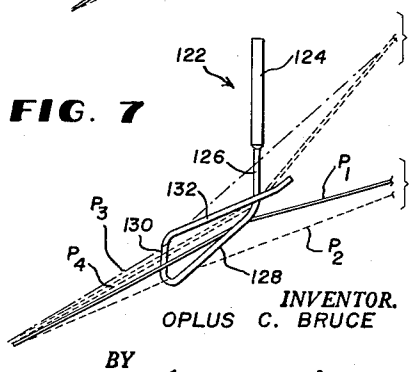


FIG. 7



INVENTOR.
OPLUS C. BRUCE

BY

Church & Church

ATTORNEYS

United States Patent Office 2,988,907
Patented June 20, 1961

2,988,907

YARN GUIDING APPARATUS FOR CIRCULAR KNITTING MACHINES

Oplus Clintus Bruce, Princeton, Ky., assignor to Princeton Hosiery Mills, Inc., Princeton, Ky., a corporation of Kentucky

Filed Sept. 16, 1960, Ser. No. 56,498
6 Claims. (Cl. 66—136)

This invention relates to yarn guiding apparatus for circular knitting machines, and more particularly to apparatus for guiding a plating yarn to a circular knitting machine during the plating of the heels and toes of circular knit hosiery.

The particular problem to which the invention is directed arises because of the shifting of the mode of operation of the circular knitting machine from a continuous unidirectional rotary motion during the knitting of the leg and instep portions of the stocking to a rotary oscillation during the knitting of the heel and toe of the stocking. Yarns are fed to the needle cylinder from yarn guiding fingers located at positions spaced from the circumference of the needle cylinder and, during the continuous unidirectional rotation of the cylinder, pass into tangency with the circumference of the cylinder at respective points dependent upon the location of the respective yarn guiding fingers. During continuous rotation of the cylinder in one direction, it is easy to control the point at which the respective yarns move into operative relationship with the cylinder. However, during the continuous reversals of direction of rotation of the cylinder while the heel or toe of the stocking is being knitted, the relative positions of the respective yarns to each other and to the periphery of the cylinder constantly shift. As a result, the yarns in the heel and toe present an undesirable, irregular appearance because the reversing of the cylinder causes an alternation of the yarns on the exposed surface. Where the yarns are of like material, this continuous shifting of relative relationship may be unimportant. However, in order to eliminate this undesirable appearance in a plated stocking, it is necessary that the plating yarn be fed to the needle cylinder in the same relationship to the conventional yarn regardless of the direction of rotation of the cylinder. To accomplish this, the plating yarn must be guided into operative relationship with the needle cylinder at a point in advance of the other or ground yarn regardless of the direction of rotation of the cylinder.

This particular problem has received the attention of several prior workers in this field. However, prior devices of which I am aware are usually quite bulky when compared with the size of a conventional yarn guiding finger and frequently require structural modifications of a permanent nature to existing portions of the machine. In many cases the prior devices are of quite complex structure and are intended to become a more or less permanent fixture on the machine. These characteristics interfere with the shifting of the machine upon which they are mounted from a plating operation to other types of knitting operations.

It is a primary object of the invention to provide apparatus for guiding a plating yarn to a circular knitting machine to maintain the yarn in the desired relationship to the needle cylinder during rotation of the cylinder in either direction which is of relatively small size and which may be easily moved into and out of operative relationship with the needle cylinder.

Still another object of the invention is to provide a plating yarn guide which may be employed to feed the plating yarn to the needle cylinder from either above or below the ground yarn while maintaining the desired

relationship between the yarns in both directions of rotation of the needle cylinder.

Other objects and features of the invention will become apparent by reference to the following specification taken in conjunction with the accompanying drawings.

In the drawings:

FIG. 1 is a perspective view showing a plating yarn guide member embodying the present invention in operative relationship with the needle cylinder of a circular knitting machine;

FIG. 2 is a plan view of the structure of FIG. 1;

FIG. 3 is a plan view similar to FIG. 2 showing the orientation of the yarns upon rotation of the needle cylinder in direction opposite that of FIGS. 1 and 2;

FIG. 4 is a perspective view, similar to FIG. 1, showing the feeding of the plating yarn to the cylinder from above the ground yarn;

FIG. 5 is a side elevational view of the plating yarn guide of FIGS. 1 through 4;

FIG. 6 is a front elevational view of a modified form of plating yarn guide; and

FIG. 7 is a side elevational view of the structure of FIG. 6.

Referring first to FIG. 1, the invention is shown being applied to a circular knitting machine of conventional construction. Since such machines are well known in the art, only a portion of the machine has been shown and many parts have been omitted since they do not have any direct cooperation with the invention. For purposes of illustration, it may be assumed that the invention is disclosed as being applied to a so-called "Komet" machine.

In FIG. 1, reference numeral **10** indicates a portion of the needle cylinder of the machine which, during operation, is driven in rotation about its central vertical axis by apparatus well known to those in the art. During the knitting of the leg and instep portion of the stocking, needle cylinder **10** is driven in one direction, while during the knitting of the heel and the toe portions of the stocking, needle cylinder **10** is driven in rotary oscillation. Other conventional parts of the machine customarily include a plurality of thread guiding fingers such as **12, 14** and **16** having tubular thread guiding bushings such as **18** fixedly mounted at the end of the finger adjacent needle cylinder **10**. Fngers **12, 14** and **16** are supported upon the machine frame as at **20** for movement into and out of operative relationship with needle cylinder **10**. In the usual case, a plurality of thread guiding fingers are employed during the knitting of the stocking, as in the case where different colored yarns are used, and the machine is provided with means for automatically advancing and retracting the fingers to and from their operative position to place the yarns in the stocking in a desired pattern.

One form of a plating yarn guide **22**, embodying the invention is shown in FIG. 1 as being mounted at the distal end of a support rod **24**. Support rod **24** is preferably mounted upon the machine frame by a support structure designated generally **26** which can be operated to advance and retract plating yarn guide **22** to and from operative relationship with needle cylinder **10**. The specific structure of the support means **26** does not form any part of the present invention since other than providing a support for plating yarn guide **22** in operative relationship with the needle cylinder, the structural details of the support means **26** have no influence on the operation of yarn guide **22**.

Yarn guide **22** includes a clamping block **28** provided with a slot **30** which may be expanded or compressed by a screw **32** to removably mount block **28** on the end of support rod **24**. A plate **34** of sheet material is fixedly

secured at its upper end, as by welding, to block 28 and is formed with an elongate arcuate opening 36 which extends between upper and lower tip portions 38 and 40 projecting from the general outline of the lower portion of plate 34.

Opening 36 is of a generally arcuate configuration, having spaced elongate front and rear side walls 42 and 44 which curve upwardly and then outwardly away from needle cylinder 10 from a lower end wall 46 to an upper end wall 48. The lower tip portion of plate 34 is bent inwardly toward block 28 so that the lower end of opening 36 is offset laterally toward the block from the upper end of opening 36.

Plating yarn guide 22 thus provides a plating yarn guide opening 36 having curved side walls 42 and 44 which, when guide 22 is in its operative position relative to needle cylinder 10, are inclined downwardly toward the periphery of the needle cylinder and are also inclined circumferentially of the needle cylinder so that with respect to the periphery of needle cylinder 10, the upper end of opening 36 is radially, circumferentially, and vertically offset from the lower end of the opening at tip portion 40.

Opening 36 is operative to selectively guide plating yarn P to the needle cylinder to pass into operative relationship to the needles of the cylinder either from above or from below a ground yarn G guided to needle cylinder 10 by guide finger 12. Selective control of feeding plating yarn P from above or from below ground yarn G is accomplished by varying the position of a guide eye 50 through which plating yarn P passes to plating yarn guide 22. Guide eye 50 is supported for vertical adjustment relative to plating yarn guide 22 by a clamping block 52 suitably supported upon the machine frame which receives an elongate shank 54 attached to guide eye 50 for sliding vertical movement. Shank 54 is locked to block 52 at the selected vertical position by means of a clamping screw 56 threadably received in block 52.

In FIGS. 1, 2 and 3, the structure is shown disposed to feed plating yarn P to needle cylinder 10 from below ground yarn G. Both plating yarn P and ground yarn G pass from supply spools (not shown) to the needle cylinder through conventional yarn tensioning mechanisms (not shown). Guide finger 12 is positioned with its bushing 18 spaced slightly radially outwardly from the periphery of needle cylinder 10 at a location slightly above the needles so that ground yarn G in passing from bushing 18 into operative relationship with the needles is inclined slightly downwardly from the tip of bushing 18.

Plating yarn guide 22 is positioned at one side of guide finger 12 with the upper end of opening 36 located above bushing 18 and the lower end of opening 36 located below bushing 18. Lower end wall 46 of plating yarn guide 22 is located at substantially the same radial distance from the vertical axis of needle cylinder 10 as is the end of bushing 18.

Guide eye 50 is positioned rearwardly of opening 36 and somewhat vertically above upper end wall 48 of opening 36. The vertical relationship between guiding eye 50 and opening 36 when feeding plating yarn to the needle cylinder from below the ground yarn is best shown at 50*a* in FIG. 5. With guiding eye 50 in the position shown at 50*a* in FIG. 5, plating yarn P is so located that the shortest distance from guide eye 50 to the needle cylinder, regardless of its direction of rotation, is over rear side wall 44 of opening 36. When needle cylinder 10 is rotating in a counter-clockwise direction, as viewed in FIG. 3, the circumferential offset relationship between the upper and lower ends of opening 36 causes the plating yarn to be maintained against lower end wall 46 of opening 36 since this path represents the shortest possible distance between guide eye 50 and the point at which plating yarn P moves into operative relationship with the needle cylinder. Since lower end wall 46 of plating

yarn guide 22 is located vertically below bushing 18 through which ground yarn G passes to the cylinder, the plating yarn moves into the cylinder from below ground yarn G during counterclockwise rotation of the needle cylinder.

When the direction of rotation of needle cylinder 10 is reversed to a clockwise direction as indicated in FIG. 2, the point at which the respective ground yarn and plating yarn move into engagement with the needle cylinder shifts to that illustrated in FIG. 2. During this shifting movement, the point at which ground yarn G moves into the needle cylinder travels along the periphery of the cylinder from the position indicated in FIG. 3 to that indicated in FIG. 2. The point at which the plating yarn moves into the cylinder is likewise simultaneously shifted. During this shifting movement, the tension applied to both yarns by the conventional tensioning mechanism prevents any slack from occurring. As the point of engagement shifts, plating yarn P begins to slide upwardly along rear wall 44 of opening 36 and the curvature of rear wall 44 is such that as the plating yarn swings past bushing 18 of guide finger 12, it passes underneath bushing 18 so that when the yarns are finally oriented as in FIG. 2, plating yarn P is engaged with upper end wall 48 of opening 36 and passes from upper end wall 48 underneath bushing 18 and thence to the needle cylinder. Thus, bushing 18 maintains plating yarn P below ground yarn G during rotation of needle cylinder 10 in the clockwise direction indicated in FIG. 2.

Since it is also necessary to guide plating yarn P to the cylinder at a point in advance of ground yarn G, the upper end of opening 36 is, as indicated in FIG. 2, located radially outwardly of needle cylinder 10 relative to the inner end of bushing 18. While the inner ends of both bushing 18 and plating yarn guide 22 are located at substantially the same radial distance from the axis, the circumferential offset between bushing 18 and guide 22 which finds guide 22 in advance of bushing 18 during rotation in the counter-clockwise direction of FIG. 3, likewise permits plating yarn guide P to move into the cylinder in advance of ground yarn G.

In some instances, it is desirable to feed plating yarn P into the needle cylinder from above ground yarn G. To modify the system described above to this latter purpose, it is only necessary to elevate guide eye 50 from the position 50*a* of FIG. 5 to the position 50*b* of FIG. 5. When guide eye 50 is in the 50*b* position, plating yarn P is maintained in engagement with front side wall 42 of opening 36. The relationship between plating yarn guide 22 and guide finger 12 remains the same as in the previous case when the plating yarn was fed to the needle cylinder from below ground yarn G.

Since upper end wall 48 of opening 36 is located above guide finger 12 and bushing 18, during rotation of the needle cylinder in a clockwise direction plating yarn passes through opening 36 at its upper end and passes above and clear of bushing 18 on guide finger 12 to the needle cylinder. Upon reversal of direction of rotation of needle cylinder 10, plating yarn P moves downwardly along front side wall 42, but by virtue of the relatively elevated position of guiding eye 50 the plating yarn does not go all the way to the lower end of opening 36, but passes around front side wall 42, the side of plate 34 adjacent guiding finger 12, and the edge of plate 34 facing needle cylinder 10 at some point approximately one half or two thirds of the distance downwardly along side wall 42. The relatively elevated position of guiding eye 50 maintains the plating thread in this relationship and the plating yarn again passes to the needle cylinder from above ground yarn G.

This latter relationship of the plating yarn is perhaps more clearly apparent with an alternative form of the invention shown in FIGS. 6 and 7. In the FIGS. 6 and 7 embodiment, a modified form of plating yarn guide 122

is constructed from a piece of bent wire having a vertical shank 124 which may be fixedly attached to a clamping block similar to clamping block 28 of the FIG. 1 embodiment. From the lower end of shank 124, the guide 122 is formed with a first portion 126 extending vertically downwardly from the lower end of shank 124, a second portion 128 inclined to the vertical and, as best seen in FIG. 6 also horizontally offset from the vertical, section 128 functionally corresponding to rear wall 44 of guide member 22. That portion of guide 122 analogous to front wall 42 of guide 22 is formed in two sections, a first section 130 being inclined upwardly from the lower end of portion 128 and second section 132 inclined upwardly and rearwardly to pass closely adjacent portion 126.

In operation, the embodiment of FIGS. 6 and 7 is employed in exactly the same fashion as guide 22 described above. During feeding of plating yarn P to the needle cylinder, guiding eye 50 is located relative to guide member 122 in exactly the same fashion described above in connection with guide 22 to determine whether the yarn is fed to the cylinder from above or from below the ground yarn. During feeding of the plating yarn from below, the yarn travels along section 128 from the full line position indicated at P1 in FIGS. 6 and 7 during rotation of cylinder 10 in the FIG. 2 direction to the lower broken line position P2 upon reversal of rotation of the cylinder. During feeding of the plating yarn to the cylinder from above ground yarn G, the elevated position of guide eye 50 maintains the plating yarn in engagement with section 132 of guide 122, reversal of rotation of cylinder 10 from the FIG. 3 direction to the FIG. 2 direction causing the plating yarn to slide between the juncture of section 130 and section 132 and an upper limit defined by the intersecting relationship of vertical sectional 126 and section 132 best seen in FIG. 7, the respective paths of the yarn being indicated at P3 and P4.

While exemplary embodiments of the invention have been described, it will be apparent to those skilled in the art that the disclosed embodiments may be modified. Therefore, the foregoing description is to be considered exemplary rather than limiting and the true scope of the invention is that defined in the following claims.

I claim:

1. In a circular knitting machine having a needle cylinder, and a yarn guiding finger for guiding a first yarn to said cylinder from an inner end spaced outwardly from the periphery of said cylinder at a first radial distance from the axis of said cylinder; a plating yarn guide having an opening through which a plating yarn is passed to said cylinder, said opening being defined in part by an elongate side wall extending between an upper and a lower end, means for supporting said guide at one side of said guide finger with the upper end of said side wall spaced circumferentially and radially outwardly of said cylinder from said finger and located above the inner end of said finger, said side wall being inclined downwardly toward said cylinder and circumferentially of said cylinder a direction away from said finger to said lower end of said side wall, the lower end of said side wall being located below said inner end of said finger at a radial distance from the axis of said cylinder substantially equal to said first radial distance, and supplemental yarn guiding means for maintaining plating yarn passing through said opening against said elongate side wall.

2. In combination with a circular knitting machine having a needle cylinder, and a yarn guiding finger for guiding a first yarn to said cylinder from an inner end spaced outwardly from the periphery from said cylinder at

a first radial distance from the axis of said cylinder; a plating yarn guide assembly comprising means defining an elongate opening through which a plating yarn is passed to said cylinder, said opening defining means including an elongate side wall extending between an upper and a lower end of said opening, means for supporting said guide assembly at one side of said guide finger with the upper end of said opening spaced circumferentially of said cylinder from said one side of said finger at a location above said finger at a radial distance from the axis of said cylinder greater than said first radial distance, said side wall being inclined from said upper end downwardly toward said cylinder and circumferentially of said cylinder in a direction away from said finger, said lower end of said opening being located below said finger at a radial distance from the axis of said cylinder substantially equal to said first radial distance, and means for guiding thread to said opening from a location above and radially outwardly from said upper end of said opening.

3. A plating yarn guide assembly as defined in claim 2 wherein said opening defining means comprises a plate like member of sheet material having said opening formed therein.

4. A plating yarn guide assembly as defined in claim 2 wherein said opening defining means comprises a rod like member having a first portion thereof defining said outer side wall and a second portion extending upwardly and rearwardly from the lower end of said opening to define the upper end of said opening.

5. In combination with a circular knitting machine having a needle cylinder, a yarn guiding finger for guiding a first yarn to said cylinder from an inner end spaced outwardly from the periphery of said cylinder at a first radial distance from the axis of said cylinder, and a retractable support member mounted for movement to and from an operative position adjacent said yarn guiding finger; a plating yarn guide member having an opening through which a plating yarn is passed to said cylinder, said opening being defined in part by spaced elongate front and rear side walls extending between the upper and lower end of said opening, means for securing said yarn guide member to said support member to locate said guide member at one side of said guide finger when said support member is in said operative position with the upper end of said opening located above said guide finger and lower end of said opening located below said guide finger, said side walls being inclined from said upper end of said opening downwardly toward said cylinder and circumferentially of said cylinder in a direction away from said guide finger and said lower end of said opening being located at a radial distance from the axis of said cylinder substantially equal to said first radial distance, and supplemental plating yarn guide means for guiding plating yarn to said opening from a location above and radially outwardly of said cylinder from the upper end of said opening.

6. Apparatus as defined in claim 5 including means for locating said supplemental plating yarn guide means relative to said guide member to selective guide plating yarn passing to said cylinder into engagement with said front side wall or said rear side wall.

References Cited in the file of this patent

UNITED STATES PATENTS

1,023,311	Hirner	Apr. 16, 1912
1,255,851	Beavers	Feb. 12, 1918
2,402,744	Fregeolle	June 25, 1946