Nov. 11, 1952 E. F. REICHERT 2,617,282

KNITTING MACHINE

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FIG.5

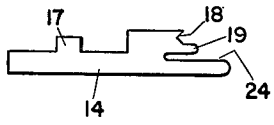
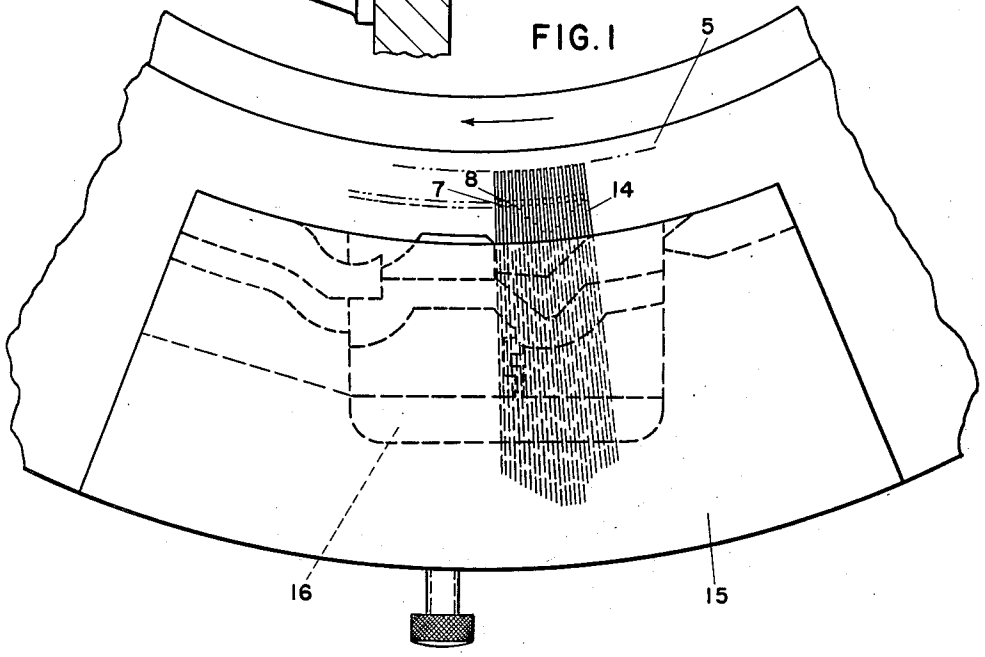



FIG.2




FIG.1



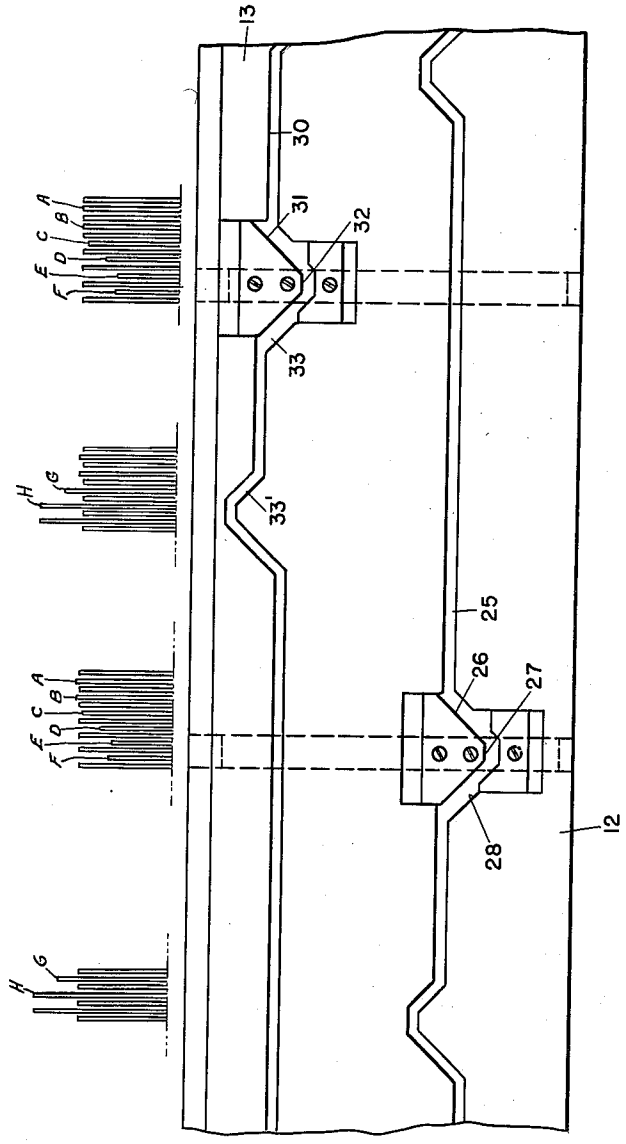

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FIG. 3




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FIG. 4

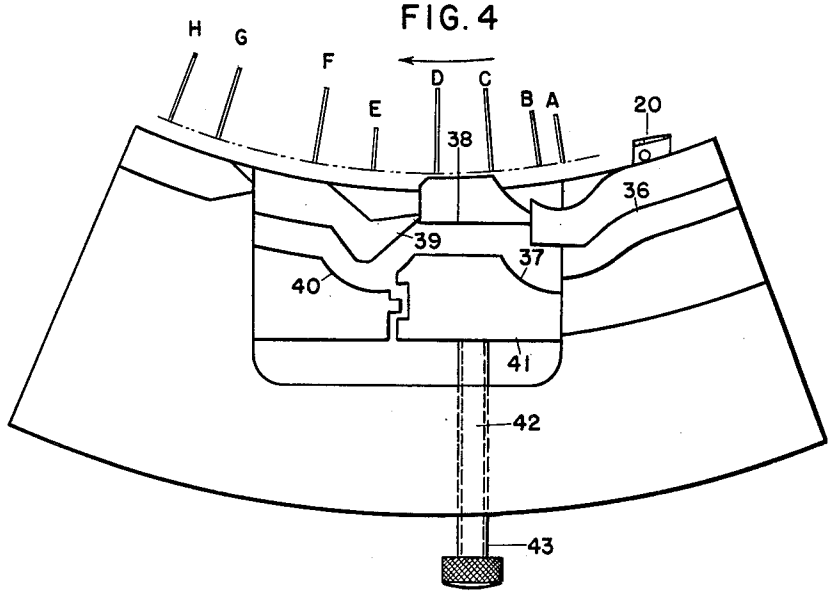
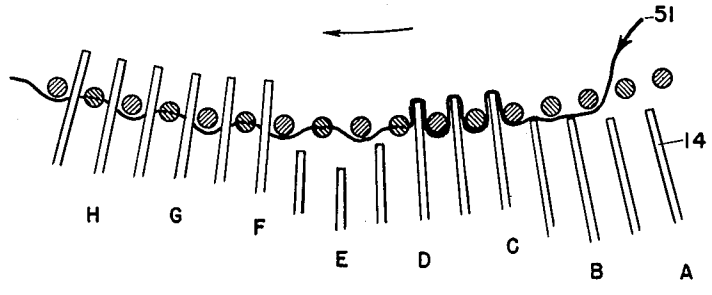



FIG. 14




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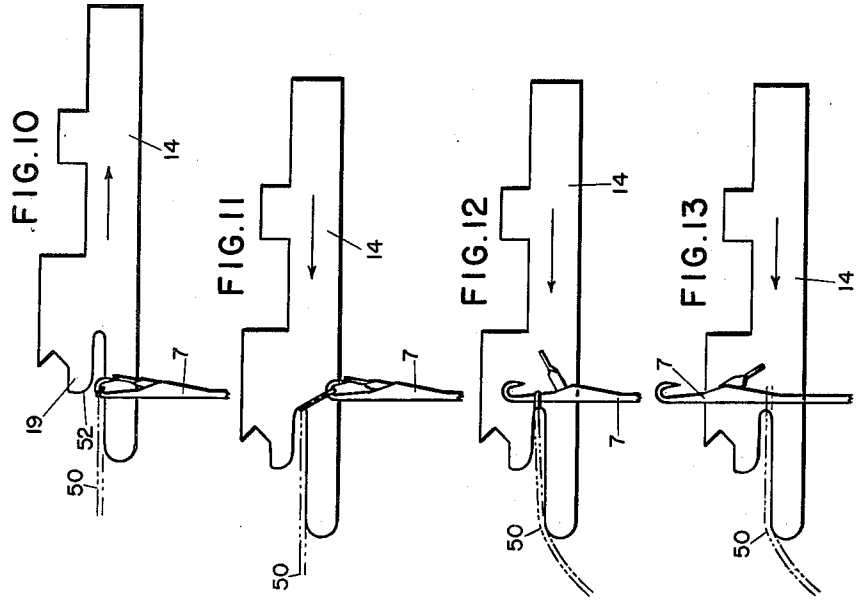
Herman Zeid

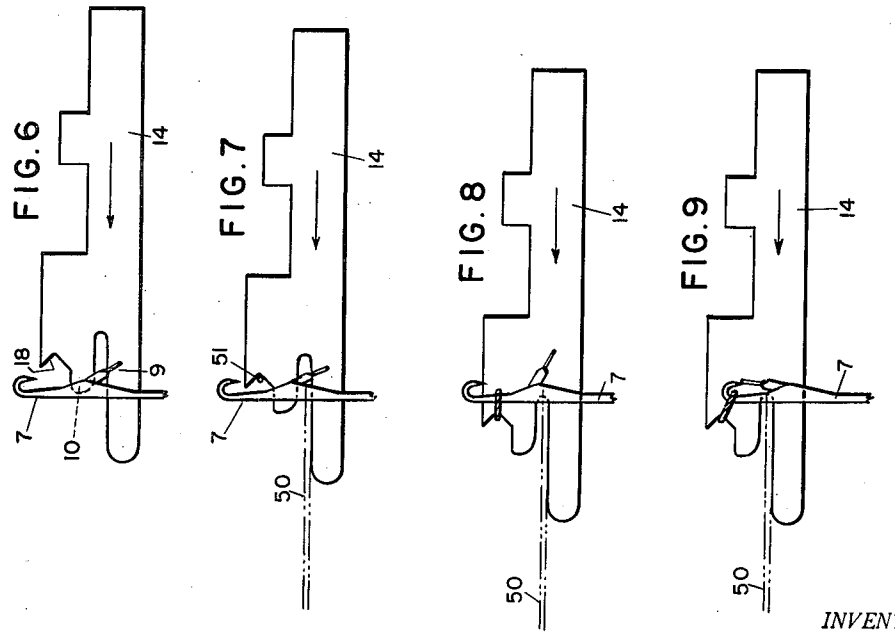
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KNITTING MACHINE

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FIG. 15

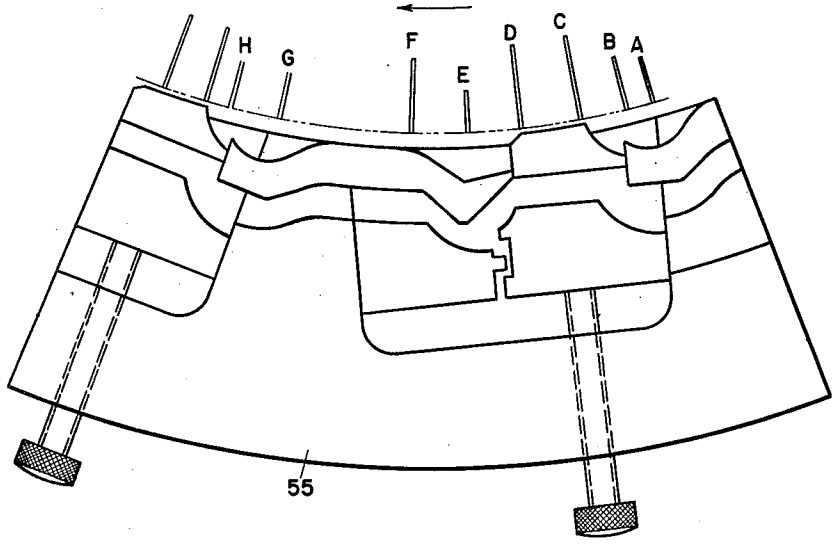
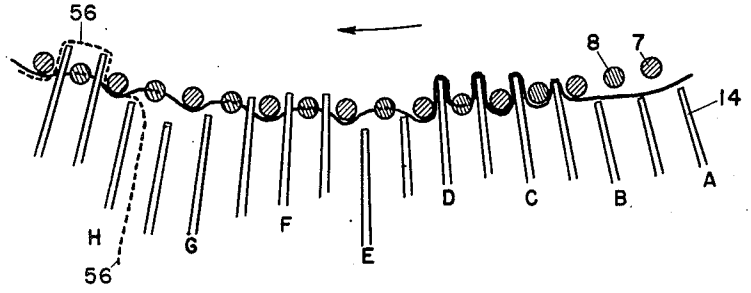



FIG. 16




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Patented Nov. 11, 1952

2,617,282

# UNITED STATES PATENT OFFICE

2,617,282

## KNITTING MACHINE

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Application August 7, 1948, Serial No. 43,021

16 Claims. (Cl. 66—38)

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This invention relates to the art of knitting and more particularly to an improved circular type interlock knitting machine and its method of operation whereby the machine is capable of producing knitted fabrics over a wide range of weights, such fabrics having a ribbed characteristic on one side and a substantially smooth surface on the opposite side, the adjacent ribs of the fabric being interlocked by means of interconnecting yarns or threads which fabrics were heretofore not capable of production on circular interlock machines.

In my co-pending application, Serial No. 725,555, filed January 31, 1947, now abandoned, I have disclosed a knitting machine of the circular type employing long and short, latch needles in which the needles draw the necessary length of yarn over the sinker drawing platform to form the desired loop. While this machine is satisfactory in use, I have discovered that its flexibility may be greatly improved and a fluffier, softer fabric produced by incorporating the improvements of the present invention.

The chief object of the present invention is to provide a simplified circular interlock knitting machine capable of producing varied types and designs of fabrics in greater quantities in a given time than circular interlock knitting machines heretofore known.

An object of the present invention is to provide a knitting machine of the circular type incorporating long and short, latch needles and in which the sinkers are employed to determine the length of yarn incorporated in each loop or stitch.

An object of the present invention is to provide a knitting machine of the circular type adapted to produce an interlock fabric and which employs long and short, latch needles, the sinkers being actuated by adjustable cams to draw or push a desired length of yarn to be looped about each needle.

A further object is to provide a method of operation of a circular knitting machine in which the sinkers are actuated to measure a desired length of yarn to form a loop about an individual needle and to hold such yarn in position for the needle to form the stitch.

A still further object is to provide a sinker capable of drawing a desired length of yarn to enable long and short, latch needles to form the fabric.

A still further object is to provide a circular interlock knitting machine in which the sinkers measure the length of yarn supplied to each

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needle thereby permitting the needle to form the stitch without tension on the yarn.

A still further object is to provide a simplified, economical circular interlock knitting machine embodying latch needles, suitable cams to actuate the needles, sinkers to draw enough yarn for each individual needle thereby obviating tension created if the needle were employed to draw the required yarn and adjustable cam mechanism by which the movement of the sinkers may be regulated to vary the length of yarn drawn by the sinkers thus permitting a more varied and wider range of fabrics to be made and permitting a fluffier, tighter or looser fabric to be knitted as desired. Other objects of my invention will be readily perceived from the following description.

This invention relates to a knitting machine of the circular type adapted to produce an interlock fabric, comprising in combination a cylinder, a plurality of long, latch needles carried by the cylinder, a plurality of short, latch needles carried by the cylinder and alternating with the long, latch needles, means for feeding yarn to the needles, sinkers disposed between the needles, means to actuate the sinkers to draw a desired length of yarn for each needle, cam members to raise and to lower the needles to form interlocking stitches, and means for effecting relative movement between the needles and sinkers and sinker actuating means and cam members.

This invention further relates to a method of operation of a circular interlock knitting machine including a series of long, latch needles and a second series of short, latch needles disposed alternately about the cylinder of the machine in which the steps consist in actuating a sinker to hold a yarn being supplied to a needle of the machine, moving the sinker inwardly to draw a desired length of yarn which is disposed about a raised needle, actuating the needle to move downward to form the stitch while the sinker is holding the yarn, then retracting the sinker to release the yarn, knitting the stitch into the fabric, again moving the sinker forward to apply tension to the knitted fabric while the needle casts off or clears the stitch, again raising the needle while holding the sinker in its innermost position, and retracting the sinker to enable it to again engage yarn.

The attached drawing illustrates a preferred embodiment of my invention, in which:

Figure 1 is a diagrammatic plan view of a section of the knitting machine of my invention;

Figure 2 is a sectional view of the machine illustrating the cylinder actuating mechanism;

Figure 3 is a view in elevation of the needle actuating cams;

Figure 4 is a plan view of the sinker actuating cam;

Figure 5 is a view in elevation of the sinker employed in the circular knitting machine;

Figures 6–13 inclusive are diagrammatic views illustrating the manner in which a sinker and its adjacent needle are moved with respect to one another to measure the yarn, knit in and cast off the stitch;

Figure 14 is a diagrammatic view illustrating the manner in which the yarn is disposed about the needles;

Figure 15 is a sectional view of a modified sinker cam employed in the manufacture of loop fabric; and

Figure 16 is a diagrammatic view similar to Figure 14 illustrating the manner in which a yarn is inlaid in the formation of loop fabric.

Referring to the drawings, there is illustrated the circular knitting machine of my invention. A base (not shown) is provided adapted to support a table 3 by legs or braces 4. Table 3 supports a cylinder 5 having its exterior peripheral surface grooved to form sockets or pockets 6 for the reception of a series of latch needles 7 of long length and a second series of latch needles 8 of short length. The needles 7 and 8 are alternated about the periphery of the cylinder 5. The latch needles 7 and 8 may be of the usual type well known in the art, manufactured by Torrington Company of Torrington, Connecticut. Each of needles 7 and 8 is provided with a latch 9 hinged to the butt of the needle at 10. The latch 9 serves to interlock the thread or yarn as hereinafter described. In my invention for the formation of interlock fabric the end of the latch is below the line of the fabric or cloth on which the latch rests when the needle is raised to its normal or floating position, as hereinafter described.

Table 3 supports cam carrying ring 11. Ring 11 supports cams 12 adapted to actuate long, latch needles 7 and cam 13 adapted to actuate short, latch needles 8.

Sinkers 14 are disposed between adjacent needles 7 and 8 about the periphery of the cylinder. In the present invention, sinkers 14 serve to measure the length of yarn supplied to each needle and to support or extend the cloth. By employing the sinkers 14 to draw or measure the length of yarn supplied to each needle 7 or 8, each needle is able to form an interlocking stitch without the application of tension to the yarn. A ring member 15 mounted on table 3 carries sinker cam 16. Similar cams 16 are disposed at each station about the cylinder.

Sinker 14 includes a lug 17 extending from its body portion and adapted to engage cam 16, a V-shaped notch 18 which forms the throat of the sinker and which holds yarn as hereinafter described, a platform 19 and a support platform 24 for the cloth. The notch 18 is necessarily V-shaped in order to hold the yarn securely while measuring the desired length of yarn for each needle. Platform 19 permits operation of the sinker without interference with or obstruction of adjacent needles.

Suitable yarn guides 20 are provided to direct yarn at each station to the needles 7 and 8, it being understood, as previously stated, that sinkers 14 measure or draw the amount of yarn fed to each needle.

In the device illustrated cylinder 5 rotates while



the needle cams 12 and 13 and sinker cams 16 are stationary. It will be understood, of course, in some types of knitting machines to which my invention is adapted rotatable cam members may be used and in such cases the cylinder is stationary, other actuating mechanism being employed to rotate the cams.

As illustrated, a rack 21 is formed in the under or lower surface of cylinder 5 and is adapted to mesh with a pinion 22 mounted on a shaft 23 adapted to be rotated by means of pulleys and a belt, for example, connected to a motor (not shown) or other suitable prime mover.

In Figure 3, there are shown the contour of the needle cams 12 and 13. As illustrated, a guide surface 25 is provided to hold needles 7 in normal position; the cam is provided with a surface 26 adapted to urge the needles 7 downward, with a second surface 27 adapted to hold the needles 7 in lowermost position, and a third surface 28 adapted to raise the needles 7 to their normal raised position. This is the first station of the machine in which the long, latch needles are actuated to form stitches, knit in the stitches and then cast off the stitches, again rising to normal position while the short, latch needles are actuated at a second station. It will be appreciated these stations repeat about the periphery of the machine.

Considering cam 13, it will be noted guide surface 30 is provided to hold the short, latch needles in normal position. Surface 31 moves the needles 8 downward. Surface 32 holds the needles 8 in lowermost position. Surface 33 again raises needles 8. Surface 33' raises the needles to their uppermost position. The contours of cams 12 and 13 are generally similar, one being employed to actuate long, latch needles at a first station while the other holds the short, latch needles in normal or floating position; at the second station the short, latch needles are actuated by the second cam to form the stitch, knit in and cast off while the first cam holds the long, latch needles in floating or normal position.

Referring to Figure 4, there is shown a section of the sinker cam 16 at the first station. It will be understood the cam is contoured similarly at all stations (both long and short needle stations) about the periphery of the cylinder. This cam 16 is designed to move the sinkers 14 radially inward toward the center of the cylinder and outward again to its normal position. The working surface of the cam, as are the needle cams 12 and 13 shown in Figure 3, is illustrated rather than its exterior which would be shown when the machine is in operation.

Cam 16 is provided with a guide surface 36 which holds the sinker in its normal position. Surface 37 serves to move each sinker 14 inward to grasp the yarn in the V-notch 18 and to draw or measure a predetermined length of yarn for each needle 7 or 8 depending upon which station about the periphery is being considered. Surface 38 permits the V-notch 18 to hold the yarn while the stitch is being formed and knitting is commenced by the needle. Surface 39 serves to retract the sinker slightly to permit the loop of yarn formed about the needle to be knitted into the cloth. Then the sinker is again moved radially inward by surface 40 while the needle casts off the loop and the sinker again assumes its normal position.

An important feature of my invention resides in the fact that surfaces 37 and 38 are formed on a segment 41 of the cam which is adjustable.

This segment 41 is adjustable by means of shaft 42 threaded into the side wall of the segment and knob 43 which permits the segment to be moved radially as desired. Movement of this segment radially permits the length of yarn drawn or pushed by the sinker to be regulated in length thereby forming a tighter or looser stitch between the ribs of the fabric and enabling a softer, more fluffy fabric to be knitted.

This adjustable mechanism permits speedy variation in the length of yarn being drawn by each sinker for supply to an adjacent needle without requiring any changes in the sinkers. I have found, however, that it is not essential that such cam segment be adjustable for satisfactory results may be obtained by revising the working surface of the sinker while retaining the same degree of radial movement. This modification is not as satisfactory, however, since any given variation in the length of yarn measured by each sinker requires that all the sinkers of the machine be changed thus necessitating that many sets of sinkers be held on hand for use with each machine.

In Figures 6–13 inclusive, I have illustrated diagrammatically the manner in which the sinkers and needles are actuated with respect to one another to form the fabric. In these figures, I have assumed cloth is already knitted and that the sinker and needle are being actuated to add a loop thereto. The various sinkers and long and short, latch needles at all stations function similarly to the sinker and needle illustrated.

The cloth line is shown at 50 in all figures. In Figure 6, the needle 7 and sinker 14 are in normal position (Stage A). It will be noted yarn 51 has not yet been grasped in the V-notch of the sinker. Reference to Figures 3 and 4 will indicate similar positions of the needle and sinker with respect to their respective cams at these various stages of the operation.

In Figure 7 (Stage B) sinker 14 has been moved radially inward to grasp the yarn 51 in the V-notch 18 of the sinker. It will be noted at this point the needle 7 is moved downward slightly from the position shown in Figure 6. The sinker 14 is moved radially inward to measure the length of yarn disposed about needle 7 and the needle forms the stitch, as shown in Figure 8 (Stage C).

In Figure 9 (Stage D) the sinker is shown in the same position it occupies in Figure 8 but the needle has moved downward to commence knitting. In Figure 10 (Stage E) the loop is knitted into the fabric as shown by the position of the needle. The sinker here is retracted slightly to permit the loop to slide over the lip 52 at the edge of platform 19 of the sinker to be knitted into the cloth. These various stages are indicated in Figures 3 and 4 and it will be helpful to refer to such figures to ascertain the manner in which the needle and sinker are actuated by their respective cams.

In Figure 11 (Stage F), the sinker has again been moved inward to apply tension to the formed cloth. In this position, the needle casts off the loop after it has passed through the cloth.

In Figure 12 (Stage G), the sinker continues to apply tension to the cloth while the hook of the needle has risen through the cloth and is moving upward preparatory to having another section of yarn disposed thereabout. In Figure 13 (Stage H) the sinker continues in its tension applying position while the needle has reached its highest point. The sinker is then retracted to enable it to again engage yarn and the various stages are repeated.



It will be noted by consideration of these various stages that the yarn in all cases does not have tension applied thereto by the needle thus permitting a more satisfactory cloth to be manufactured than was heretofore obtainable. In each case, the sinker measures the actual amount of yarn desired and the needle knits such yarn into the formed cloth without the application of tension thereto. The length of yarn desired may be varied since the sinker cams are adjustable, as described above, permitting a greater or lesser amount of yarn to be drawn or measured by each sinker for an adjacent needle.

In Figure 14, I have illustrated the manner in which the yarn 51 is disposed by the sinkers 14 about the long and short needles 7 and 8. The various stages for the long needles are indicated by the letters A–H inclusive, the various similar stages for the short needles being interposed between. It will be noted at Stage A the yarn 51 has not yet been placed in the notch or throat 18 of sinker 14, while at Stage B the sinker has grasped the yarn 51. It will be noted the yarn is disposed about needle 7 between Stages B and C. The following stages are conducted as described in connection with Figures 6–13 inclusive.

It will be appreciated the present machine may be employed with slight changes to knit loop cloth and other types of fabric. In Figure 15, I have illustrated a modified sinker cam 55 which permits loop cloth to be knitted. It will be understood that in the manufacture of loop cloth an additional yarn or thread is inlaid in the interlock fabric formed as described above. It will be observed that the sinkers 14 are operated as described in connection with Stages A–E inclusive, the cam contour being changed to permit additional yarn 56 to be drawn or measured by sinker 14 at Stage F and inlaid into the fabric.

This invention provides a circular type interlock knitting machine capable of producing knitted fabric over a wide range of weights and designs. The knitting machine so provided has been greatly simplified in comparison with other interlock circular knitting machines heretofore known thus permitting more ready access by mechanics in setting up or changing the machine for operation and greatly decreasing its initial cost. My invention eliminates cumbersome dial mechanism heretofore employed in circular, knitting machines and obviates tension on the yarn during the formation of the stitch by the needles. In the machine described, the amount of yarn supplied to each needle is measured by the sinkers thus enabling the needles to knit and to cast off without application of tension to the yarn. Since the cams actuating the sinkers to measure yarn are adjustable it will be readily perceived the amount of yarn drawn by the sinkers may be varied as desired.

While I have described a preferred embodiment of my invention, it will be understood my invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

I claim:

1. In a circular interlock knitting machine, the combination of a cylinder, a plurality of long, latch needles carried by said cylinder, a plurality of short, latch needles carried by said cylinder and alternating with the long, latch needles,

means for supplying yarn to the needles, means for raising and lowering said needles to form stitches and to knit the stitches into the cloth being formed, sinkers disposed between adjacent needles and means for actuating the sinkers to measure yarn supplied to adjacent needles.

2. A circular knitting machine according to claim 1 in which the sinker actuating means are adjustable to vary the length of yarn being drawn by the sinkers.

3. In a circular interlock knitting machine, the combination of a cylinder, a series of long, latch needles carried by said cylinder, a second series of short, latch needles carried by said cylinder and alternating with the long, latch needles, cam members for raising and lowering said needles respectively at stations about the cylinder, sinkers disposed between said needles about the periphery of the cylinder, and a cam member at each station about the cylinder to actuate the sinkers to measure yarn supplied to adjacent needles.

4. A circular interlock knitting machine according to claim 3 in which the sinker cams are adjustable to vary the length of yarn measured by each sinker.

5. In a circular interlock knitting machine, the combination of a cylinder, a series of long, latch needles carried by said cylinder, a second series of short, latch needles carried by said cylinder and alternating with the long, latch needles, cam members for raising and lowering said needles respectively at stations about the cylinder, sinkers disposed between said needles about the periphery of the cylinder, a cam member at each station about the cylinder to actuate the sinkers to measure yarn supplied to adjacent needles, and means for effecting relative movement between the cylinder carrying the needles and sinkers and the cam members for actuating the needles and sinkers.

6. A circular interlock knitting machine according to claim 5 in which the cam members are stationary and means are provided for rotating the cylinder carrying the needles and sinkers.

7. In a circular interlock knitting machine, the combination of a cylinder, a series of long, latch needles carried by said cylinder, a second series of short, latch needles carried by the cylinder and alternating with the long, latch needles, a cam member for actuating the first series of long, latch needles at a first station about the periphery of the machine to form an interlocking stitch without the application of tension to the yarn, a second cam member for actuating the second series of short, latch needles at a second station about the periphery of the machine to form an interlocking stitch without the application of tension to the yarn, similar stations alternating about the periphery of the machine, sinkers disposed between said needles, and a third cam member at each station for actuating the sinkers to measure yarn supplied to adjacent needles.

8. A circular interlock knitting machine according to claim 7 in which the needle cams hold the needles in floating or normal position between the stations at which the respective needles are actuated, each needle in its normal floating position having the end of its latch below the cloth line on which the latch rests.

9. A circular interlock knitting machine according to claim 8 in which the cam members are stationary and means are provided for rotating the cylinder carrying the needles and sinkers.

10. A circular interlock knitting machine according to claim 9 in which the sinker cam member is adjustable to vary the length of yarn measured by the sinker.

11. In the method of operation of a circular interlock knitting machine including long, latch needles and short, latch needles disposed alternately about the cylinder of the machine and sinkers disposed between adjacent needles, the steps which consist in actuating a sinker to grasp a yarn being supplied to a needle of the machine, moving the sinker radially inwardly to draw a desired length of yarn which is disposed about a raised needle, actuating the raised needle to move downward to form the stitch while the sinker is holding the yarn, then retracting the sinker to release the yarn, knitting the stitch into the fabric, again moving the sinker radially inward to apply tension to the knitted fabric while the needle casts off the stitch, raising the needle while holding the sinker in its innermost position, and retracting the sinker to enable it to again engage yarn.

12. A method of operation of a circular interlock knitting machine according to claim 11 in which the process is repeated at each station about the cylinder of the machine.

13. In the method of operation of a circular interlock knitting machine including a series of long, latch needles, a second series of short, latch needles extending in the same direction as the long, latch needles and alternating with the long, latch needles about the cylinder of the machine, and sinkers disposed between adjacent needles, the steps which consist in moving a sinker radially inward to grasp a yarn being supplied to an adjacent raised needle, utilizing inward movement of the sinker to measure the length of yarn disposed about the adjacent raised needle, moving the raised needle downward to form the stitch without application of tension to the yarn by the needle, the sinker holding the yarn during such movement of the needle, then retracting the sinker to release the yarn, knitting the stitch into the cloth, again moving the sinker radially inward to apply tension to the knitted cloth while the needle casts off the stitch, raising the needle to a position in which the end of its latch is below the cloth line on which the latch rests, retracting the sinker to enable it to again engage yarn, and repeating the process.

14. In the method of making a fabric having an interlock stitch, the steps which consist in measuring the length of yarn supplied to a latch needle by an adjacent sinker, and actuating the needle to knit the measured length of yarn into the fabric without application of tension to the yarn.

15. In the method of making a fabric having an interlocking stitch, the steps which consist in actuating a sinker to grasp a yarn being supplied to an adjacent needle in raised position, utilizing the sinker to measure a desired length of yarn, actuating the needle to form the stitch without application of tension to the yarn while the sinker holds the yarn, then moving the sinker to release the yarn while the yarn is knitted into formed cloth, applying tension to the formed cloth by means of the sinker while the needle casts off its stitch, raising the needle to a position in which the end of its latch is below the cloth line on which the latch rests, moving the

sinker to enable it to again measure yarn, and repeating the process.

16. In the method of making a loop fabric, the steps which consist in actuating a sinker to grasp a yarn being supplied to an adjacent needle in raised position, utilizing the sinker to measure a desired length of yarn, actuating the needle to form the stitch without application of tension to the yarn while the sinker holds the yarn, then moving the sinker to release the yarn while the yarn is knitted into formed cloth, inlaying a second yarn into the formed cloth, applying tension to the formed cloth by means of the sinker while the needle casts off its stitch, raising the needle to a position in which the end of its latch is below the cloth line on which the latch rests, moving the sinker to enable it to again measure yarn.

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