Dec. 26, 1922. 1,440,266

H. T. BALLARD.

KNITTING MACHINE FOR PRODUCING ZIGZAG STRIPES.

FILED JAN. 15, 1920.

Fig. 1

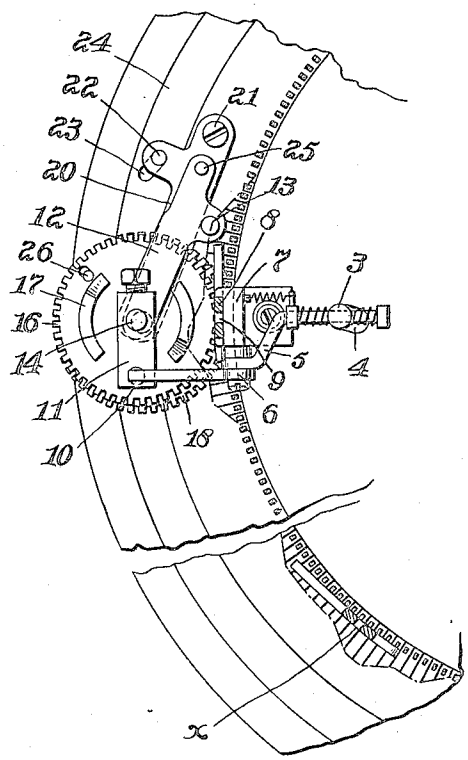


Fig. 2.

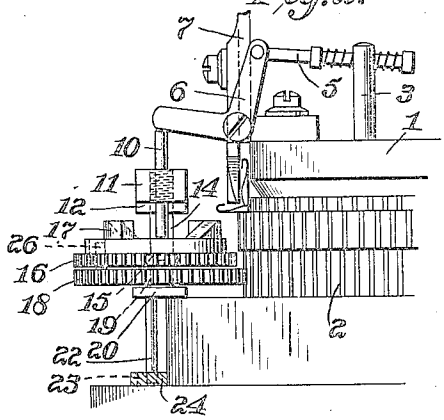


Fig. 3.

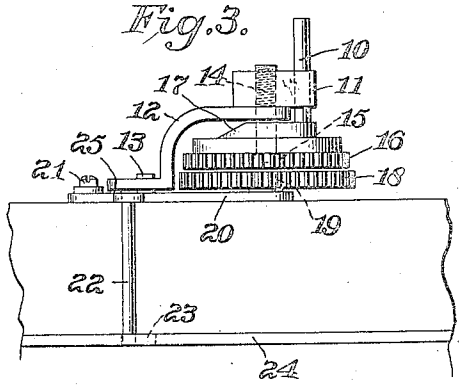
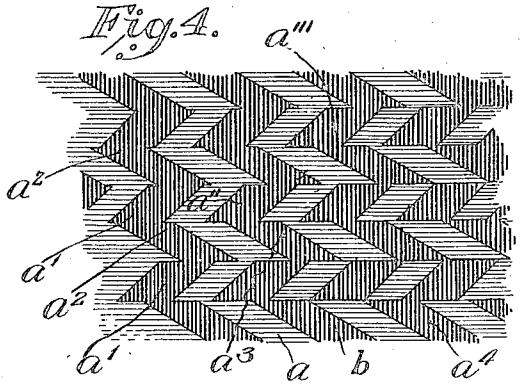


Fig. 4.



Inventors

Herbert T. Ballard,

By Spear, Middleton, Donnelly & Spear

Attorneys

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UNITED STATES PATENT OFFICE.

HERBERT T. BALLARD, OF NORRISTOWN, PENNSYLVANIA.

KNITTING MACHINE FOR PRODUCING ZIGZAG STRIPES.

Application filed January 15, 1920. Serial No. 351,702.

To all whom it may concern:

Be it known that I, HERBERT T. BALLARD, a subject of Great Britain, and a resident of the city of Norristown, county of Montgomery, State of Pennsylvania, have invented certain new and useful Improvements in Knitting Machines for Producing Zigzag Stripes, of which the following is a specification.

My invention relates to means for making changes in the knitting of a tubular fabric on a rib knitting machine, and it consists in the features and combination of parts hereinafter described and particularly pointed out in the claims.

In the accompanying drawings,

Figure 1 is a plan view of a rib knitting machine head embodying my invention, this view being in the nature of a diagram.

Fig. 2 is a view of part of the cylinder and dial of rib knitting machine, with my improvements in place.

Fig. 3 is a side view of the parts shown in Fig. 2.

Fig. 4 is a conventional view of a portion of the fabric produced by my invention.

In carrying out my invention I employ a mechanism which may be mounted as an attachment upon a rib knitting machine of ordinary form, and without making any change in the structure of said machine, though the invention is not limited in its scope to an attachment form of mechanism but may be embodied in a machine in which the improvement is incorporated in the structure thereof as originally built.

In the drawing 1 indicates the dial and 2 the cylinder of a rib knitting machine.

The improvement may be embodied in different forms but I have shown one form as an example for illustrative purposes and not as a limitation upon the scope of my invention, which is defined by the appended claims.

In the particular form shown I provide at one of the feeds a mechanism for shifting the wing cam in and out, so as to occupy at times its knitting position and at other times its tucking position. This mechanism comprises a post 3 attached to wing cam extending up through a slot 4 in the dial cap, which post is connected by a link 5 with a bell crank lever 6 pivoted onto bracket 7, which supports the yarn guide 8, the eye of which is shown at 9. This lever is operated by a vertically movable pin 10 guided through a block or bracket 11 suitably supported by a lever 12 pivoted to the frame of the machine at 13. From this block a stud or screw 14 depends having a lower head 15 which holds a toothed wheel 16 which at times is intended to mesh with the stems of the cylinder needles and at other times to be out of mesh therewith.

This wheel, on its upper surface has a cam 17 or cams adapted to operate the pin 10 and thus move the wing cam in or out. It will be understood that this wing cam is the ordinary cam for operating the needles to form the stitches. When the pin 10 is moved upwardly by the cam 17 the wing cam will be moved inwardly towards the axial center of the machine to tucking position. When the cam 17 is not acting on pin 10 the wing cam will be moved outwardly to knitting position.

Below the wheel 16 there is another wheel 18 toothed to engage and be driven from the revolving part of the machine and in the particular form shown this wheel meshes with the stems of the needles of the cylinder.

It, like the toothed wheel 16 above described is intended to engage with and be rotated by the needle stems and at other times to be free therefrom. It is carried by a stud 19 extending up from the lever 20 which is pivoted to the frame of the machine at 21 and is operated by a rod or post 22 extending down therefrom with its lower end entering a cam slot 23 in a ring 24 arranged to be turned slightly about the head of the machine by any suitable pattern mechanism.

This ring and pattern mechanism are not new and need not be illustrated in detail.

The lever 12 carrying the upper toothed wheel is connected pivotally to the lever 20 carrying the lower toothed wheel by a pin 25, the arrangement being such that when the lever 20 is operated to throw its toothed wheel 18 into mesh with the stems of the cylinder needle the other wheel 16 will be thrown out of mesh with the said needle stems and will not be rotated thereby.

However, whichever toothed wheel is in mesh with the needle stems the cam 17 will be rotated because the two wheels are connected by a pin and slot at 26.

It will thus be seen that when the upper wheel is in mesh the cam 17 will be driven by this wheel which has say 46 teeth as

against say 324 needles in the cylinder. The wheel 18 has a greater number of teeth than the wheel 16 and each number is such that it will not divide evenly into the number of needles, so that at the beginning of each revolution of the needle cylinder the same tooth of the wheel, 16 or 18, whichever happens to be in mesh will not be in engagement with the same needle stem.

In the case of the larger diameter wheel 18 there will be, say, one needle less than the number required to make the number of needles a multiple of the number of teeth in the wheel, and hence for each revolution of the needle cylinder the wheel 18 will lag in respect to the revolutions of the said cylinder and the changes in the knitting resulting from the use of the wheel 18 as a driver for the cam 17 will not occur on the same wale but will lag and occur on a following wale and thus the changes will occur in a spiral in one direction around the tube being knit.

When this wheel 18 is thrown out of mesh with the cylinder needles and the other wheel 16 is thrown in, the changes in the knitting will take place spirally around the fabric but in the opposite direction from the changes occurring when wheel 18 was in mesh.

As above stated, we will say for example, that the wheel 16 has 46 teeth to engage the needles. This divides into the 324 needles with two needles over as a remainder and it follows that the wheel 16 will be advanced a distance of two needles for each revolution of the needle cylinder and hence the changes consequent upon the operation of the feed will be out of time with any given wale and may be said to advance in respect thereto.

No spiral will be complete in either direction, however, owing to the change of control shifting from one toothed wheel to the other. The structure of the fabric will be understood from Fig. 4, in which *a* represents plain rib and *b* tuck or cardigan. The cardigan has a portion a' running at an inclination or spirally in one direction in respect to the length of the fabric indicated by the line *c*—*c* and also a portion a^2 joining the portion a' but running spirally or at an inclination in the other direction and the plain rib has the same form so that in the particular structure illustrated there is a zig zag stripe of tuck or cardigan made up of the part a'—a^2 and intermediate zig zag stripes of plain rib. If red and blue yarns are knitted in, the blue at the special feed and red at the ordinary feed, there will appear a zig zag stripe with blue predominating in the tuck and a stripe of plain rib with alternate course of red and blue will appear.

It will be observed that the tuck portion a' is spirally in line with other tuck portions a'', a''', while the tuck portion a^2 is spirally in line with the tuck portions a^3, a^4, the spiral line a', a'', a''', being interrupted by plain rib portions, which is true also of the spiral line a^2, a^3, a^4.

It may be said that the cam 17 is common to both of the toothed wheels because either one or the other is employed to rotate this cam according to which of the wheels is in mesh with the stems of the needles.

The ordinary feed at which plain knitting is done or at which the two loops are cast off for tucking is shown at *x*, there being here the ordinary yarn guide and a wing cam which always remains in position to perform knitting. Because of the difference in the numbers of teeth in the two wheels 16 and 18 there will be more of the substantially rhomboid forms in one circle made by the smaller wheel than there will be in the circle or zone made by the larger wheel and while the forms made by one wheel will merge in large degree with those made by the other wheel the points where they merge will not be uniformly located in respect to the said forms. In other words, the forms made by one wheel will lag around the circle in respect to the forms made by the other wheel. Therefore an irregular zig-zag pattern will be formed leaving tails at certain points and other irregularities, and the irregularities will be accentuated because of the distortion of the fabric due to the fact that it is made up of alternating portions of plain rib or tuck stitches.

The fabric has been made the subject of a divisional application filed April 29, 1922, Serial No. 557,492.

I claim:—

1. In combination with a cylinder and dial of a rib-knitting machine, needles, yarn feed means, a wing cam, controlling means comprising means for throwing said cam into tucking position and causing the tuck work to run spirally about the fabric in one direction and means for reversing the direction of the tuck work to make it run spirally about the fabric in the opposite direction but with different spacing between its parts in respect to the spacing between the parts of the first spiral and means for alternating plain rib with the tuck work in each course, substantially as described.

2. In combination in a rib knitting machine, a dial and cylinder, needles, two yarn feeds, one of which includes a wing cam means for controlling the wing cam to make tuck changes lag and a second means for controlling the wing cam to make tuck changes advance around the tube of fabric, and connections for throwing one of said means into operation and the other out alternately, with means for alternating plain rib

knitting in the courses with the tuck work, the second yarn feed being adapted to produce plain rib, substantially as described.

3. In combination with a rib knitting machine, a cam for shifting the dial wing cam to either knitting or tucking position, means for operating said cam to cause it to lag in respect to the starting point of the revolutions of the machine and means for operating said cam to cause it to advance in its operation in respect to the revolutions of the machine and connections for throwing the said two means into and out of operation, one going into operation as the other goes out of operation, the shifting actions of the wing cam being timed differently by one of said means in respect to the timing by the other means and a second feed for knitting, substantially as described.

4. In combination with a rib knitting machine, a yarn feed, a pair of toothed wheels, to mesh with a rotating part of the machine to be driven thereby, and located at the said feed, means for throwing one wheel in mesh and the other out of mesh with the machine alternately, and connections operated from the wheel in mesh for shifting the wing cam of the dial from knitting to tucking position and the reverse, one of said wheels having such a number of teeth as will cause the changes in the knitting to lag around the fabric spirally and the other wheel having such a number of teeth as will cause the changes to advance spirally about the fabric in the other direction, substantially as described.

5. In combination with a rib knitting machine, a yarn feed, a pair of toothed wheels, to mesh with a rotating part of the machine to be driven thereby, and located at the said feed, means for throwing one wheel in mesh and the other out of mesh with the machine alternately, and connections operated from the wheel in mesh for shifting the wing cam of the dial from knitting to tucking position and the reverse, one of said wheels having such as number of teeth as will cause the changes in the knitting to lag around the fabric spirally and the other wheel having such a number of teeth as will cause the changes to advance spirally about the fabric in the other direction, the part of the machine with which said wheels mesh being the stems of the cylinder needles, substantially as described.

6. In combination with a rib knitting machine, a yarn feed, a pair of toothed wheels located at said feed to mesh with a rotary part of the machine, a cam with connections for operating the wing cam of the needle dial to tucking position and to knitting position, said cam being carried by the upper of the two wheels, said wheels being coupled together but to allow shifting movement of each into and out of mesh with the rotary part of the machine, means for shifting one toothed wheel into mesh and the other out of mesh alternately, one of said wheels having such a number of teeth as will cause the changes in the fabric to lag spirally thereabout and the other having such a number of teeth as will cause the changes in the fabric to advance spirally about the fabric, and a second yarn feed, substantially as described.

7. In combination with a cylinder and dial of a rib knitting machine, needles, yarn feed means, a wing cam, controlling means for said wing cam to make alternate portions of plain rib and tuck work in each course with the changes in a series of courses occurring on different wales to make the pattern run in a spiral direction along the fabric, and with the changes in the next series of courses occurring to make the pattern take a different direction, the changes first mentioned being differently spaced apart from the spacing of the changes last mentioned, substantially as described.

8. In combination in a rib knitting machine, means for shifting the wing cam of the dial with timing means for making the shifting actions occur successively on different wales and a second means for shifting the wing cam to make the changes in the fabric occur in a different direction in successive courses from the changes first mentioned and with different spacing in respect to the spacing of the changes first mentioned, substantially as described.

9. In combination in a rib knitting machine, a pair of toothed wheels having different numbers of teeth and driven from the machine, means operated by each of said toothed wheels for controlling the position of the dial wing cam to tuck or knit and means for shifting the said wheels into and out of engagement with the driving means so that when one wheel is acting as a driver, the other will be idle, substantially as described.

10. In combination in a rib knitting machine, a pair of toothed wheels to engage the needle stems and having different numbers of teeth, each of said wheels being shiftable into and out of engagement with the needle stems, a connection between the two wheels, a cam driven from whichever of the two wheels is in engagement with the needle stems, means for shifting the wheels so that first one and then the other is out of engagement with the needle stems and connections from the cam to the dial wing cam for shifting the same to tucking or knitting position, substantially as described.

11. In combination in a rib knitting machine, a yarn feed, a pair of toothed wheels, an adjustable cam to produce rib or tuck work, means operated by the wheels alternately for adjusting said cam to produce ad-

jacent bands of alternate tuck and rib fabric, and with the alternations in one band differing in spacing from that of the other band.

12. In combination in a rib knitting machine, cam means shiftable for tucking or making plain rib fabric, a pair of toothed wheels, cam means associated therewith and operated thereby for controlling the shiftable needle cam means, one of said wheels rotating differentially in respect to the other to make the shifting actions in a different time from the other in relation to the revolutions of the machine, and means for rendering the said wheels effective and ineffective alternately in relation to each other, substantially as described.

13. In combination with a cylinder and dial of a rib knitting machine, needles, yarn feeding means, cam means shiftable for tucking or knitting plain rib, controlling means comprising means for shifting the cam means into tucking position and causing the tuck work to run spirally about the fabric in one direction, and means for reversing the direction of the tuck work to make it run spirally about the fabric in the opposite direction but with different spacing between the opposing parts of this second spiral in respect to the spacing between the opposing parts of the first spiral, the tuck work alternating with plain rib in each course, substantially as described.

In testimony whereof, I affix my signature.

HERBERT T. BALLARD.