

Dec. 28, 1965

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3,225,569

CIRCULAR KNITTING MACHINE HAVING WELT HOOKS WHICH COOPERATE ONLY WITH ALTERNATE NEEDLES

Filed April 14, 1964

2 Sheets-Sheet 1

Fig. 2

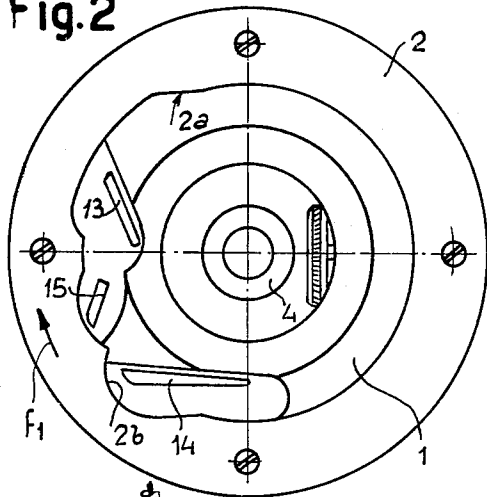


Fig. 3

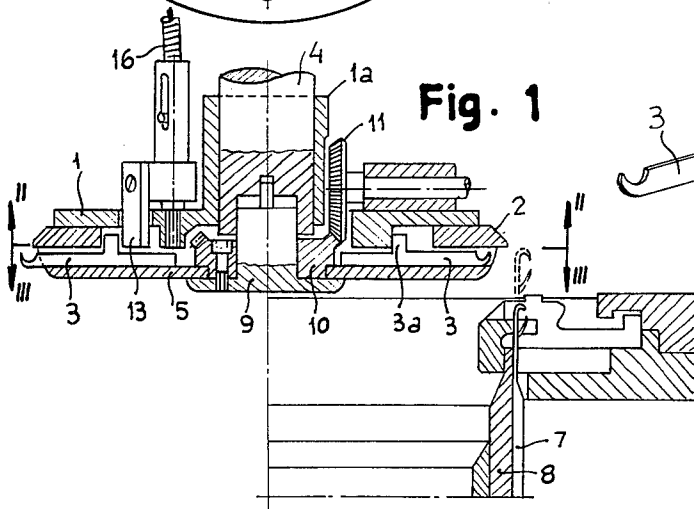
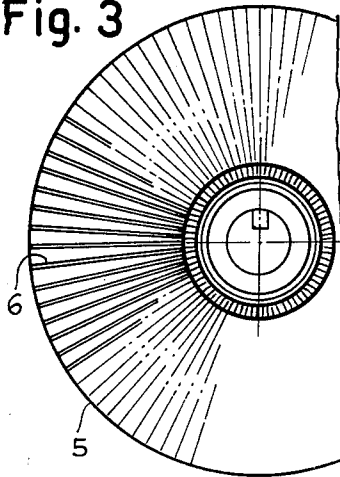


Fig. 1

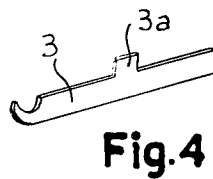
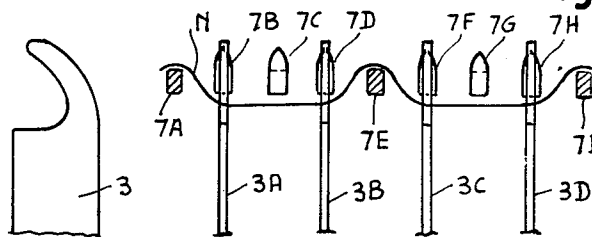


Fig. 4

Fig. 5



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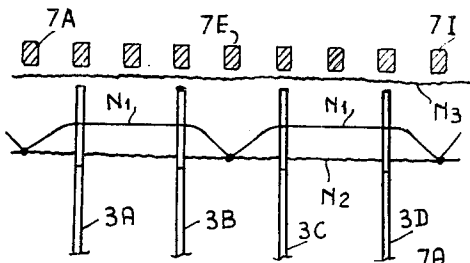


Fig. 6

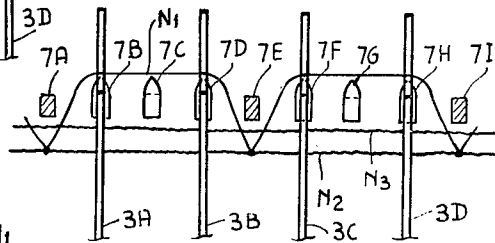


Fig. 7

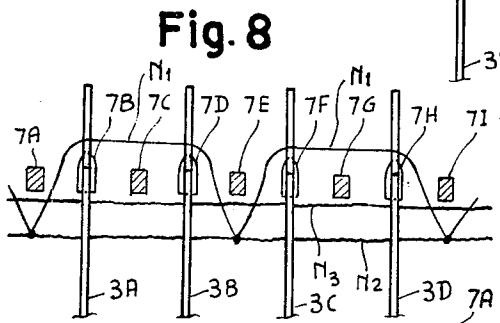


Fig. 8

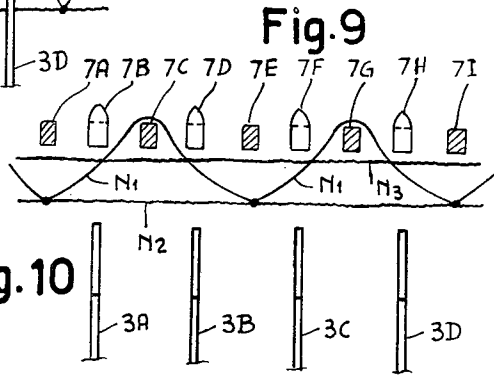


Fig. 9

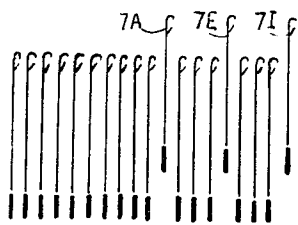


Fig. 10

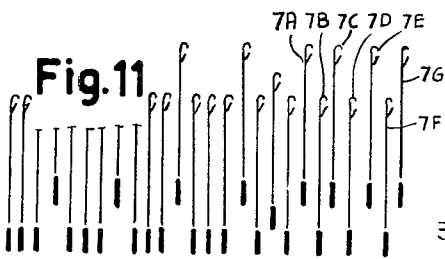


Fig. 11

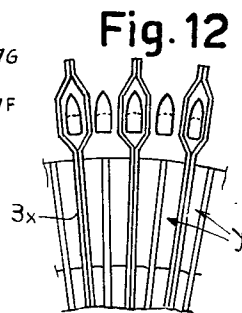


Fig. 12

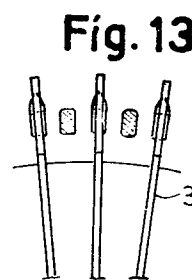


Fig. 13

PRIOR ART

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**CIRCULAR KNITTING MACHINE HAVING WELT HOOKS WHICH COOPERATE ONLY WITH ALTERNATE NEEDLES**

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Filed Apr. 14, 1964, Ser. No. 359,719

Claims priority, application Italy, Apr. 17, 1963,

7,775/63

1 Claim. (Cl. 66—95)

This invention relates to circular knitting machines for hosiery manufacture.

In conventional machines of this type, a welt hook dial is provided, coaxially above the needle cylinder in which radial tricks are cut with a pair of welt hooks in each trick. These welt hooks are relatively thin and so shaped as to allow the insertion of a cylinder needle into the space between the two hooks housed in the same trick of the dial. This arrangement has disadvantages both with regard to the accuracy required in the timing between the needle cylinder and the dial, and with regard to the necessary thinness of the welt hooks, because of the limited space between the needles of the cylinder.

The present invention provides a circular knitting hosiery machine having a welt hook dial formed with continuous radial tricks which are of constant width throughout their lengths, each of the tricks having a single flat welt hook slidable therein, and wherein the needles are so controlled that at the start of the welt formation selected needles are raised so that each of the initial stitches of the welt is supported by two welt hooks, whilst at the end of the welt formation, the first selected needles are raised and after the insertion of the welt hook others of the needles are raised to deliver the stitches supported by the pairs of spaced welts hooks.

The present invention also provides a circular knitting hosiery machine having a welt hook dial in which each welt hook is angularly spaced by two needle spaces from the adjacent welt hooks, wherein one-half of the cylinder needles, equal in number to the welt hooks, are kept lowered at the start and end of the welt formation, and wherein the needles of the cylinder are so selected at the start of the welt formation that one needle at the end of each group of four adjacent needles is raised, whereby each of the initial stitches of the welt is supported by two adjacent but spaced welt hooks and at the end of the welt formation, the needles of the cylinder are once again so selected that the one needle in each group of four adjacent needles is again raised, the welt hooks are inserted, the middle needle in each group of three lowered needles is now raised to enter into the stitch supported by the adjacent pair of welt hooks, and the initial stitches are knitted into the fabric.

The invention will be better understood from the following description of one embodiment of the invention which is given, by way of example, with reference to the accompanying drawings in which:

FIG. 1 is a partial diametrical section through a needle cylinder and the mechanism for forming a welt;

FIGS. 2 and 3 are sections on the lines II—II and III—III of FIG. 1;

FIG. 4 is a perspective view of a welt hook;

FIGS. 5, 6, 7, 8, and 9 are diagrammatical developments of part of the cylinder needles and welt hooks, illustrating five stages of operation of the needles and welt hooks, namely the start of the welt formation during the welt formation and three stages of clearing the welt hooks at the end of the welt formation;

FIGS. 10 and 11 diagrammatically illustrate the positions of the needles as they cooperate with the welt hooks; and

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FIGS. 12 and 13 illustrate and compare the conventional arrangement of welt hooks with that according to the invention.

As can be seen in the accompanying drawings, in particular with reference to FIGS. 1 to 3, the machine has a stationary dial cap 1 provided with an annular rim 2, which is also stationary and forms a cam track. The profile of this track includes an inwardly inclined portion 2a, and a concave portion 2b to act on the butts 3a of welt hooks 3 during their re-insertion, the hooks rotating in the direction of the arrow F<sub>1</sub> of FIG. 2. A sleeve 1a surrounds the control shaft 4 of the dial 5. This dial 5 is provided with a plurality of radial tricks 6 (see FIG. 3) equal in number to half the number of needles in the needle cylinder. A single welt hook 3 is housed in each trick, and the distance between adjacent tricks 6 is such that at the needle circumference, the distance between adjacent hooks is equal to the distance between alternate needles 7 of the needle cylinder 8. The longitudinal axes of the tricks 6 intersect the longitudinal axes of alternate ones of the needle positions. Each hook 3 is flat and thick. The dial 5 is coupled to the shaft 4 by a flanged member 9, which carries a bevel gear 10 meshing with a pinion 11 for driving a yarn-cutting device, of which only a drive shaft is shown.

The control cams for the butts 3a of the welt hooks are also arranged on the stationary dial cap 1. In particular, a cam 13 is provided to effect a small radial outward movement of the hooks each to an intermediate operative position; a second cam 14 serves to effect a larger radial outward movement of the hook butts and thus of the hooks each to an extended operative position, while a cam 15 (which is operationally coupled to the cam 14) is designed to effect the withdrawal of the hooks moved outwardly by the cam 14, in cooperation with the cam profile 2b each to a retracted inoperative position. The withdrawal of the hooks moved by the cam 13, on the other hand, is effected by the cam profile 2a. The cam 13 is controlled by a sheathed flexible cable 16, FIG. 1, which controls the vertical movement of the cam 13 into and out of engagement with the butts of the welt hooks. A similar control (not shown) is provided for the cams 14 and 15.

The welt hook control effected by the cams 14 and 15, by the cam 13 and by the cam profiles 2a and 2b is such as to cause a limited outward movement of the hooks to receive the initial stitches each to an outer intermediate position, a partial withdrawal of the hooks during the welt formation each to an inner intermediate position, an insertion of the hooks for the initial stage of the stitch clearing operation at the end of the welt formation, and the withdrawal of the hooks each to a retracted inoperative position during the continued formation of the article after completion of the welt.

FIGS. 5 to 9 illustrate the different operational positions of the welt hooks. In these figures, the hooks are references 3A, 3B, 3C, and 3D and the needles 7A, 7B, 7C, 7D, 7E, 7F, 7G, 7H and 7I. The raised needles are indicated by a cross-sectioned rectangle, while those needles which are not raised are indicated by a bullet-shaped outline. It is to be noted that the hook 3A is substantially aligned with the position of the needle 7B, the hook 3B with the position of the needle 7D, the hook 3C with the position of the needle 7F, and the hook 3D with the position of the needle 7H.

When the fabric is to be begun with the welt formation, the hooks are partially inserted by the cam 13 so that the yarn N is taken by the hooks, whilst only one needle at the end of each group of four adjacent needles is raised and that is (in FIG. 5), the needles 7A, 7E, and 7I. The needle selection is similar to that shown in FIG. 10 and is obtained in one of the manners well

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known in connection with welt patterning, under welt formation and tuck stitch or seamless pattern formation. The hooks can easily be inserted without any danger of damaging contact with the needles, since the hooks are angularly spaced apart by twice the angular spacing between the needles and only alternate needles are raised. It is to be noted that the hooks have a relatively large thickness, which is permitted by the wide angular spacing between adjacent hooks, and the fact that only one hook is individually disposed in each trick 6.

The yarn N, engaged by one needle in four (such as the needles 7A, 7E, 7I shown in FIG. 5), serves to form the stitches N<sub>1</sub> (FIG. 6) which remain on the hooks when the latter are partly withdrawn by the cam profile 2a after formation of the initial stitches. FIG. 6 shows the initial welt stitches, the initial welt portion N<sub>2</sub> and the end portion N<sub>3</sub> of the welt, the welt having been formed by the needles using one or more feeds.

When the welt is finished and the stitches N<sub>1</sub> must be transferred from the welt hooks to the needles prior to the knitting of the under-welt and leg, the hooks are inserted further than in FIG. 5 by the cam 14 (see FIG. 7), while the needles 7A, 7E and 7I of FIG. 8 are raised. After the insertion of the hooks as shown in FIG. 7, the needles 7C and 7G are also raised, i.e. a one and one needle selection as shown in FIG. 11. By raising the intermediate one of three lowered needles following a one-in-four selection, these intermediate needles (such as 7C and 7G) enter the stitches N<sub>1</sub> and thus the same stitches are engaged by the needles 7C and 7G when the hooks are withdrawn as shown in FIG. 9, by the cam 15. In the arrangement of FIG. 9, therefore, the fabric portions N<sub>2</sub> and N<sub>3</sub> are knitted together by the initial stitches N<sub>1</sub>. The welt formation is thus finished and the under-welt is begun in the usual manner.

FIGS. 12 and 13 illustrate the relatively greater spaces available for the hooks 3 in the present arrangement than in the conventional arrangement (FIG. 12), using double hooks 3x, in spite of the fact that the hooks 3 have a greater thickness. Furthermore, the hooks 3 are guided to the edge of the dial, while the tricks for the hooks 3x must be enlarged at their outer end such as at Y in FIG. 12.

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The drawings illustrate only one example of the invention which can be modified. For example, according to one possible modification, one may provide for a selection of a group of three needles, instead of a group of four needles. In the first stage, one needle in each three needles is raised (that is two needles are not raised), two hooks always projecting between two raised needles, to engage the stitch formed by these needles. A similar needle selection is effected in the first stage of the delivery of the stitches at the end of the welt formation, and in the second stage of delivery, a second needle in each group of three needles is raised to be inserted in the stitch retained by the two hooks.

What I claim is:

A knitting machine of the class described, comprising: a needle cylinder defining a circumferentially arranged series of uniformly spaced needle positions; a vertically reciprocable needle in each of said needle positions; a series of radially movable sinkers cooperating with said needles; a dial arranged for rotation in unison with said cylinder coaxially therewith, said dial having a series of radial tricks formed therein equal in number to one-half the number of said needles, the angular spacing between adjacent tricks being twice the angular spacing between adjacent needle positions, the longitudinal axes of said tricks intersecting the longitudinal axes of alternate ones of said needle positions; a welt hook slidably disposed individually in each trick; and cam means for selectively moving each welt hook between an extended operative position, a retracted inoperative position, and at least one intermediate operative position therebetween, each welt hook, in the course of its operation, cooperating with a needle in a position adjacent to one of said alternate positions, all of said welt hooks being inoperative with respect to the needles in said alternate positions.

#### References Cited by the Examiner

##### FOREIGN PATENTS

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P. C. FAW, *Assistant Examiner.*