Aug. 13, 1935. T. S. GRIEVE 2,011,360

MEANS FOR KNITTING ON AXIALLY OPPOSED NEEDLE CYLINDER CIRCULAR KNITTING MACHINES

Filed Nov. 22, 1934 3 Sheets-Sheet 1

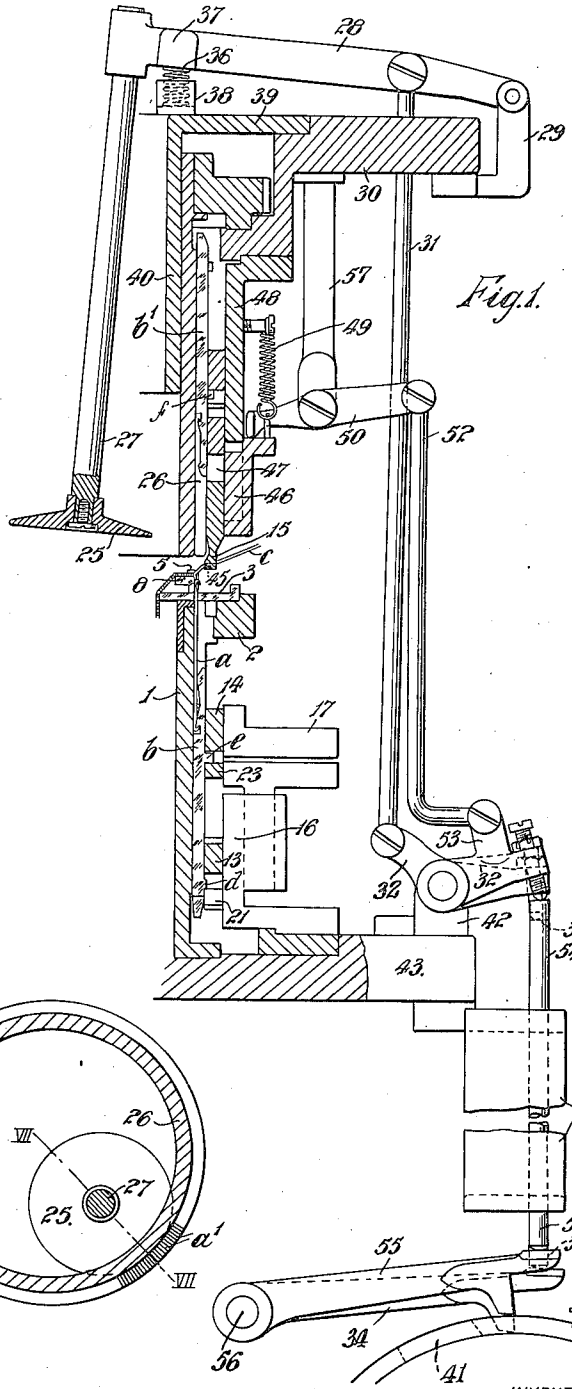


Fig. 1.

Fig. 6.

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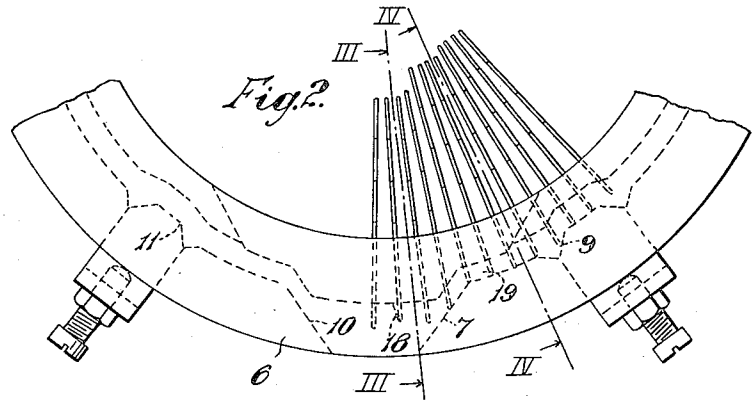
Attys

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Fig.2.



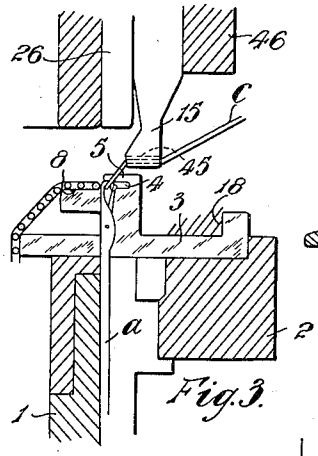


Fig.3.

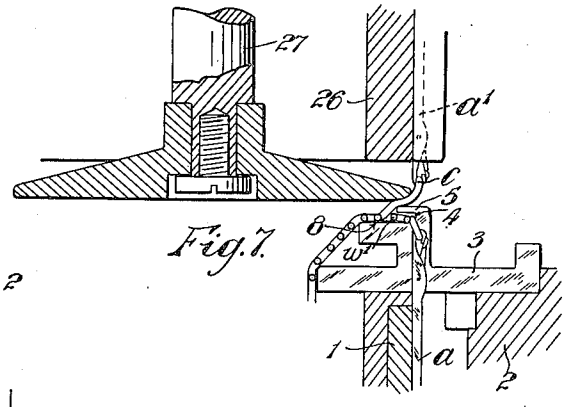


Fig.7.

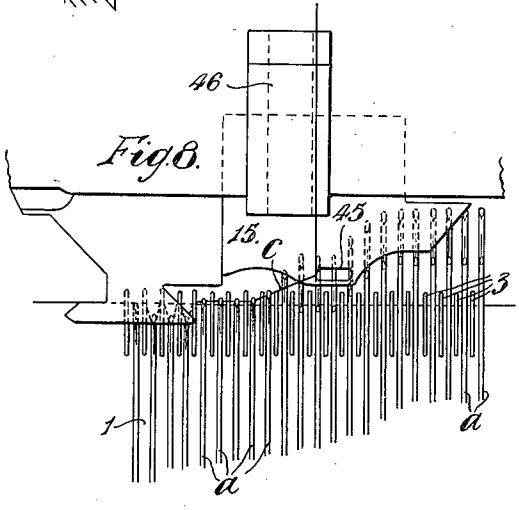


Fig.8.

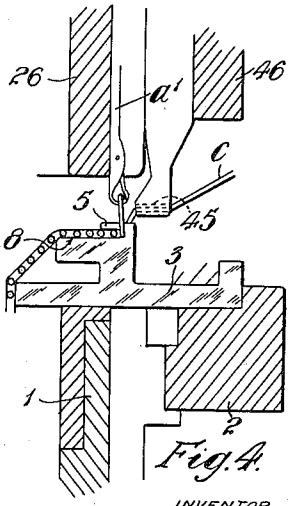


Fig.4.

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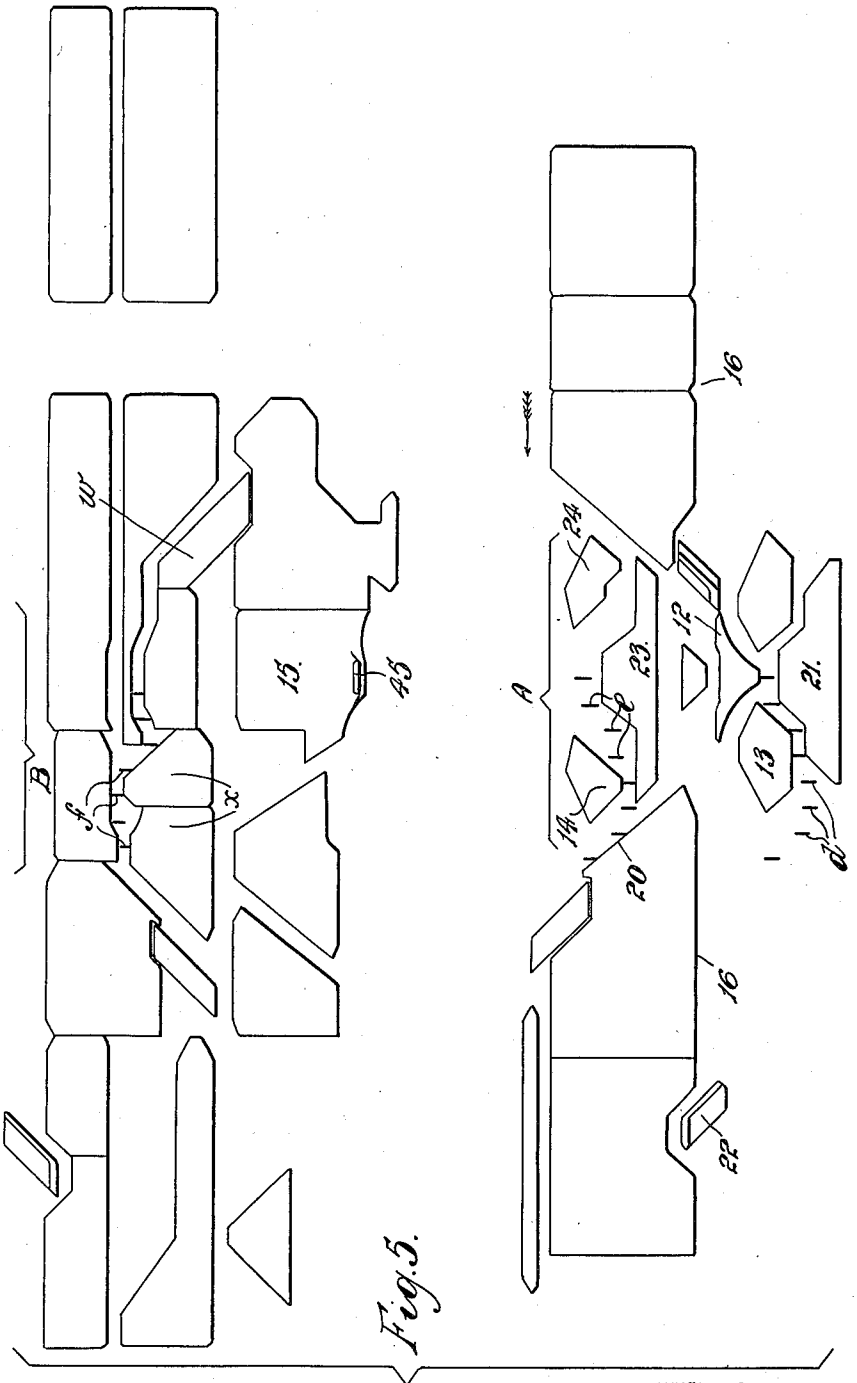


Fig. 5.

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UNITED STATES PATENT OFFICE

2,011,360

MEANS FOR KNITTING ON AXIALLY OPPOSED NEEDLE CYLINDER CIRCULAR KNITTING MACHINES

Thomas Scott Grieve, Leicester, England

Application November 22, 1934, Serial No. 754,351
In Great Britain November 28, 1933

6 Claims. (Cl. 66—14)

This invention relates to circular rib knitting machines of the double axially opposed needle cylinder type furnished with holding-down sinkers or web holders, and the object of the invention is to provide an improved method of and means for controlling loop formation by rib and plain needles.

The invention is intended to be carried into effect mainly, though not necessarily exclusively, in connection with machines of the superposed rotary needle cylinder type employing double-ended needles operable by means of sliders.

The invention is moreover applicable both to machines having inside holding-down sinkers or web holders, and to machines having outside holding-down sinkers or web holders, such elements in each case consisting of thin blade-like pieces each furnished with a nib and a throat for holding down the knitted loops or web and a draw edge over which usually the plain needles draw yarn in loop formation and which assists in casting an old loop completely off the needle.

In order that the invention may be clearly and readily understood a convenient and practical example will now be described with reference to the accompanying drawings wherein,

Figure 1 is a sectional elevation of part of a circular knitting machine of the superposed rotary needle cylinder type adapted for carrying the invention into practice, and furnished with auxiliary holding-down means including an eccentrically disposed wheel or disc hereinafter described.

Figure 2 is a plan view of part of the cam means employed in the machine for controlling the holding-down sinkers or web holders.

Figure 3 is a sectional elevation taken on line III—III of Figure 2 showing one of the plain needles drawing yarn down upon the draw edge of an adjacent holding-down sinker or web holder.

Figure 4 is a sectional elevation taken on line IV—IV of Figure 2 showing a rib needle drawing yarn round the nib of an adjacent holding-down sinker or web holder.

Figure 5 is a layout or developed view of the rib and plain knitting cam systems of the machine.

Figure 6 is a sectional plan of the rib needle cylinder showing the aforesaid eccentrically disposed wheel or disc therein in the operative position.

Figure 7 is a sectional elevation of said wheel or disc and adjacent parts of the machine, taken on line VII—VII of Figure 6, and

Figure 8 is a front elevation of the feeder plate of the machine showing the disposition of the plate in relation to the needles during reciprocating knitting.

Figures 3, 4 and 7 are drawn on an enlarged scale.

Referring to the drawings, in one convenient and practical example of carrying the invention into effect in conjunction with a circular rib knitting machine of the superposed rotary needle cylinder type furnished with double ended needles *a*, *a'* operable by means of sliders *b*, *b'*, for producing seamless hosiery, I utilize, in association with the bottom cylinder 1, an outside sinker attachment including, in an outer bed 2, horizontally and radially slidable holding-down sinkers or web holders 3 (see particularly Figures 3 and 4) with comparatively wide throats 4 below the nibs 5. As shown in Figure 2 I provide in the sinker cam cap or ring 6 a sinker cam arrangement including a fixed cam 7 disposed so that during circular rib knitting these holding-down sinkers or web holders are moved inwards after the plain needles *a* have engaged the yarn *c* and laid or drawn it down upon the usual draw edges 8, as shown in Figure 3, but before the hooks of the rib needle *a'* engage the yarn, so that after such inward movement of the sinkers or web holders by the cam the nibs 5 of the holding-down sinkers or web holders extend over the said yarn, as shown in Figure 4, whereby, when the rib needles *a'* rise to form loops and knit, they draw yarn round the lower edges of the aforesaid nibs, as shown in Figure 4. This movement of the holding-down sinkers or web holders is earlier and less than the customary movement for web holding purposes. The sinker cam cap is also fitted with an adjustable cam 9 for imparting further inward movement to the holding-down sinkers or web holders 3 so that they function as usual to hold down the knitted web when the plain needles rise after knitting. The sinker cam arrangement also conveniently includes cams 10 and 11, similar to the cams 7 and 9, for imparting similar inward movements to the holding-down sinkers or web holders during the reverse strokes of reciprocating knitting.

Referring to Figure 5, the plain knitting cam system A is divided into two parts one of which comprises cams 12, 13 for action upon the transfer butts *d* of the bottom sliders *b* in advance of the stitch forming or knocking over cam 14 for the plain needles, during circular knitting, so as to cause the corresponding needles to descend sufficiently to take the yarn supplied through the feeder 15 and draw same down upon the draw

edges 8 of the holding-down sinkers or web holders, as described with reference to Figure 3, and to maintain the needles at this level until the holding-down sinkers or web holders are moved inwards by the cam 7, Figure 2, as aforesaid and the rib needles *a'* commence to draw their loops. The other part includes the stitch or knocking over cam 14 for action on the knitting butts *e* of the same sliders during circular knitting and which is disposed at the requisite distance in a circumferenial direction from the feeder 15 to enable the needles to pause or dwell in their descent as aforesaid. The cams 12, 13 for initially lowering the plain needles are carried by a fixed part of the bottom cam box 16 and the stitch forming or knocking over cam 14 is mounted on a support 17 movable up and down in the cam box 16 so as to enable the stitch length to be varied as hereinbefore alluded to, the up and down movement of said support being controlled from the main control drum of the machine through suitable intermediate connections of a form usually adopted in circular knitting machines of the character concerned and therefore not necessary to describe and show.

Describing the method according to the invention with particular reference to Figures 2, 3, 4 and 5, as the needle cylinders rotate the needles and sliders travel in the direction of the arrow in Figure 5. When the transfer butts *d* of the sliders *b* engage the cams 12 and 13 the corresponding needles are pulled down to the position shown in Figure 3, thus being caused to take yarn at the feeder 15 and to draw same down upon the upper edges or breasts 8 of the holding-down sinkers or web holders which at this stage have been moved radially outwards to their normal position at the feeder by the usual sinker retracting cam 18. As the slider butts *d* pass under the cam 13 the needles are caused to dwell in the position shown in Figure 3 while the holding-down sinkers or web holders are pushed inwards by the cam 7 to the position shown in Figure 4 in which they remain for a short time by reason of the formation of the sinker cam track at 19, so that the rib needles *a'* can draw yarn round the lower edges of the sinker nibs, as shown, when raised to take yarn at the feeder 15 and to knit by the action of the rib knitting cam system B upon the knitting butts *f* of the sliders *b'* as represented in Figure 5. Following the dwell as aforesaid the plain needles are operated by the stitch forming or knocking over cam 14 so that they form stitches in the usual manner and the holding-down sinkers or web holders are in their turn moved further inwards by the cam 9 so that they function to hold down the knitted web when the plain needles rise under the action of the cam 20 on the knitting butts of the associated sliders.

As shown in Figure 5, the rib knitting cam system is generally of customary form, and includes a welt cam *w* adapted to be automatically withdrawn for a predetermined number of courses so as to enable the knitting butts of the sliders in the top cylinder to pass below knitting cams *x* so that knitting is suspended on the rib needles while continued on the plain needles to form welt courses after which the cam is rendered operative again so that knitting is resumed on the rib needles to complete the welt. In addition to the cams described a guard cam 21 and a reverse slider lowering cam 22 are provided on the fixed part of the cam box 16, and a guard 23 and a reverse stitch forming or knocking over cam 24 are provided on the aforesaid movable part 17 for reciprocating knitting.

Referring to Figures 1, 6 and 7, a small disc or wheel 25 is movably supported eccentrically within the top cylinder 26 with its axis vertical or substantially so on the side adjacent to the stitch forming point of the rib needles so as to enable it to be moved to and from a position wherein its periphery is disposed within the needles circle between the lower end of the top cylinder and the nibs of the holding-down sinkers or web holders and in close proximity to the backs of the rib needles at this point, as shown in Figure 7, in order to constitute a temporary draw edge for the rib needles upon resumption of rib knitting after the formation of welt courses represented diagrammatically at *w'* in Figure 7 by the plain needles. This disc or wheel is mounted so as to enable it to revolve freely on the lower end of a rod 27 suspended longitudinally within the top needle cylinder from one end of a lever 28 pivotally mounted at the other end on a bracket 29 attached to the top plate 30 of the machine. This lever is connected by a link 31 with a lower lever 32 operable by or from the control drum 33 e. g. through the medium of another lever 34 and a push rod 35, the lever 28 being moved up and down to move the disc or wheel 25 from the operative position (Figure 7) to the inoperative position (Figure 1) and vice versa. Conveniently the upward movement of the lever is imparted by a compression spring 36 interposed between a boss 37 on the lever and a socket 38 on the flange 39 of the top cylinder bearing sleeve 40, and the downward movement is imparted by a cam bit or piece 41 on the control drum which is racked round as usual so that the movements of the disc or wheel are effected at the proper times. Normally the disc or wheel 25 is maintained in the inoperative position shown in Figure 1 by the spring 36, and just prior to the resumption of rib knitting to form a locking course for the welt, the lever 34 is operated by the cam bit or piece 41 so that the disc or wheel is moved to and temporarily held in the operative position at the back of the rib needles, as shown in Figure 7, so that the adjacent portion of the periphery provides a temporary draw edge for these needles as aforesaid. The lever 32 is mounted in a bracket 42 attached to the bottom plate 43 of the machine, and the push rod 35 is slidably mounted in a bracket 44 also attached to the bottom plate. The lever 34 is mounted on the lower part of the machine frame as usual.

In a circular rib knitting machine of the superposed needle cylinder type adapted to operate with both circular action for tubular knitting and reciprocatory action, e. g. for heel and toe knitting as in a seamless hosiery machine, and to knit in accordance with the method hereinbefore described, I provide a feeder movable up and down for varying the angle at which the yarn extends to the needles from the feed hole or slot so that the yarn may be disposed at a steeper angle for reciprocating knitting than it is for circular knitting. Conveniently, as shown in Figures 1 and 8, the feeder consists of the plate 15 provided with the requisite hole or slot 45 and formed or mounted on a block or like piece 46 slidable in a guideway 47 in one of the cam boxes, e. g. the top cam box 48 as shown. This feeder may be operated in one, e. g. the upward direction by a spring 49 and moved in the opposite direction by a lever 50 operated through intermediate connections by a cam 51 on the control

drum 33. These intermediate connections comprise a link 52 connected to the lever 50 and to a lower lever 53 mounted in the bracket 42, a push rod 54 mounted in the bracket 44 for action upon the lever 53 and a lever 55 mounted on the same pivot pin 56 as the lever 34 and acted upon by the cam 51. The lever 50 is pivoted on a pin in an eye piece 57 or equivalent fixed in the top plate 30. As shown in Figure 1, the cam 51 is of such circumferential extent as normally to maintain the feeder plate in the lower position for circular knitting. At the commencement of reciprocating knitting the lever drops off the cam 51 so that the feeder plate is raised to the position shown in Figure 3 and, as shown in this figure, the yarn c between the last needle to knit it and the feed hole or slot 45 is disposed at a steeper angle for reciprocating knitting than it is for circular knitting. Figure 3 represents the position of the feeder and needles at the commencement of the first stroke of reciprocating knitting. The purpose of this adjustment of the feeder is to prevent the nibs of the holding-down sinkers or web holders which move inwards on each side of the group of operative needles from engaging the length of yarn between said needles and the feed hole or slot, and pressing same sinuously between the adjacent inoperative needles. This is an objection to be avoided on account of the fact that when the machine reverses the take-up usually provided has to straighten out the yarn in addition to pulling it back through the feeder so that the yarn is subjected to undue tension and is liable to break especially if, as may be the case, it has been mutilated by the aforesaid nibs and/or a fine yarn is in use. It may, however, be pointed out that while the feeding of the yarn with the feed hole or slot at the higher level is desirable for reciprocating knitting, and might be suitable for circular plain knitting, the height of the feed hole or slot must bear a definite relation to needles knitting in the top cylinder and for this reason a disposition of the feed hole or slot at a level suitable for reciprocating knitting may not be satisfactory or even possible for rib knitting. It is therefore an advantage to be able to vary the height of the feed hole or slot aforesaid so that after raising the feeder for reciprocating knitting said feeder may be restored to its original position for circular knitting and rib knitting in particular. The feeder may be moved down to a stop in order to locate the feed hole or slot in the desired definite normal position, in which case the intermediate connections may be of a yieldable character.

The invention herein described is not limited to double axially opposed needle cylinder machines furnished with the outside sinker attachment particularly referred to nor to seamless hosiery machines as it may be carried into practice in machines of the same type furnished with inside sinkers of known form and arrangement and in machines for producing fabric or articles other than seamless hosiery.

What I claim then is:—

1. A circular knitting machine furnished with double axially opposed needle cylinders, double ended needles, needle operating sliders having knitting and transfer butts for transferring needles from one cylinder to the other so as to enable needles to operate in both cylinders for rib knitting, a series of holding-down sinkers or web holders, a sinker cam arrangement adapted to move the holding-down sinkers or web holders inwards from their normal outward position at the yarn feeding location earlier but to a lesser extent than is customary for web holding purposes, a rib cam system, and a plain knitting cam system formed in two parts one of which is fixed and carries cam means for action upon the transfer butts of the sliders to move the plain needles to a position in which they pause or dwell in their loop forming movement with the yarn laid upon the usual draw edges of the holding-down sinkers or web holders until the latter have been moved inwards as aforesaid and the other of which parts carries the stitch forming or knocking over cam means for action upon the knitting butts of said sliders and is adjustable so as to enable the stitch length to be varied, so that after the plain needles have laid the knitting yarn upon the usual draw edges of the holding-down sinkers or web holders the rib needles are caused to draw the yarn round the lower edges of the sinker or web holder nibs.

2. In a circular knitting machine which has double axially opposed needle cylinders, needles adapted to operate in both cylinders for rib knitting, a series of holding-down sinkers or web holders, and is adapted automatically to produce welts by suspending knitting on the rib needles for a plurality of courses and then resuming rib knitting, means adapted to control and operate the holding-down sinkers or web holders conjointly with the needles in such a manner that needles knitting in both cylinders are caused respectively to draw yarn, in forming loops, round different draw edges presented by the holding-down sinkers or web holders, and a member adapted for use temporarily as auxiliary holding-down means in association with the rib needles after the formation of plain knitted welt courses to enable said needles definitely to draw loops, when they resume knitting, independently of the holding-down sinkers or web holders.

3. In a circular knitting machine which has double axially opposed needle cylinders, needles adapted to operate in both cylinders for rib knitting, a series of holding-down sinkers or web holders, and is adapted automatically to produce welts by suspending knitting on the rib needles for a plurality of courses and then resuming rib knitting, means adapted to control and operate the holding-down sinkers or web holders conjointly with the needles in such a manner that needles knitting in both cylinders are caused respectively to draw yarn, in forming loops, round different edges presented by the holding-down sinkers or web holders, a small eccentrically disposed disc-like member movably arranged on the inside of the needle circle at the side or location where the rib needles form the loops so that said member can be caused temporarily to occupy an operative position in close proximity to the backs of the rib needles just clear of the nibs of the holding-down sinkers or web holders for the purpose of holding-down the old rib loops formed prior to the welt until the rib needles cast them off after the formation of the plain knitted welt courses, and means for moving said member to and from its operative position.

4. In a circular knitting machine which has superposed rotary needle cylinders, needles adapted to operate in both cylinders for rib knitting, a series of holding-down sinkers or web holders, and is adapted automatically to produce welts by suspending knitting on the rib needles for a plurality of courses and then re-

suming rib knitting, means adapted to control and operate the holding-down sinkers or web holders conjointly with the needles in such a manner that needles knitting in both cylinders are caused respectively to draw yarn, in forming loops, round different edges presented by the holding-down sinkers or web holders, auxiliary holding-down means comprising a small disc mounted so as to revolve freely on a rod suspended longitudinally within the top needle cylinder from one end of a pivoted lever, and means for automatically operating the lever so as to move the disc to and from an operative position wherein its periphery is disposed eccentrically within the needle circle between the lower end of the top cylinder and the nibs of the holding-down sinkers or web holders and in close proximity to the backs of the rib needles in order to constitute a temporary draw edge for the rib needles at predetermined times.

5. A circular knitting machine furnished with superposed rotary needle cylinders, needles adapted to operate in both cylinders for rib knitting, a sinker or web holder bed mounted on the outside of the needle cylinders, a series of holding-down sinkers or web holders in said bed, a cam cap mounted co-axially with the said bed, means adapted to control and operate the holding-down sinkers or web holders conjointly with the needles in such a manner that needles knitting in both cylinders are caused respectively to draw yarn, in forming loops, round different draw edges presented by the holding-down sinkers or web holders, and a member adapted to be rendered operative temporarily after suspension of knitting on rib needles for use as auxiliary holding-down means upon resumption of rib knitting to enable the rib needles definitely to draw loops for at least one course independently of the holding-down sinkers or web holders.

6. A circular knitting machine furnished with superposed needle cylinders operable with circular action and with reciprocatory action, needles adapted to operate in both cylinders for rib knitting, a sinker or web holder bed mounted on the outside of the needle cylinders, a series of holding-down sinkers or web holders in said bed, a cam cap mounted co-axially with the said bed, means adapted to control and operate the holding-down sinkers or web holders conjointly with the needles in such a manner that needles knitting in both cylinders are caused respectively to draw yarn, in forming loops, round different draw edges presented by the holding-down sinkers or web holders, a member adapted to be rendered operative temporarily after suspension of knitting on rib needles for use as auxiliary holding-down means upon resumption of rib knitting to enable the rib needles definitely to draw loops for at least one course independently of the holding-down sinkers or web holders, and a yarn feeder having a feed hole or slot and mounted for movement up and down for varying the angle at which the yarn extends to the needles from the feed hole or slot so that the yarn can be disposed at a steeper angle for reciprocating knitting than it is for circular knitting.

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