

Nov. 18, 1930.

T. S. GRIEVE

1,782,298

CIRCULAR KNITTING MACHINE

Filed Nov. 19, 1926

4 Sheets-Sheet 1

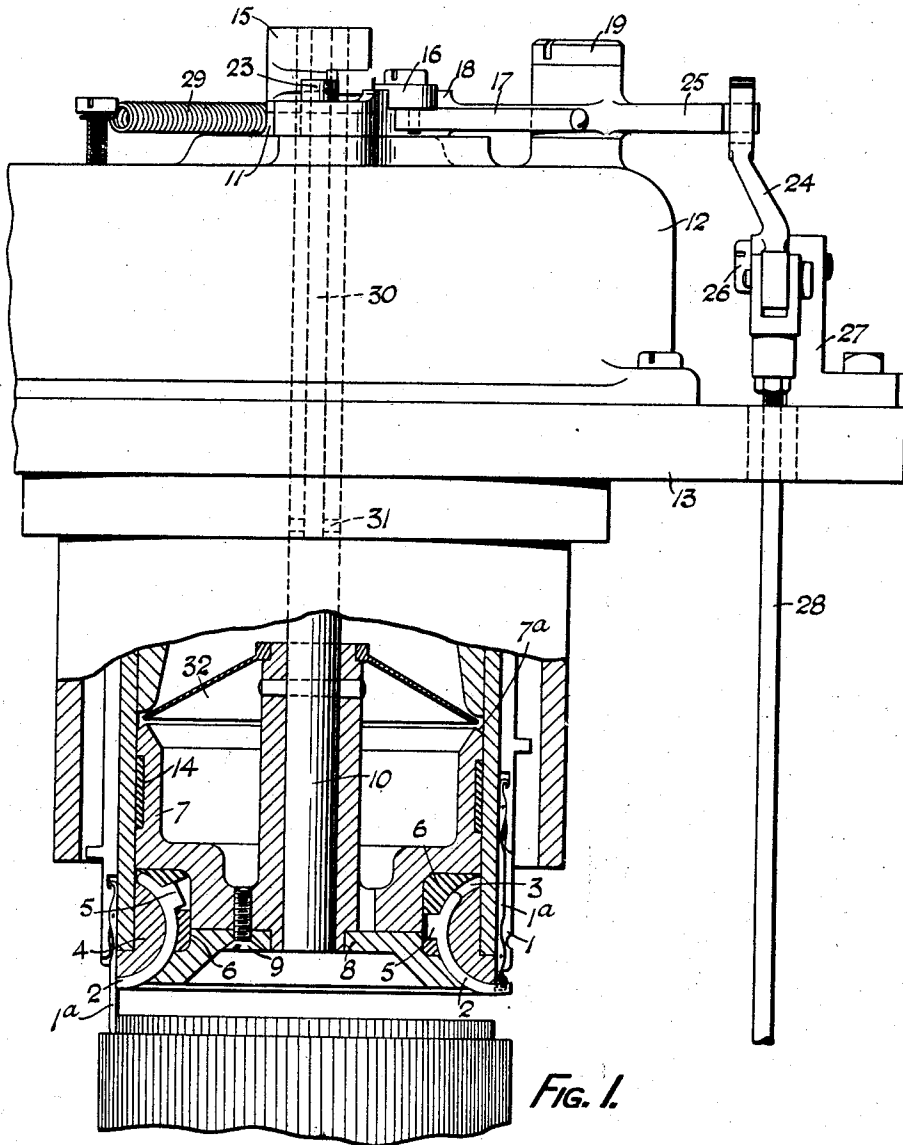


FIG. 1.

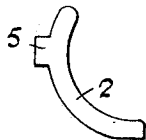


FIG. 2.

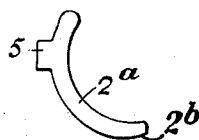


FIG. 3.

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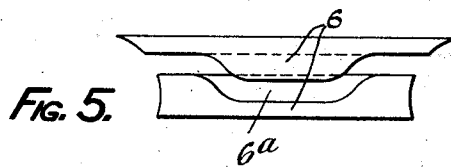
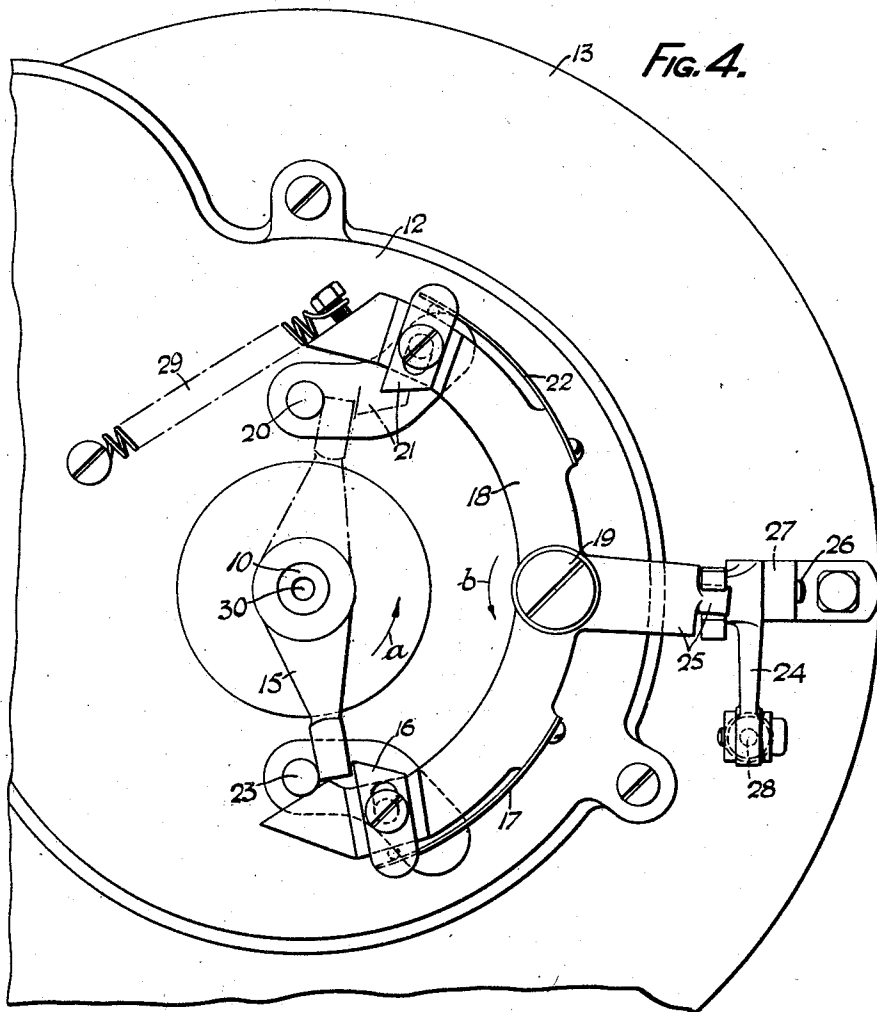
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4 Sheets-Sheet 2



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CIRCULAR KNITTING MACHINE

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4 Sheets-Sheet 3

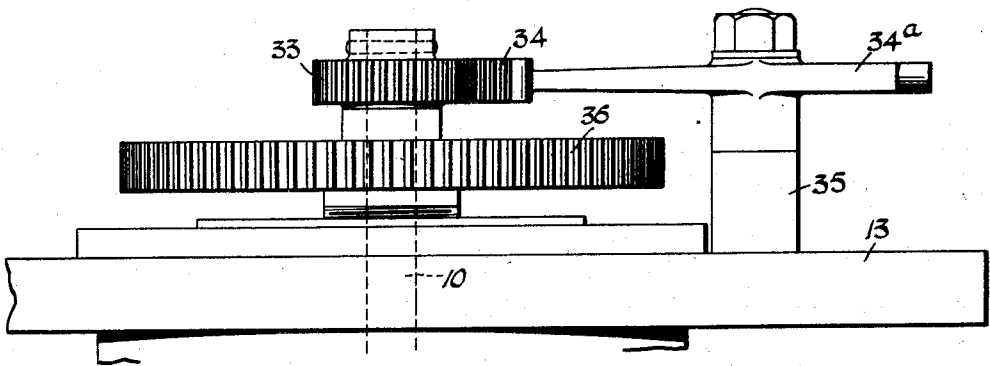


FIG. 6.

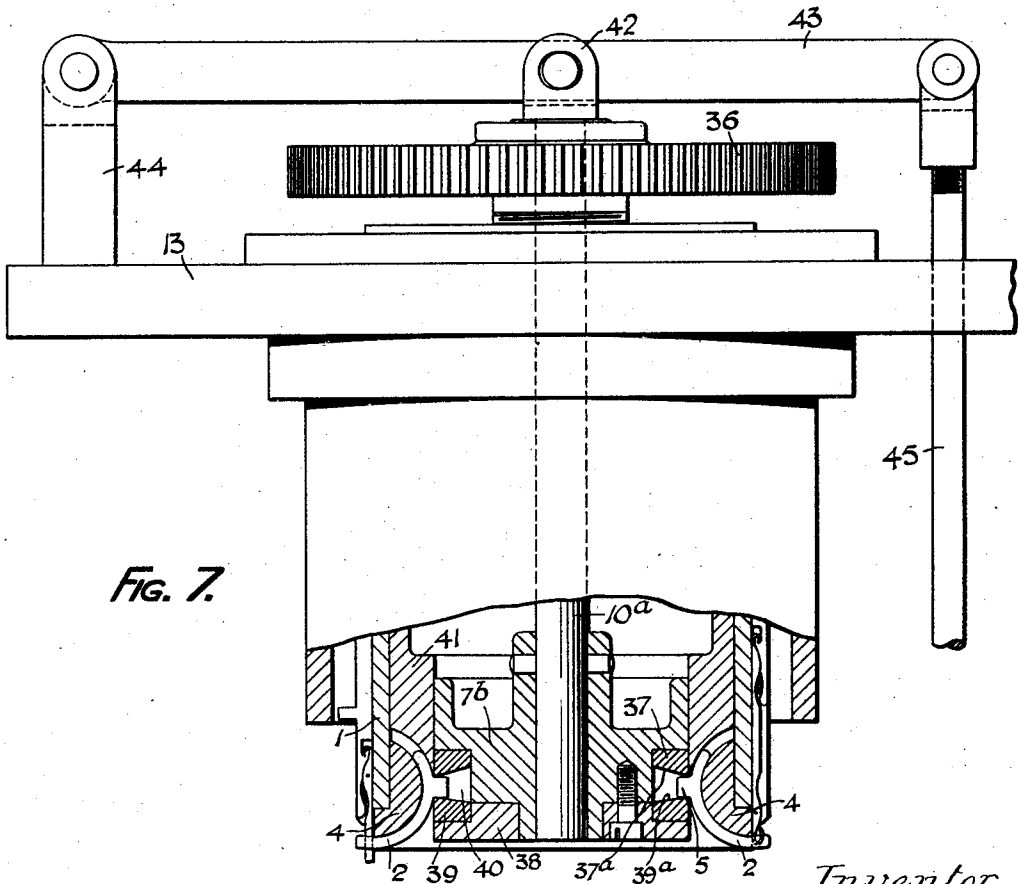


FIG. 7.

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4 Sheets-Sheet 4

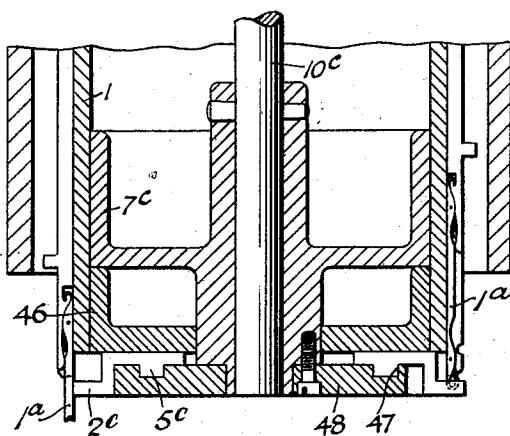


FIG. 8.

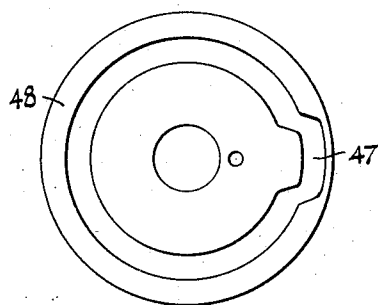


FIG. 9.

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UNITED STATES PATENT OFFICE

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CIRCULAR-KNITTING MACHINE

Application filed November 19, 1926, Serial No. 149,393, and in Great Britain November 21, 1925.

This invention relates to circular knitting machines and concerns those of the type having co-axial opposed needle cylinders viz, a rib cylinder and a plain cylinder, and is applicable to both stationary and revolving cylinder machines of this type and which operate also with an oscillating motion such for example, as for the purpose of making heels and toes in the production of seamless hosiery.

As is well known, in machines of this type the needle cylinders are usually superposed, the top one acting as the rib cylinder and the bottom one as the plain cylinder.

The object of the invention is to provide for such machines improved means to facilitate levelling up and knocking over of the rib loops as will be hereinafter described.

In order to enable what is known as broad rib fabric to be knitted on machines of the type concerned or to enable knitting to take place upon two or more adjacent rib needles without the co-operation of the opposing plain or frame needles, means have been provided to facilitate the action of the rib needles in drawing their loops and prevent the knitted web from being drawn upwards. For instance, a ring, the periphery of which has been formed with vertical and radial grooves has been used in the top cylinder; or again the top cylinder has been provided with vertically movable sinkers or knocking over bits.

Now to be effective for the intended purpose the means adopted should project outwards between the rib needles to an extent sufficient to prevent the yarn or web from slipping up over the outer end of such means. For example, if the rib needles are working in vertical grooves in the peripheral edge of a ring or disc then the walls of such grooves should, if possible, project outwards between the needles to such an extent as to constitute ledges which will hold the yarn or web down when the rib needles rise. When a circular knitting machine is operating with a to and fro or oscillating movement, for instance when making seamless toe and heel pouches, knitting action continues on some of the needles while the others remain idle. In such action the relative traverse between the feeder

and the needles in the acting group carries the yarn beyond the outermost needles in the said group so that alternately on opposite sides of said group the yarn is momentarily laid across the front of a number of the idle needles. This yarn since these needles are not in operation is not knitted and upon reversal of the motion is drawn back through the feeder by the take up device of the machine. It is this yarn which is laid across the idle needles which is herein referred to as the slack yarn or thread and it is of importance that the projecting means or elements provided for holding down the fabric should not offer obstruction likely to catch or to be caught by such slack yarn.

Where the rib needles have operated in conjunction with a grooved ring or some similar device in the top needle cylinder it has generally been found necessary to limit the projection of the intervening walls or to round or level off the lower corner of such walls for the purpose of preventing the slack thread from catching therein during reciprocating knitting, with the result that owing to the insufficient projection there has been a tendency for the yarn or web to slip upwards over the outer edge during the up-draw motion of the rib needles.

To overcome the difficulty the present invention provides in the rib needle cylinder of machines of the kind referred to a device the essential feature of which is that its periphery, while being formed to provide between the rib needles radial projections which are of adequate extent to hold down the yarn or web, is collapsible or contractile in order to provide clearance when necessary and clear the slack thread during reciprocating knitting.

The operative portion of the periphery is constituted by sinkers, blades, bits or like elements disposed radially between the rib needles and capable of radial movement. The important feature is that the sinkers, bits or the like are radially movable whereby they may occupy either a projected or extended position for use or a withdrawn or contracted position, and the in and out movement thereof may be imparted by any

convenient means. The circular series of sinkers or like elements may be contracted and expanded in part or as a whole. For instance, the series may be expanded in the region of the rib stitch cam only. That is to say, those sinkers located near the rib stitch cam may be moved out of the projected position while the others remain in the contracted position.

In further describing the invention, reference will be made to the accompanying drawings wherein,

Figure 1 is a sectional elevation of a convenient embodiment of the invention, as applied to a machine wherein the needle cylinders rotate and reciprocate within stationary cam boxes.

Figure 2 shows a sinker used in such embodiment.

Figure 3 shows a modified form of sinker.

Figure 4 is a plan of part of the mechanism shown in Figure 1.

Figure 5 shows a groove cam for operating the sinkers.

Figure 6 is an elevation of a modification of the aforesaid embodiment.

Figure 7 is a sectional elevation of a further modification.

Figure 8 is a sectional elevation of another example of the invention, and

Figure 9 is a plan of a cam employed in such example.

According to the embodiment of the invention illustrated in Figures 1, 2, 4 and 5, I provide in the lower end of the top needle cylinder 1 a series of radial sinkers 2 of arcuate form which sinkers work in corresponding curved grooves 3 in a ring 4 fitted in the lower end of said cylinder. Each sinker has a butt or projection 5 for engagement with a groove cam 6, the upper part of which is attached to a central sleeve 7 and the lower part to a ring or plate 8 fixed to said sleeve by screws, one of which is shown at 9. The cam 6 is arranged and designed to impart arcuate sliding movement to the sinkers whereby the outer extremity of each sinker is moved radially in and out between the adjacent rib needles 1^a and in a plane substantially at right angles to the direction of movement of said needles. The sinker at the right hand side of Figure 1 is shown projected and that on the left hand side withdrawn. As shown in Figure 5, the groove in the cam 6 is formed at a uniform level for the greater part of its length in order to retain the majority of the sinkers in the withdrawn position, but the remaining part of the groove is offset at 6^a or formed at a lower level. When the cam is in position in the machine, the active part 6^a thereof is normally located in the vicinity of the rib stitch cam (not shown) in order to project the corresponding sinkers at this point. When the heel and toe is to be made the

sinker cam is changed in position so as to enable the active part thereof to operate on the opposite side of the needle circle or at some other suitable point so that the sinkers 2 in that portion of the needle circle where a slack thread is located during reciprocating knitting are withdrawn and thus clear said thread. The sleeve 7 is therefore held by a device which turns said cam or allows it to be turned when its position is to be changed. For example, the said sleeve may be pinned on or otherwise attached to a central vertical shaft 10 passed through a bearing (not shown) in the upper part of the machine head and through a boss 11 on a cover 12. This cover is fixed upon the top plate 13 of the machine and serves to protect parts such as the cylinder driving gears (not shown). A spring ring or band 14 is inserted into a corresponding recess in the sleeve 7 for frictional engagement with the interior of the needle cylinder 1. Fixed upon the upper end of the shaft 10 is an arm 15 engaged by a catch or stop 16 controlled by a spring 17, on one end of an arcuate lever 18 fulcrumed centrally at 19 on the cover 12, as represented in Figure 4. Normally, i. e. during the normal rotation of the cylinders in the direction of the arrow *a* in said figure, the aforesaid stop and arm hold the sinker cam in a definite position for projecting the sinkers as they pass the rib stitch cam. When however, reciprocating knitting is to take place the lever 18 is turned in the direction of the arrow *b* to disengage the stop or catch 16 from the arm 15, whereupon the sleeve 7 by reason of the frictional engagement of the spring ring or band 14 with the cylinder 1 is turned by and with said cylinder until such movement is arrested by the engagement of the said arm with a stop 20 on the cover 12 as represented by dot and dash lines. Movement of the sinker cam in the opposite direction when the rotation of the cylinders is reversed is prevented by the engagement of the arm 15 with a catch or stop 21 controlled by a spring 22 on the lever 18 which stop is moved into its active position (indicated by dot and dash lines) when the said lever is turned as aforesaid. The position of the sinker cam is thus changed and said cam is held in its new position while reciprocating knitting takes place after which the lever 18 is turned back to its original position thereby disengaging the stop or catch 21 from the arm 15 so that the sleeve 7 is again turned by the needle cylinder 1 to carry the sinker cam back to the position previously occupied thereby. This movement is limited by the contact of the arm with another stop 23 in the cover 12, while the catch or stop 16 again holds the arm until its release is brought about by a further movement of the lever 18. As the arm 15 moves into one position or

the other the corresponding stop or catch i. e. 16 or 21, yields to allow the arm to pass it, the inner ends of the stops or catches being bevelled for this purpose. The movement of the lever 18 is controlled by a pattern chain or controlling drum (not shown) of the machine through intermediate connections which conveniently comprise a bell crank lever 24 bifurcated at one end for engagement with a projection 25 on the lever 18, and fulcrumed at 26 on a bracket 27 attached to the top plate 13. The other end of the bell crank lever has connected to it a link 28 which is operated by pattern mechanism of a known kind. The lever 18 is moved to and held in its normal position by the action of said pattern mechanism and when released thereby is actuated by a spring 29.

Oil passages 30 and 31 may be drilled in the shaft 10 and a deflector 32 attached to the sleeve 7, the upper edge of which is beveled, for the purpose of supplying oil between the said sleeve and the needle cylinder 1.

Instead of moving the sleeve 7 frictionally as just described the vertical shaft may be positively actuated in some suitable manner to turn the sinker cam from one position to another.

To this end the said sleeve is made freely rotatable in, i. e. it has no frictional engagement with the needle cylinder, the spring ring 14 (Figure 1) being omitted, and as shown in Figure 6, the shaft 10 may have a pinion 33 pinned thereon which meshes with a toothed segment 34 fulcrumed on a pin 35 fixed in the top plate 13, said segment being formed with an arm 34^a which is connected to or engaged by actuating means. The oscillation of the segment to impart the required movement to the shaft 10 may be effected by means similar to those employed to rock the lever 18 described with reference to Figures 1 and 4. That is to say, a bell crank lever similar to the lever 24 (Figures 1 and 4) may be arranged in engagement with the arm 34^a and actuated to turn the segment first in one direction and then in the other by the pattern mechanism aforesaid to effect rotation of the sleeve at the required times.

When this arrangement is adopted, the cover 12 (Figures 1 and 4) is dispensed with but, if desired, a cover of modified form may be fitted over the driving gear (which includes the gear wheel 36) for the top needle cylinder.

The extent of rotation of the sleeve in either direction is determined by the pattern mechanism aforesaid.

According to an alternative arrangement instead of projecting part of the circular series of sinkers, the whole may be expanded and contracted simultaneously. For example, if arcuate sinkers are used these may be controlled by a ring or other body grooved or

otherwise formed for engagement with the butts or projections of the sinkers and capable of vertical movement within the cylinder.

An example of such an arrangement is illustrated in Figure 7 according to which the arcuate sinkers 2 which work in a grooved ring 4 as previously described herein are controlled by a sleeve 7^b carrying a ring 37 and a flanged collar 38 on which another ring 39 is mounted. The rings are so located as to form a groove or space 40 between them for the reception of the sinker butts 5. The sleeve 7^b is fitted slidably within a sinker guard sleeve 41 fixed in the needle cylinder 1. When the sleeve 7^b is moved downwards the lower ends of the sinkers are projected (as shown) and when upward movement of the sleeve is effected, said ends are withdrawn. The opposing faces 37^a and 39^a of the rings are oppositely bevelled or inclined to allow for the arcuate movement of the sinker butts. The sleeve 7^b is pinned on a shaft 10^a slidably mounted in the upper part of the machine head and fitted with a bifurcated eye screw 42 for the connection thereto of a lever 43 fulcrumed at one end in a fitment 44 on the top plate 13 and having a link 45 connected to its opposite end. This link extends through the top plate 13 and may be actuated by the pattern mechanism hereinbefore referred to, for imparting vertical movement to the shaft 10^a and consequently to the sleeve 7^b, at the required times, and determining the positions thereof.

The desired object may be achieved by using straight instead of arcuate sinkers such straight sinkers being carried in a radially grooved dial, plate or ring in the lower end of the needle cylinder. These sinkers should be disposed substantially horizontal and moved in and out by a cam or other appropriate means.

A convenient arrangement of this kind is illustrated in Figures 8 and 9 according to which there is fixed in the lower end of the needle cylinder 1, a radially grooved dial 46 equipped with horizontally disposed sinkers 2^c, the butts 5^c of which work in a cam groove 47 in a disc 48 which is attached to a sleeve 7^c and also serves to support the sinkers. As will be seen on reference to Figure 9, the cam groove is circular for the most part so as to retain the majority of the sinkers in the withdrawn position, but the remaining part is offset so that the corresponding sinkers are projected thereby. This offset portion is normally located in the vicinity of the rib stitch cam (not shown).

The sleeve 7^c is fixed on a shaft 10^c and, to bring the projection of the sinkers in the vicinity of the stitch cam at one time, and at a point remote from said cam at another time, said sleeve may be either frictionally actuated like the sleeve 7 or positively actuated like the sleeve 7^b in the manner previously described

herein with reference to Figures 1 and 4, or Figure 6.

It will be understood that it is the lower edge of the sinkers, bits or like elements which constitutes the holding means for the yarn or web. I may, if desired, bevel, incline or otherwise form this edge so that it will vary in relation to the needles in accordance with the extent of projection of the extremity. For instance, in the case of the arcuate sinker 2^a (Fig. 3), the outer edge is made eccentric at 2^b, it being understood that such formation is applied only to that part of the sinker which projects between the needles, then by projecting such sinkers to a greater or less extent according to requirements the active edge thereof will be varied slightly in relation to the needles so that the length of loop will be correspondingly varied. In this manner the quality of the fabric can be varied.

When such sinkers are used the variable projection may be obtained by providing for the adjustment of the actuating cam vertically, as for instance, by slight vertical movement of the shaft 10 or in the case of the arrangement shown in Figure 7, by limiting the downward movement of the shaft 10^b. As regards the arrangement shown in Figure 8, provision may be made for slight vertical movement of the shaft 10^c to effect adjustment of the sinkers 2^c so as to vary the relationship between the lower edges thereof, and the needles 1^a for varying the quality of the fabric.

What I claim then is:—

1. In a circular rib knitting machine, rib and plain needle cylinders co-axially opposed, needles operable in said cylinders for rib and plain knitting, said machine operating with rotary motion and also with reciprocating motion during which latter the knitting yarn slackens; a circular series of web holding elements arranged in the rib cylinder for projection outwards between the rib needles to hold the knitted web against the loop drawing action of said needles, and means whereby said elements can be withdrawn inwards to such extent as to avoid contact with the slack yarn during reciprocatory knitting action of the machine.

2. In a circular rib knitting machine, rib and plain needle cylinders co-axially opposed, needles operable in said cylinders for rib and plain knitting, said machine operating with rotary motion and also with reciprocating motion during which latter the knitting yarn slackens; a circular series of web holding elements respectively furnished with butts and arranged in the rib cylinder so that their outer ends are capable of movement towards and from the cylinder axis, and means operative upon said butts whereby from an outward projected position wherein the outer ends of said elements hold down the knitted web against the loop drawing action of the

rib needles, said ends can be withdrawn completely to an inward contracted position to miss the slack yarns during reciprocatory action of the machine.

3. In a circular rib knitting machine, rib and plain needle cylinders co-axially opposed, needles operable in said cylinders for rib and plain knitting, said machine operating with rotary motion and also with reciprocating motion during which latter the knitting yarn slackens, a circular series of web holding elements movably arranged in the rib needle cylinder, and cam means normally positioned to project the elements outwards between the loop forming rib needles so as to hold down the knitted web during the loop drawing action, said cam means being movable to another position during reciprocating knitting so that the web holding elements in that portion of the needle circle where the slack yarn is located are withdrawn to avoid contact with the said yarn.

4. In a circular rib knitting machine, rib and plain needle cylinders co-axially opposed, needles operable in said cylinders for rib and plain knitting, said machine operating with rotary motion and also with reciprocating motion during which latter the knitting yarn slackens, a circular series of web holding elements respectively furnished with butts and arranged in the rib cylinder so that their outer ends are capable of movement towards and from the cylinder axis, a cam normally positioned for acting on the said butts so that the elements are projected outwards between the loop forming rib needles so as to hold down the knitted web against the loop drawing action, said cam being movable to another position during reciprocating knitting so that the elements in that portion of the needle circle where the slack yarn is located are withdrawn to avoid contact with said yarn, and means for determining the position of said cam.

5. In a circular rib knitting machine, rib and plain needle cylinders co-axially opposed, needles operable in said cylinders for rib and plain knitting, said machine operating with rotary motion and also with reciprocating motion during which latter the knitting yarn slackens, a circular series of web holding elements respectively furnished with butts and arranged in the rib cylinder so as to be individually slidable radially between the rib needles, a cam normally positioned for acting on the said butts so that the elements are projected outwards between the loop forming rib needles so as to hold down the knitted web against the loop drawing action, said cam being movable to another position during reciprocating knitting so that the elements in that portion of the needle circle where the slack yarn is located are withdrawn to avoid contact with said yarn, a rotatable member carrying said cam and op-

erable to move it from its normal to the other position, and vice versa, and means for controlling the rotation of said member, for the purpose described.

5 6. In a circular rib knitting machine, rib and plain needle cylinders, co-axially opposed, needles operable in said cylinders for rib and plain knitting, said machine operating with rotary motion and also with reciprocating motion during which latter the knitting yarn slackens, a circular series of arcuate web holding elements each furnished with a butt, a grooved ring in the rib needle cylinder in which the said elements are slidably arranged so that their outer ends can be moved in and out between the rib needles, a cam operative upon the butts, said cam being normally positioned so that the outer ends of the elements are projected outwards between the loop forming rib needles to hold down knitted web against the loop forming action, means for moving the cam to another position during reciprocating knitting so that the ends of the elements in that portion of the needle circle where the slack yarn is located are withdrawn to avoid contact with said yarn, and means for controlling the movement of said cam, for the purpose described.

30 7. In a circular rib knitting machine, rib and plain needle cylinders co-axially opposed, needles operable in said cylinders for rib and plain knitting, said machine operating with a rotary and also with reciprocating motion during which latter the yarn slackens, a circular series of web holding elements arranged in the rib needle cylinder so that their outer ends can be moved radially in and out between the rib needles, and means for effecting such movement whereby said elements can be projected outwards between the loop forming rib needles to hold down the knitted web against the loop forming action, and withdrawn inwards to such extent as to avoid contact with the slack yarn during reciprocatory action of the machine, each of said elements having its operative edge formed so that it will vary in relation to the needles according to the extent of its projection, and said means being adjustable axially in the rib cylinder to vary the extent of such projection, for the purpose described.

55 8. In a circular rib knitting machine operating with rotary motion and with reciprocating motion during which latter the knitting yarn slackens, rib and plain cylinders axially opposed, needles operable in said cylinders for rib and plain knitting, a radially grooved bed in the rib needle cylinder, web holding elements slidable in said bed so that their outer ends can be moved in and out between the rib needles so that when projected they hold down the knitted web against the loop drawing action of the rib needles, means whereby said elements can be withdrawn in-

wards to such extent as to avoid contact with the slack yarn during the reciprocatory action of the machine, and means exterior of the rib cylinder for controlling said projecting and withdrawing means.

9. In a circular rib knitting machine of the rotary and rotary reciprocatory needle cylinder type having axially opposed rib and plain needle cylinders with needles operable in each for rib and plain knitting, a radially grooved bed in the rib needle cylinder, web holding elements slidable in said bed, means within the rib cylinder for projecting said slidable elements between the loop forming rib needles during circular knitting to hold down the knitted web and for withdrawing said elements to such extent as to avoid contact with the slack yarn engendered during the reciprocatory knitting action of the machine, and means operable externally of the cylinder for controlling said interior means, all for the purpose set forth.

10. In a circular rib knitting machine of the rotary and rotary reciprocatory needle cylinder type having axially opposed rib and plain needle cylinders with needles operable in each for rib and plain knitting, a radially grooved bed in the rib needle cylinder, web holding elements slidable in said bed, a cam operative upon said elements and normally positioned to project same outwards between the loop forming rib needles so as to hold down the knitted web against the loop drawing action during circular knitting, a rotatable sleeve mounted centrally within the rib needle cylinder to carry said cam, and means external to the rib cylinder for controlling rotation of the sleeve to another position wherein during the reciprocatory action of the machine the cam withdraws the elements in that portion of the needle circle where the slack yarn is located so that they avoid contact with said yarn.

In testimony whereof I affix my signature.

THOMAS SCOTT GRIEVE.