United States Patent [19]

Schindele

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[54] **APPARATUS FOR CONTROLLING THE JACKS AND NEEDLES OF CIRCULAR KNITTING MACHINES**

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[52] **U.S. Cl.** ..... **66/42,** 66/50 A, 66/57

[51] **Int. Cl.** **D04b 15/68,** D04b 15/32

[58] **Field of Search** ..... 66/57, 50 R, 38, 66/50 B, 25, 78, 40, 42, 50 A

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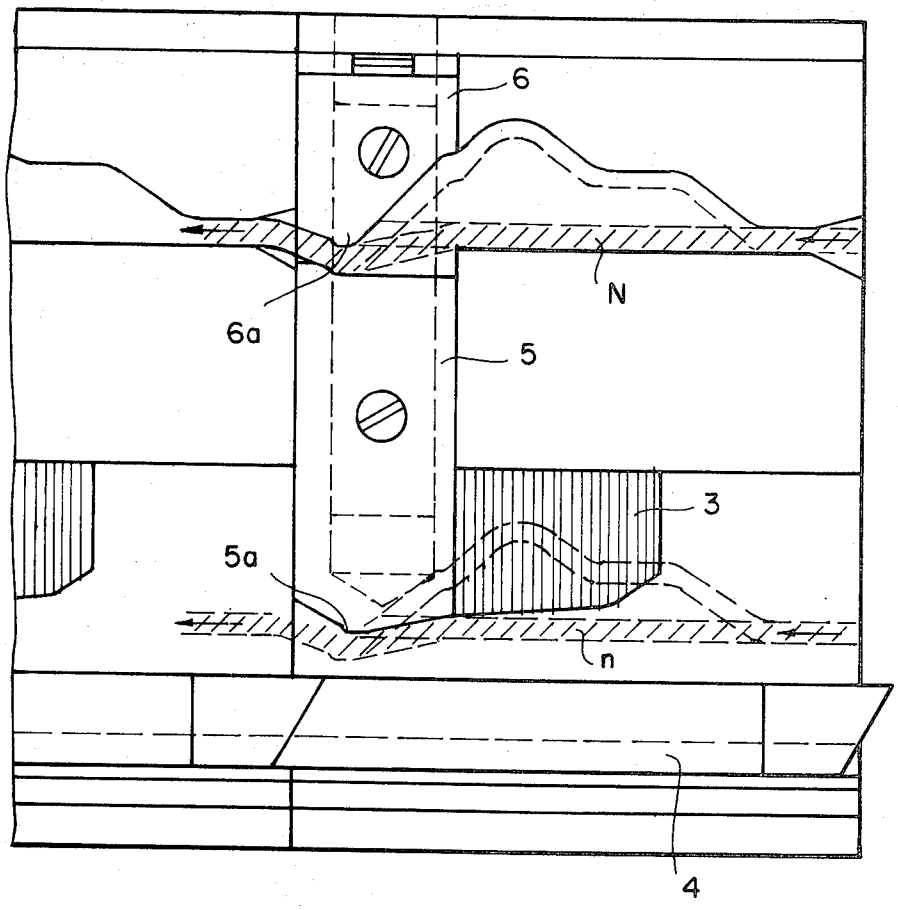
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Primary Examiner—Wm. Carter Reynolds
Attorney—Arthur O. Klein

[57] **ABSTRACT**

Apparatus for the control of jacks and needles of a circular knitting machine with a needle track. The machine has gradually sloping cam means disposed around the cylinder of the circular knitting machine which position the non-knitting needles, such cam means being so arranged that the needle butt or cam follower is indirectly moved by a gently sloping portion of the cam means, without having the needle butt of the non-knitting needles engage the steepest portion of the curve of the stitch cam mechanism; every needle is provided with a swinging jack having a jack butt or cam follower, and the retracting of the non-knitting needles is accomplished by the interaction of the gently sloping portion and the jack butt or cam follower. The apparatus results in a greatly longer life of the needles by avoiding impacts between the needle butts and the steepest portion of the stitch cam mechanism.

3 Claims, 9 Drawing Figures



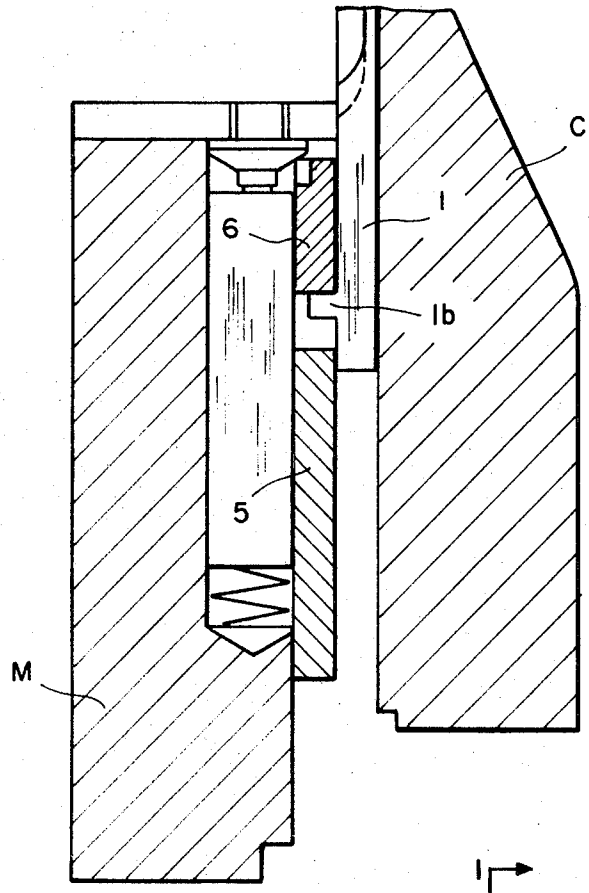


FIG. 1
PRIOR ART

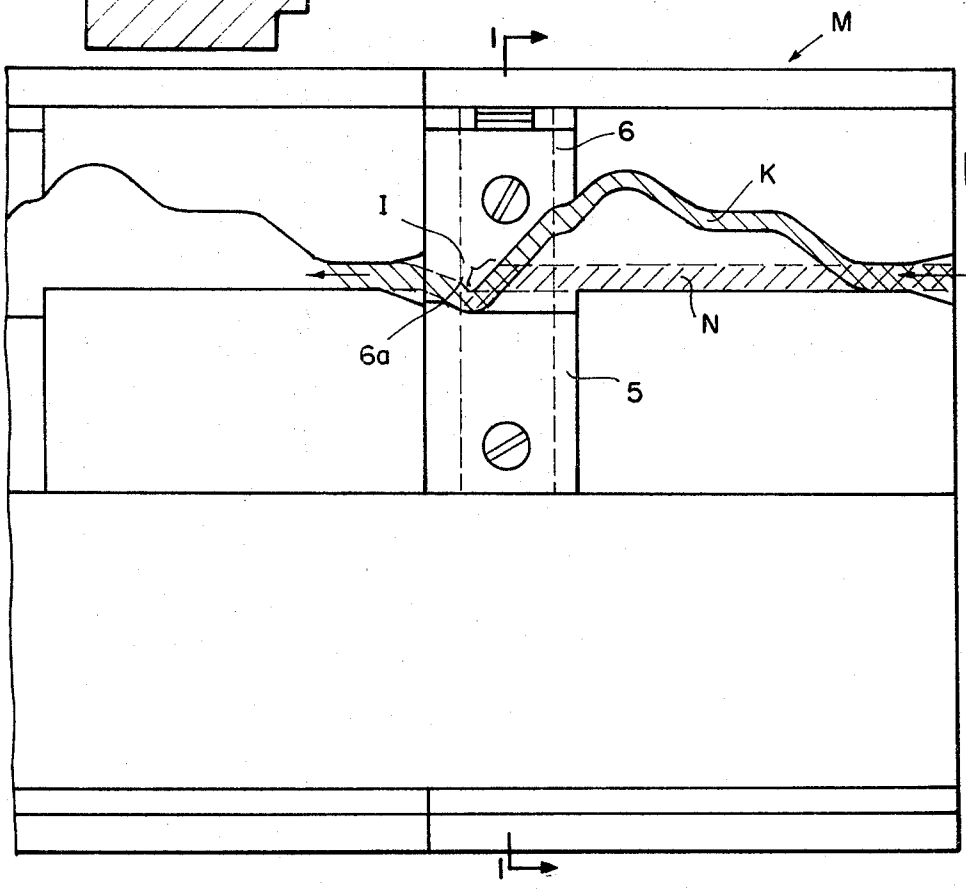


FIG. 2
PRIOR ART

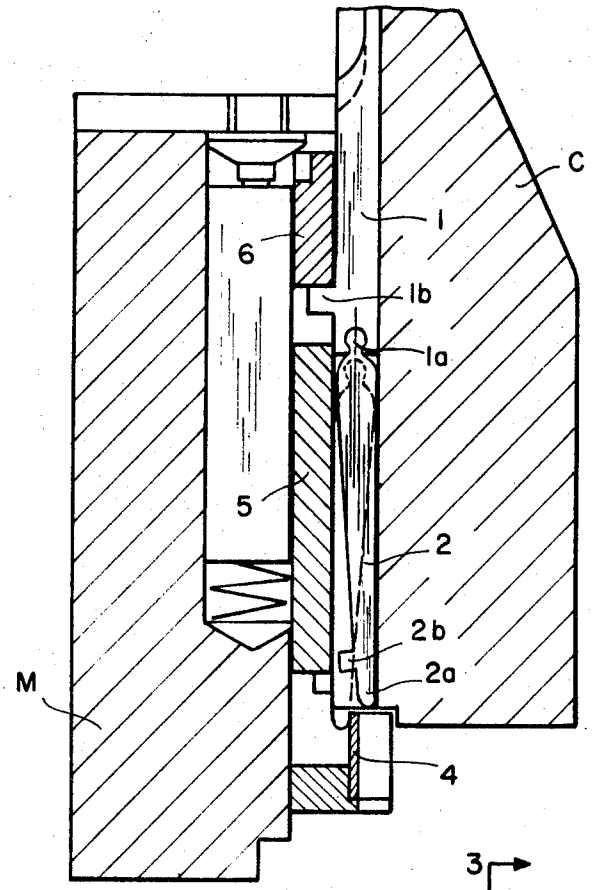


FIG. 3

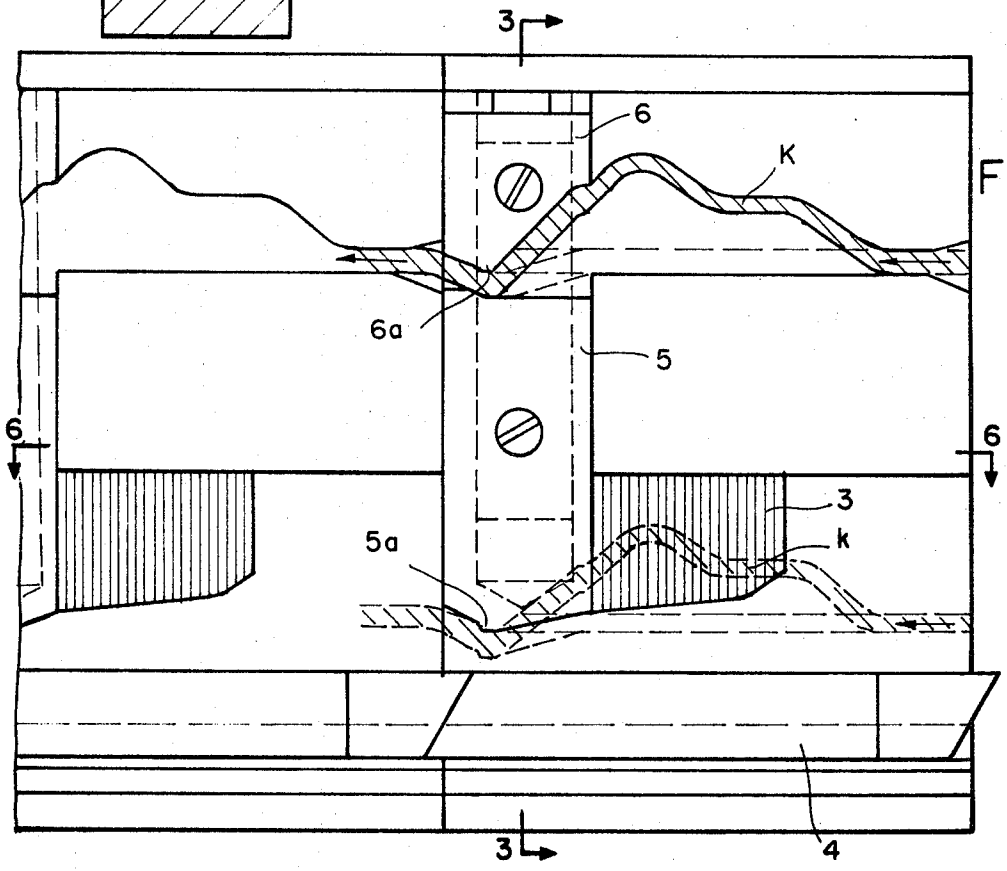


FIG. 4

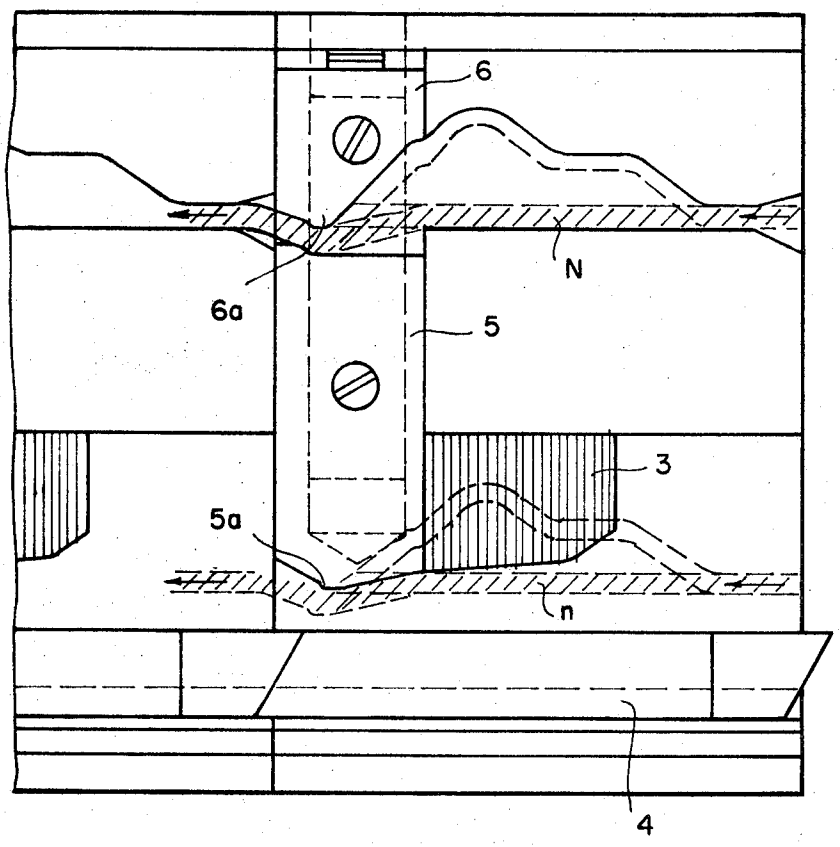


FIG. 5

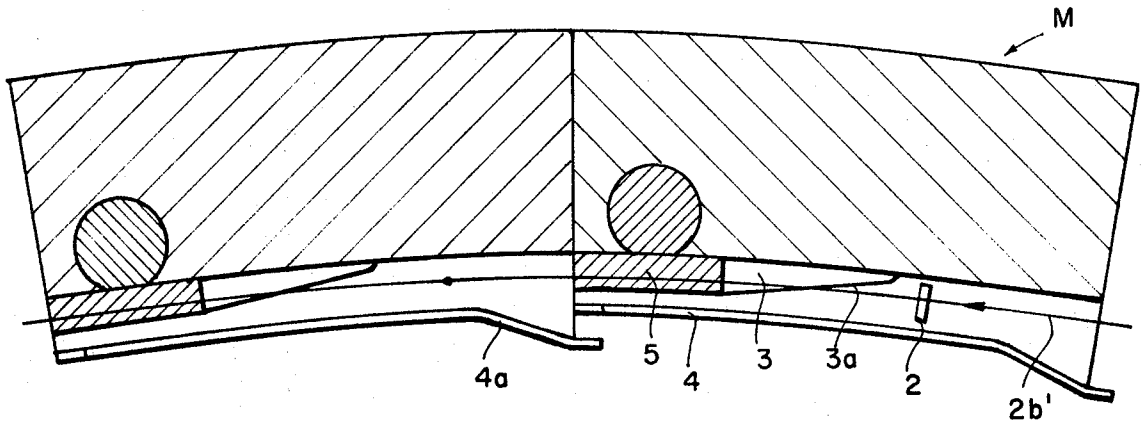


FIG. 6

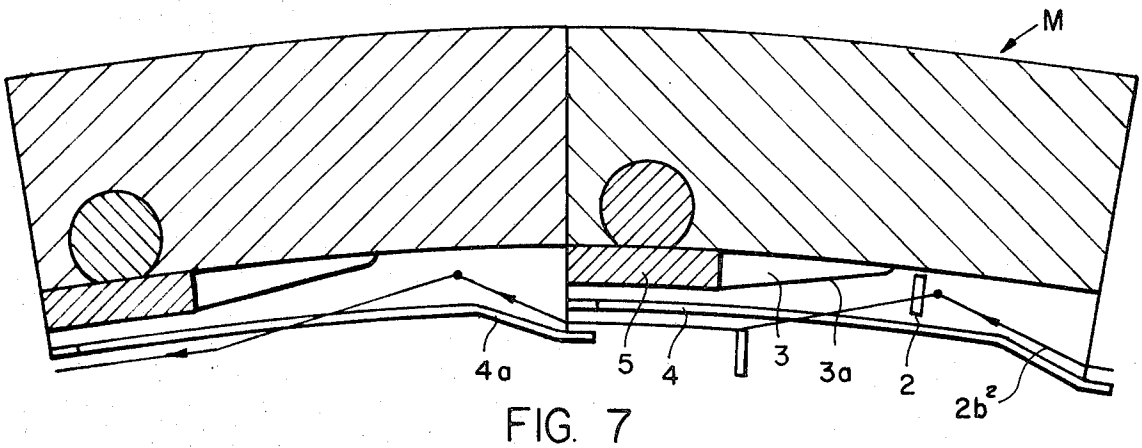


FIG. 7

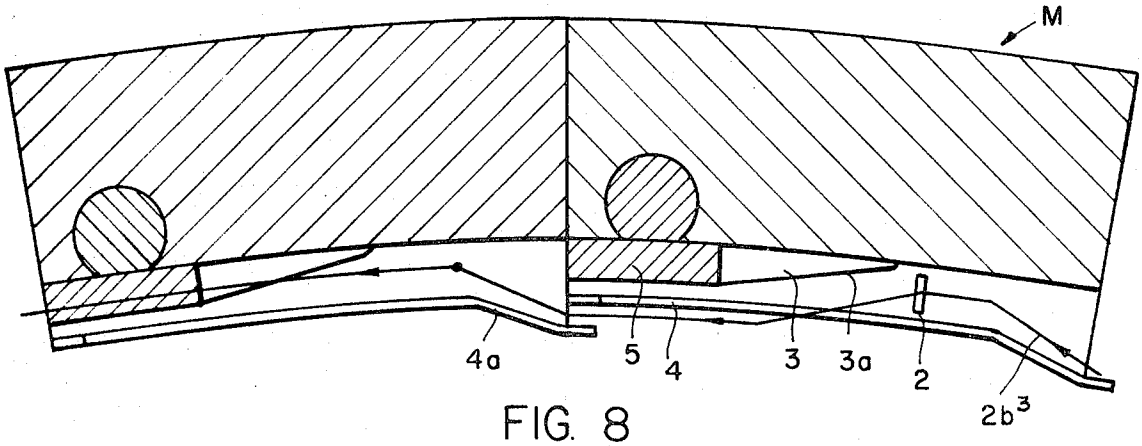


FIG. 8

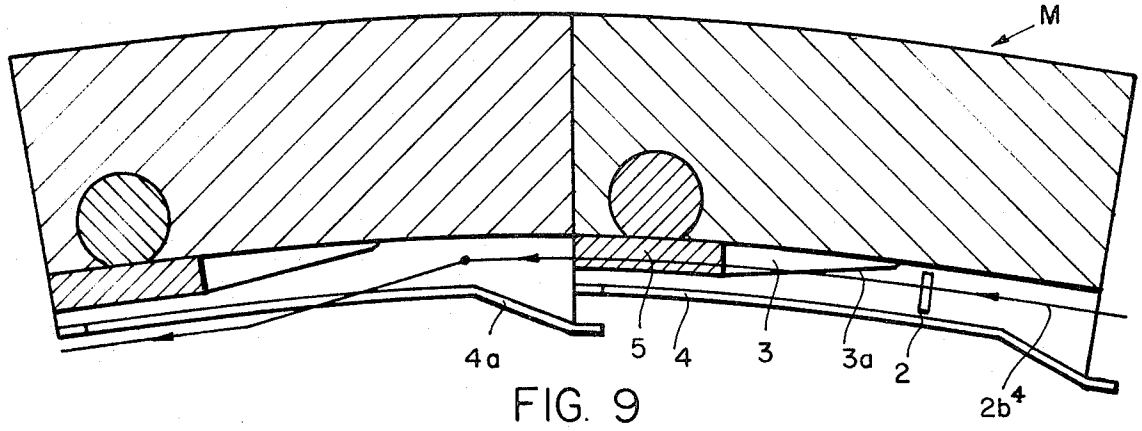


FIG. 9

APPARATUS FOR CONTROLLING THE JACKS AND NEEDLES OF CIRCULAR KNITTING MACHINES

This invention relates to an apparatus for lengthening the life of the jacks and needles of a circular knitting machine provided with mechanism for driving the cylinder needles in an outward direction. In published German Pat. application No. P 1585412, assigned to the present assignee, there have been described jacks and needles of a circular knitting machine with two or more needle tracks provided with a gently sloping cam to increase the life of such jacks and needles.

The present invention relates to a circular knitting machine with only a single ejection cam for driving the cylinder needles outwardly, in which there are arranged knitting and non-knitting needles. The present invention is characterized by a combination of the following features:

a. A gently sloping cam is arranged for the smooth retraction of the non-knitting needles, so that the needle butts are moved in the loop-forming direction in such manner that the needle butts of the said needles do not engage the steep curve and the corner of a cam governing the loop forming.
b. Every needle is provided with a swinging jack and with a jack butt or cam follower.
c. The retraction of the non-knitting needles is accomplished by means of interengagement of the gently sloping cam and the jack butts or cam followers.

It is advantageous that the gently sloping cam is affixed to the stitch cam portion which carries a slider (pusher) and that this is mounted in one of the cam carrying cam rings of the machine and is longitudinally adjustable.

Since the needle selection is made not by way of the jacks but directly upon the needles, the jacks must be made safe against accidental, unwanted thrusting in an operative direction. For this purpose, there is provided a control mechanism for the jacks of the non-knitting needles in form of a sheet metal separator, such control mechanism bringing the jacks under the control of the gently sloping cam, the control mechanism also simultaneously causing the jacks of the operative knitting needles to escape from the control of the gently sloping cam.

The needle jacks may be controlled by a mechanical apparatus, preferably a sheet metal strip.

In FIGS. 1 and 2, labelled "PRIOR ART," there is shown a previous similar machine without the present invention.

In FIGS.3–9, inclusive, there is shown an illustrative embodiment of the described invention:

FIG.1 is a view in vertical section through the prior art machine of the same generaly type, the section being taken along the line I—I of FIG.2;

FIG.2 is a fragmentary view in side elevation of a portion of the stationary cam of the machine of FIG.1, such cam being shown in a developed, flattened shape;

FIG.3 is a view in vertical section through an illustrative circular knitting machine in accordance with the invention, the section being taken along the line III—III of FIG.4;

FIG.4 is a fragmentary view in side elevation of a portion of the stationary cam of the machine of FIG.3, such cam being shown in a developed, flattened shape,

the figure showing the paths of the respective needle butt or cam follower and the jack butt or cam follower 1*b* and 2*b* of a needle engaged in a knitting operation;

FIG.5 is a view similar to FIG.4 but showing the positions of the needle and the jack when the needle does not knit;

FIG.6 is a view in horizontal section of the machine, such section being taken along the line VI—VI of FIG.4, the figure showing the hypothetical case in a machine in accordance with the invention in which all of the needles are not knitting;

FIG.7 is a view similar to FIG.6 but showing the path of the cam follower on the platen of the permanently knitting needle;

FIG.8 is a view similar to FIG.6 but showing the path of a needle from a knitting to a non-knitting position; and

FIG.9 is a view similar to FIG.6, but showing the path of a needle from a non-knitting to a knitting position in accordance with the invention.

As above-indicated, FIGS. 1 and 2 of the drawings illustrate a prior art circular knitting machine of the same general type. A needle cylinder C which rotates about a vertical axis carries a plurality of knitting needles 1 in vertically extending parallel channels on the outer surface of the cylinder C. Each needle carries adjacent its outer end an outwardly projecting needle butt or cam follower 1*b* which moves the needle in a known manner by reason of the interaction of the needle butt 1*b* with cams 5 and 6 which are mounted on a cam supporting ring or mantle M which surrounds the cylinder C coaxially thereof and is affixed to a machine frame, not shown.

The selective paths of the needle butt 1*b* as the needle is carried by the needle cylinder C past the cams 5 and 6 on the mantle or supporting ring M are shown in FIG.2. In its knitting motion, designated K, in which the needle is thrust upwardly by a conventional cam, not shown herein, the needle is retracted by smoothly engaging the ramp-like inclined right-hand surface of cam 6 as shown, such surface impelling the needle downwardly toward the lower end or nose 6*a* of the cam 6. After rounding nose 6*a*, the needle foot 1*b* is thrust upwardly somewhat, again by the above-indicated conventional cam means, into engagement with the upper cam in the next system or section of the mantel M. Such motion of the knitting needle entails no great wear upon either the needle or the cams, since the changes of direction of the needle take place at moderate speeds.

When the needle is positioned by conventional pattern selection means into its non-knitting or lower position, however, the needle butt 1*b*, having been carried horizontally for a substantial time, engages the right-hand ramp-like surface of the cam 6 at the zone of impact I above the nose 6*a* of the cam (FIG. 2). If the speed of operation of the circular knitting machine is substantial, the butt 1*b* of the needle engages the surface I of the cam 6 very forcibly; eventually, this can result in the breaking of the needle butt. After passing downwardly around the nose 6a of the cam 6, the needle butt 1b rises somewhat as shown, and is free selectively to be raised into a knitting stroke or to remain at the horizontal position shown in FIG.2 whereby to repeat its non-knitting cycle.

The machine of the invention, which is illustrated in FIGS. 3–9, inclusive, minimizes the shock of engage-

ment between a needle butt or cam follower and a cam. Theoretically, other numerous solutions for such problem are possible, for example, mechanical or electromagnetic braking gear for the needles and the like can be used. None of such solutions has, however, the same advantages as the mechanism of the present invention.

In FIGS. 3–9, inclusive, parts which are similar to those in FIGS. 1 and 2 are designated by the same reference characters.

Turning now to FIGS.3, 4, and 6, it will be seen that each of the needles 1 has, at its lower end, a coupling groove 1a which receives the upper end of a swinging jack 2. When the needle cam follower 1*b* interacts with the conventional cam means (not shown) or a conventional pattern wheel, for example to cause a selected needle to be driven upwardly, the respective swinging jack 2 connected to such needle travels upwardly with it. Adjacent its lower end the jack 2 carries a radially outwardly projecting cam follower or butt 2*b*. To the right (as illustrated in FIGS. 4 and 6) there is fixedly positioned a ramp-like cam 3 having a horizontal wedge-shaped portion of generally triangular shape as shown in FIG.6. The thicker end of the cam 3 has the same radial thickness as that of vertically spaced cams 5 and 6 which are affixed to the supporting ring or mantel M and between the confronting faces of which the needle foot 1*b* reciprocates. The cam 3 has a radially inner ramp surface 3*a* (FIG.6) and a lower edge surface (FIG.4) which varies from a steep inclination at its entering, right-hand end to a shallowly inclined generally straight portion aligned with the similarly inclined right-hand bottom surface of the cam 5, as shown in FIG.4. The cam 5 has a lower end or nose 5*a* which is of the same configuration as the nose 6*a* of cam 6, the configurations of the cams 5 and 6 to the left of the nose (FIG.4) being the same.

When the needle 1 and the jack 2 are projected or driven upwardly over the respective paths K and *k* as shown in FIG.4 the cam follower or jack butt 2*b* is disposed in the path k of the cam 3. When the cam follower or butt 2*b* arrives at the ramp 3*a*, the ramp causes the jack 2 to swing radially inwardly as shown in full lines in FIG.3 into its channel in the rotating cylinder C of the machine.

Affixed to the frame of the machine, by means not specifically shown, at each section or system thereof at a location somewhat below the lower edges of the cams 3, 5, there is a sheet metal separator 4 having a main portion which is coaxial of the cylinder C and the supporting ring or mantel M, and an entering or right-hand end portion which is generally funnel-shaped in order to present a wide entrance port for the lower end portion 2a of the jack 2.

When the needle 1 and its jack 2 are positioned by conventional pattern selection means in a knitting operation (paths K and k in FIG. 4) the needle butt 1*b* traces the path K and the cam follower or butt 2*b* on the jack 2 traces the path *k*. It will be seen that the cam follower or butt 2*b* in such operation engages the ramp face 3*a* of the cam 3 so that jack 2 is swung radially inwardly or counter-clockwise (FIG.3) so that the lower end 2*a* of the jack drops, when being retracted by cam 6, radially inwardly of the sheet metal separator 4. The vertical downward or retracting movement of the needle and jack, in this operation, is effected by the interaction of the butt 1*b* of the needle with the cam 6. Cam follower or butt 2*b*, being held in its counter-clockwise position, is removed from effective interaction with either of the cams 3 and 5.

When the needle 1 is positioned by conventional pattern selection means so that it remains in its non-knitting position (position N in FIG.5), the needle butt 1*b* is retracted smoothly by the action of cam portion 5*a* on jack butt 26 before the needle butt engages the right-hand surface of the cam 6, whereby the needle butt 1b passes smoothly beneath the nose 6*a* of the cam 6 without any effective impact thereagainst. In this action, as can be seen in FIG.5, the jack 2 will have been retracted with its needle 1 so that the jack then lies vertical with the lower end 2*a* thereof disposed to the left or radially outwardly of the upper edge of the separator plate 4, as shown in connection with the jack which lies immediately rearwardly of the jack 2 which faces the reader in FIG. 3 said outwardly lying jack 2 being illustrated in dotted lines. The jack cam follower or butt 2*b*, therefore, remains at a given height as the cylinder C carries it around until such cam follower engages the lower right-hand ramp surface of the cam 3 and then the similar aligned surface of the cam 5. The jack 2 is thereby retracted or pulled downwardly, and the needle 1 attached to it is similarly retracted.

Since the parts 5 and 6 are affixed to the same thrusting member of the cam, it will be apparent that in every operative stitch cam system position of the circular knitting machine:

a. the corner of the stitch cam is no longer engaged, whereby the lifespan of the needles is lengthened.
b. the travel of the needles and jacks over the parts 5 and 6 is lengthened by only an insignificant amount (about 0.05 to 0.1 mm over the travel of the knitting needles).

After leaving the cam parts 5 and 6, the lower ends 2*a* of the jacks which arrive behind the sheet metal body member 4 radially outwardly of the cylinder C are again brought into their radially inward normal position by the ramp 4*a* of the separator member 4.

FIG.6 shows the hypothetical case in accordance with the present invention in which all of the needles have been situated in non-knitting positions by conventional pattern selection means. In this case all of the jacks 2 will remain in the position shown by the arcuate line 2*b*′, the butt 1*b* of the needle traversing the path N (FIG.5) and the cam follower or butt 2*b* traversing the path *n*.

FIG.7 shows the path $2b^2$ of the jack cam follower or butt 2*b* of the jack of a needle which has been positioned by conventional pattern selection means into a permanent knitting position. As can be seen by tracing the line $2b^2$, the cam follower 2*b* on the jack will be positioned mostly radially outwardly of the separating member 4, and is found radially inwardly of separating member 4 only when the needle cam follower is thrust upwardly in the upper channel of the needle cylinder C in the usual manner by a conventional selection member (not shown). It is to be understood that in the embodiment of the circular knitting machine shown, the jacks have nothing to do with the needle choice.

FIG. 8 shows the path $2b^3$ of the jack cam follower 2*b* which is placed by conventional pattern selection means from a knitting to a non-knitting position.

FIG.9 shows the path $2b^4$ of a jack cam follower 2*b* which is placed by conventional pattern selection means from a non-knitting to a knitting position.

Although the invention is illustrated and described with reference to one preferred embodiment thereof, it is to be expressly understood that it is in no way limited to the disclosure of such a preferred embodiment, but is capable of numerous modifications within the scope of the appended claims.

What is claimed is:

1. In a circular knitting machine, an arrangement for prolonging the life of jacks, needles, and cams of a circular knitting machine having a rotating cylinder and coacting stationary cam means, including a plurality of uniformly spaced stitch cam means, wherein a plurality of cylinder needles are operatively mounted in said cylinder for reciprocating movement in tracks of said cylinder, said cylinder needles being adapted to be moved into knitting and non-knitting positions, comprising in combination,

a. each one of said cylinder needles having at least one radially projecting butt,

b. a jack is pivotally connected to each cylinder needle,

c. each jack having at least one radially projecting butt,

d. a first stitch cam means having a steeply inclined cam surface, those of said cylinder needles which have been placed in their knitting positions being retracted by the coaction of said steeply inclined cam surface and said butts of said cylinder needles,

e. a second cam means having a gradually inclined cam surface,

f. those of said cylinder needles which have been placed in their non-knitting position do not come into contact with said steeply inclined cam surfaces and are actually retracted by the coaction of said gradually inclined cam surface and said butts of said jacks,

g. common members for supporting both said first cam means and second cam means operatively mounted at each stitch cam of said stationary cam means,

h. said second cam means having a wedge-shaped portion which coacts with said butts of said jacks to pivot the latter radially inwardly so that the butts thereof cannot engage said gradually inclined cam surface if the corresponding cylinder needle is in its knitting position.

2. In a circular knitting machine, the arrangement as set forth in claim **1**, wherein said stationary cam means includes a supporting ring coaxially disposed with respect to said rotating cylinder, said common supporting members for said first and second cam means being adjustably mounted in said supporting ring.

3. In a circular knitting machine, the arrangement as set forth in claim **2**, including mechanical guide means coaxially mounted on said supporting ring for guiding said jacks from a radially inward position to a radially projected position.

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