The present invention relates generally to knitting machines, and in particular it relates to the cam race components, their structure and operation, in knitting machines of the circular, multiple-feed type.

In conventional circular knitting machines of this general type, there is usually provided a cam race of irregular pattern within which race or groove the butts of the vertically reciprocating knitting needles are confined. In these machines, the needles must be frictioned in order to prevent them from overriding the path defined by the cams. This frictioning is undesirable because it results in increased wear on the needle butts and on the actuating cams, and also because it increases the machine load, and it is highly desirable that it be avoided.

Further, in this same type of knitting machine, the lower or raising cam elements usually fixed, and the upper or stitch cam are so disposed as to be vertically adjustable. In these machines, adjustment of the upper or stitch cams usually increases or decreases the width of the race or track within which the needle butts travel, permitting a varying amount of undesirable play, which play is reflected in the irregular size and character of the stitch formed thereby.

The main object of my invention, therefore, is the provision, in an apparatus of the character described, of a segmental cam race which will confine the actuated needle butts within a path of constant size, and cushion such particularly during the downward travel of the needle butts.

Another object of my invention is the provision, for use in a circular multiple feed type of knitting machine, of a cam race component having an upper stitch cam portion and a lower raising cam portion both mounted on the same slide post for simultaneous movement during adjustments.

Still another object of my invention is the provision of a cam race component having a stitch cam portion and a raising cam portion thereon, both mounted on a member which is inclined laterally of the needle bed, permitting adjustment of the cam elements along a helical path.

Still another object of my invention is the provision of a stitch cam and a raising cam construction, in which the space between is constant, and both cam elements are adjustable mounted to move during adjustments at an inclination to the vertical.

Still another object of my invention is the provision of a stitch cam and a raising cam mounted on a post for simultaneous reciprocating adjustment thereon, the post moving along a helical line along the needle cylinder.

Still another object of my invention is the provision of a cam race component for a circular, multiple-feed type of knitting machine, having a raising cam and a stitch cam, and means to adjust same helically with respect to the needle cylinder.

Still another object of my invention is the provision of a cam race component for a circular, multiple-feed type of knitting machine, having a base portion, a member thereon inclined therefrom, the cam race component being reciprocably mounted on a post slideable within the member for helical movement with respect to the needle cylinder.

Still other objects of the invention will in part be apparent, and still others will be pointed out specifically in connection with the following description of an illustrative embodiment thereof.

In the drawings annexed hereto and forming a part hereof,

Figure 1 is a developed diagrammatic view of a series of cam race components disposed with relation to a portion of the needle cylinder and showing the positioning and movement of the knitting needles, the top line of the needle cylinder being indicated by a dotted line;

Fig. 2 is a top plan view of one form of cam race component and mounting therefor constructed according to and embodying my invention;

Fig. 3 is a rear elevational view thereof; and

Fig. 4 is a section on the line 4—4 of Fig. 3, with parts broken away to show internal details of construction; and

Figs. 5, 6, and 7 are, respectively, front, side, and rear elevational views of my cam race component.

My device, indicated generally by reference numeral 10, comprises a base 12 of any suitable metallic material, which is disposed atop a cam bed ring 14. The upper surface of bed ring 14 is radially grooved as at 16, each of the grooves 16 being adopted to receive a rib 18 extending vertically and downwardly from the underside of base 12, so as to properly locate each cam block 12 in place on the ring and prevent side-shifting thereon. A headed bolt 20 may be provided, extending through an inclined bore 22 in base 12, and engaging a threaded socket 24 in bed 14, so as to secure the cam block in position atop the cam bed 14. A cam post retainer or socket shaft 30 is provided which may be integral with base or block 12, and as seen best in Figures 2 and
3, the cam post retainer or socket shaft 30 is angled sidewise with respect to, and upwardly from base 12. Retainer or socket shaft 30 is transversely apertured as at 32, and axially apertured as at 34 down from the top thereof, the apertures communicating with each other (see Fig. 9) for reasons to be developed hereinafter. The front face or aspect 36 of retainer or socket shaft 30 is axially and inwardly grooved, as at 38. The facing marginal edges of groove 38 are slightly curved, as will be developed below.

Within groove 38 on retainer 30, I dispose a cam post 40 on the front of which is mounted a pair of cam components of the cam race 50, which race is formed by a plurality of cam pairs 52, 54, mounted on base members 12, 12, which are disposed side by side on the cam bed 14 about the periphery of the circular ring in which the needles 60, 60 are mounted for vertical reciprocatory movement.

The cam pairs are mounted on the face of each cam post 40, and project laterally therefrom, comprising an upper or stitching cam 52, and a lower or raising cam 54 spaced therefrom by an annular groove or track 66. It is these grooves 66, 66, between each pair of cams which combine with the spaces 61, 61 between adjacent cam members which define the cam race or the path 59 of the knitting needle 60, 60 butts 13, 13. The front faces of each pair of cams 52, 54 are laterally and transversely curved or arched, as at 62, 64, the degree of curvature depending on the radius of curvature of the needle cylinder about which the cam race is mounted. The upper or stitching cam 52 is generally of V-shape in elevation, and the lower or raising cam 54 is generally of inverted V-shape in elevation, slightly offset with respect to the upper cam. Each upper cam 52 has one long, downwardly angled, straight side 66, and a shorter side 70 reversely angled with respect thereto, and a further side 72 angled rearwardly of side 70 and substantially parallel to long side 66. Each lower cam 54 has a long, upwardly angled straight side 74, and an angled shorter side 76, and a further side 78 angled reversely of side 76 and parallel to long side 74. The top line 93 of the upper cam 52, and the bottom line 95 of the lower cam 54 are of no particular importance. As seen in Fig. 7, post 40 is inclined at such an angle as to be parallel to the surfaces 70, 74.

Referring now to Figure 1, when a number of cam base blocks 12, 12 are mounted in side-by-side relation, there is left between each pair of cam members a space 107 defined by side 70 of the upper cam of one member and side 74 of the adjacent cam member defining a groove or track 87. In practice, the cylinder in which needles 60, 60 are mounted may be rotated with respect to the parts, or the cam ring may be rotated with respect to the needle cylinder (not shown), but whatever the relative movement as indicated by the arrows (Fig. 1), the butt portions 3, B of needles 60, 60 are trapped within the grooves 66 and spaces 87 which make up race 50, and as the cam ring moves to the left, in the direction of the lower arrow, the needle butts B, B will be actuated thereby to be shifted upwardly along raising cam sides 74, 74, and their direction reversed downwardly when they are brought against the long, downwardly angled side 60 of the associated stitching cam 52, moved upwardly again by the long edge 74 of the adjacent raising cam, etc. The grooves or tracks between the raising and between the stitching cam of each race component on the stitching phase remains constant; that is the down-stroke stitching movement of the needle butts is always within a track or groove of predetermined, fixed dimension. The space or track 67, 67 between the pairs of adjacent cams is determined by the distance between two adjacent cam bases, and in my invention this distance too will always be constant, so that the danger of different stitch sizes and shapes is thereby obviated.

Referring now to Figure 4, it will be seen that each cam post 40 is provided with a threaded socket 93 in the rear thereof, adapted to be engaged by the threaded end of a bolt 85 extended through horizontal aperture 32, the head of which bolt is wider than opening 32, so as to secure loosely the post 40 within groove 38 and permit it to shift therewithin. The aperture 32 is larger than the width of bolt 85, and the bolt and the attached slide post 40 may thus be reciprocably adjusted lengthwise of the inclined portion of the cam retainer 30. A coil spring 88 may be disposed within axial bore 34 bearing against the underside of bolt 86, normally urging same upwardly, and a threaded bolt 80 may be screwed down through the opening 32 aligned with bore 34, to bear against the top of bolt 86 and secure the same against upward movement which may be employed to prevent any movement of bolt 80 upwardly after it has been adjusted to any desired position, this arrangement locking the cam posts to the retainer sockets.

The rear aspect of cams 52, 54 is curved along a single curved line as 84, resting on the surfaces of correspondingly curved edges of legs 83 extending forwardly from the sides of the cam post retainer or socket 30. The cam post retainer 30 is inclined away from the vertical with respect to base 12, and with the curved bearing edges 81, 81, any adjustment of the cam slide 40 within post retainer 30 will be substantially along the line of the cam sides 76, 74, along a path which is slightly curved to follow the cylindrical surface of the needle cylinder, for cam sides 76, 74 are generally parallel to the line of post 30, and the curvature of the opposed surfaces 31, 33 follows the cylinder curve. Because of this particular construction, the space of track between side 74 of one raising cam and the side 76 of the adjacent cam will thus always remain constant during any adjustment, the only change in taking place occurring at the point where the needle butt B movement is reversed from the upward to the downward phase, as the butt contacts long side 68 of the stitching cam 52 and is directed downwardly.

In conventional machines of the general type described herein, the raising cams are fixed, and only the stitch may be adjusted, and these along a vertical line, the adjustment thereof always resulting in altering the space, track or groove between the cams within which the needle butts travel, resulting in "binding" or in the creation of an undesirable amount of play, reflected in loose, uneven stitching. In my new and improved cam construction, the adjustment of the stitching cams does not alter the proper positioning thereof with respect to the raising cam, and the needle butts or grooves are brought against the long, downwardly angled side 68 of the associated stitching cam 52, moved upwardly again by the long edge 74 of the adjacent raising cam, etc. The grooves or tracks between the raising and between the stitching cam of each race component units to be disposed about the periphery of the needle cylinder.
I claim:
1. A device of the character described comprising a horizontally extended base portion, a cam post receiving member extending upwardly therefrom and angled away from the normal with respect to the base, and a cam post reciprocable within and lengthwise of the receiving member.

2. In a knitting machine including a needle cylinder, a horizontally extended base portion, a cam post receiving member extending upwardly from the base and at an inclined angle thereto, a cam post disposed within the receiver for axial reciprocating movement therealong, the contacting portions of the receiver and post being curved so that the cam post reciprocates along a helical path following the curvature of the needle cylinder.

3. A device of the character described comprising a horizontally extended base member, a cam post receiver extending upwardly therefrom and at an inclined angle thereto, a raising cam and a stitching cam mounted on said post for simultaneous axial reciprocating movement along the axis of the receiver.

4. A device of the character described comprising a horizontally extended base member, a cam post receiver rising upwardly therefrom and inclined laterally thereof, a cam post disposed within the receiver, said cam post having a needle raising cam and a stitch cam thereon, and means to adjust said cam post reciprocably axially of the receiver.

5. A device of the character described for use in a circular knitting machine having a needle cylinder, which device comprises a horizontally extended base member, a cam post receiver rising upwardly therefrom and inclined laterally with respect thereto, a slidable cam post disposed within the receiver, a raising cam and a stitching cam on the post, and means to adjustably reciprocate the post along a curved line corresponding to the curvature of the needle cylinder.

6. A device as in claim 5, in which the bearing surfaces of the cam post and the receiver are curved transversely and axially thereof.

7. A device of the character described comprising a horizontally extended base member, a cam post receiver extending upwardly therefrom and at an angle thereto, a cam post mounted in said receiver containing a raising cam and a stitch cam, said post member being axially reciprocable within said receiver, and means on the receiver and post to cause helical movement of the post and cams thereon.

8. A device of the character described comprising a horizontally extended base member, a cam post receiver rising upwardly therefrom and inclined laterally thereof, a cam post disposed within the receiver, said post having a raising cam and a stitch cam integral therewith, means to reciprocate said post along the length of the receiver axially thereof, and means to lock the said post in any predetermined position along said receiver.

9. A device of the character described comprising a horizontally extended base member, a cam post receiver rising upwardly therefrom and inclined laterally with respect thereto, a slidable cam post disposed within the receiver, a raising cam and a stitch cam on the post, means to adjust said member reciprocably along a line inclined laterally with respect to the base member, means to limit the extent of reciprocating movement, and means to direct said reciprocating movement along a path curving outwardly from the receiver.

10. A device of the character described for use in a circular knitting machine including a needle cylinder and a plurality of knitting needles mounted in the cylinder for vertical reciprocating movement, each of said needles having an outwardly projecting butt portion, a plurality of horizontally extending members, a post receiver on each base inclined upwardly therefrom and at an angle thereto, a cam post, a raising cam and a stitch cam on said post, a needle butt track between each pair of cams, and a needle butt track between the cams of adjacent members, each pair of cam elements being simultaneously and reciprocatably adjustable axially of said post, said axial movement of any pair of cam members maintaining the size of the needle butt track between it and the adjacent member without alteration.

11. A device as in claim 10 in which the faces of the raising and stitching cams are curved concentrically with the outer surface of the needle cylinder.

WILLIAM A. ZIEVE.

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