Knitting machine

The invention relates to a knitting machine of the general kind set forth in the classifying portion of claim 1.

Numerous patterning devices are already known for carrying out what is known as the three-way procedure, that is to say any desired selection of all knitting implements for knitting, tuck and non-knitting on a knitting system. The patterning devices essentially comprise cam members forming knitting, tuck and non-knitting tracks and mechanical, electronic or electromagnetic control means, by means of which the knitting implements are distributed to those tracks.

It is known for example (German laid-open applications (DE-OS) Nos 19 52 827 and 35 37 679) to associate pivotable pressers, sinkers or the like with the knitting needles, and to arrange the former in such a way that they can be pivoted into three positions in which their control butts which are of the same or different heights project entirely, partially or not at all out of the bed of the knitting machine. In that case the patterning arrangement comprises on the one hand control means for pivoting the knitting implements and on the other hand cam members which in one case engage either all or only the control butts which project entirely from the bed and in the other case act either only on high butts or only on low butts. Control arrangements of that kind are not very suitable for very high-speed knitting machines and in particular high-output circular knitting machines because they require control means which are complicated and therefore susceptible to trouble. In addition they make it impossible to provide for continuous positive guidance of all the knitting implements involved and therefore, particularly in the case of high-speed circular knitting machines, promote the occurrence

of damage caused by the uncontrollable impingement of the butts on separating tips or other projecting edges of the cam members.

In another known patterning arrangement which is suitable for the three-way procedure (German laid-open application (DE-OS) No 37 39 924), the knitting implements are firstly distributed by means of a first control means in such a way that selected knitting implements are lifted into a tuck position whereas all other knitting implements are guided into a non-knitting track. The knitting implements which are raised into the tuck position are then again subjected to a selection operation by virtue of a second control means which is disposed in displaced relationship in the direction of the usual relative movement between the bed and the cam, by the butts of those knitting implements being guided partially into a tuck track and partially into a knitting track. That means however that the width of the system is almost doubled because the knitting implements cannot be positively guided and the second selection operation can take place only after the butts of the knitting implements have stabilised in the tuck position if that is at all possible at high speeds of operation.

Finally it is already known (US patent specification No 4 827 740) to carry out the three-way procedure with knitting needles which are practically continuously positively guided and which for that purpose have an operating butt and four pivotable control butts. That gives the advantage that it is possible to achieve high speeds of operation because the knitting implements can be arranged in the associated channels of the bed with an extremely low level of friction which otherwise must be intentionally provided for stabilising the knitting implements. As however the knitting implements are provided with at least four pivotable control butts, that means that the knitting needles are of a comparatively great overall length. Although knitting needles of that kind are therefore

suitable for a flat bed knitting machine or as cylinder needles of a circular knitting machine, they are however not also suitable as rib needles for circular knitting machines.

In comparison therewith the invention is based on the problem of so designing the knitting machine set forth in the opening part of this specification that the three-way procedure can be carried into effect without a substantial increase in the width of the system in comparison with the usual two-way procedure and also with short knitting implements which are also suitable for rib plates. In that connection the invention also seeks to make it possible in particular for the knitting implements to be continuously positively guided.

The characterising features of claim 1 serve to solve that problem.

The invention provides the advantage that the control butts are already subjected to a second selection operation during the upward movement of the knitting implements into the tuck position and not just after attaining the tuck position so that there is practically no need for the width of the system to be increased. In that connection the invention relies on the surprising realisation that the second selection operation can be carried out without problems and without the occurrence of troublesome frictional forces by the control butts being relieved of loading during that selection operation and by the knitting implements being further raised simultaneously with their operating butts. Another advantageous consideration is that in principle only a single pivotable control butt is required and therefore the knitting implements can also be of the short overall length required for them to be used in a rib plate. Finally the invention makes it possible to provide second control butts which are kinematically coupled to the first control butts so that the knitting implements can be continuously positively guided without a substantial increase in the length of the knitting

implements being necessary.

The invention is described in greater detail hereinafter by way of the example of a circular knitting machine with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic view in vertical section through a circular knitting machine according to the invention,

Figure 2 is a diagrammatic front view of a cam portion of the circular knitting machine shown in Figure 1,

Figure 3 is a perspective diagrammatic view of the parts of the circular knitting machine shown in Figure 1, which are essential for selection of the knitting implements,

Figures 4 and 5 are diagrammatic front views of a patterning arrangement which is extended over a system width and the associated functional members which are shown in vertical section, Figure 4 diagrammatically indicating the knitting implements selected for passing through a non-knitting and a knitting track and Figure 5 diagrammatically indicating the other knitting implements selected for passing through a tuck track, and

Figure 6 is a view corresponding to that shown in Figures 4 and 5 but on a larger scale, of a second embodiment of the patterning arrangement, with the vertical sections being omitted.

Figure 1 shows the details of a circular knitting machine which are necessary to understand the invention, namely a first bed 1 in the form of a needle cylinder with vertically extending lands 2 between which knitting implements 3, in this case knitting needles in the form of conventional latch needles, are slidably mounted, each needle having a shank or stem 5. Arranged above the first bed 1 is a second bed 6 in the form of a sinker ring which has radially extending lands between which further knitting implements 7, in this case sinkers, with butts 8, are slidably mounted. The knitting implements 3, 7 are controlled by cams 9 and 10 which each comprise a

cam plate 11 and 12, at least one carrier 14 and 15 respectively secured thereto and cam members 16 and 17 respectively mounted thereon, which act on the butts of the knitting implements 3, 7. In that connection the beds 1, 6 and cams 9, 10 can be moved relative to each other in the usual way while, depending on the cam members used, at the same time the knitting implements 3, 7 can be raised or lowered parallel to their longitudinal direction or can be held in the non-knitting or laying position.

As is more clearly apparent from Figure 2, the kitting implements 3 each have an operating butt 19 which is preferably rigidly secured to the stem 5 and at least one control butt which is pivotably mounted on the stem 5. The illustrated embodiment has two pivotable control butts 20 and 21 which are provided on a common selection element 22 which is mounted in a recess 23 rotatably or pivotably but preferably axially immovably with respect to the stem 5. The selection element 22 can be pivoted by means of electromagnetic or any other control means in such a way that either the first control butt 21 projects beyond the front side of the stem 2 and the second control butt 20 is pivoted back behind said front side, or vice-versa (see also Figures 4 and 5).

Knitting machines, cam assemblies, knitting implements 3 of the described kind and the selection and control thereof are basically known to the man skilled in the art from US patent specification No 4 827 740 and EP-A1-0 319 007 to which reference is hereby expressly directed for the avoidance of repetition, and they therefore do not need to be described in greater detail herein.

As is further apparent from Figure 2, a patterning arrangement which extends over the width of a knitting system for carrying out the three-way procedure comprises a cam assembly 24 with a plurality of cam members 25 to 30 which are arranged one above the other. In that connection a lower cam member 25 defines with its top side 31 a

knitting track for the control butts 21. The underside 32 of a central cam member 26 substantially defines a non-knitting or laying track for the control butts 20. The underside 33 of a defining member 27 essentially forms a tuck track for the control butts 20. The top side 34 of the defining member 27 essentially defines a non-knitting or laying track for the operating butts 19. The top side 36 of a separating cam member 29 essentially defines a tuck track for the operating butts 19. The underside 37 of an upper cam member 30 defines a knitting track for the operating butts 19. Finally a counter-cam member 28 can also act with its top side 38 on the operating butts 19. In that connection the relative movement between the cams 10, 11 and the beds 1, 6 (Figure 1), as indicated by an arrow v (Figures 2 to 5) is so selected that the knitting implements 3 pass through the specified tracks from right to left.

The patterning arrangement shown in Figure 2 also includes two positioning cams 40 and 41 and two control means 42, 43. In that connection the positioning cams 40 and 41 serve to act on the control butts 20 and to pivot all projecting control butts 20 of the knitting implements 3 moving therepast into the position shown in Figure 2 so that when the knitting implements 3 move past the control means 42, 43, all control butts 21 project beyond the front side of the needle stems 5, as shown in Figure 2. On the other hand the control means 42 and 43 serve to leave the control butts 21 of selected knitting implements 3 in the position shown in Figure 2 and to pivot the control butts 21 of all other knitting implements 3 inwardly so that the control butts 20 project beyond the front sides of the needle stems 5. In that respect the positioning cams 40, 41 and control means 42, 43 are displaced relative to each other in the direction of the arrow v in such a way that firstly the positioning cam 40, then the control means 42, then the positioning cam 41 and finally the control means 43 comes to act at any knitting implement 3.

As Figure 3 shows, the pivotal movement of the selection elements 22 is desirably effected in known manner by means of a control needle 47 which can be driven by an electromagnetic drive 46 and which transmits the motional energy obtained from the drive 46 in the form of a resilient thrust on to a lower end portion 22a of the respective selection element 22 (EP-A1-0 319 007). For that purpose, the lower cam member 25 has a gap 49 in a flat portion 48 of its top side 31, which portion 48 guides a lower edge 22b of the control butt 21. Selection occurs when the control butt 21 is disposed opposite the gap 49 upon transportation in the direction of the arrow v. If at that moment the control needle 47 is advanced in the direction of an arrow w, that results in a pivotal movement of the selection element 22 about a pivot edge 22c whereby a small part of the front edge 22d of the control butt 21 passes into the gap 49.

Upon further movement of the selection element 22 in the direction of the arrow v, the front edge 22d therefore passes on to an inclined surface 50 which adjoins the rear end of the gap 49 whereby the selection element 22 is pivoted further about the pivot edge 22c until the butt 21 slides along the front surface 51 of the cam member 25 and thereby practically disappears in the stem 5 of the knitting implement 3 while the control butt 20 is pivoted fully out. Unintentional return pivotal movement of the selection element 22 is prevented by the front surface 51. If on the other hand the control needle 47 is not pushed forwardly at the moment at which the control butt 21 passes the gap 49, the control butt 21 then remains in the position shown in Figures 2 and 3. Upon further movement of the selection element 22 in the direction of the arrow v therefore its lower edge 22b passes on to a raising portion 52, which follows the gap 49, of the cam member 25.

The mode of operation, the control options and the advantages of the invention are particularly apparent from Figures 4 and 5 in

which the knitting implements 3 and cam members 25 to 30 are shown on an exaggeratedly large scale in order to make it easier to understand the invention. In that respect, in the front views of the cam portions shown in Figures 4 and 5, the butts which are shown in black throughout, for example 19a, 20b and 21a (see Figure 4) are those which project beyond the associated cylinder lands 2 and can be raised and lowered by the cam members. Butts which are only bordered with a black line, for example 20a and 21b (see Figure 4) on the other hand are those which are fully lowered into the associated stem 5 and which can therefore be neither raised nor lowered by the cam members.

As shown in Figures 4 and 5, upon movement of the knitting implements 3 in the direction indicated by the arrow v, the positioning cam 40 firstly acts on the butts 20 so that they are pivoted into that position which in each case is shown in the left-hand one of the two side views of the knitting implement 3 shown in Figures 4 and 5. The projecting control butts 21 are then pivoted or not pivoted in accordance with the pattern by means of the first control means 42 so that the unpivoted control butts (for example 21c) pass on to the raising portion 52 while the pivoted control butts (for example 21b) are guided on to the front side 51 of the cam member 25.

As in the illustrated embodiment the selection elements 22 are admittedly mounted rotatably in the stems 5 but are axially immovable, the operating butts 19 are also raised as soon as the control butts 21 pass on to the raising portion 52. In that connection a separating tip 54 of the separating cam member 29 may easily be so arranged as certainly to avoid impact of the operating butts 19, for example by the drive portion 52 beginning somewhat earlier than a raising portion 55, acting on the operating butts 19, of the separating cam member 29, which extends substantially parallel

to the raising portion 52 but leads only into the tuck position. The operating butts 19 (for example 19c) are therefore raised without the risk of breakage by way of the separating tip 54 and then are raised into the knitting position together with the knitting implements 3 and the associated control butts 21 (for example 21f) by the raising portion 52 of the lower cam member 25 so that the butts 19, 21 are each guided in a respective knitting track 56, 57 shown in broken lines. In that situation the associated control butts 20 (for example 20f) slide on the front side of the cam members 26, 27 along a knitting track 58.

On the other hand the control butts 21 (for example 21b) which are pivoted by the control means 42 pass on the front side of the cam member 25 into a non-knitting track 59. At the same time the projecting control butts 20 (for example 20b) and operating butts 19 (for example 19b) are guided in corresponding non-knitting tracks 60, 61.

If a knitting implement 3 is to be selected for the tuck position, the control means 43 is activated, which is provided with a control needle 47a corresponding to the control needle 47, and those control butts 21 (for example 21l, Figure 5) which are only to be raised into the tuck position are pivoted away from the raising portion 52 until they are fully sunk in the stem 5, corresponding to the side view of the knitting implement 3 which is shown entirely at the right in Figure 5. The control butts therefore pass on to the front surface 51 of the cam member 25 and are not raised further but are guided in a tuck track 63 as shown in Figure 5. The associated control butts 20 (for example 20l) and operating butts 19 (for example 19l) are similarly guided in tuck tracks 64, 65 which are in part identical in their rising portions to the knitting tracks 56 and 58. The second positioning cam 41 ensures in that respect that the control butts 21 are precisely positioned relative to the second control means 43 shortly before the second control means 43 is reached, and do not assume an undesired pivotal position as a result of centrifugal movements or the like.

Selection of the control butts 21 by the control means 43 is effected as shown in Figures 4 and 5 at a location which is disposed in a central part of the raising portion 52. That gives the substantial advantage that there is no need for an increase in the width of the system and the raising portion 52 can extend straight throughout. A disadvantage in that respect is the fact that selection is effected while the portion 52 is acting on the control butts 21 in order to lift the knitting implements 3 into the knitting position because in that way considerable frictional forces have to be overcome. In accordance with the invention therefore the patterning arrangement is provided with a means for relieving the load on the control butts 21 in the region of the raising portion 52 so that during the selection operation they are subjected to practically no or only very slight frictional forces.

In a practical embodiment in respect of said means, it is provided that the spacing between the two raising portions 52 and 55 which extend substantially parallel is selected to be slightly greater, approximately from the location where the second control means 43 begins to approximately that location at which the portion 55 ends, than the spacing of the bottom edges of the operating butts 19 and control butts 21, in order momentarily to relieve the load on the control butts 21 (for example 21d) and in that region to provide that the operating butts 19 (for example 19d) slide on and are guided by the raising portion 55. As shown in Figure 4, that is achieved for example by the raising portion 52 being displaced towards the left in parallel relationship by for example about 0.3 mm at a location 66 (butt 21c) in order to provide a recess 67, a free space or the like. The control butts 21 therefore firstly slide on the raising portion 52 and are lifted thereby. As the operating butts 19 are certainly lifted by way of the separating tip 54, for example at a location 66, in contrast the control butts 21 are relieved of load while at the

same time the operating butts 19 are put on to the raising portion 55 and are then lifted by same. The lower edges of the control butts 21 (for example 21d in Figure 4) are therefore freely floatingly guided at a small distance closely above the raising portion 52 on a path of movement shown in broken lines at 68 so that they suffer from practically no friction and can be selected by the control means 43 practically without the application of force. In that situation the butts 19 which slide on the raising portion 55 prevent the control butts 21 from undesirably dropping out into the raising portion 52 in the region of the recess 67.

At the end of the raising portion 55 the operating butts 19 have a tendency to run on to the substantially horizontal part of the top side 36 of the separating cam member 29. Since as a result of that the control butts 21 move towards the displaced part of the raising portion 52 and are gradually set down thereon, in accordance with the invention at that time there is a new change in the way in which the knitting implements 3 are guided, in that the raising portion 52 is brought back into operation again in order to move the control butts 21 (for example 21f in Figure 4) and therewith also the operating butts 19 (for example 19f in Figure 4) and the knitting implements 3 definitively into the highest raised position. In this last part of the lifting movement therefore the upper edges of the operating butts 19 are guided substantially along a path indicated in broken line at 56a (Figure 4).

At the beginning of the recess 67 the other control butts 20 are firstly still guided on the front side of the cam member 26. Shortly thereafter however they slide in a freely floating mode in an intermediate space between the two cam members 26 and 27 (for example 20k in Figure 5) so that, upon passing the recess 67, the associated selection elements can be freely pivoted without substantial frictional forces or the like having to be overcome. In that

situation the second positioning cam 41 ensures that said selection elements 22 cannot pivot unintentionally prior to the second control means 43 being reached. In other respects the selection operation is effected by means of the second control means 43 similarly to Figure 3, with an associated gap 49a being arranged in a corresponding part of the raising portion 52.

The described arrangement ensures that the three-way procedure can be carried into effect without an increase in the width of the system. The three-way procedure can also be performed without the knitting implement 3 having to be provided with additional control or operating butts, in comparison with a two-way procedure (for example knitting/non-knitting), so that it is also possible to use extremely short knitting implements 3, as may be desired for example for controlling rib needles.

Alternatively it is possible to design the recess 67 in such a way that the part of the raising portion 52 which is disposed downstream thereof initially rises somewhat more sharply than normal and thus approaches the line 68. The only difference would be that the control butts reach their highest position at a location which is substantially in line with the line 68 while in the embodiment first described above the highest position is reached at a time which is later, by the extent of the displacement, in this case for example about 0.3 mm.

It is also possible to envisage further embodiments of the means for relieving the load on the control butts 21. In particular, instead of the recess 67, it would be possible to provide a corresponding projection in the raising portion 55, which, when the operating butts run thereonto, causes the control butts 21 to be lifted off the raising portion 52 at the same time. At any event provided within the rising part of the knitting track 57 is a region in which the control butts 21 which are subjected to selection are relieved of load.

The described patterning arrangement also makes it possible in accordance with the invention to provide for continuous positive guidance of the knitting implements. For that purpose the patterning arrangement is of the following configuration.

Guidance of the knitting implements 3 in the region of the raising portions of the various cam members will first be described.

As Figure 4 shows, the knitting implements 3 which are selected for non-knitting are guided with their operating butts 19 on the top side 34 of the defining member 27 and with their control butts 20 at the underside 32 of the central cam member 26, wherein the underside 32 additionally has an inclined draw-down portion 69 which comes into operation downstream of the first control means 42 and which certainly prevents impingement of the associated operating butts 19 against the separating tip 54 (for example 19b and 20b in Figure 4).

The knitting implements 3 selected for knitting purposes are guided during the raising operation in the above-described manner on the one hand by the raising portions 52 and 55 respectively and on the other hand by the rising part of the underside 37 of the upper cam member 30.

During the raising phase the knitting implements 3 selected for the tuck operation (see Figure 5) are initially guided just like the knitting implements 3 which are selected for knitting purposes and are therefore securely guided past the separating tip 54. As soon as the second selection operation has taken place, as can be seen in Figure 5 by the transfer of the control butts 20, 21 for example from the position 20k, 21k into the position 20l, 21l, the now projecting control butt 20 (for example 20l, 20m) is in contrast guided by the underside 33 of the defining cam member 27 and at the same time the associated operating butt 19 (for example 19l, 19m) is guided by the top side 36 of the separating cam member 29, thereby ensuring even at high speeds of operation that the operating butts 19 could not be

raised beyond the top side 36.

In comparison, guidance for the knitting implements in the region of the draw-down portions of the various cam members is as follows.

The knitting implements 3 coming from the knitting position are firstly transferred by way of a gentle arc in the underside 37 of the cam member 30 on to the draw-down portion 70 thereof which at its lower end has a stitch-forming edge 71 for establishing the stitch length. In that situation, the knitting implements are prevented from dropping out, which could be connected to dropped stitches, by the falling part of the top edge 36 of the separating cam member 29 and/or by the falling part of the top side 31 of the lower cam member 25 while at the same time an inclined run-in portion 72 in the top side 38 of the counter-cam member 28 serves to catch the operating butts 19 or cause them to impinge softly on the counter-cam member 28.

The control butts 20 of those knitting implements which were raised into the tuck position are taken over (for example 20n) in the drawing-down operation by a drawing-down portion 73 which preferably becomes operative somewhat before the drawing-down portion 70, at the underside 33 of the defining member 27, and are then progressively moved towards the drawing-down portion 70 or the stitch-forming edge 71 of the cam member 30. That is achieved by an inclined run-off portion 74 which is provided at the end of the underside 33 of the defining member 27 and which extends at a shallow angle. Thereupon the operating butts 19 of the knitting implements 3 coming from the tuck position are gently put on to the counter-cam member 28 by means of the inclined run-in portion 72, as is also the case in regard to the needles coming from the knitting position. The drawing-down portion 70 can be adapted to be adjustable, if required, for adjusting the stitch length. The knitting implements are once again

prevented from dropping out by means of the top side 36 of the separating cam member 29.

The non-raised knitting implements 3 finally pass on to the inclined run-off portion 74 (Figure 4) at the end of the non-knitting track 60, with their control butts 20, and are progressively moved by the portion 74 towards the tracks of the raised knitting implements 3, that is to say with the operating butts 19, gently towards the drawing-down portion 70 or the stitch-forming edge 71. By virtue of that arrangement, on the one hand, the drawing-down depth of all knitting implements is established, by virtue of the stitch-forming edge 71, while on the other hand that arrangement eliminates severe impacts against the stitch-forming edge 71 or corresponding points on other cam members and in particular the counter-cam member 28. The knitting implements 3 are therefore constantly positively guided by two butts and the associated cam members.

As finally the knitting implements 3 are also positively guided in the region of the control means 42 and 43 or the recess 67 by the cam members 27, 30 and 29, 30 respectively which act on the operating butts 19 (for example 19a and 19d respectively), it is practically not possible to leave the position selected for any knitting implement 3 or any butt 19, 20 or 21 respectively. Therefore no part of the knitting implement 3 needs to be provided or mounted with friction, which on the one hand permits an optimum reduction in the forces required for the selection operations while on the other hand permitting movements with the generation of a small amount of heat.

The drawing-down portion 70 is desirably secured to a slider 75 which also carries the cam member 28, is mounted in or on the cam member 30, and can be displaced parallel to the drawing-down portion 70 in order thereby to permit adjustment of the stitch length.

In the embodiment shown in Figure 6 in which identical components are identified by the same reference numerals and which

permits the knitting implements 3 to be positively guided in a different manner, which was hitherto considered to be the best, the knitting implements are not shown once again in vertical section, for the sake of simplicity.

Instead of the cam members 25, 27, this arrangement has cam members 25a, 27a. The cam member 25a corresponds in the rising portion to the cam member 25 while additionally arranged in the top side 31a of its falling portion is a recess 76 at a location where the tuck track 63a changes from its straight part into the falling part. The defining member 27a, in its part at the right in Figure 6, corresponds to the defining member 27 whereas its underside 33a, in the part at the left in Figure 6 and in the direction of the movement of the knitting implements (arrow x), firstly has a slightly downwardly curved portion 77, adjoining same a third positioning cam 78 and adjoining same a portion having an inclined run-off portion 74a.

The positioning cam 78 is like the positioning cams 40, 41 and is of such a configuration that it acts on projecting control butts 20 of the knitting implements 3 and pivots them until they are sunk fully into the stems of the knitting implements 3 and instead the first control butts 21 project forwardly. In that respect the relative position of the positioning cam 78 is so selected that it comes into operation shortly before the end of the separating cam member 29 and the pivoting operation is terminated before that end is reached. In addition the recess 76 is disposed at the location of the positioning cam 78, as is clearly shown by broken lines 79 in Figure 6. In other respects the arrangement and configuration of the cam members 25a, 27a are so selected as to provide the mode of operation described hereinafter.

In the embodiment shown in Figure 6, selection of the control butts 20, 21 with the control means 42, 43 and guidance for the

knitting implements 3 in the raising phase occur in a similar manner to selection and guidance as described with reference to Figures 1 to 5. On the other hand the effect described hereinafter arises in relation to the drawing-down phase.

The operating butts 19 of the knitting implements 3 which are knitting are initially guided after the raising operation to the drawing-down portion 70, in a gentle arc, and are guided between the portion 70 and the top side 36 of the separating cam member 29. Alternatively or in addition and in particular before the beginning of the recess 76, the control butts 21 of those knitting implements 3 can be guided on the top side 31a of the cam member 25a. In contrast, at the end of the separating cam member 29, only the control butts 21 of those knitting implements 3 provide the positive guidance effect insofar as immediately downstream of the recess 76 they pass on to the top side 31a of the cam member 25a (for example 21s in Figure 6) until finally the operating butts 19 are taken over by the inclined run-in portion 72.

The knitting implements which are non-knitting are initially guided in a similar manner to Figures 4 and 5 between the cam members 27a and 29. In contrast, downstream of the end of the defining member 29 on the one hand the operating butt 19 is further supported on the top side 34a of the defining member 27a while at the same time the control butt 20 (for example 20r) of those knitting implements 3 passes on to a bottom edge 80 which is provided at the end of the defining member 27a and beneath the positioning cam 78 and which has an inclined run-off portion 74a corresponding to the portion 74 shown in Figures 4 and 5. That bottom edge 80 provides two substantial advantages. On the one hand a knitting implement 3 which is in the non-knitting position cannot jump up and in so doing, if it is a knitting needle, unintentionally pick up the yarn (not shown) or parts thereof, which would result in undesired tuck stitches. On the

other hand the operating butts 19 (for example 19r) of the knitting implements which are guided in the non-knitting position are guided to the drawing-down portion 70 at a shallow angle by means of the inclined run-off portion 74a, as in the embodiment shown in Figures 4 and 5, so that they impact gently against the portion 70. Moreover the counter-cam member 28a which follows the separating cam member 29 prevents the knitting implements from dropping out, irrespective of the stitch length selected in the specific situation involved.

The knitting implements 3 which are raised into the tuck position are initially guided by the operating butts 19 on the top side 36 of the defining member 29 and by the control butts 20 on the underside 33a of the defining member 27a. In the region of the broken line 79 in Figure 6, the positive guidance effect is taken over by the drawing-down portion 70 and the top side 36 of the separating cam member 29, with the portion 77 of the defining member 27a ensuring a gentle transition for the operating butts 19 on the drawing-down portion 70. At the same time the third positioning cam 78 acts on the control butts 20 of the knitting implements 3 (for example 20b) and presses same in the stems thereof while the control butts 21 (for example 21p) are pivoted outwardly. At the end of the separating cam member 29 that operation is concluded (see control butts 20q and 21q) with the result that the outwardly pivoted control butts 21 pass immediately adjoining the gap 76 on to the top side 31a of the cam member 25a and the knitting implements 3 are now guided between the latter and the drawing-down portion.

A particular advantage of the embodiment which is preferred at the present time, as shown in Figure 6, is that positive guidance for the knitting implements 3 which are raised into the knitting position or into the tuck position respectively, is substantially identical during the drawing-down phase and is not interrupted at any point, and that the knitting implements 3 which are selected for the non-

knitting position are also accurately guided between the end of the separating cam member 29 and the then following part of the drawing-down portion 70.

The invention is not restricted to the described embodiments which can be modified in many ways. That applies for example in regard to the control means which basically could also be replaced by mechanical and electronic but also all other known electromagnetic control means, and the described cam members which could be modified in particular in regard to the positive guidance effect. However it is also possible to envisage knitting implements other than the illustrated knitting implements 3. The knitting implements 3 which in the described embodiment are in the form of latch needles could also be for example in the form of slider needles, or pressers, sinkers, plush hooks or the like which are provided in addition to the knitting needles. In addition, instead of selection elements which are mounted rotatably or pivotably in the stems of the knitting implements, it would also be possible to use those which are hingedly connected to the lower end of the stem (see for example German laid-open application (DE-OS) No 20 00 578) and which have only one control butt which could also be formed from the lower end of the selection element. The position of the operating butt relative to the control butts is also variable (see in that respect US patent specification No 4 827 740). Finally the invention may also be used in connection with flat bed knitting machines or those circular knitting machines which have only rib needles (German patent specification No 18 16 864) or cylinder and rib needles (German laid-open application (DE-OS) No 35 07 004) or in which there are cylinder needles and sinkers which perform opposite movements for the purposes of stitch formation (US patent specification No 4 584 851).

CLAIMS

1. A knitting machine comprising a bed, knitting implements which are mounted displaceably in the bed and which each have at least an operating and a pivotable first control butt, and at least one patterning arrangement which has a cam portion intended for guiding the butts, with at least one respective non-knitting, tuck and knitting track formed by cam members, and a selector means which is intended to pivot the control butts and by means of which the butts are distributed to a respective one of said tracks, wherein the selector means includes a first control means for controlling selected knitting implements into the non-knitting track and a second control means for selective distribution of the other knitting implements on to the tuck or knitting track, characterised in that the tuck track (65) includes a first raising portion (55) for the operating butts (19), which leads into the tuck position, and the knitting track (57) includes a second raising portion (52) for the first control butts (21), which is substantially parallel thereto but which leads into the knitting position, that the patterning arrangement has a means (67) for relieving the load on the first control butts (21) in the region of the first raising portion (55) and that the second control means (43) is disposed in the region of said means (67).

2. A knitting machine according to claim 1 characterised in that the first control butts (21) are provided on selection elements (22) which are mounted rotatably or pivotably in the knitting implements (3) and the selection elements each have a second control butt (20) which is pivoted back when the first control butt (21) is pivoted out and pivoted forward when the first control butt (21) is pivoted back.

3. A knitting machine according to claim 2 characterised in that the patterning arrangement has a defining member (27, 27a) which acts on the second control butts (20) and which fixes the maximum height of raising movement of the knitting implements (3) which are controlled into the tuck track.

4. A knitting machine according to one of claims 1 to 3 characterised in that the cam members (25 to 30) are of such a configuration and arrangement that the knitting implements (3) are substantially constantly positively guided when passing the patterning arrangement.

5. A knitting machine according to one of claims 1 to 4 characterised in that the first raising portion (55) is provided on a separating cam member (29) which is associated with the operating butts (19) and which has a separating tip (54) for separation of the knitting implements (3) which are guided into the non-knitting track from the other knitting implements (3), and that the second raising portion (52) begins upstream of the first raising portion (55) and is of such a configuration and arrangement that the operating butts (19) of the knitting implements (3) which are not controlled into the non-knitting track are lifted by means of the first control butts (21) by way of the separating tip (54) on to the first raising portion (55).

6. A knitting machine according to one of claims 2 to 5 characterised in that the patterning arrangement includes a central cam member (26) which acts on the second control butts (20) and which prevents the operating butts (19) of the knitting implements (3) which are controlled into the non-knitting track from impinging against the separating tip (54).

7. A knitting machine according to one of claims 1 to 6 characterised in that the patterning arrangement comprises a further

cam member (30) with a first drawing-down portion (70) which acts on the operating butts (19) and which is provided with a stitch-forming edge (71) for establishing the drawing-down depth of the knitting implements (3).

8. A knitting machine according to one of claims 3 to 7 characterised in that the defining member (27) is provided with a second drawing-down portion (73) which acts on the second control butts (20) and which becomes operative prior to the first drawing-down portion (70), for controlling the drawing-down of the knitting implements (3) which are controlled into the tuck track.

9. A knitting machine according to claim 7 or claim 8 characterised in that associated with the stitch-forming edge (71) is a counter-cam member (28) having an inclined run-in portion (72) which is designed for gently catching the operating butts (19) of the knitting implements (3) which are guided by one of the two drawing-down portions (70, 73).

10. A knitting machine according to claim 9 characterised in that at the end of the second drawing-down portion (73) the defining member (27) has an inclined run-off portion (74) which is arranged in the region of the inclined run-in portion (72) and which guides the second control butts (20) of the knitting implements (3) which are guided into the non-knitting track and into the tuck track, in such a way that the associated operating butts (19) impinge gently against the drawing-down portion (70) or the stitch-forming edge (71) thereof.

11. A knitting machine according to one of claims 7 to 10 characterised in that the defining member (27a) has a positioning cam (78) which is arranged at the end of the separating cam member (29)

and which pivots the second control butts (20) back and thereby pivots the first control butts (21) forward, that a top side (31a) of a further cam member (25a), which extends parallel to the drawing-down portion (70) and which acts on the first control butts is provided with a recess (76) disposed in the region of the positioning cam (78), and that during the drawing-down phase the knitting implements (3) which are raised into the tuck position are positively guided until they leave the positioning cam (78) with their operating butts (19) between the drawing-down portion (70) and the separating cam member (29) and after leaving the positioning cam (78) they are positively guided with their operating butts (19) at the drawing-down portion (70) and with their first control butts (21) at the top side (31a).

12. A knitting machine according to claim 1 characterised in that the knitting implements (3) selected for non-knitting are positively guided as far as the end of the separating cam member (29) with their operating butts (19) between said cam member and the defining member (27a) and thereafter with their operating butts (19) positively on the top side of the defining member (27a) or a subsequent counter-cam member (28) and with their second control butts (20) at a bottom edge (80) of the defining member (27a).

13. A knitting machine according to one of claims 1 to 12 characterised in that the knitting implements (3) are latch needles.

14. A knitting machine according to one of claims 1 to 13 characterised in that the bed is a rib plate and the knitting implements (3) comprise rib needles.