Oct. 26, 1971 E. GOLLER ET AL 3,615,145

CAM LOCK FOR FLAT KNITTING MACHINE

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FIG.1

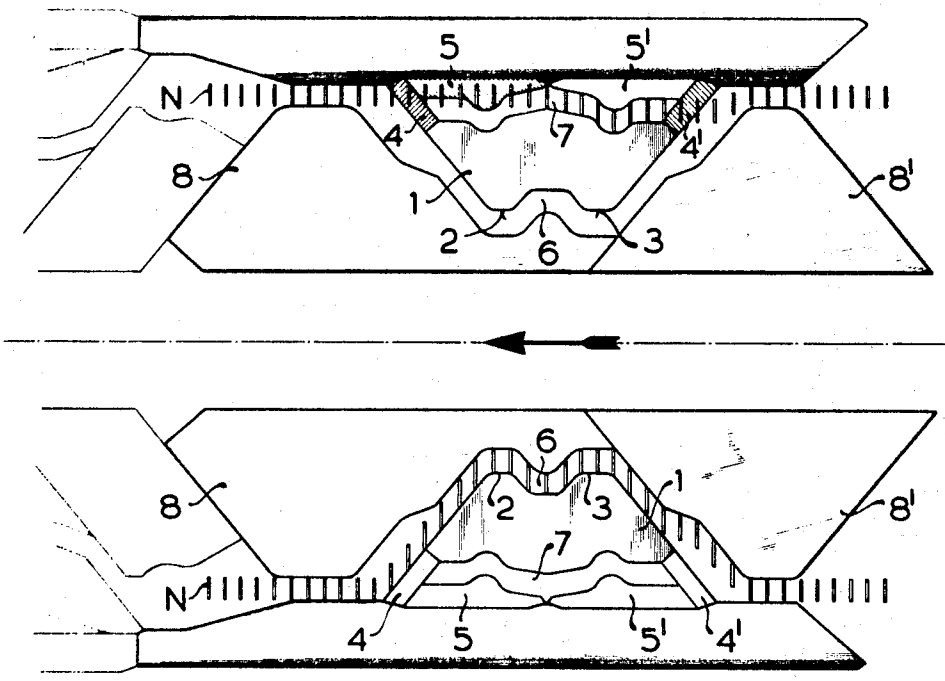
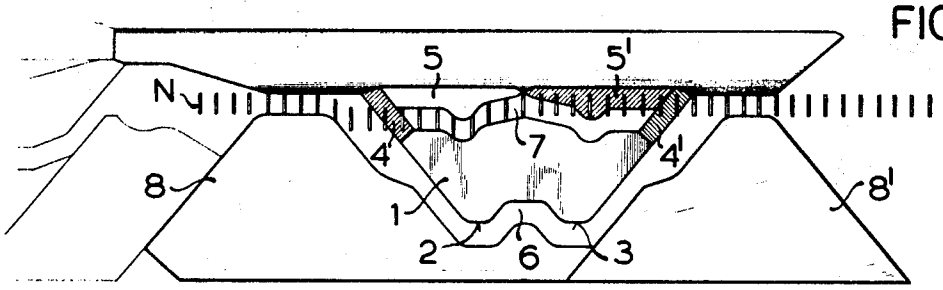
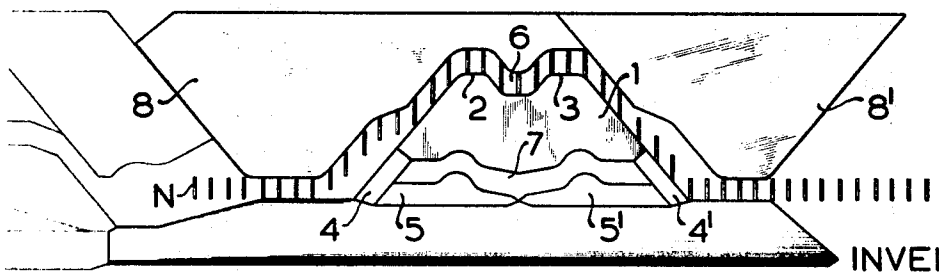


FIG.2





INVENTORS

Ernst Goller

Wilhelm Lederer

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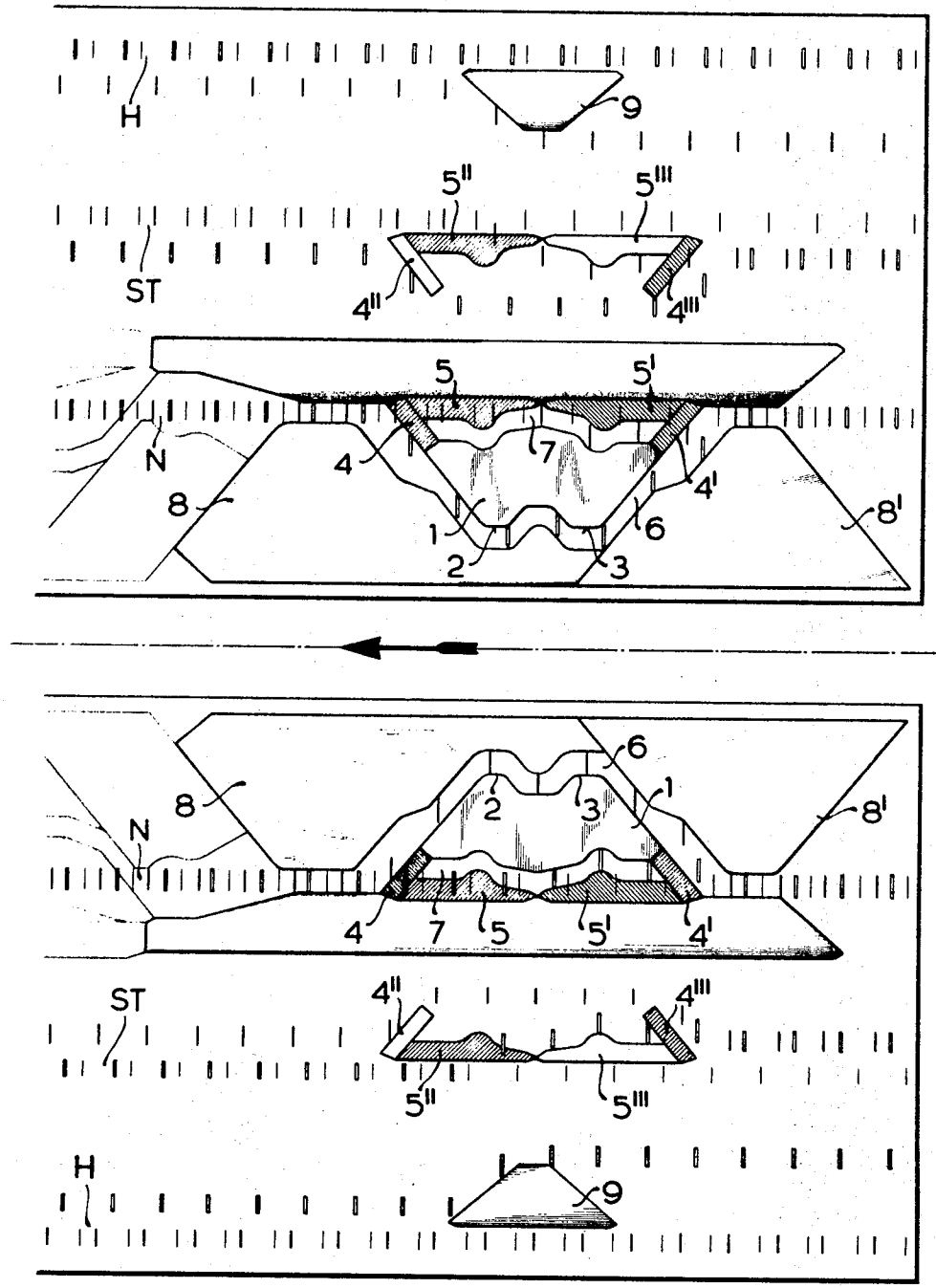
FIG.3



INVENTOR

Ernst Goller

Wilhelm Kedaw

CAM LOCK FOR FLAT KNITTING MACHINE

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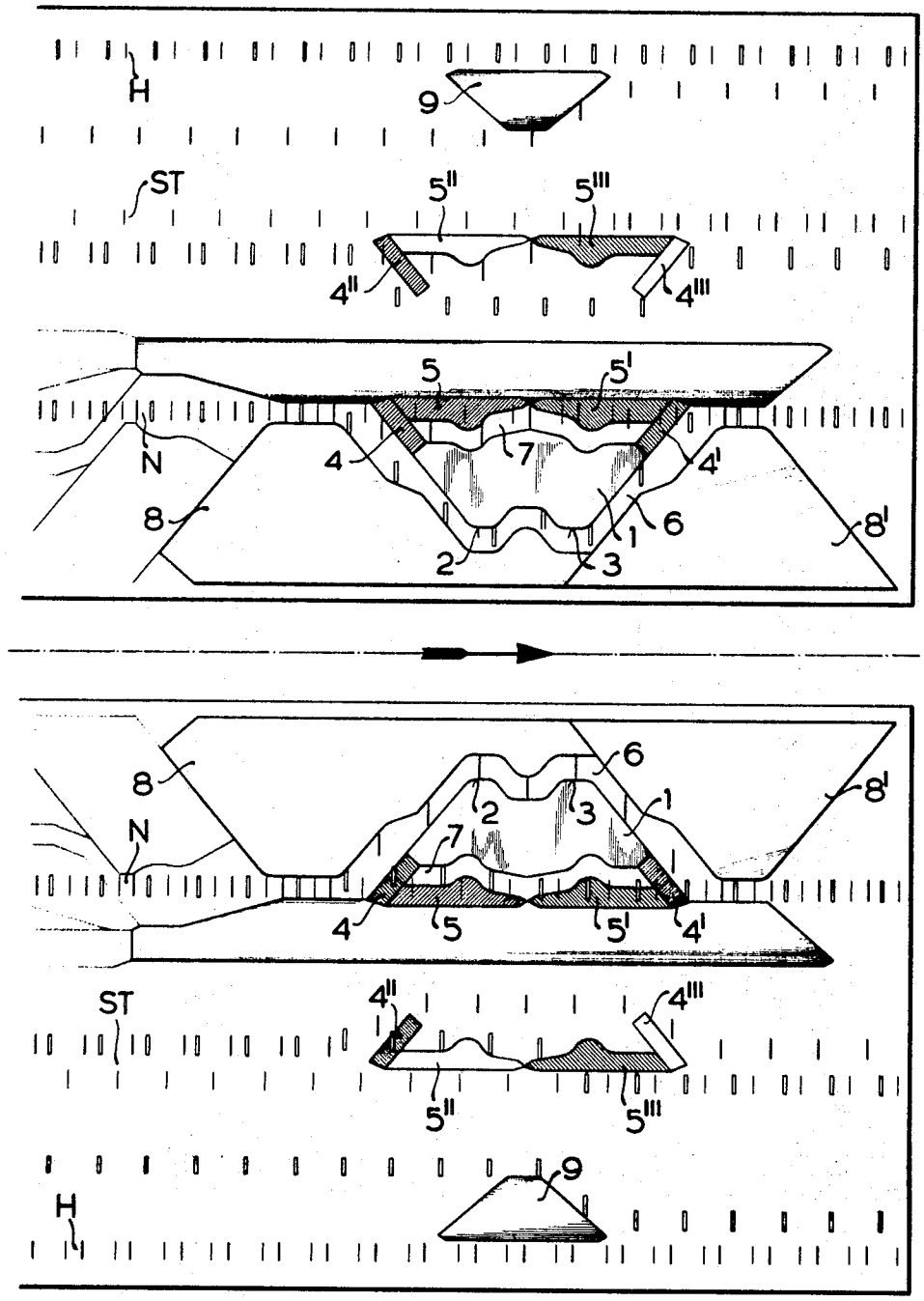
FIG. 4



INVENTOR

Ernst Goller

Wilhelm Lodam

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CAM LOCK FOR FLAT KNITTING MACHINE

Ernst Goller, Pfullingen, and Wilhelm Hadam, Reutlingen, Germany, assignors to H. Stoll and Company, Reutlingen, Germany

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Int. Cl. D04b 7/04
U.S. Cl. 66—78 10 Claims

ABSTRACT OF THE DISCLOSURE

Locks for transferring stitches between needle beds of a flat knitting machine. A symmetrical mirror-image arrangement of cams form opposed stitch transfer and stitch receiving channels. Switch cams select the path of movement of the needle butts through the cams and hence determine the direction of stitch transfer, regardless of the direction of travel of the lock carriage.

BACKGROUND OF THE INVENTION

This invention relates to knitting, and in particular it relates to locks of the type having cams for use in a flat knitting machine for effecting transfer of stitches from needles of either needle bed or plate to the needles of the opposed needle bed or plate. The invention is particularly useful with flat knitting machines such as the Lamb type having means for automatically opening the hooks of needles advanced to stitch receiving stations.

In known locks of the present type, the cams for advancing needles to stitch-transferring and stitch-receiving positions are variously constructed, but have heretofore always been so arranged that at any one location, there existed only one pair of opposed cooperating stitch transferring and stitch receiving cams. Each stitch-transfer cam associated with one of the two needle beds is isolated and lies opposite to an isolated stitch-receiving cam associated with the other, i.e. opposed, needle bed. For example, in the usual arrangement previously adopted, stitch transfer cams are arranged respectively at the left-hand side of the front needle bed and the right-hand side of the rear needle bed, whereas corresponding stitch-receiving cams are arranged at the left-hand side of the rear bed and the right-hand side of the front bed, respectively. By virtue of such an arrangement it follows that whenever the cam carriage moves from right to left, stitches will be transferred from needles in the front bed to needles in the rear bed, whereas whenever the said carriage moves from left to right, stitches will be transferred from needles in the rear bed to needles in the front bed.

Such an arrangement of locks certainly provides the possibility of opening the hooks of stitch-receiving needles before a transference of stitches takes place—either in the preceding course of knitting by means of stitches on the needle stems, or by any suitable hook or latch-opening elements. On the other hand, the stitch transfer operation itself is limited by the prior arrangement in as much as the direction of transfer (i.e. from front to rear bed or vice versa) is dictated by the direction of travel of the cam carriage. Thus, if heretofore it was required to transfer stitches from needles in the front bed to needles in the rear bed, such transfer could only take place when the cam carriage was travelling from right to left; similarly, transference of needles in the rear bed to needles in the front bed could only take place during a traverse of the carriage from left to right.

The herein described prior arrangement in which the sets of stitch-transfer and stitch-receiving cams are offset

or staggered accordingly served the purpose of making available time in which to prepare the stitch-receiving needles by the opening of their hooks. But with modern devices which function automatically to open the hooks of needles during the actual time the latter are being advanced into their stitch-receiving positions, this advantage of the offset or staggered arrangement of cams disappears and there remains only the disadvantage concerning the dependence of the direction of stitch transfer upon the direction of carriage movement.

SUMMARY OF THE INVENTION

Thus, it is a purpose of the present invention to provide a new and improved lock design for a flat knitting machine of the type described, which overcomes disadvantages of previous lock designs. In particular, it is a purpose of the present invention to provide a lock design for a machine of the type described, wherein stitch transfer can be effected in either direction during either direction of carriage travel.

In carrying out this purpose of the invention, the stitch transfer cams of the locks of one needle bed oppose stitch transfer cams of the locks of the other needle bed in symmetrical, mirror-image fashion, and the same is true of the opposed stitch receiving cams. Means are then provided on each needle bed for selecting for operation, either of said stitch transfer cams or said stitch receiving cams.

According to the present invention the improved lock comprises, on each needle bed, both stitch-transfer and stitch-receiving cams, these cams being so combined with needle-retracting cams as to provide between the cams two appropriately contoured channels or tracks for reception of needle butts, one channel being a stitch-transfer channel and the other being a stitch-receiving channel. Each needle bed further includes switch cams which are movable into and out of operation suchwise as to permit selective passage of needle butts into one channel or the other so that needles are selectively advanced into their stitch-transfer or stitch-receiving positions, according to knitting requirements.

There are two switch cams located at respectively opposite ends of the stitch-receiving channel or track, each of these cams, when operative, functioning to close the relevant end of the stitch-receiving channel and at the same time to direct and land needle butts into the stitch-transfer channel on to the appropriate edge of the stitch-transfer cam, according to the direction of travel of the cam carriage. But when withdrawn to their inoperative positions, the switch cams open the stitch-receiving channel, thereby permitting needle butts to pass along it, and at the same time making it impossible for the butts to be landed on to the stitch-transfer cam.

The switch cams are, therefore, in the nature of control and guide cams manipulation of which selectively determines which of the two channels is to be in use during any relevant traverse of the cam carriage either rightwards or leftwards.

In a preferred embodiment of the invention, the transfer lock associated with each needle bed of the machnie includes a central stitch-transfer cam with two spaced needle-advancing protuberances, the leading one of which moves needles for the purpose of spreading the stitches thereon to be transferred and the trailing one of which finally advances such needles to their transfer position irrespective of the direction of travel of the cam carriage. This central cam, in combination with needle-retracting cams flanking it, defines a stitch-transfer channel for reception of needle butts, the lock also including

(a) displaceable stitch-receiving cams which, when operative define in combination with the central stitch-trans-

fer cam a stitch-receiving channel for reception of and action upon needle butts to advance needles to their stitch-receiving positions and

(b) displaceable switch cams which are located at the ends of the stitch-receiving channel and are operable to control passage of needle butts into one channel or the other selectively.

Thus, it is an object of this invention to provide a new and improved lock design for a flat knitting machine.

It is another object of this invention to provide, in a flat knitting machine of the type described, stitch transfer cams arranged to permit stitch transfer in either direction between the needle beds, regardless of the direction of travel of the cam carriage.

It is another object of this invention to provide, in a flat knitting machine of the type described, a set of transfer cams on each needle bed, for stitch transfer and stitch reception, which set is symmetrical, opposed to and the mirror image of a corresponding set on the other needle bed.

It is another object of this invention to provide, in a flat knitting machine of the type described, a set of cams including switch cams for determining the path of movement of the needle butts through either a stitch transfer channel or a stitch receiving channel.

Other objects and advantages of the invention will become apparent from the detailed description to follow.

BRIEF DESCRIPTION OF THE DRAWINGS

There follows a detailed description of a preferred embodiment of the invention to be read together with the accompanying drawings which are provided to illustrate a preferred embodiment of the invention.

FIG. 1 is a diagrammatic plan view of two opposed stitch transfer locks of the present invention showing the paths taken by needle butts when the cam carriage of the machine is making a stroke in the direction of the arrow from right to left and stitches are in the course of being transferred from needles in the front (lower) bed to needles in the rear (upper) bed.

FIG. 2 is a similar view of the same locks depicting the needle butt paths when the carriage is travelling from left to right and a transfer of stitches is again being made from front bed needles to rear bed needles.

FIG. 3 is a plan view corresponding to that of FIG. 1 illustrating the combination, with the opposed transfer locks for action directly upon needles, of jack cam systems also similarly capable of effecting stitch transference from desired needles through the medium of associated jacks.

FIG. 4 is a plan view similar to FIG. 3 but with the cam carriage travelling rightwards instead of leftwards.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to each of FIGS. 1 and 2, it will be seen that each of the two opposed transfer locks comprises a central stitch transfer cam **1** formed with two spaced needle-advancing protuberances **2** and **3**. This central cam **1** is flanked, at opposite sides thereof, with two opposite-handled needle-retracting cams **8** and **8'**. The cam **1** and the two cams **8** and **8'** define between them an appropriately contoured stitch-transfer channel **6** for reception of needle butts N.

Below the central stitch-transfer cam of each lock is a pair of separate but opposite-handed stitch-receiving cams **5** and **5'** each of which is of the movable bolt type so that it can be either projected inwardly into an operative (unshaded) position or withdrawn to an inoperative position (depicted by shading). The lower edge of the cam **1** and the opopsed upper edges of the two cams **5** and **5'** define between them an appropriately contoured stitch-receiving channel **7**. The two channels **6** and **7** are accordingly at respectively different levels and extend very approximately parallel to one another. There are provided,

in association with the stitch-transfer cam **1** and the two stitch-receiving cams **5** and **5'**, two movable switch cams **4** and **4'**. These switch cams **4** and **4'**, like the cams **5** and **5'**, are of the bolt type and thus either projectible into operative (unshaded) positions or withdrawable to inoperative (shade) positions, according to requirements. The switch cams **4** and **4'** are, in fact, movable under control such as to permit of selective passage of needle butts N etither into the channel **6** or into the channel **7** so that needles in the beds are selectively advanced into their stitch-transfer or stitch-receiving positions, according to knitting requirements. Moreover, the two switch cams **4** and **4'** are located at the opposite ends of the stitch-receiving channel **7** of the lock. Thus, in the front (lower), lock in FIG. 1, both of the switch cams **4** and **4'** are in their operative positions to close the stitch-receiving channel **7**, the cam **4** functioning at the same time to direct and land needle butts N on to the left-hand edge of the central stitch-transfer cam **1** so that these butts then pass along the channel **6** as the cam carriage travels leftwards; in FIG. 2, where the carriage is travelling rightwards, the cam **4'** similarly functions to direct and land needle butts N on to the righthand edge of the cam **1**. But in the rear, i.e. upper, lock in each of FIGS. 1 and 2 both switch cams **4** and **4'** are withdrawn thereby opening the stitch-receiving channel **7** and permitting needle butts N to pass along it in either direction, depending on the direction of the traverse of the cam carriage, the said cams **4** and **4'** at the same time making it impossible for the butts to be landed on to the stitch-transfer cam **1**.

It will be noted from a consideration of FIGS. 1 and 2 that only one of the pair of stitch-receiving cams **5** and **5'** is in operation at any one time during stitch-transference so that, in effect, only half of the channel **7** is effective. Thus, with the cam carriage travelling from right to left as in FIG. 1, only the trailing stitch-receiving cam **5'** is in operation, the leading stitch-receiving cam **5** being withdrawn and inoperative. But with the carriage travelling from left to right as in FIG. 2 only the cam **5** is in operation—the cam **5'** being withdrawn. That is to say, in both cases it is the second, i.e. trailing half only of the stitch-receiving channel **7** which is effective. In contrast, the stitch transfer channel **6** is wholly effective during a stitch transferring operation.

The reason for the central stitch-transfer cam having two spaced protuberances **2** and **3** is as follows:

Depending on the direction of travel of the cam carriage, the leading protuberance (**2** in FIGS. 1 and 3 in FIG. 2) initially advances the needles in the front bed to their maximum projected position. As a consequence, the stitches on these front needles are laterally spread and thus opened out in readiness for penetration by the opposed receiving needles in the rear bed. Thereupon, the fully advanced needles are withdrawn slightly and are only subsequently and finally advanced into their transfer position by action upon their butts N of the trailing protuberances (**3** in FIGS. 1 and 2 in FIG. 2). As will be seen the operative stitch-receiving cam of the rear bed always lies opposite to the trailing protuberance of the transfer cam **1**, the stitch transfer taking place in known fashion at this particular location. That is to say, the receiving needles in the rear bed remain in readiness while the stitches on the front needles are being spread (as a consequence of advance of the last mentioned needles by the leading protuberance of cam **1**), the said receiving needles being finally advanced to take the spread stitches only as their butts pass along the second half of the channel **7**.

For convenience, the specific description has so far been concentrated upon the transference of stitches from needles in the front bed to needles in the rear bed of the machine. However, it is to be clearly understood that similar transference of stitches can optionally be made from needles in the rear bed to needles in the front bed, during a carriage stroke either from right to left or left

to right. In such a case, all the cams 4, 4' and 5, 5' of the rear stitch-receiving lock would be in their operative (unshaded) positions, whereas the corresponding cams in the front stitch-receiving lock would be so manipulated that some were in operation and others not, according to requirements and the direction of carriage travel.

In FIGS. 3 and 4 there is illustrated a developed construction of the front and rear lock systems including switch cams 4'' and 4''' and pairs of opposite-handed stitch-receiving cams 5'' and 5''' all for action upon needle-actuating jacks ST, as well as a feed cam 9 disposed below such additional cams for action upon auxiliary jacks H.

Such a developed version of the lock construction according to the invention provides the possibility of transferring, simultaneously and selectively, stitches from needles in the front needle bed to needles in the rear bed, and also from needles in the rear bed to needles in the front bed—during carriage strokes in either direction. This is achieved by virtue of the fact that during a carriage stroke from right to left (FIG. 3) and also during a carriage stroke from left to right (FIG. 4), the cams 4, 5 and 4', 5' of both of the opposed needle locks can be rendered inoperative as indicated by the shaded parts in both of these figures.

In the main jack locks provided below the needle locks and having switch cams 4'', 4''' and stitch-receiving cams 5'', 5''', the leading switch cams 4'' in FIG. 3 and 4''' in FIG. 4 and the subsequent stitch-receiving cams 5''' in FIG. 3 and 5'' in FIG. 4 are in operation at any time. The selected jacks ST, that is to say the ones brought into the range of their switch cams 4'' and 4''' are projected out of each needle bed to advance their associated needles into the range of the central stitch-transfer cam 1 and thus into the stitch transfer position.

The selected auxiliary jacks H are projected by the feed cam 9 to advance the butts N of the associated needles into the stitch-receiving position, through the medium of their associated jacks ST and the trailing stitch-receiving cams 5''' or 5'' depending upon the direction of carriage travel—the stitch transfer then taking place in the manner hereinbefore described.

Although the invention has been described in considerable detail with respect to preferred embodiments thereof, it should be apparent that the invention is capable of numerous modifications and variations apparent to those skilled in the art without departing from the spirit and scope of the invention.

We claim:

1. In a flat knitting machine having opposed needle beds and locks associated with each needle bed for transferring stitches from the needles of one bed to the needles of the other bed, the improvement wherein each lock of each bed includes means, including a set of cams, for guiding needles to either transfer or receive stitches, and for accomplishing said transfer or receiving of stitches for either direction of travel of the locks relative to the needle bed, said set of cams including a stitch-transfer cam, a needle retracting cam, and a stitch receiving cam, a stitch transfer channel formed by said stitch-transfer cam and said needle retracting cam for guiding needles which transfer stitches, and a stitch-receiving channel formed by the stitch-transfer cam and the stitch-receiving cam for guiding needles which receive stitches; and including two switch cams located one at each end of the stitch receiving channel, each switch cam being movable between a first position and a second position, and wherein in the first position each switch cam permits movement of the needles into said stitch receiving channel and in the second position, the switch cam permits movement of the needles into the said stitch-transfer channel, whereby the needles are selectively advanced to their stitch-transfer or their stitch-receiving positions, and wherein the two said locks are mirror images of each other about a plane between the two said locks, whereby depending on the setting of the switch cams, each said set of cams is capable of guiding needles to either transfer stitches or receive stitches for either direction of relative travel between the needle beds and the locks.

2. The invention of claim 1, wherein in the said first position the switch cams are raised to an operative position to block the stitch receiving channel and guide the needles into the stitch-transfer channel, and wherein the second position, the switch cams are recessed to an inoperative position, thus permitting the needles to move into the stitch-receiving channel.

3. The invention of claim 2, wherein the two switch cams of a given lock are movable to said operating position or said inoperative position together such that the position of the said switch cams determines the channel into which the needles will be guided irrespective of the direction of relative movement between the needles and the locks.

4. The invention of claim 1, wherein said stitch-transfer cam includes, on the edge thereof forming the stitch-transfer channel, two spaced needle advancing protuberances, including a leading protuberance to move the needles for spreading the stitches thereon to be transferred and a trailing protuberance for finally advancing said needles to their transfer position, the said protuberances being operative as said leading and said trailing protuberances regardless of the direction of relative movement between the needles and the locks.

5. The invention according to claim 4, wherein said stitch-receiving cam comprises a pair of stitch-receiving cams in each lock and located side-by-side to define one side of said stitch-receiving channel, and wherein said stitch-receiving cams are each associated with one of said protuberances on the opposed lock, and wherein either of said stitch-receiving cams can be rendered operative, and the other inoperative, depending upon the direction of relative movement between the needles and the bed.

6. The invention according to claim 5, wherein the stitch-receiving cams on each lock occupy one-half of the stitch-receiving channel, and wherein said stitch-receiving cams are symmetrical about a plane passing between them, and wherein, in operation, for either direction of relative movement between the needles and the locks, only the trailing one of said stitch-receiving cams is operative.

7. The invention of claim 2, wherein said locks are of the developed form, and wherein each of said locks includes a further set of switch cams and a further set of opposite-handed additional stitch-receiving cams associated with said further set of switch cams, said further stitch-receiving cams being movable between an operative and an inoperative position, such that when operative, the stitch-receiving cams act upon needle-actuating jacks as the locks and the needles move relative to each other.

8. The invention of claim 7, including, on each lock, a feed cam for acting upon auxiliary jacks, the feed cam on each lock being located centrally between said further stitch-receiving cams, wherein, in a knitting machine having two opposed said developed locks, stitches from needles in one bed may be transferred to needles in the other bed, and vice-versa, simultaneously and selectively during relative movement between the locks and the needle beds.

9. In a flat knitting machine having opposed needle beds and locks associated with each needle bed for transferring stitches from the needles of one needle bed to needles of an opposed needle bed, each said lock being characterised in that it includes a central stitch-transfer cam with two spaced needle-advancing protuberances, a leading one of which moves needles for the purpose of spreading the stitches thereon to be transferred and a trailing one of which finally advances such needles to their transfer position irrespective of the direction of travel of the cam carriage, this central cam, in combination with needle-retracting cams flanking it in both directions, defining a stitch-transfer channel for reception of needle butts, the lock also including (a) displaceable stitch-receiving

cams which, when operative, define in combination with the central stitch-transfer cam a stitch-receiving channel for reception of and action upon needle butts to advance needles to their stitch-receiving positions and (b) displaceable switch cams which are located at the ends of the stitch-receiving channel and are operable to selectively control passage of needle butts into one channel or the other.

10. A lock for a flat knitting machine according to claim **9**, wherein there are two opposite-handed stitch-receiving cams each extending along half only of the stitch-receiving channel, such cams being so operable that

only the trailing one of them is in operation during a stroke of the cam carriage in either direction such that only the trailing half of the said stitch-receiving channel is effective.

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RONALD FELDBAUM, Primary Examiner