NEEDLE FOR TRANSFERRING STITCHES THEREFROM TO ADJACENT NEEDLES FOR HOSIERY KNITTING MACHINES OR THE LIKE

Technical Field

The present invention relates to a needle for transferring stitches from the needle itself to adjacent needles for hosiery knitting machines or the like.

Background Art

In the field of knitting machines or hosiery-making machines, needles are known which are provided in order to allow to transfer a stitch from one needle to an adjacent needle.

One of such needles is disclosed in International Publication WO-02/070799. Said needle has, along its shank, a contoured tab which extends laterally with respect to the shank of the needle and forms, on one side of the needle, a receptacle which can be crossed by the head of another needle arranged laterally to the needle being considered. When a needle of this kind is mounted on the knitting machine or hosiery-making machine, said receptacle is aligned with the adjacent needle. The needle being considered, or transferring needle, in a certain step of the knitting of an item is moved so that the loop of knitting or stitch, which is arranged on its shank, is arranged at this receptacle. The adjacent needle, or receiving needle, is then actuated so as to pass through the receptacle, crossing completely the loop of knitting with its head. The transferring needle and the receiving needle are then actuated so that the transferring needle releases the loop of knitting, which remains attached to the head of the receiving needle.

By means of this type of needle and by means of the method disclosed in International Publication WO-02/070799, to which reference is made for the sake of completeness, it is possible to transfer stitches from one needle to an adjacent needle in order to obtain particular patterns, in particular to obtain open-work effects.

This type of needle, due to the fact that it has a receptacle on a single side, allows to transfer the stitch only to one of the two needles which, in the machine, are arranged laterally to the transferring needle, i.e., to the needle that is aligned with the receptacle of the transferring needle.

The possibility to transfer the stitch only in one direction is not devoid from drawbacks.

By transferring the stitch only in one direction with plain jersey knitting, the knitting in fact tends to rotate in the direction of the transferred stitch. This tendency can be compensated partially by using yarns with specific twists, which however are difficult to obtain.

Moreover, the possibility to transfer the stitches only on one side of the needle constitutes a limitation to the patterns that can be produced.

Other methods which instead allow to transfer the stitch in one direction or the other, depending on the knitting requirements, are known in knitting machines and hosiery-making machines.

In two-bed rectilinear knitting machines, for example, the transfer of the stitch from one needle to the adjacent needle can be performed by transferring the stitch from a needle of one bed to a needle of the other bed, moving the carriage to the end of its stroke, then moving one bed with respect to the other, again transferring the stitch onto the required needle of the bed from which it had been transferred earlier, then returning the carriage to the end of its stroke, thus returning the displaced bed to the working position, and finally resuming knitting. This operation is rather laborious, entails high mechanical precision in performing the movements of the beds, and requires, for its execution, times which penalize substantially the productivity of the machine.

In two-bed circular knitting machines, the procedure is similar to the one used in rectilinear machines, since the stitch to be transferred is passed from a needle of one bed to a needle of the other bed and is then transferred again to a needle of the bed from which it had been previously transferred

after adequately displacing one bed with respect to the other. In this case, in order to displace one bed with respect to the other it is necessary to deactivate the feeds of the machine which must then be reactivated in order to resume knitting. This technique suffers substantially the same problems mentioned above with reference to the method for transferring the stitch on rectilinear machines.

In circular hosiery knitting machines, stitch transfer can be performed by means of two punches arranged laterally, one for each side of the needle, and capable of removing the stitch from the needle, transferring it onto the adjacent needle.

Again in circular hosiery knitting machines, stitch transfer can be performed also by using the hooks of the dial, which lies above the needle cylinder of the machine, as if they were needles of another bed. In both of these cases, the use of elements which are external to the needle limits the gauge that can be reached. Currently, the gauge that can be reached on circular hosiery knitting machines capable of transferring the stitch from one needle to an adjacent needle is 18 n.p.i. (needles per inch).

Disclosure of the Invention

The aim of the present invention is to solve the problems described above by providing a needle which allows to transfer the stitch from the needle itself to one of the two adjacent needles, i.e., in either direction, without requiring the intervention of elements other than the needle that transfers the stitch and the needle that receives the stitch.

Within this aim, an object of the invention is to provide a needle which, while offering the possibility to transfer the stitch to one or the other of the two adjacent needles, can have a reduced thickness, so as to allow its use on fine-gauge machines (greater than 18 n.p.i.).

Another object of the invention is to provide a needle which allows to perform various known types of pattern and also allows to develop new patterns.

Another object of the invention is to provide a needle which can be used advantageously both on circular machines and on rectilinear machines, both of the single-bed and of the two-bed types.

This aim and these and other objects, which will become better apparent hereinafter, are achieved by a needle for transferring stitches from the needle itself to adjacent needles for hosiery knitting machines or the like, which comprises a shank, a head arranged at a longitudinal end, or upper end, of said shank, and a latch which is pivoted to said shank proximate to said head, about a pivoting axis which is substantially perpendicular to the longitudinal axis of said shank and can rotate about said pivoting axis in order to open or close said head, characterized in that it comprises at least one elastically flexible lamina which is associated with said shank and forms, on the two opposite sides of said shank, below said latch, two receptacles, one for each side of said shank, in each of which it is possible to insert the head of an adjacent needle in order to transfer the loop of knitting, carried by said shank and arranged at said receptacles, from the needle to said adjacent needle.

Brief description of the drawings

Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of the needle according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a side elevation view of the needle according to the invention;

Figure 2 is a front elevation view of the needle according to the invention;

Figure 3 is an enlarged-scale view of a detail of Figure 1;

Figure 4 is an enlarged-scale view of a detail of Figure 2;

Figure 5 is a view of the same detail of Figure 4, with the at least one lamina compressed elastically against the shank;

Figure 6 is a side elevation view of a needle according to the invention and of an adjacent needle, which also illustrates part of the machine on which they are mounted, during transfer of the stitch from the needle to the adjacent needle;

Figure 7 is a sectional view of Figure 6, taken along the line VII-VII;

Figures 8a, 8b to 10a, 10b illustrate three moments of the transfer of the stitch from a needle according to the invention to an adjacent needle, shown respectively in a side elevation view in Figures 8a, 9a and 10a and in a front elevation view in Figures 8b, 9b, 10b.

Ways of carrying out the Invention

With particular reference to Figures 1 to 5, the needle according to the invention, generally designated by the reference numeral 1, comprises a shank 2, a head 3 and a latch 4.

The head 3 is arranged at a longitudinal end, or upper end, of the shank 2 and is shaped like a hook which is open toward the front face of the shank 2, in a manner similar to known types of needle.

The latch 4 is pivoted to the shank 2 proximate to the head 3 about a pivoting axis 5 which is substantially perpendicular to the longitudinal axis of the shank 2, and can rotate about the axis 5 to open or close the head 3, as in known types of needles.

The needle according to the invention comprises at least one lamina 6a, 6b, which is elastically flexible and is associated with the shank 2 and forms, on the two opposite sides 7a, 7b of the shank 2, below the latch 4, two receptacles 8a, 8b, one for each side 7a, 7b of the shank 2, in each of which it is possible to insert the head of an adjacent needle 1a in order to transfer the loop of knitting 40, carried by the shank 2 and arranged at the receptacles 8a, 8b, from the needle 1 to the adjacent needle 1a, as will become better apparent hereinafter.

Preferably, there are two elastically flexible laminas 6a, 6b, each of which is connected to a side 7a, 7b of the shank 2, and each one of these

two laminas 6a, 6b forms a receptacle 8a, 8b for the adjacent needle 1a.

Each one of the laminas 6a, 6b is shaped so as to separate, with one of its portions, from the corresponding side 7a, 7b of the shank 2, so as to form the receptacle 8a, 8b, and can flex elastically toward the corresponding side the shank 2 in contrast with its elastic reaction.

Preferably, each side 7a, 7b of the shank 2 has, at the corresponding lamina 6a, 6b, a seat 9a, 9b, which is adapted to accommodate, substantially completely, the corresponding lamina 6a, 6b when it is pushed toward the shank 2 in contrast with its elastic reaction, as illustrated in particular in Figure 5.

The shank 2 has, along its extension, on its front face or side toward which the head 3 opens, and proximate to its longitudinal end or lower end, which lies opposite with respect to the head 3, at least one heel 10, which protrudes at the front and can engage in a per se known manner the actuation cams of the needles provided in the hosiery knitting machine or the like on which the needle 1 is to be mounted.

The receptacle 8a, 8b formed by each one of the laminas 6a, 6b is open both toward the upper end of the shank 2 and toward the lower end, so as to allow the adjacent needle 1a to enter the receptacle 8a, 8b and exit from said receptacle 8a, 8b.

Each one of the laminas 6a, 6b is fixed, proximate to its lower end 11a, 11b, to the shank 2 and rests with its upper end 12a, 12b against the corresponding side 7a, 7b of the shank 2.

Each lamina 6a, 6b is shaped so as to have, if no forces are applied thereto, a lower region 13a, 13b, which adheres to the corresponding side 7a, 7b of the shank 2; an intermediate region 14a, 14b, which is spaced from the corresponding side 7a, 7b of the shank 2 in order to define the receptacle 8a, 8b; and an upper region 15a, 15b, which ends with the upper end 12a, 12b or which, as in the illustrated embodiment, is limited to said upper end 12a, 12b which rests against the corresponding side 7a, 7b of the shank 2.

Preferably, the intermediate region 14a, 14b of the lamina 6a, 6b is formed, starting from its lower end, by a first portion 16a, 16b, which is folded away from the corresponding side 7a, 7b of the shank 2; by a second portion 17a, 17b, which is substantially parallel to the corresponding side 7a, 7b of the shank 2; and a third portion 18a, 18b, which is folded toward the corresponding side 7a, 7b of the shank 2.

Moreover, each lamina 6a, 6b has, in its region which forms the receptacle 8a, 8b, an upper portion, which is offset toward the rear side of the shank 2 with respect to the underlying lower portion, so as to form a lower opening 19a, 19b for accessing the receptacle 8a, 8b. In the illustrated embodiment, said lower opening 19a, 19b is formed substantially at the connection between the first portion 16a, 16b and the second portion 17a, 17b of the intermediate region 14a, 14b of each lamina 6a, 6b.

Conveniently, the front face of the third portion 18a, 18b of the intermediate region 14a, 14b of each lamina 6a, 6b is shaped like an inclined plane and gradually approaches the front face of the shank 2 toward the upper end of said shank 2, connecting thereto at the upper region 15a, 15b of each lamina 6a, 6b.

In each lamina 6a, 6b, the lower opening 19a, 19b is preferably substantially aligned with the region where the upper region 15a, 15b of the lamina 6a, 6b rests against the corresponding side 7a, 7b of the shank 2 along a direction which is parallel to the longitudinal axis of the shank 2.

By equipping a hosiery knitting machine or the like with needles according to the invention, and by providing for them an actuation as described hereinafter, it is possible to transfer directly stitches 40 from one needle 1 to an adjacent needle 1a arranged laterally, on either side of the needle 1, without requiring additional elements which take the stitch or loop 40. For the sake of greater clarity, the needle that is adjacent to the one being considered has been designated by the reference numeral 1a, but it can be constituted by a needle 1 according to the invention.

The description of the execution of the transfer of a loop of knitting 40 from a needle 1 to an adjacent needle 1a is given, for the sake of greater clarity, with reference to a circular hosiery knitting machine or the like, assuming that the needles between which the loop of knitting 40 is transferred are in the needle cylinder of the machine, without altering the fact that the needle according to the invention can also be used in the dial of circular machines with a cylinder and dial or, more generally, both in rectilinear and circular single-bed or two-bed machines.

In order to transfer the loop of knitting 40 from a needle 1 to an adjacent needle 1a, the needle 1, after forming the loop of knitting 40 and releasing the previously formed loop of knitting, is transferred, by means of the actuation cams of the needles with which its heel 10 engages, so as to protrude partially above the knitting forming plane 21, which is formed by the sinkers 22, which retain the loops of knitting 40 that have just been formed. The extent of the lifting of the needle 1, which must transfer the loop of knitting and is termed hereinafter "transferring needle", is such as to place the intermediate region 14a, 14b of the laminas 6a, 6b at the knitting forming plane 21 and extract the intermediate region 14a, 14b completely from the region occupied by the so-called bars which delimit laterally the axial slots of the lateral surface of the needle cylinder in which the needles slide. In Figures 8a, 8b to 10a, 10b, the plane of the upper end of the bars has been designated by the reference numeral 23. In this manner, the laminas 6a, 6b, previously pressed against the shank 2 of the transferring needle 1 by the presence of the bars, move away by elastic reaction from the shank 2 with their intermediate region 14a, 14b, forming the receptacles 8a, 8b at which the loop 40 is positioned.

At this point, the adjacent needle 1a, onto which the loop of knitting 40 is to be transferred, and which is termed hereinafter "receiving needle", is moved upwardly with respect to the transferring needle 1. It should be noted that the receiving needle 1a is aligned with its head below the lower

opening 19a or 19b of the receptacle 8a or 8b, and its upward movement produces the insertion of its beak within the receptacle 8a or 8b through the lower opening 19a or 19b. In the case shown in Figures 8a, 8b to 10a, 10b, the receiving needle 1a is constituted by the needle which, in the front views, lies to the right of the transferring needle 1 and therefore enters the receptacle 8b, passing through the lower opening 19b, as shown in Figures 8a, 8b.

Then, after completing the lifting of the receiving needle 1a so that its head lies above the knitting forming plane 21 and therefore above the loop 40 to be engaged (Figures 9a, 9b), the transferring needle 1 is lowered while the receiving needle 1a is kept motionless, preferably in a position which corresponds to the tuck-stitch position.

The descent of the transferring needle 1 causes the receiving needle 1a to exit with its head upwardly from the receptacle 8b, passing with its head between the upper end 12b of the lamina 6b and the shank 2 of the needle 1. Moreover, the descent of the needle 1 causes the loop of knitting 40, arranged around the laminas 6a, 6b, to slide along the inclined-plane part of the portion 18b, displacing it toward the shank 2 and bringing it into the head of the receiving needle 1a, as shown in Figures 10a, 10b.

When, during its descent, the transferring needle 1 with its latch has moved beyond the loop of knitting 40, which is in the head of the receiving needle 1a and produces the at least partial closure of the head 3 of the transferring needle 1 by the latch 4, the two needles 1 and 1a can be lowered together below the knitting formation plane 21.

In order to transfer the loop of knitting 40 not to the adjacent needle located to the right of the needle 1 but to the adjacent needle located to the left, it is sufficient to actuate said needle located to the left as described above with reference to the receiving needle 1a.

Of course, if the needles according to the invention are used in a dial of a cylinder-and-dial machine, the needles are moved radially outwardly

instead of being raised and radially inwardly instead of being lowered.

The adaptation of the movements to be imparted to the needles according to the invention with reference to the machine on which they are mounted can be derived in any case straightforwardly on the basis of the explanation given above with reference to a single-bed circular machine.

It should be noted that during the transfer of the loop of knitting 40 from the transferring needle 1 to the receiving needle 1a, the latter is never raised or rather moved beyond the tuck-stitch position. For this reason, the laminas 6a, 6b optionally present on said needle 1a are unable to move away with their intermediate region 14a, 14b from the shank of the needle, being retained against it by the side walls of the axial slot of the needle cylinder or other needle supporting element in which it is contained.

The particular structure of the needle according to the invention with elastically flexible laminas which can move elastically toward the shank of the needle allows to provide the needle according to the invention with a reduced thickness, such as to allow its use in fine-gauge machines (more than 18 n.p.i.).

It should be noted that the needle according to the invention can be used advantageously also on two-bed machines to transfer a stitch from one bed to the other also with a transfer from a needle of one bed to an adjacent needle of the same bed without requiring relative movements of the beds and thus avoiding the problems of precision and complexity of execution that these movements involve.

Moreover, the use of needles according to the invention with the possibility to transfer the stitches on either side of the needles on machines which can be actuated with a reciprocating motion allows to produce items of knitting with knitted regions of any shape with added and cast-off stitches, increasing their quality and their degree of finish.

In practice it has been found that the needle according to the invention fully achieves the intended aim, since it allows direct transfer of

the stitch from the needle itself to one of the two adjacent needles, i.e., in either direction.

Moreover, the needle according to the invention can have such a low thickness that it can be used in fine-gauge machines.

The needle thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

In practice, the materials used, as well as the dimensions, may be any according to requirements and to the state of the art.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

CLAIMS

1. A needle for transferring stitches therefrom to adjacent needles for hosiery knitting machines or the like, comprising a shank (2), a head (3) arranged at a longitudinal end, or upper end, of said shank (2), and a latch (4) which is pivoted to said shank (2) proximate to said head (3), about a pivoting axis (5) which is substantially perpendicular to the longitudinal axis of said shank (2) and can rotate about said pivoting axis (5) in order to open or close said head (3), characterized in that it comprises at least one elastically flexible lamina (6a, 6b) which is associated with said shank (2) and forms, on the two opposite sides of said shank (2), below said latch (4), two receptacles (8a,8b), one for each side of said shank (2), in each of which it is possible to insert the head (3) of an adjacent needle (1a) in order to transfer the loop of knitting (40), carried by said shank (2) and arranged at said receptacles (8a,8b), from the needle (1) to said adjacent needle (1a).

2. The needle according to claim 1, characterized in that it comprises two elastically flexible laminas (6a,6b), each of which is connected to one side (7a,7b) of said shank (2) and forms a receptacle (8a,8b) for said adjacent needle (1a).

3. The needle according to claims 1 and 2, characterized in that said laminas (6a,6b) are elastically flexible toward the corresponding side of the shank (2) against their elastic reaction.

4. The needle according to one or more of the preceding claims, characterized in that each side (7a,7b) of the shank (2) has, at the corresponding elastically flexible lamina (6a,6b), a seat (9a,9b) which is adapted to accommodate the respective lamina (6a,6b) pushed toward said shank (2) against its elastic reaction.

5. The needle according to one or more of the preceding claims, characterized in that said shank (2) has, along its extension, on its front face, arranged between said two sides (7a, 7b), and proximate to its longitudinal end or lower end, which lies opposite with respect to the head (3), at least one heel (10) which protrudes at the front and can engage needle actuation cams of the hosiery knitting machine or the like.

6. The needle according to one or more of the preceding claims, characterized in that the receptacle (8a,8b) formed by each one of said laminas (6a,6b)

is open both toward the longitudinal end of said shank (2) with said head (3) and toward the opposite longitudinal end.

7. The needle according to one or more of the preceding claims, characterized in that each one of said laminas (6a,6b) is fixed by means of its lower end (11a,11b) to said shank (2) and rests with its upper end (12a,12b) against the side (7a,7b) of said shank (2).

8. The needle according to one or more of the preceding claims, characterized in that each one of said laminas (6a,6b) has, if no forces are applied thereto, a lower region (13a,13b) which lies in contact with the corresponding side (7a,7b) of said shank (2), an intermediate region (14a,14b) which is spaced from the corresponding side (7a,7b) of said shank (2) in order to form said receptacle (8a,8b), and an upper region (15a,15b) which rests against the corresponding side (7a,7b) of said shank (2).

9. The needle according to claim 8, characterized in that said intermediate region (14a,14b) of the lamina (6a,6b) has, starting from its lower end: a first portion (16a,16b), which is folded away from the corresponding side (7a,7b) of the shank (2); a second portion (17a,17b), which is substantially parallel to the corresponding side (7a,7b) of the shank (2); and a third portion (18a,18b), which is folded toward the corresponding side (7a,7b) of the shank (2).

10. The needle according to one or more of the preceding claims, characterized in that each one of said laminas (6a,6b) has, in its region which forms said receptacle (8a,8b), an upper portion which is offset toward the rear side of the shank (2) with respect to the underlying lower portion in order to form a lower opening (19a,19b) for accessing said receptacle (8a,8b).

11. The needle according to claim 10, characterized in that said lower access opening (19a,19b) is formed proximate to the connection between said first portion (16a,16b) and said second portion (17a,17b) of said intermediate region (14a,14b) of each lamina (6a,6b).

12. The needle according to one or more of claims 9 to 11, characterized in that the front face of said third portion (18a,18b) of the intermediate region (14a,14b) of each lamina (6a,6b) is shaped like an inclined plane and gradually approaches the front

face of said shank (2) in the direction of the upper end of said shank (2) and connects thereto at said upper region (15a,15b) of each lamina (6a,6b).

13. The needle according to one or more of claims 10 to 12, characterized in that, in each lamina (6a,6b), said lower access opening (19a,19b) is substantially aligned with the region where said upper region (15a,15b) of the lamina (6a,6b) rests against the corresponding side (7a,7b) of the shank (2) in a direction which is parallel to the longitudinal axis of the shank (2).

14. A method for transferring a stitch from a needle (1) to an adjacent needle (1a) in hosiery knitting machines or the like equipped with needles according to one or more of the preceding claims, characterized in that it comprises the following steps of:

- moving the needle (1), provided with said at least one lamina (6a,6b), on which the loop of knitting (40) to be transferred is arranged, or transferring needle (1), with respect to the loop of knitting (40) formed by said needle (1) until the loop of knitting (40) is arranged around said receptacles (8a,8b) located proximate to the knitting formation plane (21);
- retaining the loop of knitting (40) around said receptacles (8a, 8b);
- moving a needle designed to receive said loop of knitting (40), or receiving needle, arranged laterally to the transferring needle, toward the head (3) of the transferring needle and along a direction which has at least one component which is parallel to the longitudinal axis of the transferring needle, inserting it with its head (3) in the receptacle of said two receptacles (8a,8b) that is located on the side of said transferring needle (1) that is directed toward said receiving needle (1a) until it moves above and beyond said loop of knitting (40);
- moving said transferring needle (1) with respect to said receiving needle (1a) and to said loop of knitting (40) along said direction until the head (3) of said receiving needle (1a) protrudes upwardly from said receptacle (8a,8b) and so as to move said loop of knitting (40) above said receptacle (8a,8b);
- moving said transferring needle (1) further along said direction until it moves, with its latch (4), beyond the loop of knitting (40);

- moving both needles (1,1a) along said direction with respect to the loop of knitting (40) until the loop of knitting disengages from said transferring needle (1).