IMPROVEMENT OF TECHNOLOGICAL INDICATORS OF THE DEVELOPMENT OF KNITTING PRODUCTS ON A ROUND- KNITTING PURL MACHINE

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ABSTRACT

The article considers the conditions of laying plush yarn on circular knitting machine. Supply parameters of plush yarn depend on the location of a fall plate for knocking-over of this yarn. As the result of research of the two ways creation a second fall plate on circular knitting machine was proved that in the development of double plush knit the increase in length of plush sticking when using the second method is more appropriate than the first. During knitting the plush knit there is a need to change the depth of fundamental yarn knocking-over to remain constant the size of fundamental stitchs.

The length of the plush sticking can be increased by the Garnett teeth width increasing as long as the design of the machine allows.

Increasing the length of plush sticking by increasing the fundamental stitches knocking-over depth is undesirable, since a decrease in the density of the fundament negatively affects the quality of the resulting plush.

Analysis of the above methods for plush sticking length increasing showed that the first of them complicates the process of stitch formation, the second requires significant changes in the design of the machine and the third negatively affects the quality of the resulting plush knitwear.

Key words: plush bilateral knitted, knocking-over of plier, fall plate, circular knitting machine.

INTRODUCTION

Before embarking to the development of knitting technology of double-sided plated plush knitwear on a circular knitting machine, it is necessary to determine the necessary conditions for the normal course of the stitch process, taking into account the features of the machine, allowing not making major changes in the design.

As you know, to get a plush knit on all knitting machines it is necessary to lay both ground and plush threads on the needles [1].

The process of laying a plush thread on different machines occurs differently depending on the conditions of knitting and the design of the machine. Since the double plush sticking are located on both sides of the knitwear, plush thread should be laid on the needles of one or the other of the needle point ring maintaining the feed parameters of the plush threads. The feed parameters of the plush thread are the needle and stitch corners of the thread feed. The feed parameters of the plush thread depend mainly on the location of the fall plate for the knocking-over of this thread.

MATERIALS AND METHODS

Theoretical studies in the work are performed using the basic principles and methods of higher mathematics of textile materials science; nonlinear mechanics of a flexible thread.

From the analysis of the existing methods of plush knitwear developing, it was found that in order to form a plush stitch, it is necessary to have not one, but two fall plates on the machine. Thread knocking-over into fundamental stitches take place related to one fall plate and relative to the other is knocking-over into plush stitches. The fall plate for the fundamental thread cannot be used to knocking-over the plush thread since it is necessary to knocking-over the plush thread to a greater depth to obtain elongated plush sticking.

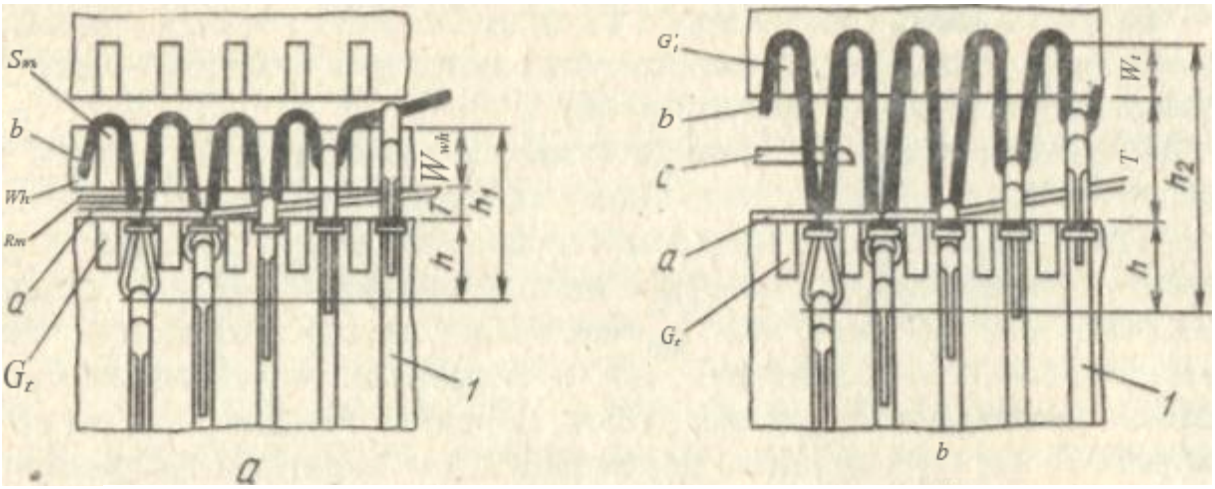

Fig. 1. Ways to create a second fall plate of plush thread

As can be seen from the structure of bilateral plush knitwear, plush sticking come out on both sides of it, in connection with which fall plate for knocking-over of a plush thread should be on both point ring and fundamental thread. To obtain plush sticking of the same size from both sides of knitwear, the depth of their knocking-over should be the same.

In the process of knitting, the plush thread is knocking-over by all the needles to a great depth. This may cause a pinch in the thread. In the presence of this phenomenon, the plush yarn can be destroyed, and therefore, it is necessary to perform the process of knocking-over of plush yarn without pinching.

The second fall plate is obtained with the help of a wheel with slides placing them between the needle point rings (the first method).

The distance between the platines should be equal to the needle pitch, i.e. slides must be in line with the Garnett tooth. The wheel K (fig. 1, a), rotating on its axis, should rotate together with the locks of the machine. At that at first, a plush thread *b* is laid on the needle *1*, and then a fundamental thread. The plush thread is knocking-over on the slides of the P_k wheel, and the fundamental thread is, as usual, on the working surface of the O_3 Garnett tooth. Thus, the fall plate for a plush thread is the set of points on the wheel slides, and for the fundamental thread- the set of points on the working surface of the Garnett tooth [1].

When creating a fall plate by the second way, it is based on the design features of the machine.

Garnett teeth of the upper point ring can serve as a fall plate for the plush thread, if the stitch formation process is performed at the lower point ring, and vice versa, the Garnett teeth of the lower point ring can serve as a fall plate for the plush thread, if the stitch formation occurs at the upper point ring. Thus, the Garnett teeth can be used to knock-over a plush thread without changing the design of the machine. It is enough to polish the side of the Garnett tooth ft, on which the plush thread will be laid, since earlier this side of the tooth did not participate in the stitch formation process, and equalize the width of the Garnett teeth to obtain plush sticking of the same size.

The process of getting double-sided plush knitwear, where the fall plate for plush thread *b* is the Garnett teeth of the upper point ring, is shown in Fig.1.6.

In order for the plush thread *b* to be knocked-over on the Garnett teeth of the 0'3 upper point ring, it must be laid on the needle until the needle hook crosses this line. To lay a plush yarn on the Garnett teeth 0'3, the plush yarn guide is located behind the Garnett teeth of the upper point ring. When the needle *1* step back with its hook first grabs the plush thread *b*, and then the fundamental thread *a* which is laid on the needle in the intervals between the Garnett teeth. Thus, the plush thread lay on the needle earlier than the fundamental thread is knocking-over of the Garnett teeth of upper point ring $0'_3$, and the fundamental thread at the Garnett teeth of O_3 lower point ring. Plush sticking are dropped from the Garnett teeth and removed from the knitting zone using removable device C and a guide (see figure 1, *b*).

The formation of plush sticking on the other side of the knitwear occurs in the next stitch-forming system. In this case, the process is repeated with the only difference that the plush thread is stopped on the Garnett teeth of the lower point ring, and the fundamental thread on the Garnett teeth of the point ring [2]. Due to the fact that the fall plate of the plush and fundamental threads are located at different levels, the depth of knocking-over of the ft_2 plush thread is greater than the depth of *h* knocking-over of the fundamental thread by an amount equal to the sum of the distance between the Garnett teeth *3* and the width of the Garnett tooth $Ш_3$ (see Fig. 1, b). This difference between the depths of knocking-over of the threads is enough to get plush sticking.

$$h_2 = h + T + W_T$$

Considering the first and second ways of creation of second fall plate, we can draw the following conclusions.

To create a second fall plate according to the first method, an additional mechanism must be placed between the point rings - a wheel with slide. The plush sticking obtained with the help of such a wheel is not long enough, since the difference in the depths of fundamental and plush threads is insignificant. It is possible to add the length of a plush sticking only by increasing the shed between the cylinders, whereas it is already extended to fit the wheel and the guide between them.

Further expansion of the shed is difficult also in connection with the transfer of needles from one cylinder to another. As a result, the range of variation of the length of plush sticking is limited. In addition, the first method of creating the second fall plate cannot be used on flat knitting machines [3].

When creating the second fall plate according to the second method, it is not necessary to install any additional mechanisms on the machine, and consequently, there is no need to increase the shed between the point rings.

We will compare the ranges of variation of the length of plush sticking in the first and second methods. Since the main, decisive factor in the length of plush sticking is the depth of

knocking-over of a plush thread, consider the range of variation of the depth of knocking-over by the first and second methods.

At the same time, the depth of knocking-over of the fundamental thread is left the same for both methods. The minimum depth of knocking-over with the first method.

$$h_{1\min} = h + Bl + W_{k\min}$$

and in the second method

$$h_{2\min} = h + T_{\min} + W_{k\min}$$

where h_1, h_2 and h is the depth of knocking-over of the plush thread according to the first and second methods and, accordingly, the fundamental thread; Bl - the gap between the cylinder and the wheel, ensuring the smooth passage of the knitwear; $W_{k\min}$, $W_{T\min}$ - the minimum width of the slide of the wheel and the Garnett tooth; 3min - the minimum distance between the points rings.

RESULTS AND DISCUSSION

The minimum distance between the points rings 3min should correspond to the thickness of the knit produced. The minimum widths of slide and the Garnett tooth can be taken equal, since the requirements for them are the same. It is possible to reduce the width of the slide and the Garnett tooth within certain limits, since they can sag under the influence of the thread on them [3].

On this basis, it can be assumed that the minimum depth of knocking-over in the first and second methods can be the same, i.e.

$$h_{2\min} = h_{1\min}$$

at

$$T\min = Bl \; ; \; W_{k\min} = W_{T\min}$$

The maximum depth of a plush thread knocking-over in the first method is achieved by increasing the width of slide and this in turn requires an expansion of the shed between the point ring. Therefore, the width of slide can be increased as long as the process of transferring needles from one point ring to another takes place normally.

$$h_{1\max} = h + T + W_{k\max}$$

at

$$2Bl + W_{k\max} = T_{\max}$$

$$h_{1\max} = h + T_{\max} - Bl$$

where $W_{k\max}$ - the maximum width of the slide wheel; $T_{\max}$ - the maximum distance between the point ring.

The maximum depth of the plush thread knocking-over using the second method can be obtained by increasing the width of the Garnett tooth to the maximum (see Fig. 1,b).

$$h_{2\max} = h + T_{\max} + W_{T\max}$$

where $W_{T\max}$ - the maximum width of the burr tooth.

In this case, the distance between the point rings is the same as in the first method. The width of the Garnett tooth can be increased to the width allowed by the machine structure. Comparing equations (4) and (5), it can be argued that the maximum depth of the plush thread knocing-over using the second method is obtained [4, 5] more than by the first method,

$$h_{2\max} - h_{1\max} = Bl + W_{T\max}$$

This shows that the range of variation in the length of plush sticking in the second method of creating a fall plate is wider than in the first method.

CONCLUSION

Thus, we can conclude that the second method of second fall plate creating when developing bilateral plush knitwear on the reverse machine is more appropriate to use than the first one. Based on the above, it is clear that an increase in the length of plush sticking using the second method can basically be achieved as follows:

increasing the distance *3* between the point rings;

increasing the width of the Garnett tooth $Ш_3$;

increasing the depth of knocking-over *h* of fundamental thread;

using movable Garnett teeth on the machine.

Increasing the distance between the point rings on a circular knitting machine is achieved by changing the position of the upper point ring towards to the lower one. After changing the position of the upper point ring, the needle path does not change, but the position of the fall plate relative to the needle path changes. Therefore, when knitting plush knitwear, it is necessary to change the depth of knocking-over of the fundamental thread, so that the size of the fundamental stitches remains constant.

The distance between the point ring can be increased until such moment as there will be a pinching of the plush thread and while the process of transferring the needles from one point ring to another is normal.

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