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THE METHOD OF OBTAINING PATTERNED PLUSH KNITWEAR

Abstract. The paper presents new ways of pattern formation in the development of plush knitwear on two-contour machines.The purpose of the research work is to improve the technology for the production of knitted fabrics.

As a result of the experimental work, the technological capabilities of the modern LIBRA 3.130 flat knitting machine were studied and new types of combined knitwear based on plush weave were obtained. It has been found that air permeability coefficients can be reduced by up to 30% (46.3-66.9 $cm^3/cm^2 \cdot sec$) for combined plush knitwear by reducing the length of the thread in the loop.

Based on the analysis of the parameters of the produced fabrics of plush knitwear, it was found that a decrease in the surface density of plush knitwear can be achieved in various ways. The most effective are the ways in which the decrease in the surface density of knitwear is achieved by changing the base weave and combining weaves. The use of these methods makes it possible to reduce the surface density of knitwear by 1.5-2 times, and the bulk density by 15-20% compared to full plush. At the same time, knitwear retains its marketable appearance and high quality indicators.

Keywords: knitted fabrics, structure, combined interlooping, plush knitwear, volume density.

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Introduction. The demand for knitwear is increasing by consumers due to several special properties. The design of knitwear is a long process due to many important characteristics with other types of design and technology.

The efficiency of modern textile production depends on the degree of satisfaction of the population's need for fashionable clothes by reducing the cost of raw materials used per unit of production. The purpose of the proposed research work is to study the influence of new structures of cross-knit knitwear on the technological parameters and physical-mechanical properties of the sheet, to improve the technology of knitwear production.

Clothing is considered the environment close to the human body, made of various materials such as knitwear, fabric and non-woven. Among them, knitted knitwear is a type of knitwear obtained by weaving threads horizontally. These types

of sheets are gaining popularity among consumers day by day because of their excellent mechanical properties and high comfort. However, these properties of the sheet are highly dependent on the type of fibers used to make knitted knitwear and the structure of the fabric [1-3].

The properties of flexible knitwear sheets often depend on the types of knitwear structure used for weaving [4,5].

Other researchers studied three types of knitted sheets made of 100% cotton fibers [6]. They found that press loop knitted knitwear increased surface density, width, pilling resistance, and width shrinkage while reducing lengthwise shrinkage and twist.

Although both the fabric structure and the composition of the fibers affect the properties of knitwear, comparative studies of fabrics made of 100% natural, regenerated and synthetic fibers according to the structure of the knitted fabric are still insufficient. Therefore, in this study, the influence of knitwear structure on technological parameters and physical-mechanical properties of knitwear was investigated. In this study, 4 versions of knitted knitted goods of interlaced knits, which differ in structure in the repetition of knitting, were woven on a modern horizontal knitting machine LIBRA 3.130. Machine parameters affecting textile properties were kept constant for the production of each sample in this study to free the outcome from variables other than structure. This study aims to determine how different knitwear structures affect breaking lengths, breaking load, air permeability, shrinkage, and reversible and irreversible deformation of knitwear.

Conditions and methods of research. In order to expand the assortment of knitted fabrics, improve the quality indicators of plush knitwear and maximize the technological capabilities of the modern LIBRA 3.130 horizontal knitting machine, 6 versions of plush knitted knitwear were developed and produced, using cotton yarn with a linear density of 20 tex as raw material.

On two-contour machines, as well as single-contour ones, changing the length of plush broaches is achieved in various ways [7]. In work for this purpose, it is proposed to use a special-shaped platinum 1 on a two-contour circular knitting machine, containing a lower protrusion 2, and an upper protrusion 3 for cooking plush threads (Fig.1).

Platinas are installed in the cylinder, and knitting needles are installed in the grooves of the disk. Each platinum has a heel 4, which interacts with a movable and obliquely fixed wheel 5. With the help of platinum 1, plush broaches of smaller length are formed, and the lower protrusion 2 to obtain longer plush broaches.

Figure 1 shows the relative position of the plates, the wheel and the wedge in relation to the horizontal plane AA.

Wedge 6 serves to lift the heels of 4 platines. The sampling wheel 5 acts on the platinum in accordance with the specified pattern.

For example, platinum I and IV are raised to form broaches of shorter length, and platinum II and III - plush broaches of longer length. Platinum V and VI plush broaches do not form. This happens when the sampling wheel does not have a cracker in the groove. In this case, a platted loop is formed from two threads. The lifting height of the plates depends on the width of the working area of the cracker. Using this method, you can get various drawings on the canvas.

We propose a method for changing the length of plush broaches on two-contour machines, where a tongue needle is used as an additional element. According to this development, the change in the length of plush broaches is achieved by changing the number of needles forming plush broaches.

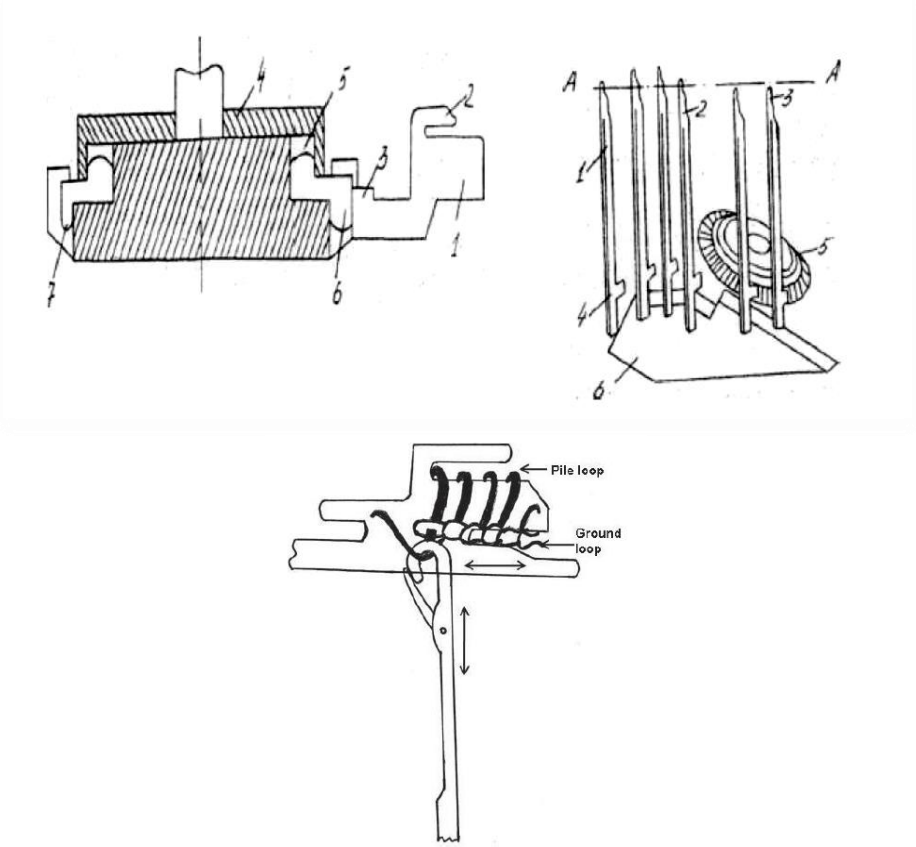

Fig. 1. Shapes of plates used on a two-contour circular knitting machine to produce embossed plush knitwear

Usually, for the production of plush knitwear on a multi-system two-contour circular knitting machine, in its first loop-forming system, a plush thread is laid on all the needles of both needles, plush sketches are pulled by the needles of one needle holder and in the same system ground loops are formed by the needles of another needle holder, after which plush broaches are dropped from the needles.

In this case, a smooth jersey is obtained, since the number of plush loops is the same as the number of ground loops. Based on this method, a method for producing plush knitwear with different lengths of plush broaches was developed. It consists in changing the number of needles involved in obtaining plush broaches: one, two or more needles can participate in the formation of a plush broach. By increasing the number of needles involved in the formation of one plush broach, you can increase the length of the thread in this broach. The proposed method was used by the author for knitting patterned plush knitwear.

Figure 2, shows a graphic record of laying threads on needles when knitting patterned plush knitwear, and Figure 2, shows a conditional image of the knitwear obtained after finishing.

In the first system, the plush thread b is laid on the needles of the I cylinder according to the rapport of the drawing and every third needle of the 2 disk. The ground thread is also laid on every third needle of the disc. Needles that are not involved in the knitting process are turned off from work. Due to this, in the first system, platted loops are knitted from plush thread bi ground thread a and with needles of the I cylinder, plush broaches 3 and 4 of different lengths are formed

during culling. In the second system, the plush broaches are reset. It is recommended to use low-shrink threads as plush threads, and high-shrink threads as ground threads.

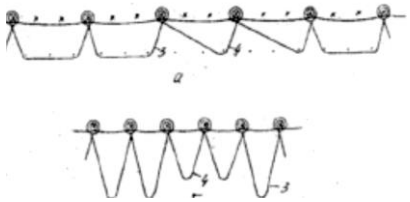

Fig. 2. Laying of threads when knitting embossed plush knitwear

After removing the knitwear from the machine, it is trimmed to shrink the ground threads. As a result, plush broaches 3, in the formation of which three needles participated, are obtained longer than plush broaches 4, in the formation of which one needle participated. By selecting the needles of the cylinder with pattern-forming mechanisms, it is possible to obtain various relief drawings on the canvas. Plush broaches of different lengths can also be obtained by changing the sequence of laying the plush thread on the cylinder needles (additional elements) and using a high-shrink thread as a ground thread, and a low-shrink thread as a plush thread. To do this, in the first system, the plush thread 6 is laid on the needles of the I cylinder according to the rapport of the drawing and on every third needle of the disk 2.

The ground thread and is also laid on every third needle of 2 discs.

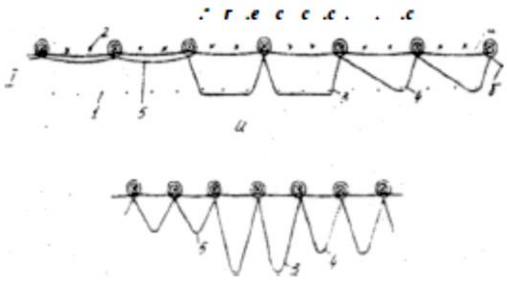

Fig. 3. Changing the length of plush broaches by changing the number of additional elements

In this case, the plush thread is formed in one case with three cylinder needles to form one plush broach, in the second case with one needle, and in the third it is not cultured with cylinder needles, forming platted loops with ground thread a (Fig.3, a).

After finishing, plush broaches of three types 3, 4, 5 appear on the surface of the canvas, differing from each other in length (Fig. 3b). Plush broaches of various lengths are obtained by changing the number of needles forming these broaches and by shrinking the ground thread. Selecting the needles of the cylinder with the help of a pattern-forming mechanism according to the rapport of the drawing, it is possible to create various patterned effects on the canvas.

By changing the colors of the plush thread, you can get colored relief drawings. To do this, in the first loop-forming system, together with the pound thread

a, for example, a white plush thread A is refilled, and in this system, plush broaches of small and medium length are formed from this plush thread (Fig.4).

In the second system, together with the ground thread, a black plush thread is filled in, and in this system, small and large broaches are formed from this plush thread. In the third system, the plush broaches are reset from the cylinder needles. After finishing, plush broaches of 1,2,3 of various lengths and colors appear on the surface of the canvas (Fig.4). The length of the plush broaches I and 2 is sufficient to completely close the plush stretches 3 of small length.

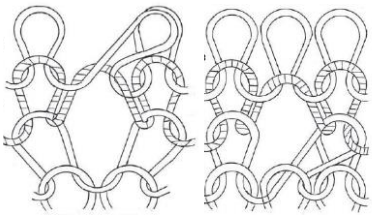

Fig. 4. Laying of threads when knitting colored embossed plush knitwear

But the formation of plush broaches of small length on the surface of the canvas instead of platted loops, which were formed during the development of ordinary two-tone plush knitwear, increases the density of plush broaches in knitwear, as a result of which its heat-protective properties increase.

The length of the plush broaches on two-contour machines, where a tongue needle is used as an additional element, can also be changed by changing the depth of the plush thread with these needles. To do this, in the first needle system of the I cylinder, the plush thread bv plush broaches 2 is cultured to a lesser depth, and in the second needle system of the I cylinder, the plush thread bv plush broaches 2 is cultured to a greater depth (Fig. 5).

As a result, the canvas will have enlarged plush broaches of different lengths and heights. By applying pattern-forming mechanisms on the machine, it is possible to expand the patterned capabilities of this method.

Changing the length of plush broaches on one- and two-contour machines can also be achieved by using non-shrinkable threads or threads of different thicknesses as plush. For example:5, filling the first system with a low-shrink thread or a thread of greater thickness (in the quality of plush) and the second system with a high-shrink thread or a thread of lesser thickness, you can get a relief pattern on the canvas.

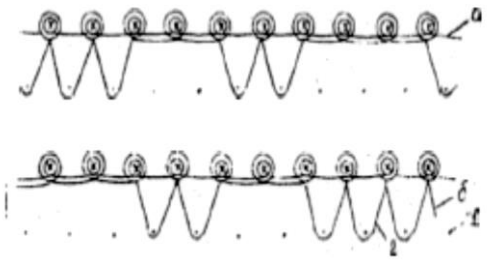

Fig. 5. Changing the length of the plush broaches by changing the depth of the cooking of the plush lit and additional elements

Thus, a method has been developed for obtaining a pattern on two-contour knitting machines in the production of plush knitwear.

Research results. In order to compare the physical and mechanical properties of the new structures of knitted knitwear based on plush weave from cotton yarn, experimental samples of knitwear sheets were developed on a modern horizontal knitting machine LIBRA 3.130. The physical and mechanical properties of the prepared samples were studied according to the standard. The obtained results are shown in Table 1.

Table 1

Physical and mechanical properties

Options	Linear thread density, Tex		Loop step, A (mm)	Height of the loop row, V (mm)	Horizontal density, Pg	Vertical density, Rv	Thread length in loop, mm	
	ground thread	plush thread					Plush, L1	Ground, L2
I	20×3	20×3	1,19	0,83	42	60	3,6	5,2
II	20×3	20×3	1,66	1,25	30	40	9,4	5,5
III	20×3	20×3	1,66	1,11	30	45	9,14	5,6
IV	20×3	20×3	1,66	1,25	30	40	9,3	5,7

If the bulk density of the IV variant of the lined knitwear with a surface density of Ms = 390 g/m2 and a thickness of T = 1.25 mm is 312 mg/cm3, then the bulk density of the basic lined knitwear (option – I) with a surface density of Ms = 318 g/m2 and thickness T = 0.89 mm is equal to 357 mg/cm3, the absolute volumetric relief, compared to the basic one, is:

$\Delta\delta = \delta Б - \delta = 357 - 312 = 45$ mg/cm3;

The relative relief is:

$$\theta\Delta = (1 - \frac{\delta}{\delta_{Á}}) 100 = (1 - \frac{312}{357}) \times 100 = 13\%.$$

Discussion of scientific results. The air permeability of the plush knitted fabric of the lined interweaving is significantly less than the basic interweaving. Among the samples of the plush knitted fabric of the lined interweaving, variant III has the lowest air permeability[8].

The air permeability of this variant is 46.3 cm3/cm · sec, which is less than 33.1% compared to the basic weave. Changing the filling leads to a change in the physical and mechanical properties of the plush knitted fabric of the lined weave.

The air permeability of experimental samples of plush knitwear of lined weaving varies from 46.3 to 66.9 $cm^3/cm \cdot sec$.

The influence of various factors on the resistance of knitwear to abrasion was studied in a number of works. For example, the influence of the knitting density of knitwear on its resistance to abrasion was investigated and it was concluded that with

an increase in the density of knitting, the resistance to abrasion of knitwear increases. At the same time, it is noted that the influence of the density of knitting on the resistance of knitwear to abrasion is small and the latter depends to a greater extent on the resistance to abrasion of the thread itself than on the density of knitting.

Conclusion. Regularities of the influence of elements of the structure of knitwear on the parameters and physical and mechanical properties of the fabric of knitwear are established.

In order to evaluate the reduction of the material capacity of knitted products, that is, to simplify its structure, the indicator of the volume density of knitwear in space was used. At the same time, the degree of lightness of knitwear is evaluated by absolute and relative volume density.

As a result of experimental work, the technological capabilities of the modern horizontal knitting machine LIBRA 3.130 were studied, and new types of knitted knitwear were obtained on the basis of plush braids. The laws of influence of knitwear structure elements on the parameters and physical-mechanical properties of knitwear sheets have been established. By comparing the bulk density of knitted knitwear of different structures, it can be seen that the presence of elastic layers and derivative layers in the structure of plush knitwear not only reduces stretch and increases shape stability, but also reduces the bulk density of knitwear in some cases.

The regularities of the influence of the elements of the knitwear structure on the parameters and physical and mechanical properties of the knitted fabric are established.

It has been found that air permeability coefficients can be reduced by up to 30% (46.3-66.9 $cm^3/cm^2 \cdot sec$) for combined plush knitwear by reducing the length of the thread in the loop.

Based on the analysis of the parameters of the produced fabrics of plush knitwear, it was found that a decrease in the surface density of plush knitwear can be achieved in various ways. The most effective are the ways in which the decrease in the surface density of knitwear is achieved by changing the base weave and combining weaves. The use of these methods makes it possible to reduce the surface density of knitwear by 1.5-2 times, and the bulk density by 15-20% compared to full plush. At the same time, knitwear retains its marketable appearance and high quality indicators.On the basis of a comprehensive comparison, optimal options for new models of knitwear structures with improved physical, mechanical and consumer properties were proposed.

The results of the research allow to expand the assortment of knitted products, to reduce the cost of raw materials per product unit, as well as to improve the quality and consumer properties of the produced assortment, to choose high-quality models and technologies for them.

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СУРЕТТІ ПЛЮШ ТРИКОТАЖ АЛУ ӘДІСІ

Аңдатпа. Берілген мақалада екі фонтуралы машинада плюш өрімінің негізінде қиыстырылған өрімді трикотаж құрылымын өндіру әдістері қарастырылды. Зерттеу жұмысының мақсаты - трикотаж бұйымдарын өндіру технологиясын жетілдіру.

Эксперименталдық жұмыс нәтижесінде қазіргі заманғы LIBRA 3.130 көлденең тоқу машинасының технологиялық мүмкіндіктері зерттеліп, плюш өрімдерінің негізінде қиыстырылған өрімді трикотаждың жаңа түрлері алынды. Трикотаж құрылымы элементтерінің трикотаж жаймаларының параметрлері мен физикалық-механикалық қасиеттеріне әсер ету заңдылықтары орнатылған. Қиыстырылған өрімді трикотаж үшін ілмектегі жіптің ұзындығын қысқарту арқылы ауа өткізгіштік коэффициенттерін 30% (46,3-66,9 $см^3/см^2$ сек) дейін төмендетуге болатыны анықталды.

Плюш өрімі негізінде тоқылған қиыстырылған трикотаждың беттік тығыздығының төмендеуіне ілмек бағандарын өткізіп жіберу арқылы да қол жеткізуге болатыны анықталды. Трикотаждың беттік тығыздығының төмендеуіне негізгі тоқуды өзгерту және өрімді қиыстыру арқылы қол жеткізілетін әдістер ең тиімді болып табылады. Бұл әдістерді қолдану толық плюшпен салыстырғанда трикотаждың бетінің тығыздығын 1,5-2 есе, ал көлемді тығыздығын 15-20% азайтуға мүмкіндік береді. Бұл ретте трикотаж өзінің тауарлық түрін және жоғары сапа көрсеткіштерін сақтайды.

Тірек сөздер: трикотаж жаймалары, құрылымы, қиыстырылған өрімдер, плюш трикотаж, көлемдік тығыздық.

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СПОСОБ ПОЛУЧЕНИЯ РИСУНЧАТОГО ПЛЮШЕВОГО ТРИКОТАЖА

Аннотация. В работе приводятся новые способы образования рисунка при выработке плюшевого трикотажа на двухфонтурных машинах. Целью исследовательской работы является совершенствование технологии выработки трикотажных полотен.

В результате проведенных экспериментальных работ исследованы технологические возможности современной плосковязальной машины LIBRA 3.130 и получены новые виды комбинированного трикотажа на базе плюшевого переплетения.

Установлены закономерности влияния элементов структуры трикотажа на параметры и физико-механические свойства полотна трикотажа. Установлено, что коэффициенты воздухопроницаемости можно снизить до 30% (46,3-66,9 $см^3/см^2 \cdot сек$) для комбинированного плюшевого трикотажа за счет уменьшения длины нити в петле.

На основании проведенного анализа параметров, выработанных полотен плюшевого трикотажа, установлено, что уменьшение поверхностной плотности плюшевого трикотажа можно достичь различными способами. Наиболее эффективным являются способы, по которым уменьшение поверхностной плотности трикотажа достигается путем изменения базового переплетения и комбинированием переплетений. Использование этих способов позволяет уменьшить поверхностную плотность трикотажа в 1,5-2 раза, а объемную плотность на 15-20% по сравнению с полным плюшем. Трикотаж при этом сохраняет товарный вид и высокие показатели качества.

Ключевые слова: трикотажные полотна, структура, комбинированное переплетение, плюшевый трикотаж, объемная плотность.