ABOUT INFLUENCE OF THE LINEAR DENSITY OF THE THREAD OF THE BACK LAYER OF DOUBLE-LAYER KNITTED FABRIC`S ON ITS TECHNOLOGICAL PARAMETERS

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ABSTRACT

The article presents the results of a study of technological parameters and material consumption of new structures of two-layer knitted fabric. To study the technological parameters of new variants of two-layer knitted fabric on a Long Xing 252 SC flat knitting machine, five variants of two-layer knitted fabric were developed, which differed from each other in the structure.

Key words: two-layer knitted fabric, technological parameters, material consumption, flat knitting machine.

INTRODUCTION

Knitwear used as a material for clothing must meet a number of requirements.

Knitted items must be resistant to mechanical and physical impacts experienced by clothing during wear, i.e. must withstand repeated bending, stretching, abrasion, have the ability to stretch and regain its shape, withstand the effects of light weather, washing, etc.

The requirements for clothing depend on its purpose (underwear, outerwear, sportswear, stockings, socks, etc.) and on the season for which it is intended (winter, summer, demi-season). For example, underwear and sports products must have good elongation and, at the same time, the ability to well restore their shape; fabrics used for outerwear must have sufficient stability in order to maintain their original shape when worn; materials for summer clothes must ensure its porosity, air permeability; knitwear for winter clothing must have good heat-shielding properties, etc.

The indicators characterizing the structure of knitted fabrics are: surface density, density (number of loops per unit length) in longitudinal and transverse directions, loop length, skew angle of loop rows and loop stitches, thickness.

The parameters of any knitted fabric are influenced by the properties of raw materials, knitting of threads, and the type of finishing [1-5]. Double-layer knitwear consists of two identical or two different single jersey, one jersey`s may have different parameters from the other. This circumstance determines the interaction of the layers. One layer, when connected to another, can change its initial parameters, and the other, in turn, change the parameters of the first. Therefore, the density and length of the threads in the loops of the layers of double-layer knitwear cannot be determined according to the corresponding formulas for single jersey. In addition, these parameters depend on the type and method of connection [6].

It is of interest to study the interaction of layers in the plane of the fabric, since it affects the parameters of double-layer knitwear. The layers will not affect each other in the plane of the knitwear if the parameters of the constituent weaves are the same, and the connecting elements have an equal effect on the loops of the front and back sides.

The impact of one layer on another depends on the type of yarn, its mechanical properties: the greater the elasticity of the yarn, the greater the change in parameters with an increase in its linear density.

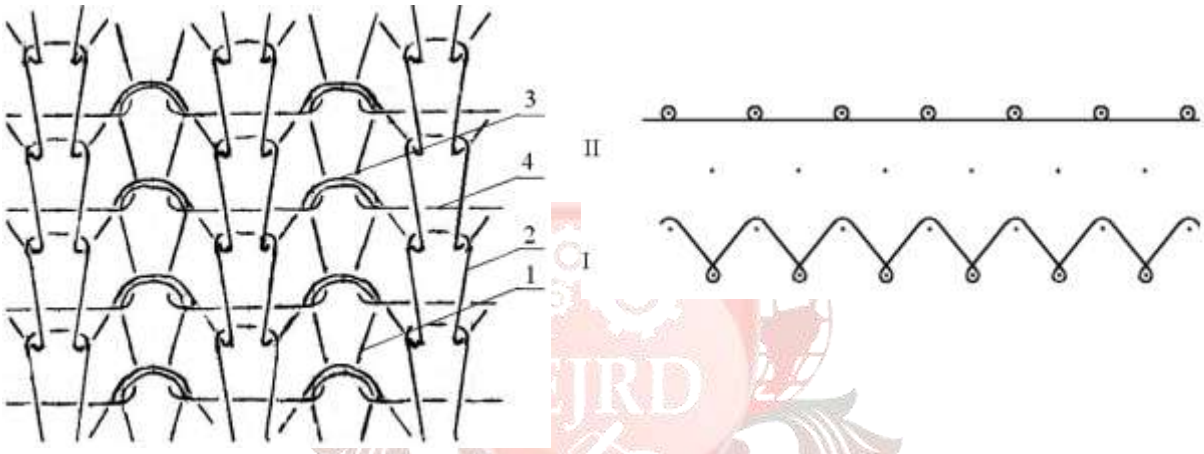
Another factor that determines the degree to which one layer of a double-layer knit will affect another is the length of the thread in the buttonhole. Earlier it was noted that with a constant length of the thread in the

loop of one layer, the knitting processes allow changing the length of the thread in the loop of the other layer within wide limits.

In order to study the influence of the linear density of the thread of the back layer of a double-layer knitted fabric on its technological parameters, six variants of double-layer knitting samples were developed on a Long Xing 252 SC flat-knitting machine. The variants of the double-layer knitwear differed from each other in the linear density of the thread on the back layer of the knitted fabric. Double-layer knitwear was developed on the basis of semi-cardigan jersey, where the press method of joining with warp threads is used to join the layers of knitted fabric.

Figure 1. presents the structure and graphic record of double-layer knitting fabric`s.

The structure of double-layer knitwear is illustrated in fig. 1, a. The jersey consists of elongated purl loops 1, front loops 2, sketches 3 and broaches 4. In the formation of one repeat of the proposed double-layer knitwear on a flat knitted machine, two systems are involved.



а б

Fig. 1. Structure (a) and graphic record (b) of the production of double-layer knitwear

The first system forms a press row and the second system, on the needles of the rear bed, forms the stitch rows of the smooth surface (Fig. 1, b).

EXPERIMENTS AND DISCUSSION

Cotton yarn with a linear density of 20 tex x 1 was used as a raw material for the seamy and front sides of the double-layer knitting fabric`s. The technological parameters of the double-layer knitwear were determined according to the standard method [7, 8] in the “CentexUz” laboratory at Tashkent Institute of Textile and Light Industry, the results are shown in Table 1.

A change in linear density leads to a change in the thickness of the thread.

$$F = \frac{\lambda}{\sqrt{\frac{1000}{T}}} = \frac{1{,}25}{\sqrt{\frac{1000}{20}}} = \frac{1{,}25}{7{,}07} = 0{,}177\ мм$$

Here:

F - thread thickness, mm;

λ - coefficient connecting the linear density of the thread with its thickness;

T is the linear density of the thread.

The thickness of the thread used in the production of all variants of double-layer knitting fabric`s is given in table 1.

Table 1

Technological parameters of double-layer knitted fabrics

Parametrs		Variants					
		I	II	III	IV	V	VI
Type and liner density of the yarn in sample	Front layer-cotton thread	20 teks x 3					
	Back layer-cotton thread	20 teks x 1	20 teks x 2	20 teks x 3	20 teks x 4	20 teks x 5	20 teks x 6
Yarn thickness F, mm	Front layer	0,31					
	Back layer	0,177	0,25	0,31	0,36	0,39	0,43
Quantity of yarn (thread) in sample, %	Front layer (press)	80	50	43	37	35	33
	Back layer (supreme)	20	50	57	63	65	67
Loop width A, mm		0,74	1,04	1,28	1,48	1,64	1,8
Loop row height B, mm		0,64	0,9	1,11	1,28	1,42	1,56
The horizontal density of the Rg, loops in 5 sm		67	48	39	34	30	28
The vertical density of the Rv, loops in 5 sm		78	55	45	39	35	32
Loop length *l*, mm	Front layer	8	9,1	9,6	9,2	9,7	9,7
	Back layer	3,02	4,2	5,2	6,02	6,75	7,3
Surface density Ms, gr/m^2		336,5	360,25	436,5	513	555,1	598,2
Fabric thickness T, mm		1	1,1	1,2	1,5	1,6	1,8
Volume density δ, mg/sm^3		336,5	327,5	363,75	342	346,9	332,3

An analysis of the results obtained shows that a change in the linear density of the yarn of the back layer of knitted fabric affects all technological parameters of a double-layer knitted fabric.

When calculating the material consumption of knitwear, it is advisable to consider the knitted fabric as a three-dimensional structure, i.e. take into account the thickness of the jersey. This indicator of the material consumption of knitwear is the volume density δ (mg/sm^3), which is the ratio of the surface density M_S (g/m^2) to the thickness of the knitted fabric T (mm). The change in the surface and volume density depending on the change in the linear density of the thread of the back layer of a double-layer knitted fabric is shown in

Fig. 2.

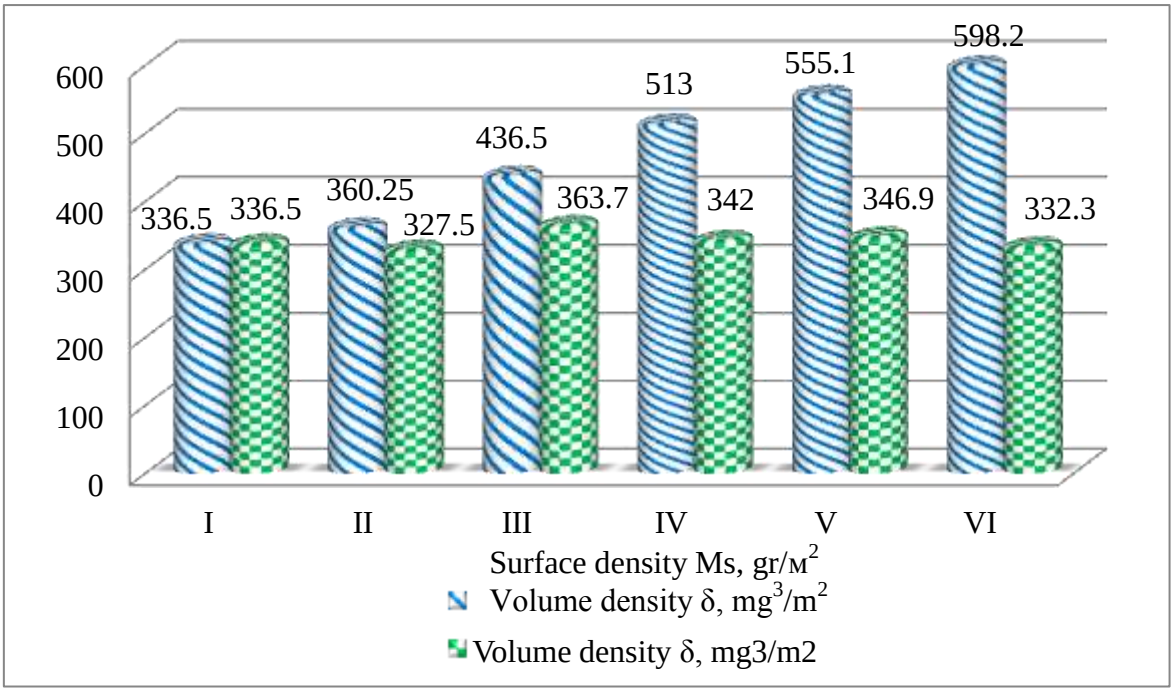


Fig. 2. Histogram of changes in surface and bulk density from the thickness of the thread of the back layer of double-layer knitwear

Changes in the technological parameters of double-layer knitwear, depending on the thickness of the thread of the back layer of knitwear are given in table. 2.

Table 2

Change of technological parameters of double-layer knitting fabric`s depending on the thickness of the thread of the back layer of knitted fabric

Parametrs		Variants					
		I	II	III	IV	V	VI
Thread thickness of the front layer, mm		0,31					
Thread thickness of the back layer, mm		0,177	0,25	0,31	0,36	0,39	0,43
%		-	41,2	75	103	120	143
Indicators of the back layer of knitting fabric`s	Loop pitch A, mm	0,74	1,04	1,28	1,48	1,64	1,8
	%	-	40,5	73	100	122	143
	Hinge row height B, mm	0,64	0,9	1,11	1,28	1,42	1,56
	%	-	40,6	73	100	122	144
	Loop area A·B, (mm^2)	0,47	0,94	1,42	1,89	2,33	2,8
	%	-	100	202	302	396	495
Surface density Ms, gr/m^2		336,5	360,25	436,5	513	555,1	598,2
%		-	7	30	52,5	65	78
Fabric thickness T, mm		1	1,1	1,2	1,5	1,6	1,8
%		-	10	20	50	60	80

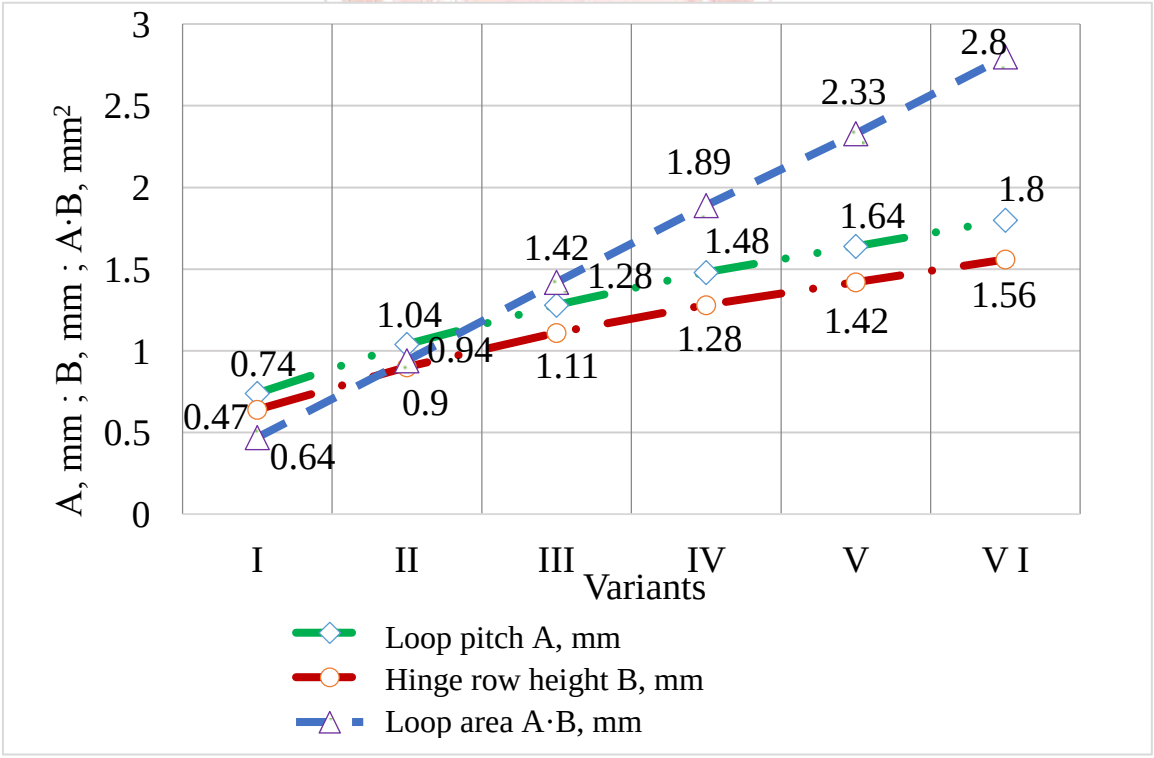


Fig. 3. Graph of dependence of the parameters of the loop (A, B, A·B) of double-layer samples on the thickness of the thread of the back layer of knitted fabric

With an increase in the thickness of the thread of the back layer of the knitted fabric, the surface density and the thickness of the double-layer knitted fabric increase, and the volume density varies within the range of 327,5-363,75 mg/sm^3, i.e. by 11% (Fig. 2).

It has been established that all variants are characterized by an increase in the loop step, the height of the loop row and the loop area, and the latter to the greatest extent. With an increase in the thickness of the thread of the purl of a double-layer knitwear by 143%, the loop step A of the purl of the knitwear increases by 143%, the height of the loop row B - by 144% and the area of the loop A·B - by 495% (Table 2).

In accordance with this, in double-layer knitwear, there should be a significant change in the parameters of one layer under the action of the other with an increase or decrease in the thickness of the thread of one of them (Fig. 3).

CONCLUSION

The study of the effect of the thickness of the thread of the back layer of double-layer knitting fabric`s on the technological parameters of knitwear made it possible to reveal the regularities of such parameters as the loop step, the height of the loop row, loop area, surface and volume density of knitting sample`s.

Thus, by changing the thickness of the thread of one layer of double-layer knitwear, a reduction in the consumption of raw materials, an improvement in the quality of knitwear and an expansion of the range of knitted fabrics are achieved

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