# Development of Experimental Samples of Multicomponent Knitted Fabrics

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**ABSTRACT:** This article provides analyzes some of the literature reviews on the use of natural silk and information on the technical characteristics of flat-fanged machines. The results of the characteristics of the structure of experimental samples of multicomponent knitted fabrics, which are recommended for sewing women's upper sets, are presented.

**KEYWORDS:** Multicomponent knitted fabrics with different surface density zones, silk yarn, silk thread, cotton yarn, flat knitting multi-system elastic machines.

## I.  INTRODUCTION

In recent years, with the growth of consumer wardrobe of clothes, increased awareness of the population, aesthetic, ergonomic, operational and other requirements of various social and gender and age groups of the population to the range and quality of knitwear have significantly increased and integrated.
This problem is especially relevant for the Republic of Uzbekistan, where the formation of needs and demand of the population has a number of features due to natural and climatic conditions, the stability of national traditions and a kind of demographic situation[1].

In order to effectively use the unique properties of natural silk, Tashkent Institute of Textile and Light Industry scientists, including R.Z.Burnashev, I.Z.Burnashev, H.A.Alimova, M.M.Mukimov, M.Z.Abdukarimova and others, conduct scientific research on development of multicomponent raw materials, materials and products mixed with natural and chemical fibers. The researches of famous Russian scientists V.U.Usenko, S.D. Nikolaev, A.S.Dalidovich, V.P.Sklyannikov, B.A.Buzov, V.I.Bazhenov and others laid the fundamental foundations for obtaining mixed materials from multicomponent raw materials.

Researchers of Tashkent Institute of Textile and Light Industry, professors Kh.A.Alimova and M.Mukimov, as well as their students, study and conduct research on the use of raw silk in knitwear[2-6].

Professor V.A.Usenko developed a technology for using fibrous waste silk in a mixture with wool[7], which was tested in the production of knitted outerwear, textile haberdashery and various fabrics.

D.U.Aripdzhanova has developed a new methodology for the integrated design and production of clothing from blended materials, based on the application of the systematic approach "raw material-material-cloth"[8]. In her dissertation work, a structural and logical information model of the process of complex production of clothes from blended fabrics was developed. A method for mixing raw materials and a method for producing wool-silk yarn has been developed, which makes it possible to more than double its relative discontinuity characteristic in comparison with pure wool. A new method for calculating the porosity of a material has been proposed, which makes it possible to quickly assess the shape-generating characteristics of clothing.

The analysis of scientific research has shown that the peculiarity of designing outerwear based on predicting the operational properties of multicomponent knitwear is practically not carried out.

Above this, there is a need for garment workers, technologists, designers, fashion designers to dictate in advance the image and shape of a modern suit to the designers and manufacturers of knitwear and, of course, to the raw material technologists.

## II. MATERIALS AND METHODS

In this study, research was conducted on purl stitch knitted fabrics. Cotton yarn, silk yarn, silk thread and lycra elastomer thread were used as raw materials.

Purl stitch is called a double cross-knit weave in which both sides consist of front and back loop stitches, located in a different combination (Figure 1).
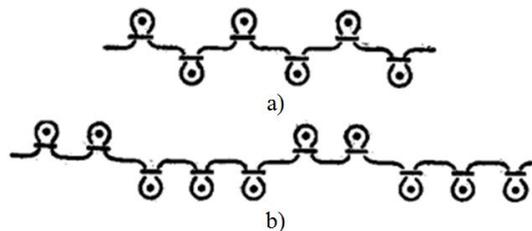


**Figure 1. Weave charts:**
**a) Purl 1x1; b) Purl 3x2**

If the front and back loop stitches alternate through one, then such a purl is designated 1x1; A purl, in which two front columns alternate with two purl ones, is designated 2x2 (Figure 1). Purl can be produced with a wide variety of combinations of front and back stitches, for example 2x1, 3x2, 5x3, etc. The sum of front and back loops, repeating in width, form the purl rapport. In the purl 1x1 the rapport is equal to two looped columns, in the purl 3x2 it is equal to five, etc.[9, 10].

In order to obtain form-stable knitwear, we have chosen the technology of knitwear production based on a purl from the following composition of raw materials:

- cotton yarn, silk thread and lycra elastomeric thread, as well as cotton yarn, silk thread and lycra elastomeric thread. These machines are designed for the production of parts of knitted outerwear in semi-regular and regular ways from woolen, cotton and blended yarns, synthetic threads and yarns.

Details of products on these machines are produced along a given contour.

Flat-fan machines have extremely rich technological and drawing capabilities. Their device allows you to get top products for any purpose and model.

Raw materials are one of the main factors that shape the quality of knitwear. Currently, knitwear enterprises process almost all types and varieties of fibers and threads obtained from them[11].

Elastic knitted fabric requires a qualitatively new approach to solving problems of designing clothing, in which zones of different extensibility can alternate depending on the type of human activity and the requirements for clothing.
For the production of knitwear with different areas of surface density, it is proposed to use regular and semi-regular knitting methods with the attachment of elastane threads. The search for the modeling of new forms of VTI was

based on the study of the development trend of modern cuts. To the design of women's outerwear, consumer and production requirements, the shaping properties of new knitwear; modeling the structure, technological parameters

and properties of knitwear; principles of artistic design of women's tops; information about technological processing methods and methods of fixing the form. This made it possible to predict the structure of the new knitwear.

When creating or choosing a particular weave, it is necessary to take into account four main factors: raw materials, the type of knitting equipment, the class of machines and the structure of the weave. The appearance of knitwear also depends on the properties of the yarn and threads. In knitwear production for the manufacture of outer knitwear, including everyday ones, with elastic properties, elastic, interlock, plush, combined weave are successfully used[12]. Products made from them have high elongation and increased dimensional stability.

In this scientific work used general methodological principles of the system approach and analysis of the experiment, instrumental methods for studying the properties of knitwear.

In the production of knitwear, natural silk threads with a linear density of 25x2 tex, silk yarns with a linear density of 16.5x1 tex, cotton yarn with a linear density of 20x1 tex, as well as 50x1 tex and lycra elastomeric thread were used as raw materials.

More than 10 variants were obtained at the educational and scientific base of the Piraeus University of Technology (Greece), and at the production of DILHANTex LLC (Namangan, Uzbekistan) 6 variants were obtained (based on 1x1 purl structure) of samples of new elastic knitted fabrics with different zones extensibility on the surface density of the canvas (Table 1).

Figure 1 shows the structure of a highly elastic knitted fabric in biaxial stretching. Silk-cotton yarns (as well as silk threads) and a highly elastic lycra thread are knitted together, forming double loops.

Table 1.
Characteristics of the structure of the investigated canvases

| № Sample | Machine class | Weave type | Raw material composition of canvases,% | | | Surface density, $g/m^2$ | Thickness, mm |
|---|---|---|---|---|---|---|---|
| | | | Cotton | Silk | Lycra | | |
| 1 | KH-323D 12 class | Purl | 60 | 39 | 1 | 557,0 | 1,4 |
| 2 | | Purl | 50 | 48 | 2 | 701,5 | 2,2 |
| 3 | | Purl | 40 | 60 | - | 380,5 | 1,6 |
| 4 | | Purl | 55 | 45 | - | 570,0 | 1,3 |
| 5 | | Purl | 53 | 32 | 5 | 584,8 | 1,4 |
| 6 | | Purl | 65 | 30 | 5 | 439,6 | 1,4 |
| 7 | CIXING 5-7 class | Purl | 58 | 37 | 5 | 562,0 | 1,5 |
| 8 | | Purl | 50 | 45 | 5 | 586,2 | 2,7 |
| 9 | | Purl | 54 | 46 | - | 389,2 | 1,8 |

## III. RESULTS AND DISCUSSIONS

The characteristics of the structure of the investigated canvases showed that the seventh sample compared to the first, the eighth sample to the second and ninth sample to the third sample, the indicators are much higher in surface density and thickness. Based on the results of the characteristics of the structure of the investigated fabrics of all samples, it can be recommended for sewing upper products. These results allow us to ensure dimensional stability and a beautiful neck in the designed products.

**Technical characteristics of the KN-323D automat machine**

Class-12                                                                                   Overall dimensions, mm;

Working length of the machine, mm-2400;
Number of needle beds – 2;
Knitting systems – 2;
Yarn guide-12;
Needle positions-2;
Needles-1920;
Lock carriage speed, m/s-0,1 ÷ 1;
Electric motor power, kW-2,5;

Weight, kg – 550;
Height- 1850;
Length – 3300;
Width-900;



**a)**            **b)**
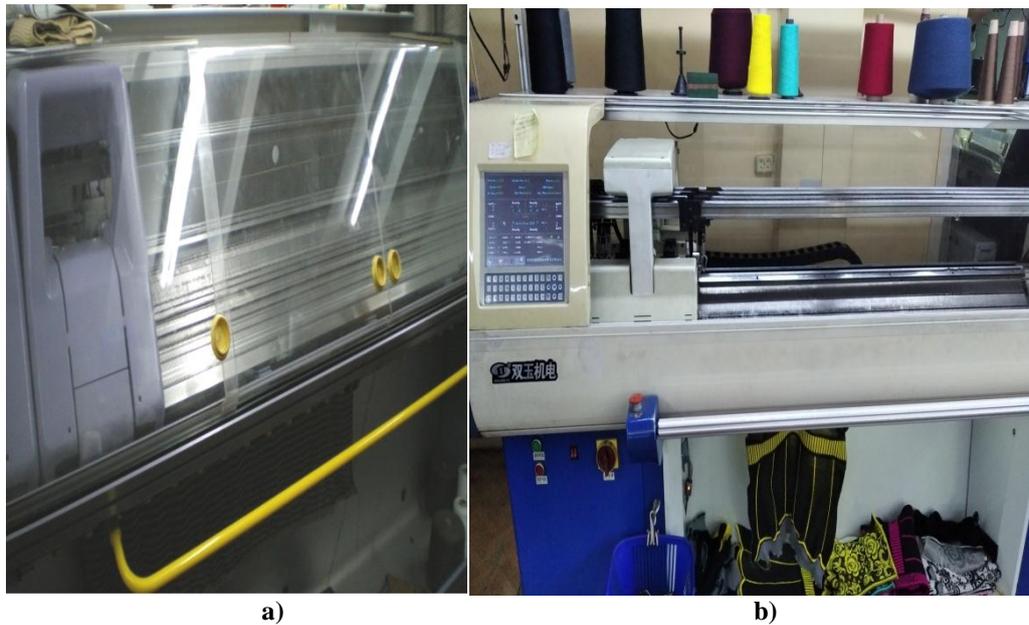
**Figure 2. View of a flat knitting machine with program control:**
**a- KN-323D, b- "CIXING".**
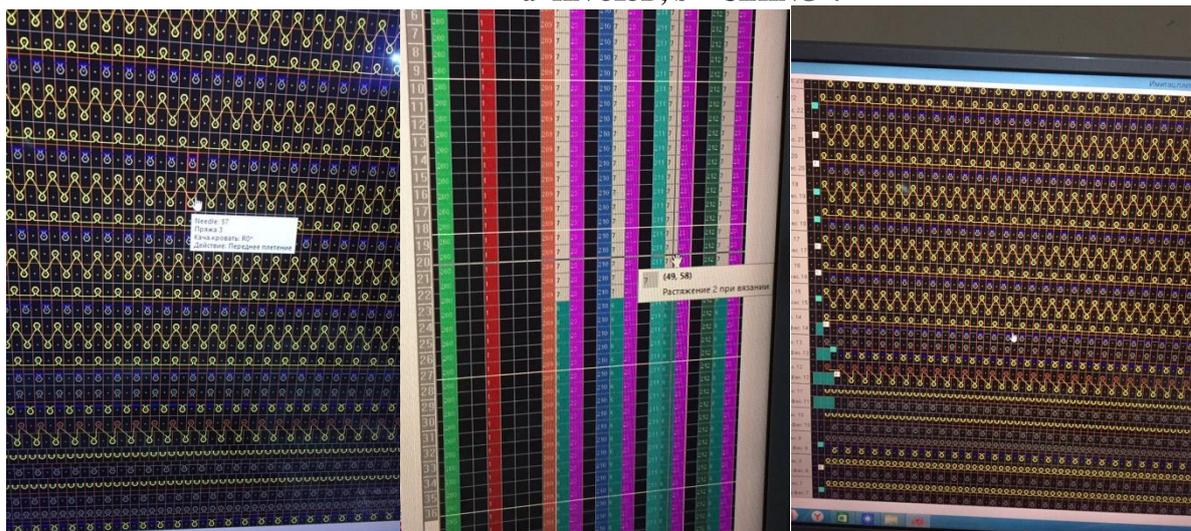


**Figure 3. Programming the flat knitting machine "CIXING" for knitting new poly-component knitwear**
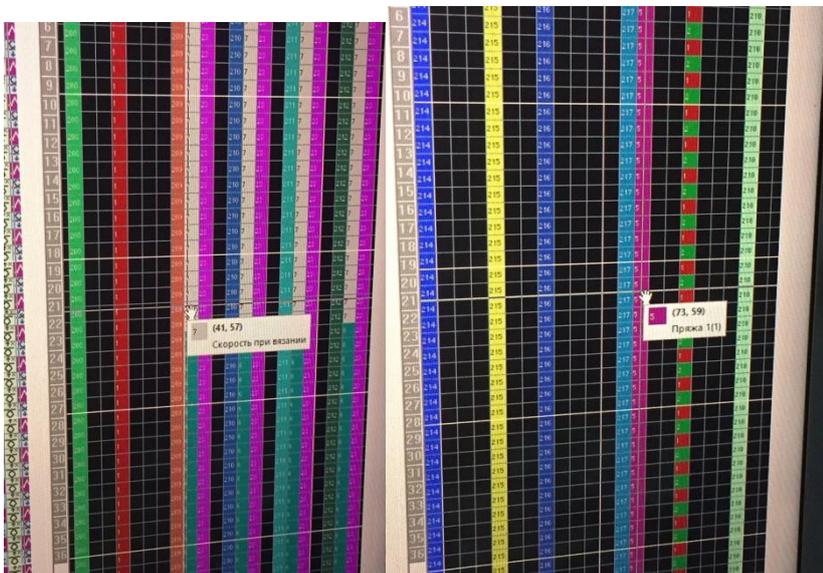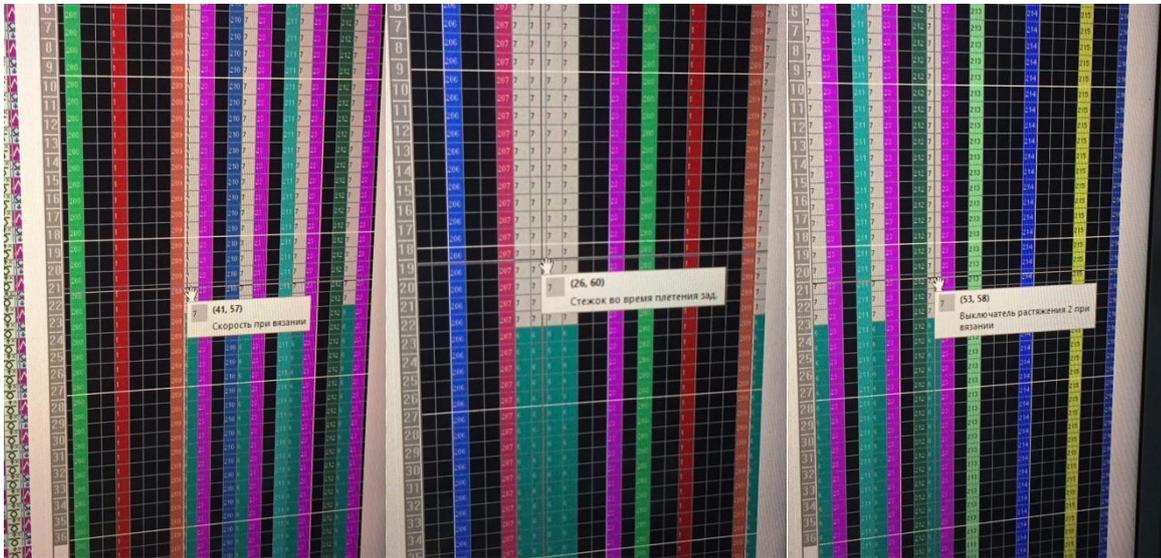
Each figure shows the tasks of the CIXING machine. For example: knitting speed, knitting stretch switch, used yarn number, front weave pattern, knitting stretch and weaving stitch (with a predetermined).

Below is the development of a new range with different tensile zones made of cotton with the addition of lycra elastomeric thread.
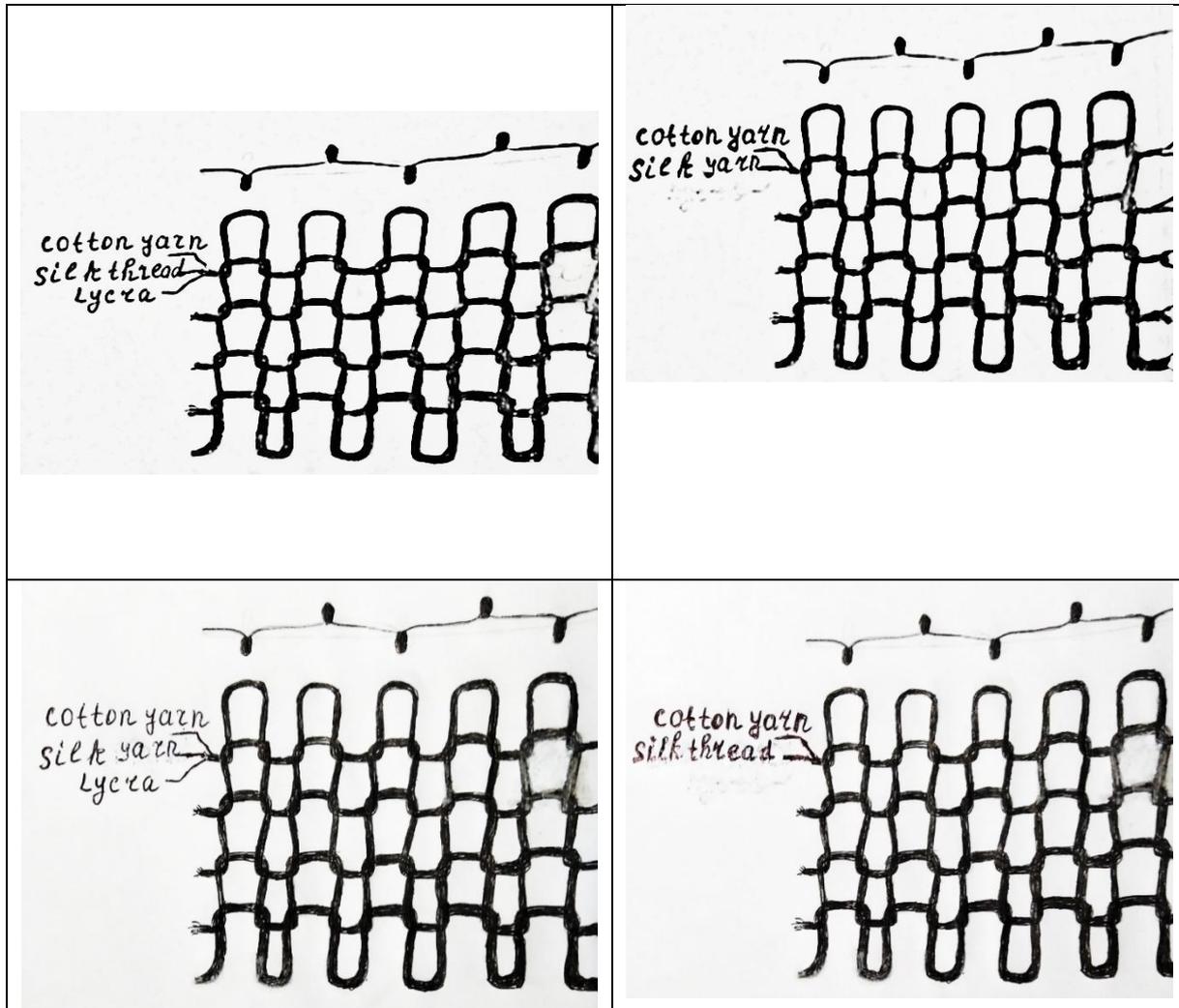
**Figure 4. The structure and graphic record of purl elastic knitwear produced on a flat-fanged machine**

Table-2-Samples of experimentally produced cotton-silk knitwear, obtained on a flat-knitting machine KN-323D

| № Sample | Weave | Applied composition of raw materials (%) | Linear density (tex) of blended yarn and thread | Weave pattern | Appearance of cotton-silk and lycra specimens |
|---|---|---|---|---|---|
| | | | | | |

| 1 | Purl 1x1 | 60% cotton<br>39% silk thread<br>1% lucre | 20x2/1<br>25x4/1 |  |  |
|---|---|---|---|---|---|
| 2 | Purl 1x1 | 50% cotton<br>48% silk thread<br>2% lycra | 20x2/1<br>25x4/1 |  |  |
| 3 | Purl 1x1 | 40% cotton<br>60% silk thread | 20x2/1<br>25x4/1 |  |  |
| 4 | Purl 1x1 | 55% cotton<br>45% silk thread | 20x4/1<br>16,5x4/1 | |  |
| 5 | Lace 1+1 | 53% cotton<br>32% silk thread<br>5% lycra | 20x3/1<br>25x3/1 |  |  |
| 6 | Purl 1x1 | 65% cotton<br>30% silk thread<br>5% lycra | 20x3/1<br>16,5x3/1 |  |  |
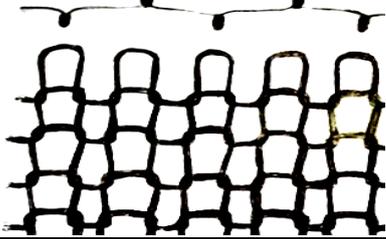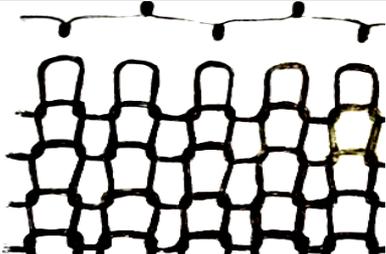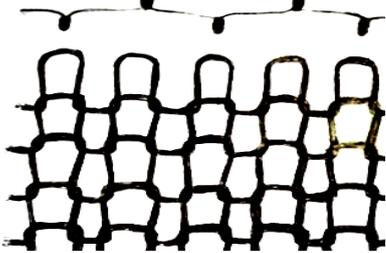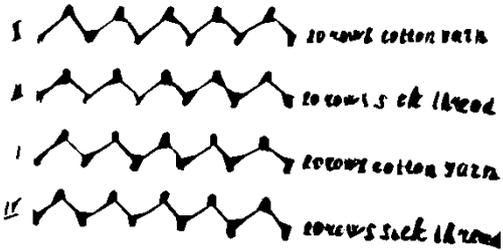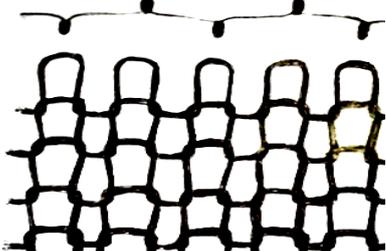
Table-3 -Samples of experimentally produced cotton-silk knitwear, obtained on a CIXING flat-knitting machine

| | Weave | Applied composition of raw materials (%) | Linear density (tex) of blended yarn and thread | Weave pattern | Appearance of cotton-silk and lycra specimens |
|---|---|---|---|---|---|
| 7 | Purl 1x1 | 58% cotton 37% silk thread 5% lycra | 50x4/1 12,5x4/2 | | |
| 2 | Purl 1x1 | 50% cotton 45% silk thread 5% lycra | 50x4/1 12,5x4/2 | | |
| 3 | Purl 1x1 | 54% cotton 46% silk thread | 50x4/1 12,5x4/2 | | |
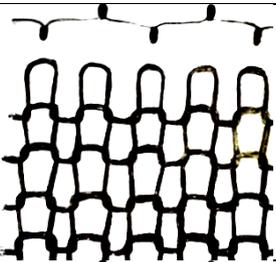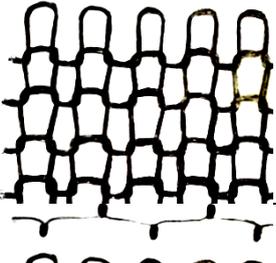
## IV. CONCLUSION

In the obtained experimental samples, the concentration of silk ranges from 30-60%. According to the results of the increased surface density and thickness of knitted fabrics, samples 7, 8 and 9 were selected for the manufacture of women's outerwear. From the samples taken through this experiment, it is planned to produce a sketch model collection of clothing sets for everyday use for women, with the aim of improving its design.

## V. ACKNOWLEDGEMENTS

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