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Research Article

THE FEATURES OF PATTERN FORMATION ON FLAT KNITTING MACHINES

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ABSTRACT

The development of the production of knitwear will lead to the further application of new technologies and the expansion of the range of knitwear. In the fields of trade industry, as well as in the service sector, the main requirement is the production of knitwear, which is combined with high manufacturability and wide distribution, which will lead to low cost, with relatively acceptable consumer characteristics and parameters. In this regard, the solution to the above problems in the technological part of the production of knitwear is of particular importance and is necessary. The article explores the features of improving the technology of production of knitted fabrics using knitted elements, the development of practical methods for obtaining knitted knitwear based on scientific generalization, the formation of patterns on flat knitting machines.

KEYWORDS

Flat knitting machines, knitted fabric produced on double-knit flat knitting machines, design methods based on elastic weave, with the introduction of a press pattern into the structure.

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INTRODUCTION

Currently, issues related to obtaining high-quality knitted products, as well as expanding its range are very relevant. Modern fashion trends offer the design of knitwear with various relief effects. The range of knitted products and their quality is mainly determined by the artistic design of the surface of the fabric by designing its looped structure. Therefore, the object of study is the looped structure of knitwear, which allows the formation of various relief effects on the surface of the fabric, as well as the influence of the arrangement of individual motifs in the plane of the ornament. Knitwear has characteristics that allow it to be used for the production of products for various purposes - household and technical. When changing the filling primary data during the production of knitwear, it becomes possible to regulate its various properties, for example, extensibility. The use of knitted materials and products tends to expand, while all-new needs and requirements become stimulating to develop a qualitatively new range of materials and products based on fabrics with different characteristics. All of the above can be achieved through a combination of new types, both raw materials and weaves. In this case, both low-stretch fabrics are obtained, which are close to fabrics in their characteristics, and fabrics, the extensibility of which is 100% or more.

In this area of science, fundamental works are known to obtain new structures of fabrics, expand the range of knitwear and study the technological parameters and physical and mechanical properties of knitwear prof. A.S. Dalidovich, L.V. Shengelia, I.I. Shalova, L.A. Kudryavina, N.A. Kuzovkova Yu.S. Grechukhina, V.M. Lazarenko, I.G. Tsitovich, B.B. Stroganova, V.A. Zavarueva, A.V. Truevtseva, M.M. Mukimova, K.Z. Yunusova and others [1-7].

The issues of creating knitted products with hygienic properties, studying the deformation properties of knitted fabrics and products are considered in the research works of such scientists as prof. HA. Alimova, F.U. Nigmatova, S.Sh. Tashpulatov, V.S. Rybina, D.U. Aripzhanova. V.A. Kubliakov [1-4].

At this point, many fabrics are suitable for the manufacture and creation of knitted materials and products, incl. sports goods are made using elastic weaves, where mainly cross-knitting machines are used [2]. The creation of new warp-knitted elastic fabrics, as well as the study of their characteristics, are relevant tasks because they allow enterprises that operate with the use of warp-knitting equipment can lead to an increase in the level of competitiveness of their products.

In the case when the question arises regarding the determination of the actual values of the main parameters of the loop structure formation of warp-knitted elastic knitwear, which turned out to be close to the theoretical ones, the difference between the actual and theoretical values ranges from 0-13%. Therefore, it is possible to use recommendations on the use of different software packages that were obtained in the

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Delphi programmed system to design the characteristics of the loop structure of warp knitwear in the form of elastic waves. No less interesting are the works that consider methods for obtaining integrally moulded parts of garments using polymer coatings, methods for assessing the dimensional stability of bulk parts of garments [3].

It is also noted that the manufacture of knitted knitwear is one of the main directions for improving the processes of manufacturing products. The paper proposes a method for knitting a two-layer jersey of a new structure, taking into account the physiological heat-shielding comfort with reduced consumption of raw materials [4]. Physiological comfort is determined during the physical activity of the body, and heat-shielding comfort is determined by the feeling of warmth (cold and moisture) during the evaporation or absorption of sweat released from the human body. In [5], two-layer knitwear with reduced consumption of raw materials for outdoor activities is proposed, in which one layer is made from a natural type of fibre, and the second layer is made from synthetic threads.

The manufacturing sector plays an important role in the development of the state economy. This fact is given special attention by Japanese scientists-statisticians [6-8]. With the acquisition of independence in Tajikistan, much attention has also been paid to the manufacturing sector. Among them, the textile industry has a special place. The development of the knitwear industry, an increase in the growth in the productivity of knitted fabrics and products is clearly expressed in the development of the economy of Uzbekistan. For the design of any canvas, one must bear in mind, first of all, the possibility of manufacturing a different assortment of products on equipment of a certain type using patterned weaves with multi-coloured, as well as textured effects. When designing products, one should take into account the effect of the structure-forming elements of knitwear on the magnitude of the visual perception of the pattern. Therefore, the issues of pattern formation are issues of paramount importance [9]. The use of the needle selection method directly reveals the characteristics and repeat capabilities of the pattern formed on the canvas. In the case of considering the process of knitting weaves of a patterned type, it becomes possible to select needles or other working bodies exclusively on flat knitting machines.

MATERIALS AND METHODS

The advantage of the method of knitting knitwear on flat knitting machines over the method of knitting the fabric is that after cutting the details of the product do not require hemming of the lower edges; the belt and cuffs of the product can be made with weaves that differ from the weave with which the frame of the product is connected, and this finish is one with the main part of the part. The quality of such products is much better than those in which the belt and cuffs are hemmed or seamed with a camp or sleeve. The labour costs for cutting and sewing operations are also reduced by 8-11%. Because there are no side seams and allowances for hem and reduction of

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inter-pattern waste, this method of manufacturing products is characterized by a decrease in the consumption of knitted fabric per product by 2-5% compared to the method of knitting and cutting the fabric. At present, the trend of using various weave structures based on main and patterned weaves to reduce material consumption is widely used in the knitting industry. Extensive work is being done at the world level on the development of technology and the production of knitted products on flat knitting machines since they have wide technological capabilities both in terms of the weave structure and in terms of methods for producing knitted products [9]. Flat knitting machines are widely used due to the possibility of knitting semi-regular products on them.

The work [10-12] gives a method for the production of one-piece knitted products on a production machine from SHIMA-SEIKI. The proposed method is carried out on a flat knitting machine with electronic control. The method ensures the production of the camp and sleeves with their simultaneous connection and knitting of the neckline. The scheme of selection of needles and transfer of loops during the development of products is given. At present, much attention in the world is paid to the use of local raw materials [13-19], the expansion of the range based on local resources. The current state of the textile market creates the prerequisites for expanding the assortment base of raw materials based on local resources [20–24].

We consider the technological scheme for obtaining coupon sections on a circular machine [22-27]. On the machine, the needle guides are arranged in such a way that the lower needle guide with a low heel is opposite the upper needle guide with a high heel and vice versa. The pushers are arranged in this way: two with high heels, then two with low heels. The knitting of the camp of the previous coupon ends with the formation of loops with all the needles in the lower cylinder. Before starting to knit a new product, the fixing rows are first knitted, as well as the dividing rows. Subsequently, they start knitting the second row. In the looping system, 4 needles with sufficiently elevated heels are transferred from the side of the lower cylinder to the side of the upper one. The transmission of needles occurs through one. For this, the lower transmission and side wedges are included. The edge of the onboard wedge acts only on the high heels of the needle guides, directing them into the knitting channel, and the needle guides with low heels move along the non-knitting channel and the needles that are engaged with them do not knit, but hold the old loops. In this case, the knitting of the surface in the upper cylinder through the needle takes place. The knitting of the camp of the previous coupon ends with the formation of loops with all needles in the lower cylinder. Before knitting a new product, fastening and separating rows are knitted. Next, the second row is knitted. In the loop-forming system, 4 needles with high heels are transferred from the lower cylinder to the upper one. The transmission of needles occurs through one. For this, the lower transmission and side wedges are included. The edge of the onboard wedge acts only on the high heels of the needle guides, directing them into the knitting channel, and the

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needle guides with heels move along the non-knitting channel and the needles that are engaged with them do not knit, but hold the old loops. In this case, the knitting of the surface in the upper cylinder through the needle takes place.

Flat knitting machines are machines of a universal type that allow for quick reloading to create materials and products of a new type, dimensions and weave, which have great patterning capabilities. The developed new equipment is aimed at the automatic production of piece products, saving raw materials and reducing the time of creating products by eliminating sewing operations. Over the past 30-40 years there has been rapid progress in computing technologies.

The economic and social transformations that arose on this basis have changed everything that happened in the past. In the developed countries of the world, there are also tendencies to reduce the consumption of raw materials, while not losing product quality. With the improvement and expansion of the technological capabilities of flat knitting machines, world-famous manufacturers of knitting equipment such as STOLL, SHIMA-SEIKI are engaged [27-31].

The desire to obtain whole-knitted knitwear on flat knitting machines is a modern trend at the world level [31-37]. The expansion of the technological capabilities of flat knitting machines and the range of products for outer knitwear and children's assortment is one of the topical issues in this period [32-39]. On this basis, we have chosen a flat-fan machine, studied its advantages and disadvantages, the possibility of improving production technology, while not losing quality and achieving savings in raw materials. We set the goal of developing a technology for the development of new weaves on a flat knitting machine. The development of such technology makes it possible: to develop coupons with a separating row, as a result, and with a non-ravelling edge of the product; expand the technological capabilities of flat-fan machines; save raw materials consumption and reduce the amount of waste; improve the quality of products, improving their consumer properties.

Depending on the weave, texture, composition of the designed model of a knitted product, the choice of knitting equipment is carried out [37-41]. In this case, knitwear can be made in the following ways:

- Cutting (first, the flooring of the canvas is prepared from several layers, then the details of the product are cut, after that, they are connected in the sewing process to give the necessary shape);
- Semi-regular (knitted fabric is knitted in the form of coupons; common in the manufacture of upper knitwear, underwear);
- Regular (products are knitted entirely without seams or individual parts are knitted along the contour, and then sewn together).

In the production of the top range, knit&wear (3D) machines are of particular interest, according to the regular method of knitwear production. For products created in this way, there is no need for assembly, only the WTO will

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be enough. Such equipment includes electronic flat knitting machines manufactured by SHIMA-SEIKI, UNIVERSAL, STOLL, BOOSAN and others [39-43]. The equipment of the new generation is characterized by high technological capabilities due to the use of constructively new mechanisms, such as sinkers, pull-back mechanisms, additional needle beds. Almost all the main mechanisms of the machines have undergone significant changes. For example, program control mechanisms have gone from mechanical to electronic; program carriers - from typesetting circuits and punched cards to a floppy and optical disks for computers, etc. Therefore, it is of interest to consider the design features of the latest flat knitting machines and their technological capabilities [43-45].

RESULTS AND DISCUSSION

Fundamentals of the formation of patterns of flat-knitting colour fabrics.

To realize the advantages of flat knitting machines, an artist-technologist needs to master the basics of knitting technology, know the patterning capabilities of machines, and the basic principles of pattern formation using selection mechanisms. One of the most acute problems, especially in connection with the transition to market relations, is the problem of the assortment flexibility of production to changes in market conditions. This problem can be solved by the widespread use of computer technology in the control of technological processes for obtaining canvases. Currently, abroad, computer technology has found its wide application in a 3D format both in the technological and educational process, as well as in the analysis process. On flat knitting machines, four methods of selecting needles are used: general, group, individual and combined. With general and group selection, needles are selected all at the same time or in groups. For group selection, needles with high, medium and low heels or needles with heels located at different distances from the needle head are used. Additional auxiliary elements are also used in the form of pushers equipped with heels of different lengths, or with heels located at different levels along with the height of the pusher.

All working bodies (needles and pushers) are pre-arranged on the machine following a given pattern. The general and group selection of needles is carried out on flat knitting machines with the help of machine locks. To obtain a variety of patterns, individual selection of needles is used, performed using selection mechanisms containing a knitting program for a pattern. The executive bodies of such mechanisms are the selection plates and drums. In combined needle selection, two or three of the selection methods listed above are used simultaneously. Formation and design of coloured patterned structures of weaves on canvases.

The principle of obtaining patterned weaves is that each of the threads of different colours is laid only on certain needles included in the work, in the order that depends on the pattern. At the same time, if a new thread is laid on the needles selected according to the pattern, then the old

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loops from these needles must be discarded; all other needles that are not involved in the work are idle without forming loops. Patterned knitwear from flat knitting machines, along with other types of knitwear, has become widespread. Patterned weaves, depending on the design of the selection mechanism available on the flat knitting machine, make it possible to obtain a variety of colour patterns of simple and complex shapes. These drawings can be, in the simplest case, an alternation of coloured stripes, a combination of various rectangles and squares, and also consist of complex elements arranged in rapport or coupon.

Drawings of a small rapport. The simplest type of patterned fabric is needle jacquard, which is patterned knitwear obtained without the use of a jacquard mechanism. The colour pattern on the needle jacquard is formed by combining elongated front loops with ordinary front loops of one of the smooth weaves: satin stitch, eraser, fang, semi-fang. A characteristic feature of needle jacquard patterns is the formation of pattern elements on the canvas, which can only have a rectangular shape and consist of a combination of coloured rectangles or squares against a background of vertical and horizontal coloured stripes. Depending on the pattern, the width of the vertical stripes can be any. Their dimensions are determined by grouping the needles of the two positions before threading the machine. The width of the horizontal stripes formed by periodically switching the thread guides threaded with threads of different colours is set by the program of the colouring machine. Large rapport drawings. The formation of colour patterns of large rapport is possible only on flat knitting machines equipped with selection mechanisms. A complex arrangement of patterned pushers allows you to get a variety of patterns with several vertical axes of symmetry. In the process of performing the dissertation work, the technological capabilities of both circular knitting and flat knitting machines were deeply investigated and studied, new variants of pattern repeats were developed [79].

In the variants, elements of the motif of a geometric ornament with the corresponding symmetrical repetition of rapport are selected and used. Symmetry is a property of a figure (or an ornamental motif) superimposed on itself in such a way that all its points occupy their original position. Symmetry is characteristic of both organic and inorganic nature. In the visual arts, symmetry is widespread, being one of the important means of constructing an art form. Symmetry finds its greatest use in ornamentation, usually being present in any ornamental composition or its elements. Symmetry is one of the most common forms of manifestation of the rhythmic beginning in the ornament. In the theory of ornament, it has a special place. Consider the main types of symmetry used in the composition of ornaments. These types of symmetry, are symmetrical transformations of figures in the process of forming various motifs and compositions, depending on the use of such basic elements of symmetry, the translation axis, the plane of sliding reflection. Antisymmetry. A figure painted in one colour can be equal to a

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figure painted in another colour. The positive relief form (bulge) can be equal to the negative one (recess). This kind of equality is called the opposite equality, or antisymmetry. To depict equal and anti-equal figures, black and white colours are used. Therefore, two-colour black-and-white or other colours of figures can serve as models of antisymmetric figures. Antisymmetric figures are widely used in the ornamentation of fabrics and knitted fabrics. The possibilities of antisymmetry in ornamental compositions are very large. The artist can use them taking into account the colouristic, technological and other solutions of the composition.

Conclusion

The use of knitted materials and products tends to expand, while all-new needs and requirements become stimulating to develop a qualitatively new range of materials and products based on fabrics with different characteristics. All of the above can be achieved through a combination of new types, both raw materials and weaves. An analysis of the directions for expanding the range and improving the structure of knitwear showed that special attention should be paid to the development of effective technologies for obtaining weave structures with the addition of patterned elements.

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