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# Technology of Obtaining Two-Layer Knitted Fabrics in a New Structure of a Flat Two-Needle Knitting Machine with the Needles Placed in a Rubber Arrangement

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**Annotation.** Using the technological capabilities of modern double bed flat knitting machines, the technology for producing double-layer knitted fabrics of a new structure, made by arranging the needles in rib positions, has been studied.

**Key words:** ribana, needle, double-layer, knitting, technology.

Common to all structures of two-layer knitted fabrics is that each of its independent layers creates a basic, derived, patterned or mixed single-layer fabric. In the process of weaving, the fabric or layers are connected to each other with the help of certain elements of the loop structure on the back, in which it is possible to remove one fabric and save the other without breaking the loop connection. [1].

The double-layer mixed knitted fabric is woven on a multi-system circular needle tire machine, and therefore, this fabric, which has the properties of shape retention and heat retention, can be used in the production of household, sports and technical goods. [2].

Kursk State Technical University scientists Yu.A.Romanenko, E.A.Pyanikova and O.G.Diev created a method of consecutive production of two-layer knitted fabric on a flat four-needle machine [3].

In this method of obtaining two-layer knitted fabric on a flat four-needle knitting machine, four rows of loops of different layers are formed on four needles of the carriage in one movement of the carriage. The research work is focused on shortening the loop forming process and increasing the productivity of the flat needle machine.

Prof. M.M. Mukimov and N.R. Khankhadzhaeva [4, 5] created the technology of obtaining three-, four- and five-ply knitted fabrics on the Japanese flat needle machine "SHIMA-SEIKI". The results of the research of the produced samples showed that with the change of the ratio of the fabric woven from polyacrylonitrile kalava yarn with a linear density of 31 tex x 2, the surface density of the knitted fabric and its thickness increased compared to the base fabric (double elastic).

Currently, research work is being carried out on the improvement of flat needle machines, often in these works polyacrylonitrile yarns are used in the weaving process [6]. The German company "Stoll" produced variable class machines. For example, cars of class 5.2 can be used as cars of classes 5 to 10, and cars of classes 6.2 and 7.2 as cars of classes 7 to 12 and 7 to 14, respectively. Thus, depending on the required class of the machine, it is possible to weave one needle or on each needle. On machines of class 5.2, depending on the linear density of the thread, it is possible to knit on every third needle.

In N.R. Khankhadzhaeva [7]'s dissertation work, methods of producing three-ply, four-ply and five-ply knitted fabrics and new structures of knitting were created using domestic polyacrylonitrile kalava yarn on modern flat needle machines made by the "SHIMA-SEIKI" company. The physico-mechanical properties of the new knitted fabrics produced on the basis of two elastic fabrics were investigated and their technological parameters were determined..

From the results of the conducted scientific research, it became clear that the development of new methods and technologies for obtaining double-layer knitted fabrics with a new structure due to the expansion of the assortment, saving the consumption of raw materials, and the use of mixed knitted fabrics in the composition of the fabric became important..

According to him, in order to solve the actual problems mentioned above, the technology of obtaining two-layer knitted fabrics of a new structure was developed. 6 variants of double-layer knitted fabrics of new structure were woven on a 14-class flat double-needle knitting machine manufactured by Long Xing LXA 252 SC of China.

It is known that obtaining mixed fabrics in the repetition of fabric rows or individual elements in a certain order is one of the most promising directions for creating a new assortment of knitted fabrics. One of them is dubrilinization of single-layer fabrics in the weaving method. In two-layer knitted fabrics, these fabrics are connected to each other by loop elements during the knitting process.

In the production of mixed double-layer knitted fabrics, knitted fabrics with their own characteristics are woven from two yarns, one of which forms the loops of the front side and the other of the loops of the back side. It was called two-layer tissue by E.P. Pospelov [8].

In order to expand the assortment of knitted fabrics, reduce the consumption of raw materials and improve quality indicators, the technology of taking samples of two-layer knitted fabrics obtained in a new structure has been developed..

Accordingly, two-layer knitted fabrics of a new structure were woven using polyacrylonitrile (PAN) yarn with a linear density of 30 tex x 2. The new two-layer knitted fabric samples differ from each other in the production method and the change in the fabric structure.

The double-layer knitted fabric samples of the new structure were knitted on a flat double-needle knitting machine in the following order.

Variant I of the new structure, the carriage of the knitting machine moves from left to right in the production of the I-row of two-layer knitted fabric. As a result, the front needle needles are raised to the full completion process due to the lifter being in working position and make their loops for the front layer of fabric from the acrylic raw material, and the rear needle needles are raised to complete the incomplete completion process due to the lifter half off and form half loops. At the end of the process, full loops are formed on the front knitting needles, and half loops are formed on the rear knitting needles. When knitting the II row of the knitted fabric, the front needle needles do not participate in the loop formation process due to the fact that the lifting loop is not in working condition during the movement of the machine carriage from right to left. And the back needles are fully raised to the finishing process due to the working position of the lifting bar and form the glad rings from the acrylic raw material. As a result, the front and back layers of the tissue are attached with the help of open press half-rings (Fig. 1). The knitted fabric consists of elongated loops of the back layer 1, loops of the front layer 2, half loops connecting the two layers 3 and spacers 4.

The peculiarity of this process is that the knitting needles of the knitting machine are located and work in a rubber pattern when obtaining a double-layer knitted fabric with a new structure. This is expressed by the development of a new technology for obtaining two-layer knitted fabrics of a new structure, the needles of which are located in a rubber arrangement. Subsequent two-layer samples were also woven using this method.

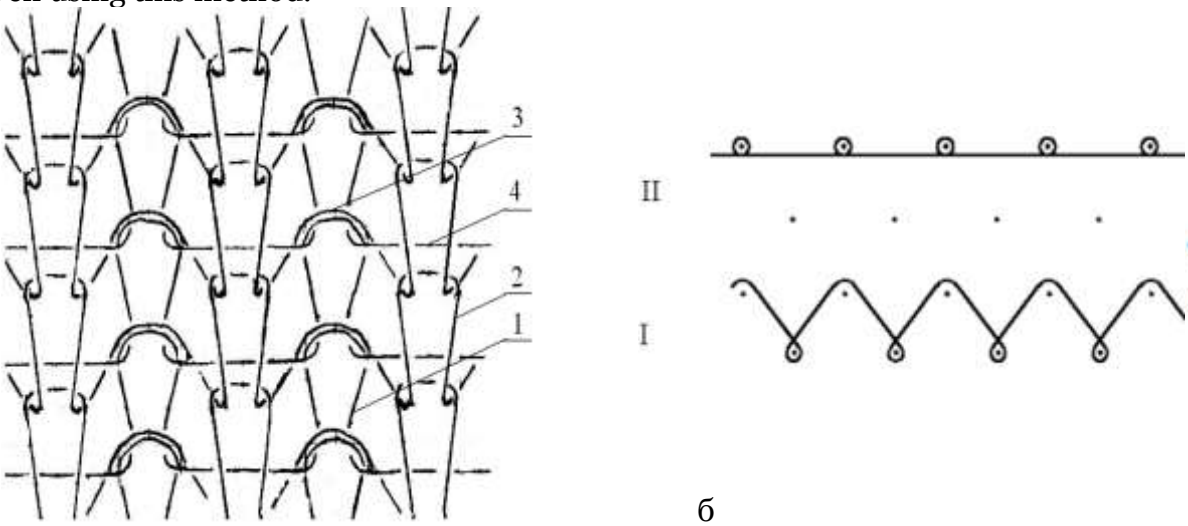


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**Figure 1. The structure (a) and graphic record (b) of the two-layer knitted fabric (option I) in the new structure**.

The total ratio of the two-layer knitted fabric of the new structure II option consists of four rows, and in the process of moving the carriage of the knitting machine from left to right in the production of the I-row of the fabric, the front needle needles are raised to the full completion process due to the working position of the lifting loop, and the front layer of the fabric is removed from the glad ring rows. creates. At this time, the rear needle needle does not rise to the finishing process due to the removal of the lifting thread and does not participate in the process of forming the ring. In the process of moving the carriage of the knitting machine from left to right when knitting the II row of the fabric, the rear needle needles are raised to complete the process of completion due to the working state of the lifter, and the back needle of the fabric, and the front needle needles are raised to complete the process of incomplete completion due to the partial removal of the lifter. creates loops for the front layer. This results in full loops on the back needles and half loops on the front needles.

When weaving the III row of the fabric, the front needle needles are not involved in the process of loop formation due to the fact that the lifting loop is not in working condition during the movement of the machine carriage from right to left. And the rear needles are fully raised to the finishing process due to the lifter being in working position and form the glad rings for the back layer. When knitting the IV row of double-layer fabric, the front needle needles are raised to the full completion process due to the lifting loop being in working position, and their loops for the front layer of the fabric, and the rear needle needles are raised to complete the incomplete completion process due to the lifting loop being turned off in half, and the half loops of the back layer creates.

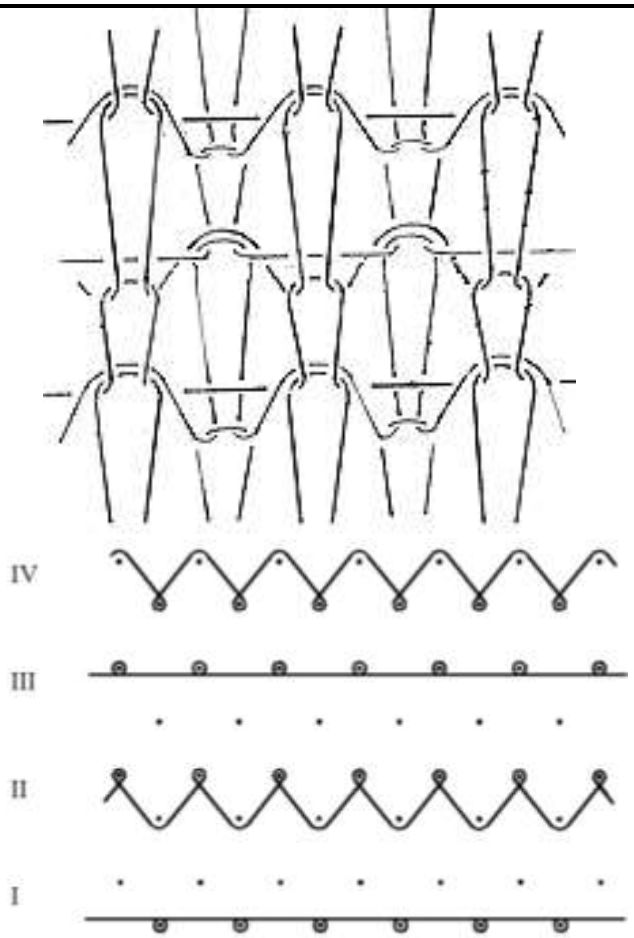


**Figure 2. The structure (a) and graphic record (b) of the two-layer knitted fabric (option II) in the new structure.**

At the end of the process, full loops are formed on the front knitting needles, and half loops are formed on the rear knitting needles. As a result, a two-layer knitted fabric of a new structure is produced (Fig. 2).

Variant III, the general ratio of two-layer knitted fabric consists of four rows, in the movement of the knitting machine carriage from left to right, in the production of the I-row of the fabric, due to the fact that the needles of the front needle are raised to the complete completion process, full loops of the front layer are formed, because the odd-numbered needles of the back needle are raised to the completion process knits the press half-loops of the back layer. Needles with an even number do not rise to the completion process and do not participate in the process of forming a loop (Fig. 3).

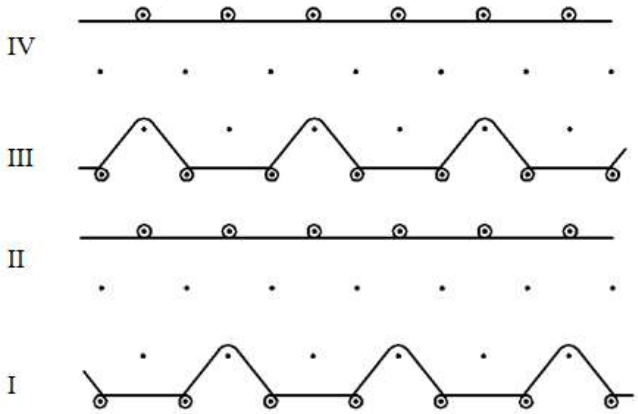


**Figure 3. A graphic record of a two-layer knitted fabric (variant III) in a new structure.**

And in the production of the second and fourth ring rows, all the needles of the back needle are raised to the finishing process to form the glad ring rows for the back layer. And the front knitting needles do not participate in the process of forming a loop. When knitting the III row of loops, the front knitting needles are raised to the completion process and knit the full loops of the front layer. As the even-numbered needles of the back needle are raised to the finishing process, the press of the back layer knits the half-loops. And the odd numbered needles do not rise to the completion process and do not participate in the loop formation process. As a result, version III of the two-layer knitted fabric with a new structure is produced.

Option IV of the two-layer knitted fabric of the new structure is knitted in the following sequence. The fabric rapport consists of three rows, and during the movement of the carriage of the knitting machine from left to right, the front needles form glad rings of the front layer, and the rear needles do not participate in the loop formation process without rising to the completion process. When knitting the II ring row of the fabric, since every third needle of the front needle is raised to the incomplete completion process, two needles intertwine to form the press half-rings of the front layer, as a result of the rear needle needles rising to the complete completion process, a loop is formed on all the needles for the back layer. Ring row III is made by knitting in the same sequence as ring row II, only by moving one needle back (Fig. 4).

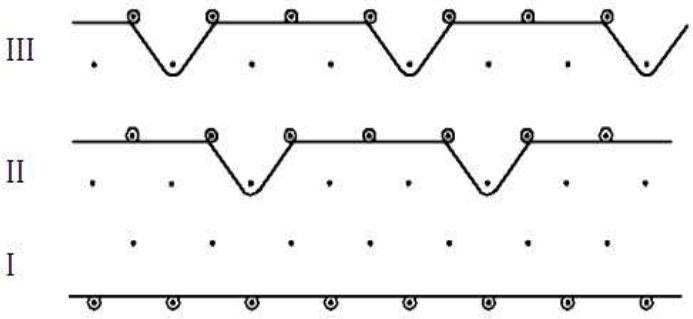


**Figure 4. A graphic record of a new structured two-layer knitted fabric (option IV) in a new structure.**

In the production of the first and second rows of the V variant of the double-layer knitted fabric of the new structure, during the left-to-right movement of the knitting machine carriage, the front needle needles are raised to the full completion process and form full glad loops for the front layer, while the rear needle needles participate in the loop formation process without raising to the completion process. they don't. When knitting the third loop row of the fabric, every third needle of the front needle rises to the incomplete completion process and forms the press half-rings of the front layer, as a result of the rise of the rear needle needles to the complete completion process, a full loop is formed on all needles (Fig. 5).

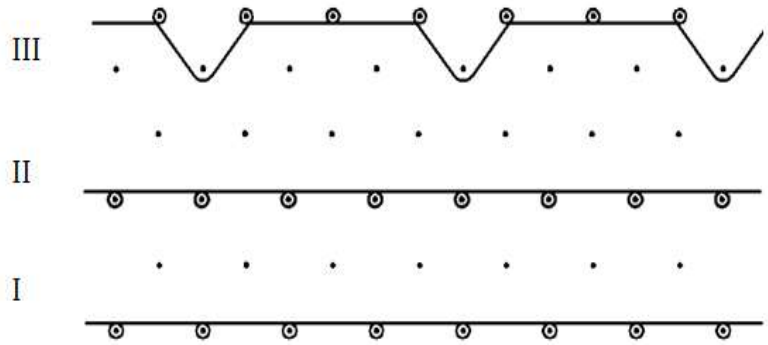


**Figure 5. A graphic record of a two-layer knitted fabric (variant V) in a new structure**.

When knitting the first and third rows of the VI version of the double-layer knitted fabric of the new structure, during the movement of the knitting machine carriage from left to right, the front needle needles are raised to the full completion process and form full glad loops for the front layer, and the rear needle needles are in the process of forming loops without rising to the completion process do not participate. When knitting the second loop row of the fabric, every fourth needle of the front needle is raised to the incomplete completion process, and three needles are spun to form the press half-loops of the front layer, while the even needles of the back needle are raised to the complete completion process, and since the odd needles are not raised to the completion process, the process of forming a ring is performed by spinning one needle . The IV ring row of the fabric is formed by knitting in the same sequence as the II ring row, only by shifting it to the front of one needle (Fig. 6).

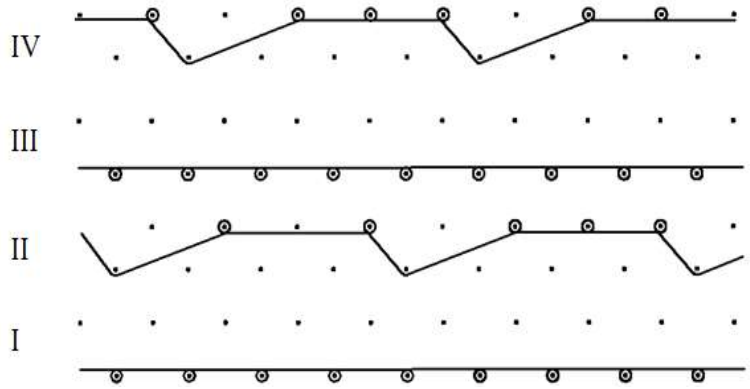


**Figure 6. Graphic record of a two-layer knitted fabric (variant VI) in a new structure (b).**

As a result, new assortments of two-layer knitted fabrics with a new structure were woven due to the arrangement of the knitting needles of the flat needle knitting machine in a rubber pattern, as well as the development of a new technology of obtaining knitted fabrics.

Taking into account the high shape and heat retention properties of the resulting knitted fabric, it is appropriate to use it in the production of outer knitted products.

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