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Development of the technology for producing new structures of shape-resistant two-layer plush knitwear

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Abstract: This paper presents methods for improving the shape stability of plush knitwear, which, despite its advantages, tends to deform under load due to the structure of the ground yarn. The structures of two-layer plush knitwear are considered, in which one layer is plush knitwear, and the other layer consists of more shape-stable weaves. Three variants of double-layer plush knitwear with different structures are described. These developments improve shape stability, reduce elongation, enhance thermal protection properties, and expand the range of knitwear applications. The advantages of the new variants include increased durability, improved quality, and an aesthetically pleasing appearance.

Keywords: Plush knitwear, shape stability, pressed weave, thermal protection properties, double-layer knit fabric, knit structure, elongation, knit weaves.

Introduction: Despite its softness and comfort, plush knitwear has some disadvantages, the main one being a high tendency to deform under external loads. This is due to the structure of the plush knitwear's ground yarn, which, unlike woven plush, has lower shape stability. As a result, the application range of plush knitwear is limited, especially in cases where high quality and resistance to deformation are required.

METHODOLOGY

We have developed several new knitwear structures, one of which is a method of reducing elongation along the length of the knitwear by including pressed stitches in its structure. The elongation of pressed weaves is somewhat smaller compared to the main or derivative weaves on which they are based, due to the presence of the stitches. This disadvantage can be eliminated by creating double-layer knitwear where one layer consists of plush knitwear, and the other layer consists of more shape-stable weaves such as plain, ribbed, and pressed weaves.

In the first variant of double-layer plush knitwear, the reverse layer is made of plush weave, and the front layer consists of triple-pressed weave. The structure of the layers of the first variant of the double-layer plush knitwear is shown in Figure 1.

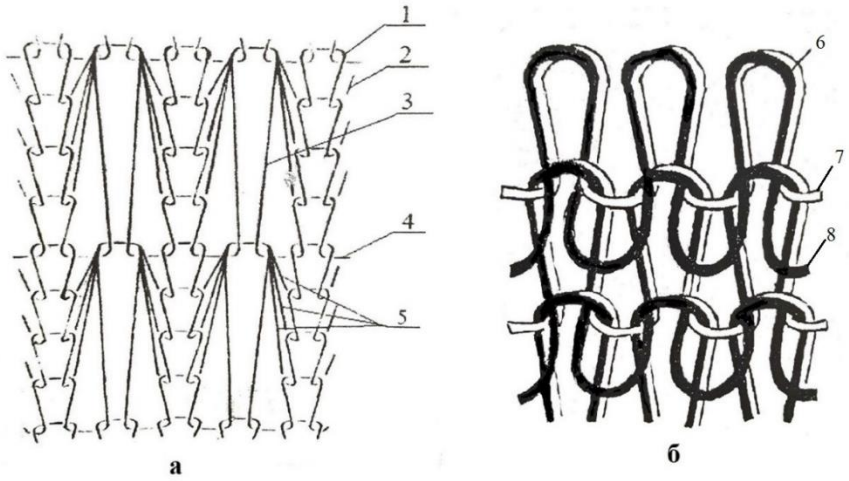

Figure 1. Structure of the layers of the first variant of double-layer plush knitwear.

The front side of the first variant of double-layer plush knitwear consists of regular-sized loops (1) formed from yarns (2), elongated loops (3) formed from yarns (4), and stitches (5) (Figure 1a). The reverse side consists of plush loops (6) formed from ground yarn (7) and plush yarn (8) (Figure 1b). The loops (1) of the front layer are connected to the loops (6) of the reverse layer of the same row by means of a connecting yarn (9) (Figure 1). The plush stretches between the layers of double-layer knitwear increase the thickness, thus enhancing the thermal protection properties. The presence of elongated loops and stitches in the knitwear structure reduces elongation along the length, increases shape stability, and creates a cellular effect on the surface of the fabric.

To expand the range of knitwear, improve quality, and enhance shape stability, the structure of the second variant of double-layer plush knitwear was developed, where the front layer is made with a double-pressed weave, and the reverse layer is made with a plush weave.

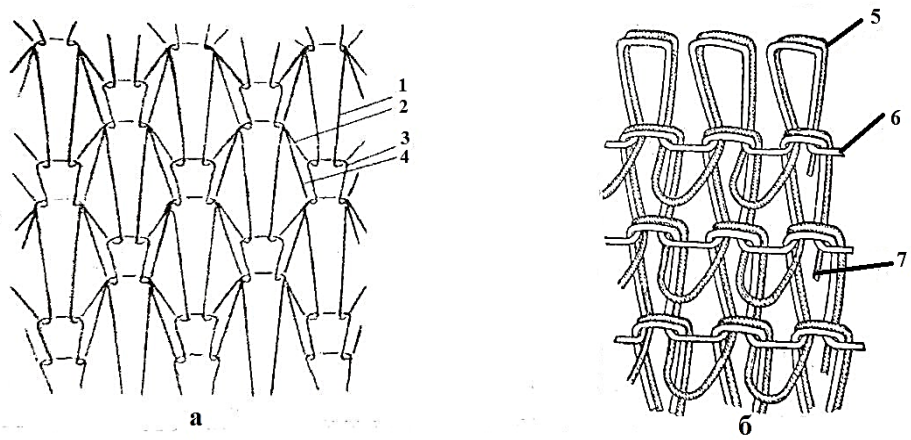

Figure 2. Structure of the layers of the second variant of double-layer plush knitwear.

The front side of the second variant of double-layer plush knitwear consists of elongated loops (1), stitches (2), regular-sized loops (3), and a second stitch (4) (Figure 2a). The reverse side consists of plush loops (5) formed from ground yarn (6) and plush yarn (7) (Figure 2b). The loops (1) of the front layer are connected to the loops (5) of the reverse layer using a connecting yarn (Figure 2). The plush stretches are located between the layers of the double-layer plush knitwear, so the knitwear has high thermal protection properties. The presence of elongated loops in the front layer of the double-layer knitwear reduces elongation along the length, increases shape stability, and the positioning of the elongated plush stretches between the layers increases the thermal protection properties of the knitwear.

The third variant of double-layer plush knitwear is produced on a flat knitting machine. The front layer of the double-layer plush knitwear consists of incomplete double-pressed weaves, and the reverse layer is made of plush knitwear.

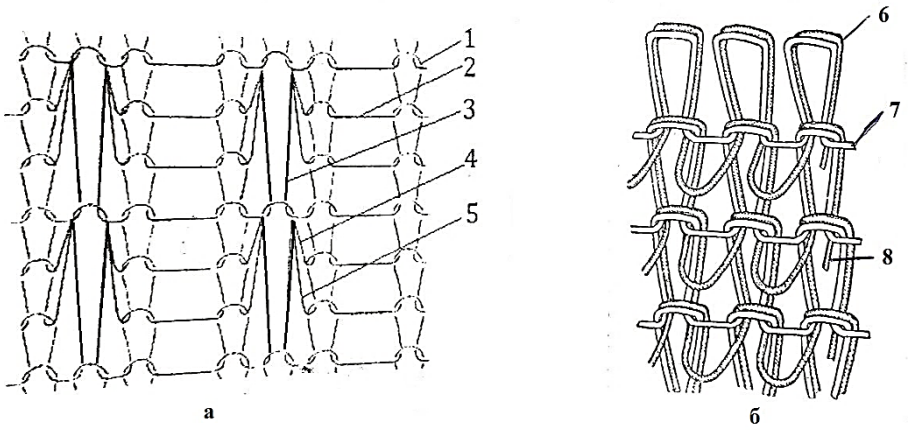

Figure 3. Structure of the layers of the third variant of double-layer plush knitwear.

The front side of the third variant of double-layer plush knitwear consists of regular-sized loops (1), elongated stretches (2), elongated loops (3), stitches (4), and a second stitch (5) (Figure 3a). The reverse side consists of plush loops (6) formed from ground yarn (7) and plush yarn (8) (Figure 3b). The loop (1) of the front layer is connected to the loops (6) of the reverse layer by a connecting yarn (9) (Figure 3). The presence of elongated loops and stitches in the knitwear structure reduces elongation along the length, and the elongated stretches reduce elongation across the width, resulting in improved shape stability of the double-layer plush knitwear. The positioning of plush stretches between the layers of double-layer knitwear increases its thickness, improving the thermal protection properties of the knitwear.

CONCLUSION

In the proposed variants of double-layer plush knitwear, plush stretches are positioned between the layers of the double-layer knitwear. This knitwear has a number of advantages over plush knitwear where plush stretches are located on the surface of the fabric, such as:

Improved quality due to the lack of access to the stretches, preventing their catching and pulling out of plush yarn from the fabric;

Enhanced thermal protection properties due to the formation of a highly porous three-dimensional structure;

High shape stability due to the double-layer structure, and importantly, for outerwear, an attractive appearance that allows it to be used for double-sided garments.

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