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EFFICIENCY OF USING NEEDS KNITTING MACHINES WITH FIXED HEELS

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The peculiarity of knitting machines is the considerable contact stresses in the needle-wedge pair [1… 3], which adversely affect the reliability and durability of the knit fabric. Dynamic load reduction is one of the urgent problems of knitwear engineering. One design solution is to replace existing needles with rigid heel needles containing heeled heels [4].

The practice of knitting machines shows that the working surface of the wedges is exposed in the area of contact zone with the heels of the needles of the action of the pulsating compression stresses and is destroyed not by normal but by the tangent stresses [1]. To prevent this, the condition must be:

$$\tau_{max} < [\tau] \qquad (1)$$

where τ_{max}, $[\tau]$ – respectively maximum and allowable tangential stresses.

For the interaction of steel parts such as needles and wedges [5]:

$$\tau max = 0{,}145\sqrt{\frac{NE}{l\rho}} = 0{,}145\sqrt{\frac{FE}{l\rho\, cos\alpha}}, \qquad (2)$$

where N – is the maximum normal load in the contact area;

E – reduced modulus of elasticity of needle and wedge materials;

l – is the length of the contact line of the needle-wedge heel pair;

ρ – is the radius of curvature of the pair of heels of the needle-wedge heel;

F – is the horizontal component load in the contact zone of the needle-wedge heel pair;

α – is the angle of the wedge profile in the study area of the interaction of the needle with the wedge.

As can be seen from (2), one of the parameters that significantly affects the magnitude of the maximum tangent stresses, and therefore the wedge durability, is the parameter ρ.

For the general case: $\rho = \frac{\rho_1\rho_2}{\rho_2 \pm \rho_1}$

Where ρ_1, ρ_2– are the radii of curvature of the work surface, respectively, the heel of the needle and the wedge.

A wedge with a curvilinear profile (Fig. 1), as a rule, have a working surface consisting of two sections: sections with a negative radius of curvature (section *ab* and *de*) for which $\rho = \frac{\rho_1\rho_2}{\rho_2 - \rho_1}$ρ = and areas with a positive radius of curvature for which $\rho = \frac{\rho_1\rho_2}{\rho_2 - \rho_1}$.

The calculations show. As for there placement of type machines CK of needles with heel bends (Fig. 2), the maximum voltage in the area of their interaction is reduced more than reduction in 6 (from τ_{max} = 1146 MP to τ_{max} = 181 MP) in the replacement of circular knitting machines of conventional needles.

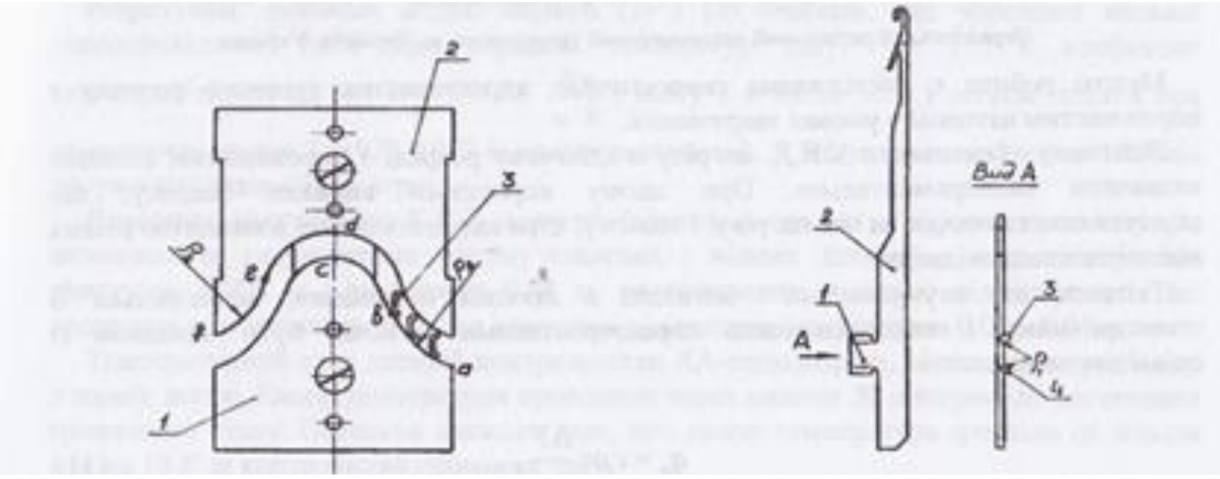

Fig. 1. The scheme of interaction of the needle with the wedges: 1 - lifting wedge; 2 –draw cam; 3 - needle heel

Fig. 2. The needle of a knitting machine with a heel with bends

Analyzing the results of the research, we can draw the following conclusions:

– the proposed design of needles with heels with bends when used in circular knitting machines of type KO allows to reduce more than 6 times the voltage contact in a pair of needle-wedge;

–research findings can be used in the analysis of the interaction of needles with wedges of all existing types of knitting machines and will be useful both in improving the existing and in designing new designs of knitting machines.

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