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Combined Strengthening of Batan Teeth of the Stb Loom

Kasimov Bakhtiyor Murat o'g'li
Assistant Andijan Machine-building Institut
Muminov Mansur Rakhimovich
PhD Cotton industry scientific center JSC
Shin Ilarion Georgievich
Doctor of Technical Sciences Professor
Tashkent Institute of Textile and Light Industrial

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ABSTRACT

The combined strengthening of the batan teeth of the STB loom is considered, including chemical and thermal treatment-nitrocementation and surface plastic deformation in the form of shot blasting. Shot hardening forms compressive residual stresses in the surface layer, which, together with the increased hardness, increases the wear resistance of the batan teeth.

Keywords: Batan tooth, nitrocementation, wear resistance, hardening, hardening, fraction, hardness.

STB machines are widely used in all branches of the textile industry (wool, silk, cotton, linen)., they are the most universal and perfect of the seamless looms. The use of these machines instead of shuttle machines, for example, in the wool industry, can increase the productivity of equipment by 1.7-3.5 times and labor productivity by 2-2. 5 times [1]. However, the experience of operating STB machines has shown insufficient reliability and durability of individual parts and assemblies, what is reflected in the quality and weightlessness of the produced tissue due to the increased costs of technological maintenance and repair, increases in prostes due to disorders. The most vulnerable point in STB machines is the weft laying mechanism (about 80% failure rate), the repair and restoration of which affects most of the allotted time. All other things being equal, the wear resistance of the batan teeth [2, 3], it should depend on the state of the contact surface layer, which is determined by a number of physical, mechanical and geometric parameters. Thus, along with an increase in the hardness of the surface layer and a decrease in roughness, an improvement in the micro-profile of the surface plays an important role in increasing wear resistance, resulting in an increase in the support surface, as well as the formation of residual compressive stresses, depth and degree of strain hardening during surface plastic deformation. For the manufacture of batan teeth, a steel belt made of low-carbon steel 20 (GOST 2284-79) is used. The tape must have a clean, smooth surface and a roughness within the limits of R=0.63...1.25 microns. The contour and complex profile of the tooth are achieved on the die-cut using the operation of cold sheet stamping. Roughness along the contour of the tooth surface Ra=1.25 microns.

Nitrocementation of batan teeth is carried out in a gas environment, which consists of a mixture of kerosene or benzene vapors and ammonia for 2 hours in special furnaces C-35 and C-25 [4]. The parts are heated to a temperature of 840±10 0C (high-temperature nitrocementation), next, they are cooled in a spindle oil that has a temperature of 50...90 0C. After nitrocementation, quenching and low tempering at 160 are dehumidified...180 0C and kept at this temperature for 3-4 hours, the teeth are then removed from the furnace and

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cooled in air. The hardness is reached by HRC 58...62 at a saturation layer depth of 0.15...0.3 mm. For hardening of textile machinery parts, working in particularly difficult conditions, gas-nitrocementation is the most effective method of chemical and thermal treatment. Such types of processing, as cementation followed by quenching, they require heating the parts to high temperatures (920...950 0C) for 4 ... 24 hours [5], this causes significant deformation and the need for subsequent straightening and grinding. This complicates the manufacturing technology of parts and increases the marriage. Therefore, low-temperature (temperature below point A3) chemical-heat treatment processes are becoming increasingly common, providing hardening of the surface layer at temperatures below the temperatures of phase transformations, in particular, low-temperature gas nitrocementation. A reliable way to increase the resistance to bending and contact stresses is the combined hardening by chemical-thermal treatment followed by surface plastic deformation (PPD) treatment.), providing surface hardening (strain hardening) [6]. Surface hardening by the PPD method can be carried out in various ways: shot-blasting (shot-blasting) processing, running-in with a ball or roller, mandrel, centrifugal ball riveting, etc. Plastic deformation has a number of significant advantages over other methods of surface hardening, expressed in the simplicity of the tooling design, in the possibility of strengthening parts of almost any shape and size (low-rigid, shaped, thin-walled), in a significantly lower reduction in the impact strength of the material with an increase in fatigue strength compared to other processing methods. The last circumstance, first of all, due to the effect of residual compression stresses, formed as a result of the interaction of forces during the deformation of the surface layers of the metal with the underlying undeformed layers.

There is a positive experience of the introduction of shot-impact processing of cemented and cyanized parts in machine-building enterprises, as well as rolling rollers for cemented parts. There is not enough information about the effect of roller rolling on the fatigue and contact strength of cemented and nitrided steel, and experimental data on the effect of shot-casting are often contradictory. Practical information about the combined hardening of nitrocementation and riveting shot, although the effect of plastic deformation due to the formation of a hardened layer can significantly improve the performance of machine parts after pre-CTO. Thus, a significant increase in the fatigue strength of cemented steel was obtained during shot riveting [6] , and despite the change in roughness from Ra=0.16 microns to Ra=2.5 microns, the fatigue strength distribution as a result of shot riveting after grinding increased by 56 %. Based on the above and the experience of implementing shot-impact processing [7], for surface hardening of parts of cotton-processing machines, it is proposed to increase the wear resistance of the batan teeth of the STB loom by shot-blasting their working surfaces with a stream of micro-balls with a diameter of 0.4...0.6 mm, moving under the influence of compressed air. The basis of shot blasting is the plastic deformation of the surface layer of metal under the action of the kinetic energy of the shot flow. Processing quality (roughness of the treated surface, rivet depth, residual compression stresses) depends on the following technological factors: fraction size, speed, and consumption; duration of processing; angle of attack of the shot; distance of the treated surface from the point of departure of the shot; physical and mechanical properties of the processed material.

Considering the complex profile of the working surfaces of the batan teeth, shot processing must be carried out in a special device with protective elements, allowing to strengthen only the internal contact surfaces of the tooth. It should be noted that the steel shot (micro balls) provides better microgeometry of the treated surface. Shot blasting allows you to get a riveted layer with a depth of up to 1.5 mm, and the hardness, for example, normalized grade 20 steel increases by 40 %. The parameters of strain hardening (depth and degree of hardening) increase with increasing speed and fraction consumption per unit of the treated surface, its angle of attack and diameter. In the hardened layer, the compressive residual stresses can reach values up to 800 MPa, this has a positive effect on increasing the fatigue strength of parts under the action of alternating loads, and the high hardness of the surface layer increases its wear resistance.

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