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ANALYTICAL CALCULATION OF THE DEFORMATION STATE OF THE SAW GIN SAW TEETH BENDING UNDER THE ACTION OF A LOAD

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Abstract: The article developed a mathematical model of the technological process of heat treatment of saw teeth using a laser beam and recommended a modern and highly efficient technological process for processing saw teeth using a laser beam, which allows preserving the natural quality of products. As a result of the increased strength of the saw teeth using the new laser processing technology, the service life of saw blades has increased, the cost, productivity and efficiency of the saw cylinder has increased.

Keywords: with saw, cleanliness, grinding, release, technological process, residual deformation, geometric size, layer, hardness, durability, minimum heat, polished surface, solution exposure, cooling, cycle time, load, saw. tooth, equation, slope.

Introduction. One of the most common heat treatment methods is laser etching technology. The essence of the method we have chosen for this work is that a highly concentrated energy source - a laser beam as a source of local heat treatment (hardening) has high technological and technical and economic advantages over traditional bulk or thermal and chemical-thermal processing technologies.

When considering this method from a scientific point of view, laser equipment of surfaces eliminates the shortcomings of volumetric thermal equipment, chemical-thermal treatment and, at the same time, opens up new potential technological possibilities when equipping the surface layer of machine parts and mechanisms [1].

The current level of development of laser technology and technology considers the laser as a convenient, economical and reliable tool for thermal grinding of the surface layer of machine parts of a wide range.

The impact of a laser beam on the surface of steels leads to a comprehensive improvement in the physicochemical and mechanical properties of the surface layer, which manifests itself in a high dispersion and isotropy of the structure of the surface layer, increased microhardness, heat resistance, corrosion resistance, and abrasion resistance [2].

The advantages of laser resurfacing can be classified into technological, energy, operational and environmental types.

- The method of laser thermal clarification (hardening) has a number of technological advantages over traditional methods of heat treatment, which are manifested in the following properties [3]:
- it is not required to carry out the technological process of extracting after laser resurfacing;
- residual deformations will be minimal or absent at all;
- during laser polishing, the geometric dimensions of the part are kept within acceptable limits;
- the hardness of the exfoliating layer increases;
- increased resistance to abrasion;
- - the processed detail demands the minimum heating;
- locally affects the deposited surface;
- coolants are not required;
- easy to automate and robotize;
- the duration of the thermal annealing cycle is reduced.

Main part. An analysis of the operational state of the saw-demon teeth shows that the main criterion for their performance is the eroding strength. In this case, the main attention is paid to abrasive corrosion and mechanical corrosion in the form of plastic crushing [3].

When the saw teeth are connected to the raw roller during dismantling, a continuous load occurs on the border of their front surface from the end to the base. Intensive erosion of the teeth of the demon saw occurs during the decay of low-grade cotton raw materials containing, in addition to impurities, hard mineral particles of abrasive properties (corundum, granite, limestone), corroding and removing micro-dimensions at the junction of the surface layers of the tooth. With this interaction, the geometric parameters of the tooth change: its height decreases, an edible chamfer forms at the back, the tip of the tooth and the edges of the lateral surface become impenetrable (rounded). Such changes in the profile of the teeth decrease their gripping ability, which of course reduces the fecundity of the molt and increases the hairiness of the molt.

Crushing the plastic at the ends of the saw teeth prevents them from penetrating the raw bead and reduces the amount of fibers that can be plucked from the seeds.

Solution. The transformation of the tip of the tooth and its bending in the direction of rotation of the saw chisel can lead to a decrease in cutting efficiency at a high level due to a decrease in the technological gap between the teeth. The loss of such performance by a sawtooth tooth can occur due to insufficient rigidity of sawtooth materials, the presence of random solid foreign objects in cotton raw materials, as well as when processing low-grade dense and wet cotton materials.

Figure 1. Graph of tooth profile changes due to plastic bending and crushing

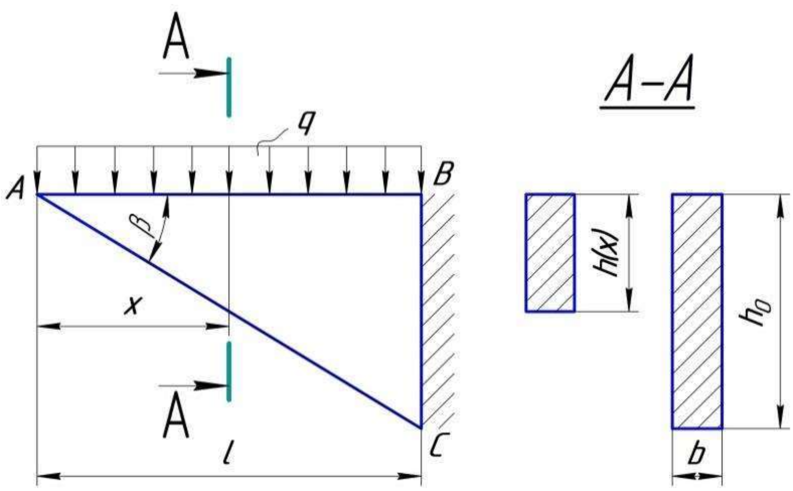

Figure 2. Cantilever hammer with length l, constant width b and variable height h(x), loaded with a uniformly distributed load q;

The initial inclination of the toothed end or its top can be considered as the bending of the cantilever hammer under the action of a variable shear force at the junction with the unfinished bead (Fig. 1). Although the nature of the load on the front surface of the tooth is uneven, in the first approximation, we assume that the tooth is loaded with a flat distributed load q (Fig. 2).

Therefore, the analytical assessment of the tooth bending under the influence of a technological load according to the given geometric parameters is of pronounced scientific and practical interest, since it allows you to calculate the amount of bending of the tooth tip (the tip of the cantilever hammer), determine the degree of influence of the tooth parameters and justify their values, which can subsequently be changed for increasing their curvature and resistance to plastic crushing.

The saw gin tooth b of constant width, h(x) of variable height VS trimming is taken in the form of a reinforced AV cantilever hammer (Fig. 2). The uniformly distributed load q is equal to the ratio of the total force acting on the apex VAS of the wedge to the length AV of the front surface of the tooth.

M0 is the bending moment, Let W0 be the modulus of the part VS to which the hammer is attached. The condition of equal resistance (equal strength) of this hammer to bending can be used by the following expression [4]:

$$\sigma_{max} = [\sigma]$$

$$\sigma_{max} = \frac{M_0}{W_0} \tag{1}$$

ere: [σ] – allowable normal bending stress, MPa.

If we take into account M (x), W (x) - respectively, the bending moment and the shear resistance moment at a distance x from the end of the hammer, then (1) Determine the expressions for the quantities included in the equation:

$$M(x) = \frac{qx^2}{2};\ W(x) = \frac{b[h(x)]}{6}$$

$$M_0 = \frac{ql^2}{2};\ W_0 = \frac{bh_0^2}{6}$$

we get

$$\frac{M(x)}{W(x)} = \frac{qx^2}{2}\cdot\frac{6}{b[h(x)]} = \frac{ql^2}{2}\cdot\frac{6}{bh_0^2} \tag{2}$$

From proportional ratio

$$\frac{h_0}{l} = \frac{h(x)}{x}$$

Output h(x)=h_0·x/l, or 〖h〗_0=l_0·tgβ, taking into account the law of cutting height change, we get:

$$h(x) = h_0\cdot\left(\frac{x}{h_0}\right)\cdot tg\beta, \tag{3}$$

In this case, the shear moment of inertia mn depends on the moment of inertia J0:

$$J(x) = J_0\left(\frac{x}{h_0}\cdot tg\beta\right)^3, \tag{4}$$

from the hammer equation with a bent axis [3]

$$EJ(x)\cdot\frac{d^2y}{dx^2} = -\frac{qx^2}{2} \tag{5}$$

(4) given the expression,

$$EJ_0\cdot\left(\frac{x}{h_0}\cdot tg\beta\right)^3\cdot\frac{d^2y}{dx^2} = -\frac{qx^2}{2},\ EJ_0\cdot y'' = -\frac{q}{2}\left(\frac{h_0}{tg\beta}\right)^3\cdot\frac{1}{x} \tag{6}$$

(6) integrating the differential equation on x, we obtain the following expression

$$EJ_0\cdot\frac{dy}{dx} = -\frac{q}{2}\left(\frac{h_0}{tg\beta}\right)^3 lnx + C_1,$$

here: S1 integration constant x=l=ho/tgβ, y´=0 is found from the initial condition when:

$$C_1 = \frac{q}{2}\left(\frac{h_0}{tg\beta}\right)^3 \cdot ln\left(\frac{h_0}{tg\beta}\right)$$

$$EJ_0\frac{dy}{dx} = -\frac{q}{2}\left(\frac{h_0}{tg\beta}\right)^3 \cdot lnx + \frac{q}{2}\left(\frac{h_0}{tg\beta}\right)^3 \cdot ln\left(\frac{h_0}{tg\beta}\right). \qquad (7)$$

(7) if we integrate the differential equation for the second time, it will look like this [5]:

$$EJ_0 \cdot y = -\frac{q}{2}(x \cdot lnx + \frac{q}{2}) \cdot \left(\frac{h_0}{t\beta}\right)^3 \cdot x + \frac{q}{2} \cdot \left(\frac{h_0}{tg\beta}\right)^3 \cdot ln\left(\frac{h_0}{tg\beta}\right) \cdot x + C_2.$$

S2 constant if x=l=ho/tgβ, from the initial condition we determine y=0:

$$C_2 = -\frac{q}{2}\left(\frac{h_0}{tg\beta}\right)^4.$$

So the bending equation will look like this.

$$EJ_0 \cdot y = -\frac{q}{2}\left(\frac{h_0}{tg\beta}\right)^3\left(x\ lnx - x - x\ ln\left(\frac{h_0}{tg\beta}\right) + \left(\frac{h_0}{tg\beta}\right)\right) \qquad (8)$$

The greatest bending of the considered hammer will be at a shift x = 0. To take this condition into account, it is necessary to reformulate the last product of expression (8):

$$x\ lnx - x\ ln\left(\frac{h_0}{tg\beta}\right) = x\ ln\left[\frac{x}{h_0/tg\beta}\right].$$

If x → 0, then the right side of the last equation tends to zero, that is:

$$\lim_{x\to 0}\left[x \cdot \ln\left[x/(h_0/tg\beta)\right]\right]=0.$$

Thus, the largest value of beam bending is:

$$y_{max}=-\frac{q}{2EJ_0}\left(\frac{h_0}{tg\beta}\right)^4. \qquad (9)$$

We evaluate the bending of the genie saw tooth under technological loads. Data for calculation: Ye = 2 105 N/mm2 – toughness modulus of steel; b = 0.95 mm is the thickness of the teeth; h0 = 1.5 mm - measurement of the height of the base of the tooth; β = 200 – tooth sharpening angle;

$J_0=(bh_0^2)/12$, mm4 - moment of inertia relative to the axis of the cutting edge corresponding to the base of the tooth; q=P/l – uniformly distributed load, N/mm; R is the total force acting on the tooth up to 6-10 N, l, mm is the length of the front surface of the tooth, equal to 3 mm.

Conclusion. The greatest bending of the tip of the genie saw teeth, calculated from theoretical calculations by equation (9), is 0.008 mm, which is more than 5 times the bending under the action of the total force applied to the end of the tooth. Thus, the technological load on the capture of free fibers by the front surface of the tooth leads to a slight bend in the direction opposite to the rotation of the saw during piercing.

The bending of the tooth tip can be caused by the intense impact of a dense raw bead on the back surface of the tooth, which leads to a greater inclination of the profile towards the direction of rotation. In this case, the front surface of the tooth is connected to the free fiber only when it enters the raw roller and breaks the fibers. Then the back surface actively interacts with the raw bead along the entire arc of engagement and is subjected to a long-term force in relation to the front surface of the tooth [6].

Changing the plastic shape of the toothed tip in the direction of rotation of the sawtooth cylinder can also cause a concentration of specific load in the erosion zone created by the raw roller on the back surface of the tooth.

The slope of the tooth profile can also be caused by its insufficient rigidity or uneven distribution in thickness due to decarburization of the surface layer during heat treatment of the surface layer of the structure.

Thus, the deflection of a variable-section cantilever gin beam saw tooth under the action of technological loads is estimated as the largest deviation in accordance with the axis equation. It is based on the fact that it is possible to avoid large deviations of the tooth profile, which reduce the efficiency of dismantling due to the introduction of mechanical reinforcement technology, which leads to deformation reinforcement (compaction) of the surface layer and the formation of residual compressive forces in it.

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ANALYSIS OF HEADWEAR AND BERET IN FASHION

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Abstract:

Objective. the purpose of the research is to improve the quality of the beret based on the analysis of women's headdresses, to make effective use of natural and seasonal fabrics.

Methods. in this article, the history of creation and development of European, American and Asian headdresses, as well as the changes and losses that occurred during this interval, were studied. Various types of headwear were studied, and their fabrics were tested and analyzed for their physical and mechanical properties. The design-project construction documents for the production of women's headwear from the optimal options of gauzes with high air and water permeability characteristics of knitwear, cloaks, artificial leather, seasonal fabrics are proposed.

Results. Weather conditions in the territory of Uzbekistan were analyzed and hair, scalp, skin diseases and symptoms caused by adverse weather were studied by medicine, taking into account hot and cold temperatures and negative health effects for women. It is planned to launch the production of comfortable and seasonal headgear that does not show secrets.

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