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Tempering of the Circular Saw of Fiber Separation Machines using a 5-Coordinate Laser Machine

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ABSTRACT: In this paper, the reasons for reducing the reliability and durability of the saw cylinder Assembly, the parameters of disc saws, technical characteristics and the control panel of the laser machine are given. Advantages and method of laser quenching of disc saw of fiber separation machines.

KEYWORDS: aser hardening, steel, circular saw, heat treatment, reliability, fiber separation, cotton, saw cylinder, laser machine, laser head.

I.INTRODUCTION

Production of saws used in cotton gins for processing raw cotton is widely used toothed circular saws with an outer diameter of 320 mm, internal-100 mm and a thickness of 0.95 mm [1-3]. The annual output of Genie disc saws for cotton gins reaches several million pieces (Fig.1). To increase durability, these products are subjected to heat treatment [4].

When hardening circular saws used volumetric and induction hardening (HDV). For the manufacture of these products, carbon tool steels U8G, 65G with a hardness of HRA 66-69 are used. Despite the increased hardness, the resistance of disc saws is insufficient. In this regard, every year for the manufacture of circular saws spent several hundred tons of very expensive steel U8G, 65G. Further increase in wear resistance due to the use of steel of higher hardness is not possible due to the difficulty of mechanical processing (cutting discs, notching teeth) [5].

Fig. 1. Circular saw of the saw cylinder Assembly

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The choice of hardening technology to achieve the required level of wear resistance, maintaining the flatness of disc saws during heat treatment and reducing their cost is not completely solved for our companies and at the same time a very difficult task [6].

Compact and high-precision 5-axis laser machine TruLaserCell 3008 (Fig.2) allows two-or three-dimensional welding and cutting from single parts to mass production. High accuracy of transmission and dynamics for small circuits due to stable beam conduction through a fiber-optic cable. In addition, using a machine for three-dimensional laser processing, you can perform laser surfacing.

The relevance of this laser machine for this work was its universal system, which demonstrates its superiority at all stages of work-from the manufacture of the prototype (in our case, Fig. 5, Fig.6) to large-scale production (in the future) with a high proportion of automated processes. Manufactured by the German company TRUMPF laser processing equipment has been tested by many years of experience in the industry both in Russia and abroad for conducting various technological processes confirms the use of TRUMPF lasers in industry as the most stable and highly reliable, with a significant service life of at least 50,000 hours. [7]

Technical characteristics of TruLaserCell 3008:

Max. laser power-4000 W

The new standard for repeat accuracy is < 5 microns.

The working area is 3000 mm x 1500

X/Y axis movement-1000 x 500 mm x 500 mm

The movement in the Z-axis - 400 mm 400 mm

The pulse duration of the CW laser is 150 W 10 m/s

Pulsed lasers-for LLK 01: 500 W 0.1 m/s

for LLK 02: 560w 0.08 m/s

for LLK 04: 500W 0.4 m/s

for LLK 06: 500W 0.5 m/s

Max. speed when moving simultaneously-140 m/min

Max. the thickness of the structural steel - 20 mm

Max. thickness of stainless steel-15 mm

Max. thickness of aluminum-10 mm

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Fig.2. 5-coordinate laser processing center TRUMPF TruLaserCell 3008 LMD.

The TruLaserCell 3008 uses a simple intuitive interface developed by TRUMPF based on the Siemens 840D solutionline (Fig. 3). When cutting, you can use the cutting parameters stored in the control system and optimized by TRUMPF for the most common types of laser and materials of different types and thicknesses.

Fig. 3. TRUMPF interface based on Siemens 840D solution line.

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The machine is equipped with high-dynamic direct linear drives and a fiber-optic laser head (Fig.3). They provide fast and accurate positioning and virtually wear-free. Additional advantage: thanks to the cantilever design, designed to use up to four axes (X, Y, Z and B) directly in the beam, the laser machine can be easily automated for the production of large volumes of products.

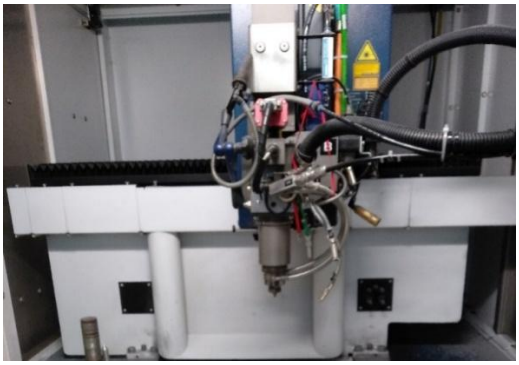

Fig. 4. Linear drive with optical fiber laser head.

The TruLaserCell 3008 is equipped with a unique optical system for automatically adjusting the diameter and focus position. There is no need to replace optical devices. Depending on the processing task - deep or heat — conducting welding, cutting materials of different thickness or laser surfacing-the program automatically changes the image scale.

A direct absolute measuring system with an optical ruler allows you to measure the positioning of the x/y axis. For the Z axis, a measuring system with a rotor position sensor is built into the motor. Additional analysis of the axis position is carried out using absolute value sensors. A reference cycle is not required when the control system is started.

In the two-section mode with a change of direction of rotation, you can simultaneously perform the production cycle and equipment of the machine. This is most appropriate when the production volume is high. In addition, the loading and unloading position makes it easier to manipulate parts. The TruLaserCell 3008 has optimal access from the side. This also makes it easy and convenient to integrate the machine into complex production lines that include systems for linear transport and change of workpieces.

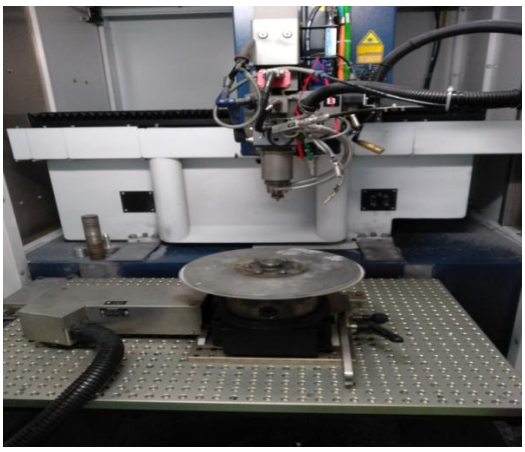

Fig. 5. Preparation and installation of a circular saw for laser quenching.

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Laser hardening on this machine was carried out at the MSTU "STANKIN" landfill. In order to choose the most suitable tempering mode, we selected 10 samples of circular saw processed according to different modes, variable power, height and speed of processing with a continuous flow of the beam itself.

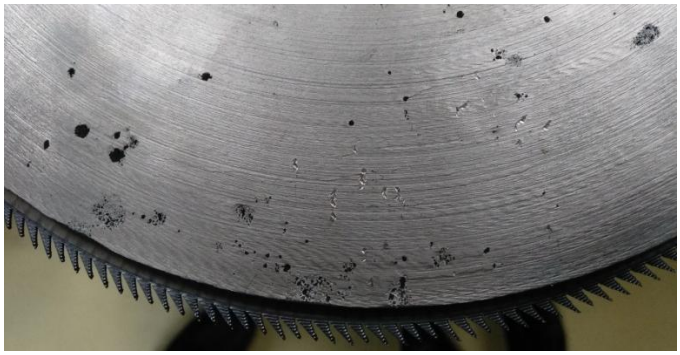

Fig. 6. Circular saw after laser quenching.

II. CONCLUSION.

1. A new method of hardening the surfaces of laser quenching teeth of saw blades of fiber separation machines has been developed;
2. A rational method of laser hardening of the teeth of a gin circular saw with variable parameters of the hardening mode is theoretically determined.
3. The use of the described methods of hardening treatment allows to significantly increase the hardness of the saw teeth of the saw cylinder Assembly of the fiber separation machine, while maintaining a high hardness in the thickness of the saw blade itself, which will dramatically increase its resistance at an important stage of primary processing of cotton.
4. Studies have shown that the performance of saw blades with hardened teeth exceeds the resistance of non-hardened laser saws by 2-2. 5 times, which significantly reduces the time of fiber separation machine. Consequently, this reduces the cost of changing sets of circular saws and reduces the consumption of material for their manufacture.

REFERENCES

1. N.Urinov, M.Saidova, A.Abrorov, N.Kalandarov. Technology of ion-plasma nitriding of the teeth of the saws of the saw cylinder node. // International Journal of Advanced Research in Science, Engineering and Technology. India,Vol. 6, Issue 5 , May 2019 p.p. 9117-9121.
2. N.Urinov, M.Saidova, A.Abrorov, N.Kalandarov. A device for measuring seed sizes of raw cotton and the calculated values of microradios edges of the teeth of circular saws. // ISSN: 2350-0328 International Journal of Advanced Research in Science, Engineering and Technology. India,Vol. 6, Issue 5 , May 2019 p.p. 9056-9060.
3. Information of the State Committee of the Republic of Uzbekistan on statistics for 2012-2017
4. GOST 1413-48. Cotton gin machines. Saws for gins and linters.
5. Akhmedkhodjaev H. T., Umarov A. A., "Technology and equipment of the industry" lecture notes, Namangan, 2015.
6. Babadzhanov M. A. "Technology and equipment of primary processing of cotton" (PART-I). Educational and methodological guide for the study of the course. Titlp, 2012.
7. User manual for TrumpfTruLaser Cell 3000. www.mytrumpf.com/training/en.