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## NamMTI ILMIY-TEXNIKA JURNALI TAHRIR HAY'ATI A'ZOLARI

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# BASIS OF IMPLEMENTATION OF RESOURCE-EFFECTIVE SHAFT PRODUCTION

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**Abstract:** Increasing energy efficiency in the cotton industry is one of the pressing issues. This article presents the results of research aimed at reducing energy consumption during the operation of a cotton 5LP linter machine. The issues of creating and refining methods for calculating high-performance machine drives and shafts are of particular importance in creating machines for the cotton ginning industry. The article shows that the task of reducing the mass of the main working body of the linter, the sawn cylinder shaft, was performed by grooving and slotting, and the design features of the resource-saving shaft are determined.

**Keywords:** Linter, sawn cylinder, shaft, raw material shaft, cooling, mass reduction, shear, structural features, bending stiffness.

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**Introduction.** In a market economy, manufacturing enterprises, in their activities to improve and introduce new techniques and technologies into production, focus on creating innovations with characteristics required by the market [1-2]. In practice, the production activities of the enterprise should be fully oriented to market requirements in terms of understanding the "image" of the product and the consumer's willingness to purchase it. In this regard, effective conditions for ready-made innovative developments in machine-building and similar production (cotton ginning) enterprises are an important condition for the development and introduction of new types of products. This requires continuous communication between manufacturers and scientists (researchers) to identify the need to improve certain characteristics of basic technologies.

In particular, the number of failures encountered by manufacturers in introducing new products to the market, both in mechanical engineering and cotton ginning enterprises, is due to the fact that these products were developed and created based on emerging needs, rather than on new knowledge gained by manufacturers through the introduction of scientific and technological advances.

It should be noted that the analysis of the potential for introducing newly created machines and parts into the enterprise should be planned at the development stage, based on both expert and mathematical assessment methods. After identifying potential technical ideas, the enterprise should be able to distinguish those that are not promising from a production point of view. The initial selection should include testing the ideas for their production and compliance with production requirements.

In this process, it is necessary to determine the production strategy of devices based on the potential for further implementation. The economic analysis of innovative products should be carried out methodically in the following stages:

- forecasting the costs associated with the implementation and commissioning of machines and parts;
- assessment of the scope of efficiency (technological, economic).
- profit forecast;
- taking into account uncertainty and factors related to implementation.

This means that the assessment of the prospects for the implementation and operation of innovative products allows for the effective operation, timely replacement of the device or its parts, and the planning of the introduction of modified products from the product range. This reduces instability and increases flexibility in the production process, including in optimizing the use of machine parts [3-4].

In particular, the introduction of the new design of the linter machine saw shaft proposed in the research work into production is also a responsible process of the research.

The resource-saving shaft design was introduced into the 5LP linter machine operating at the Turakurgan cotton ginning enterprise (Figure 1).

The purpose of introducing the new shaft was to study its error-free operation in the production process in a resource-saving mode. The tests conducted on the linter machine were carried out based on the 5-fold re-run method [5], the results were recorded in tables.

During the initial tests, no failures or malfunctions were observed in the linter machine, and the testing was carried out using established methods together with the company's specialists.



**Figure 1.** Shaft-mounted linter machine and saw drum

The theoretical and practical results obtained in the previous chapters were also substantiated by the tests carried out on the resource-saving shaft installed in the linter machine operating in the technological process of the enterprise. The results obtained in the production tests of the resource-saving shaft installed in the process are given in a comparative manner compared to the existing shaft (Table 1).

**Table 1.** Results of production tests

T/r	Indicators	Unit of measurement	Indicator quantity	
			There is	Improved
1.	Productivity on fluff	kg/hour	80	80-82
2.	Seed productivity	kg/hour	2000 until	2100 until
3.	Amount of fluff separation (total)	%	6-8	6-8
4.	Seed damage	%	2,5	2,1
5.	Required power including	kW	30,6	26,6
	- saw cylinder		18,5	14,5
	- feeder and feeder		11,0	11,0
6.	- lifting mechanism		1,1	1,1
	Saw diameter	mm	310	310
7.	Saw drum shaft dimensions			
	- length	mm	2200	2200
	- diameter		100	100
	- weight		110	87

During the production tests, the rational parameters determined for the bending position were checked, taking into account the fact that the mass of the proposed shaft (Figure 2) was reduced. It was found that as a result of reducing the mass of the proposed linter saw cylinder shaft, the energy consumption required for shaft rotation decreased (Table 1), and this and the reduction in material consumption for shaft manufacturing also indicated that the main goal of the research work was achieved.



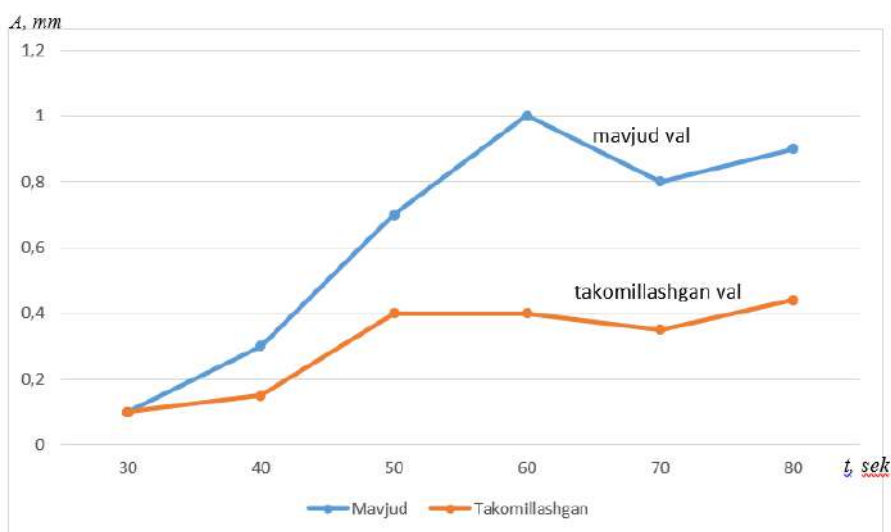
**Figure 2.** Experimental copy of a resource-saving shaft

As is known, the results obtained in any scientific research work should serve to improve production conditions and facilitate human labor. In addition, the innovative

developments or improved working details created must be compatible with production conditions and ensure uninterrupted operation of machines and equipment. Therefore, the machine with a resource-saving shaft developed in the research work and the parameters set for it were thoroughly tested in the conditions of the enterprise.

It was determined during production tests that the shaft part with a new improved design bends within the permissible amplitude and therefore does not exceed the strength limit. As a result of the reduction in the mass of the shaft, the vibration state decreased by 1.3 percent (usually this value exceeds 0.9 mm).

In the production of a resource-efficient shaft, the state of strength (resistance to bending) was studied separately.



**Figure 3.** Diagram of the shaft vibration state over time

The vibration state of the shaft introduced in the research work was also checked in production conditions (Figure 3). When a simple shaft in a previously operating linter machine was studied, it was found that the vibration amplitude during the operation of the machine exceeded 0.9 mm. However, in a linter machine with an improved shaft, it was found that the shaft vibration did not exceed 0.4 mm and that its stability was ensured during its operation.

Taking into account the above, the reduction in the mass of the shaft ensures its bending within the permissible limits, and as a result, the machine's ability to operate smoothly increases.

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