AMERICAN JOURNAL OF MULTIDISCIPLINARY BULLETIN
ISSN: 2996-511X (online) | ResearchBib (IF) = 9.512 IMPACT FACTOR
Volume-3| Issue-6| 2025 Published: |30-06-2025|

IMPROVING PRODUCT QUALITY INDICATORS IN THE SEPARATION OF FIBER FROM SEED COTTON

https://doi.org/10.5281/zenodo.15723647

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Annotation

Based on the needs of the cotton ginning industry, the practical significance of the research results was implemented. As a result, it was determined that by adjusting the speed of the toothed cylinder in accordance with the change in the tooth profile of the toothed cylinder, the labor productivity by fiber and the staple length of the fiber increased, and the mass share of defects and impurities in the fiber decreased, which brings high economic efficiency to cotton ginning plants.

Keywords

toothed cylinder, tooth, speed, diameter, staple length, defects and impurities.

In recent years, comprehensive measures are being implemented in our country to develop the textile and sewing-knitwear industry, and to support the investment and export activities of sector enterprises. At the same time, the intensification of competition in world markets and the reduction of costs by foreign manufacturers through the production of mixed-type products necessitate additional measures for the development of this sector.

Comprehensive measures are being implemented in our country to develop the cotton growing sector, modernize and technically re-equip cotton ginning enterprises, increase the profitability of production and processing of cotton raw materials, as well as enhance the competitiveness of the products being manufactured.

Low product quality from producers and the continued use of outdated toothed cylinder (ginning) models remain critical issues for the US cotton industry. As a result of years of research and experimentation, efforts have been directed towards increasing the labor productivity, improving, and fully automating the toothed cylinder machine.

American cotton industry machines for fiber separation are equipped with toothed cylinders (gins) featuring a large number of teeth made from strong,

durable materials. These cylinders have 305 teeth and a diameter of 400-450 mm. Another advantage is the increased step and size of the teeth, which ensures maximum ability to grab fibers. For example, the Lummus Imperial III Hullerless 170 model ginning machine has 170 teeth, a cylinder rotation speed of 850 rpm, a feed roller speed of 504 rpm, and a productivity of 15 bales per hour. Specialists conducting research in the US have developed a special heat treatment method to increase tooth strength by reducing the number of teeth on the ginning machine (i.e., increasing the step width) while maintaining the tooth profile.

S. Aslam and N. Soomro investigated the effect of the working cylinder speed of a toothed gin on the density of the feed roller. Their experiments were conducted on a MNH-93 toothed gin stand with a diameter of 305 mm. It was reported that when the toothed cylinder speed was increased from 300 m/s to 800 m/s, the staple length of the cotton fiber remained unchanged and productivity increased.

The problems concerning the creation of a resource-saving technology for controlling the speed of the toothed cylinder in a ginning machine, as required, including in accordance with the tooth profile, which allows preserving the natural properties of the cotton, have not been sufficiently studied.

The teeth of the toothed cylinder perform the main task during the ginning process. Its structure, the quality of processing of its working surface, as well as the sharpness and completeness of the teeth, are of great importance. The main task for the toothed cylinder teeth during the ginning process is to grab the fibers to the maximum extent and fill its surface area between the teeth.

Based on the analysis of existing research on toothed gin cylinder speeds, a rational direction for improving the process of adjusting the toothed cylinder speed in relation to the changing diameter of the cylinder has been identified, using new devices and systems for controlling technological processes. This relates to the connection between the cylinder diameter and the toothed cylinder speed with the machine's labor productivity and the quality indicators of the fiber.

Experiments were conducted on the DPP-30 laboratory stand at the "Textile Fiber Engineering" department laboratory of the Namangan Institute of Textile Industry (Figure 1) to determine the machine's labor productivity by fiber, the staple length of the fiber, and the mass fraction of defects and impurities in the fiber, with changes in the toothed cylinder tooth profile and speed. Tests were carried out on hand-harvested cotton of the And-35 selection variety, the I-industrial variety, with a moisture content of 8.3% and a contamination level of 0.34%. The tests were conducted in three replications, and the results were entered into Table 1.

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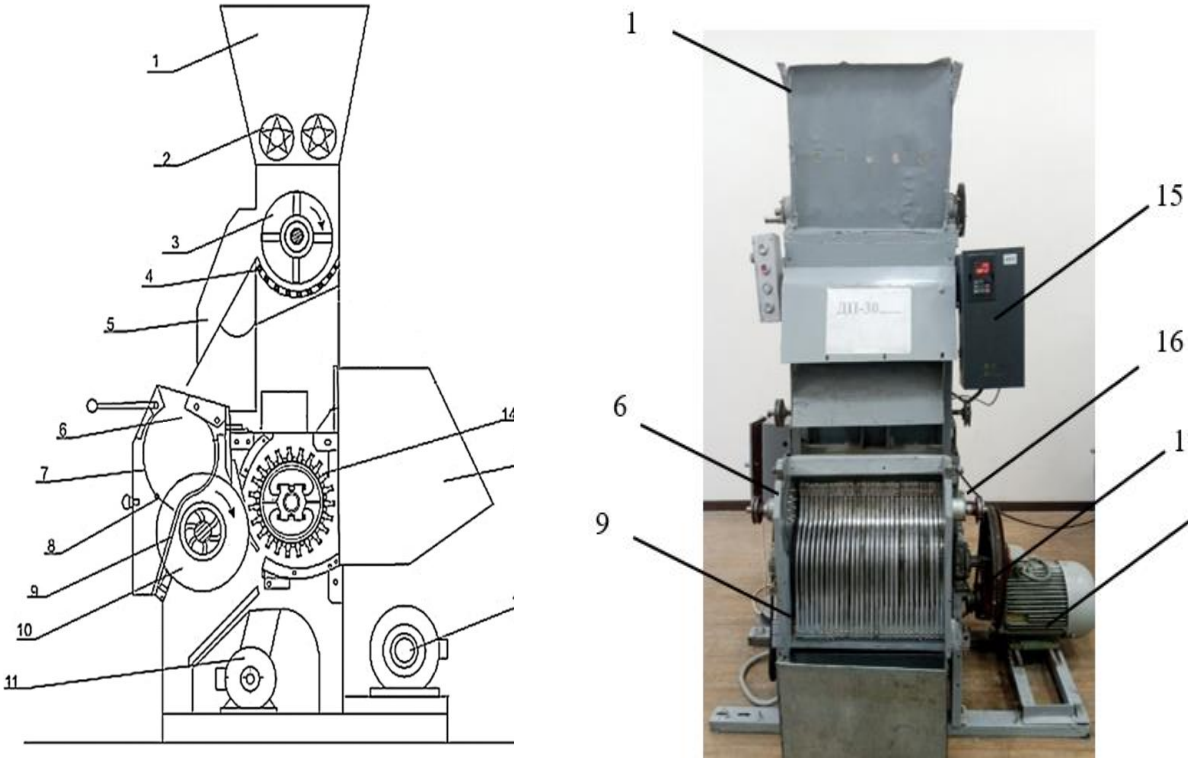

Figure 1. DPP-30 type experimental stand.

1 – hopper, *2* – feeding rollers, *3* – troughed drum, *4* – mesh surface,
5 – chute, *6* – working chamber, *7* – skirt, *8* – seed separator, *9* – apron,
10 – toothed cylinder, *11* – motor (for rotating the brush drum)
12 – motor (for rotating the toothed cylinder), *14* – brush drum,
15 – frequency converter, *16* – driving pulley, *17* – driven pulley.

Frequency control ensures the automated startup of the motor, allows for its smooth start without initial resistance, and enables regulation of the current within the required range. This makes it possible to reduce the number of errors generated during startup and increases the overall system productivity. The same applies to reversing and stopping [4].

The labor productivity of the toothed gin machine depends on the tooth profile and the speed of the toothed cylinder. Therefore, from our side, we proposed adjusting the rotational speed accordingly to maintain the linear speed of the cylinder as its tooth profile changes. This condition is achieved by regulating the motor speed through a frequency converter. A technical solution based on adjusting the rotational speed via a frequency converter, while maintaining the linear speed of the cylinder, was proposed to ensure process labor productivity or product quality.

The effect of toothed cylinder speed and tooth profile changes on the products exiting the toothed gin machine

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Speed of toothed cylinder, rpm	*Experiment №*	Machine productivity by fibe $П_{тола}$, kg tooth/*h;*	Fiber staple length L, *mm;*	Mass fraction of defects and impurities in the fiber $И$, *%;*
600	*1*	*2,2*	*31,9*	*1,3*
	2	*2,1*	*32,1*	*1,4*
	3	*2,7*	*31,9*	*1,6*
Average		***2,3***	***32***	***1,4***
750	*1*	*3,21*	*32,2*	*1,8*
	2	*2,76*	*31,6*	*1,5*
	3	*2,75*	*31,8*	*1,6*
Average		***2,9***	***31,5***	***1,6***
900	*1*	*3,04*	*31,33*	*1,8*
	2	*2,97*	*31,24*	*1,6*
	3	*3,08*	*31,4*	*1,9*
Average		***3,03***	***31,3***	***1,8***

From the above, it is clear that the process of fiber separation is largely dependent on the tooth profile and speed of the toothed cylinder in the machine, affecting the machine's fiber productivity, the staple length of the fiber, the mass fraction of defects and impurities in the fiber, and the quality of the products manufactured in them.

Based on the multi-factor regression model developed as a result of the experiment to study the relationship between the machine's productivity and the fiber staple length with the toothed cylinder diameter and speed on the DPP-30 ginning machine, a law was determined: as the tooth profile and speed of the toothed cylinder increase, the machine's productivity increases, while the quality of the fiber decreases.

REFERENCES:

1. “Paxta-to‘qimachilik klasterlari faoliyatini qo‘llab-quvvatlash, to‘qimachilik va tikuv-trikotaj sanoatini tubdan isloh qilish hamda sohaning eksport salohiyatini yanada oshirish chora-tadbirlari to‘g’risida”. O‘zbekiston Respublikasi Prezidentining Farmoni, 10.01.2023 yildagi PF-2-son

2. Hughs S.E., Valco T.D., Williford J.R. 100 Years of Cotton Production, Harvesting, and Ginning System Engineering: 1907-2007. https://elibrary.asabe.org/abstract.asp/25234.

3. S. Aslam, N. Soomro "Submissions of Saw Gin Speed on the Quality of Cotton" Sindh University Research Journal (Science Series) Vol 47, No 1, 25-28 (2015).

4. К.И.Ортиқова Аррали жинлаш технологияси самарадорлигини ошириш. Техника фанлари бўйича фалсафа доктори (PhD) диссертатсия. Наманган. 2021 й.

5.Olimjon Sarimsaqov, Bahodir Obilov, Shahboz Isayev, Ibrohim Muhsinov, Maftuna Inamova Theoretical study of the process of contaminants from raw cotton moving on the surface of the grate "Problems in teha textile and light industry in the context of integration of science and industry and ways to solve them"(PTLICISIWS-2022) International conference PTLICISIWS-2022.Scopus webof science indexed.