# SCIENTIFIC JUSTIFICATION OF THE FRICTION-REDUCTION CONCEPT THROUGH CONTROLLED HEATING OF THE SAW-GIN WORKING CHAMBER

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**Abstract.** This thesis provides a scientific justification, based on a review of the literature, for the idea of reducing friction between the seed-cotton roller and the inner metal surfaces of the saw-gin working-chamber front apron and front beam through controlled heating. A comparative analysis of existing constructive and technological solutions showed that reducing friction specifically through controlling the temperature regime of the working-chamber surfaces has not been sufficiently studied. Based on the identified research gap, a conceptual approach linking the thermal state, friction coefficient, electric load and process productivity is proposed at the

theoretical level; its experimental verification is planned for the subsequent stage of the research.

**Keywords:** saw-gin machine, working chamber, friction coefficient, surface temperature, controlled heating, electric load, energy efficiency.

**Introduction.** In the global cotton industry, saw-gin machines are the principal technological equipment used to separate raw cotton into fiber and seed. The constant contact of the seed-cotton roller with the inner metal surfaces of the front apron and front beam within the working chamber determines the energy characteristics of the ginning process. The friction forces that arise in this contact zone not only increase the load on the saw-cylinder drive motor but also significantly reduce the machine's productivity. Reducing friction losses on the working-chamber inner surfaces has been studied for many years as one of the pressing directions in cotton-cleaning engineering.

**Literature review.** Studies by J. Ergashev demonstrated the possibility of increasing fiber-separation efficiency by directing an additional air flow into the working chamber. Fundamental research by R.G. Makhkamov theoretically established the surface cleanliness of the working-chamber walls and raw-cotton moisture as the main factors affecting the friction coefficient, although the friction reduction achieved was based mainly on passive methods. O. Maksudov proposed a constructive solution for shaping an optimal working-chamber profile, but its constructive complexity limited its wide industrial adoption. Research by S.Z. Yunusov experimentally confirmed a reduction in friction force through partial heating of only the front-apron section of the working chamber, but the effect of comprehensive heating that also covers the front-beam surface, and its description within a mathematical model, has not been sufficiently studied.

**Comparative analysis of existing solutions for reducing friction in the working chamber** ***Table 1***

| Solution / author | Main principle | Limitation |
|---|---|---|
| Air-flow effect (J. Ergashev) | Enhancing fiber detachment via additional air injection | Does not directly address the source of friction |
| Passive surface treatment (R.G. Makhkamov) | Optimizing surface roughness and material | Does not eliminate the effect of moisture |
| Optimal chamber profile (O. Maksudov) | Forced rotation using additional rollers | Constructively complex |
| Partial heating of the front apron (S.Z. Yunusov) | Heating only the front-apron surface | Front beam not accounted for; no mathematical model |

Table 1 shows that none of the existing solutions describes the thermal state of the working-chamber surfaces, the friction coefficient, the drive-motor load and process productivity as a single mathematical system.

**Proposed conceptual approach.** To address the identified research gap, the following working hypothesis is advanced, based on the idea of jointly and controllably heating the working-chamber front-apron and front-beam surfaces: the amount of heat supplied to the chamber surface increases the surface temperature; the rise in surface temperature is expected to reduce the effective moisture in the contact zone, leading to a decrease in the friction coefficient ($\mu = f(T, W)$, where $\mu$ decreases as $T$ increases and increases as $W$

increases); the decrease in the friction coefficient may, in turn, be associated with a reduction in the drive-motor current load and an increase in process productivity.

It should be emphasized that these relationships are currently expressed only in qualitative terms (as directional trends); their precise quantitative form and coefficients have not been experimentally determined. Practical verification of the proposed approach — namely, measuring the real values of the friction coefficient, current load and productivity at various surface temperatures, and comparatively evaluating it against existing (unheated and partially heated) designs — is planned for the subsequent, experimental, stage of the research.

**Conclusion.** The literature review conducted on reducing friction on the saw-gin working-chamber front-apron and front-beam surfaces through controlled heating established that the question of reducing friction by controlling the temperature regime of the working-chamber surfaces — in particular, the combined effect of heating the front apron and front beam together — has not been sufficiently studied.

Based on the identified research gap, a conceptual approach linking the thermal state, friction coefficient, electric load and process productivity was proposed. This approach and its coefficients are currently theoretical in nature and have not been confirmed by any experimental results. The next stage of the research plans to test the proposed approach on an experimental test bench and to determine it quantitatively using real measurement data. Nevertheless, the analysis conducted can serve as a scientific and methodological basis for planning further theoretical-experimental research on improving the saw-gin working chamber.

**REFERENCES**

1. Ergashev Zh.S. Improving saw-ginning technology to increase quantitative and qualitative indicators. Candidate (PhD) dissertation. — Tashkent, 1991.

2. Makhkamov R.G. Fundamentals of the interaction process between machine working elements and raw cotton and fiber. — Tashkent: Fan, 1989. — 160 p.

3. Yunusov S.Z. Development of efficient designs and improvement of the scientific foundations for calculating the parameters of saw-gin working elements and mechanisms. Doctoral (DSc) dissertation. — Tashkent, 2017.

4. Maksudov O. et al. Ways of reducing electricity consumption in saw ginning // Cotton Industry. — 1975. — No. 4. — P. 15.

5. Sharipov J.Q. Scientific and technical solutions for improving the new design of the saw-gin working chamber: PhD dissertation.

Namangan, 2026.