



ISSN 2181-8622

Manufacturing technology problems



Scientific and Technical Journal

Namangan Institute of

Engineering and Technology

INDEX COPERNICUS
INTERNATIONAL

Volume 10
Issue 2
2025



INCREASE PRODUCTION VOLUME BY REGENERATION OF COTTON

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Abstract: Cotton fiber is one of the main products of the textile industry in the world. Research work is carried out aimed at delivering raw cotton to processing processes while preserving its natural parameters and developing new scientific and technical solutions for resource-saving technologies and technical means. In this regard, priority is given to research on the technology of preliminary processing of cotton, cleaning cotton from small and large impurities, efficient organization of cotton processing, and the development of energy-saving technologies. At the same time, special attention is paid to the development of technical solutions that eliminate problems and increase the efficiency of all technological processes.

Keywords: regeneration, cotton, seeds, fiber, fly, production volume, saw drum, knife, grate, gap, result.

Introduction. In many leading research centers and universities of the developed textile industry of the world, a number of scientific studies have been conducted on the development and improvement of technology for cleaning raw cotton from various impurities. As a result of these studies, significant scientific achievements have been achieved: A series of scientific studies on cleaning cotton fiber from small and large impurities were carried out at the Southwest Cotton Cleaning Laboratory, the Australian Cotton Research Corporation, the National Research Center for Cotton Processing and Technology, and the Brazilian Agricultural Research Corporation, and as a result, effective technologies for cleaning cotton from waste were created.

Main part. Previously, the working parts of the device used in the process of cleaning raw cotton from large impurities were analyzed. Development of design drawings and construction of a new device for extracting cotton particles from the composition of impurities. The working parts of this device are the same as the working parts of the regenerator device, and before developing new working parts of the regenerator device, the movement of the cotton flow under the action of the saw drum and the grate placed under it was studied.

According to the conducted research, the main working parts of the device when extracting lumps of raw cotton from waste of existing regenerative machines are the saw drum, knives and grate, and their location, shape and interaction with each other have significant differences, affecting the cleaning efficiency. In the devices used, the grate shape has the form of a cylinder with a diameter. During the operation of the device, in the process of separating lumps of raw cotton from the composition of waste, cutting lumps of raw cotton from waste mixed with lumps of raw cotton without interruption depends on the geometric shape of the grates and the location of the blades. Taking into account the movement of waste mixed with cotton particles under the influence of a saw drum and factors affecting it, the working bodies of a new design of the regenerator device are proposed, the movement of cotton particles in it and the processes of separation and their removal from the waste were theoretically analyzed (Fig. 1).

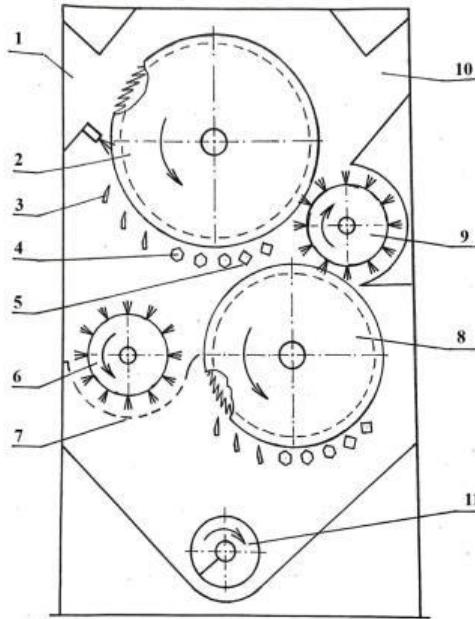


Fig.1. Technological scheme of the improved cotton regenerator

1-waste inlet shaft, 2-saw drum, 3-knife, 4-hexagonal grate, 5-four-sided grate, 6-brush drum, 7-mesh surface, 8-saw drum, 9-brush drum, 10- impurity outlet, 11-screw drum.

To determine the kinetic energy of a cotton ball with a mass of m , the equation of motion in time can be derived from equation (1) and it is equal to:

$$T = \frac{m}{2} (\dot{x}^2 + \dot{y}^2) = \frac{m}{r} (R^2 \omega^2 + r^2 + r^2 \omega^2 + 2R\omega r \sin \alpha - 2R\omega^2 r \cos \alpha) \quad (2)$$

Using the Lagrange type II equation, the partial derivative is obtained from equation (2):

$$\frac{d}{dt} \left(\frac{\partial T}{\partial \dot{r}} \right) - \frac{\partial T}{\partial r} = Q_r \quad (3)$$

(3) The generalized forces of external forces acting on the flow of cotton particles on the surface of the saw teeth of the saw drum are determined from the equation, and general and partial solutions of the inhomogeneous equation are calculated.

$$m\ddot{r} = m\omega^2(r - R \cos \alpha) + Q_r \quad (4)$$

Here: Q_r – The generalized force is found by the following formula:

$$Q_r = \sum X_i \frac{\partial x}{\partial r} + \sum Y_i \frac{\partial y}{\partial r} \quad (5)$$

X_i , Y_i – OX and OY the projection of the external forces on the axis is as follows:

$Y_i = mg \sin(\alpha - \omega t)$ $X_i = 0$ Let's make an equation for the relationship between the weight of a cotton ball, the friction force by mass and the Coriolis force.

$$F_{TP} = -f \cdot m \cdot g \cos(\alpha - \omega \cdot t) + f \cdot F_{\text{before}} \quad (6)$$

Here, the Coriolis force occurs when the de lint separates from the sawtooth.

$$F_{\text{before}} = -2 \cdot \omega_e \cdot \dot{r}_r \cdot \sin \alpha \quad (7)$$

Here, the angle is α - the angular relationship between the relative speed of the saw and P - the force of gravity acting on the cotton ball, and λ - the angle of the surface of the saw tooth is shown in Figure 3.

$$P = S \cdot p \sin \lambda \quad (8)$$

Here, S is the contact surface of a lump of raw cotton with a tooth, and λ is the angle between gravity and the surface of the saw tooth.

$$\lambda = \arcsin \frac{R \sin \alpha}{\sqrt{R^2 + h_0^2 - 2Rh_0 \cos \alpha}} \quad (9)$$

With this in mind, the overall bond strength of the delint to the tooth is determined by the following formula:

$$Q_r = mg \sin(\alpha - \omega t) + fmg \cos(\alpha - \omega t) + 2mfr\omega \cos \alpha + P \sin \lambda, \quad \left(\frac{\pi}{2} < \alpha < \pi\right) \quad (10)$$

The experimental results showed that the dynamic load of the technological load of the regenerator grate rod was calculated as the load passing through the radial direction of the saw drum. The results of processing experimental studies show that the technological force is distributed along the length of the grate groove.

$$q_1 = \int S \cdot \sin \frac{\pi x}{L} \frac{dx}{dl} \quad (11)$$

according to the law of forced vibration, the grate rod with a vibration load will look like this.

$$q(x) \sin \theta t \quad (12)$$

According to the law, in the first approach, we will consider a grate rod of a new geometric shape in the form of a uniformly distributed beam supported by five supports. The equation of motion is not taken into account when composing the equations: due to the small impact loads of the rod perpendicular to the radial direction, the influence of vibration of other arrows of the grate, as well as the loads of the rod in the axial direction. Imagine the unaccounted-for amounts mentioned above in the form of an uncut beam on a support. For dynamic calculation, we will take this beam as a single-span, without taking into account all intermediate supports that are statically undefined, and replace them with a force acting on the beam with an unknown reaction force.

The stiffness of the supports at points A and E is equal to each other and is defined as the reverse fluidity of those installed at these points. The stiffness of the intermediate supports C 2, C 3 at points B, C, D is defined as the yield strength and stiffness of the beam itself. To formulate the differential equation of forced beam vibration under oscillating load, we differentiate the equation of the curved beam axis twice:

$$EY \frac{\partial^4 y}{\partial x^4} + m \frac{\partial^2 y}{\partial x^2} + \Sigma P_k = q(x) \sin \theta t \quad (13)$$

Here u – moving the impact part;

$m \frac{\partial^2 y}{\partial x^2}$ – acceleration of the upward forces of inertia;

$\Sigma P_k = R_A + R_B + R_C + R_D + R_E$ - the force of resistance to upward movement;

$q(x) \sin \theta t$ - an oscillating load that creates a forced vibration of the grate.

θ - angular frequency

$EY = \text{const}$ - thus, the grate is homogeneous and has the same cross-section along its entire length.

It is known that the free vibration of the beam decays over time, while only forced vibration occurs in a fixed mode, therefore, the free end of the beam is not taken into account in equation (13).

The partial solution of the equation will have the following form:

$$Y_{\text{often}}(X, T) = (X) \sin(\theta t)$$

If you substitute it into the original equation, it will look like this:

$$Y_4^{IV}(X) - S^4 \cdot y(X) = \frac{q(X)}{EY} \quad (14)$$

Here, $S^4 = \frac{m\theta^2}{EY}$ the general solution of the equation will look like this:

$$Y_{\text{comm}}(X) = Q \cdot A_{sx} + b \cdot B_{sx} + c \cdot C_{sx} + d \cdot D_{sx}$$

Here,

$A_{sx}, B_{sx}, C_{sx}, D_{sx}$ It is determined by the recommended method, which affects the function. is a particular solution of the equation if $q(x)$ is not polynomial

$$Y_{\text{often}}(X) = \frac{q(X)}{S^4 EY}$$

Then the general solution of the equation (the complete integral) will have the following form:

$$(X) = Y_{\text{comm}}(X) + Y_{\text{often}}(X) = Q \cdot A_{sx} + b \cdot B_{sx} + c \cdot C_{sx} + d \cdot D_{sx} + \frac{q(X)}{S^4 EY} \quad (15)$$

where a, b, c, d are determined by successive differentiation of equation (15) using the initial conditions:

$$y(0); y'(0); M(0) = EJy''(0); Q(0) = EJy'''(0)$$

CONCLUSIONS

1. The effect of the saw drum, which is the main working part of the regeneration device, and the grate structures placed on its axis on the efficiency of the device has been studied.
2. The movement of raw cotton and various impurities in the inlet and working chambers of the regenerator device, the forces acting on them, and their effect on the geometric cleaning efficiency were determined by analyzing the actual working organs of the regenerator device.
3. The main working organs of the device are a saw drum, knives and a multi-faceted grate, while it was found that their location, shape and interaction with each other affect the cleaning efficiency.
4. As a result of processing experimental studies, it was possible to determine the technological force distributed along the length of the grate rod, the vibration load and the forced vibrations of the rod.

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CONTENTS

TECHNICAL SCIENCES: COTTON, TEXTILE AND LIGHT INDUSTRY

Kadirov K., Xoldorov B., To'xtashev A.	3
Analysis of power quality indicators in light industry enterprises	
Monnopalov J., Kayumov J., Maksudov N.	
Evaluation of deformation properties of highly elastic knitted fabrics in sportswear design	15
Nazarova M., Musayeva G., Mirzarakimova S.	22
Study of clothing quality control and analysis	
Abdullayev R.	
Theoretical basis of technological parameters of the new pneumo-mechanical gin machine	28
Bakhritdinov B.	33
Increase production volume by regeneration of cotton	
Otamirzayev A.	38
Measures to dangermine during the initial processing of cotton	
Kamolova M., Abdulkarimova M., Maksudov Sh.	42
Measures to dangermine during the initial processing of cotton	
Shogofurov Sh., Jurabayev N., Xolikov K.	
Analysis of the technology of obtaining knitted fabrics with patterns and their physical and mechanical properties	55
Jurabayev N., Shogofurov Sh., Yusupov S.	
Study of the physical and mechanical properties of hosiery products made from bamboo yarn	64

TECHNICAL SCIENCES: AGRICULTURE AND FOOD TECHNOLOGIES

Nasriddinov B., Serkaev Q., Yo'lchiev A.	70
Effect of solvent compositions on oil indicators in cotton oil extraction	
Yulchiev A., Yuldashev Sh.	79
Economic efficiency in the production of cream-perfumed soap	
Ikromova Y., Ikromov F., Khamdamov A., Xudayberdiyev A.	85
Modeling of primary distillation process of vegetable oil micella	
Ismailov M., Adashev B.	
Prevention of external flood formation on the surface of heat exchanger pipes	92

CHEMICAL SCIENCES

Tajibayeva N., Ergashev O.	
Nanofibers based on chitosan and synthetic polymers: a review of properties and applications	99

Kuchkarova D., Soliyev M., Ergashev O.

Quantitative determination of adsorption activity of adsorbents obtained on the basis of cotton stalk and cotton boll **104**

Abdullaxanova G., Ergashev O.

Differential heat and entropy of adsorption of methanethiol in sodalite **112**

Paygamova M., Khamzakhojayev A., Ochilov A., Paygamov R.

Physicochemical properties of carbon adsorbents derived from renewable biomass **121**

Kochkarova R.

Use of electron spectra in determining the coordination number of central atoms of complex compounds based on Ni(II) and Co(II) ions **131**

Yusupova M., Mamadjonova M., Egamberdiev S., Abduvohidov I.

Study of the conditions for the aminolysis of secondary polycarbonate **136**

Ikramova G., Askarova O., Siddikov D., Karimov A., Botirov E.

Chemical components of perovskia kudrjashevii **142**

Kaxarova M., Soliyev M.

Types of plant growth regulators and their application in agriculture **147**

Juraboev F.

Investigation of the synthesis of acetylene amino alcohols and the study of their biological activity **151**

Salikhanova D., Usmonova Z.

Thermal activation of plums **155**

Kadirxanov J., Urinov A.

Development of composite materials for corrosion protection of main gas and oil pipelines with increased chemical adhesion **160**

Sotiboldiev B.

Synthesis of hybrid composites of polysaccharides based on methyltrimethoxysilane **167**

Jumayeva D., Nomonova Z.

Chemical characterization of raw materials used for adsorbent production **174**

Muratova M.

Method for producing a fire retardant agent with nitric acid solutions of various concentrations **183**

Shamuratova M., Abdikamalova A., Eshmetov I.

Physicochemical properties and results of sem analysis of soils in the regions of Karakalpakstan **192**

Dadakhanova G., Soliev M., Nurmonov S.

Composition of oil products and methods of separation of individual substances **199**

Hoshimov F., Bektemirov A., Ergashev O.**206**

Effectiveness of the drug "Akaragold 72%" against cotton spider mites

Abdirashidov D., Turaev Kh., Tajiiev P.Analysis of the physicochemical properties of polyvinyl chloride and the **213**
importance of mineral fillers in increasing its fire resistance

TECHNICAL SCIENCES: MECHANICS AND MECHANICAL ENGINEERING

Makhmudjonov M., Muminov Kh., Tilavkhanova L.**219**

Classification and analysis of level measurement methods

Mukhammadjanov M.Digital modeling of the heat transfer process in oil power transformers in **226**
operation

Mukhtorov D.Investigation of drying efficiency in a solar installation with composite **230**
polyethylene film depending on the product thickness

Tursunov A., Shodmanov J.Advancing sustainable environmental strategies in the cotton industry **239**
through dust emission reduction

Saidov O.Event-driven process orchestration in e-governance: modeling **247**
asynchronous integration patterns

Obidov A., Mamajanov Sh.Organization of scientific and research processes based on information and **252**
digital technologies in higher education

Turdaliyev V., Akbarov A., Toychieva M.Theoretical study of the vibration of chain networks **259**

Abdusattarov B., Xamidov S.Modeling the process of separating cotton particles from air in the working **265**
chamber of a cotton gin

Toirov O., Amirov S., Khalikov S.Diagnostics of the condition of elements of electric power supply substation **272**

ADVANCED PEDAGOGICAL TECHNOLOGIES IN EDUCATION

Mukhtorov D., Jamoldinov K.**281**Development and improvement of drying technologies in a solar dryer

Uzokov F.Graphical solution of systems of equations in two-and three-dimensional **291**
spaces using MS excel



ECONOMICAL SCIENCES

Yuldashev K., Kodirov X.

Financing of pre-school educational institutions based on public-private partnerships and their results **299**

Boltaboev D.

Specific aspects of labor resource management in different countries **304**