

ISSN 2181-8622

Manufacturing technology problems



Scientific and Technical Journal Namangan Institute of Engineering and Technology

INDEX  COPERNICUS
I N T E R N A T I O N A L

**Volume 9
Issue 4
2024**



THE EQUATION OF MOTION OF COTTON FIBER IN THE CONDENSER

GANIKHANOV KHUSANKHON

Doctoral student of Tashkent Institute of Textile and Light Industry, Tashkent, Uzbekistan
Phone.: (0897) 707-9144, E-mail.: ganikhanovxusan@mail.ru

MAVLYANOV AYBEK

Professor of Tashkent Institute of Textile and Light Industry, Tashkent, Uzbekistan
Phone.: (0888) 008-8201, E-mail.: mavloniy82@mail.ru

ABDUSAMATOV ALISHER

Assistant of Tashkent Institute of Textile and Light Industry, Tashkent, Uzbekistan
Phone.: (0893) 411-9126, E-mail.: abdusamatov.alisher@inbox.ru

MIRZAUMIDOV ASILBEK

Associate professor of Namangan Institute of Engineering and Technology, Namangan, Uzbekistan
Phone.: (0850) 100-0088, E-mail.: abdusamatov.alisher@inbox.ru
Corresponding author.

Abstract: This article is discussed the equation of motion of cotton fiber in the condenser, describing the motion of a fiber in a condenser, equations can be used that take into account the forces acting on the fiber, as well as the characteristics of the airflow and the interaction of the fiber with the surface of the condenser, calculating the value of the cross-sectional area, showed the dependence of the distance traveled by the fiber on the time in the condenser at the specified parameters.

Keywords: cotton, separation, condenser, motion of fiber, main forces.

Introduction. The fiber condenser is an important element in the process of the cotton gin industry. Its main function is to condense and remove short fibers, fine debris and dust from cotton fiber to improve the quality of the final product.

The fiber condenser plays an important role in ensuring the quality of cotton fiber and the efficiency of its further processing, which makes it an indispensable element in the cotton gin industry [1-5].

To describe the motion of a fiber in a condenser, equations can be used that take into account the forces acting on the fiber, as well as the characteristics of the airflow and the interaction of the fiber with the surface of the condenser.

The condenser is used to separate the cotton fiber from the air, as well as to thicken the dissolved fiber mass and feed it into the press box. Condensers are also the simplest fiber cleaning machines, since part of the fine litter, dust and short fiber is released through their mesh drums with exhaust air.

There are a large number of different designs of condensers, but all have the same principle of operation and consist of a mesh drum, sealing and exhaust rollers. The fiber is removed from the mesh drum of the condensers by special removable rollers or under the action of centrifugal force.

Fiber condensers of the 5KV (8KV) grade operating in the cotton gin industry (Fig.1.) do not meet the requirements both in terms of performance and from the point of view of safety. When combined with jeans of the 5DP-130 brand, due to the discrepancy in their performance, frequent fiber slaughtering occurs. Since the introduction of condensers in cotton mills, dozens of fatal accidents have occurred when operators tried to eliminate slaughters.

High-speed capacitors have a number of significant disadvantages, which include:

- high aerodynamic drag;
- fiber ignition;
- unevenness of the outgoing canvas;
- frequent slaughtering;
- unsatisfactory service conditions leading to accidents.

Low-speed capacitors do not have the above disadvantages. They improve the quality of fiber and lint, and give a uniform canvas density.

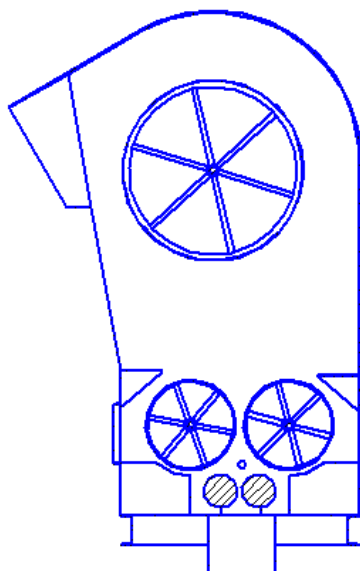


Fig.1. Cross section of the 5KV fiber condenser

We have developed an improved model of a new high-efficiency, safe fiber condenser with low-speed working bodies that ensure stable operation and low energy consumption. Compared to the current 5KV (8KV), it is characterized by simplicity of design and maintenance, small dimensions, low cost and reliability [6].

This installation (Fig.2.) consists of a housing 1 in which a mesh drum 2 is mounted, relative to which a movable sealing roller 3 and a fixed removable roller 4 are placed at a certain angle and gaps, mounted in a carriage 5, under which the unloading shaft 6 is located.

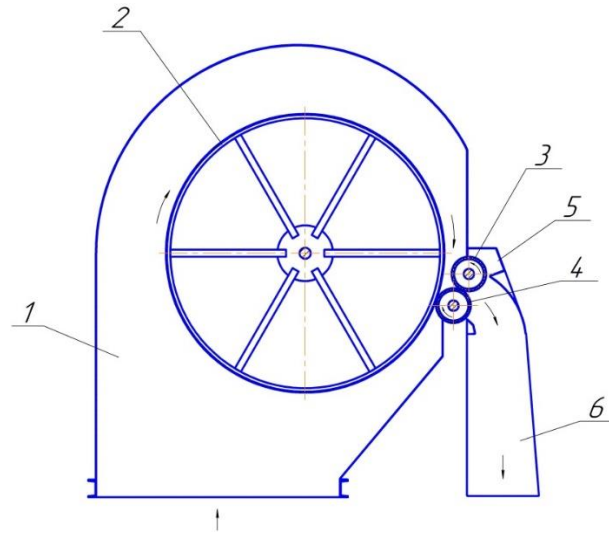


Fig.2. The technological scheme of the condenser

The housing is a welded metal structure providing dynamic rigidity of the entire installation. The mesh drum consists of a rigid frame and a mesh wrapped around the outer diameter. The sealing and removable rollers are grooved cylinders rotating relative to each other.

Due to the possibility of replacing the mesh of the mesh drum with a corresponding change in speed and aerodynamic modes, the condenser becomes universal, which ensures its smooth operation, both for fiber and lint. The performance of the proposed condenser will be at least 6 t/h in fiber and at least 1 t/h in lint.

Technical documentation is currently being developed and calculations have begun for the production of a prototype of a new condenser.

Methods. Let's consider the main forces acting on the fiber:

1. Gravity (mg): directed downward.
2. Aerodynamic force (F_d): directed in the direction of air movement.
3. Friction force (F_f): depends on the contact of the fiber with the surface of the drum.

In this case, the equation of motion of the fiber can be described using Newton's second law:

$$m \frac{d^2 r}{dt^2} = F_g + F_d + F_f$$

where:

m — mass of the fiber,

r — position of the fiber in space,

F_g — gravity, $F_g = mg$,

F_d — aerodynamic force,

F_f — friction force.

The aerodynamic force is determined by the equation:

$$F_d = \frac{1}{2} \rho v^2 C_d A$$

where:

ρ – air density,

v – the air flow velocity relative to the fiber,

C_d – coefficient of aerodynamic drag,

A – projection of the fiber area onto the flow direction.

The friction force depends on the normal force, which, in turn, can be related to aerodynamic and gravitational forces:

$$F_f = \mu N$$

where:

μ – coefficient of friction,

N – normal force.

When considering movement along the axis of the drum (for example, the x axis), the equation of motion can be simplified to a one-dimensional form:

$$m \frac{d^2 x}{dt^2} = mg \sin(\theta) + \frac{1}{2} \rho v^2 C_d A - \mu N$$

where:

θ – the angle of inclination of the condenser surface relative to the horizontal.

Given that the angle of inclination of the condenser surface θ is zero, the friction force μN will be zero. Also, we can assume that $N = mg$, since the normal force is equal to gravity in this case.

Results. Now we can write down the equation of motion of the fiber in a simplified form:

$$m \frac{d^2 x}{dt^2} = \frac{1}{2} \rho v^2 C_d A$$

Substituting known values:

$m = 1,5$ kg (with a condenser capacity of 5.4 t/h),

$g = 9.81$ m/s² (acceleration of gravity),

$\rho = 1.225$ kg/m³ (air density under normal conditions),

$v = 13.6$ m/s (air flow rate),

$C_d = 2,15$ (coefficient of aerodynamic drag)

Results. We can roughly calculate the value of the cross-sectional area A using the formula:

$$A = \frac{m}{\rho v^2 C_d} = \frac{1.5}{1.225 * 13.6^2 * 2.15} = 0.42 \text{ m}^2$$

Now let's substitute this value into the equation of motion of the fiber:

$$1,5 \frac{d^2 x}{dt^2} = \frac{1}{2} * 1,225 * 13,6^2 * 2,15 * 0,042$$

$$\frac{d^2 x}{dt^2} = 126,96 \text{ m/s}^2$$

This will give us an acceleration of the fiber movement in the condenser.

Integrating this time acceleration twice, we get:

$$\iint \frac{d^2 x}{dt^2} dt dt = \iint 126.96^2 dt dt$$

$$\int \frac{dx}{dt} dt = 126.96t + C_1$$

$$\frac{dx}{dt} = 126.96t + C_1$$

$$\int dx = \int (126.96t + C_1) dt$$

$$x = 63.48t^2 + C_1t + C_2$$

where C_1 and C_2 are the constant integrations that we need to define. To determine the constants C_1 and C_2 , it is necessary to know the initial conditions of the fiber movement, for example, the initial velocity and position. If the initial velocity is $v_0 = 0$ (the fiber starts moving at rest), then $C_1 = 0$. Also, if the initial position is $x_0 = 0$ (the fiber starts moving from the zero coordinate), then $C_2 = 0$.

From these, a scheme for calculating the equation of motion (Fig. 3, b) was constructed using Carioles, elasticity, tensile and compressive forces in the condenser working zone (Fig. 1, a).

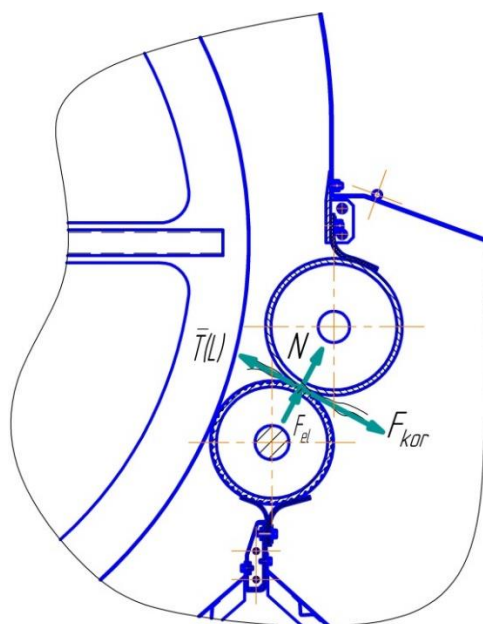


Fig. 3. Calculation scheme of the equation of motion of the fiber condenser

Discussion. Thus, the final equation of motion of the fiber will have the form:

$$x=63.48t^2$$

This equation shows the dependence of the distance traveled by the fiber on the time in the condenser at the specified parameters.

Conclusion. The equation of motion of a fiber in a condenser involves balancing gravity, aerodynamic forces, and friction. To accurately simulate this motion, it is necessary to take into account the geometry of the condenser, the properties of the airflow and the physical characteristics of the fiber.

References

1. Мирошниченко Г.И. Основы проектирования машин первичной обработки хлопка. М.: Машиностроение. 1972.
2. Салимов А.М., Лугачев А.Е., Ходжиев М.Т. Технология первичной обработки хлопка. "Адабиёт учқунлари". Ташкент. 2018.- С. – 112-115.

3. Лозинский И.Б., Пономаренко Д.И., Третьяков М.С. Модернизация конденсора волокна ЗКВ. //Хлопковая промышленность. №1-1977.
4. Абдусаматов, А. А., & Мавлянов, А. П. (2023). Результаты производственных испытаний усовершенствованного пыльного диска волоконочистителя. *European Journal of Interdisciplinary Research and Development*, 15, 351-353.
5. Патент ПНР №115870. Конденсор / Woźnmk Jerzy, Loszkowicz Bogusław, Bagiński Jan, Skoworoński Kazimierz, Janczak Antoni // Wiadomości Urzędu Patentowego Październik – 1982, №10.
6. Хайдарова, Н. О. К., Ганиханов, Х. Ш. У., & Мавлянов, А. П. (2022). Новая конструкция конденсора волокна. In *Молодежь и XXI век-2022* (pp. 354-356).

CONTENTS

PRIMARY PROCESSING OF COTTON, TEXTILE AND LIGHT INDUSTRY

Korabayev Sh.	3
From street traffic to space: innovations in autonomous vehicles	
Egamov N.	10
Investigation of vertical forced vibration in the longitudinal - vertical plane of a binder that softens the crush between cotton rows	
Khamraeva S., Kadirova D., Davlatov B.	15
Determination of alternative technological factors for the production of functional fabric with a complex structure	
Khamraeva S., Kadirova D., Daminov A.	21
Designing fabrics for a given stretchability	
Kuliyev T., Rozmetov R., Tuychiev T., Sharipov Kh.	28
The effect of the angle of heat agent supply to the drying - cleaning equipment on cotton quality and cleaning efficiency of the equipment	
Abdujabbarov M., Alieva D., Karimov R.	35
Determination of the influence of the length of the tested yarn samples on their mechanical characteristics	
Jurayeva M., Nabidjonova N.	41
Research on physical and mechanical properties of fabric selected for special clothing of preschool children	
Yangiboev R., Allakulov B., Gulmirzayeva S.	45
Studying the alternative technological factors of the loom in the production of textiles based on basalt yarn	
Ganikhanov Kh., Mavlyanov A., Abdusamatov A., Mirzaumidov A.	55
Analysis of the maintechnologicalparameters of the condenser	
Mavlyanov A., Mirzaumidov A.	60
The scientific basis of the lightened shaft	
Elmanov A., Mirzaumidov A.	69
Modeling of laser processingof thin-walled steel gears	
Nurillaeva Kh., Mirzaumidov A.	77
Cotton cleaner with multifaceted grates	
Ganikhanov Kh., Mavlyanov A., Abdusamatov A., Mirzaumidov A.	83
The equation of motion of cotton fiber in the condenser	
Khuramova Kh., Xoshimxojaev M.	89
Progressive method of cotton regeneration	

Abdulkarimova M., Lutfullaev R., Usmanova N., Mahsudov Sh.	94
Evaluation of aestheticity of women's dress models based on deep learning models	

GROWING, STORAGE, PROCESSING AND AGRICULTURAL PRODUCTS AND FOOD TECHNOLOGIES

Zufarov O., Isroilova Sh., Yulchiev A., Serkayev K.	101
Theoretical aspects of obtaining oxidation-stable vegetable oils	
Toshboyeva S., Dadamirzaev M.	110
Filling sauces for canned fish and their layer kinetics	
Atamirzaeva S., Saribaeva D., Kayumova A.	115
Prospects for the use of rose hips in food technology	
Turgunpolatova Sh.	121
Study of the quality of fruit pastela products	
Sultanov S.	126
Analysis of experiments on the process of deodorization of vegetable oil using floating nozzles	
Adashev B.	132
Physical-chemical analysis of oil taken from seeds of safflower	
Ismailov M.	137
Influence of surface layer thickness on hydraulic resistance of the device	
Khurmamatov A., Boyturayev S., Shomansurov F.	142
Detailed analysis of the physicochemical characteristics of distillate fractions	
Madaminova Z., Khamdamov A., Xudayberdiyev A.	154
Preparing peach seed for oil extraction and improving oil extraction through pressing	
Aripova K.	162
Methods of concentration of fruit juices and their analysis	
Djuraev Kh., Urinov Sh.	168
Theoretical and experimental study of the crack formation device in the shell of apricot kernels	

CHEMICAL TECHNOLOGIES

Urinboeva M., Abdikamalova A., Ergashev O., Eshmetov I., Ismadiyarov A.	175
Study of the composition and main characteristics of petroleum oils and their emulsions	
Tursunqulov J., Kutlimurotova N.	182
Application of 1-(2-hydroxy-1-naphthoazo)-2-naphthol-4-sulfo acid in amperometric determination of scandium ion	
Kucharov A.	191

Development of coal enrichment and gas extraction technology for the use of construction materials industrial enterprises	
Abdulkhaev T., Mukhammadjonov M., Mirzarakhimova F.	
Isotherm of benzene adsorption and differential heat of adsorption on AgZSM-5 zeolite	198
Vladimir L., Eshbaeva U., M.Ergashev	
Innovative environmental packaging for separating storage of two components, allowing to extend the lifetime without preservatives	204
Kodirov O., Ergashev O.	
Energetics of adsorption of water molecules to aerosol	212
Yusupov K., Erkabaev F., Ergashev D., Rakhimov U., Numonov M.	
Synthesis of melamine-formaldehyde resins modified with n-butanol	219
Ergashev O., Abdikamalova A., Bakhronov Kh., Askarova D., Xudoyberdiyev N., Mekhmonkhonov M., Xolikov K.	
Thermodynamics of Congo red dye adsorption processes on mineral and carbon adsorbents	228
Ergashev O., Maxmudov I.	
Water vapor adsorption isotherm in zeolites regenerated by microwave thermoxidation method	235
Jumaeva D., Zaripbaev K., Maxmudov F.	
The elements and oxide content of the chemical composition of the feldspar	242
MECHANICS AND ENGINEERING	
Khudoyberdiev U., Izzatillaev J.	
Analysis of research on small wind energy devices	249
Atajonova S.	
Mathematical model of system analysis of technological processes in the form of key principles for effective decision-making	258
Kuchkarbayev R.	
Mathematical modeling of heat transfer through single-layer and multi-layer cylindrical walls in buildings and structures	264
Atambaev D.	
Difference in the length of individual yarn composition of twisted mixed yarn and comparative analysis of single-thread elongation deformations	269
Abdullayev S.	
Modeling the functionalities of an automated system for managing movement in the air	276
Turakulov A.	
Describing computational domains in applications for solving three-dimensional problems of technological processes	285
Mamaxonov A.	

Mathematical model of machine aggregate of tillage equipment process	293
Khudayberdiyev A.	
Technical and economic aspects of processing pyrolysis distillate into motor fuel	304
Abdurahmonov J.	
Research results on the selection of the mesh surface of a lint-cleaning device	311
Vohidov M.	
Development of a program for determining eccentricity by analyzing the magnetic field in the air gap of an asynchronous motor	319
Utaev S., Turaev A.	
Analysis of methods and prospects for application of optical methods for control of working surfaces of cylinder liners of internal combustion engines	327
Boltabayev B.	
Determination of seed damage in the pneumatic transport system by conducting experiments	335
Azizov Sh., Usmanov O.	
Simulation of equation of motion of the new construction gin machine	339
Sharibaev N., Homidov K.	
Theoretical analysis of the coefficient of friction induced by the pressure force of a vertical rope acting from above and below	347
Aliyev B., Shamshidinov M.	
Improvement of the linter machine and development of its working scheme	356
Mukhametshina E.	
Analysis of cotton flow behavior in different pneumatic pipes	362
Yangiboev R., Allakulov B.	
Obtaining and analyzing correlational mathematical models of the sizing process	369
Mirzakarimov M.	
Efficient separation of fibers from saw teeth in the newly designed gin machine	379
Azambayev M.	
Measures to improve the quality of fluff	387
Abdullayev R.	
Scientific innovative development of cotton gining	392
Kholmiraev F.	
Air flow control factors in pneumatic transport device	397
Sharibaev N., Makhmudov A.	
Separation of cotton from airflow in pneumatic transport systems of the cotton industry	404
Sharibaev N., Mirzabaev B.	

Effect of steam temperature on yarn moisture regulation in textile industry **410**

Sultanov S., Salomova M., Mamatkulov O.

Increasing the useful surface of the mesh surface **415**

Muhammedova M.

Kinematics of the foot in a healthy person's foot and ankle injury **421**

ADVANCED PEDAGOGICAL TECHNOLOGIES IN EDUCATION

Abdullayev H.

Algorithm for creating structured diagrams of automatic control systems **429**

Kodirov D., Ikromjonova N.

On delayed technological objects and their characteristics **437**

Uzokov F.

Graphing circles, parabolas, and hyperbolas using second-order linear equations in excel **444**

ECONOMICAL SCIENCES

Zulfikarova D.

Issues of developing women's entrepreneurship **449**

Ergashev U., Djurabaev O.

Methods for assessing the effectiveness of waste recycling business activities in the environmental sector **455**
