ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
Vol. 5, Issue 12, December 2018

Perfection of Designs and Theoretical Bases of Calculating Roller Tubes for Yarning

Korabayev Sherzod Ahmadjonovich, Djurayev Anvar Djurayevich, Matismailov Saypila Lolashbayevich

Researcher, "Technology of products of textile industry" department, Namangan Institute of Engineering and Technology, Kasansay 7str., Namangan, Uzbekistan 160115
Professor, Engineering science and Service department, Tashkent Institute of Textile and Light Industry, 5 Shohjohon str., Yakkasaray District, Tashkent, 100100, Uzbekistan
Docent, "Spinning technology" department, Tashkent Institute of Textile and Light Industry, 5 Shohjohon str., Yakkasaray District, Tashkent, 100100, Uzbekistan

ABSTRACT: The article presents the scheme and principle of operation of an effective tube design for pulling the yarn in a spinning device. To determine the law of motion of a ceramic roller, equations of motion for a roller were obtained. From the obtained formulas, it is possible to calculate the acceptable movements of the ceramic roller of the exhaust tube. The recommended tube design for spinning yarn spinning device allows the increase of the strength characteristics of the resulting pneumatic yarn.

KEYWORDS: yarn, pneumospinning, funnel, guide sleeve, tube, inclined riffle, ceramic roller, rotation, torsion, amplitude, coefficient.

I. INTRODUCTION

It is known that a device for removing the yarn from the spinning chamber for pneumatic spinning, containing a funnel installed coaxially with the spinning chamber and a guide sleeve placed in the side wall of the funnel, the axis of which is perpendicular to the funnel axis and displaced relative to the funnel axis in cross section along the sleeve axis so that tangent to the inner surface of the sleeve at the point of contact with her yarn in the cross section of the funnel perpendicular to the axis of the sleeve and is located along the direction of the angle of elevation of the yarn turns. The device spreads the actual twist of yarn into the chamber due to the introduction of a portion of the end surface of the sleeve into the screw groove on the yarn formed when the fibers are twisted and the twist formed into the yarn formation zone [1]. However, this design does not allow to achieve high torsion efficiency and, as a result, a noticeable reduction in breakage.

To eliminate these drawbacks, a tube for spinning the spinning device yarn was recommended, which contains the first and second sections of tubes rigidly interconnected by means of a connecting corner, which is equipped with a ceramic insert with inclined grooves on the working surface, the first section of pipe is connected to the spinning chamber [2]. The disadvantage of this design tube for pulling the yarn in the spinning device is excessive braking of the yarn when in contact with the inclined corrugated surface of the ceramic insert, as well as one-sided mixing of the yarn in the transverse direction due to the fixed inclined flute of the working surface of the insert, which lead to additional elongation of the yarn and reduce its torsion.

II. METHODOLOGY

In order to improve the strength characteristics of the yarn, the design of the tube for spinning the spinning device yarn has been improved.

During operation, the spinning unit yarn 3 through the tubular sections 1 and 2 is pulled out to the outside. In the transition zone of the tubular sections 1 and 2, the yarn 3 contacts the inclined grooves 8 of the ceramic roller 5, which will rotate around the axis 7. Due to the rotation of the ceramic roller 6, the resistance from it to the pulling yarn 3 will be smaller, which virtually eliminates additional elongation of the deformation yarn 3. In addition, due to the inclined flute 8 during the rotation of the roller 6 is an effective torsion of yarn 3 (Fig. 1).

ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
Vol. 5, Issue 12, December 2018

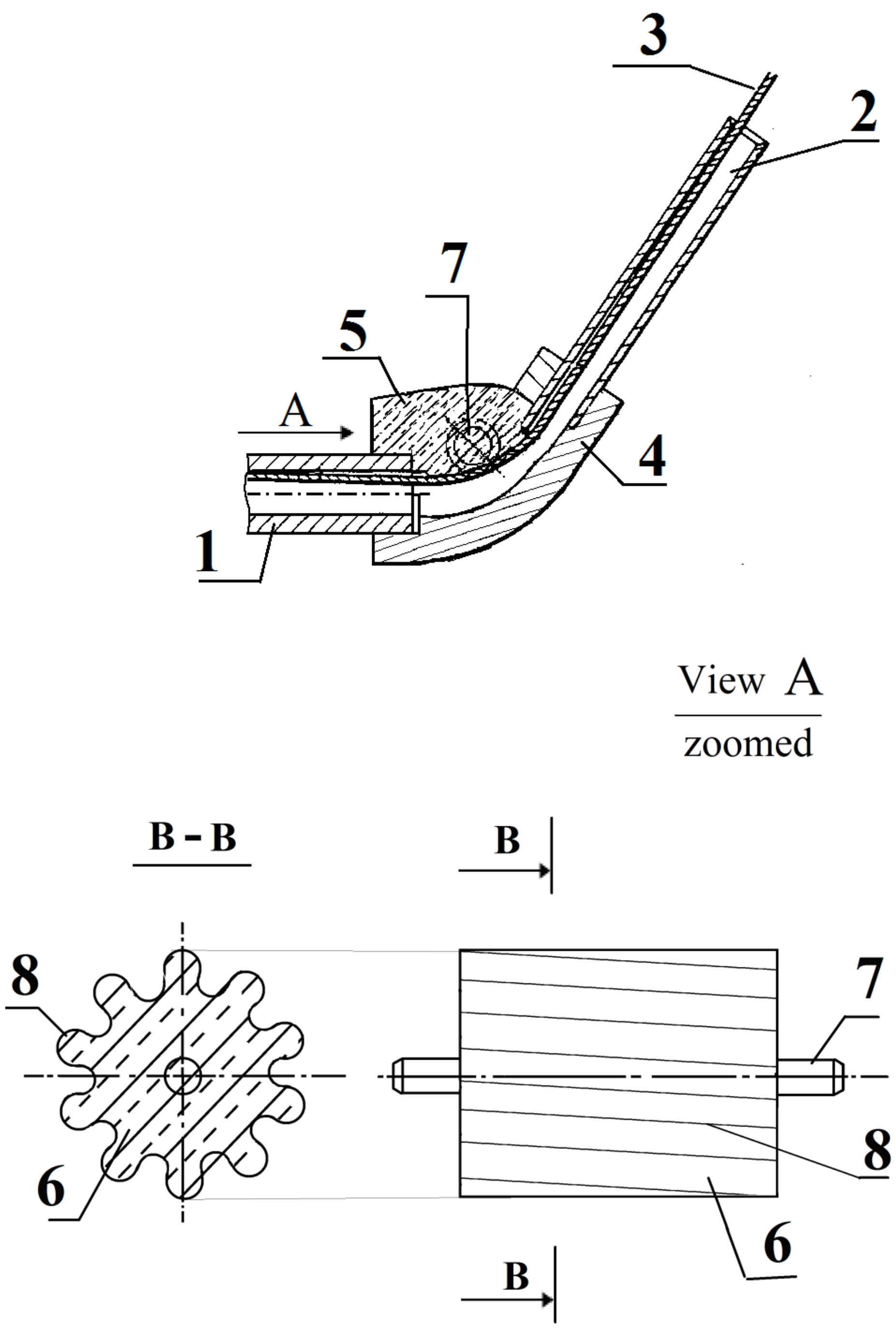

Fig.1-Tube for spinning yarn spinning device

The recommended tube design for spinning the spinning device yarn allows for an increase in the strength characteristics of the yarn produced.

For a more reliable, uniform stretching of the yarn, the construction of a ceramic roller was made of a concave curved shape.

ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
Vol. 5, Issue 12, December 2018

In operation, the spinning unit of the yarn 3 is pulled out to the outside through the tubular sections 1 and 2 [4]. In the transition zone of the tubular sections 1 and 2, the yarn 3 contacts the inclined riffles 10 of the curved concave surface 11 of the outer ceramic sleeve 9 of the ceramic roller 6, which will rotate around the axis 7. Due to the rotation of the ceramic roller 6, the resistance from it to the pulling yarn 3 will be smaller, which virtually eliminates additional lengthening of the deformation of the yarn 3. In addition, due to the inclined flute 10 and the curvilinear concave surface 11 of the ceramic outer sleeve 9, when the roller 6 is rotated, an eff Objective torsion to centering the yarn 3. The rubber bushing 8 absorbs and ensures a constant tension when the yarn pulling force changes due to a change in the number of fibers (Fig. 2).

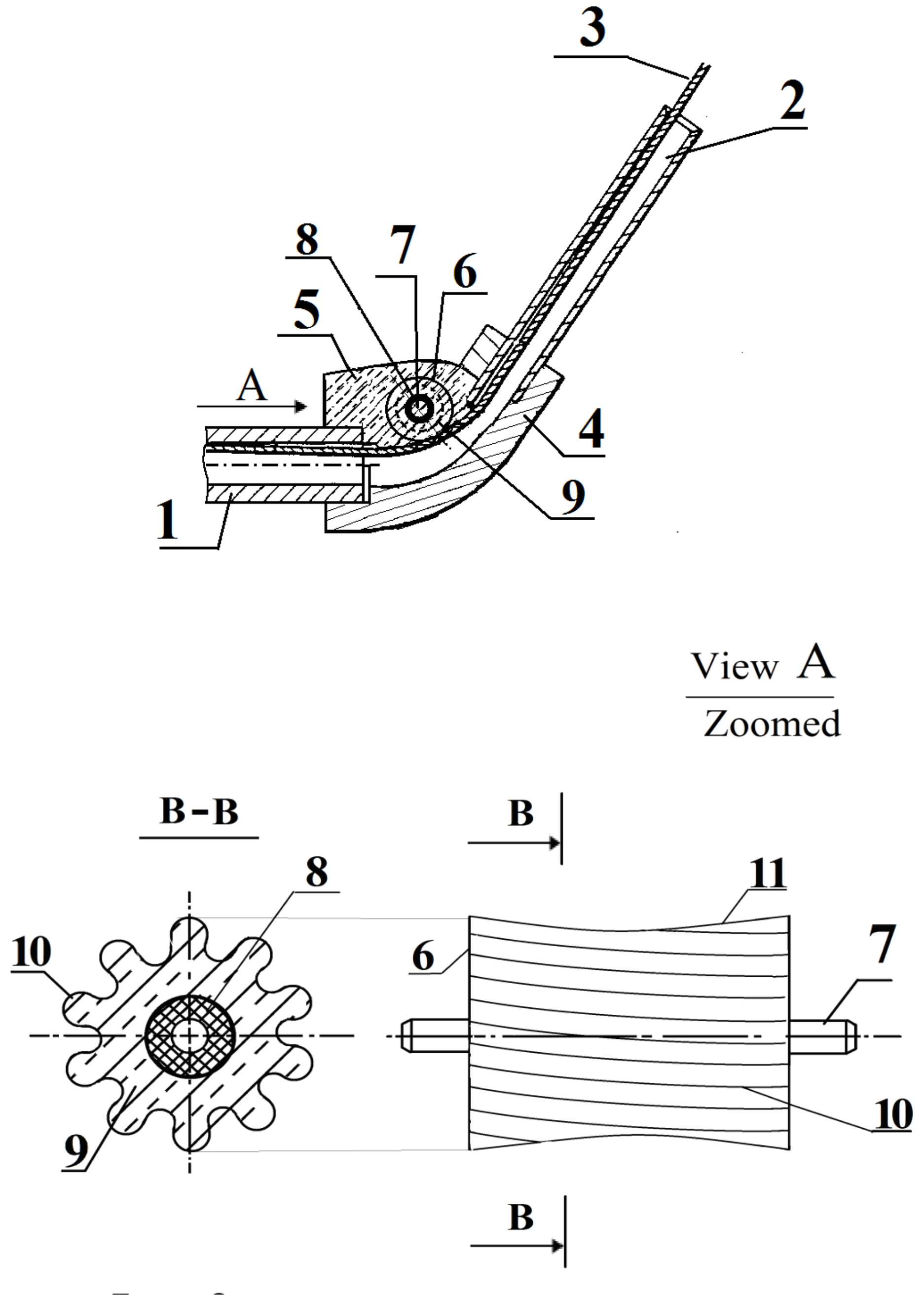

Fig.2-Tube for spinning yarn spinning device

ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
Vol. 5, Issue 12, December 2018

To determine the law of motion of a ceramic roller, the equations of motion were obtained in the following form [5]:

$$\frac{1}{2\omega_0 M_K} M_\partial + \frac{S_K}{2M_K} M_\partial = \frac{\omega_0 - \varphi_\partial}{\omega_0}$$
$$I_n \ddot{\varphi}_\partial = M_\partial - M_C \qquad (1)$$
$$M_C = \frac{1}{i}(M_1 + M_0 \sin \alpha t)$$

where, MS is the reduced total moment of resistance from the yarn, M_1 is the constant component of the resistance of the ceramic roller, M_0 is the amplitude oscillation of the moment of resistance from the yarn, *i* is the total gear ratio of the hard kinematic transmission system.

System (1) is a system of linear differential equations with constant coefficients. We rewrite its second differential equation as

$$I_n \dot{\omega}_\partial = M_\partial - M_C \qquad (2)$$

We differentiate this equation by time.

$$I_n \ddot{\omega}_\partial = \dot{M}_\partial - \dot{M}_C \qquad (3)$$

Substituting in the first equation of system (1) instead of M_∂ from equation (2), we get

$$\frac{1}{2\omega_c M_K} M_\partial + \frac{I_n S_K}{2M_K} \dot{\omega}_\partial + \frac{S_K}{2M_K} M_c = \frac{\omega_0 - \omega_\partial}{\omega_0} \qquad (4)$$

In equation (4) we put the value of the derivative of (3);

$$\frac{I_n \omega_0}{2\omega_c M_K} \ddot{\omega}_\partial + \frac{I_n S_K \omega_0}{2M_K} \dot{\omega}_\partial + \omega_\partial = \omega_0 - \frac{\omega_0}{2\omega_c M_K} \dot{M}_c - \frac{S_K \omega_0}{2M_K} M_c \qquad (5)$$

Take the time derivative of the moment of resistance

$$\dot{M}_c = \frac{\alpha M_0}{i} \cos\alpha t \qquad (5)$$

We substitute values $\dot{M}_c$ and M_c in (5)

$$\frac{I_n \omega_0}{2\omega_c M_K} \ddot{\omega}_\partial + \frac{I_n S_K \omega_0}{2M_K} \dot{\omega}_\partial + \omega_\partial = \omega_0 - \frac{\alpha M_0 \omega_0}{2\omega_c M_K} \cos \alpha t - \frac{S_K \omega_0 M_1}{2M_K i} - \frac{S_K \omega_0 M_0}{2M_K i} \sin \alpha t \qquad (6)$$

Denote the constant coefficients by

$$A = \frac{I_n \omega_0}{2\omega_c M_K},\ B = \frac{I_n S_K \omega_0}{2M_K},\ C = 1,\ D = \omega_0 - \frac{S_K \omega_0 M_1}{2M_K i},\ E = \frac{\alpha M_0 \omega_0}{2\omega_c M_K},\ K = \frac{S_K \omega_0 M_0}{2M_K i}$$

The members of expression (6) are rewritten with trigonometric functions in the right-hand side as

$$\sin \alpha t - \frac{E}{K}\frac{I_n \omega_0}{2\omega_c M_K} \cos\alpha t = \sqrt{1 + \left(\frac{E}{K}\right)^2} \sin\left(\alpha t - arctg \frac{E}{K}\right)$$

As a result, equation (6) takes the form

$$\ddot{\omega}_\partial + \frac{B}{A}\dot{\omega}_\partial + \frac{C}{A}\omega_\partial = \frac{D}{A} - \frac{1}{A}\sqrt{1 + \left(\frac{E}{K}\right)^2} \sin(\alpha t + \beta) \qquad (7)$$

where β = arctg (E / K)

IJARSET

ISSN: 2350-0328

International Journal of AdvancedResearch in Science, Engineering and Technology

Vol. 5, Issue 12, December 2018

The general solution of equation (7) with initial conditions $\omega_\partial = \omega_n$, $\acute{\omega}_\partial = \acute{\omega}_n$ for a ceramic roller has the form

$$\omega = e^{-\frac{B}{2A}t}\left(\omega_n \cos\sqrt{\frac{C}{A}-\frac{B^2}{4A^2}}t + \frac{\frac{B}{A}\omega_n + \omega_n}{\sqrt{\frac{C}{A}-\frac{B^2}{4A^2}}}\sin\sqrt{\frac{C}{A}-\frac{B^2}{4A^2}}\right) -$$

$$-He^{-\frac{B}{2A}t}\left[\sin(\beta-\gamma)\cos\sqrt{\frac{C}{A}-\frac{B^2}{4A^2}}t + \frac{\alpha\cos(\beta-\gamma)+\frac{B}{2A}\sin(\beta-\lambda)}{\sqrt{\frac{C}{A}-\frac{B^2}{4A^2}}t}\sin\sqrt{\frac{C}{A}-\frac{B^2}{4A^2}}t\right] + \quad (8)$$

$$+\frac{D}{A} - H\sin(\alpha t + \beta - \gamma)$$

where

$$tg\gamma = \frac{B\alpha}{C - A\alpha^2}, \quad H = \frac{\sqrt{1-\left(\frac{E}{K}\right)^2}}{A\sqrt{\left(\frac{C}{A}-\alpha^2\right)^2 + \frac{B^2}{A^2}\alpha^2}} \quad (7)$$

III. CONCLUSION

Analyzing the general solution of the differential equation (8), the first term in (8) is the free oscillations of the angular velocity ω_∂, which occurs as a result of the initial velocity ω_n and the acceleration $\acute{\omega}_n$ given to the ceramic roller. The frequency of these oscillations is less than the natural frequency of the system. Usually in machine units with a synchronous electric drive $\omega_n = 0$ and $\acute{\omega}_n = 0$, therefore, the first term in (8) is also zero. The second term is damped oscillations of the same frequency as the free ones, but arising from the effect of the total moment of resistance on the roller. The third term is the forced oscillations of the angular velocity of the roller, having the frequency of the disturbing moment of resistance. The amplitude of this oscillation does not depend on time. The first part of the third term is a constant value representing the average value of the angular velocity of the roller in steady motion. Due to e-(B / 2A) t, the first two terms of equation (8) will fade out over a large period of time and tend to zero. Therefore, when considering the steady state motion of a machine unit with a synchronous electric drive, the first two terms in formula (8) can be neglected, which is acceptable for reliable engineering calculations. At the same time for the steady motion of the roller can be written

$$\omega_\partial = \omega_{cp} - \Delta\omega_\partial,$$

where

$$\omega_{cp} = \frac{D}{A}, \quad \Delta\omega_\partial = H\sin(\alpha t - \beta - \gamma)$$

As can be seen, the oscillation of the angular velocity of the ceramic roller occurs with the frequency of the total moment of technological resistance, but with a certain phase shift (β-γ). The average value of the angular velocity of the machine unit with the steady state is determined by the formula

$$\omega_{cp} = \frac{2\omega_C M_K}{I_n} - \frac{S_K \omega_C M_1}{iI_n}$$

Developed effective tube designs for pulling yarn. The law of motion of the ceramic roller was determined, the equations of motion of the roller were obtained. The formulas obtained allow us to calculate the acceptable motion of the ceramic roller of the exhaust tube.

ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
Vol. 5, Issue 12, December 2018

REFERENCES

[1] USSR author's certificate 950818, 08/15/82, D 01 H 1/135.
[2] Patent US 5,044,151, 09/03/1991 D01H 4/40
[3] Sh.A. Korabayev, prof. HELL. A.D.Djuraev, Assoc. S.L. Matismailov "Effective design of the tube for pulling yarn in a spinning device." TTLPI Republican Conference, Tashkent, 2018 May., II-section, pp. 4-5.
[4] Sh.A. Korabayev, prof. HELL. A.D.Djuraev, Assoc. S.L. Matismailov "Tube for pulling yarn with a composite ceramic roller spinning device." NAMITI Collection of materials of the international conference. Namangan 2018, page 210-212
[5] Dzhuraev A., Mukhitdinov S.S., Samarhodzhaev Kh.Kh., Mirkhamidov D.Kh. Rotational mechanisms of technological machines with variable gear ratios. Tashkent "Mehnat", 1990.