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Research the Position of the Base Plate is Located at a Distance from the Axes of the Working Elastic Covering Shafts

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ABSTRACT: This article examines the movement of a mechanical machining machine on a flat material between a pair of shafts with an elastic coating and a base plate. Using Lagrange's 2-Round motion equations, the motion differential equations of a pair of shafts with an elastic coating are structured. Graphs were built and analyzed on the basis of solutions of the differential equations of motion.

KEYWORDS: elastic coating shaft, flat material, base plita, chain conveyor, kinetic energy, compressive strength, mass, weight strength, angular velocity.

I.INTRODUCTION

Certain works are being carried out in our country on the basis of deep processing of leather raw materials in order to expand the volume and types of export-oriented finished products, as well as providing the population with locally produced quality and cheap shoes and leather products.
Comprehensive attention is paid to promoting the implementation of advanced technologies in enterprises, modernization and technical re-equipment of organizations.

II. RELATED WORK

Including the modern creation of skin processing and processing is one of the pressing issues [1].
The researcher by R.V.Zaitsev, the analysis of free and forced oscillations of two shaft modules of shaft machines was carried out. Finite solutions obtained as a result of the calculation of free oscillations allow to determine the full range of frequencies of equipment, as well as to base the structure of the equipment [2].

III. LITERATURE SURVEY

A.V.Podyachev's dissertation, devoted to the study of the theoretical and practical basis of the design of shaft modules of machines of the textile industry, proposed mathematical models of determining the cases of static equilibrium between the shaft pairs from the presence of an elastic base with a fabric. The differential equations of the free oscillations of the shaft pairs are quoted and their algorithms are developed. The software, developed on the basis of the created algorithms, allows for a wide-coverage study of shaft pairs and a significant reduction in the complexity of their design [3].
From the above research, it can be seen that a lot of scientific research has been carried out and put into practice by researchers on the val pairs of technological machines. But to this day, many, despite the scientific research carried out, technological machines are beginning to have shortcomings in the process of working of shaft couples. We can say that the research work considered above also has shortcomings.
When the skin extends the semi-porous product through the base plate in a vertical direction to the coverage zone of the shaft pairs, the results of the deformations formed in the elastic coatings of the semi-porous product of the skin and the shaft pairs are calculated by experiment and finite method [4, 5]. Applications for industrial application valli machines, new analytical dynamic models have been developed [6].
We have developed the design of flat material from the side, that is, the molding of the semi-finished products of the mold and the mechanical processing line. There are three main working zones of this technological line, in which various technological processes are carried out using working pairs of shafts and base plates. As the working series are

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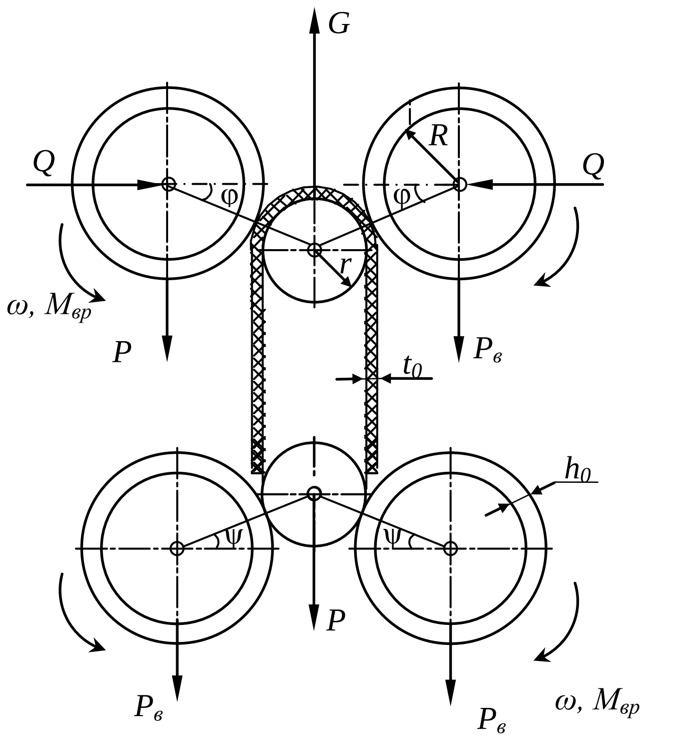
combined: the pair of the leveling and compression water release shafts form the first working series, the pair of the leveling and opening shafts on both sides form the second working series, the pair of the leveling and combing shafts form the third working series.

IV. METHODOLOGY

The machine is provided with base plates, which are hung on the chain of the chain conveyor, so that the chain conveyor and the shaft pairs of working rings have access one by one to the processing zone [7]. The aim of scientific study of flat material forming and mechanical processing line is to eliminate the shortcomings of this line, improve its processing speed and productivity. As a result of this, the efficiency of the mechanical machining process on the flat material increases, the quality of the product is further improved.

Pairs of shafts and the interaction of the base plate we consider a certain technological process with analytical methods in order to study and verify the effect of the technological line on the overall working process, that is, the energy consumption and the smooth operation of the line.



1-picture. Scheme of vertical transmission of fl
the pairs of shaft with an elastic coating

V. EXPERIMENTAL RESULTS

In the process of the study, the movement of the base plate was considered for the following situation. That is, the position of the base plate is located at a distance from the arrows of the working elastic covering roller bearings is lowered. In order to check the movement of the valve pairs and the base plate with an elastic coating on the bun, using the second round motion equations of Lagrange, the motion differential equations were drawn up. In the process of resolving the issue, the angle of coverage as a generalized coordinates φ was obtained. In this will be equal $\varphi = \psi$ to the angle of coverage. We can also see it from the 1st picture. To solve the problem, we calculate the kinetic energy of the base plate and the elastic covering roller. In this tries to hook the base plate to the flat material researched and its kinetic energy is expressed as follows [8]:

$$T_1 = \frac{1}{2} m_1 \dot{y}^2, \tag{1}$$

In this T_1 – kinetic energy of the base plate,

m_1 – the mass of the chain, base plate and flat material.

The observed shaft pair moves in a straight parallel (Figure 1) and their kinetic energy is written as follows [8]:

$$T_2 = T_3 = \frac{1}{2} m_2 \dot{x}^2 + \frac{1}{2} J_2 \omega_2^2, \tag{2}$$

In this T_2, T_3 – kinetic energy of shaft.

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$m_2 = m_3$ mass of shaft, $J_2 -$ inertial moment of shaft, $\omega_2 -$ angle speed. The moment of inertia of the shaft in the matter equal to $J_2 = \frac{m_2 R^2}{2}$, in this $R-$ radius of shaft.So x and y coordinators ψ we connect with the angle of coverage, then we get the following expression:

$$x = (R + r + t_0 + h_0)\cos\psi, \quad y = (R + r + t_0 + h_0)\sin\psi, \tag{3}$$

In this $R-$ radius of shaft $r-$ the "nose" part of the base plate radius, $h_0 -$ monshon thickness of shafts, $t_0 -$ the initial thickness of the flat material.

(3) If we take the derivative from the expression, it will be equal to the following.

$$\dot{x} = -(R + r + t_0 + h_0)\dot{\psi}\sin\psi, \quad \dot{y} = (R + r + t_0 + h_0)\dot{\psi}\cos\psi. \tag{4}$$

To formulate the motion differential equation of a pair of shafts with an elastic coating, we use the second round motion equation of Lagrange:

$$\frac{d}{dt}\frac{\partial T}{\partial \dot{\varphi}} - \frac{\partial T}{\partial \varphi} = Q_\varphi, \tag{5}$$

$$\frac{d}{dt}\frac{\partial T}{\partial \dot{\psi}} - \frac{\partial T}{\partial \psi} = Q_\psi \tag{5.1}$$

In this $Q_\varphi, Q_\psi -$ generalized forces.

Now we calculate the total kinetic energy. To do this, we take the sum of (1) and (2) expressions, as well as (4) taking into account the expression, we can write the total kinetic energy in the following form:

$$T = T_1 + T_2 + T_3 = \frac{1}{2}m_1\dot{y}^2 + 2\left(\frac{1}{2}m_2\dot{x}^2 + \frac{1}{2}J_2\omega_2^2\right) = = \frac{1}{2}m_1\dot{\psi}^2(R + r + t_0 + h_0)^2\cos^2\psi + m_2\dot{\psi}^2(R + r + t_0 + h_0)^2\sin^2\psi + J_2\omega_2^2. \tag{6}$$

Now we calculate the complete and specific derivatives of kinetic energy.

$$\frac{\partial T}{\partial \dot{\psi}} = m_1\dot{\psi}(R + r + t_0 + h_0)^2\cos^2\psi + 2m_2\dot{\psi}(R + r + t_0 + h_0)^2\sin^2\psi, \tag{7}$$

$$\frac{d}{dt}\frac{\partial T}{\partial \dot{\psi}} = m_1(R + r + t_0 + h_0)^2\cos^2\psi\ddot{\psi} - 2m_1(R + r + t_0 + h_0)^2\sin\psi\cos\psi\dot{\psi}^2 + + 2m_2(R + r + t_0 + h_0)^2\sin^2\psi\ddot{\psi} + 4m_2(R + r + t_0 + h_0)^2\sin\psi\cos\psi\dot{\psi}^2, \tag{8}$$

$$\frac{\partial T}{\partial \psi} = -m_1(R + r + t_0 + h_0)^2\cos\alpha\sin\psi\dot{\psi}^2 + 2m_2(R + r + t_0 + h_0)^2\sin\psi\cos\psi\dot{\psi}^2. \tag{9}$$

We find the work done by giving the generalized power at an angle φ, the displacement, calculated. Because $\varphi = \psi$ is equal to, φ and ψ the expressions calculated on will be equal to each other.

$$\delta A_\varphi = Q_\varphi \delta\varphi, \tag{10}$$

$$\delta A_\varphi = -2M_{вр}\delta\varphi - 2Q\delta x - P\delta y + 2P_в\delta y + G\delta y, \tag{11}$$

or, to base $\varphi = \psi$,

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$$\delta A_{\varphi} = -2M_{\textit{вр}}\,\delta\psi - 2Q\delta x - P\delta y + 2P_{в}\delta y + G\delta y. \tag{11.1}$$

In this $G-$ impact, pulling force on base plate by chain,

$P-$ weight strength of chain, base plate and flat material,

$P_{в}$ $-$ the weight strength of the shafts

$Q = Q_2 = Q_3 -$ the pressure force acting on the shafts,

$M_{вр}$ $-$rotating torque.

(11) in expression δx and δy migrations will be equal to.

$$\delta x = -(R + r + t_0 + h_0)\sin\psi\,\delta\psi.$$
$$\delta y = (R + r + t_0 + h_0)\cos\psi\,\delta\psi, \tag{12}$$

(12) in expression to put (11.1), we form the expression of the generalized forces:

$$Q_{\psi} = 2Q(R + r + t_0 + h_0)\sin\psi + (G - P + 2P_{в})(R + r + t_0 + h_0)\cos\psi - 2M_{вр}. \tag{13}$$

(8), (9) and (13) expressions (5.1) putting it into the equation, we get the equation of motion of the shaft pair:

$$\left(m_1\cos^2\psi + 2m_2\sin^2\psi\right)(R + r + t_0 + h_0)^2\ddot{\psi} + (m_2 - \frac{m_1}{2})\sin 2\psi(R + r + t_0 + h_0)^2\dot{\psi}^2 =$$
$$= 2Q(R + r + t_0 + h_0)\sin\psi + (G - P + 2P_{в})(R + r + t_0 + h_0)\cos\psi - 2M_{вр}. \tag{14}$$

In the process of research $M_{вр} = 0$ we also consider the case when it is equal. In this case (14), if we consider the rotating torque in the equation as zero, then the equation will come to this view.

As you know, since the base plate moves with constant speed, the angular velocity of the shafts equal to $\omega = \dot{\psi}$ =const and speed of angle is equal to $\varepsilon = 0$. In this case (14) the equation of motion comes in the following form:

$$(m_2 - \frac{m_1}{2})\sin 2\psi(R + r + t_0 + h_0)^2\omega^2 = (2Q\sin\psi + (G - P + 2P_{в})\cos\psi)(R + r + t_0 + h_0). \tag{14.1}$$

(14) taking into account the above conditions of the equation of motion, for a state in which the rotating moment is not equal to zero, we can write the following in the following form.

$$(m_2 - \frac{m_1}{2})\sin 2\varphi(R + r + t_0 + h_0)^2\omega^2 = (2Q\sin\varphi + (G - P + 2P_{в})\cos\varphi)(R + r + t_0 + h_0) - 2M_{вр} \tag{14.2}$$

(14.1)

if we solve the equation with respect to the external radius of the shafts, the following expression is formed.

$$R = \frac{(2Q\sin\psi + (G - P + 2P_{в})\cos\psi}{(m_2 - \frac{m_1}{2})\sin 2\psi\omega^2} - (r + t_0 + h_0) \tag{15}$$

(14.2) we can see from the equation, to $(R + r + t_0 + h_0)$since the relative quadratic equation.

$$a(R + r + t_0 + h_0)^2 + b(R + r + t_0 + h_0) + c = 0 \tag{16}$$

In this $a = (m_2 - \frac{m_1}{2})\sin 2\varphi\omega^2$, $b = -(2Q\sin\varphi + (G - P + 2P_{в})\cos\varphi$, $c = 2M_{вр}$.

(16) the solution of the quadratic equation can be written as follows.

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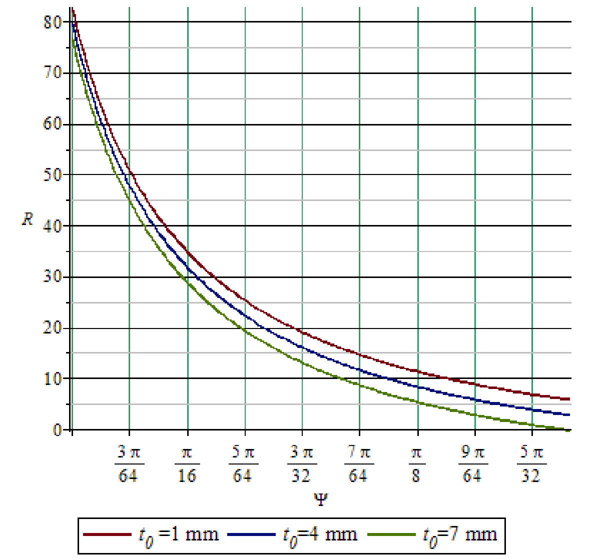
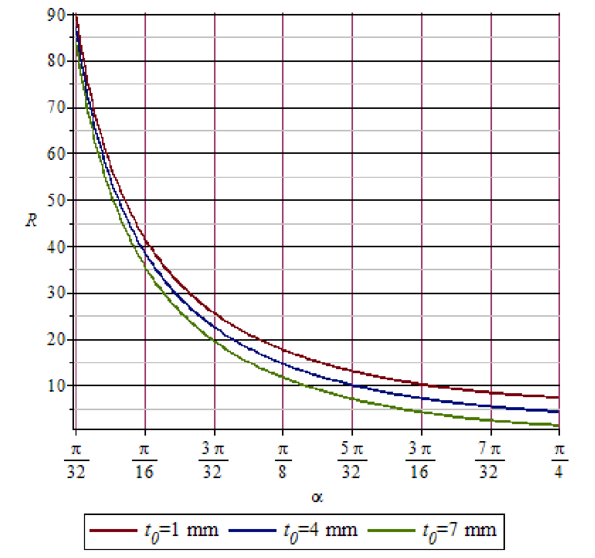
$$R_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} - \left(r + t_0 + h_0\right). \tag{17}$$

In the course of the study, graphs were constructed based on (15) and (17) solutions. If we distinguish the calculated (15) and (17) solutions from each other (15), then the torque in the solution is equal to zero and and the coverage angle is associated with ψ. (17) In the solution, the rotating torque is not zero, and the coverage angle is connected with φ. In the process of the study, graphs were constructed based on (15) and (17) solutions and two cases were compared with each other. On the basis of each constructed graphs, we conclude our research work: (figure 2, a, b) the graphs of the binding of elastic covering valence pairs radius to the coverage angle are constructed at different numerical values of the initial thickness of the flat material. A) variant (15) of the graphs is built on the basis of the solution, that is, for a situation where the rotating torque is zero. As can be seen from the graph, the number values of shafts radius are decreasing as the coverage angle of the shafts grows as the number values increase. Figure 2, B) in the graph built on the variant, the number values of the rotating moment are taken into account, in this case, as the number values of the shafts radius decrease, the coverage angle of the shafts as the number values increase. Given the rotating torque, we can see from the graph that the number values of the shafts radius, from the case when the rotating torque is not taken into account, a large number of values up to 10 mm are received.



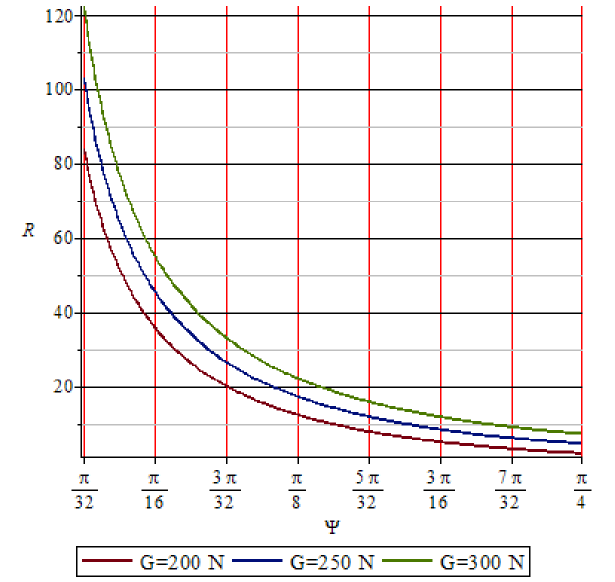
a) a state in which the rotating torque is equal to zero



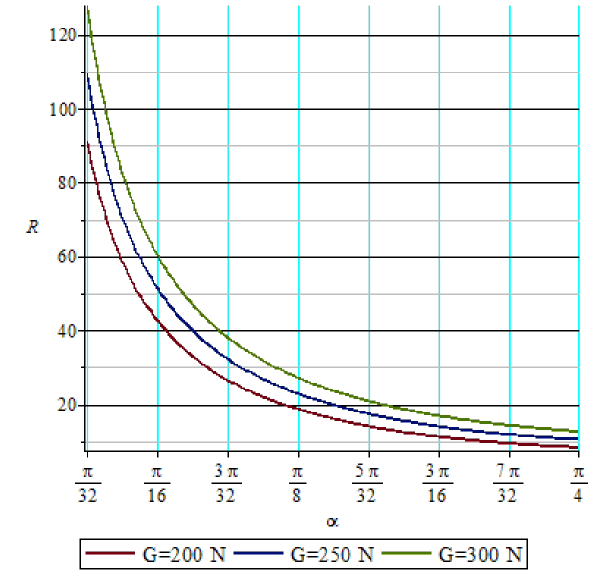
б) the rotating torque is a non-zero position

2-figure. Graphs of the connection of the elastic covering shaft pairs radius to the corner of the coverage (graphs are constructed at different numerical values of the initial thickness of the flat material)

(Figure 3, a,b) the graphs of the binding to the coverage angle of the radius of the shaft pairs with elastic coating are constructed by the chain for cases where the different numerical values of the pulling force are in effect, affecting the base plate. (Figure 3, a, b) from the graphs we can see that the more we increase the number value of the pulling force, the more the number values of the shafts radius decrease, as the angles of the coverage of the shafts grow. Even in this case, given the rotating moment b) from the graph in the variant, we can see that the number values of the shafts radius in the case when the rotating moment is equal to zero, a large number of values up to 10 mm is received. Even if we reduce the values of the gravitational force in the figure (Figure 4, a,b), then the area is falling exponentially with the graphs in figure 3. But, based on the graphics, we can say that the greater the volume of our shafts, the more we need to pull up the flat material the researched base plate with the maximum values of the pulling force. Because in both cases, in the largest number values of the pulling force, the shafts radius is reaching the maximum value. Even in this case, when the rotating torque is taken into account by the number of values, the shaft radius is approximately greater than 10 mm, the number accepts the values.

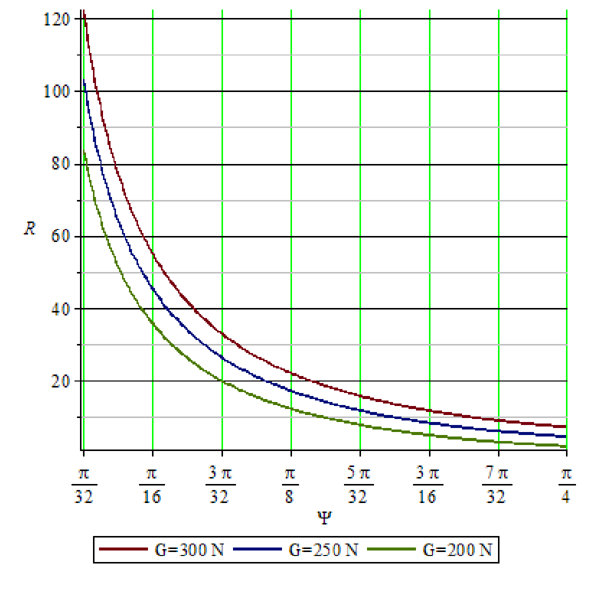


a) a state in which the rotating torque is equal to zero

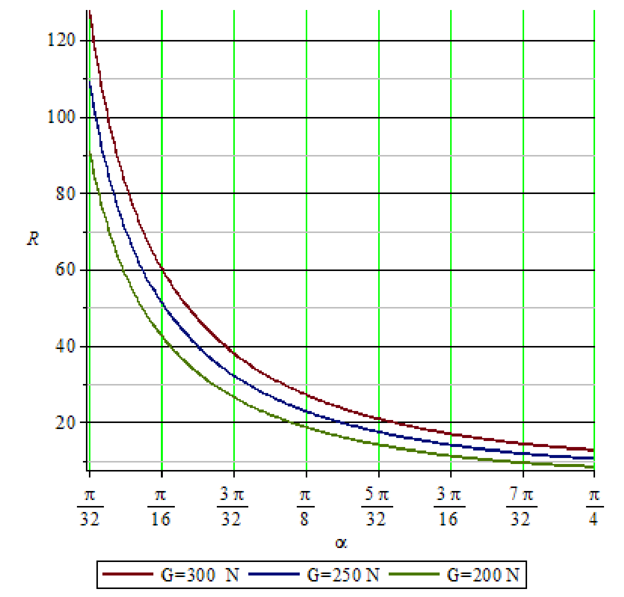


б) the rotating torque is a non-zero position

3-figure. Graphs of dependence on the angle of coverage of the radius of the shaft pairs with an elastic coating (the graphs are built in such a state that the pulling force increases the value of the number)



a) a state in which the rotating torque is equal to zero



б) the rotating torque is a non-zero position

4-figure. Graphs of the dependence of the elastic covering shaft pairs radius on the angle of coverage (the graphs are built in a state where the values of the pulling force are reduced)

(Figure 5, a,b) the graphs of the binding of the elastic covering radius of shaft pairs to the corner of the coverage shafts are built at different numerical values of the thickness of the monshon. From the results on these charts, we can see that even in these charts, we can see that as the number values of the shafts radius as above decrease, the coverage angle of the shafts will increase as the number values increase. From the graphics we can see that the larger the thickness of the

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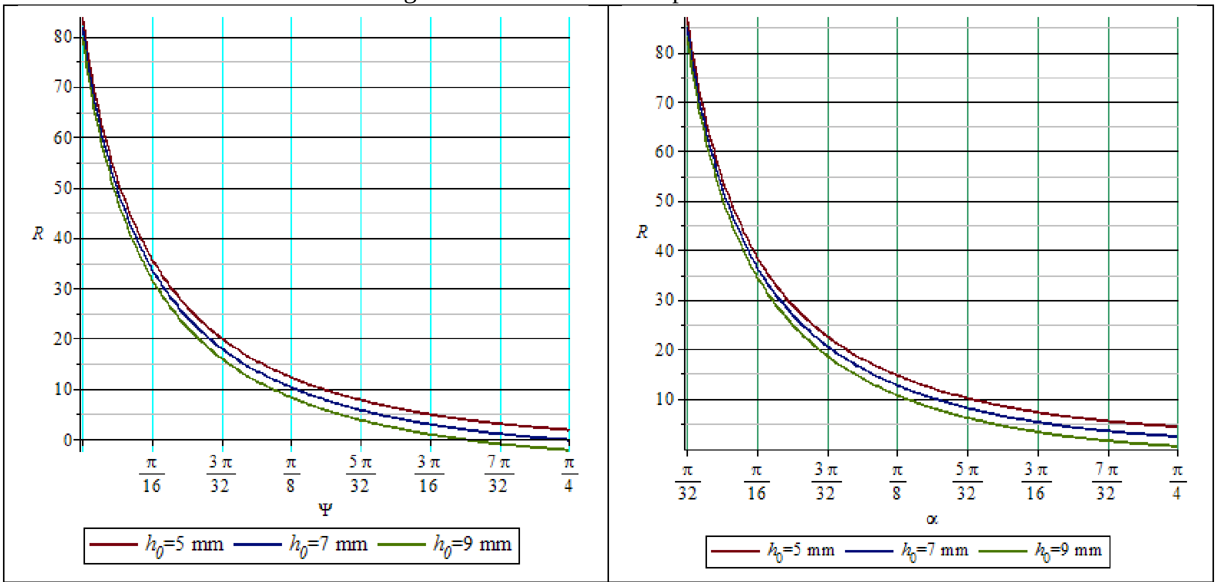
shafts monshon, the greater the coverage angle of the shaft radius is the relative change graph, since the thickness of the shafts would be smaller than that of the graph built in small values. Also in the case where the rotating torque is not taken into account, the numerical values of the valence radius are approximately 4-5 mm smaller than the graph in the case when the rotating torque is taken into account.

VI. CONCLUSION AND FUTURE WORK

Based on the results and the built in graphs, we can conclude that in the process of the research considered, that is, for the position of the base plate at a distance from the axes of the working elastic covering shafts, the torque of the rotating shafts has a great influence on the number values of the number of shafts, the number of shafts. From all the graphs that have been built, it is clear that the larger we get the shafts of the valence, the more we need to influence the moment of rotation of the valence at large values in the research process.



a) a state in which the rotating torque is equal to zero

б) the rotating torque is a non-zero position

5-figure. Graphs of the connection of elastic covering shaft pairs radius to the corner of the coverage (graphs shafts are built at different numerical values of the thickness of the monshon)

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