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EXPERIMENTAL STUDIES ON DETERMINATION OF LOADING AND LAWS OF MOTION OF THE ACCELERATOR OF THE RAW MATERIAL CHAMBER OF THE SAW GIN

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С О Д Е Р Ж А Н И Е

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EXPERIMENTAL STUDIES ON DETERMINATION OF LOADING AND LAWS OF MOTION OF THE ACCELERATOR OF THE RAW MATERIAL CHAMBER OF THE SAW GIN

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Abstract: *The findings of research conducted on the saw gin's accelerator in its raw chamber are displayed at different belt drive eccentricity values, both in the absence of load and with technological load. It has been discovered that, in a steady-state scenario without a load, the maximum torque value increases as the eccentricity of the system's tension roller increases in a technological load scenario, the torque minimum is noted at an eccentricity of e = 3 mm. When conducting experiments under load, the average angular velocity fluctuation amplitude and the coefficient of unevenness of rotation have minimum values at zero eccentricity and rise as eccentricity increases. The followings are determined: the raw roller's moment of resistance under load on the shaft; the relationship between the gin's productivity and the moment of technological resistance, patterns of changes in the accelerator shaft's angular velocity and linear accelerations, the impact of variable speed conditions on the raw roller, and the raw roller's pressure on the working chamber walls based on the eccentricity of the tension roller. It has been found that the range of force variations on the working chamber wall, the coefficient of uneven normal pressure, and the average density of the raw roller all increase with increasing roller eccentricity. The patterns of alternating rotation's influence on the kinematic and dynamic parameters of the accelerator shaft and raw roller were made evident by the produced graphs. A description of the experimental methods is given. Both the calculation of a two-mass dynamic system and the field of saw fiber separation can benefit from the experimental results.*

Keywords: *process load, steady state, uneven rotation, torque, calibration coefficient.*

Annotatsiya: *Arrali djinning xom ashyo kamerasining tezlatgichining eksperimental tadqiqotlari natijalari yuksiz va texnologik yuk ostida tasmali uzatmaning taranglovchi rolikining eksantrikligining turli qiymatlarida keltirilgan. Ma'lum bo'lishicha, yuksiz barqaror holat sharoitida, tizimning tasma uzatmasining taranglovchi g'altagining eksantrikligi oshishi bilan aylanish momentning maksimal qiymati ham oshishi hamda texnologik yuklanishda aylanish momentning minimal qiymati g'altagining ekssentrikligi e=3mm bo'lganda kuzatildi. Yuklanishda o'tkazilgan tajribalarda o'rtacha burchak tezligidagi tebranishlar amplitudasi va aylanishning notekislik koeffitsienti nol ekssentriklikda minimal qiymatlarga ega va eksantriklik ortishi bilan ortadi. Yuklanishda valdagi qarshilik momenti, texnologik qarshilik momenti bilan djinning ishlash unumdorligi bog'liqliki, tezlatgich valining burchak tezligi va chiziqli tezlanishlarining o'zgarishi qonuniyatlari, o'zgaruvchan tezlik sharoitlarining xom ashyo rolikga ta'siri, taranglik rolikining eksantrikligiga qarab ish kamerasining devorlariga xom ashyo valikining bosimi aniqlanadi. Rolikning eksantrikligi oshishi bilan xom ashyo valikining o'rtacha zichligi pasayadi, normal bosimning notekislik koeffitsienti va ish kamerasi devoridagi kuch tebranishlari diapazoni ortadi aniqlangan.Olingan grafiklar asosida tezlatgich vali va xom ashyo valikning dinamik va kinematik parametrlariga o'zgaruvchan aylanishning ta'sir qilish qonuniyatlari aniqlandi. Eksperiment o'tkazish usullari keltirilgan. Eksperimental natijalar paxta tolasini arrali djin yordamida ajratish sohasida, shuningdek, ikki massali dinamik tizimni hisoblashda foydali bo'lishi mumkin.*

Tayanch iboralar: *texnologik yuklanish, barqaror holat, notekis aylanish, aylanish momenti, kalibrlash koeffitsienti.*

Аннотация: *Приведены результаты экспериментальных исследований ускорителя сырцовой камеры пильного джина при различных значениях эксцентриситета натяжного ролика ремённой передачи без нагрузки и при технологической нагрузке. Выявлено, что при установившемся режиме без нагрузки с ростом эксцентриситета натяжного ролика ремённой передачи системы значение максимального крутящего момента также*

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увеличивается, при технологических нагрузках минимальное значение крутящего момента наблюдается при эксцентриситете е = 3 мм. В опытах под нагрузкой размаха колебаний средней угловой скорости и коэффициента неравномерности вращения имеют минимальные значения при нулевом эксцентриситете и увеличиваются с ростом эксцентриситета. Определены момент сопротивления при нагрузке на валу, связь момента технологического сопротивления с производительностью джина, закономерности изменения угловой скорости и линейных ускорений вала ускорителя, влияние переменных скоростных режимов на сырцовый валик, давление сырцового валика на стенки рабочей камеры в зависимости от эксцентриситета натяжного ролика. Определено, что с ростом эксцентриситета ролика падает средняя плотность сырцового валика, возрастает коэффициент неравномерности нормального давления и размах колебаний усилия на стенку рабочей камеры. По полученным графикам выявлены закономерности влияния переменного вращения на динамические и кинематические параметры вала ускорителя и сырцового валика. Описаны методика проведения экспериментов. Результаты экспериментов могут быть полезны в области пильного волокно отделения, а также расчёта двух массовой динамической системы.

Ключевые слова: *технологическая нагрузка, установившийся режим, неравномерность вращения, крутящий момент, коэффициент тарировки.*

Introduction

Saw gins are the main technological machine and are installed in gin or gin-linter shops of cotton mills. The process of fibre separation in saw gins is carried out by a saw cylinder and fixed grates [1-2]. But the productivity depends largely on the density of the raw material chamber and the nature of its movement. To increase the productivity and better separation of denuded seeds, we have developed a new mechanism of raw material chamber accelerator, where the accelerator rotates with variable angular speed. The drive has a belt transmission with variable tension [3].

The experiments were carried out in a small-sized 30-saw gin under production conditions. The purpose of experimental studies was to study the force loading of the accelerator of the raw material chamber and its rotation characteristics under the conditions of the technological process of ginning at constant and variable speed modes of motion of the accelerator drive mechanism.

The research objective was to conduct a series of experimental studies to determine:

a) the moment of resistance from the cotton on the shaft of the raw material chamber accelerator. This is necessary to determine the force loading of the shaft, the relationship of the moment of technological resistance to the gin productivity, the permissible limits of load variation, and the nature of technological resistances;

b) patterns of change of angular velocity and linear accelerations on the accelerator shaft.

c) regularities of influence of variable speed modes on the raw roll, which gives the dependence of the degree of change of acceleration and shaft revolutions on the density of the raw roll.

Determination of the actual law of motion of the shaft makes it possible to determine the limits of variation of angular velocity fluctuations based on technological requirements [4, 5, 6].

Materials And Methods

The information on force loading of the mechanism links is determined by a widespread method of electrotensometry. Strain gauges are used to record force parameters; magnetoelectric sensors are used to record velocity parameters, linear accelerations - vibration acceleration sensors. The methods of selection and installation of strain gauges and magnetoelectric sensors were carried out according to the known works [7-10]. Fig. 1 shows the electrical scheme of measurements.

Signals from induction sensors 1 and 2, registering speed parameters of the accelerator shaft and raw material roller, are directly fed to oscilloscope H-145. Signals from torque measurements, normal pressure from raw cotton on the apron of the working chamber and linear accelerator are fed to the oscilloscope through strain gauge UT-8.

Fig. 2. shows the principle scheme of measurements. For force calculations of the accelerator shaft, its moment of inertia was experimentally determined using the torsional vibration method (bifilar suspension method) [11, 12].

The moment of inertia of the shaft is determined by the formula [12]:

$$J = mr^2 = \left(\frac{ma^2}{4\pi^2}\right) \cdot \frac{T^2 g}{l}, \tag{1}$$

here: m - mass of shaft with pulley, m = 14,65 kg; a - arm of suspension, a = 17,5 mm.; T - period of oscillation, s; g - acceleration of free fall; 1 - length of thread, l = 2290 mm;

The time of one hundred complete oscillations of the shaft for three repetitions was: t_1 =500 c,

t_2 = 497s, t_3 = 505s, $t_{cp} = (t_l + t_2 + t_3)/3$ = 501c.

Oscillation period

$$T = t_{cp} / 100 = 501/100 = 5,01\, c.$$

Substituting the values into formula (3.1), we obtain the numerical value of the shaft moment of inertia J = 0.0122 kgm^2.

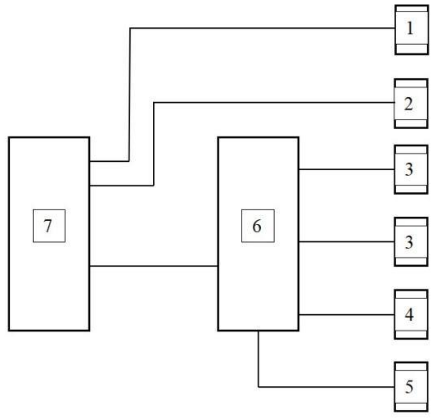

Fig.1. Electrical scheme of measurements: 1, 2 - induction sensors; 3 - normal pressure meter; 4 - torque meter; 5 - acceleration meter; 6 - strain gauge UT-8; 7 - oscilloscope H-145.

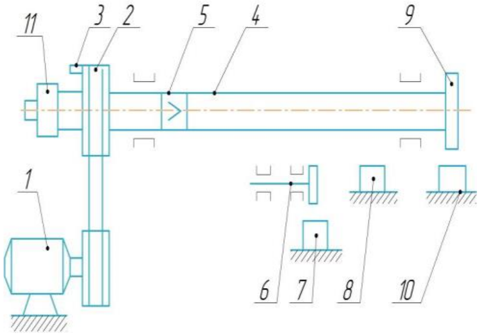

Fig.2. Principal scheme of measurements: 1- driving electric motor; 2 - pulley; 3 - vibration acceleration sensor; 4 - accelerator shaft; 5 - strain gauges for torque measurement; 6 - fixture for measuring raw roll revolutions with toothed wheel Z=40; 7 - induction marker; 8 - strain gauges for normal pressure measurement; 9 - toothed wheel Z=40; 10 - induction marker; 11 - current collector

Determination of the driving force and the moment of resistance on the shaft of the raw chamber accelerator.

To determine the force loading of the shaft and resistance forces from raw cotton, the method of electrochemistry with signal amplification and subsequent recording on the of the oscilloscope tape.

The following equipment and devices were used: oscilloscope H-145; strain amplifier UT-8 with power supply unit; strain gauges PKB 20-200, ShchB110-200, PKB 5-200; induction markers and current collectors; vibration acceleration sensor DU-5s.

The load cells were glued to the accelerator shaft using a half-bridge scheme at an angle of 45^0 relative to the shaft axis. In order to increase the reliability of the results, the tests were repeated 3-5 times for each mode [10].

The statically balanced accelerator shaft was calibrated by suspending a weight on a lever mounted on one end of the shaft, with the shaft locked at the other end. As a result, the torque calibration coefficient $\mu_м$ = 8n/mm was obtained.

Oscillographic records of torque curves characterising the kinematics and dynamics of the gin under real conditions at different operating modes were processed using the ordinate method [14-15].

According to this method, the zero-torque line was divided into equal intervals, the normal were restored to the intersection with the torque oscillogram curves and the corresponding ordinates were measured. The latter were multiplied by the tare factor to obtain the true torque values on the accelerator shaft at a given time.

$$M = h\ \mu_м$$

The obtained torque values were used for further processing and analysing the results.

To obtain reliable characterisations, the experiments were conducted:

- at idle with no load at variation of idler eccentricity and accelerator speed;

- in operating mode with minimum, medium and maximum raw cotton loads in the working chamber and variations in accelerator speed.

Fig.3 and Fig. 4 are plots of torque variation over time at different eccentricities of the idler without load and with load 10 - 12 kg/p.hr. As can be seen from the graphs, the largest amplitude range of the torque curves is observed at the eccentricity of the idler e=6 mm.

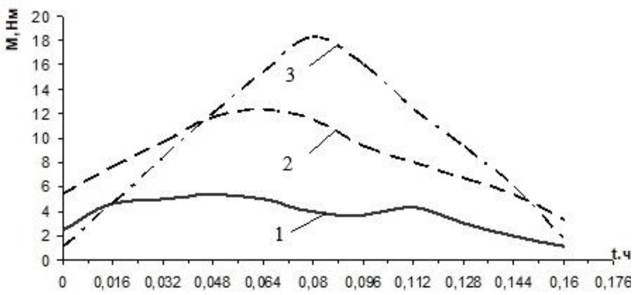

Fig. 3. Graph of torque variation at steady state without load at different eccentricities of the idler: 1 - at eccentricity e = 0; 2 - at eccentricity e= 3 mm; at eccentricity e = 6 mm

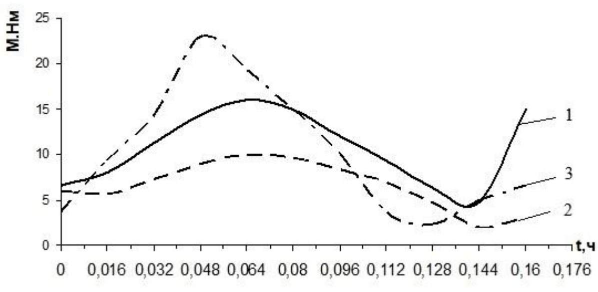

Fig. 4. Graph of torque variation at saw gin productivity 10-12 kg/p.h. at different eccentricities of the tensioning roller: 1 - at

eccentricity e = 0; 2 - at eccentricity e = 3 mm; at eccentricity e = 6 mm

From Fig. 3 at eccentricity e = 6 mm, the maximum torque varies in the range of M_{Max} =1.6 - 19 nm; at eccentricity e = 3 mm, M_{Max} = 3.2 - 15 nm and at e = 0 mm, M_{Max} = 1.6 - 5.5 nm. At maximum eccentricity the torque change reaches 13, 5 nm, and at eccentricity e = 3 mm it reaches 9, 5nm.

From Fig. 4, the experiments were carried out at loads of 10-12 kg/p.h. At eccentricity e = 6 mm, the maximum torque varies in the range M_{Max} = 2.3 - 23.5 nm; at e = 3 mm, the torque varies in the range M_{Max} = 2.5 - 10.8 nm and at e = 0 mm M_{Max} = 4.5 - 20.5 nm.

Analyses of graphs of torque variation at steady-state mode without load have shown that as the eccentricity of the belt idler of the system increases, the value of the maximum torque also increases (Fig. 3). At loads of 10-12 kg/p.h., the minimum torque value is observed at eccentricity e = 3 mm the curve changes along a sinusoid. In the no-load mode, the period of change of torque amplitude is 0.72 s. on average (Fig. 3). (Fig. 3), at load mode the period of change of amplitudes decreases with the increase of eccentricity of the idler and makes on average 0,56 s.

Measurement of angular velocities of the accelerator shaft of the raw material chamber of the saw gin.

To record on the oscillogram the speed modes of shaft rotation, the method of recording the rotation speed using magnetoelectric sensors was used [16]. A disc with the number of teeth equal to 21 was installed at the end of the accelerator shaft. The magnetoelectric sensor is a coil with a wire winding and a magnetised core mounted on a fixed bracket, (Fig. 2). When a disc tooth passes by the coil with the core, a current pulse is generated in the coil. To determine on the oscillogram the section corresponding to one revolution of the shaft, one of the teeth was removed; and in one complete revolution a current is induced 20 times in the coil. This is recorded on the oscillogram as a peak line. The distance between the peaks determines the time of 1/n part of a revolution of the shaft (where n is the number of teeth of the disc, equal to 21).

In order to reduce the relative error, measurements were taken from the first peak. The difference between measurements from two neighbouring peaks gave the time of 1/21 of the shaft revolution. To obtain reliable values of angular velocity for each 1/21st part of rotation, their arithmetic mean values for five repetitions of each mode of motion were determined. The difference between the values of 1/21st part of rotation was used to determine the values of angular velocity for each variation according to the formula [1]:

$$\lg = \lg \frac{\pi \cdot v_{ол}}{30n} - \lg\left(T_{icc} \pm \Delta T_{ij}\right), \qquad (2)$$

here: v_{ol} = 100 mm/s - speed of oscillographic tape movement;

T_{jcp} is the rms distance between peaks for each part of the turnover;

ΔT_{ij} - difference of measured distances between peaks and their RMS values;

i - number of teeth, i =21; j - number of repetitions, j = 1, 2, 3, 4, 5.

As noted above, the experiments were carried out at different accelerator speeds. At n = 150 rpm and oscillographic tape speed equal to v_{ol} = 100 mm/s.

$$\lg \frac{\pi \cdot v_{ол}}{30n} = 0{,}498 \qquad (3)$$

At n = 350 rpm $\lg \frac{\pi \cdot v_{ол}}{30n} = 0{,}198$.

For n = 550 rpm $\lg \frac{\pi \cdot v_{ол}}{30n} = 0{,}155$.

Experiments were carried out to obtain reliable characterisation:

- ✓ in idle mode without raw cotton load when varying the eccentricity of the idler roller and the number of shaft revolutions;
- ✓ in operating mode with process resistance under varying raw cotton load, idler eccentricity and shaft speed.

Having T_{icp} for each 1/21 part of a revolution and having determined ΔT_{ij} for five cycles for each variation of shaft revolutions, the values of angular velocity of the accelerator shaft were determined and graphs of angular velocity variation in time were plotted (Fig. 3.9 and Fig. 3.10).

In the process of oscillogram processing, the dependences of the change in the oscillation spread of the angular velocity Δω and the rotation irregularity coefficient δ of the accelerator shaft, which is determined by the formula [5], were obtained:

$$\delta = \frac{\omega_{\max} - \omega_{\min}}{\omega_{cp}}. \qquad (4)$$

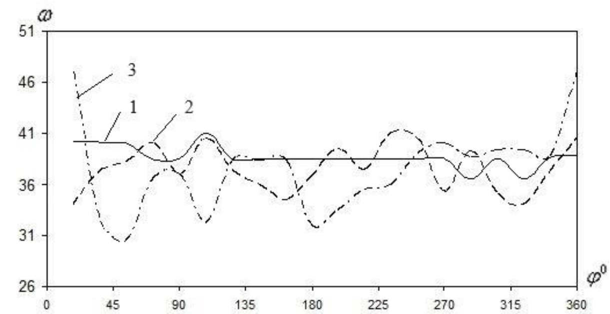

Fig.5. Graph of angular velocity change at n=350 rpm, idle running: 1 - at eccentricity e = 0;

2 - at eccentricity e = 3 mm; at eccentricity e = 6 mm

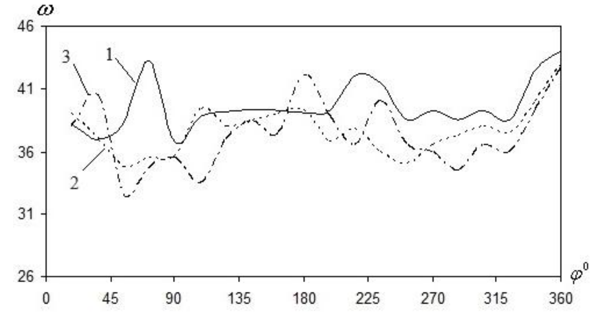

Fig. 6. Graph of change in angular velocity at n = 350 rpm and loads of 10-12 kg/p.h.: 1 - at eccentricity e = 0; 2 - at eccentricity e = 3 mm; at eccentricity e = 6 mm

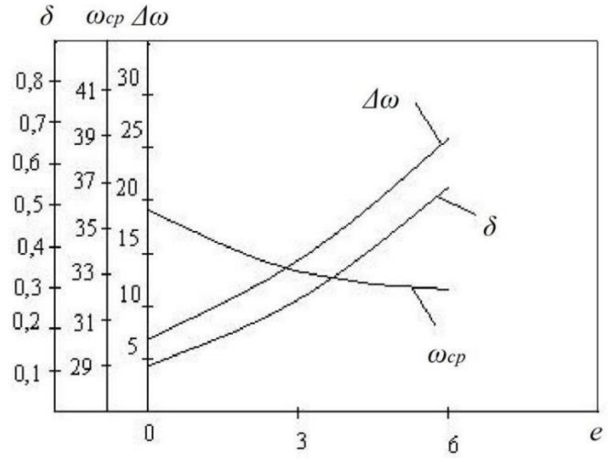

Fig.7. Graph of variation of Δω, ωcp and δ as a function of idler eccentricity

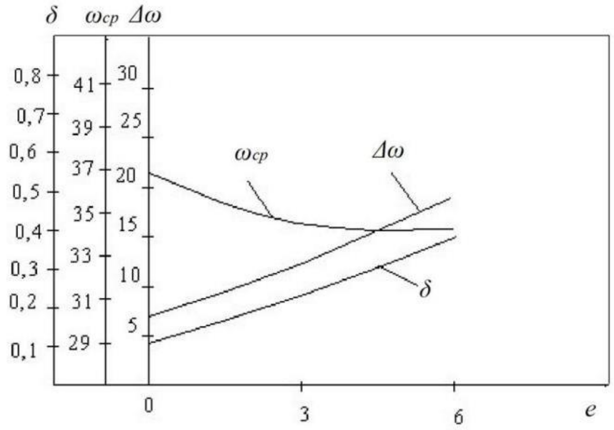

Fig.8. Graph of variation of Δω, ωcp and δ as a function of the eccentricity of the idler at a load of 10-12 kg/hr

In Figs. 7 and 8 are plotted graphs of dependence of the angular velocity oscillation range Δω, average angular velocity ω_{av}, and rotation non-uniformity coefficient δ on the eccentricity of the idler roller. As can be seen from Fig. 7, at idle running the largest amplitude of change of angular velocity is observed at eccentricity e = 6 mm.

From Fig. 5, the highest angular velocity reaches 47 sec-1, the lowest - 30.6 s-1. The period of change of angular velocity at eccentricities e = 3 mm and e = 6 mm is approximately the same. In Figure 5, a small section at shaft angles φ^0 = 120° to 270° and Fig. 6 φ° = 100° to 200° at eccentricity e = 6 mm, runs almost parallel to the abscissa axis (angular velocity does not change much). This can be explained by the small slip of the belt in this section. The amplitude of angular velocity oscillations at eccentricities e = 3 mm and e = 6 mm, compared to Fig. 6 decreases, which is explained by the action of moments of resistance forces of raw cotton. When analysing the graphs of change of oscillation span Δω, average angular velocity ω_{cp} and rotation non-uniformity coefficient at idle running (Fig. 7), oscillation span Δω and rotation non-uniformity coefficient δ increase with eccentricity growth, average angular velocity ω_{cp} decreases with eccentricity growth.

In the loaded experiments (Fig. 8), Δω and δ have minimum values at e = 0 and increase with increasing eccentricity.

Results and Discussion

To determine linear accelerations, a vibration acceleration sensor DU-5s, fixed on the accelerator shaft pulley, was used (Fig. 2). Signals from the sensor through a strain amplifier were transmitted to the oscilloscope loop. Records of linear acceleration curves were processed using the ordinate method [15]. Each of the five processed cycles was divided into 21 parts (according to the number of peaks per one revolution of the shaft) and the normals were drawn up to the intersection with the corresponding ordinates, which were multiplied by the tare coefficient (μ_a = 0.654 m/sec^2 mm) using a tare graph.

The calibration chart was constructed as follows: weights were suspended from a thread wrapped around the shaft pulley and the shaft was rotated. The time of falling of the weight from a certain height was recorded using a stopwatch. The experiments were carried out in full-scale conditions with different masses of weights G_1, G_2, G_3. The time of falling was the main measured parameter; therefore, the experiments on determining the time of falling of weights were determined each in 5 repetitions, and the arithmetic mean of five measurements was taken as the final value.

The acceleration of falling weights is equal to the linear acceleration of the pulley and was determined by the formula:

$$a = \frac{2H}{t^2} \cdot f_1 \cdot f_2,$$

here: H - height of falling of the load, H=1,1 m; t - time of falling of the load, c; f_1 = 0,99 - efficiency factor of the rolling bearing [17]; f_2 =0,9 - coefficient of tension of the thread.

Having determined the linear acceleration for each 1 /21 part of the revolution in five cycles and finding their average values, graphs were plotted for variations in idler eccentricity, raw cotton loads and accelerator shaft revolutions (Fig.9. and Fig.10.).

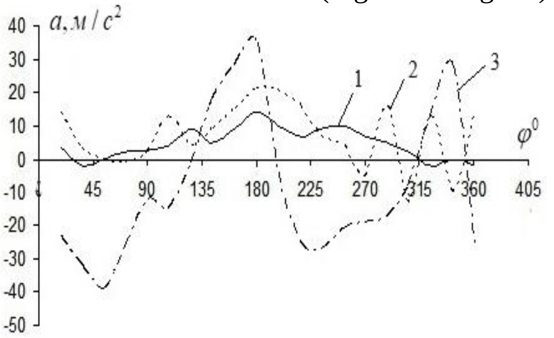

Fig. 9. Graph of change of linear accelerations at idle running and accelerator revolutions n=350 rpm: 1 - at eccentricity e = 0; 2 - at eccentricity e = 3 mm; at eccentricity e = 6 mm

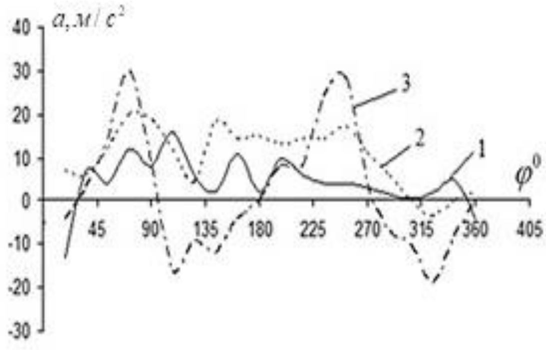

Fig.10. Graph of change of linear accelerations at load 10-12 kg/p.h. and revolutions n=350 rpm: 1 - at eccentricity e = 0; 2 - at eccentricity e = 3 mm; at eccentricity e = 6 mm

The figures show that as the eccentricity increases, the amplitude of linear acceleration oscillations also increases, both in experiments with and without load. At zero eccentricity a change of linear acceleration is observed. Under load the frequency of change of acceleration increases. Acceleration is not constant due to the presence of slip in the belt transmission, as well as the presence of inertial, elastic and dissipative properties of the elements. This can lead to an unstable gear ratio.

Analysis of the results of changes in raw roll speed and normal force on the apron wall of the working chamber. The purpose of this experiment was to determine the impact of the non-uniformity of the accelerator shaft rotation on the raw material roll revolutions depending on the from the eccentricity of the idler pulley.

To determine the angular velocity of the raw material roller, a device was made, consisting of a housing and a shaft rotating on two bearings, on the end of which is fixed a toothed disc, which with its teeth passes into the slit of the apron of the raw material chamber. During the technological mode, the rotation of the raw material roller causes the toothed disc to rotate.

To record on the oscillogram the speed of rotation was used magneto-electric sensor (Fig. 2), which is rigidly fixed on the bracket. Signals from the disc teeth are fed through this sensor directly to the oscilloscope. This is recorded on the oscillogram as a sawtooth line.

Oscillographic recordings were also processed using the ordinate method [15]. One of the 40 teeth was removed to determine the area corresponding to one revolution of the disc on the oscillogram. The distance between the peaks determines the time of 1/n part of a disc revolution. To reduce the relative error, measurements were taken starting from the first peak; the difference between the two measurements gave a time of 1/40th of a disc revolution.

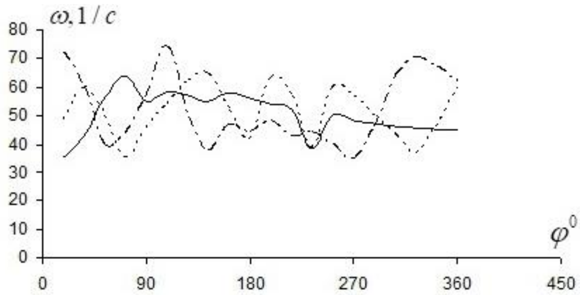

Fig.11. Graph of change in angular velocity of the raw roll at accelerator revolutions n = 350 rpm and a load of 10-12 kg/p.h.: 1 - at eccentricity e = 0; 2 - at eccentricity e = 3 mm; at eccentricity e = 6 mm

Fig. 11 shows the graph of angular velocity variation of the raw material roller under load. The graph shows that the range of angular velocities increases with increasing eccentricity of the idler roller. At eccentricities of the idler roller e = 3 mm and e = 6 mm, there is a sharp drop in angular velocity. This is explained by the influence of the impulse force transmitted by the accelerator to the raw material roller.

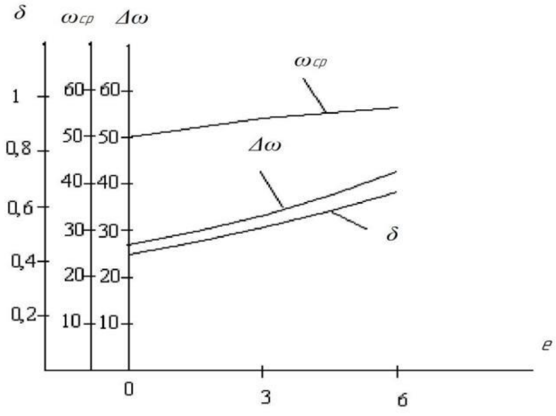

Fig. 12. Graph of change ω_{cp} , $\Delta\omega$ and δ depending on the eccentricity of the idler and

eccentricity speed n=350 rpm and load 10-12 kg/p.p.h.

According to Fig. 12, the angular velocity oscillation range Δω, the rotation irregularity coefficient δ and the average angular velocity ω_{cp} increase with increasing eccentricity of the idler. The purpose of determining the values of normal pressure on the apron wall of the working chamber is to determine the effect of uneven rotation of the raw material roller accelerator on the forces created by the rotating mass of raw cotton on the wall of the working chamber [18].

On the apron wall, 16 x 80 mm slots are made, where a 0.20 mm thick steel plate is fixed flush with the apron radius. On the middle of the steel plate sensors are glued, the signals from which are fed to the oscilloscope via a strain-gauge amplifier.

When selecting a steel plate, we focused on the force P = 3...20 N/dm^2, exerted by the

mass of raw cotton on the apron wall [19, 20]. According to the graph of taring by obtained taring coefficient μ_p = 5.4 g/mm.

Fig.13. and Fig.14. give plots of the variation of normal pressure, as well as the mean pressure, the coefficient of non-uniformity and the range of pressure fluctuations.

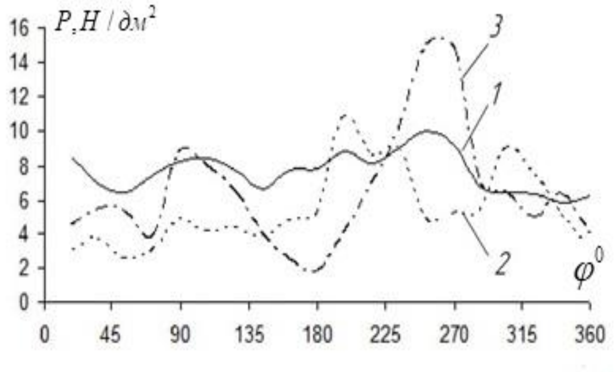

Fig.13. Graph of the normal pressure change on the apron of the working chamber at revolutions n =350 rpm and load 10-12 kg/p.h.: 1 - at eccentricity e = 0; 2 - at eccentricity e = 3 mm; at eccentricity e = 6 mm.

Analysis of the results of changes in raw roll speed and normal force on the apron wall of the working chamber. Uneven raw material roll rotation in the working chamber is influenced by uneven raw cotton feeding and uneven, impulsive rotation of the raw material roll accelerator. The uneven raw material roll rotation at zero idler eccentricity is mainly due to the uneven cotton supply to the raw material chamber. With eccentric idler rollers, the uneven raw material roll rotation is also influenced by the pulse rotation of the accelerator.

From the graph of change of angular velocities (Fig. 11) it is clear that at eccentricity

e = 3 mm, the pulsation of the curve amplitudes has a more pronounced character than at e = 6 mm. the same picture is characteristic for the graphs of the normal force variation on the wall of the working chamber apron (Fig. 13).

As mentioned above, the unevenness of the shaft rotation increases with increasing eccentricity (Fig. 8). At the same time, the impulsive force acting on the cotton mass also increases. When the accelerator shaft rotates unevenly, microcracks appear in the raw cotton mass, the greater the impulsive force acting on the cotton mass. These microcracks contribute to the increase of seed falling out of the working chamber and decrease the density of the raw cotton chamber. The latter contributes to a reduction in the pressure of the raw material roll on the bale chamber wall.

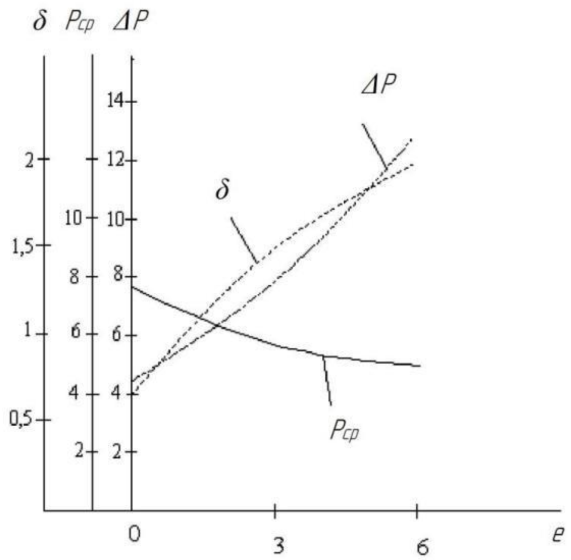

Fig.14. Graph of variation of average pressure Pcp, pressure non-uniformity coefficient δ and ΔP depending on the eccentricity of the idler roller

From Fig.11. and Fig.14. it can be seen that at eccentricity e = 6 mm. the rotational speed and mean normal pressure of the raw roll decreases.

The decrease in the pulsation of the amplitude of the raw material roller speed amplitude (Fig. 11) at eccentricity e = 6 mm. can be explained by the fact that the fibre content of the raw material chamber increases and the associated decrease in the pressure of the fibrous mass on the wall of the working chamber. Less force is transmitted through a more fibrous mass.

When the gin works with eccentric tension roller e=3 mm. the impulsive force is transmitted to the whole fibre mass; at the same time the raw material roll rotation speed increases (Fig.12). Because of more intensive removal of bare seeds in comparison with the work of gin with eccentricity of roller e=0, the average density of raw material roll falls (Fig.14), the coefficient of non-uniformity of normal pressure δp and the range of force fluctuations ΔP increases. As the eccentricity increases, the density of the raw material roll decreases and the impulsive force transmitted to the mass of raw cotton increases. This can be seen from Fig. 14, where with increasing eccentricity increases the force fluctuation range ΔP and the coefficient of unevenness of the force on the walls of the working chamber.

Conclusions

- As the eccentricity of the idler roller increases, the amplitude of torque variation increases. The period of torque variation at different eccentricities in steady state mode without load is equal to one revolution of the accelerator shaft, at medium loads the period of torque variation is inversely proportional to the increase of the idler eccentricity.
- The amplitude of change of angular velocity at technological resistance from raw cotton at eccentric idlers decreases, and at zero eccentricity increases due to the action of resistance forces from cotton. The range of oscillations Δω, the coefficient of non-uniformity δ in the experiments with the load from raw cotton reach the maximum at e =3mm. due to the reduction of the moments of resistance forces from cotton.
- The amplitude of change in the angular velocity of the raw material roller decreases with increasing eccentricity of the idler roller. The coefficient of unevenness of raw material roll rotation δ and oscillation range Δω reach the lowest value at eccentricity e =Z mm., which is explained by the increase in fibre content of raw material roll and decrease in its density.
- The normal pressure exerted by the raw cotton mass on the walls of the working chamber decreases with increasing eccentricity.

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