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RESEARCH RESULTS TO FIND THE POSSIBILITY OF REPLACEMENT SEED COMB ON A ROTATING DRUM

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ABSTRACT:

The results of studies on determining the influence of the parameters of the throwing drum on the indicators of the ginning process are presented. An equation for determining the tensile forces of the fibres of the flywheel when using the throwing drum instead of the seed comb is obtained. The influence of the parameters of the throwing drum on the indicators of the ginning process has been studied with two variants of the location and three diameters of the toothed discs of the throwing drum at a rotation frequency of 335; 530 and 685 rpm. Studies have shown that the optimal value of the throwing drum rotation speed is 365 rpm. On modern gins, the use of a throwing roller instead of a seed comb is impractical, since the feeder does not provide a uniform supply of raw cotton to the working chamber.

KEYWORDS: Technological parameters, methodological program, products, cotton, raw cotton.

INTRODUCTION:

Improvement of technological machines of cotton ginning factories in order to improve the quality of products, reduce their losses and waste energy consumption is an urgent problem, especially in the context of modern market relations. In this aspect, the improvement of the sperm mechanism of the saw gin is of great interest. In order to improve the process of withdrawing seeds from the working chamber of the sawing gin, it was proposed to use a throwing drum located in the lower part of the working chamber to supply the fractions of the raw roller to the saw cylinder. It was assumed that this drum would impart additional acceleration to the raw roll, which would facilitate better capture of the fly fibres by the teeth of the saw cylinder and thus achieve greater fibre removal.

Based on the Euler equation, an equation was compiled to determine the tension of the fibres of the fly by the teeth of the saws of the saw cylinder, which has the form:

$$T = T_o e^{k\varphi} + qr\left[\frac{1-k^2}{1+k^2}\left(e^{-k\varphi} - \cos\varphi\right) - \frac{2k}{1-k^2}\sin\varphi\right] + \frac{m(V_n + V_б)^2}{r}\left(e^{k\varphi} - 1\right)$$

there: T and T_o – tension forces acting on the flyer;

k – coefficient of friction of the fly over the surface of the throwing drum;

q – the weight of the flyer;

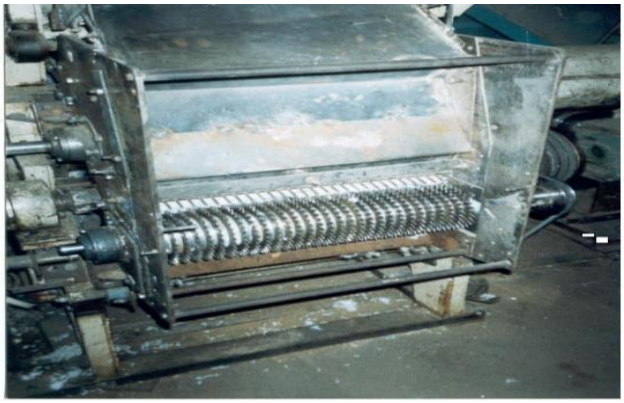
Vn – saw cylinder speed;

$Vб$ – throwing drum speed;

φ – the angle of the throwing drum wrap-around;

r – the radius of the throwing drum;

In order to determine the complex influence of the technological parameters of the throwing drum on the quality of the produced products and other indicators of the ginning process, as well as to determine the optimal size, location and rotation frequency of the throwing drum in the laboratory conditions of JSC "Paxtasanoatilmiymarkazi" on the saw bench of the gin, the general view of which is shown in Fig. 1.



General View of the Bench Saw Installation Gin with a Throwing Drum

The experiments were carried out according to the developed methodological program, according to which the influence of the parameters of the throwing drum on the indices of the ginning process was studied at two different locations and diameters of the toothed discs of the throwing drum at its rotation frequency equal to 335; 530 and 685 rpm.

The cleaning of raw cotton was carried out according to the technical regulations, taking into account its initial quality indicators, according to the recommendations for choosing the optimal cleaning plans depending on the contamination of the feedstock.

To ensure in the experiments an approximately constant load of the saw cylinder, the intensity of the supply of raw cotton to the working chamber was controlled according to the indication of an ammeter connected to the electric motor circuit of the saw cylinder. In all experiments, the current strength was maintained at the level of the nominal value of the load current of the electric motor of the bench installation of 30 saws.

The performance of the saw gin was determined by the mass of fibre produced during the experiment. The density of the raw roller was determined by dividing its mass by the value of the internal volume of the working chamber, and the specific consumption of electrical energy was determined by the ratio of the power consumed by the saw cylinder to the amount of fibre produced in a fixed period of time.

The fibre content of the raw roll was determined by processing the mass of the sample of the raw roll on a 10-saw laboratory gin. The qualitative assessment was carried out through laboratory analyzes of samples of raw cotton, fibre, seeds and fibrous waste collected during each experiment. Determined: for raw cotton - moisture, weediness, clogging, mechanical damage to seeds; by fibre - a mass fraction of defects and weeds, length; for seeds - complete omission, mechanical damage, weediness, the content of volutes and seeds with "pigtails".

The obtained results of quantitative and qualitative indicators are shown in tables 1 and 2.

Table 1. Averaged results of laboratory analyzes of qualitative indicators of raw cotton Namangan 77 second grade second class of the original and after cleaning

Raw cotton	Debris,%	Humidity,%	Exclusion,%	Mechanical sowing rate of seeds,%
Original	8,21	8,90	0,53	2,6
After cleaning	0,89	8,35	0,51	4,2

Table 2. Average qualitative and quantitative indicators of fibre and seeds, density and fibrillation of the raw roll and specific energy consumption

Indicators	Rotation frequency, rpm					
	365		530		685	
	Throwing drum diameter, mm					
	135	165	135	165	135	165
1	2	3	4	5	6	7
Fibre						
After the gin						
Mass fraction of defects and weeds,% of total including:	3,50	3,27	3,94	3,63	3,88	3,84
litter, total including:						
large	1,80	1,8	1,82	1,68	2,1	1,92
small						
ulyuk	1,2	1,32	1,34	1,26	1,57	1,47
broken seed	0,6	0,48	0,48	0,42	0,53	0,48
peel with fibre	0,47	0,24	0,58	0,44	0,50	0,77
After the fibre cleaner	0,5	0,54	0,88	0,99	0,66	0,60
Mass fraction of defects and weeds,% of total including:	0,72	0,56	0,64	0,52	0,58	0,52
rubbish all including:						
large						
small						
ulyuk	2,63	2,52	2,96	280	2,91	3,23
broken seed						
peel with fibre	1,39	1,03	1,37	1,29	1,58	1,48
Seeds after gin						
Debris,%	0,97	0,63	1,01	0,972	1,18	1,0
Complete pubescence,%	0,42	0,40	0,36	0,32	0,40	0,48
Mechanical damage to seeds,%	0,37	0,51	0,44	0,34	0,38	0,6
Volatile content in seeds,%	0,41	0,46	0,66	0,764	0,50	0,67
Productivity, kg per saw per hour	0,46	0,52	0,48	0,4	0,44	0,48
Cleaning effect,%3						
Raw roller						
Density, kg / m^3	0,30	0,32	0,26	0,28	0,21	0,24
Fibre,%	12,9	12,8	12,6	12,40	12,6	12,7
Specific power consumption kWh / t in-on	3,00	2,70	3,91	3,94	5,63	5,46
	0,07	0,105	0,22	0,11	0,518	0,129
	8,6	8,8	8,1	8,3	7,8	8,0
	17,0	17,4	16,4	16,6	16,7	16,5
	267	273	260	257	250	247
	8,14	8,52	10,7	10,4	11,25	13,41
	32,6	32,1	31,3	30,9	31,4	29,2

Analyzing the data shown in Table 2, it should be noted that a change in the speed of the throwing drum affects the change in the main indicators of the ginning process, such as productivity, quality of fibre and seeds, the

density of the raw roll and specific power consumption.

With an increase in the frequency of rotation of the throwing drum, there is a decrease in productivity, a decrease in the density of the raw roller and a slight decrease in the specific power consumption. At the same time, there is a deterioration in the quality of fibre and seeds.

So, if at a frequency of rotation of the throwing drum equal to 365 rpm, the averaged values of productivity, the density of the raw roll and specific power consumption were, respectively, with its diameter of 135 and 165 mm: 8.6 and 8.8 kg of fibre per saw per hour; 267 and 273 kg / m3; 32.6 and 32.1 kWh / t, then at 530 rpm the productivity decreased to 8.1 and 8.3 kg of fibre per saw per hour, with a raw roller density of 260 and 257 kg / m3 and specific power consumption of 31, 3 and 30, 9 kWh / t, and at 685 rpm these indicators were 7.8 and 8.0 kg of fibre per saw per hour, 250 and 247 kg / m3, 31.4 and 29.2 kW / t.

In this case, if the average values of the mass fraction of flaws and trash impurities in the fibre at 365 rpm were 2.63 and 2.52% (abs), respectively, with a diameter of 135 and 165 mm, then at 530 rpm the average values of these indicators are 2.96 and 2.80% (abs), and at 685 rpm - 2.91 and 3.23% (abs), i.e. there is a deterioration in the quality of the fibre. The decrease in fibre quality is explained by an increase in the content of litter, broken seed and skins with fibre.

Analyzing other indicators, it should be noted that with an increase in the frequency of rotation of the throwing drum, the fibre content of the raw roller increases, but there is no increase in productivity. This is due to the specific design feature of the PD brand gin feeder, the peg drum of which does not provide effective loosening and separation of the raw cotton mass into separate volatiles and feeds it into the working chamber in an uneven, thick, lumpy layer. When such a layer is fed to the saw cylinder, the fibre is captured from the layer of raw cotton directly adjacent to the saw teeth, and the rest of it, due to the adhesion between the fibres by inertia, is pulled into the zone of the seed comb and, filling this space, prevents the release of ginned seeds, increases in them the volatile content of raw cotton, thereby reducing the efficiency of the ginning process and, accordingly, the productivity of the gin.

This circumstance explains a slight decrease in the cleaning effect of the gin as the speed of the throwing drum increases. So, if at 365 rpm this indicator was 17.0 and 17.4%, respectively, with diameters of 135 and 165 mm, then at 530 rpm - 16.4 and 16.6%, and at 685 rpm min - 16.7 and 16.5%.

At the same time, the contamination of the ginned seeds also decreases, which indicates a decrease in the cleaning ability of the throwing drum as its rotation frequency increases. So, if at 365 rpm the contamination of seeds with a drum diameter of 135 and 165 mm, respectively, was 0.30 and 0.32%, then at 530 rpm - 0.26 and 0.28%, and at 685 rpm - 0.21 and 0.24%.

The value of the pubescence index of ginned seeds in all variants is approximately the same. Thus, the studies carried out have shown that the optimal value of the frequency of rotation of the throwing drum is 365 rpm. At the same time, a ginning mode is provided that allows you to produce high-quality products with the least fibre loss.

However, the increase in productivity and the cleaning effect of gin restrains the unevenness both in thickness and in the level of the raw cotton layer fed into the working chamber due to the design feature of the feeder for gin brand PD. Because of this, it follows that on modern gins, the use of a throwing roller instead of a seed comb is impractical.

CONCLUSIONS

1. An equation has been drawn up to determine the tensile forces of the fibres of the flywheel when using a throwing drum instead of a seed comb.
2. Studied the influence of the parameters of the throwing drum on the indicators of the ginning process with two variants of the location and three diameters of the toothed discs of the throwing drum at a speed of 335; 530 and 685 rpm.
3. The conducted research has shown that the optimal value of the speed of the throwing drum is 365 rpm.
4. On modern gins, the use of a throwing roller instead of a seed comb is impractical, since the feeder does not provide a uniform supply of raw cotton to the working chamber.

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