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Increasing Efficiency Of The Surface Of The Separator Mesh

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Annotation: The mesh surface located in the separator working chamber is fixed and has a circular shape. The holes of the mesh surface are 6 mm in diameter. The suction, mixed with air, enters the working chamber of the cotton separator moving in the tube of the pneumotransport device and falls into the vacuum valve under the influence of its inertia.

After checking the performance of SX and SS-15A separators used in cotton ginning enterprises, the following conclusion was reached:

The main disadvantage of the SX separator is that the channel of the inlet tube towards the vacuum valve is clogged with cotton.

The placement of the mesh surface in front of the inlet tube increases the probability of the cotton hitting this surface.

The main reasons for this are:

Because the air bubble is sucked through the mesh side of the inlet pipe;

As a result, breakage of seed and deterioration of fiber quality increases. In addition, the possibility of the fiber coming out with air and small impurities increases.

SS-15A mesh has been proven to reach the surface in the amount of 25% of the total cotton.

Based on the preliminary research, it was found that a part of the fiber is exposed to the air flow with small impurity impurities and a large amount of air pressure is lost due to the high aerodynamic resistance. One of the main reasons for these shortcomings is due to the fact that the structure of the mesh surface of the separator is not properly designed.

The mesh surface located in the separator working chamber is fixed and has a circular shape. The holes of the mesh surface are 6 mm in diameter. The suction, mixed with air, enters the working chamber of the cotton separator moving in the tube of the pneumotransport device and falls into the vacuum valve under the influence of its inertia.

The part of the cotton entering the working chamber that moves closer to the mesh surface sticks to this surface. The mesh holes do not fit the seed, but due to the high air force of the cotton to the mesh surface, some fibers that are not well connected with the seed will leave the separator through these holes. In addition, when extracting cotton from the surface of the net with a strainer, the quality of the fiber deteriorates, that is, cases of damage to the seed are observed. At the same time, excessive loss of air pressure in the separator is caused by the fact that the useful surface of the mesh is not large enough.

A number of scientific research works have been carried out in order to increase the useful surface of the separator mesh. In one of these works, it is proposed to install a mesh drum on the squeegee shaft, the drum rotates with the squeegee shaft and air is sucked through it. The cotton stuck to the surface of the mesh drum is separated by a fixed scraper. With this change, a positive effect was obtained to a certain extent, but during the operation of the separator, since it was not possible to clean the inside of the mesh drum, there were frequent clogging points in its holes.

It was determined that changing the height of the cone-shaped mesh surface changes its air-absorbing surface area and affects the velocity of air passing through the mesh openings, air pressure loss, and fiber escape through the mesh.

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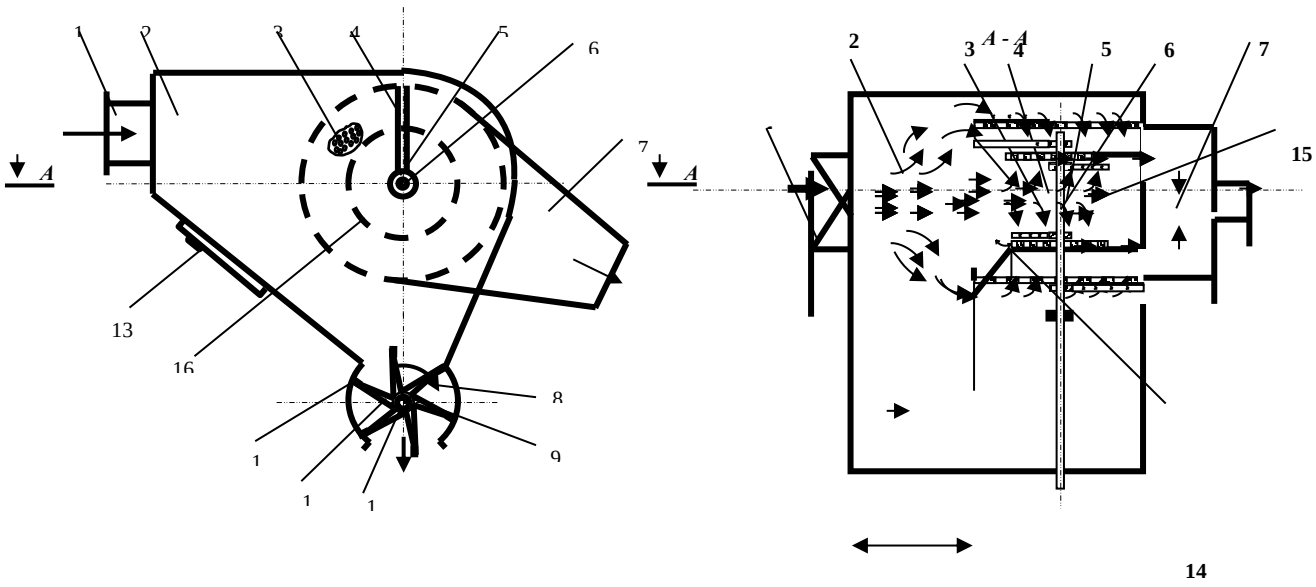

Conical mesh surface separator.

The air-absorbing surface of the separator mesh can be determined as follows:

$$F_0 = \frac{\pi d_0^2}{4} \cdot Z; \quad (1)$$

Here: d0 is the diameter of the mesh hole, mm; Z is the number of holes in the grid.

After the surface that can absorb air is known, we determine the speed of air passing through the hole of the mesh:

$$v = \frac{Q_0}{F_0}; \quad (2)$$

where: Q0 - air volume, m/s; F0 is the useful surface of the grid, m.

In this case, the amount of air flow corresponding to one holeQ0 is the ratio of the total air flow through the separator to the total number of holes in the sand:

$$Q_0 = \frac{1}{2} \cdot \frac{Q_{ум}}{Z}; \quad (3)$$

where: 1/2 - the coefficient indicates the distribution of air flow on two mesh surfaces. Then the pressure loss on the surface of the separator mesh can be determined:

$$\Delta P = \xi \frac{\rho \cdot V^2}{2}; \quad (4)$$

in which:□- air density, kg/m3; V - air speed, m/s;□- coefficient of local resistance.

Using the above formulas, the results obtained by changing the height of the cone-shaped mesh surface are presented in the table below.

The results show that when the shape of the mesh surface of the separator is made in the form of a cone, the change in its height leads to an increase in the surface of the mesh surface.

A decrease in the air speed leads to a decrease in the pressure force that sticks the cotton to the mesh surface

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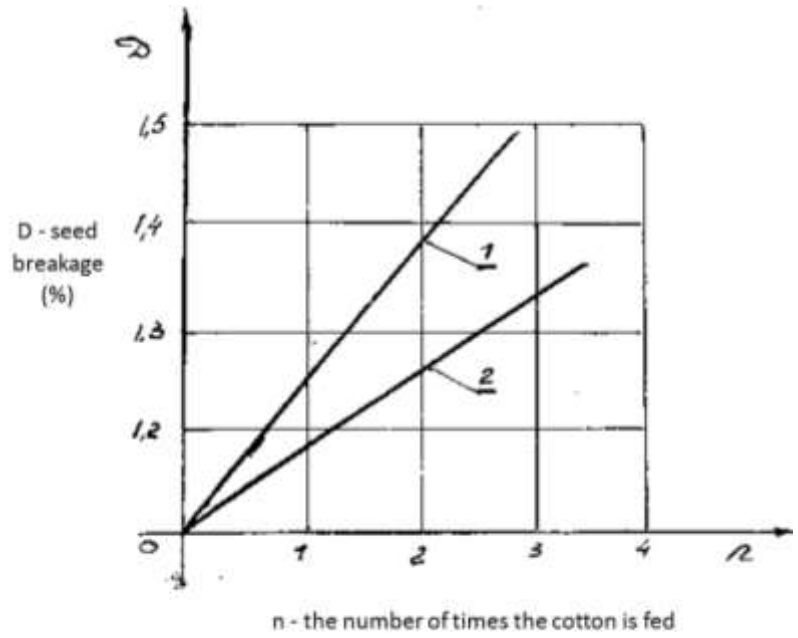
Air suction surface, velocity and pressuredependence on the height of the cone.

No	**cone height,**mm	**A surface that can absorb air,**m2	**The speed of air passing through the holes,** m/s	**Pressure loss,**Pa
1	100	0.283	8.8	385
2	200	0.301	8.2	334
3	300	0.329	7.5	280
4	400	0.364	6.8	230
5	500	0.405	6.1	185
6	600	0.449	5.5	153
7	700	0.497	5.0	124
8	800	0.547	4.5	103

This reduces the deterioration of its quality indicators - seed breakage and fiber damage during the separation of cotton stuck to the mesh surface in the separator.



Effect of cone-shaped mesh surface on seed breakage.

When the net surface is made in the form of a cone, its effect on the quality indicators of cotton was studied by conducting an experiment.

In order to find out the effectiveness of the cone-shaped mesh surface, cotton was passed through the experimental equipment several times in a row.

The graph constructed based on the obtained results shows that the influence of the cone-shaped mesh surface on seed breakage is significant. From the results, it was found that when a cone-shaped netting surface is installed, seed breakage is reduced by 2 times compared to a right circle-shaped netting surface.

But increasing the height of the cone increases the probability of its meeting with cotton. In order to reduce this situation, the shape of the mesh surface of the cotton separator has been changed. It was proposed to prepare the mesh surface in 3 different ways. The results obtained using the above formulas for the proposed grid surfaces are presented in the following table:

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Relation between Mesh Surface Shape and Air Absorbable Surface Velocity and Pressure Loss

No	**The shape of the mesh surface**	**A surface that can absorb air,**m2	**The speed of air passing through the holes,**m/s	**Pressure loss,**Pa
1.	Truncated cone	1,791	3.8	71
2.	Ball	1,878	3.2	50
3.	Cylinder	1,937	3.0	44

Calculations based on the table show that the change in the shape of the mesh surface of the separator has a significant impact on its efficiency.

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