ISSN NO: 2770-4491
Date of Publication:20-12-2022

# Improving the Design of the Multi-Pocket Stone Trapper

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**Abstract:** In order to increase the efficiency of the device for retaining heavy impurities in the cotton gins during the transportation of cotton by air, the design of the separator has been improved, as a result of which high efficiency is achieved in the separation of heavy impurities in the pneumatic transport device.

**Key words:** cotton, duster, pneumatic transport, multi-pocket, injury, heavy body, working chamber.

One of the main ways to develop cotton ginning enterprises is to develop and implement highly efficient techniques and technological processes.

Heavy objects and metal fragments of various sizes fall into the cotton during the process of weighing cotton, drying it in field conditions, and breaking the scum in cotton gins and transferring it to processing. In this case, objects fall into the working chamber of the machines installed in the cotton processing system, disrupt their work process, damage the working organs, as a result, the productivity of the machines decreases and the working organs quickly fail. At the same time, heavy objects, metal fragments are the main cause of fires in cotton ginning factories. The impact of heavy mixtures on the metal parts of the working bodies rotating at high speed causes a fire.

Therefore, the problem of separating heavy impurities during cotton processing is important.

This article presents the results of scientific research carried out on the comprehensive study of the working processes of the existing devices that trap heavy impurities in cotton ginning enterprises today and on the elimination of shortcomings.

In cotton ginning plants, devices that trap heavy impurities are mainly installed at the transition from the horizontal part of the pneumatic transport line to the vertical part. In this case, the air velocity that the cotton can lift and move in a vertical direction allows the separation of other compounds that are heavier than it. The biggest disadvantage of the device based on this principle is that the cotton along with heavy impurities falls to the bottom of the chamber.

To overcome this, it is necessary to reduce the dimensions of the pocket at the bottom of the camera. Such a change found a new way to increase the surface of the useful part of the pocket of the stone holder. In this method, it was proposed to install additional pockets at certain distances in the stone holder chamber, not by directly increasing the useful surface area. An experimental device designed to determine the number of pockets was developed with the ability to change the number, size and location of pockets. [1]

Taking into account that the main part of the refrigerator is the separation chamber where the process of trapping heavy objects takes place, it is necessary to determine its structural and geometrical parameters.

The working chamber of the existing linear crushers is often cylindrical or rectangular. Stone crushers with a rectangular working chamber are more common.

The width of the chamber ensures the normal movement of the processed material during the capture of heavy mixtures.

If the width of the chamber is large enough, if the layer of material is smaller than it, good conditions are created for trapping heavy mixtures, and it is easier for these mixtures to fall into the stone collector in the pocket.

When the freezer chamber is small, the thickness of the processed material is large, and it is difficult to separate heavy impurities (especially small objects) from the cotton content. In this case, the unity of heavy objects with cotton will be more perfect.

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In order to increase the productivity of the process of catching heavy objects from cotton, it is recommended to make the cross-sectional area of the separation chamber 0.25 m2 (in 2ChTL and LKS separators) and the air velocity in the chamber to be 12.5 m/s and 16 m/s. Therefore, we can make the working chamber of the experimental device 0.25 m2. There was a need to conduct an experimental study to determine the shape and dimensions of the working chamber for efficient and reliable operation of the refrigerator.

3 different types of working chamber of the incinerator were selected for the experimental study. These chambers differ from each other in the location of the pockets and the geometric shape of the spaces between them, in addition to the trapping process, the main use, centrifugal force and inertial forces. These cases depend on the mode of transportation and the dimensions of the working chambers, as well as the physical-mechanical and aerodynamic properties of cotton and heavy objects.

Each selected working camera type was considered separately. At the bottom of the working chamber of the first type of grinder, the pockets are bent under a certain radius. The space between them is in the form of a smooth surface and is placed at a certain angle to the horizontal.

Thus, it can be concluded that the process of separation of heavy objects from cotton in the working chamber of the first type of crusher mainly depends on the speed of transportation, centrifugal force, the weight of cotton and heavy objects, and the coefficient of friction.

The second type of working chamber also consists of an inclined surface that forms pockets at the bottom. The curve between the pocket sections is bent towards the inside of the working chamber, which prevents small impurities from being entrained by the air and allows them to fall into the first pocket.

The working chamber of the third type is rectangular, the location of the pockets and the shape of the intermediate surfaces are the same as the second type, the difference is that the exit pipe is located at the top of the separation chamber, which is installed at an angle to the inlet pipe. The change in the air flow rate causes the cotton to hit the back wall of the separation chamber, and the disturbance of the cotton and the mixing of the heavy impurities with the cotton increases the trapping efficiency. Thus, in the working chamber of the third type, gravity and centrifugal force are used at the same time. In addition, additional cotton thread is formed. [2] This causes maximum pocketing of heavy objects. The upper part of the pockets located in the working chamber of this selected stone catcher is equipped with a semi-circular grid. (Figure 1)

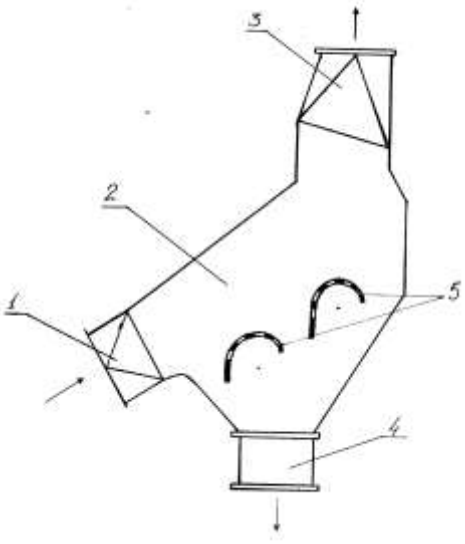


***Figure 1. Advanced stone holder with multiple pockets***

The stone catcher consists of the following main parts: an inlet pipe 1, a separation chamber 2, an outlet pipe 3, a hopper 4 and pockets 5 for collecting heavy objects.

When the stone catcher is working, cotton enters the separation chamber 2 through the inlet pipe 1 with the help of air flow. Since the size of the separation chamber is large compared to the inlet pipe, the speed of the cotton decreases. Part of the heavy objects falls into the first, the rest into the second and third pockets, and accumulates in the hopper 4. The cotton cleaned from heavy objects is transferred to the next machine through the outlet tube 5 with the help of air flow. At the same time, the semi-circular mesh surfaces installed on the upper part of the pockets allow cleaning of small impurities in the seed cotton. The fact that the mesh surfaces are installed on an elastic base significantly reduces the impact force. As a result, the factors affecting the quality of seed cotton, which have a mechanical effect, are eliminated to a certain extent.

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