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Justification of the Technological Scheme for a Disc Potato Digger with Elastic Fingers

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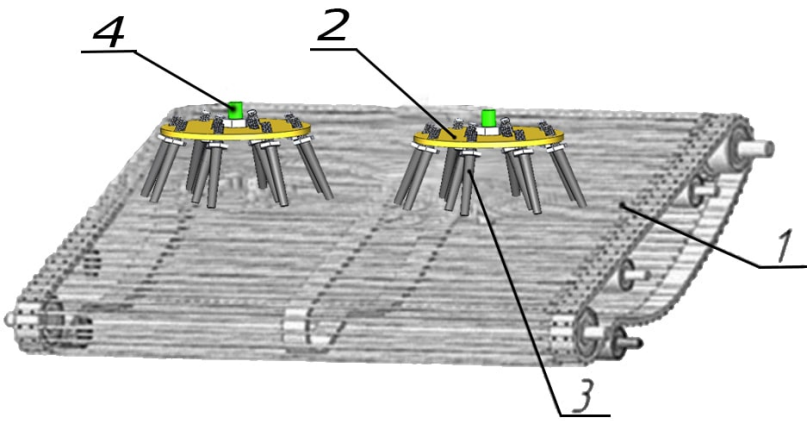
Abstract: The study revealed a decrease in the efficiency of the sieving process due to uneven distribution of the soil-potato mixture along the sorting elevator in potato harvesters. To address this issue, a design for a sorting elevator with an elastic-fingered disc was proposed. This device evenly distributes the mass across the elevator's transverse surface, intensifies sieving, and reduces damage to tubers.

Keywords: elevator; soil; elastic finger; disc mechanism; damage reduction.

Introduction

Analysis of the literature reveals that in potato harvesters, the soil-potato mixture and tuber layer do not fall uniformly across the width of the sorting elevator's surface. More material falls on one section while almost none falls on another. Consequently, soil sifting efficiency decreases and the load on subsequent working components increases [1,2,3]. To address this issue, it is proposed to incorporate an elastic finger disc sorting elevator into the design and technological scheme of the potato harvester. This modification aims to ensure uniform distribution of the incoming mass across the width of the elevator (Fig. 1).



1 - plowshare; 2 - elevator; 3 - elastic finger; 4 - disk; 5 - shaft.

Figure 1. Schematic diagram of a flexible-fingered disc elevator

A digger equipped with such a device (Fig. 1) consists of a lifting elevator 1 and elastic fingers 3 on its upper part, a disk 2, and a shaft 4 fixed to it. The disk with elastic fingers is made in the form of flat discs rotating around its axis, which are installed perpendicular to the plane of the rod elevator 1. The fingers 3 are made from a rubber-coated spring, with their upper parts threaded for easy attachment to the disk. Бармоқ эса резина билан қопланган пружина бўлиб юқори қисми резбали стержендан иборат бўлиб уч хил кўринишда ясалган (2-расм).

The potato digger operates as follows. Potato tubers, along with the soil layer, are excavated by a plowshare and deposited onto a rod elevator. As the soil layer moves along with the elevator bed, it separates from the tubers and falls through the gaps between the elevator rods.

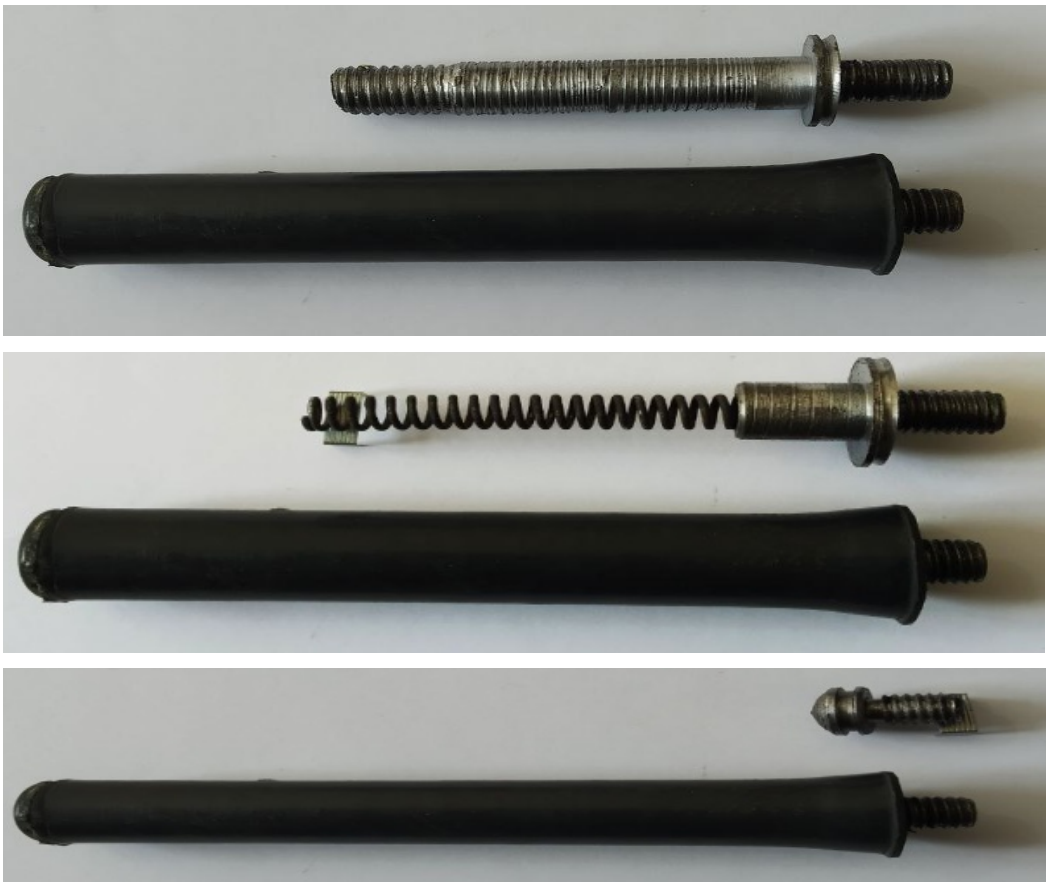


Figure 2. Types of Elastic Fingers

When the elastic-fingered disk interacts with the tuber layer, the fingers installed at the bottom of

the disk evenly penetrate the layer and rotate around their axis at a specific angular velocity. This evenly distributes the mass along the transverse surface of the elevator, thereby accelerating the sieving process. Since the fingers are made of rubber and the elevator rods are covered with rubber, damage to potato tubers is reduced.

The reason for the uniform penetration of fingers into the layer is that the fingers attached to the disks are made in the shape of a truncated cone and are positioned at a 30-degree angle to the disk.

Consequently, in our opinion, to create a new model of the screening process, it is necessary to conduct research in the following areas:

- manufacturing screening acceleration devices from elastic elements to prevent damage to potato tubers;
- design sieving acceleration devices for the upper part of the elevator, taking into account the physical and mechanical properties of the soil, in a way that ensures the spread of mass across the transverse surface:
- To increase the efficiency of separating potato tubers from soil and prevent the accumulation of potato-soil mixture on the elevator surface, coordinate the movements of the sifting accelerator's working part with the elevator. This coordination ensures the soil is spread along the width of the elevator, thereby enhancing the sifting process;
- Justification of the design, operating mode, and main parameters of a potato harvester equipped with a mechanism that accelerates the spreading and sieving of the potato-soil mixture across the transverse surface of the elevator.

Conclusion

The analyses conducted and the constructive solutions proposed demonstrate that the elastic-fingered disc sorting elevator practically eliminates a number of issues present in potato harvesters. The device evenly distributes the soil-potato layer on the elevator surface, intensifies the sieving process, and reduces the excessive load on subsequent working components. As a result of using elastic elements, damage to the tubers is significantly reduced. Future research should focus on substantiating the optimal design parameters of the device, mathematically modeling the work process, and confirming its effectiveness through experimental tests. The proposed solution serves to increase both the productivity and work quality of potato harvesting equipment.

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