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## INNOVATIVE MACHINES FOR POST-HARVEST GRAIN HANDLING

**Abstract:** In the article the problems of creating high-performance and efficient machines on the basis of grain casters. Optimal parameters of technological operations for cleaning grain from various impurities. Development of the optimal design of pneumatic rotary classifier, which allows the combination of the transfer and primary processing preliminary drying of grain products.

**Key words:** The grain thrower-classifier pneumonectomy classifier, combining handling operations with technological, grain cleaning from impurities, disinfection and pre-dried.

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### Introduction

Post-harvest grain processing (hereinafter POS), the current consists of preliminary treatment, primary treatment, temporary storage of wet grain, drying, secondary cleaning, sorting. Freshly harvested grain weight, coming in at zernotoka, is characterized by high humidity. The average humidity of the grain mass is 23-25%, and in some

wet years and more. Humidity impurities in the grain pile is 40-45%, and sometimes much more. When storing such grain in it is the redistribution of moisture between the impurity and the grain, which leads to higher grain moisture. This additional cost for grain drying. Moisture exchange between the weeds and the wheat ends mostly in the first day of storage, so pre-cleaning of grain should be carried



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out immediately as soon as the grain is received on the current. To cope with this work, the performance of primary cleaning machine should be 1.5 times more performance combine Park.

Currently in a market economy, producers of grain, grain and grain-processing enterprises of Kazakhstan and CIS is not able to effectively and timely to make POSES, so as existing warehousestyle, grain cleaning machines, pneumoseparation, mounted bulky, complicated, energy-intensive with low throughput and operational capacity. Pneumatically and de-dusting devices do not provide efficient cleaning of grain from light impurities and dust [1].

### Materials and Methods

Pre-cleaning is performed on machines MPO-50 and SPO-100, are part of a complex HEAD 50 and seed lines, as well as purifiers samoperedelny heap OBC-25, MS-4.5 and . In the process of pre-treatment of seed should not be less than 50% weed impurity of grain and straw all organic impurity. Used for pre-cleaning grain cleaning separators, warehousestyle worn out and obsolete, and their components (sieves, disks, etc.) are expensive [2].

A brief overview of previous studies conducted in the world relating to the subject studied, and their relationship to the proposed Project:

Known scalperator for the separation of grain mixtures into fractions consisting of a cylindrical horizontal separators installed inside the blades, rotating brushes, boot device, containing the feed pipe, feed pan, the bottom of which is made of lattice set over it the valves and the finger gratings. A. S. USSR №1282916. Publ. BI 1987, No. 2, [3]. The disadvantage of this scalperator is the clogging of the holes of the cylindrical and the finger gratings, which reduces the efficiency of grain cleaning from coarse impurities.

Known de-dusting chamber, duoaspirator, pneumocystitis, pneumoseparation and pneumatic classifiers, including housing, feed and discharge devices, and distribution of galuzi-wide grid with adjustable louvers and pylevozdushnogo nozzles. A. S. USSR №1222326 A. Publ. 1986, bull. No. 13 [4]. These devices have significant disadvantages: low productivity, low technological efficiency of separation of impurities from the product because of the impossibility to ensure the necessary fluidized bed at high flows, the device is quite bulky, high energy consumption.

Known aeroplanitaliani classifier, comprising a housing within which are mounted at an angle distribution device, loading and unloading devices located respectively in the upper and lower housing parts, delivery and suction hoses. A. S. USSR №1688938 A1. Publ. 1991, bull. No. 41, [5]. The disadvantage aeronavigational classifier is low constwo products classification due to insufficient

intensity of loosening the granular products in the area of classification, which complicates the removal of the air flow light impurities and dust.

Known usernameamely ZM-60 and P6-MZS-100, designed for loading and unloading of granaries, mechanical grains at the sites zernotok to form heaps of grain and loading in transport facilities, separation with the separation of light impurities, consisting of conveyors, belt thrower, chassis with electric drives [6]. The lack of sinamatella: low technological efficiency of separation of light impurities due to the lack of pneumatic classifying technological devices.

We offer innovative technology relates to the acceptance and processing of grains and "grain thrower-classifier" [7] is designed for transferring, reloading and cleaning of grain mainly of grain and grain products from large, metallomagnetic, light impurities and dust, as well as for disinfection and pre-drying of grain products.

The task and the technical result of the innovative technology is to enhance technological capabilities "of the grain thrower-classifier". This is achieved by the fact that the "grain thrower" between the scraper conveyor and belt thrower set "Pneumotomy classifier" [8] having feed or discharge pipes, control valves with electromagnets, an annular rotor mounted inside it mimoletnye regulators of the gap, with the outer side cut scraper and nozzle outlet big impurities, from the front side cleaning hatch, pneumocephalus the camera closed in on the outer sides-adjustable louver grilles, one of which communicates with the inlet of the suction fan, and at the end face the observation window.

POSES aimed at bringing the fields removed from the grain mass in a persistent state while maintaining or improving the quality of grain received. The full cycle of POSES includes: grain receiving and batching, cleaning from impurities, drying and aeration [9]. POS is one of the most important technological operations determining the safety of grain. Unlike the existing cleaning technology based on the use of a large set of bulky, power-consuming and expensive cleaning machines and dryers standard, according to the proposed technology, the process of handling the grain consists of three technological operations: cleaning-normalization of the grain heap from large, small and light impurities-chaff, straw, dust and other light impurities, with simultaneous pre-drying and disinfection.

Despite the obvious advantages, poliobraces machines for grain processing (hereinafter MPAS) in Kazakhstan has so far not produced. Arriving in the country NOT from near and far abroad are very expensive, and not sufficiently adapted to the realities of Kazakhstan, which leads ultimately to higher prices of manufactured end products. In this



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regard, the problem of developing NOT adapted to local conditions, meeting the requirements of resource-saving technologies, low-cost and reducing the cost of production of crops is relevant, and its solution is important for the agriculture of Kazakhstan.

The scientific novelty of the results scientific and (or) scientific and technical activities (RNTD) confirmed Innovation patents for utility model. The new development is that "Pneumotomy classifier" [8] installed on grain thrower: between the feed conveyor and trimmer, which will allow to combine transshipment operations with technology, as grain cleaning from small, large, metallomagnetic, light impurities and dust, as well as a pre-disinfection and drying of grain.

The combination of a swap and POSES on the currents of peasant and individual farms will result in: productive efficient and timely manner cleaning from impurities, to reduce operating costs on the acceptance and processing of grain, greatly reduce the infestation of grain by stored-grain pests, to create favorable conditions for drying and storage of grain.

Practical and commercial interest adjustment in Kazakhstan industrial production of modern MPOS original design for the grain-producing enterprises,

which in turn will ensure the integration of science and production, creation of conditions for commercialization of intellectual property products and technologies. Given the increasing preference of customers and consumers to MPAS and its regional deficit, their production provides a clear competitive advantage for manufacturers.

The main scientific results of the proposed project was obtained in the framework of the conducted scientific research on a proactive basis and the candidate's dissertation on topic "Improvement in machines for cleaning grain from impurities in the lines of taking" [10], defended at the Moscow state Academy of food production.

Laboratory and experimental sample "of the grain thrower-classifier" was made at the expense of innovation grant "NATD". Innovative grant for commercialization of technologies at the stage of proof of concept project for commercial use of technologies and JSC "National Agency for technological development". Contract No. 233 dated 8.12, 2014

Laboratory and experimental sample "grain thrower-classifier" is a pneumatic rotary classifier, mounted on the "grain thrower", between the feed conveyor and trimmer.



Figure 1 - Shows a General view "of the grain thrower-classifier".

Practical value of results of scientific activities are:

-the original classification structure thermometallic machines.

-justified by the kinematic and structural parameters of the grain thrower;

-proposed new design solutions in the development of sinamatella;

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-experimentally verified the effectiveness of cleaning grain from light impurities by the method of separation of grain and uniformity of its distribution on the cross sectional area of pneumocephalus camera[11];

-optimized process conditions for the process of cleaning grain from the large and light impurities[12];

-developed initial requirements for the experimental sample of the "grain thrower-classifier";

-design features of the proposed development allow to upgrade existing Sinometal;

-the economic substantiation of improved design of the grain thrower.

### 2) the importance of the Project in national and international scale:

Developed home modification MPOS will be adapted to the conditions of the Republic of Kazakhstan, will ensure a high quality of work and reduce the cost of post-harvest processing of grain in 1,3-1,5 times.

Organization of production MPS will contribute to the solution of the question of import substitution of grain cleaning equipment, use of production capacities and creation of new jobs at the machine-building enterprises of the Republic.

In innovative technology for the POS demand in almost all grain-producing and grain-processing enterprises of Kazakhstan and CIS countries. Due to the implementation of the project aimed at import substitution of domestic demand will be closed according to preliminary estimates by 55%. That is very important for our country engaged in activities aimed at accelerated industrial-innovative development of agriculture.

Positive outcome of the project is that consumers will get less expensive, adapted to the conditions of Kazakhstan and is able to work in different resource systems, post-harvest handling of grain refinery complex. Developed "grain thrower-classifier" superior in quality and performance with

foreign counterparts due to lower costs from combining the process of reception and primary processing of grain. The use of the proposed MPAS, innovative technology, in addition to the cleaning of contaminants is accompanied by a preliminary drying, which has a positive effect on the safety of grain stocks.

The priority direction of agricultural engineering in Kazakhstan should include the development and implementation of a system of machines for intensive post-harvest processing of grain with application of energy - saving technologies.

3) scientific and technological needs (include social demand and economic and industrial interest), including trends relevant areas of knowledge to justify the importance and necessity of the Project;

Scientific and technological needs will be that consumers will get less expensive, adapted to the conditions of Kazakhstan and is able to work in different resource systems, post-harvest handling of grain refinery complex, not inferior in quality and performance with foreign counterparts that will eventually get breakthrough results – the use of the equipment and technologies allow to obtain an economic effect of 1.5 million tenge, in the processing of 1000 tons of grain due to lower costs from combining the process of reception and primary processing of grain.

**The presence of know-how:** Combination in a single mobile device overload operation technology, as grain cleaning from large, metallomagnetic, light impurities and dust, as well as disinfection and pre-dried grain products.

Innovative technology relates to the acceptance and processing of grains and "grain thrower-classifier" is intended for a swap, transfer grain and cleaning up mostly of grain and grain products from large, metallomagnetic, light impurities and dust, as well as for disinfection of grain products and pre-drying.

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