
SECTION 23. Agriculture. Agronomy. The technique

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CREATING A COMPLEX INNOVATIVE MACHINERY GRAIN PROCESSING

Abstract: *In this paper proposes a set of innovative machines for the processing of grain (KIMPZ) : 1. Pnevмороторный classifier; 2. Five, plant for treatment of major grain products, and light impurities; 3. Grain thrower classifier.*

Innovative developments include the agro-industrial complex, to the acceptance and processing of cereal products intended for cleaning the grain and grain products from large, metallomagnetic, light impurities and dust, as well as for disinfection of grain products.

Key words: *pnevмороторный classifier, grain thrower, classifier cleaning the grain.*

Corn growers (farms), grain-collecting stations and grain-processing enterprise of the RoK and the CIS are currently unable to carry out postharvest treatment of grains as available precleaners, grain separators, pneumatic separators, scalping machines are bulky, complicated, energy-intensive with low capacity and efficiency. Pneumatic cleaning and dust-collecting devices do not provide proper removal of light impurities and dust.

Grain separators and pre-cleaners used for primary treatment are worn and aged and their parts (sieves, disks and etc.) are expensive.

The proposed machine complex for primary processing of grain consists of five innovative developments;

- device for removal of light impurities at conveyor's loading point; pneumatic rotary classifier, pneumatic classifier of products at conveyor's discharge, unit for removal of light and coarse impurities, grain thrower-classifier.

Innovative developments refer to agro-industrial complex, acceptance and processing of grain, intended for removal of coarse, heavy, metal-magnetic admixtures and dust as well as for disinfection of grain products.

Development of innovative equipment and technology involves introduction of effective grain treatment to remove coarse and light impurities, insects and mites at barn yards of farms and receiving lines of grain-collecting and grain-processing enterprises before grain mass enters production facilities, that enables to reduce operation costs on receipt and processing and establishes more favorable working conditions for transporting and production machines.

Project purpose:

- to create and introduce complex of innovative equipment and technology for primary treatment of grains to remove coarse and light impurities enabling to increase separators capacity and efficiency of grain processing;
- to reduce costs on acceptance and processing of grain and to significantly decline contamination of grain products, carry out primary drying of grain and establish favorable conditions for drying and storage of grain products.

Project factuality:

There are currently no works on development of highly productive and efficient machine on grain throwers basis and research of optimal parameters as a process operation for removal of various impurities from grain, as well as on structure of pneumatic rotary classifier, pneumatic whirl normalization, enabling to combine overload, primary processing, and primary drying of grain products.

There are no R&D works for production of machines and devices of highly productive, efficient acceptance, primary processing, primary drying of grain products under conditions of grain-producing and grain-processing enterprises. In connection hereof the proposed project is up-to-date and actual.

Taking into account that the project is directed to development and introduction of complex of innovative machinery and technology of primary grain processing to remove coarse and light impurities, enabling to increase productivity of separators and efficiency of grain processing, decreasing contamination of grain products and establishing favorable conditions for drying and storage of grain products, thus, R7D perspectives are doubtless

Main working part of the proposed machine complex is pneumatic rotary classifier. It is designed for processing of grain and grain products in particular for removal of coarse, metal-magnetic and light impurities and dust, and can be used at the grain products enterprises, agriculture and other branches of industry.

The innovation in development is that the frame of pneumatic rotary classifier consists of two sections, that increases productivity. Cargo valve with electric magnets not only provides uniform feed of product along the cross-section, but also removes metal-magnetic admixtures. Ring rotor with installed inside cross blades is a screening element. Product passes ring rotor and is separated into several layers forming intergranular spaces that facilitates effective impact of air over light impurities in vertical pneumatic separating chamber. Fork scrapper not only separates coarse impurities from the surface of ring rotor, but also prevents jamming of particles between the rings.

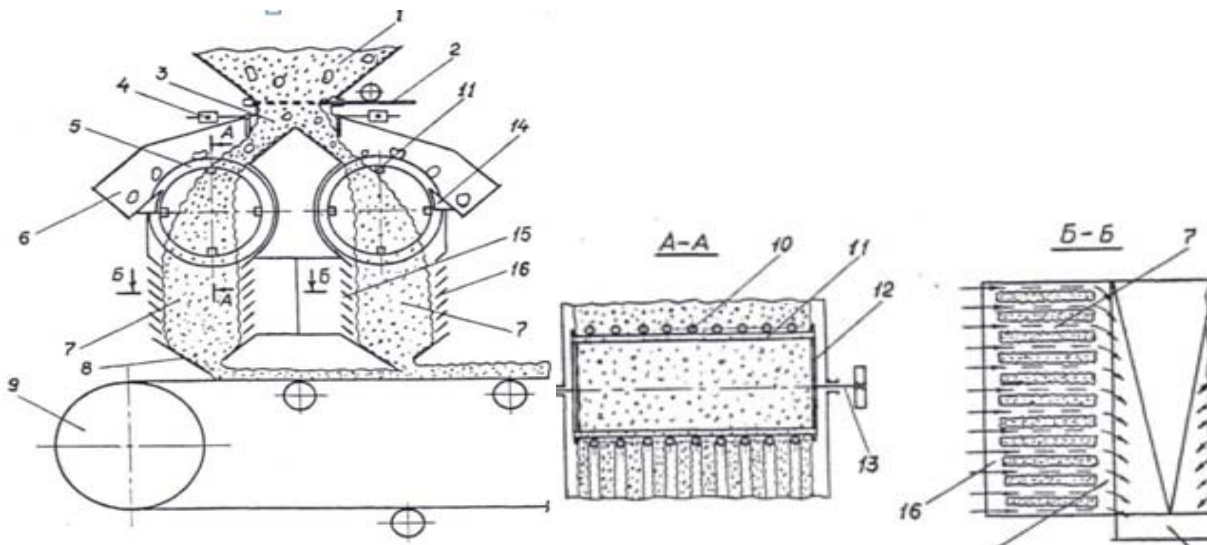
Y-scraper not only separates coarse admixtures from the surface of ring rotor but also prevents jamming of particles between the rings. In case of jamming in the interior of ring rotor cleaning holes are provided.

Second variant of innovation: pneumatic whirl normalizer is installed on grain thrower, where energy of whirl is used for separation of grain through vortex tube.

The next know-how: SHF source is installed on grain thrower for primary treatment of grain products.

The drawing 1 demonstrates circuit diagram of pneumatic rotary classifier. Classifier includes hopper 1, valves 2, receiving pipe 3 with bends and cargo valve with electric magnets 4 for regulation of product flow and removal of metal-magnetic impurities. Any bend of receiving pipe 3 is followed by ring rotor 5 with pipe 6 for coarse admixtures, pneumatic separating chamber 7 and discharge pipe 8. Conveyor 9 is located under discharge pipe.

Pneumatic rotor classifier is installed at reloading points of conveyors in grain products receiving and processing line that enables to combine transportation operation with processing ones, such as removal of metal-magnetic, coarse and light impurities as well as dust removal and disinfection of grain. Electromagnetic sheet not only provides uniform feed of product to ring rotor but also discharges metal-magnetic impurities. Ring rotor with installed inside cross blades is a screening element.

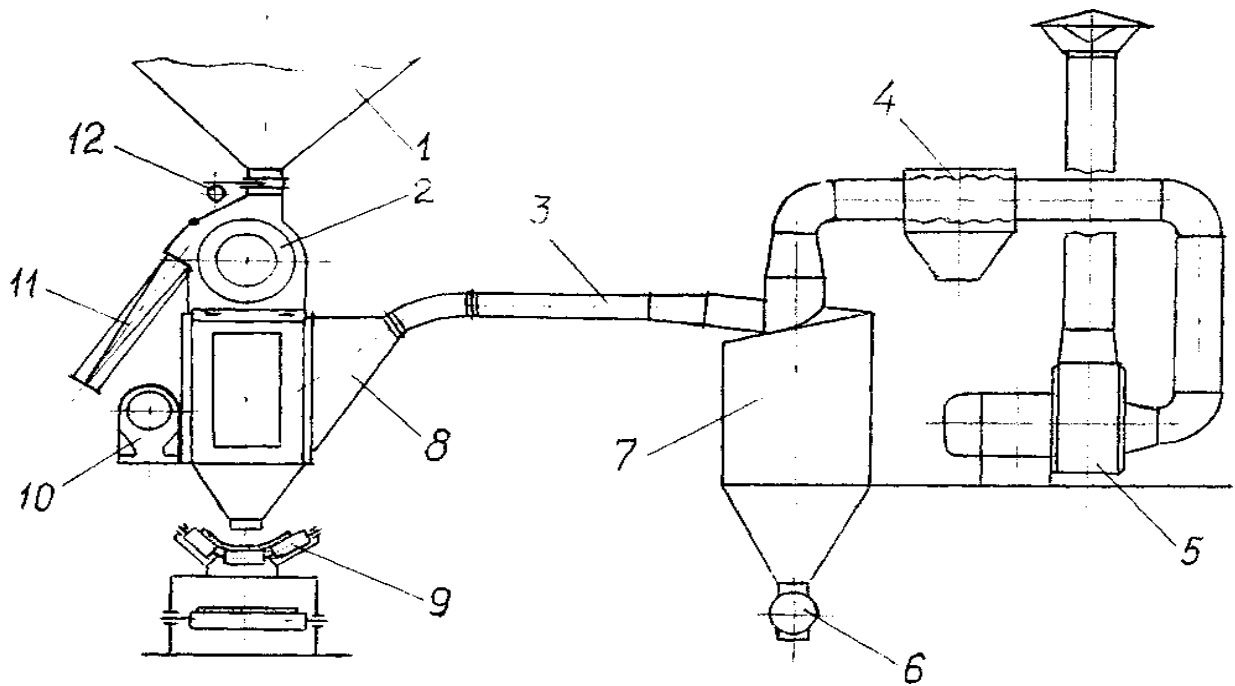


Picture 1 - Circuit diagram of pneumatic rotor classifier.

Drawing 2 demonstrates circuit diagram of unit for removal of coarse and light impurities from grain, that consists of pneumatic rotary classifier 2, air ducts 3, cyclone-separator 7, filter 4 and suction fan 5.

Unit operates the following way. Grain from charging bin 1 passes through valve 12 and enters pneumatic rotary classifier 2, where coarse and light impurities are removed from grain. The removed impurities are discharged through pipe 11 to discharge collector. Light impurities from pneumatic separating chamber are sucked out by fan 5 through suction pipe 8 and system of air ducts 3 to cyclone-separator 7, where centrifugal forces make impurities and dust settle and discharge them through rotary lock 6 to discharge collector. The remained dust is cleaned in filter 4. The air purified from light admixtures and dust is exhaled to atmosphere. The purified grain enters working conveyor 9.

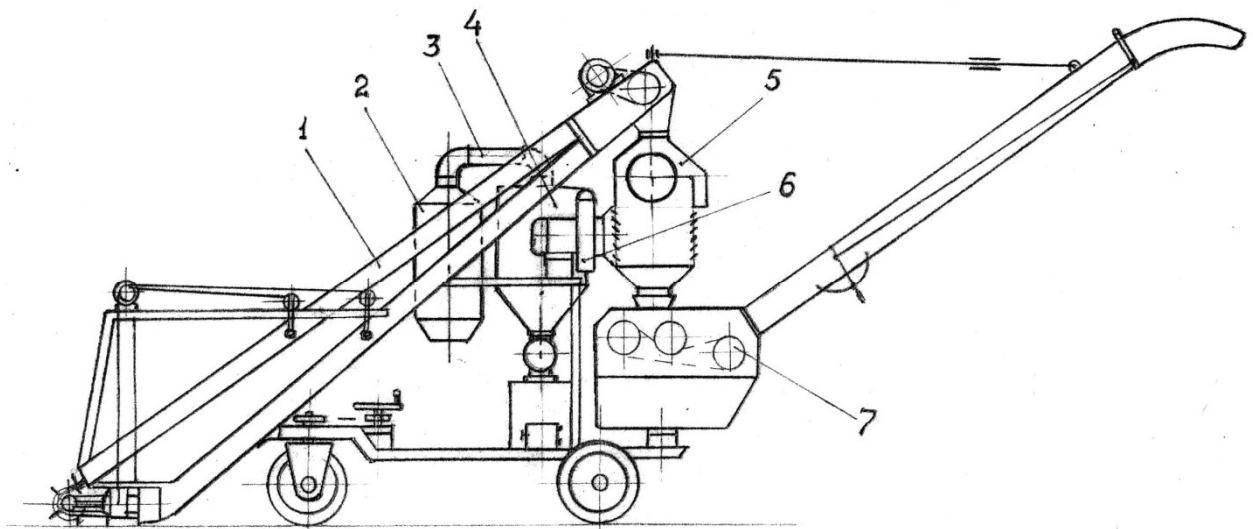
Rotation of ring rotor is carried out through geared motor 14 by chain belt 13. Adjustment of ring rotor frequency is included. There is an inspection door 11 for observation over coarse impurities removal process and inspection window 7 for observation of light impurities treatment.



Picture 2 - Circuit diagram of coarse and light impurities removal unit.

Drawing 3 demonstrates circuit diagram of grain thrower – classifier consisting of grain thrower (P6-M3C-100) and pneumatic classifier (PRK-100). Basic elements are scrapper conveyor 1 and belt thrower 7. Pneumatic rotary classifier includes classifier 5, suction fan 6, cyclone separator 4, air duct 3, bag hose 2. Classifier 5 is installed between scrapper conveyor 1 and belt thrower 7.

Grain thrower – classifier operates the following way: grain passes through scrapper conveyor 1 and enters classifier 5, where metal-magnetic and coarse impurities are removed. Light impurities including dust and insects from pneumatic separating chamber of classifier 5 are removed by high-pressure fan 6 and are delivered to cyclone-separator 4, where light impurities are removed and dust-air mixture through air duct 3 is delivered to bag hose, where dust is settled. Purified grain from discharge pipe of classifier 5 enter endless belt of grain thrower 7.



Picture 3 - Circuit diagram of grain thrower – classifier.

Thus, the advantage of proposed classifier is high productivity and efficiency of removal of impurities from grain, as well as combination of transportation operations with processing ones.

Primary treatment of grain in receiving line prior to entering production facilities permits to reduce dust content, explosion hazards and premature wear of processing equipment and to increase resistance of grain during storage.

Introduction of complex for primary grain processing into production positively affects environmental conditions, as dust emissions to environment and production facilities are eliminated, thus providing basic principle of environmental protection.

Introduction of machinery and technology of primary processing of grain products excludes emission of dust into both production facilities and atmosphere. Application of highly effective equipment and up-to-date technology permits to reduce unexpected risks and increase culture of agricultural production.

Combination of reversal and primary treatment of grain products at barnyards of farms and farm households enables to effectively and timely carry out removal of impurities, to reduce operation costs on receipt and processing of grain, to decline contamination of grain with pests, to establish favorable conditions for drying and storage of grain. Application of the proposed equipment and technology enables to reach economic effect of 1.5 million tenges through reduction of costs by combining receipt and primary treatment of grain.

Freshly gathered grain in northern regions is known to have high moisture, thus food value is lost without primary treatment and grain resistance is reduced dramatically by 20% during storage. Application of the proposed technology except for removal of harmful (vegetative, compounds of grain piles and impurities) impurities is accompanied by blow-off, i.e. preliminary drying, that positively affects preservation and disinfection of grain reserves. As a result of primary processing of newly harvested grain, in northern region of RoK in particular, moistening of grain is eradicated and its resistance during storage is increased.

Production and effective primary treatment of grain in receipt lines of grain-collecting and grain-processing enterprises before entering production facilities enables not only to increase resistance of grain during storage by 20% but also to provide safe working conditions; dust and explosion hazards are excluded, sanitary and hygienic conditions are improved, premature wear of processing equipment is prevented.

Almost all farms and farm households, grain-collecting and grain-processing enterprises gain profit from introduction of the proposed equipment and technology in the amount of at least 1600000 tenges, as they are reliable in operation, simple in structure, are cost-effective and can be easily installed in transport communication lines of receipt and primary processing of grain.

Profit of all grain manufacturers from introduction of a whole complex of innovative machinery and technology of primary treatment of grains is in reduction of expenses by 2.5 times per 1 ton of processed grain at the expense of increase in productivity and efficiency of removal of coarse, metal-magnetic, light impurities and dust as well as harmful pests.

Market objects are all grain producing enterprises: farms and farm households, grain-collecting and grain processing enterprises: elevators, mills, mash-, alcohol-, beer- and oil-producing enterprises. Almost all grain producing and grain processing enterprises of the RoK and CIS require equipment and technology of primary processing of grain.

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