

# DETERMINATION TECHNIQUE OF KEY PARAMETERS THE CLOSED SMALL-SIZED GRAIN SEPARATORS

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The closed small-sized grain separators (ZMPZ) are applied when production is demanded much on ecology and sanitary and hygienic working conditions. Therefore development of ZMPZ which in comparison with available analogs have big simplicity of a design, smaller power consumption of process of separation and smaller metal consumption, is an actual problem of postharvest processing of grain.

The closed small-sized grain separators scheme with the diametrical counterflow fan that is distinctive feature in comparison with existing analogs is developed. Use of such fan, which output channel is directly connected to the air channel (PSK), reduces overall dimensions of ZMPZ and by that reduces metal consumption of ZMPZ [1].

Key parameters of ZMPZ are height of  $H$  and  $h$  PSK depth; depth of  $h_{II1}$  of the pneumatic transporting channel (PTK), depth of  $h_{II2}$  of the channel of the zhalyuziynny air cleaner (ZhV), and radiuses of  $R_{II}$ ,  $R_C$ ,  $R_{\mathcal{K}}$ ,  $R_B$  of cylindrical walls of these channels. All channels have rectangular sections with a constant width of  $L$  that provides simplicity of production of ZMPZ [2].

Width of  $L$  and depth of  $h$  PSK are defined by the set productivity of ZMPZ, and the radius of  $R_C$  of an external cylindrical wall of PTK from the general configuration of ZMPZ. Height of  $H$  PSK is defined by demanded efficiency of purification of grain from impurity. Parameters of the diametrical fan are selected from a high-speed mode of an air stream of grain necessary for effective cleaning.

At violation of smoothness of surfaces of internal and external walls of PTK and

ZhV and their connections the zones of a separation of an air stream and turbulences appear. It leads to adjournment of impurity particles on an external surface of an internal wall of PTK and, therefore, to increase in power consumption of ZMPZ. For elimination of these phenomena internal and external walls of PTK and ZhV are carried out in the form of the interfaced cylindrical surfaces [3, 4].

Curvilinear PTK looks like a confusor. Narrowing of the section through passage leads to alignment of a high-speed pressure of air on depth, turbulence reduction owing to movement of an air stream with acceleration. At particle movement in such channel it is affected by the increasing force of reaction of an air stream. As numerical experiments show, the particle successfully passes PTK [3].

For determination of ranges of values of depth of  $h_{II}$  PTK and radius of  $R_{II}$  of an internal cylindrical wall of PTK movement of an impurity particle on an external surface of an internal wall of PTK and conditions of its separation from a wall are considered. In this case the particle tests the greatest resistance.

The PTK directly passes to ZhV. It provides an optimality of configuration of ZMPZ. The ZMPZ zhalyuziyny air cleaner is also made in the form of a curvilinear confusor. It provides uniformity of air selection through a zhalyuziyny lattice and high quality of purification of air from light impurity. The particles of impurity which are taken out by an air stream from PTK, can enter in by-pass the ZhV channel with various initial coordinates, speeds and corners [4, 5].

The made numerical experiments by a Runge-Kutta method by means of the software package of computer mathematics of SciLab v.5.2.1 considered all set of options and allowed to determine ranges of values of depth of  $h_{II2}$  and radiuses of  $R_{Ж}$ ,  $R_B$  of cylindrical walls of ZhV. Critical values of speeds of a vitaniye of the easiest particles of impurity which can pass through a zhalyuziyny lattice of ZhV in an entrance branch pipe of the ZMPZ diametrical fan are received. It allows to estimate extent of cleaning of an air stream from light impurity [4, 5].

Ranges of values of the key design data of the ZMPZ small-sized sedimentary chambers were investigated in work [6].

Thus, setting the speed of an air stream in PSK taking into account the speed of a

vitaniye of components of a grain material, productivity of ZMPZ and making numerical experiments, it is possible to determine ranges of values of key parameters of PSK, PTK, ZhV and sedimentary cameras of small-sized grain separators with the closed cycle of an air stream. The offered technique can be applied by the scientific, design organizations to development of perspective cars for purification of grain from impurity.

### **References**

1. The closed pneumatic separator of grain mixes: Patent No. 68374 Russian Federation, / V.E. Saitov, A.I. Burkov, D.V. Grigoriev, A.L. Glushkov. - No. 2007125005/22; 2007, Bulletin No. 33.
2. Saitov V.E., Farafonov V.G., Suvorov A.N. Research of processes in working bodies of separators of grain: Monograph. - Saarbrucken: LAP LAMBERT Academic Publishing, 2012. - 190 p.
3. Saitov V.E., Farafonov V.G., Grigoriev D.V. Determination of parameters of the curvilinear pneumatic transporting channel of a small-sized pneumatic separator // Mechanization and agriculture electrification. - 2011 . - No. 4. - P. 9-11.
4. Saitov V.E., Farafonov V.G., Suvorov A.N. Research of process of office of impurity in the curvilinear by-pass channel of the zhalyuziyny air cleaner // Mechanization and agriculture electrification. - 2012 . - No. 1. - P. 3-5.
5. Saitov V.E., Farafonov V.G., Suvorov A.N. Constructional and technological parameters of the zhalyuziyny air cleaner with the curvilinear by-pass channel // Tractors and agricultural cars. - 2012 . - No. 11. - P. 35-38.
6. Saitov V.E., Grigoriev D.V. Key parameters of a design of the small-sized sedimentary camera // Tractors and agricultural cars. - 2012 . - No. 1. - P. 16-18.