«CAMSTech-2020: Современные достижения в области материаловедения и технологий»

«Mathematical modeling of the impulse bubbling process of bulk mass by the coolant flow»

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The aim and objective of research

The objective of the conducted researches is the theoretical substantiation of the operating mode parameters of the pneumatic impulse agitating of grain products during the warehouse storage under the conditions of effective spatial mixing of the bulk mass while minimizing energy consumption to create and maintain the oscillatory process.

• To accomplish this objective, the following tasks are to be performed:
  • development of conceptual and computational scheme of the process of pneumatic impulse bubbling of bulk medium;
  • method of obtaining analytical dependencies and their graphical interpretation for the force parameters of the developed pneumodynamic agitator;
  • theoretical substantiation of the number of pneumatic impulse flows to ensure the studied process efficiency.
Методы решения
Выводы

Результаты, внедрение

As a result of mathematical modeling of the impulse bubbling process of bulk mass by the coolant flow, the efficiency of creating a standing pneumodynamic wave at the pulse generators opposite location has been found out, which allows to transfer kinetic energy of the flow both in the longitudinal and transverse directions, significantly intensifying its product agitating. The working pressure of the impulse bubbler should be within 0.3...0.5 MPa and the pressure ratio of the opening and closing of the diaphragm of the pneumatic working chamber, should be respectively \( P_3 = (3.5...5.0) P_2 \).

The spectrum of the geometric parameters change of fixed-length pulses at different intervals of cyclic frequencies has shown their parabolic nature and sufficiently close trajectories, which confirms the tendency of such waves to superposition at their counter-motion and high potential for process intensification of bubbling and stirring of grain-mass agitating; the most favourable parameters of the studied process are the wavelength of 0.2 s within the frequency range from 0...100 rad/s.

The wave energy of two oppositely positioned pneumatic impulse generators is sufficient to overcome the resistance of the grain medium in 81 directions for one working capacity, which is reasonable to allow it to agitate efficiently the bulk mass with the flow of the coolant.
Контакты

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