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WAYS TO INCREASE DOSING PRECISION OF GRANULAR FOOD PRODUCTS THE BATCHER OF DISCRETE ACTION

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Abstract: *Actual scientific and practical task is to improve the accuracy of dosing bulk solids. Solving this problem will decrease risks in the production of packaged products.*

To solve this problem it is necessary to perform the steps: Refine the technology and layout of the modules filling and dosing systems in a packaging machine.

Key words: flow, dynamic error, construction.

I. Introduction

To evaluate the metrological characteristics of these modules, and their productivity needs to identify the specific types and kinds of bulk products.

This gives you the opportunity to find ways to improve the accuracy of dosing.

Two main phases exist today for dispensing bulk products: volume and weight[1]. The volumetric method consists of streaming and corrective on chosen option.

Volumetric dosing method significantly simplifies the operation of the dosing and gives to ensure high productivity of packaging machines.

To weight method of batching include: combined (volume, mass, weight, weight double action), matching (weighing doses on parts in constant conditions).

Weight batching involves three types of errors (sources of errors):

- drift – characterized by starting modes the metering device. This type of error reaches a minimum value when the delay between turn on and start dosing. The introduction of delay reduces the efficiency of the device;

-static inaccuracy due to the implementation of constructive elements of the weighing system. This kind of errors is the tenth part of the relative error in the technology;

- dynamic – caused transients in the weighing system during the transfer of bulk materials in a weighing system. To reduce error is needed additional time costs (installation of filters, programmed to find the average value of the weight). This method reduces the productivity of the metering device.

The dynamic error has two components: modal and own. Modal error from depends on a flow rate of products, the area of intersection of the outlet of the hopper, the stability of the flow. Inherent error due to the physico-mechanical properties of bulk materials and its interaction with the working bodies of the pump.

Such error to reduce structurally is almost impossible.

II. Materials and methods

Therefore, the main component of regulation error of the dosing regime will be the error.

Today there are ways to improve the accuracy of weight measuring: technological and structural.[3]

The technological path can be divided into: the use of additional energy perturbations for the stabilization of the bulk density of the product and its flowability (vibration, mechanical, aeration, centrifugal, electromagnetic effect, etc.); modification of the method of forming the components of the output dose (body-weight, weight dual action, matching).

The construction area involves determining optimal values of the geometric parameters of the hopper, its discharge channel, feeder, weighing capacity and installation of stabilizers product movement feeder in saguaro capacity and the like. To construction areas may also include the selection of a weighing system (electro-mechanical, tensometric, capacitive, etc.) and systems of treatment and control dosing.

The use of such ways to improve the dosing accuracy requires the determination and setting of individual technological regimes for specific bulk materials and metering devices. It is difficult to provide in real working conditions, especially in

the transition from the dosage of one product to another or changing the size of a required dose.

In addition it should be noted that between accuracy and performance there is a certain functional dependence. In General, the accuracy decreases, the performance increases. The search for optimal matching of these two parameters for a particular type of bulk products will give you the ability to create effective samples of the dosing weight of the action.

Dispensers that implement volumetric method of dispensing bulk products, mainly characterized by low accuracy. This is due to the influences of the various factors that contribute systematic and random error.

Existing ways to improve the accuracy of volume of probation dosing can also be divided into technological and structural [2]. Structural ways to improve the accuracy of volumetric dosing of bulk materials mainly include the optimization of the geometric parameters of the hopper, a measuring vessel, static stabilizers, and the like. Technological ways along with the introduction of additional energy perturbations for the stabilization of the bulk volume weight of bulk products and its flowability can be attributed streaming and remote-batch method of dosing. Flow method is a high – performance, requires the application of appropriate flow meters with isolation valves and control system. Production method of forming the dose has limited application to the relevant groups of bulk materials (bulk density of different particles, different particle size of products, and others).

Method of dosing is that you need a dose of bulk materials is measured not one but several separate portions and then merged in the right dose. In this part of the portions will be the period with the shortfall to nominal mass, and the other part with excess mass at the nominal value. During the unification of servings in the desired dose of the inaccuracy of the measuring portions is partially mutually compensated, thereby increasing the accuracy of dosing. This method has been used successfully in machines for packaging viscous food products. Prototypes of such machines are designed for bulk products. To improve the performance of metering devices that implement dual portion dosage method developed tubular-tarlati stakanchiki of the dispenser (Fig.1.). This design combines the positive characteristics measuring cup, tubular feeders and individually-portioned way of dispensing.

III. Results and discussion

As it is established [2], the accuracy of dosing in semi-batch method of dosing is determined by:

$$\Delta M_{p/\text{п}} = \frac{\Delta M}{\sqrt{n}},$$

ΔM – error onepercentage dosing; n – number of portions

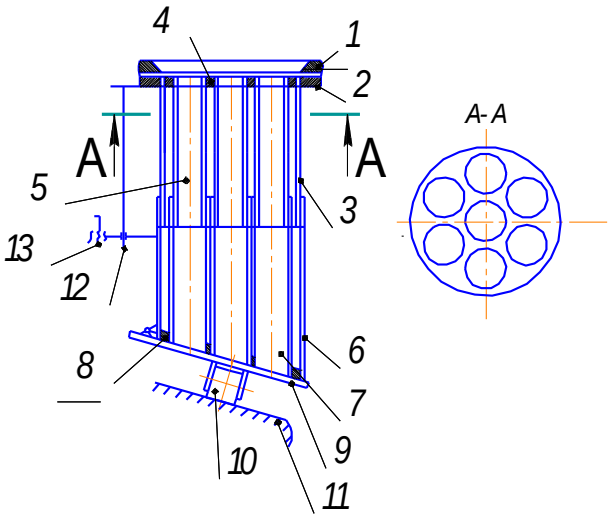

Fig. 1 *The scheme of the tubular-telescopic measuring cup dispenser: 1 - the bottom of a hopper; 2 - movable plate; 3 - top Cup; 4 - the bottom of the upper Cup; 5 - top tube; 6 - lower the glass; 7 - lower pipe; 8 - the bottom of the lower Cup; 9 - shutter; 10 - a pulley; 11 - a copy; 12 - guide; 13 - mechanism for moving the bottom of the glass is determined*

$$n = \frac{W}{W_п};$$

W- dose volume; Wn - the amount of product in one tube;

$$W_п = \frac{\pi d^2}{4}(h_i + \frac{1}{2} d\, tg\, \alpha);$$

h_i- the height of the pipe; d - is the pipe inner iameter is determined from the movement of bulk products:

$$d > d_{min} \frac{4\tau_0(1+\sin\varphi)}{\rho \times g};$$

τ_0- the sensor of shear stress production, ρ– the angle of repose of the product; φ is the volumetric weight of the product; g - free fall acceleration; α - the angle of insertion of the valve.

The rational choice of the number of tubes in the dispenser depends on the technological complexity of production and their locations.

According to these criteria, it is appropriate to place the tubes in a cylindrical glasses and in a circular pattern. The number of tubes in the glass can be determined from the expression:

$$n=1+6!$$

Under minimal resistance movement of product from the hopper to the pipe, the manufacturability can be recommended: n=7. With this value of n

$$\Delta M_{р/п} = \frac{\Delta M}{\sqrt{7}} = 0{,}38\Delta M$$

The accuracy factor of a dual portion dosage can be determined [3]:

$$K_т = \frac{2\Delta M}{\sqrt{nT}} = \frac{2\Delta M}{\sqrt{7T}} = 0{,}76\frac{\Delta M}{T}$$

T- tolerance on the weight of the output dose.

IV. Conclusions

On the analysis of factors affecting the accuracy of dosing of bulk materials there are two main ways of its improvement: structural and technological. Proposed and proved the effectiveness of tubular-telescopic measuring cup dispenser that implements a dual batch volume method.

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