

DEVELOPMENT OF ENERGYKEEPING CONSTRUCTION OF GRAVITY METERING DEVICE OF FRIABLE FORAGES

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Summary. In this work are given the final results of analysis of existent constructions of metering devices of friable materials of continuous action, marked them economic efficiency in relation to power charges on the process of dosage, the scientific hypothesis of creation of energykeeping construction of metering device is offered in which the process of dosage will be carried out due to gravity forces.

Key words: metering device, friable materials, power-hungryness, evenness of dosage.

RAISING OF PROBLEM

The decline of prime price and increase of competitiveness of products of stock-raising depends on feeding of animals and bird valuable stems, balanced after nutritives, vitamins and oligoelements, in accordance with the planned productivity [9,10]. On the whole prepares mixture of vitamins, oligoelements, amino acid and filler the method of their dosage and mixing, and its concentrate is named premix. In future, premixes will enrich the concentrated stems which are given to the bird and pigs as the mixed fodder, and given to a cattle in the type of feed mixture together with rough and juicy stems. A basic operation at preparation of the mixed fodders and feed mixture is a dosage of components, so as its quality depends on exactness of work of metering devices.

Inaccuracy of dosage reduces the feed and biological value of feed, and surplus of components which have a large cost conduces to the increase to the unit cost to violation of balance of nutritives, and on occasion - to the disease of animals and bird [2, 13, 14]. Therefore there is a necessity for creation of such batching devices which are able to work in the wide turn-down of their productivity at different mechanical and technological properties of components, to differ simplicity of construction, high technological reliability, simplicity of tuning on the set productivity, to have a low cost and main low power-hungryness.

ANALYSIS OF THE LAST RESEARCHES AND PUBLICATIONS

The technological process of dosage is known from ancient times and used as early as ancient Egypt at making of embalming mixture by the method of measurement of necessary portions (doses) of separate components. Under a dosage it is accepted to understand such mechanical process where material as a result formed in doses or began to flow with preliminary certain parameters. A size which characterizes the process of dosage is an expense of material which is measured out (volume or mass). The value of expense which it is aimed to support is named the set expense, value of expense presently to time – by an instantaneous expense. Substantial payment to development of theory practices of dosage of friable materials brought in: Y.D.Vidineev [18], P.M.Vasilenko [17], I.I.Revenko [5], V.V.Shatskiy [6], N.V.Braginets [3] and row other. The analysis of publications, devoted to the questions of dosage of friable materials, shows all complication of this mechanical process. Two methods of dosage of friable materials are known in practice: volume and gravimetric, each of which can be a la carte or continuous. Mathematical model of process of continuous dosage which is offered by Y.D. Vidineev. [3], consists in delivery an indissoluble stream with providing of set and, in particular, permanent amounts of friable material or his separate components with rejections no more possible in the elements of stream, proper to the set intervals of time:

$$\|G_p(t) - G_{\text{зад}}\| \leq \Delta G_{\text{дон}}, \quad (1)$$

where: is an amount of material in a dose,

$Q(t)$ – a current value of expense is on a perimeter (t),

$\Delta G_{\text{дон}}$ – possible rejection of dose,

t – current time; it is duration of forming of dose.

More frequent all quality of work of by volume metering devices of continuous action is estimated by relative standard deviation (by the

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coefficient of variation) [6, 4], that, by the rejection of the instantaneous productivity of metering device in this loop of it's work:

$$v = \frac{1}{x} \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}, \quad (2)$$

where: x – is mass of the portion,
 \bar{x} – mean value of mass of portion,
 n – amount of the selected tests.

RAISING OF TASK

Purpose of work - to conduct the analysis of methods and constructions of metering devices of friable materials, estimate them economic efficiency, to define directions of their improvement and offer the new construction of metering device, which will provide high-quality dosage of friable forage with minimum power charges on the process of dosage.

EXPOSITION OF BASIC MATERIAL

For realization of process of dosage of friable materials the great number of constructions of metering devices, which differ structural decisions, is created, and their names originate from the structure of working organ, for example, screw, band, drum, plate etc. [11, 15, 16].

With the purpose of ground of optimum technical decision the classification chart of batchings devices, which is presented on Picture 1, was developed by us, in basis of which the types of metering devices are incorporated on functional, structural and second properties in groups: on purpose; on principle of action; after consistency of batching material; on the method of loading of material; on the type of batchings working organs; on principle of unloading of dose; on the method of adjusting of the productivity; after the type of occasion of batching element.

Process of dosage of friable materials, it is possible to divide into three phases: feed or filling of working organ of metering device by material; forming of dose or even stream of material; delivery of material. Basic influence here on the unevenness of dosage give phase of filling of batching device by material and phase of forming of dose or stream of material [12]. Work of phase of filling of batching device depends on friable material, structural parameters of bunker and form of tape-holes of bunker,

which provide the trouble-free entering of material area of forming of dose or stream. Work of phase of forming of dose or stream depends on the structural features of batching device and renders basic influence on the unevenness of dosage. From point of power expenses for will be phases following: filling of working organ of metering device mainly takes place friable material due to gravity forces, at forming of stream, that to moving of friable material, needs considerable power expenses, delivery of friable material also takes place due to gravity forces.

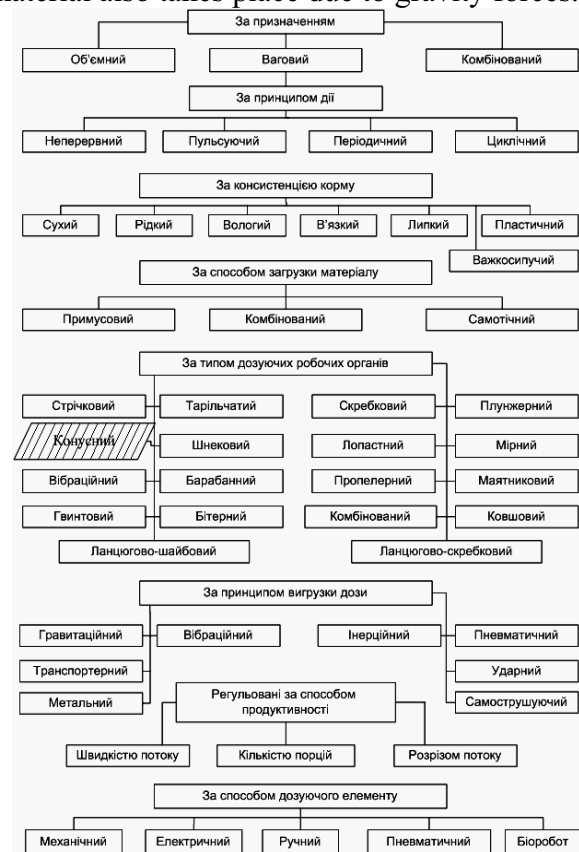


Fig. 1. Classification of metering devices of friable materials

In practice of dosage of friable materials the known constructions of metering devices are in which the process of dosage takes place due to gravity forces.

Simplest construction of gravity metering device [1] (Picture 2), it is in a general view a bunker with a sloping bottom in the underbody of which is located tape-hole with a shutter.

Advantages of similar metering devices is that they do not need power expenses for their work. However much they have a large unevenness of dosage, so as their productivity largely depends on the height of friable material which is in a bunker.

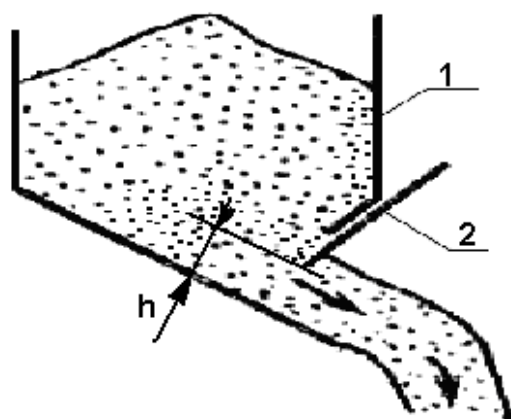


Fig. 2. Gravity metering device: 1 – bunker;
2 – shutter

If to accept physicists [7,8] into consideration of utterance, that friable material is fully surprising material. At the proper terms he can behave and as a solid, and as a liquid, and as gas. From the physical point of view, dosage at certain terms it is possible to examine as a profluvium of friable material from a capacity, like the profluvium of liquid, which takes place under the action of gravity forces. Therefore in our view [12], [19] with the purpose of the use of gravity forces, during realization of process of dosage, it is needed to give such properties which will induce him to the profluvium and such phenomenon is possible at his dilution friable material.

As a result of the conducted analytical research of directions of improvement of constructions of metering devices of friable materials, it follows notices, that efforts of designers were directed on the improvement of workings organs of metering devices without interference with transformation of properties of friable material.

Taking into account the higher expounded facts it is possible to formulate the following scientific hypothesis:

- increase of efficiency of technological process of dosage of friable forage due to the power cost cutting on the process of dosage by dilution of friable forage and motive of them to the profluvium under the action of gravity forces.[20]

Being based on this hypothesis it is suggested by us to create such construction of metering device in which dilution of friable material will take place due to destruction of vaults, which appear above tape-holes the diameters of which are apt at creation of vaults, and the pro-

fluvium of friable material will take place under the action of gravity forces.

The gravity metering device of friable forage (Picture 3) is offered consists of bunker 1, bottom of bunker 2 executed in the type of the horizontally located part of cylinder pipe with openings 3, the diameters of which are apt at creation of vaults, into a pipe the mover is set 4, that consists of two disks 5 fastened on a drive shaft 6 and connected by between itself small twigs 7. Adjusting of the productivity of metering device is carried out by a shutter 8, due to ceiling of openings of bottom of metering device.

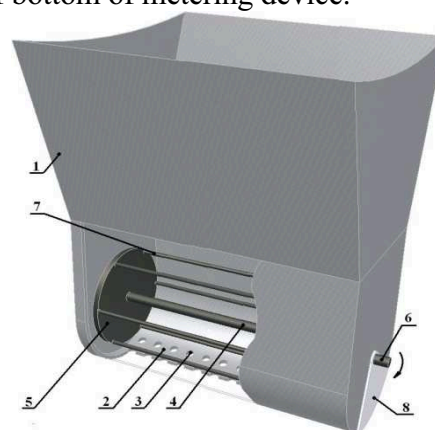


Fig. 3. Gravity metering device of
friable forages

A metering device works as follows. Friable stems are loaded in a bunker 1 and form above openings 3 of bottom 2 proof vaults and their pouring out doesn't take place. At the rotation of mover 4 there is destruction of vaults and friable stems under the action of gravity forces evenly pour out from a metering device. The set productivity of metering device is carried out by a shutter 8, for an account to ceilings of part of openings 3 of bottom 2. In addition the mover interactive with a friable feed stabilizes his closeness in the area of forming of dose which provides evenness of dosage.

CONCLUSIONS

As a result of analysis of methods of continuous dosage of friable forage, constructions of metering devices and taking into account physical and mechanical properties of friable forage the new construction of gravity metering device is offered in which due to dilution of friable materials there is it's profluvium under the action of gravity forces, in condition of destruction of vaults what helps to reduce the waste of energy on the process of dosage.

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**РОЗРОБКА ЕНЕРГОЗБЕРІГАЮЧОЇ
КОНСТРУКЦІЇ ГРАВІТАЦІЙНОГО
ДОЗАТОРА СИПУЧИХ КОРМІВ**

Анотація. В роботі приведені результати аналізу існуючих конструкцій дозаторів сипучих матеріалів безперервної дії, відзначена їх економічна ефективність відносно енергетичних витрат на процес дозування, запропонована наукова гіпотеза створення енергозберігаючої конструкції дозатора в якому процес дозування буде здійснюватись за рахунок гравітаційних сил.

Ключові слова: дозатор, сипучі матеріали, енергоємність, рівномірність дозування.