

## ANALYTICAL RESEARCHES OF METHODS AND CONSTRUCTIONS OF GRINDERS OF CORN FORAGE

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**Summary.** In this work are given the final results of analytical researches of methods and constructions of grinders of corn forage with the purpose of estimation their economic efficiency and determination of directions of their improvement.

**Key words:** methods, grinders, power-hungryness, economic efficiency.

### ACTUALITY OF PROBLEM

Development of agroindustrial complex of Ukraine is one of basic priorities of socio-economic policy of the state and by a strategic task in food safety of country. In modern economic terms at the saturation of market and constantly making progress competition basic direction at the production of products of stock-raising is creation of new energy-saving technologies and hardwares which are able to realize intensive economic processes. One of decision terms of growth of rates of production of stock-raising goods, increase of its quality acceleration a decline of prime price is a feed base Part of forage in general charges on the production of goods of stock-raising grows and makes a 60-75% prime price. It is known that the nutritives of forage are actively mastered by animal in the ground up kind, as an active surface of particles, which is instrumental in the acceleration of process of digestion and comprehensibility of nutritives [3], is increased in the ground up stems. It is known also, that growing shallow is one of the most power-hungry processes at the production of forage and which consumes to 70% electric power which is outlaid on all technological process. Therefore, exactly power-hungryness of process of growing of corn forage shallow, is one of major indexes of efficiency of production of products of stock-raising on the modern stage. The problem of situation consists in that the traditional grinding devices of corn forage and scientific knowledges in this area can not provide subsequent native perfection of this process. In this connection, development and creation of new machines for growing of corn

forage, which own more wide technological possibilities, less power-hungryness and level of containing metals, provide the good value of growing shallow, shallow will allow to promote the competitiveness of products of stock-raising due to the decline of its prime price.

### ANALYSIS OF THE LAST RESEARCHES AND PUBLICATIONS

Growing of solids shallow is a process of division of body on his more shallow parts [4, 12, 17], and in spite of plenty of methods of growing shallow, in his basis the same phenomenon lies is an origin in a body at his loading of maximum tension which brings bodies over to violation of integrity, to the decoupling of atoms and molecules between itself.

To research of technological processes of growing of corn forage shallow with the purpose of decline of power-hungryness at growing by a blow shallow, research works of Ziganshin B.G. [21], Kurmanova A.K. [11], Revenko I.I. [7] and other authors works are devoted. Presently by the scientists Sergeev N.S. [8], Abramov A.A. [9] at all research works are conducted from creation of machines for growing of corn forage shallow that work on principle of growing cutting shallow or to splitting off, which guarantee the considerable decline of power-hungryness of processes of growing shallow.

### RAISING OF TASK

Purpose of work is to conduct the analysis of methods and constructions of grinders of corn forage to estimate them economic to efficiency and to define directions of their improvement.

### EXPOSITION OF BASIC MATERIAL

Depending on the method of action of working organ of machine on the ground down material and kind in him deformations, growing shallow can be executed by squashing, blow, cleaving, elimination, sawing, cutting by a blade, cutting by a puncheon, cutting by a chisel [1] (Fig. 1).

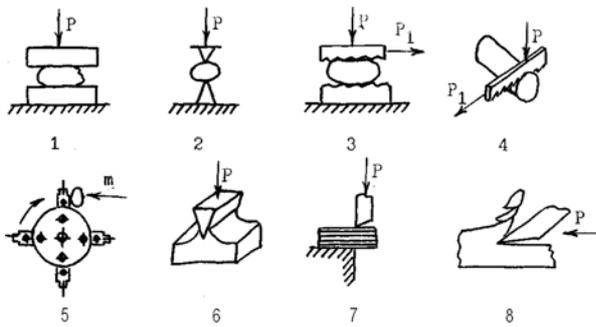


Fig. 1. Methods of growing of solids shallow: 1 is squashing, 2 is cleaving, 3 is elimination, 4 is sawing, 5 is a blow, 6 is cutting by a blade, 7 is cutting by a puncheon, 8 is cutting by a chisel

Depending on mechanical - technological properties of material and requirements to the product of growing shallow apply one of the indicated types of growing shallow. Yes, for micronizing of viscid and soft materials apply elimination, for the receipt of lump materials - cleaving, and for the receipt of particles of the set size - cutting or sawing, and others like that [14].

Every type of growing shallow is executed by the certain type of grindings down, which engulf the large group of machines which differ structural implementation and chart of organization of working process.

For to the types of influence a crush material, grinders are divided by five basic groups: millstone carriages, roller mills, shtift grinders (desintegrators), to the hammer of crusher, centrifugal-rotor grinders.

Structurally millstone carriages are simple after a structure, but bulky, power-hungry and underproductive, cause over-temperature of product pulverulent and flour factions which reduce quality of feed prevail in which [20].

To the lacks of roller mills it costs to take that even the small vibrations of size of gap between rollers cause the considerable change of degree of growing, loading on rollers and charges of energy shallow. Considerable part of energy which is outlaid grows into a warmth which results in heating of product and rollers. It is necessary also to mark, that for taking of dust and moist necessary devices for aspiration of roller mills [13].

The basic lack of the shtift grinders is an enhanceable wear of crush shtifts [19].

In an agricultural production for growing of corn forage shallow a blow, cleaving, squash-

ing, elimination and cutting, is used. Thus in none of types of grindings down the resulted methods are executed in a clean kind, however in each of them it is possible to select a prevailing method [2].

Among facilities of mechanization for growing of corn forage of most distribution shallow the universal crushers of shock type purchased with the joint suspended hammers - to the hammer of crusher. They are able to grind down the various types of raw material, comparatively simple for constructions and comfortable in service and exploitation. Their construction allows easily to change fast wear details (hammers, sounding boards, grates). However much they have a row of the substantial failings, namely, above all things, high specific charges of energy on the process of growing shallow, (18.20 kW hours/tonns) relatively high containing of metals (to 500 kg of hours/tonns) and intensive wear of hammers and sieves of crushers. In addition, the not leveled grain-size distribution has the prepared product with megascopic content of pulverulent faction which arrives at to 20%.

These failings are explained by that such methods of growing shallow as free-kick and elimination are realized in hummer crushers. Thus co-operating of grain with hammers carries casual character, and under a direct central blow gets only 5% from their general amount. The last grains are ground down for 15.40 shock co-operations [6]. It follows notices also, that in hummer crushers is created mobile ring air-grain-growing a layer, in which more large particles bed near-by a sieve and the same hinder to the exit of the ground up product from the area of co-operation of hammers, which conduces to his considerable regrinding and additional charges of energy. In addition speed air-grain-growing has a considerable size a layer and arrives at the half of angle speed of hammers [18], which results in diminishing of force of blow. In this connection, traditional crush machines - to the hammer of crusher and scientific knowledge in this area exhausted the positive potential and can not provide the subsequent native improvement of process of growing of corn forage shallow.

For more detailed analysis we will consider expression for determination of general charges of energy on the process of growing shallow. Directly before the process of growing shallow there

is deformation of material, which is accompanied by the change of his volume. Therefore work which is outlaid on the process of growing shallow in hummer crushers can be shown in the type of the following power balance:

$$A = A_d + A_s + A_k + A_u, \quad (1)$$

where: are charges of energy on resilient and plastic deformation of material;

$A_t$  - charges of energy are on creation of new surfaces of the ground up particles,

$A_k = mv^2 / 2$  - expenses of energy are on the grant of kinetic energy to the circular layer of material,

$m$  - mass of circulating circular layer of material,

$v$  - a rate of movement of circular layer is in a crush chamber,

$A_u$  - charges of energy are on a wear and heating of workings organs of crusher.

Examining the first two constituents of the resulted equalization, then it follows notices, that charges are directed directly on growing of material shallow is useful. The third constituent of equalization, grant of kinetic energy to the circular layer of material, is harmful for this type of crusher, as diminishes force of blow, due to diminishing of difference of relative speeds of hammer of crusher and ground down material. Fourth constituent, charges of energy on a wear and heating of workings organs, peculiar for all crush machines and can be diminished due to creation of new workings organs application of modern materials for their making.

Thus, from the resulted analysis follows, that the size of unproductive power charges depends on the choice of rational chart of organization of working process of growing shallow. What touches the power charges of directed directly on the process of growing and their decline shallow then it is necessary in machines for growing of corn forage shallow to realize the less power-hungry methods of growing shallow, for example, of cutting in which power charges in four times are less from squashing and seven-fold less from growing by a blow shallow.

In the last years abroad and in Ukraine with the purpose of decline of power-hungryness of processes of growing of corn forage shallow find the use centrifugal-rotor grindings [16] down, in which growing of corn forage shallow takes

place a cutting method and they practically on all indexes exceed before resulted.

Besides, in grinders, which have knife workings organs, almost absent element of elimination – grain is ground down on the particles of the set size, and content in to the prepared product of pulverulent faction considerably less than, than in the machines of other constructions. In grinders, which work on principle of cutting, the product of growing shallow is not heated, and mass of workings organs considerably less than, than in other constructions [15]. Also diminishing of power-hungryness that sliding motion of blade, which diminishes pressure of knife on the product of growing [10] shallow, has a decision value in the technological process of cutting is instrumental in accordingly, effort which needs to be attached to the worker of the organ of grinder diminishes. In addition, centrifugal-rotor crushers differ substantially less contain of metals, as compared to grinders of other constructions [8, 5].

As a result of the executed analytical researches basic principles of improvement and creation of new energykeepings machines are for growing of corn forage shallow it is possible to formulate thus:

- growing of material shallow must be conducted only to the that degree which is needed for his subsequent processing or use;

- growing shallow must be forecast, factious composition must be homogeneous, set sizes and not to have pulverulent faction;

- particles of material, ground up to the set sizes, there must be the immediately remote from an area growings shallow;

- growing shallow must be «at leisure» that not to become complicated by extraneous operations, except for overcoming of forces of the between molecules coupling, which are useful work that is outlaid on the process of growing shallow;

- diminishing of work of resilient deformations by the use of workings organs which consume the least of energy and that work on the method of growing cutting or splitting off shallow;

- increase of work on creation of new surfaces due to the increase of contacts between the ground down grain and working organs;

- a removal of the repeated co-operation of the ground up material is with the workings organs of machine.

## CONCLUSIONS

As a result of analytical researches of methods and constructions of machines for grinding of corn forage, comparison of power charges shallow it is set on the process of growing by the different constructions of grinders shallow, that to the hammer of crusher of corn forage and scientific knowledge in this area can not provide subsequent native perfection of this process. Being based on the results of researches basic principles of improving and designing of machines for grinding of friable forages are formulated with the purpose of reducing energy waste on the process of grinding.

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**АНАЛІТИЧНІ ДОСЛІДЖЕННЯ  
СПОСОБІВ І КОНСТРУКЦІЙ  
ПОДРІБНЮВАЧІВ ЗЕРНОВИХ КОРМІВ**

**Анотація.** В роботі приведені результати аналітичних досліджень способів конструкцій подрібнювачів зернових кормів з метою оцінки їх економічної ефективності та визначення напрямків їх удосконалення.

**Ключові слова:** способи, подрібнювачі, енергоємність, економічна ефективність.