INNOVATIVE TECHNOLOGIES AND EQUIPMENT FOR EFFICIENT USE OF FODDER GRAIN

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Abstract. In conditions of market relations at the forefront agricultural enterprises face the problem of organizing cost-effective production of products of animal husbandry where the determining factor is the feed that the cost structure constitutes 55-70 % of the total costs. Low efficiency of feeding reduces productivity, but also, for example, writing frame farms leads to stretching of the growing period and feeding and, consequently, to an increase in the production costs for energy, wages, depreciation. As a result, many farms produced livestock production becomes unprofitable and uncompetitive.

Keywords: fodder grain, automated feed production, mobile fodder plant.

Introduction

Increased animal productivity, reduced feed costs and labor per unit of production are inconceivable without rational use of feeds. It is important not just to feed the feed, but use them to their maximum potential.

We need the ability to control the process of preparation of feed.

In order to stabilize full feeding of animals in the world of science and practice more and more attention is paid to concentrated feed. It is due to that grain feed and feed additives of various natural enrichment can be balanced feeding of missing batteries.

Methods and research objective

According to the forecast, developed RUE "SPC for agricultural mechanization" in conjunction with the Ministry of Agriculture, to ensure the full needs of the republic in concentrated livestock feed and rational use of grain requires about 60 % of feed for large livestock and poultry complexes to be produced by state governmental Ptitseprom feed mills and bakeries of the Department of the Ministry of Agriculture. [1] The rest of it is advisable to prepare feed directly in the economic conditions.

In any economy-rated enterprise it is necessary, possible, and in most cases even easier to produce balanced feed not only for different species of animals, and even for certain groups of animals, which is practically very difficult to implement in large factories.

In addition, the approach of production of feed and feed additives to raw material sources and places of consumption allows for more complete and efficient use of raw materials by farms themselves.

Directly feed production on farms also gives the possibility to reduce expenditures for the transportation of raw materials and ready-Vågå product because of what the annual savings in transportation are only 25-30 tons of fuel [1; 2].

Currently, there are some households having only grind-mixing units and a significant portion of fodder plants are outdated and do not meet the modern requirements, but it does not mean that the economy conditions are impractical to build a modern feed mill.

In RUP "Scientific and Practical Center of the National Academy of Sciences of Belarus for Agricultural Mechanization" kits designed for the preparation of animal feed from 1.5 to 5 $t \cdot h^{-1}$ in a modular design.

Select the desired set of equipment, providing feed mi-IOM to all livestock animals available on the farm, the formula (1) can be used:

$$Q = \frac{G}{\tau_{см}} \cdot K = \frac{\sum q_i \mu_j}{\tau_{см}} \cdot K, \quad (1)$$

where q_i – norm issuance fodder j - animals;

μ_j – number j – animals;
$\tau_{см}$ – replacement time of the shop;
K – coefficient taking into account the number of working days in a week and a five-day work shop $K = 1.4$, while six daily – $K = 1.17$.

Results and discussion

Developed set of equipment provides automated feed production in the conditions of economy:

- cooking recipes given fodder;
- weight control and accounting of incoming components;
- weight control and accounting of finished products;
- automated process control system (APCS) with the master controller and the computer.

The technological scheme of the equipment set is presented in Figure 1, the fodder plant operates as follows. Grain ingredients are delivered to the shop, unloaded from the vehicle into a hopper 1. Then they are fed to the separator 2 where the metal and cleaned of other contaminants 3 and discharged to the distributor conveyor 4, which in turn loads grain silo 5.

In operation management according to the given recipe, the components of the portions of grain silos screws 6 are fed to the weighing hopper 7, which is mounted on an electronic balance 8. Weigh hopper portion of the grain components loaded into the pre-mixing tank 9, where they are mixed evenly and come in 10 grain crusher.

The flow of the crushed grain crusher conveyors 11, 12, 13 is fed into one of the chambers 14, common tap. Simultaneously, the weight of the hopper 15 in the mixer 16 is supplied in accordance with a predetermined portion of the recipe shredded dosed additives. From the mixer 16 servings shredded supplements served in the same cell as grain powder.

After mixing a portion of the finished product from the mixer 14, by one of the 17 transporters is unloaded into one of 18 bins of finished products.

Another portion of the crushed grain components and additives is fed to the second chamber of the mixer 14.

The module automated control system PCS consists of nine 19 cabinets with power equipment (circuit breakers, magnetic starters, thermal relays) and control cabinet 20 in which a controller is mounted and means to ensure its operation, as well as the computer 21 as a remote control installed desktop operator.

Managing weight batching is performed for the given program by alternately supplying components in the weight unit.

Managing the process of receiving mixed fodder components to unload the finished product is fully automated. The control system has three operating modes “Setting”, “Manual”, “Automatic”.

In the “Automatic” feed produced by prescription according to the algorithm implemented program management, is located in the computer memory, and can be adjusted to the state of the real factors of various groups of animals.

Computer collects statistics of feed mill for any period of the equipment set, taking into account the flow of each component. The operator can choose the display control button mechanisms or set the button modes PCS, as well as establish the initial settings (set recipe, weight portions, route selection process components and finished product).

The display process is monitored passage, reception grain components, dispensing, chopping, mixing, distribution and discharge of the finished product silos.

All conveyors, bucket elevators are equipped with monitoring devices and rotation of the sensors backwater feed information. All cabinets and computer are located in the control room.

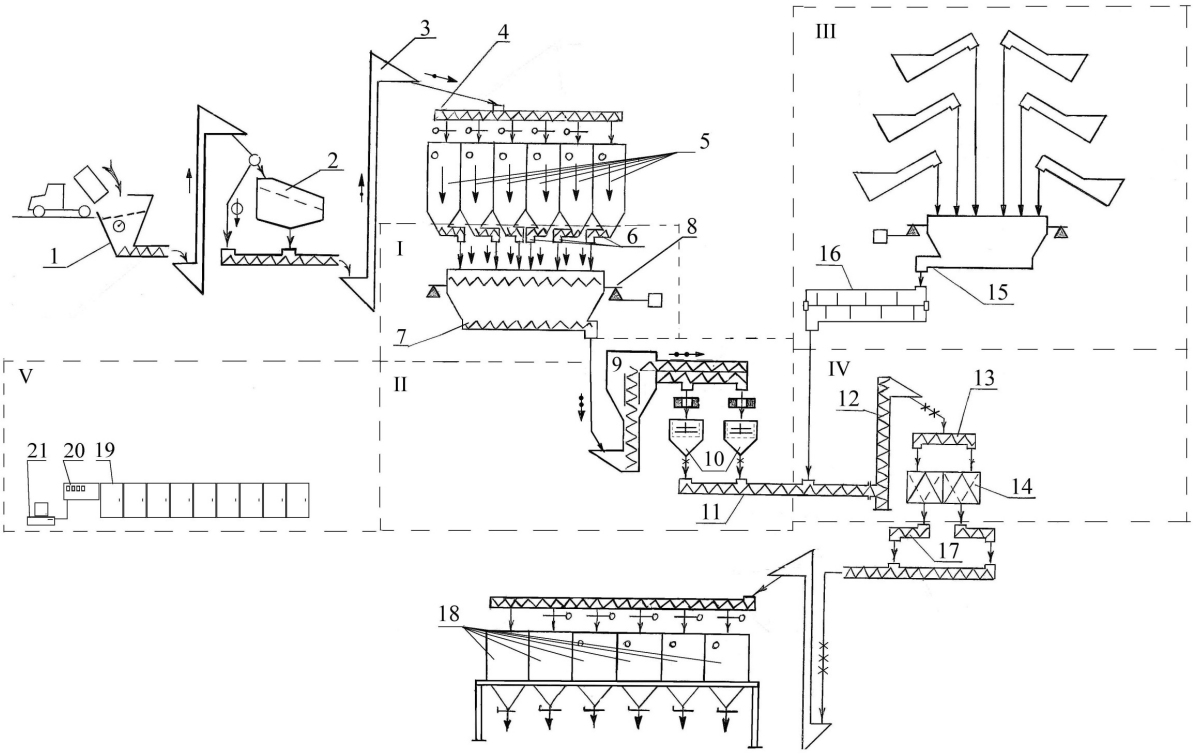

Fig. 1. **Flow diagram of a modular set of equipment:** 1 – receiving hopper; 2 – separator; 3 – elevator; 4, 13 – infeed conveyor; 5, 18 – bunker; 6, 17 – unloading conveyors; 7, 15 – weight bin; 8 – load cells; 9–bin active; 10 – crusher; 11 – modular conveyor; 12 – vertical conveyor; 14, 16 – mixer; 19 – electrical cabinet; 20 – control cabinet; 21 – remote control

It is known that feed consumption depends not only on the quality of raw components, but the possibilities of technological equipment to withstand the demands of the recipes feed, as well as rapid changes in recipes, depending on the needs of the animals, as evidenced by the results of exploitation of the equipment set on farms. Equipment set envisages preparation of fodder recipes six species of cereal components of the six kinds of loose and additives, which provide significantly more opportunities getting quality rations compared with the existing equipment on farms.

In the result of the testing the following data were obtained:

- capacity – 5.0 $t \cdot h^{-1}$;
- power consumption – 95 kW;
- dosing accuracy:
  - grain components – 87 %,
  - processing additives – 93 %.

There is a need to develop not only a feed mill in a modular, but also in container or container-mobile version. This performance will allow for additional construction work easier to reconstruct Rowan existing plant by joining such containers to the existing mixed feed shops or farms.

Flowsheet mobile fodder plant is shown in Figure 2.

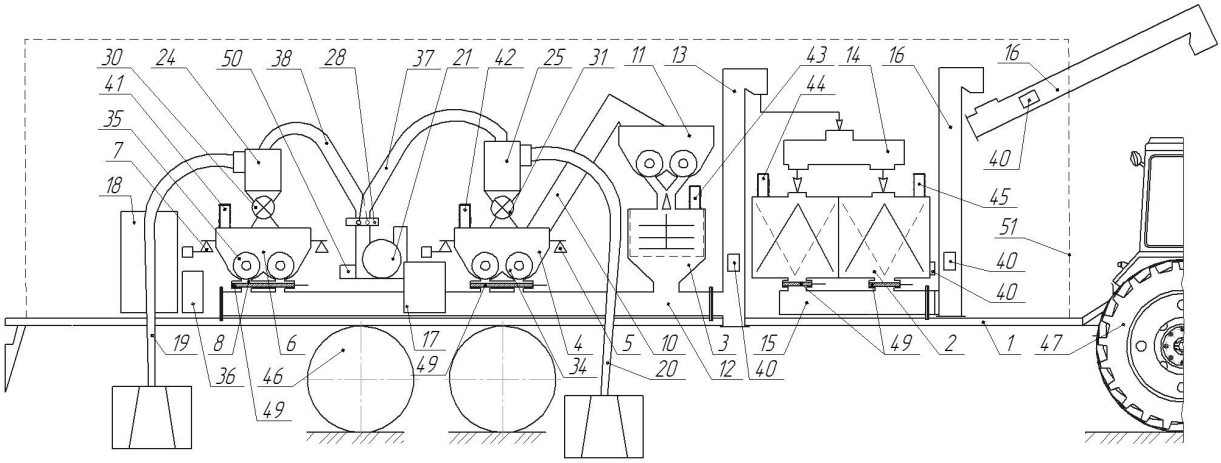

Fig. 2. **Flowsheet mobile fodder plant:** 1 – frame; 2 – two–chamber mixer; 3 – crusher; 4 – hopper with electronic scales 5, 6 – mixer-dispenser with electronic scales; 7, 10 – conveyor screw; 11 – storage bin; 12 – conveyor assembly; 13 – vertical conveyor; 14 – pipeline distribution; 15 – screw conveyor from the mixer; 16 – finished product conveyor; 17 – cabinet; 18 – power source; 19, 20 – air suction hose; 21 – blower; 24, 25, 26 – cyclones; 28, 29 – pressure equipment; 30, 31, 32 – sluice gates; 36 – conveyor premixes; 37, 38, 39 – pneumatic; 40 – level sensors; 41, 42, 43, 44, 45 – filters explosion; 46 – chassis; 47 – vehicle; 48 – guard; 49 – support

As shown by the acceptance test, the indicators are:

- performance – 4.0 t $\cdot h^{-1}$;
- rated power – 125 kW;
- total fuel consumption – 3.5 kWh$\cdot t^{-1}$;
- weight of the equipment – 6.3 t.

The merits of such a plant in cheaper by the fodder of new equipment and the elimination of transport costs on the transport of grain and fodder; higher quality compound feed by mixing the two-step enrichment additives and primary store in mixers; exclusion of manual labor in loading; unified equipment feed plants.

The developed set of equipment requires no external power supply, is characterized by simple structure, high efficiency.

Conclusions

1. Equipment that was developed on-farm feed plants allows producing high-quality and cheaper feeds.
2. Performance fodder plants allows provision to dairy farm up to 400 cow, pig to 12 thousand heads.
3. Packaging equipment on-farm feed plants in modular and container design simplifies installation, repair, setup, maintenance and organization of the process control.

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