AUTOMATION OF THE TECHNOLOGICAL PROCESS OF GRAIN DRYING

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In modern conditions of grain production, the issues of increasing labor productivity, reducing the cost of production, saving material, energy and labor resources, intensifying the use of technological equipment for post-harvest processing of combine heaps are very relevant.

One of the directions for solving this most important task is the automation of control and management of technological processes based on modern computer technology.

One of the main factors for improving the quality of grain and seeds is drying, which is an obligatory stage in the technological process of agricultural production in conditions of high moisture zones. Grain material, dried to the standard moisture, is stored for a long time and safely, which is equivalent to additional production and preservation of products, allows you to use part of the sown area for other crops and gives a significant economic effect on a national scale.

Successful solution of the tasks of automation of technological processes of grain drying production seems possible on the basis of the use of computers in closed control loops, which is confirmed by the experience of operating such systems. Recently, in connection with the development of the element base of computer technology, there has been a tendency to create decentralized control systems based on microcomputers that provide higher efficiency and reliability of operation compared to centralized ones[1].

The most expedient is the use of microcomputers in the automation of relatively small technological objects of periodic operation. The use of decentralized control systems for automating drying processes in continuous and intermittent chambers will make it possible to develop the control systems being created both in terms of the complexity of the control laws implemented for each object, and in terms of the number of control levels.

The development of a control system for the technological process of drying grain materials includes several stages.

The purpose of the first stage is to study the technological process as an object of automation, to determine the principles for building a control system. The main tasks of the first stage: analysis of the technological process and existing control systems, identification of their features and shortcomings; formation of the purpose of creation and functions of the control system, selection of the composition of the complex of technical means; improvement and development of control methods for non-stationary objects and systems for automatic control and management of individual technological parameters.

When solving these problems, it should be taken into account that the intensification of drying of grain materials in batch chambers, aimed at improving the efficiency of existing and designed control systems in drying chambers, leads to the complication of drying technological processes as control objects [2]

Relay and linear automatic control systems that have become widespread cannot provide the desired quality and reliability of control due to the lack of the necessary a priori information about the object [1]. Therefore, in the automated control systems we offer

(ACS) as humidity and temperature controllers (for zone grain dryers and exposure) non-contact logic devices based on thyristors and triacs are used [2]. In this regard, to improve the quality of control in control systems for the grain drying process, it is advisable to use adaptive control systems that allow you to adapt to changing conditions by obtaining, processing and analyzing the missing information about the controlled process using an adaptive control device [3].

Using adaptive systems, it is possible to solve a wide range of problems, which include not only control problems, but also the problems of finding optimal conditions for the operation of the system as a whole, controlling objects under parametric disturbances and in the presence of interference.

There are more and more works on the use of adaptive control systems and adaptive controllers for control objects in various industries, which allows us to hope for an expansion of their scope. This is facilitated by the constant improvement of the structure of adaptive control systems, the identification methods used , and the use of new types of control mini- and microcomputers. One of the most promising is the class of adaptive systems with an identifier that allow you to control a variety of technological objects in the conditions of their non-stationarity, noise, rapid change, non-measurability, non-observability, non-identifiability or difficult formalization of individual state parameters [3].

At present, two directions are planned at grain processing enterprises that solve one common problem - the creation of automatic control systems.

Automation "at the top level" involves the development and implementation of automated control systems (automated control systems) for production lines, associations, enterprises and individual sections .

Automation "at the lower level" involves the development of automatic control systems for local circuits, the creation of automated process control systems (APCS) and their implementation in enterprises [3].

The intensification of grain drying regimes and the increased requirements for the quality of dried materials lead to the need to equip grain dryers with new control devices and automatic control systems that allow solving the issues of monitoring and controlling drying processes in batch chambers.

To date, the features of batch drying chambers as objects of automatic control have been studied, however, the created systems for automatic control of temperature and the psychrometric difference of the drying agent do not have mode correction for the parameters of the dried material (for average current humidity and temperature), which does not allow for complex automation of the drying process. These systems do not implement negative feedback on the process state parameters (i.e., the current parameters of the material being dried), and, in fact, are stabilizing automatic control systems that allow you to automatically maintain the specified parameters of the drying agent at the input within certain ranges of values. A system and instruments have been created for measuring the average current moisture content of grain material during chamber drying, but it needs to be improved, especially when used as part of an automated process control system. The basis for the creation of automated systems is a control system that provides complete observability of control objects.

The currently existing drying process control system is implemented using local automation tools, in which many important parameters from the point of view of process control either do not change or change with significant errors and large time delays. This does not allow for an objective and prompt assessment of the state of processes, which ultimately worsens the quality of their management.

In addition, the existing system, in principle, cannot provide the following functions:

- operational diagnostics of equipment condition;
- automatic signaling about violations of the technological regime;
- operational calculation of technical and economic indicators of the work of the departments of reception and preparation for drying;
- documentation of technological and technical and economic information.

These circumstances determine the relevance of the work aimed at developing a microcomputer-based control system for the technological process of grain drying in agricultural grain dryers with intermittent and continuous chambers.

The errors in determining the average moisture content reach 5...8%, which is due to errors in determining the "dry" weight of the sample and the discreteness of control. The decrease in grain quality (protein coagulation, thermal and mechanical injury, etc.) during drying is largely caused by violations of rational operating modes due to inaccurate moisture control.

The results of studies carried out within the framework of the first stage are presented in this paper. In subsequent articles, it is planned to publish the results obtained in the implementation of the task of building a centralized control system, developing the structure of a complex of technical means, as well as its information, algorithmic and software (second stage). The next (third) stage was devoted to the development of algorithmic support for the grain drying process control system and solving problems

related to the development of an adaptive automatic control system and the creation of software for the process control system, which allow to more fully satisfy the system of principles that ensure efficiency, intensity and optimality of the studied technological process.

Conclusion.

1. Under the conditions of multidimensionality, non-linearity, multi-loop and multi-connectivity of the technological process of grain drying, the automatic control system for grain dryers must have an adaptive non-linear structure.

2. Automatic control systems for small batch dryers should have distinctive features compared to automated control systems designed for large continuous grain dryers.

3. Control systems for the grain drying process should not be based on relay elements with long delay times and low reliability, but on modern inertialess non-contact logic elements of increased accuracy and reliability.

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