

Analysis of the elevator as an object of automation

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Abstract – the analysis of the relationship between the parameters of the process, typical automation schemes and requirements for the drying process, was made. It allows to determine all the contours of regulation and measurement.

Keywords — elevator; grain dryer; temperature; humidity.

I. INTRODUCTION

Ukraine needs to have grain stocks that would meet the daily needs of grain and its processed products for all consumers. The elevator industry is engaged in creation of such stocks. It not only takes grain into its granaries, but also does a lot of work to preserve and improve its quality, while excluding losses. This industry is the material and technical base of the country's grain turnover.

Managers of enterprises in the field of storage and processing of grain face difficult questions: how to reduce the cost of production, while improving its quality? How much production capacity is used optimally? Is it possible to improve production and financial results? One of the key factors in solving these problems is to increase labor efficiency in the entire technological chain – from raw materials to shipment of finished products. Other important tasks of automation – obtaining at any time necessary for decision-making reliable technological and economic information, ensuring the continuity and safety of technological processes [1].

Nowadays, new mini-complexes are being built, existing mechanized currents, receiving-cleaning, cleaning-drying and other points are being reconstructed and expanded. They included mini-elevators and mini-grain processing plants. Requirements for service personnel have significantly increased. Ensuring continuous reception, preserving the accepted grain without loss and improving its quality during storage is the most important task of employees of the elevator industry. The enterprises of the branch are assigned important tasks on reception, placement, processing, storage and processing of grain resources, their centralized use and maintenance of all branches of a national economy of the country [2].

Elevator industry enterprises purchase, process and sell varietal seeds of cereals, legumes, oilseeds for industrial use, as well as harvest and process hybrid and varietal seeds of different crops.

Cereals are and will be one of the main sources of income in Ukraine. Currently, the grain market of Ukraine is a system that includes trade in food, feed and seed grain, as well as grain for industrial processing, which differs in quality. Ukraine has the ability to export up to 20–25 million tons of grain. Determining the quality of grain in accordance with international standards is becoming increasingly important, as it is the quality of grain that includes its market value [3].

The aim of the work is to analyze an elevator as an object for develop an automatic control system for remote control and monitoring.

II. MAIN PART

One of the main stages of grain production is post-harvest processing, which consists in its cleaning and drying. Postharvest processing of grain in the cost is about 40%, and in labor costs – more than 50% [3–6]. In this regard, post-harvest processing and storage of grain is an integral and important part of all agricultural production. At the same time, farmers face the task of not only getting a good harvest, but also to preserve it so as to avoid losses. Losses of grain and products of its processing can occur due to a number of reasons. A significant amount of grown grain is lost during grain transportation, during the post-harvest processing and storage. To reduce grain losses to a minimum, it is necessary to protect it from the effects of adverse environments, to create conditions in which metabolism is delayed. To solve these problems, granaries equipped with appropriate equipment are required for drying, active ventilation, disinfection of grain entering the enterprises engaged in the reception and placement, storage of large masses of grain [7–9].

Grain storage technology is a method and methods of influencing grain masses and the environment, which allow to ensure quantitative and qualitative preservation of grain masses taking into account their features: what storage modes to use, how long to store, how to deal with pests of grain stocks, how to dry and ventilate grain and so on [10].

Grain is a living organism, it breathes, under certain conditions it can germinate, it can die or spoil. Life processes in the grain can intensify under favorable conditions, and in an unfavorable situation – to slow down. The intensity of life processes depends on storage conditions, ie on the state of the environment (heat, cold, humidity), on the state of the grain itself (humidity, temperature, content of waste and grain impurities). This is important because only on the basis of knowledge of biochemical processes observed in stored products and their effects, it is possible to more rationally organize the storage of large masses of a plant raw material and minimize losses [10].

The main part of the elevator is grain dryer. Grain dryers must ensure complete storage or improvement of grain quality, and therefore, uniform heating and drying; simultaneous drying of grain of different humidity; drying of grain of any initial humidity to final in one pass; drying of grain without its preliminary cleaning; continuous reception of grain, ie its drying in the flow of grain; exclusion of removal and mechanical damage of grain; efficient cooling of grain; relatively low fuel consumption, electricity, capital investment. Grain dryers should be universal, environmentally friendly, fireproof, easy to maintain and automatically adjustable [2; 3; 7]. According to the method of heat supply, there are convective and conductive grain dryers. According to the condition of the grain layer, there are dryers with dense fixed, gravitationally moving, fluidized, falling and suspended layers.

Studies of the grain drying process revealed that the existing automation system is significantly outdated, as well as the main part of the equipment installed on the elevator. Certain economic and qualitative losses during grain drying are caused by non-economical (suboptimal) use of thermal resources and the need for additional drying of a certain amount of grain, which has already passed through the dryer due to the fact that the equipment is obsolete. Optimizing the initial parameters of grain moisture and improving the management of the parameters of the drying process can become a reality due to the creation of a modern functional scheme of automation. It is advisable to create a modern control system for the drying process.

We propose a certain replacement of obsolete equipment with new ones, the introduction of modern industrial means of automatic process control, the introduction of means of collecting and archiving data on the processes in the dryer.

The analysis of the relationship between the parameters of the process, typical automation schemes and requirements for the drying process, allows you to determine all the contours of regulation and measurement. The developed automation system will be able to provide all the needs of the technological process and create safe working conditions for staff.

The main parameters that characterize the course of the grain drying process are: the temperature in the dryer zones, the level of grain in the hopper above the dryer and especially the humidity of the dried grain. When one of these parameters goes beyond the

technological limits, the process of grain drying should be stopped, as there is a danger of reducing the quality of grain or significant overuse of energy resources during drying. With this in mind, the creation of the FSA must implement the appropriate locking and signaling circuits. To monitor the process, you need to ensure the output of data and parameters on the display of a personal computer.

Figure 1 shows the structure of a set of technical means developed by us that provides automation of the grain drying process.

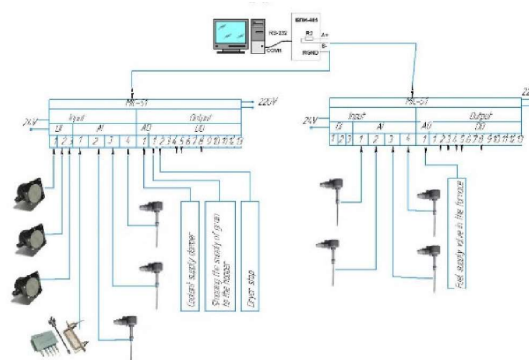


Figure. 1. Structure of a set of technical means

When choosing means of automation it is necessary to take into account not only the technical characteristics of sensors, transducers, regulators but also the environment in which they will work, in addition, the developed set of tools should ensure a smooth and predictable process.

III. CONCLUSIONS

Implementation of the developed control system should reduce grain volumes, which will require re-drying by 6–8%, with the introduction of moisture control of the source product will increase the quality of grain drying, as well as reduce the risk of dangerous and emergency situations, reduce periods of scheduled and unscheduled repairs.

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