хозяйства приводит к увеличению оборачиваемости парка запасных деталей и снижению числа аварий, поломок и внеплановых ремонтов на единицу оборудования.

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METHODS OF ORGANIZING AND PLANNING THE REPAIR OF EQUIPMENT IN THE ENTERPRISE

Annotation

The article sets out the methodology of organization and planning of equipment repairs at the plant. On the basis of the initial data on the number of equipment is determined by the amount of repair work and set a timetable for periodic repairs of equipment during the year (month).

Key words: scheduled preventive maintenance, annual schedule, the organization repairs, scheduling, scope of work, the labor intensity, the time allowed.

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DEVELOPING SYSTEM OF AUTOMATIC CONTROL OF FEED-PROCESSING UNIT CAPACITY

Annotation

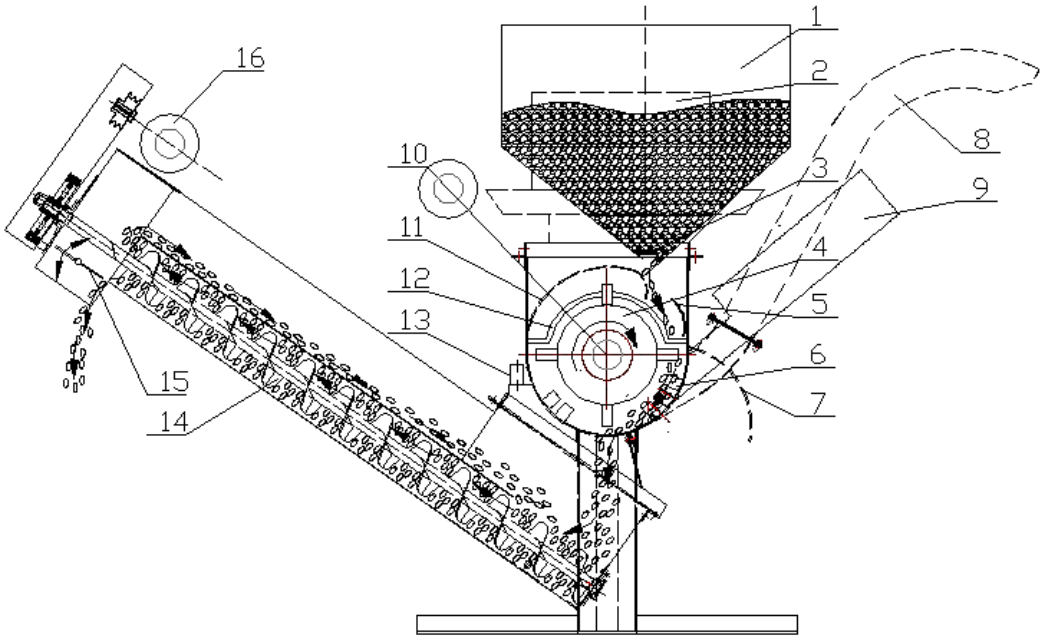
We performed experimental studies and identified parameters of a load diagram of the engine of DU-11 all-purpose compact feed-processing unit prototype depending on the gate position.

Keywords: Grinder, unit capacity, gauges, microprocessor.

Introduction

Currently, small farm households in the Republic of Kazakhstan has over than 80-85% of cattle and other farm animals. Such households are usually based on manual labor. This leads to poor preparation of animal feed, which in turn decreases feed accessibility and reduces cattle productivity.

The LLP “Kazakh Research Institute of Mechanization and Electrification of Agriculture” (LLP “KazNIIMESKh”) has developed a number of compact feed-processing units necessary for farm households. They are characterized by low cost and reliability, and are one of the few agricultural units of domestic design brought to production. For example, compact feed-processing unit DU-11 (Fig.1), which was the basis for research studies performed, is designed for grinding all kinds of stem and grain feed.



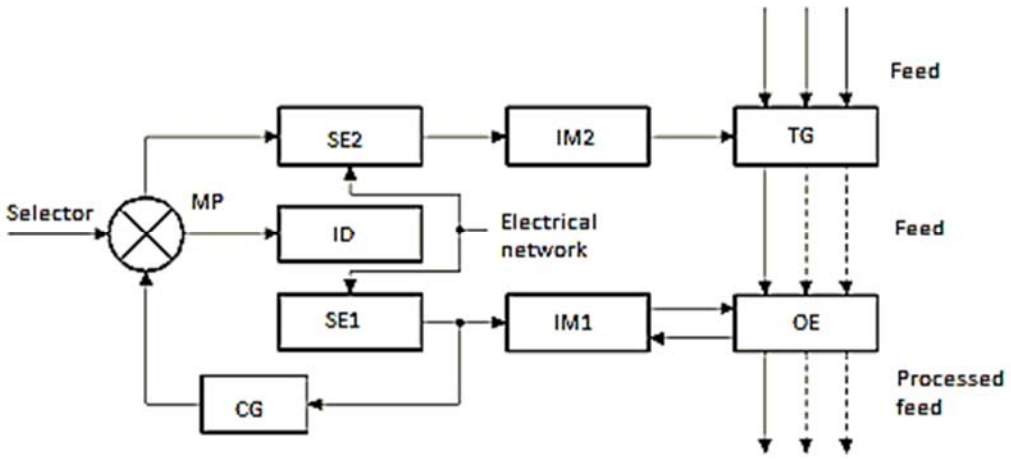
1 – grain tanker; 2 – hay tanker; 3 – gate; 4 – hammer rotor; 5 – vortex; 6 – concave;
7 – ground mirror; 8 – deflector; 9 – tray; 10 – rotor motor; 11 – splitter; 12 – grain guard; 13 – frame;
14 – blending screw; 15 – slide valve; 16 – blending screw motor.

Figure 1 – All-purpose compact feed-processing unit chart

Disadvantages of the unit during grain grinding include the need for manual control of its capacity with the help of the slide valve narrowing or widening the gap, through which the flow of grain is supplied to the operating element. Manual control usually leads to under- or overloading of the unit. In this case, as operation practice of these units shows, most of the working time the motor operates underloaded, and also motor failures are not uncommon due to overloading.

To develop the automatic control system of feed-processing unit, we used the principle of regulation by the driving motor current level, the material flow device control is the gate with reversible electric drive GRE-200.

Functional chart of the proposed control system is shown in Fig.2. In the working part of the mechanical characteristics of the IM1 induction motor of the OE operating element, the current is proportional to the torque data on its shaft and therefore to the loading of the operating element of the unit. The value of current through the CG gauge performing feedback in the system is transmitted to the MP microprocessor, which by comparing it with a predetermined current value, transmits the corresponding control signal to the TD2 trigger device of the IM2 induction motor of the TG tanker gate. As a result, the latter opens or closes by controlling the feed flow from the tanker to the operating element and thus changing the IM1 motor current. SE1 starting equipment is used to control IM1 motor, ID indication device shows the present value of the motor current and the unit operation modes.



MP – microprocessor; ID – indication device; CG – current gauge; SE1, SE2 – starting equipment; IM1 – induction motor of the operating element; IM2 – induction motor of the gate; OE – operating element; TG – tanker gate.

Figure 2 – Functional chart of the control system

Experimental Studies

On the natural sample of the universal small-sized feed-processing unit DU-11 the indicators of the load diagram of the crusher engine have been identified depending on the position of the gate valve (Fig.3).

Figure 3 – Small-sized feed-processing unit DU-11

In order to take the load diagram for manual control of the unit capacity at the plant LLP "KazNIIMESKH", a special bunker with the manual rack and pinion valve installed between the unit's bunker and the crusher has been manufactured.

The scheme for the study of the transient processes of the electric drive of the feed-processing unit DU-11 is shown in Figure 4.

To catch the dynamics of changes of the current rate of the crusher engine the light-beam oscillograph K12-22 was used.

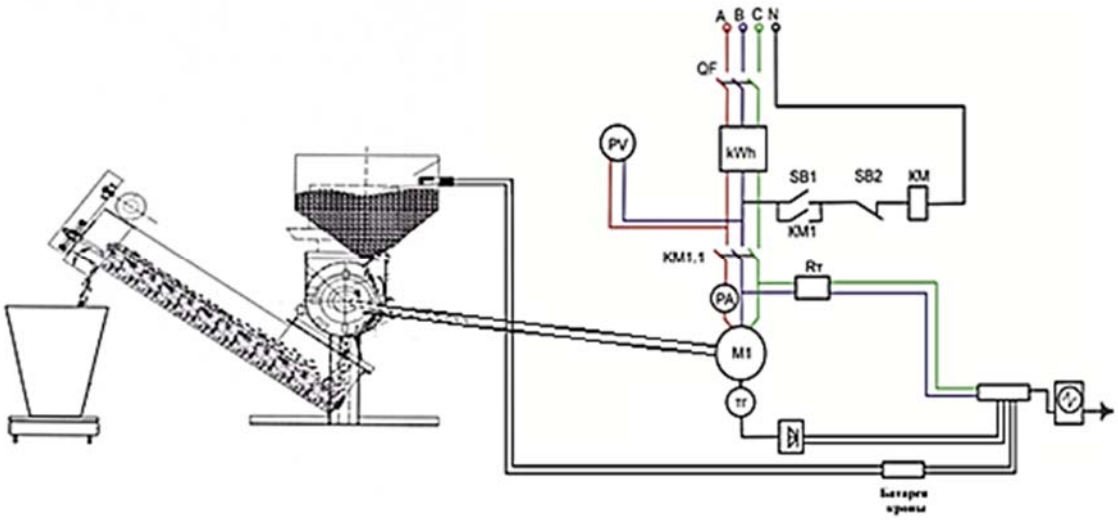


Figure 4 – Scheme for the study of the transient processes of the electric drive of the feed-processing unit DU-11

During the taking of the load diagram, in addition to the current load diagram, the engine speed variations as well as the valve opening degree variations were recorded.

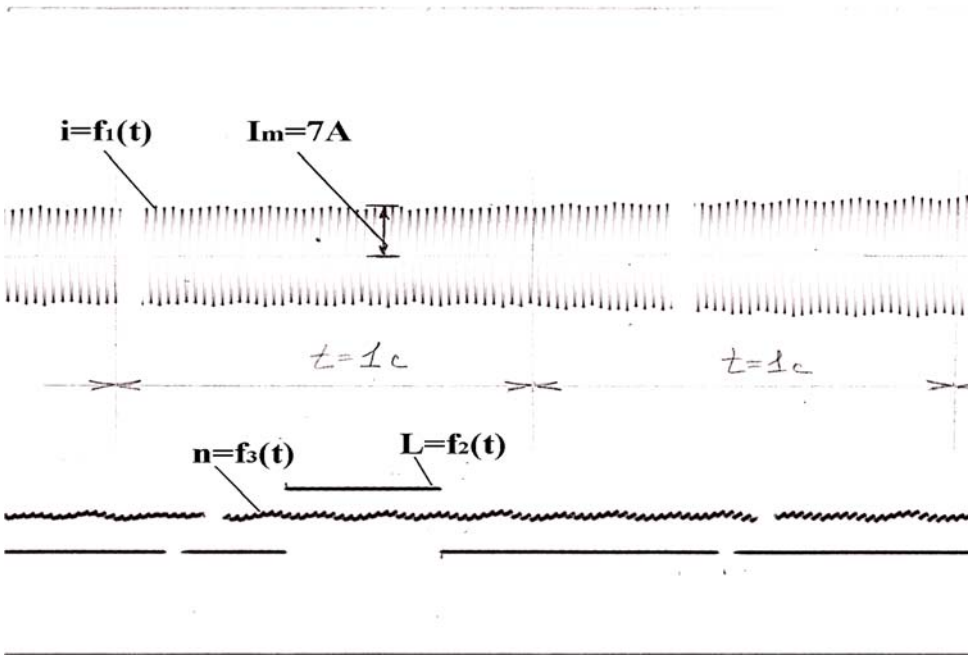


Figure 5 – Load diagram of the main engine of the crusher's working element at the valve opening degree L=60 mm

Figure 5 shows the current load variations of the main engine $I=f_1(t)$ (top), in the middle of the oscillograph chart the crusher engine speed $n=f_3(t)$ is shown, and the position changes of the gate valve $L=f_3(t)$ are shown at the bottom.

It is evident from the oscillograph charts that the current variations in time depend on the position of the gate valve and hence of the load. The main engine speed variations are practically unchanged under different provisions of the gate valve. Changes in the position of the gate valve are defined by a constant signal from the micro switch that detects the upper position of the gate valve every time the valve opens by 10 mm.

For a correct result in the analysis of such load diagrams it is necessary to use the theory of random functions. Hereafter, we will operate with the instantaneous maximum current value of the engine, because, as will further be seen, the load regulation system will be set to read exactly this value. For the selected section of the oscillograph chart, an expectation of the random function m_I, dispersion D_I, the standard deviation of the random function σ_I and the possible maximum deviation of the random function from its expectation I_m have been calculated [6].

$$m_I=7,35A,\ D_I=0,0025A^2,\ \sigma_I=0,05;$$

Thus, the current variation interval for this section is I_m=7,2-7,5A;

Taking of the current load diagram of the unit's engine to determine the time of the transient process was performed with a sharp and full opening of the valve for 5 seconds.

The load diagram of the transient process for the full opening of the valve is shown in Figure 6.

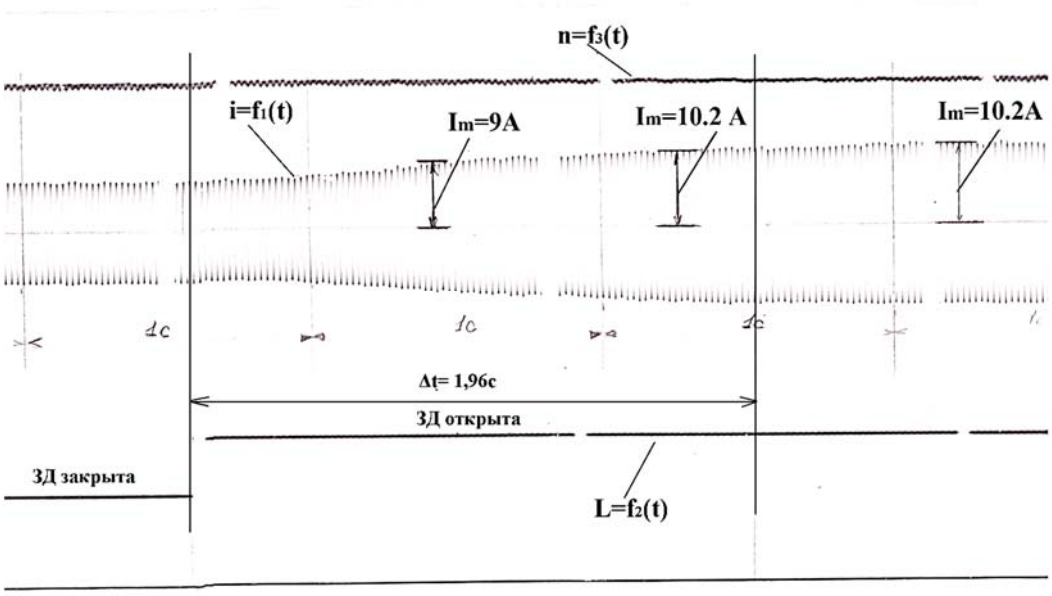


Figure 6 – Load diagram of the transient process

From this oscillograph chart it can be seen that the current value increases from the no-load current value (I_{xx} =6A) to the set current value under the load ($I_{раб}$ =10,2A). Accordingly, the transient process time value is Δt = 1,96s.

Conclusions

On the basis of the selected grinder and with the use of the developed manual gate, we performed laboratory research of the parameters of the grinder motor load diagram as a random function and calculated the expected value of the random function m_I, dispersion D_I, mean square deviation of the random function σ_I and the possible maximum deviation of the random function of its expected value I_m :. m_I=7,35A, D_I=0,0025A^2, σ_I=0,05.

Thus interval is I_m=7,2-7,5A.

At almost instant full opening of the gate, the duration of the transition process of the the current variation in the motor is Δt = 1.96s;

Experimental research studies of the control system brassboard in various operating modes were performed – at start-up, at current variations within tolerable limits, at upward or downward tolerance failure of the current value. Studies showed efficiency of the system in accordance with a predetermined operation algorithm.

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Тананова А.Д.

К РАЗРАБОТКЕ СИСТЕМЫ АВТОМАТИЧЕСКОГО РЕГУЛИРОВАНИЯ ПРОИЗВОДИТЕЛЬНОСТИ КОРМОПРИГОТОВИТЕЛЬНОГО АГРЕГАТА

Аннотация

Проведены экспериментальные исследования и выяснены показатели нагрузочной диаграммы двигателя натурального образца универсального малогабаритного кормоприготовительного агрегата ДУ-11 в зависимости от положения шибера задвижки.

Ключевые слова: Дробилка, производительность машины, датчики, микропроцессор.

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ЖЕМ ДАЙЫНДАҒЫШ АГРЕГАТЫ ӨНІМДІЛІГІН РЕТТЕЙТІН АВТОМАТТЫ ЖҮЙЕНІ ЖАСАУ

Аңдатпа

Эксперименталды зерттеулер барысында ДУ-11 шағын мөлшерді жемдайындағыш агрегатының қозғалтқышының жүктеме диаграммасының көрсеткіштері тиек қақпасының орнына байланысты анықталды.

Кілт сөздер: Дәнжарғыш, машина өнімділігі, датчик, микропроцессор.

УДК 621.577

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МАТЕМАТИЧЕСКАЯ МОДЕЛЬ ТЕПЛОНАСОСНОЙ СИСТЕМЫ

Аннотация

В данной статье представлено математическое описание и методика расчета геотермального теплообменника коаксиального типа для теплового насоса теплоснабжения дома.