

2. Братішко В.В. Продуктивність та енергоємність процесу гранулювання зерно-стеблової кормосуміші гвинтовим гранулятором / В.В. Братішко // *Техніка в сільськогосподарському виробництві, галузеве машинобудування, автоматизація : збірник наукових праць / Кіровоградський національний технічний університет.* – Кіровоград: КНТУ, 2015. – Вип. 28. – С. 138-144.

3. Вайстих Г.Я., Дарманьян П.М. Гранулирование кормов: Приложение к журналу-приложению «Комбикормовая промышленность». – 2-е изд., перераб. и доп. – М.: Агропромиздат, 1988.-143 с.

4. Субота С.В. Ефективність використання установки для виробництва паливних брикетів із рослинної сировини / С.В. Субота, Г.А. Голуб, С.П. Степаненко, В.О. Лук'янець // *Механізація та електрифікація сільського господарства: Міжвідомчий тематичний науковий збірник // ННЦ“ІМЕСГ” НААН України.* – Глеваха, 2012. – Вип. 96. – С.437-444.

УДК 681.324

ENSURING THE RELIABILITY OF COMPLEX SYSTEMS AT DIFFERENT STAGES OF OPERATION

I. AVRAMENKO, undergraduate student*

Dmytro Motornyi Tavria state agrotechnological university

E-mail: nataliia.boltianska@tsatu.edu.ua

Reliability is one of the main indicators of the quality of a technical object, which is detected over time and reflects the changes that occur throughout its operation, including the entire life cycle - from creation to disposal. Reliability is considered as a property of the machine to maintain the necessary technical and operational parameters that characterize the reliability throughout the period of its operation. The study of reliability tracks the change in the quality of the machine over time, which allows you to study the reliability through the implementation of the processes of diagnosis and forecasting directly during its operation. Considering the dynamics of changing the state of the machine as a technical object, we can conclude that reliability is a multi-stage form of changing the state of the machine [1,2].

The reliability of the product is laid down in the design, provided during manufacture and maintained in operation, ie the problem of ensuring the reliability of the machine should be addressed throughout the life cycle - from design to disposal of the machine.

When designing a machine, all the basic and necessary requirements to ensure the reliability of the machine after its manufacture are substantiated and laid down. In the manufacture of the machine taking into account the intended modes of

* Supervisor – candidate of technical sciences, associate professor Boltianska N.I.

operation, the quality of the machine is realized and the quality of manufacture of mechanisms, components is controlled, where each of them will be endowed with reliability characteristics, including structural rigidity, geometric accuracy of structural elements and other parameters [3]. During the operation of the machine, its reliability is realized, and it depends on the methods and conditions of operation of the machine, the adopted system of its repair, maintenance methods, applied modes of operation of components and mechanisms and other operational factors [4,5].

Ignoring the reliability of the technical object is the most unreliable way to create it, which leads to a decrease in the technical resource of application. Any failure of the machine will lead to significant material and financial losses. Statistics of failures and their causes provide a large amount of information about the reliability of mechanisms and components of machines and are the main source of information and identify the actual values of reliability parameters and causes of disability and durability.

Statistics on the processes of operation of the machine allow you to get a real idea of how the design, production and conditions of use, operation correspond to the established level of reliability and safety of operation. The statistical data received during diagnostics allow to carry out forecasting of a future condition of the car and improvement of process of functioning in the conditions of operation. Thus, a comprehensive approach to the study and study of the actual state of reliability of technological equipment will be laid.

During operation, the technical condition of the machine is constantly changing with different speeds of disability. If the machine, its mechanisms and components are unreliable, then there will be a partial or complete loss of performance, forcing it to restore it to a given level by organizing and conducting maintenance and repair. Unreliable machine is the main sign of loss of efficiency of its application, as each its stop due to damage of mechanisms or decrease of technical characteristics of knots with loss of technical and operational parameters will lead not only to big material losses, but also will affect deterioration of industrial and technospheric safety.

It is well known that for the entire period of operation, the cost of repairs, maintenance of machines in connection with their wear and tear is several times higher than the cost of a new car. Thus, for cars - 6 times, aircraft - up to 5 times, technological industrial equipment - up to 8 times, electrical equipment - up to 12 times. The reliability of the machine is greatly influenced, on the one hand, by external operating conditions, on the other - internal physico-chemical processes that contribute to destruction, such as aging, corrosion, increased wear, changes in the properties of materials from which components and mechanisms are made.

Reliability analysis of complex systems has its own characteristics. The specificity of assessing the reliability of a complex system is that the connections between its elements play an important role.

Problems of ensuring the reliability of equipment are solved with integrated and systematic approaches to solving problems in organizational, methodological and personnel areas. Technical objects, such as machines, are complex mechanical

systems.

With a comprehensive approach, the problem of ensuring reliability at all stages of the life cycle of the machine is solved. The system approach involves considering the machine and ensuring its reliability as a system of causation. The organizational direction of work involves the development of a program to ensure the reliability and risk reduction for all stages of the life cycle of the machine, regulations and standards that define the provisions and requirements for ensuring the reliability of equipment.

The study of physical processes that lead to changes in the reliability of the object and its mechanisms, can be most fully carried out in a systematic analysis of the state "changing environment - a functioning technical object - human activity."

The consequence of disability is the failure of components, mechanisms, which leads to machine downtime. The main downtime occurs for technical reasons, due to poor maintenance, for organizational reasons. Simple characterize the unreliability of the machine with the appearance of failures of its operation. Failure to operate is considered as an out-of-cycle loss and as an event that is a malfunction of the machine. In this case, the failure of the machine has objective causes, but is random, and the probability of its occurrence can be described by different laws of probability distribution of reliability parameters during operation.

Loss of efficiency during operation is a natural property of a real machine system. Different types of energy produced by the machine itself and which affect the machine from the outside, express reversible and irreversible processes of change of its state, which lead to the deterioration of the initial values of technical and operational parameters of the machine.

Among the main areas of improving the reliability of the machine system are the following three areas.

1. Increasing the resistance of the machine system to external operating conditions. This should be achieved through the development of methods for creating high-strength, rigid, wear-resistant structures of components and mechanisms, as well as the use of structural materials of high strength, wear resistance, corrosion resistance, etc.

2. Isolation of machines from harmful oscillating processes and influences due to installation of the car on the base for vibration isolation, creation of special temperature conditions and humidity.

3. Application of self-regulation methods, when the machine is able to automatically restore lost functions and respond to external influences. For this direction, there are unlimited opportunities to solve problems of improving the reliability, efficiency and durability of the machine.

Reference

1. Izdebski W. On the issue of increasing the completeness of feeding highly productive cows. Технічне забезпечення інноваційних технологій в агропромисловому комплексі. 2020. С. 220-223. [Електронний ресурс]. URL: <http://www.tsatu.edu.ua/tstt/wp-content/uploads/sites/6/materialy-1-mnpk-tehniche->

zabezpechennja-innovacijnyh-tehnolohij-v-ahropromyslovomu-kompleksi-m.-melitopol-01-24.04.2020.pdf

2. Skliar O. Measures to improve energy efficiency of agricultural production. Abstracts of XIII International Scientific and Practical Conference. Bordeaux «Social function of science, teaching and learning». Bordeaux, France 2020. Pp. 478-480.

3. Uskenov R.B. The need to improve the feeding parameters of cattle. Технічне забезпечення інноваційних технологій в агропромисловому комплексі. 2020. С. 184-187. [Електронний ресурс]. URL: <http://www.tsatu.edu.ua/tsst/wp-content/uploads/sites/6/materialy-1-mnpk-tehnichne-zabezpechennja-innovacijnyh-tehnolohij-v-ahropromyslovomu-kompleksi-m.-melitopol-01-24.04.2020.pdf>

4. Sklar R., Podashevskaya H. Directions of automation of technological processes in the agricultural complex of Ukraine. Минск: БГАТУ, 2020. С. 519-522.

5. Serebryakova N. Selection of optimal modes of heat treatment of grain. Технічне забезпечення інноваційних технологій в агропромисловому комплексі. 2020. С. 20-24. [Електронний ресурс]. URL: <http://www.tsatu.edu.ua/tsst/wp-content/uploads/sites/6/materialy-1-mnpk-tehnichne-zabezpechennja-innovacijnyh-tehnolohij-v-ahropromyslovomu-kompleksi-m.-melitopol-01-24.04.2020.pdf>

УДК 631.363.2

ВДОСКОНАЛЕННЯ КОНСТРУКЦІЇ ДВОСЕКЦІЙНОГО ЗМІШУВАЧА КОРМІВ

Р. В. КІСІЛЬОВ, доц., канд. техн. наук,

П. О. МАРКІДОВ, магістрант

Центральноукраїнський національний технічний університет,

E-mail: ruslan_vik@ukr.net

В статті проведений аналіз роботи і досліджень традиційних конструкцій змішувачів кормів, визначені напрямки вдосконалення процесу приготування кормових сумішей для ВРХ та запропонована нова конструкція комбінованого змішувача, принцип роботи якого пояснюється технологічними і розрахунковими схемами.

Двосекційний змішувач кормів, корми, тваринництво, кормосуміш, зоотехнічні вимоги

Актуальність проблеми. Молочне та м'ясне скотарство України є однією з провідних і найбільш важливих галузей тваринництва, яка забезпечує виробництво більше 95% коров'ячого молока і 50...60% яловичини. На світовому ринку попит на високоякісне молоко, яловичину і продукти їх переробки постійно зростає і тому має важливе господарське значення для