need to assess existing dryers that use traditional and renewable energy sources. An installation weight of technical and technological parameters of drying equipment based on peer review, taking into account individual opinions of experts. Based on the method of expert evaluations found that most weight has specific fuel consumption – 0.24, followed by performance – 0.23, the opportunity to work on different fuels – 0.20, specific power consumption for equipment – 0.16, weight and size characteristics – and other 0.07 (level of automation, specific heat capacity, thermal efficiency, quality drying equipment cost, cost of drying) – 0.1. Weight coefficients performance of the dryer allow for an objective analysis of the multi-art equipment for drying grain.

Key words: *dryer, drying equipment, performance, expert evaluation, decisive*

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JUSTIFICATION OPTIMAL METHOD OF WORK DIAGNOSING AND ACOUSTIC LOADING AT HOLOGRAPHIC

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Abstract. *There is presents original method of selecting the optimal method of diagnosing or restore operability parts of agricultural machinery, which is based on holographic their surfaces in the article. Analysis of possible ways of further improving the efficiency of agricultural technology in crop and livestock production points to promising new technologies implementation performance of service works using holographic principles of methodology. Theoretical choosing the optimal diagnostic method (recovery) is based on the consideration of the probability of occurrence and distribution of natural damage (defects) in the surface layers of the working surfaces of parts probabilistic relationship with their stress and deformation as a concrete surface and generally all the details and impact operability of the car as a whole. Generally used in research such types loading mechanical (tensile, compression, torsion, bending and integrating them), local thermal, termoradiatsiyne, acoustic load pressure or vacuum, and for the destruction of samples load stroke, as recommended special literature.*

The question of the use of acoustic pressure in the study of the technical state of shell structures thin parts of the equipment for processing agricultural raw materials using computer holography. Set to acoustic pressure in the implementation of computer holography. The use of acoustic pressure prompted the first time since this kind of lets you move and ultra micro deformations respectively. The results are mickrodeformation basic information to determine the parameters of technical condition and forecasting residual resource and allowable limits and options structures.

Key words: ***technical condition, selection method of diagnosing, cover design, load, acoustics, holography, laser generator, frequency, ultrasound, defects, damage***

Introduction. In today's, repair production agro-industrial complex of used a significant number of methods and means of diagnosing or restore operability agricultural machinery.

Formulation of problem. Established [1, 3, 4–8], that only the ultra-thin surface layers (50 – 350 mm) working areas, stand almost 80% of contact many cycles, alternating loads and conditions are uneven compression – tension that is constantly changing its intensity. Most of the destruction of parts was found by experiment begins with the surface layer, and the strength and resistance to wear is determined by the quality characteristics. The presence in it (surface layer) damage, imperfections or stress concentrators adversely affect the operational strength of the machine.

Analysis of recent research results. An analysis of the results of research conducted by scientists [4, 11, 12] and others, the value of allowable values technical condition, performance metals for hidden defects and damages are determined on the one hand design parameters and on the other – their physical and mechanical properties. Parts vary relatively small quantities of dispersion values that match the size and types of loads, microdeformation, long time load and can be presented in a fairly narrow range of permissible dissipation in the state working surfaces [6].

The problem definition and justification of rational optimal method diagnostic or recovery parts agricultural machinery devoted a significant amount of research, guidelines and more. Detailed analysis of the literature: Shadrycheva V.A. Chernoivanova V.I., Molodyk M.V., Petukhov A.M., Poliachenko A.V., Lebedev A.S., Sidashenko O.I., Telnov N.F. Kryazhkova V.M. [1–6] and other points to the absence of a common methodological approach that leads to the presence of some subjectivity in the decision making. As of theoretical and experimental studies used the classical technique proposed provisions

Shadrychevym V.A. [9, 12] and integrated approach developed Chernoivanovym V.I. [6, 10], and the methodology that takes into account the nature of the likely passage of the processes of wear and the formation of defects, the proposed Molodyk M.V. [3, 12]. Note that almost all sources not included reduced probability distribution of defects on working surfaces, nature microstrains distribution in the surface layers, their relationship with the distribution of stress on the working surface of the part and the action of the totality of these factors on the machine as a whole in specific production conditions.

Purpose of research. A definition for selecting the optimal method diagnostic or restoration of parts of agricultural machinery, which is based on holographic research technical condition of thin shell structures in agricultural acoustic load.

Results of research. Developed in this paper, theoretical foundations rational choice method of diagnostic or repair (recovery) is based on the consideration of the probability of occurrence and distribution of natural damage (defects) in the surface layers of the working surfaces of parts probabilistic relationship with their stress and deformation as a concrete surface and generally all parts and their impact on machine operability in general. In developed technique was based on three main criteria for selecting the optimal method of diagnosing (recovery) [5–8]. We used method of comparing the technical state of components: new (spare parts) that were not in operation; worn parts, remanufactured parts, welding and submerged arc shielding gases, thermal spraying and detonation, plasma welding, mechanically processed to oversize (most common in repair shops) and others. Thus considered ratios resource recovery parts that set on the machine (new and refurbished).

All figures presented take into account in substantiating technical and technological criteria. We determined ratios recovery resource parts that set on the machine. Evaluated job performance properties restored surfaces, resistance to wear and fatigue strength of the connection cover basic material, roughness, accuracy of recovery and physical and mechanical properties (hardness, elasticity, strength contact), restoration of form, integrity, density, etc. All figures presented take into account in substantiating technical and technological criteria.

Studies conducted on the parts – representatives: disc opener, hammer crusher, piston finger, tap the milk, coulter mowers, distributor cap with a tenfold repetition of the experiment. Load selected specifically with conditions of product options selected error 8–10% of the base. Disc coulter, hammer crusher, piston finger, tap the milk, distributor cap – loaded compression to the appearance in the feature "Real-time" clear interference fringes. Technical parts of the state assessed the nature of the distribution of interference fringes that are known to be the equal microstrains lines on the surface of the investigational product. The presence or absence of surface and subsurface defects, damage, their number and interaction indicates clearly formed abnormal form interference fringes. In the obtained holograms evaluated the distribution of interference fringes. Applying some readjustment of the optical system, studied the technical condition of the adjacent surfaces or parts in general. Showed character changes (if available) interference fields in specific working surfaces of parts. This place changed the placement of the applied load and strain studied the change of status of the product.

The wave field, which saw, was formed so that the light is uniformly illuminated product. Due to the presence of surface roughness (a situation typical for mechanically processed parts) specular reflection is very small and light is scattered uniformly in all directions, and each component structure that specifically examine maybe checked. On the other hand, insensitivity to defects holographic interference optical system elements allowed to conduct research facilities almost unlimited geometrical parameters and complexity of forms.

Product or part, the studies conducted and specific tasks, loaded so as to identify the most anticipated defects. The best way to load shall cause the deformation of the surface layers in which a defect at the site will be established anomaly interference pattern, which will locate the defect and evaluate its importance. In the study used mechanical, acoustic and thermal loads. Taking the developments outlined in the guidance [3] determined the average values of recovery in April and resource recovery form factor resource allocation of each surface. The coefficients determined by formulas presented in [1]:

$$K_{vyai} = \frac{t_{vi}}{t_{ni}}, \qquad (1)$$

$$K_{vyaf} = \frac{в_{vi}}{в_{ni}}, \qquad (2)$$

where: t_{vi} , t_{ni} – the average resource specific surface and new details on the i-th type of destruction as a result of the tests, h.;

$в_{vi}$, $в_{ni}$ – setting concrete forms of resource allocation surface for those cases dimensionless quantities;

i – 1,2,…,r – number of species destruction of concrete surfaces.

In control and test components, their working surfaces was considered appropriate application recovery factor K_{vyai} surface quality and form factor as the surface distribution K_{vyafi}. This assumption was made due to the lack of data that would identify named ratios. Carry out complex and long-term research is not economically viable under current conditions.

$$K_{vyai} = \frac{S_{vyi}}{S_{nyi}} \quad (3)$$

or

$$K_{vyai} = \frac{\sum_{1}^{n}(P_1^{в} + P_2^{в} ... P_n^{в})}{\sum_{1}^{n} P_n^{н}} \times , \quad (4)$$

where: S_{vyi}, S_{nyi} – he average area (based on 25-fold repetition of the experiment) surfaces experimental details and in accordance with the new (reference) for calculate off areas of damage (or average amount of interference fringes on the surfaces restored and new parts are examined by calculate off average number of interference fringes with abnormal The interference pattern) m^2;

$\sum_{1}^{n}(P_1^{в} + P_2^{в} .. P_n^{в}$ – total probability of holograms with abnormal pattern of interference fringes for the entire sample recovered by certain parts of agricultural machines;

$\sum_{1}^{n} P_n^{н}$ – total probability of holograms without abnormal pattern of interference fringes, such holographic new parts that were not in operation.

$$K_{vfi} = \frac{\sum_{0}^{m}(P_1 \bullet r_1 + P_2 \bullet r_2 + ... + P_m \bullet r_m)}{\sum_{0}^{i} P_i \bullet r_i} , \quad (5)$$

where: $в_{svi}$, $в_{sni}$ – form of distribution options as of each surface and restored under new parts are defined as the probability of interference fringes curvature;

$P_1, P_2 ... P_m, P_i$ – he probability of occurrence of interference fringes with curvature radius $r_1, r_2, ..., r_m, r_i$, mm.

The probability of occurrence of bands corresponding to the curvature of holograms to take into m parts in i-repetition of the experiment. It should be noted that the area of the fault zone is characterized by abnormally placed interference fringes, where their frequency is much higher than the same parameter for neighbor - such that no damage or defects.

In determining factors search found them statistical, probable characteristics. Experimental studies have confirmed the correctness of the chosen method of implementation and its theoretical foundations. Applications developed technique made it possible to believe correct definition of a technical solution with reliability of 0.95, which is confirmed by numerous experimental research when choosing a rational method or way to restore operability parts of agricultural machines.

In the current study was compiled solve important problems – to investigate the process and related fields microdeformation appearance on the surface of the product without destruction. In this case created conditions allowable loads and respectively - the acceptable technical condition of the product as a natural model or the real part is not destroyed, and the hologram recording was performed at the time of emergence and development microstrains.

In this connection, it is difficult to apply a universal method some clearly accepted as an axiom to identify them hidden defects and damage, that definition of their technical condition in shell structures. Especially significant difficulties arise in fault detection complex spatial configurations of parts feed production and processing of agricultural products. Conducted numerous studies have shown that the best results in determining the technical condition of equipment (tanks, reservoirs, scalders, capacities, Carter and pans) provide optical methods of flaw detection.

Experimental studies conducted at a fixed amplitude fluctuations without destroying the objects of study with double exposure using laser technology. One of the most modern expression of which is holography. Acoustic excitation passed from the acoustic oscillator frequencies for steel parts in the range – 1200–1600 Hz for polyethylene – 400–800 Hz. To conduct research to identify defects was enough to set five levels of acoustic excitation frequency changes. In the first case: 1200, 1300, 1400, 1500 and 1600 Hz, in the second case, 400, 500, 600, 700 and 800 Hz. At each change of frequency conducted recording holograms. Acoustic load transmitted through the resilient member from the loudspeaker to the details that rigidly fixed with glue on both elements. The frequency changed by a generator frequency "Simens 450".

Almost all the spatial detail and feed processing industry made of thin-walled alloy or carbon steel, about 67–79%. Some of them 20% are made of plastic and thin-walled and reinforced materials. The thickness of the first does not exceed 0.6–0.8 mm and the second – 1,6–2,5 mm. The use of traditional types of loads such as mechanical ventilation and does not allow the use of computer holography (cannot create a fixed stand parts) [1–3, 5, 7].

Research to identify hidden defects and the impact of major inherently different kinds of pressures to change the surface state of parts carried in specially created facilities that provide interaction required parameters (type of load, type of interference fields, their location, configuration). Work carried out in a complex combination of two types of optical interferometry. The image of the deformed body, represented as coloured interference fields, fixed in memory. The principle of each type of holography on the method of double exposure, when the body is observed before and after the applied load. The defect or damage details are shown in the local abnormal placement of interference lines, which would have a general view – arranged well structure. In the case of computer holography – a coloured strip (each colour corresponds to a certain amount of deformation).

Identify the following characteristics is possible only through holographic non-destructive testing method. As disadvantage The above methods, it should be noted that the experiments conducted in clearly fixed discrete points in time. This makes it impossible to investigate integrated picture of changes in the field microdeformation surface of the product over time by changing the size or nature of the load. The process is manageable under the established factors: the type of load, its value, the site of application, joint action and more.

Note that the potential practical applications of holographic methods as in industry, in agricultural engineering, are in denial aforementioned problems of existing methods of NDT. The complex shape of parts caused a significant amount of exploration work in determining the possibilities of different kinds of stress. It was found that satisfactory results may be obtained using only acoustic load.

Using holographic interferometry to study the design of thin-walled parts given mainly associated with the method of loading. It is necessary to load the design in such a way that it was possible to distinguish the hologram on the movement or deformation of the surface area of the product other than abnormal (defective). The use of acoustic methods load is very promising in the implementation of computer holography, which allows you to watch the object of study in real time and record the deformation state of the selected details and a fixed time interval [1, 2, 4]. This approach allow us to evaluate the technical condition of the product during the whole period of its existence, than to ensure its level of reliability.

Computer holography at excitation in the body parts of sound and ultrasonic vibrations provides effective detection of thin-walled structures of diverse defects. This is due to the fact that in areas such abnormal vibrations excite the moving surfaces, thus providing various changes in the interference pattern. An important advantage of this method is the possibility of a much lower frequency than the ultrasound control. Used in the study of excitation frequencies of 1 kHz or less, while conventional ultrasonic non-destructive testing in frequency range. Significantly reduced the impact of signal scattering the material, its weakening, surface roughness and complexity of configuration, geometry and thus increases the likelihood of defects. In addition, when working at low frequency control is subject to much greater area, which facilitates work and reduces its cost.

Results holographic allowed under acoustic stress not only determine the shape and size of the defect and the depth of its occurrence, which may be useful in improving or creating new processes.

Conclusions. Thus, computer holography allows you to choose the best method for diagnosing or restoration of parts of agricultural machinery and explore the technical condition of the thin-walled products, finding leaks, season, fistulas, the inclusion of a foreign material in the application of acoustic excitation and load. It was established that the best kind of thin-walled parts acoustic load is at a frequency band excitation medium. High-frequency ultrasonic load in strip virtually no excitement to create a computer hologram and adequately evaluate the technical condition of details of agricultural machinery and equipment for processing agricultural products.

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ОБҐРУНТУВАННЯ ОПТИМАЛЬНОГО МЕТОДА ПРОВЕДЕННЯ ДІАГНОСТУВАЛЬНИХ РОБІТ ТА АКУСТИЧНЕ НАВАНТАЖЕННЯ ПРИ ГОЛОГРАФІЇ

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Анотація. *В статті розглянуто оригінальну методику вибору оптимального методу діагностування або відновлення роботоздатності деталей сільськогосподарських машин, яка базується на результатах голографування їх поверхонь. Аналіз можливих шляхів подальшого підвищення ефективності використання сільськогосподарської техніки в рослинництві і тваринництві вказує на перспективність впровадження новітніх технологій виконання сервісних робіт із застосуванням голографічних методів. Теоретичні засади вибору оптимального методу діагностики (відновлення) побудовано на врахуванні ймовірності природи появи та розподілу пошкоджень (дефектів) в поверхневих шарах робочих поверхонь деталей, імовірнісного взаємозв'язку їх із напружено-деформаційним станом як конкретної поверхні так і всієї деталі загалом і впливу їх роботоздатності на машину в цілому. Загалом при проведенні досліджень застосовували такі види навантаження: механічне (розтягнення, стискання, кручення, згинання та їх комплексне поєднання); термічне локальне, терморадіаційне загальне; акустичне збудження; навантаження тиском або вакуумом, а також для руйнування зразків навантаження ударом, що рекомендовано спеціальною літературою.*

Розглянуто питання застосування акустичного навантаження при дослідженні технічного стану оболонкових тонкостінних конструкцій деталей обладнання з переробки сільськогосподарської сировини за допомогою комп'ютерної голографії. Встановлено режими акустичного навантаження при реалізації комп'ютерної голографії. Застосування акустичного навантаження запропоновано вперше, так як такий вид дозволяє отримати надмалі переміщення і відповідно мікродеформації. Отримані результати мікродеформування служать базовою інформацією для визначення параметрів технічного стану і прогнозування залишкового ресурсу та розрахунку допустимих і граничних параметрів конструкцій.

Ключові слова: ***технічний стан, вибір методу, діагностування, оболонкові конструкції, навантаження, акустика, голографія, лазер, генератор, частота, ультразвук, дефекти, пошкодження***

ОБОСНОВАНИЕ ОПТИМАЛЬНОГО МЕТОДА ПРОВЕДЕНИЯ ДИАГНОСТИЧЕСКИХ РАБОТ И АКУСТИЧЕСКОЕ НАГРУЖЕНИЯ ПРИ ГОЛОГРАФИРОВАНИИ

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Аннотация. *В статье рассмотрено оригинальную методику выбора оптимального метода диагностирования или восстановления работоспособности деталей сельскохозяйственных машин, основанную на результатах голографування их поверхностей. Анализ возможных путей дальнейшего повышения эффективности использования сельскохозяйственной техники в растениеводстве и животноводстве указывает на перспективность внедрения новейших технологий выполнения сервисных работ с применением голографических методов. Теоретические основы выбора оптимального метода диагностики (восстановление) построены на учете вероятностной природы появления и распределения повреждений (дефектов) в поверхностных слоях рабочих поверхностей деталей, вероятностной взаимосвязи их с напряженно-деформационным состоянием как конкретной поверхности, так и всей детали в целом и влияния их на машину в целом. В общем при проведении исследований применяли такие виды нагружения: механическое (растяжение, сжатие, кручение, изгиб и их комплексное сочетание), термическое локальное, и акустическое (нагрузки давлением или вакуумом), а также для разрушения образцов нагрузки ударом, рекомендуется специальной литературой.*

Рассмотрены вопросы применения акустической нагрузки при исследовании технического состояния оболочечных тонкостенных конструкций деталей оборудования по переработке сельскохозяйственного сырья с помощью компьютерной голографии. Установлены режимы акустической нагрузки при реализации компьютерной голографии. Применение акустической нагрузки предложено впервые, так как такой вид позволяет получить сверхмалые перемещения и соответственно микродеформации. Полученные результаты микродеформировroutine микродеформироваўннія служат базовой информацией для определения параметров технического состояния и прогнозирования остаточного ресурса и расчете допустимых и предельных параметры конструкций.

Ключевые слова: ***техническое состояние, выбор метода, диагностирования, оболочковые конструкции, нагрузки, акустика, голография, лазер, генератор, частота, ультразвук, дефекты, повреждения***