

DOI: 10.34677/1728-7936-2019-4-4-8

ESTIMATION OF THE INFLUENCE OF DIESEL ENGINE VALVE CLEARANCE ON INTAKE MANIFOLD PRESSURE PULSATIONS

VYACHESLAV V. YEGOROV, *postgraduate student*

E-mail: vacmsk@gmail.com

VIKTOR A. CHECHET, *PhD (Eng), Associate Professor*

E-mail: d.chechet@list.ru

Russian State Agrarian University – Moscow Agricultural Timiryazev Academy; Timiryazevskaya Str., 49, Moscow, 127550, Russian Federation

The paper considers the influence of the out-of-adjustment degree of a D-240 diesel engine valve clearance on angular acceleration at the crankshaft speedup, fuel consumption and a type of absolute pressure waveform in the intake manifold. The laboratory bench includes: a D-240 diesel engine of an MTZ-82 tractor, a MotoDoc III engine tester with a low air pressure sensor and a fuel pipe pulse detector, a digital engine power indicator IMD-C, and digital fuel flow meter DFM-100. The nominal valve clearance of 0.25 mm was set for all valves. The experiment involved three phases (without valve clearance control, with nominal valve clearance values and with valve clearance values much higher than nominal) and two variants: with a mounted and dismantled air filter. The nominal valve clearance values give better acceleration and fuel consumption, which can be caused by both better air supply and the device inaccuracy. The waveforms obtained differ insignificantly, which can be attributed to their low practical utility for diagnosing the out-of-adjustment condition of valve clearances. However, the wider valve clearances cause an iterative echo vibration impulse, which is definitely related to impact processes in the valve mechanism. It has been experimentally proved that a method of analyzing vibro-acoustic waveforms of a running engine is more informative for detecting the considered defect.

Key words: internal combustion engine, diesel engine, technical diagnostics, intake manifold, valve mechanism, timing gear, valve clearance.

DOI: 10.34677/1728-7936-2019-4-8-13

STUDYING THE TOWING CHARACTERISTICS AND EFFICIENCY OF DIFFERENTIAL AND MOVING PARTS OF THE GAZ-3302 AUTOMOBILE

YURIY G. GORSHKOV, *DSc (Eng), Professor*¹

E-mail: esch2070@mail.ru

SERGEY V. ZOLOTYKH, *PhD (Eng), Associate Professor*²

Email: starfruitworks@gmail.com

SERGEY V. SHCHIGOLEV³

E-mail: sergeysch127@mail.ru

¹ South Ural State Agrarian University; Gagarina Str., 13, Troitsk, Chelyabinsk Region, 457100, Russian Federation

² Private Educational Institution of Supplementary Education “Zolouterra”; Communy Str., 133, Chelyabinsk, 454080, Russian Federation

³ Russian State Agrarian University – Moscow Timiryazev Agricultural Academy; Timiryazevskaya Str., 49, Moscow, 127550, Russian Federation

The authors have analyzed the main disadvantages of using simple gear differentials in the conditions of low load bearing surfaces characteristic of the agricultural transport network. The imperfect design of such differentials leads to various negative consequences when driving in difficult road conditions. Using the GAZ-3302 truck as an example, the authors consider the influence of the automobile slipping degree on the efficiency of its use in terms of the efficiency of a differential and pneumatic wheel propulsion parts. Using a special set of devices, the authors have established that, under the same test conditions, a decrease in the vertical axle load leads to an increase in the split slip ratio. The use of a patented automatic differential locking mechanism in the GAZ-3302 truck makes it possible to reduce the value of the separate slipping coefficient on various types of bearing surfaces from 15 to 22%, on the average. It has been established that the efficiency loss of the propulsion parts, with reference to the GAZ-3302, is 11.6...18.4%, depending on the operating conditions of the clutch and the vehicle workload. Analyzing the results of experimental studies, the authors conclude that the efficiency loss of the propulsion parts of a wheeled vehicle is inextricably linked with the amount of separate slipping

of the driving wheels. The conclusion is made about the necessity for further improvement of systems and devices to analyze skidding and efficiency of propulsion parts to provide for their more accurate design.

Key words: truck, differential, skidding, efficiency, differential lock, bearing surface, traction characteristics.

DOI 10.34677/1728-7936-2019-4-13-18

PROSPECTS FOR THE IMPLEMENTATION OF ELEMENTS OF THE "INTERNET OF THINGS" IN CROP PRODUCTION

VIKTOR I. BALABANOV, DSc (Eng), Professor

SERGEY A. ISHCENKO, DSc (Eng), Professor

MARIYA S. ROMANENKOVA

E-mail: mashkaromanenkova@mail.ru

Russian State Agrarian University – Moscow Timiryazev State Agrarian University; Timiryazevskaya Str., 49, Moscow, 127550, Russian Federation

The paper discusses some of the features and prospects for the introduction of technologies based on the “Internet of things” in crop production. The authors present an implementation solution for monitoring soil and air indicators by eighteen sensors located in an experimental plot in the Precision Agriculture Center of Russian State Agrarian University – Moscow Timiryazev Agricultural Academy. Both remote access through existing mobile communication systems and low power consumption through the use of alternative energy sources make the maintenance of such devices an affordable and low-cost option. The low cost of sensors, as well as the use of biodegradable and safe components make it possible to avoid their subsequent collecting for disposal. The paper contains the simulation results represented, according to the observation dates, by graphs of soil and air indicators. The authors conclude that the introduction of technologies based on the “Internet of Things” will automate processes and eliminate human participation in most of them, while ensuring production efficiency.

Key words: environmental monitoring, “Internet of things”, IoT technology, information technologies, precision farming.

DOI: 10.34677/1728-7936-2019-4-18-23

PEELING OF WHITE LUPINE GRAIN IN ROLLER MILLS

SERGEY V. ZVEREV, DSc (Eng), Professor¹

E-mail: zverevsv@yandex.ru

ANDREY E. STAVTSEV²

ALEKSANDR S. TSIGUTKIN, PhD (Bio), Associate Professor²

NIKOLAY V. ALDOSHIN, DSc (Eng), Professor³

E-mail: cxm.msau@yandex.ru

ALEKSEI YU. ALIPICHEV, PhD (Ed), Associate Professor³

E-mail: al_new2003@mail.ru

¹ Federal Research Center for Food Systems named after V.M. Gorbатов; Dmitrovskoye shosse, 11, Moscow, 127434, Russian Federation

² Agro-Matik LLC; Doschatinskoye shosse, 30/2, Vyksa, Nizhny Novgorod Region, 607061, Russian Federation

³ Russian State Agrarian University – Moscow Timiryazev Agricultural Academy; Timiryazevskaya Str., 49, Moscow, 127550, Russian Federation

In cereal production, there are a number of methods for grain peeling. The process of peeling lupine grain having a specific form, which differs from the spherical one, includes grain crushing, sieve screening, and pneumatic separating. Independent variables characterizing the processing conditions include the gap between the rollers, grain moisture content, the speed of the rollers, and their slippage. Roller mills (crushers) were used for crushing. The rotational speed of the rollers was 300 and 600 min⁻¹. During pneumatic separation, the air speed in the pneumatic duct corresponded to 7.5 m/s. It has been established that the gap between the rollers and the grain moisture content significantly affect the quality indicators of the ground product. As a result of the experiments, it has been found that an increase in the gap in the range of 1.0...2.5 mm and an increase in the grain moisture content from 8 to 13.2% result in the increased output of middlings and the average size of particles. However, the number of core particles with shell remnants increases too, and the output of tailings (mainly, shells) decreases after pneumatic separation. The output of marketable kernel middlings was about 70%. The technological process of white lupine grain peeling is based on the traditional equipment of cereal production. The

results obtained suggest the possibility of the primary processing of white lupine grain with such crushers to produce kernel middlings of the required fractional composition.

Key words: white lupine, peeling, crusher, crushed grain material, shells.

DOI: 10.34677/1728-7936-2019-4-23-28

PARAMETERS AND OPERATING MODES OF THE PNEUMATIC SYSTEM OF A POTATO DECAPITATION DEVICE

BORIS A. BITSOYEV

E-mail: bicoev_boris@mail.ru

ALEKSANDR G. LEVSHIN, DSc (Eng), Professor

E-mail: alev200151@rambler.ru

SERGEY V. SHCHIGOLEV

E-mail: sergeysch127@mail.ru

IRINA N. GASPARYAN, DsC (Eng), Professor

E-mail: irina150170@yandex.ru

Russian State Agrarian University – Moscow Timiryazev Agricultural Academy; Timiryazevskaya Str., 49, Moscow, 127550, Russian Federation

Obtaining environmentally friendly potato products without additional application of agrochemicals is possible on condition that a technological method of decapitation is used. This stimulates the crop viability and helps to increase the leaf surface. The process of decapitation consists in removing the apical part of stems, which spurs the development of lateral shoots. Potato has both upright and deflected stems, therefore, the upper part should be brought to the cutting unit before decapitation, and since the stems can be easily injured, this operation needs to be very delicate. In this regard, the authors suggest paying attention to a possibility of lifting the potato stems to the cutting unit knife during decapitation, making use of suction air flow. This approach allows to perform the operation with minimal friction between a plant and the surface without injuring its stems and leaves. The authors provide grounds for a method of determining the parameters of a pneumatic system of lifting potato stems. It has been found that to ensure stem lifting with a shoot height difference of 0.10...0.15 m during potato decapitation, use can be made of a unit with a suction pipe mouth diameter of 0.35 m, and at the air velocity of 10...15 m/s, respectively.

Key words: potato, device for top-part removal, non-pressure cut, cutting edge, unit speed.

TECHNICAL SERVICE IN AGRICULTURE

DOI: 10.34677/1728-7936-2019-4-29-34

ELECTROMECHANICAL RESTORATION OF SHAFT SEATS UNDER ROLLER BEARINGS

SERGEI K. FEDOROV, DSc (Eng), Professor

E-mail: momd@yandex.ru

YULIYA S. IVANOVA, PhD (Eng)

E-mail: yyulianius@gmail.ru

MIKHAIL A. LASHUKOV

E-mail: misha2508@mail.ru

BRYAN MEJÍA RAMOS

E-mail: bry_yeah7@outlook.com

Bauman Moscow State Technical University (National Research University); 2nd Baumanskaya Str., 5, Moscow, 105005, Russian Federation

The problem of ensuring the durability of shaft seats for roller bearings and the search for optimal ways to improve their reliability is an urgent task. This study explains the reasons for the low durability of shaft seats for roller bearings associated with the mechanism of bearing wear and insufficient physical and mechanical properties of the surface layer of manufactured and reconditioned machine parts. Based on the analysis of existing methods for restoring shaft seats for roller bearings with wear of less than 0.1 mm, the authors propose a technology of electromechanical reduction hardening, which allows to increase the diameter and hardness of the surface layer of parts in one stroke of the tool. The paper presents the results of comparative wear tests of cylindrical samples of steel 40X coupled with roller bearings 180206AK-6206. After electromechanical hardening recovery, the hardness of the surface layer of samples was 52...58 HRC, at a depth of 0.8 mm with an initial hardness of 19...22 HRC. The outer diameters of the samples before and after each test stage was changed with a lever bracket at an accuracy of 0.001 mm in two mutually perpendicular directions. The inner diameter of the roller

bearings before and after each test cycle was controlled with a limit gauge-stopper. The research was carried out as follows: assembling fit-tight joints with a hydraulic press, holding for 60 seconds, pressing out the sample, visual inspecting, measuring the diameter of a sample lever bracket, controlling the inner ring of the bearing using a limit gauge. Ten operations of the assembly and disassembly of connections were taken for the test basis. The wear test results of the samples indicate the high efficiency of the electromechanical hardening recovery technology. The implementation of research results made it possible to use the developed technology for remanufacturing the gearbox of "Volga", "Gazel", "Sobol", and "Barguzin" car families and gear shafts of power reduction gears.

Key words: wear, electromechanical treatment, heat treatment, hardening.

DOI: 10.34677/1728-7936-2019-4-35-41

ANALYSIS OF FACTORS INFLUENCING THE ADHESIVE STRENGTH OF ELECTROMETALLIZING COATINGS

ALEKSANDR V. KOLOMEYCHENKO, *DSc (Eng), Professor*¹

E-mail: kolom_sasha@inbox.ru

IGOR N. KRAVCHENKO, *DSc (Eng), Professor*²

E-mail: kravchenko-in71@yandex.ru

VLADIMIR N. LOGACHEV, *PhD (Eng), Associate Professor*¹

E-mail: logvovan@mail.ru

ALEKSANDR A. IZMALKOV, *postgraduate student*¹

E-mail: izmalckow.aleks2012@yandex.ru

SERGEY V. KARTSEV, *PhD (Eng), Associate Professor*³

E-mail: vodra15426378@gmail.com

¹ Orel State Agrarian University named after N.V. Parakhin; 302019, Generala Rodina Str., 69, Orel, Russian Federation

² Russian State Agrarian University – Moscow Timiryazev Agricultural Academy; 127550, Timiryazevskaya Str., 49, Moscow, Russian Federation

³ Institute of Machine Science named after A.A. Blagonravov at the Russian Academy of Sciences, 101990, Kharitonievskiy Pereulok Str., 4, Moscow, Russian Federation

Increasing adhesion strength of coated surfaces with the method of electric arc metallization (EM) is an important task in the restoration of machine parts. The study aims at determining the factors allowing to increase the adhesion strength of deposited EM coatings due to the preliminary surface preparation – applying an underlayer, selecting EM and the aerosol fluxing (AF) modes). The paper presents methods for studying the speed of sprayed metal particles, adhesive strength and wear resistance of EM coatings, as well as the study results of the speed of sprayed metal particles depending on the metallization distance, the effect of preliminary preparation methods and aerosol fluxing on the adhesion strength of coatings applied to steel 18 XIT by the EM method. The paper presents methods and results of wear resistance study of EM coatings, which are of interest to determine a possibility of using coatings obtained by the EM method with the AF application in the repair industry. It has been established that the highest speed of sprayed material particles is achieved at a metallization distance of 140 mm. It has been shown that blasting with corundum is the preferred method of pretreatment for steel coatings with high hardness. It has been found that deposition of EM coatings with wire Cв-08Г2С increases the sprayed coating adhesion strength. The use of AF allows to increase the wear resistance of a friction couple with an EM coating obtained by spraying the Cв-08Г2С wire in 1.2 times, as compared to a friction couple with an EM coating obtained using a 50XΦА wire and in 1.4 times as compared to a reference friction couple. The research results allow to recommend the application of the EM coatings deposited using AF in the repair industry for restoring and strengthening steel parts to be used for various purposes.

Key words: electric arc metallization, adhesive strength, wear resistance, sprayed coating, aerosol fluxing, electrometallization coatings, restoration of machine parts.

ECONOMY AND ORGANIZATION OF AGRICULTURAL ENGINEERING SYSTEMS

DOI: 10.34677/1728-7936-2019-4-42-45

QUALITY INDICATORS OF RAW HOP MATERIALS

OKSANA G. KARATAYEVA, *PhD (Econ), Associate Professor*

E-mail: okarataeva@rgau-msha.ru

TATIANA S. KUKUSHKINA

E-mail: mapkiza79@mail.ru

YURIY M. ALEKSEYEV

E-mail: mapkiza@yandex.ru

Russian State Agrarian University – Moscow Timiryazev Agricultural Academy; 127550, Timiryazevskaya Str., 49, Moscow, Russian Federation

Market relations impose stringent requirements on the quality of raw hop materials and guaranteed supply volumes. The authors have analyzed the world experience, which indicates that in the hop-growing industry there are tendencies of transition to innovative resource-saving technologies, allowing not only to increase the efficiency of hop production, but also to improve the quality of the produced raw materials. The quality of raw hop materials is a decisive criterion in hop production and processing at all stages of the production process. The paper discusses issues aimed at obtaining high-quality hop products. The authors have determined technological, economic and environmental indicators of the hop quality, as well as the quality estimation criterion – the content of alpha-acid. The paper presents calculation formulas for determining the gross yield of alpha-acid, the cost of one centner, the increase in production, profits and economic efficiency as a result of improving the quality of raw hop materials. It is noted that the use of innovative resource-saving technologies will improve the quality of hop products, and increase the economic efficiency of hop production. It is recommended to hop producers to constantly conduct hop market research, introduce modern innovative production methods and processing technologies; and produce hop raw materials of different marketability taking into account the quality criteria and indicators.

Key words: hop, hop processing, hop production, hop quality, raw hop materials, hop products, hop production efficiency, import substitution.

DOI: 10.34677/1728-7936-2019-4-46-51

BIOENERGY PRODUCTION AS A AGRICULTURAL INDUSTRY SEGMENT BASED ON ORGANIC WASTE ENERGY CONVERSION

GEORGIY D. DEMEKHIN, *postgraduate student*

E-mail: 9859115550@mail.ru

Russian State Agrarian University – Moscow Timiryazev Agricultural Academy, Timiryazevskaya Str., 49, Moscow, 127550, Russian Federation

The transition to alternative energy sources is determined by the scarcity of fossil fuels and problems associated with climate change. Bioenergy production is particularly relevant in rural areas where biological factors of production play a key role. Scientific and technological progress in the development of bioenergy potential is aimed at obtaining biofuels of the second and third generation. The paper summarizes global experience of bioenergy development. Based on the obtained results, the ways and mechanisms of bioenergy development in Russia are proposed, namely, solving the problems of decontamination and recycling of organic waste, obtaining environmentally friendly organic bio-fertilizers, reducing the anthropogenic impact of agriculture on the environment and soil, increasing the profitability of agricultural organizations and employment in rural areas. The development of bioenergy potential represents a wide range of technologies and approaches to organizing energy production from organic raw materials, requires special knowledge and skills of administrative and management personnel, and should also include mechanisms for financial support of the industry through the development of a state target program. This approach can be implemented through the organization of a system of regional specialized institutes (technoparks) based on the existing agricultural enterprises.

Key words: bioenergy industry, waste processing, concept and development trends of bioenergy industry, organic fertilizers, ecology, renewable energy sources, “green” economy.

POWER SUPPLY AND AUTOMATION OF AGRICULTURAL PRODUCTION

DOI: 10.34677/1728-7936-2019-4-52-59

DIELECTRIC DEPOSITION OF DUST IN PREMISES WITH HEATED FLOORS

SERGEY A. ANDREYEV, *PhD (Eng), Associate Professor*

VLADIMIR M. BOGOYAVLENSKY, *PhD (Eng), Associate Professor*

LYUDMILA L. IVANOVA, *Engineer*

Russian State Agrarian University – Moscow Timiryazev Agricultural Academy; Timiryazevskaya Str., 49, Moscow, 127550, Russian Federation

The paper highlights a problem of increased dustiness of air in premises with heated floors. Attention is focused on the negative effect of dust on processes of natural drying and packaging of agricultural products and medicinal plants.

The authors propose a method for determining the lifting force on the basis of the difference ratio between the density of ambient air and the air in the conditional space between the dust particle and a warm floor. The authors consider a possibility of using a non-uniform electric field to deposit dust on the floor surface. They present calculations for dust particles that are at a height of from 0.001 m to 0.1 m from the deposition device. Suggestion is made about making the working element of a precipitating device in the form of a bifilar winding of two parallel conductors connected to a source of bipolar voltage. To determine the parameters of the dust deposition device, the authors used the results of an experiment to determine the dependency of the force caused by the influence of a non-uniform electric field on carrot and dodder seeds. In order to increase the intensity and uniformity of the field effect, it has been proposed to place an additional couple electrode on the outer side of the main couple electrodes of bifilar windings. In this case, the main and additional couples of bifilar windings are identical but are powered from different sources of energy. It is noted that in order to maintain the required field strength, the supply voltage should be increased to 6...8 kV.

Key words: heating systems, heated floors, dust circulation in the air, sedimentation of dust particles, electric field, ponderomotive forces, location and activation of electrodes.