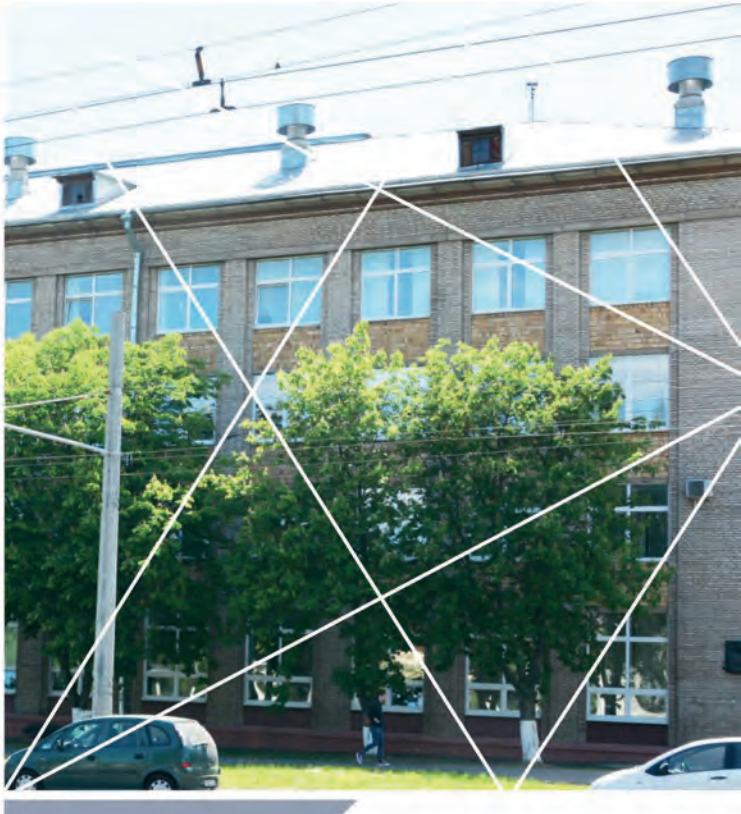
The Joint Institute of Mechanical Engineering of the National Academy of Sciences of Belarus

Leading research center of Belarus in the field of mechanics and machine science



Catalog of products and services

90 ГОД

UDC 621

The products and services catalog "The Joint Institute of Mechanical Engineering of the NAS of Belarus" contains information on the main innovative developments and services offered by the Joint Institute of Mechanical Engineering of the National Academy of Sciences of Belarus.

It is intended for a wide range of scientific and engineering workers, managers of enterprises and organizations of various forms of ownership interested in implementing of joint projects, investing and mutually beneficial cooperation.

It can be distributed at exhibitions, fairs, presentations.

CALCULATIONS. DESIGN. ENGINEERING. TESTS. CERTIFICATION

Services

- design-research

Study of the object under development, its direct competitors, determination of strengths and weaknesses considering the morphological study of the structure, ergonomic expertise conducting, examination of the product environment, research of style trends.

- design-engineering

Provides the tasks solutions of the developed concept through design draft search, development of the preliminary ergonomic scheme, development of sketch layout, preliminary selection of the main components, scale modelling, prototyping, application of virtual reality technologies.

- development of ergonomic solutions

Formation of the working space of the driver or operator is based on the current regulatory requirements for this type of equipment.
The layout of the control parts is done taking into account the usage algorithm and the degree of importance.

- technical design project

Detailed study of the structure using CAD modeling tools and output on CAM-study.

- reverse engineering

(using CAD-modeling and 3D-scanning software).

- scale modeling and prototyping

(using 3D-printing, 3D-scanning and virtual reality technologies).

- development of corporate style

(starting from the logos of companies, ending with the formation of the company's corporate identity, brand book).

- development of advertising and information materials

(animation, visualization, videos, presentations, etc.).

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Design

Services

- development and coordination with the customer of technical specifications (TOR);
- development of perspective mechanical engineering products on the basis of advanced technical solutions using modern methods of two-dimensional and threedimensional design (application of CAD-technologies);
- issue of design documentation for unified system for design documentation requirements;
- design of products made with 3D printing using topological optimization;
- conducting of research and development and experimental design work on engineering topics;
- performance of design work for the installation of various equipment on the automobile chassis;
- search for suppliers of components and coordination with them of the nomenclature and the complete set of delivery;
- technical support of production, participation in research and acceptance testing;
- conducting of independent examinations of engineering projects, design documentation and technical solutions;
- highly competent consulting on engineering documentation development;
- creation of three-dimensional models of any complexity. Correction of errors of three-dimensional models;
- development of operational and repair documentation;
- creation of electronic interactive catalogs of spare parts and technical manuals.

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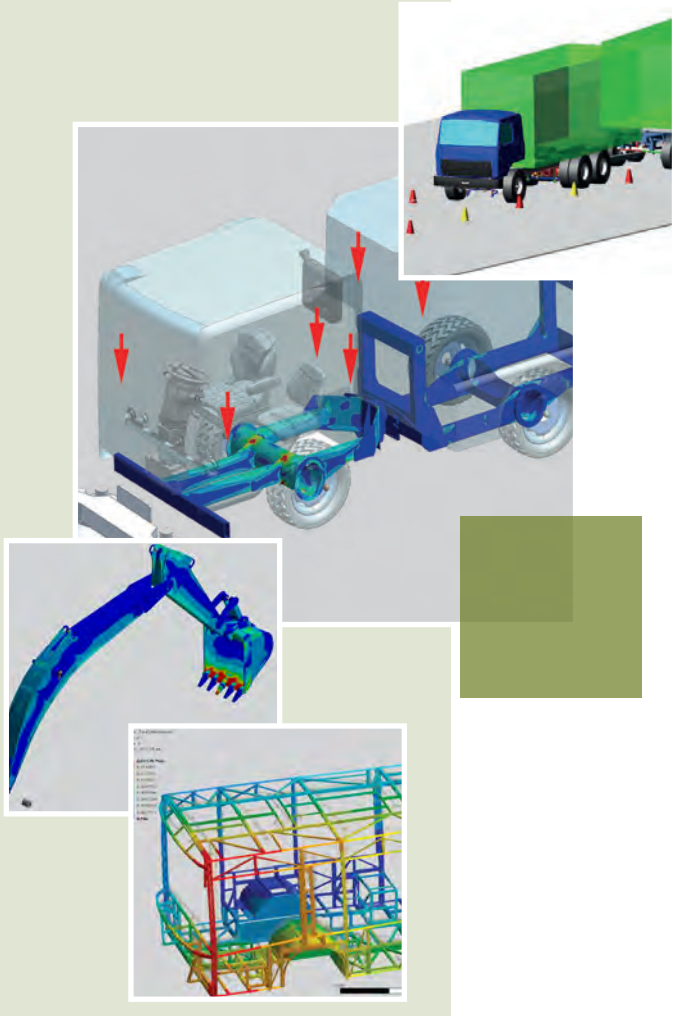
Calculations, computer simulation and resource evaluation



Calculation and study of kinematics and dynamics of multicomponent mechanical systems

multicomponent, multidisciplinary dynamic models, including elastic properties of complex structures, as well as integrated models of control system;

- kinematic, dynamic and power analysis of mechanical systems of any complexity (including models of tires, gears, belts, chain drives, bearings, cables, etc.) under operational and emergency loading conditions;
- study of the stress-strain state of parts and components of systems in the process of functioning;
- analysis of free and forced oscillations, calculations of the vibration load of multicomponent mechanical systems in the time and frequency domain;
- multicriteria optimization of the parameters of mechanical systems and components;
- simulation and investigation of mechatronic systems.

Calculation of mechanical systems and components using the finite element method

- calculations of the strength of structures taking into account all types of nonlinearities, including structures made of composite materials;
- simulation of fast dynamic processes (crash tests) taking into account the destruction;
- solving of related problems;
- solving of the problems of strength in an explicit and implicit form;
- analysis of structural stability, harmonic and modal analysis;
- identification of parameters of nonlinear material models;
- modeling of technological processes for the manufacture of parts and machine designs;
- topological and parametric optimization.

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Calculated resource evaluation

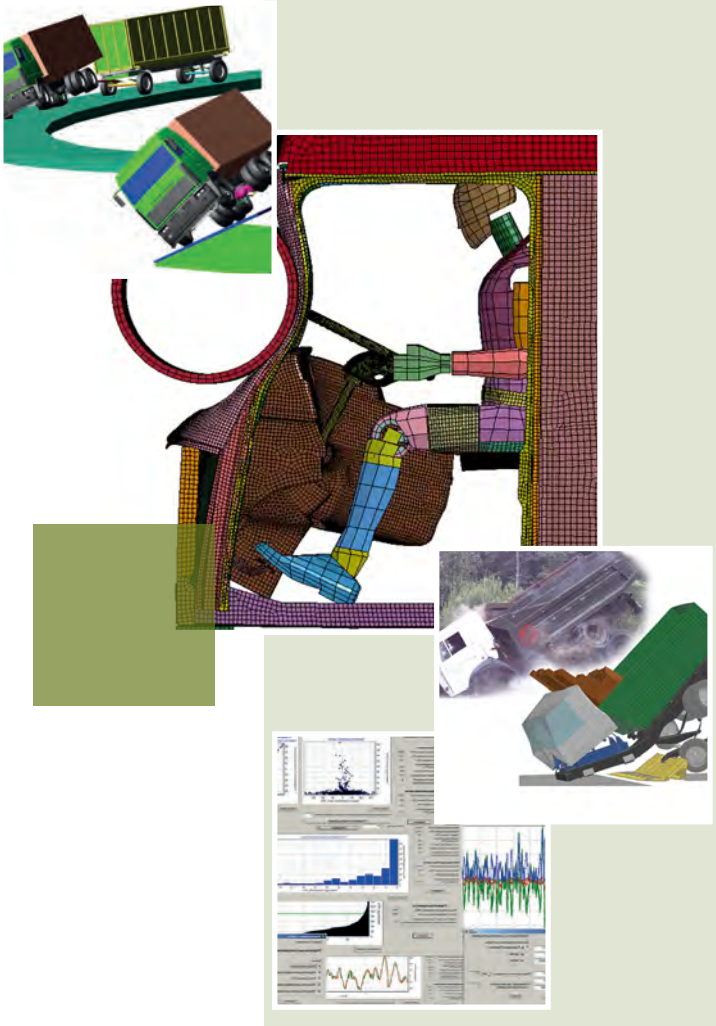
- parts and structural elements based on the results of calculating the indicators of the stress-strain state using the FEM;
- assessment of the effectiveness of a set of measures to improve the fatigue life of structures (based on a comparative analysis of the changes introduced);
- welded, threaded, glued and other types of joints;
- simulation and calculation testing of programs of accelerated bench and operational tests;
- study and diagnosis of the causes of destruction of parts and structures of machines.

Virtual testing

- development, verification and validation of computational models and methods for virtual testing of machines and components performed on the basis of numerical methods of calculations;
- conducting virtual tests to assess the compliance of indicators:

– stability, maneuverability, controllability and running smoothness (regulatory documents: GOST 31507–2012, STB 1877–2008, GOST R 52389–2005, UNECE №79, Directive 97/27/EU, GOST R 12.1.012–2004, ISO 2631–1–97, ISO 2631–2–89, etc.);
– active and passive safety of vehicles and their structures to comply with the requirements of regulatory documents (UNECE Regulations № 12,17, 29, 32, 33, 42, 52, 58, 66, 73, 80, 93, 107, 111, as well as ISO, STB, GOST standards);

- carrying out of studies to determine the parameters of material models necessary for a reliable description of the properties of machine parts and structures in virtual tests;
- development, research and improvement of test schemes, equipment and devices used.



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Calculations, computer simulation and resource evaluation

Modeling and optimization of control systems

- development of models and techniques for systems and control objects modeling using numerical methods of multi- and interdisciplinary calculation;
- multilevel modeling and analysis of machine control algorithms and its individual systems;
- verification, validation and optimization of control algorithms;
- problems solving of multidisciplinary system SIL-modeling including mechanical, hydraulic, pneumatic, electrical, electronic and other systems;
- research of systems and control objects using HIL-technologies.

Full-scale tests

- development of stands and bench equipment for resource testing of machine parts and structure;
- development of programs-techniques of full-scale research, resource accelerated (road and bench) tests of engineering products;
- support of tests;
- processing and analysis of test results;
- verification and validation of computational models and methodologies based on the results of full-scale tests;
- development of recommendations for improvement of engineering products based on test results.

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Small-sized municipal machine

Key points of the innovation

Combined municipal vacuum sweeping-brooming and thaw salt-distributing machine equipped with base universal small-size allwheel drive chassis with a hydrostatic transmission.

Purpose

- mechanized sweeping and garbage collection;
- patrol high-speed cleaning of sidewalks and roads from snow;
- distribution of solid anti-ice materials at inner-yard territories.

Competitive advantages

A complex of new technical solutions has been developed, which provides high competitiveness indicators of the equipment being mastered:

- attractive modern perspective design;
- high performance;
- simplicity of operation;
- high adaptability to manufacture and workability;
- reliability;
- environmental friendliness;
- import substitution;
- expansion of export potential of industrial complex of the Republic of Belarus.

Developers

- State Scientific Institution “The Joint Institute of Mechanical Engineering of the National Academy of Sciences of Belarus”
- ODO (ALC) “Hydro-Connect”

Manufacturer

ODO (ALC) “Dormashexpo”

The prize for the 3rd place in the nomination “Best Innovative Project” of the Republic of Belarus in 2016

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Interactive e-catalogs and technical manuals

Services

- Electronic catalogs and technical manuals make it possible to simplify the study of new technology and the conditions of its operation. They display information in a user-friendly manner and have the following capabilities:
- 3D-visualization and preinstalled projection views;
- animation (demonstrating operating principles, assembling/disassembling instructions for maintenance or repair);
- hierarchical (tree) structure of the product;
- displaying and hiding of elements, blocks, setting the mode of tranparence;
- output of additional information on the selected element (material, weight);
- use of hyperlinks to other files or Internet resources;
- spare parts order (optional);
- Adobe Reader software is sufficient for work with the catalogue.

Competitive advantages

- time reduction for information learning about new products;
- prompt information updating information display in a user-friendly form (technical manual, parts catalog, information for the order of spare parts);
- possibility to use the data of search engines built-in in the system.

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Mobile machines testing

R&D Center “Republican Proving Ground for Mobile Machines Testing” is accredited by the National accreditation system of the Republic of Belarus in compliance with STB ISO IEC 17025, it is a Testing Center E 28/Q under 1958 Geneva accord, it was included in the Unified Registry of certification authorities and test laboratories (centers) of the Customs Union carrying out assessment of compliance of products with the Technical Regulations of the Customs Union.

Services

Research, expert examination and certification tests of:

- prototypes of vehicles;
- serially produced tractor equipment;
- systems, structural elements of vehicles.

Tests types

- external and internal noise, fuel economy;
- brake system;
- speed properties, stability and steerability;
- devices (systems) for calling emergency services.

Additional services

- test drive conducting;
- new equipment presentations management;
- carrying out of sports and training activities.

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“ACADEM-SERT” Certification Authority services

Today “ACADEMSERT” is:

- Certification Authority of products and services conforming to the requirements of the National accreditation systems of the Republic of Belarus and accredited for compliance with the requirements of GOST ISO/IEC 17065-2013. Authority for certification of products and services is included in the Unified Register of Certification Authorities and Testing Laboratories of the Customs Union.
- Certification Authority of management systems conforming to the requirements the National accreditation systems of the Republic of Belarus and accredited for compliance with the requirements of GOST ISO/IEC 17021-2013.

SERVICES

- assessment of conformity (certification) of mechanical engineering products (automotive, agricultural machinery, machine-tool building, shipbuilding, road construction, municipal, lifting and transport, economic application, tools, bicycles for adults and children, prams, etc.) in compliance with

– technical regulations of the National System of Conformity Assessment;
– technical regulations of the Customs (Eurasian Economic) Union.

- certification of management systems for compliance with the requirements of STB ISO 9001-2009.

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Hinged two-row potato digger IYaBM L-671

Key points of the innovation

It is designed for digging out potatoes, sifting the soil, partial separating the tubers from the tops and laying them on the field surface for further picking.

Design features

A distinctive feature of the potato digger L-671 in comparison with the existing analogues, for example KTN-2B, is the use in its design of active working elements (share and vibration grating) with drives that include energy recuperators – the working bodies are suspended on the frame of the machine with the help of flat springs, the elastic characteristics of which are calculated from the condition of compensation of inertia forces of the working bodies by elastic forces.

Competitive advantages

The design allows reducing the forces of resistance to movement of the machine during harvesting of potatoes and the load on the drives of working bodies, to reduce the dimensions, energy intensity and its material consumption, so that the potato digger can work in the unit not only with tractors of classes 0,9 ... 1,4, but also of the class 0,6.

Specifications

- machine type – hinged;
- working speed, km/h – 1,1...3,5;
- working width, m – 1,4;
- digging depth, m – 0,22;
- performance for 1 hour of the main time, ha – 0,15...0,49;
- machine weight, kg – 550;
- overall dimensions, m:

length – 2,500;
width – 1,800;
height – 1,100.

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Modular tractor mower

Key points of the innovation

KMT series mowing machines are designed for mowing natural and sowing grasses in flat areas and mowing up slopes with folding of the cut mass into the swath.

Competitive advantages

- the mowing machines have a universal design of the drive and the cutter bar, which provides arranging a hayharvesting vehicle of the necessary width of cut from modules of the mowing machine and power tool (tractors of various modifications);
- the cutter bar of the mowing machine contains elastic elements that significantly reduce the load on the drive part and the power consumed by the mowing machine from the tractor's power take-off shaft. The design provides balancing of the inertia forces of the oscillating masses of the cutter bar, which significantly reduces vibration level during the operation of the mowing machine.

Specifications

- cutter type – double-sickle;
- cutting height, mm – 30...100;
- width of cut, m – 1,0...2,1;
- specific weight for 1 m of working width, kg/m – 50...65;
- power consumption from PTO shaft for 1 m of working width, kW/m – 1,3...1,8;
- performance, ha/h – 0,3...2,0.

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TECHNOLOGIES. MATERIALS. EQUIPMENT

Technology and equipment for application of protective coatings using hypersonic electrometallization

Key points of the innovation

The technology of hypersonic metallization, different from traditional electrometallization using a continuous source of energy to heat the gas, spraying the arc melted wire. Gas, heated to a temperature of about 2000 °C, flowing through the Laval nozzle, has a speed of 900–1300 m/s, which allows dispersing the particles of the atomized material to velocities of more than 400 m/s.

Competitive advantages

- minimum porosity of coatings (steel ≤ 4 %) with a bond strength of more than 60 MPa;
- performance of 16–18 kg/h, which is twice as high as that of high-speed methods of powder spraying;
- the cost of application of 1 kg of coating is 3–10 times lower than the known highspeed coating application methods use;
- galvanic chrome plating can be replaced.

Results

The equipment is produced and a number of technological processes for applying wear-resistant, corrosion-resistant, antifriction coatings on machine parts and structural elements are developed. The recommendations on the organization of specialized sites are developed.

Consumers

Enterprises of general and agricultural engineering, repair sites of chemical, processing, electrical industry, auto and ship repair enterprises.

Forms of cooperation

- development and supply of technologies and equipment;
- services for restoration of parts.

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Technology and equipment for application of protective coatings using thermoplastic polymer powder flame spraying

Key points of the innovation

With the use of the principle of gas-dynamic activation, a design of a thermal sprayer has been developed, that allows us to regulate the density of the heat flux of the gas flame torch, which ensures the spraying of powders of thermoplastics with any melting temperature without changing the nozzle tip.

Competitive advantages

- simplicity of process realization, possibility of drawing of coverings on structural elements without their disassembly;
- wide range of applied polymeric materials;
- coating of metals, ceramics, glass, building materials (concrete, brick, slate, wood);
- smooth regulation of the composition of the combustible mixture (propane - air) and the shape of the torch;
- there is no need for balloon oxygen;
- no control panel required – all adjustments are mounted on the housing;
- thermal sprayer is one of the lightweighted in the world in its class.

Results

- adhesion strength – 8,0–10,5 MPa;
- performance – 2,5–3 kg/h;
- material utilization ratio – 0,85;
- sprayed material – polymer powder or a composition based on it;
- particle size – 40–300 microns;
- melting temperature of the polymer – 90–400 °C;
- thermosprayer mass (without sprayed material) – 0,89 kg.

Consumers

General and agricultural mechanical engineering companies, repair sites of the enterprises of chemical, processing, electrotechnical industry.

Forms of cooperation

Development and delivery of technologies and equipment.

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Technology and equipment for application of multifunctional coatings with a centrifugal induction method

Key points of the innovation

It provides formation of multifunctional coatings on internal, external, end and simultaneously on several surfaces of parts with various antifriction and wear-resistant materials and charges based on them, including nanosized modifiers and carbide particles, with a centrifugal induction method.

Competitive advantages

- increase of parts service life;
- restoring of the original geometry of the part;
- manufacturing of parts of various repair sizes;
- obtaining of parts with the given physical and mechanical properties;
- absence of preliminary and subsequent heat treatment;
- availability of equipment development and technology implementation;
- high payback and low production costs;
- saving of high-alloy and non-ferrous alloys;
- ecological purity of the process.

Results

- an experimental industrial area for coatings application has been created;
- deliveries of parts with coatings to enterprises of the Republic of Belarus, as well as near and far abroad are carried out.

Consumers

Metallurgical, railway, mechanical engineering, road-building, petrochemical enterprises.

Forms of cooperation

- development of technological processes of induction welding;
- development, production and supply of materials and equipment;
- provision of coating services;
- organization of sites for the production of parts;
- joint production.

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Composite carbon-containing wear-resistant ceramic coatings on products from aluminum alloys obtained with microarc oxidation

Key points of the innovation

Formation of coatings is carried out using carbon and carbon-containing nanomaterials (CNM). Addition to the electrolyte of CNM improves the efficiency of the coating formation process with improved tribomechanical characteristics.

Competitive advantages

- reduction of coatings obtaining process 1,2–1,8 times;
- increase in the thickness of coatings 1,3–2,0 times;
- increase of microhardness 1,2–1,5 times;
- reduction of coefficient of friction and the wear rate of coatings 1,2–5,0 times.

Obtaining of increased physical and mechanical characteristics of coatings is made on aluminum alloys of different chemical composition, including silumin (eutectic and hypereutectic), as well as aluminum-magnesium alloys.

Results

The equipment was created, and an experimental-industrial site for coatings was organized. The parts coatings hardening was made at a number of enterprises of the Republic of Belarus.

Consumers

Enterprises of mechanical engineering, light, chemical industries, energy, aviation and space technology.

Forms of cooperation

- rendering of services on parts hardening with wear-resistant composite coatings;
- development of technologies and equipment for the formation of composite ceramic coatings.

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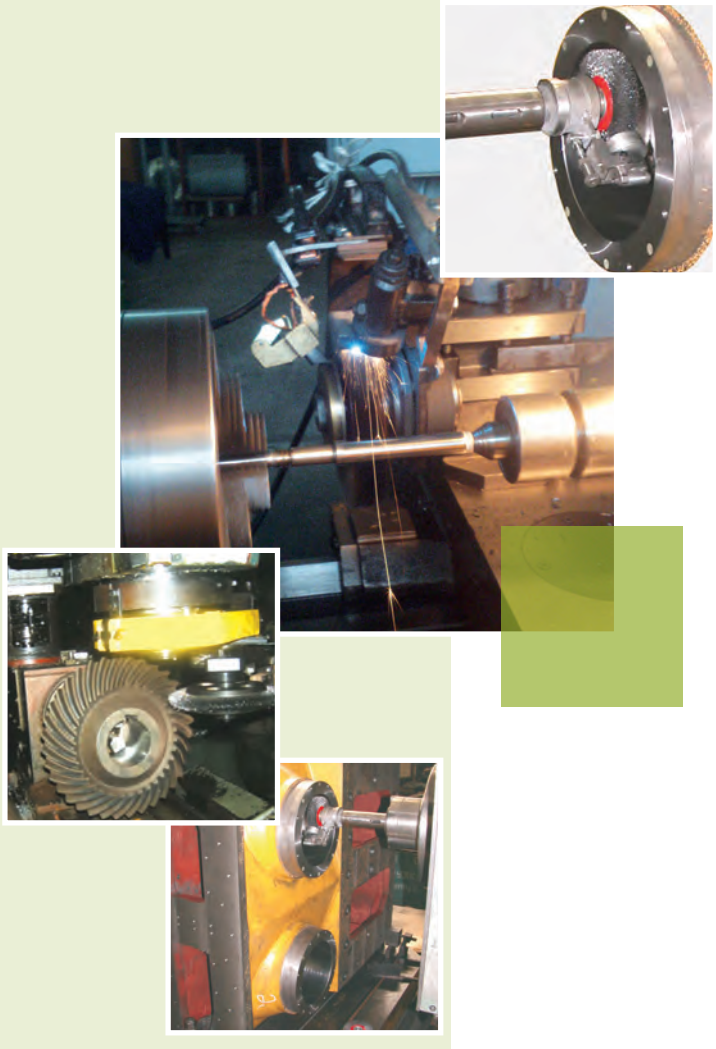
Technology and equipment for application of protective coatings using mechanical cladding with a flexible tool



Key points of the innovation

Formation of coatings is carried out by transferring the particles of the coating material (donor) with the wire bristles of the rotating metal brush at the moment of its simultaneous frictional interaction both with the donor and the surface being treated.

Competitive advantages

- small metal and energy consumption, absence of complex and harmful surface prefinishing, high performance and ecological purity of the process;
- a wide range of coating materials, possibility of obtaining of multicomponent coatings from metals and non-metals, the consolidation of which is not possible in most cases;
- no subsequent mechanical treatment of coatings is required;
- possibility of modifying of devices for the formation of coatings and intensification of the coating process.

Results

- technological modules for forming coatings with a flexible tool on the external and internal surfaces of parts of various configurations and sizes are made;
- technologies for coatings formation are implemented at the Minsk Automatic Lines Plant named after P.M. Masherov, OJSC “Gomel foundry and standards works”.

Consumers

Mechanical engineering, metallurgy, chemical industries enterprises, road construction and road machinery, oil and gas transmission lines, processing machines repair companies.

Forms of cooperation

- development, approbation and implementation of the technological process for a specific customer;
- services for coatings application made to order.

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Cemented steel, preferably for large-sized high-loaded gears of transmissions of mobile machines

Key points of the innovation

Brand: Steel 20XH3MA (20KhNZMA), interstate TR 14-132-242-2012. Patent No. 16513 “Structural Alloy Steel”.

Competitive advantages

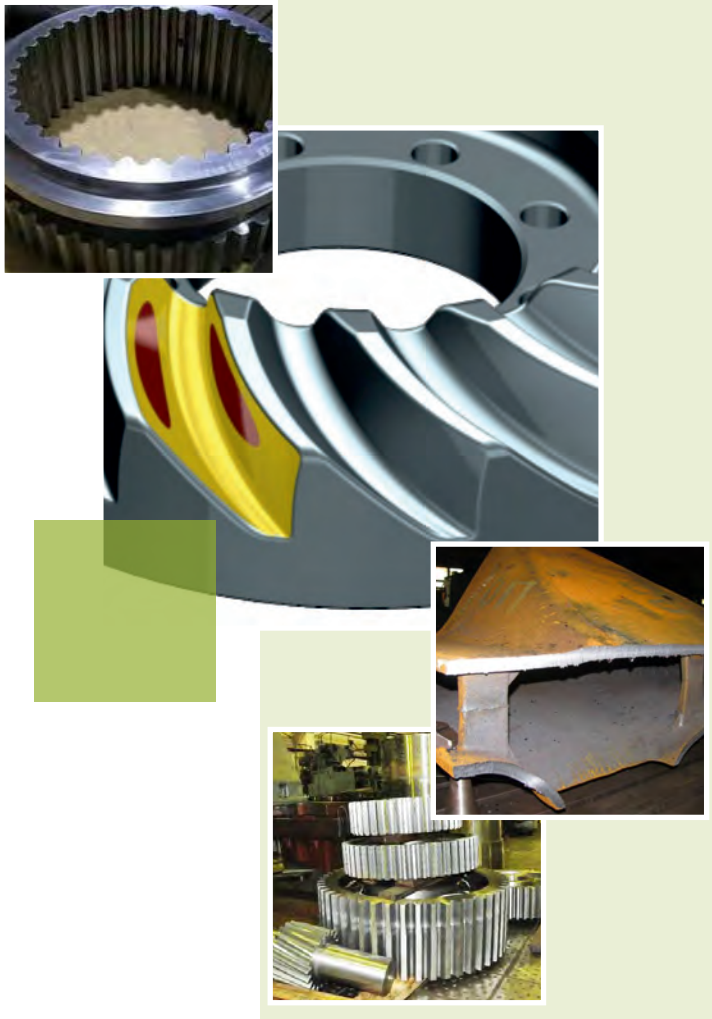
- increased hardenability of the cemented layer and the core of the part;
- the content of residual austenite in the cemented layer is up to 15 % (aircraft industry standards), which ensures stability of parts dimensions in production and in operation, increases the life of parts;
- increased diffusion of carbon and nitrogen during cementation or nitriding;
- good machinability at all stages: turning, hobbing, grinding (no grinding cracks);
- minimization of the troostite component in the surface hardened layer of non-polished cemented gears;
- the depth of the incinerated layer and the contact resistance of the tooth surface are
- increased;
- reduction of production labor and energy intensity of compared with steels of 20X2H4A (20Kh2N4A) type with an increase in similar parts life at least 2 times;
- can be used for nitrided parts.

Results

It is used in the serial production of BELAZ mining dump trucks with a payload capacity of 130–450 tons while providing a warranty run of dump trucks of 200,000 km.

Consumers

Production and use of the new material is mastered by the metallurgical enterprises of Russia: ZAO (CJSC) “Krasny Oktyabr”, OAO (OJSC)“RUSPOLYMET”, as well as in the production of motor-wheels reducing gears and driving axis of BELAZ mining dump trucks.



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Nitrided steel, preferably for large-sized high-loaded gears with internal gearing of transmissions of mobile machines

Key points of the innovation

Brand: Steel 40ХМФА (40KhMFA), interstate TR 1-806-1184-2013.
Patent of the Russian Federation No. 2553764 “Nitrided Steel for Gears”.

Competitive advantages

- nitrided steel for gears and other parts;
- does not form brittle phases in the nitrided layer, allows obtaining of an increased thickness of the nitrided layer up to 1 mm;
- prevents cracking in the nitrided layer, eliminates the emergency destruction of parts while overloads and vibrations;
- increase of endurance of teeth and rims of nitrided gears up to 30–40 % in comparison with steel 38ХМФА parts;
- has an increased machinability compared to steel 38Х2МЮА (38Kh2MYuA), recommended for large parts with a large volume of metalworking and parts with a profile of working surfaces formed with slotting.

Results

It is used in mechanical engineering for internal gears of BELAZ mining dump trucks with loading capacity of 45, 55, 60, 90, 130, 180, 220, 360 and 450 tons.

Consumers

It is mastered in the metallurgy of Russia (OAO (OJSC)“RUSPOLYMET”) and the EU (France, Italy).

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Casting cold-resistant and crack-resistant steel, preferably for large-sized castings, bearing foundry and welded systems of mobile machines and structures

Key points of the innovation

Brand: Steel 15НМФЛ (15NMFL), TR BY 600038906.082-2013 “Steel castings for loadbearing structures of quarry equipment”. Patent BY 13742 “Casting steel”.

Competitive advantages

- prevents brittle fracture of structures under low and shock loads (including in the presence of macrocracks), allows welding of structural elements in production and welding of the defects arising in the operating conditions without heating the structure and subsequent heat treatment;
- has an increased resistance to the formation of hot cracks when crystallization of castings of up to 3 tons;
- allows making stable technological processes for production of defect-free large steel castings in assembly-flow production conditions while reducing defective parts to the level of technically unavoidable 2...5 %.

Results

- processes of management of foundry technologies, which reduce the risk of cracking and discontinuities in the casting body and in the weld zone are tried and tested (with the use of IT-technologies) and mastered in the industry;
- production of foundry and welded frames made of steel 15НМФЛ (15NMFL) for BELAZ mining dump trucks with the load capacity of 95–360 tons was created, that was completely localized in the Republic of Belarus, which allowed increasing the life cycle of mining dump trucks more than 10 times – up to 1 million km to the level of the world’s best quarry equipment examples.

According to expert estimates, the annual effectiveness of the implemented development is at least 1–1,2 million US dollars.

Contacts

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Lubricant OIMOL KSC WR 2 – water resistant

Key points of the innovation

Lubricant OIMOL KSC WR 2 is processed on the basis of a mineral base oil with a kinematic viscosity of 250–500 mm^2/s at 40 °C and a complex thickener of calcium sulfonate. The structure of the dispersed phase of the lubricant is a combination of star-shaped micelles consisting of thin needle-like crystals of calcium sulfonate coated with stabilizing polymer layer and connected to each other by intermolecular mutual reactions.

Competitive advantages

- such a form of the moving structure of the disperse phase provides high adaptability of the lubricant to the level of mechanical and thermal loading of the friction unit;
- the lubricant is characterized by high antiseize properties, water resistance, thermal stability, the unique mechanical stability, improved antioxidant and anticorrosion characteristics.

Application spheres

- lubrication of high-loaded rolling and sliding bearings of machines and equipment operating at low/medium speeds in the temperature range −30 ... +200 °C (for a short time up to +230 °C);
- lubrication of mechanisms operating under conditions of high humidity (up to 100 %).

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Lubricant OIMOL KL MP 2 – multipurpose

Key points of the innovation

Lubricant OIMOL KL MP 2 – multipurpose is made from the mixture of mineral oil with kinematic viscosity of 60–110 mm^2/s at a temperature of 40 °C thickened with lithium complex and contains additives that increase antioxidant and anti-corrosion properties.

Competitive advantages

- thanks to the complex thickener, the lubricant is characterized by high mechanical stability, resistance to high temperatures, water resistance;
- the lubricant is compatible with highquality lubricants based on lithium, lithium-calcium and complex lithium thickener.

Application spheres

Lubrication of low- and medium loaded friction knots, rolling and sliding bearings which working conditions are characterized by the following parameters:

- knot temperature from –40 to +150 °C (for a short time up to +180 °C);
- ambient humidity is up to 100 %;
- operating time – round-the-clock, a stop for the preventive maintenance is available.

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Lubricants ITMOL LC FM (food-compatible)

Key points of the innovation

ITMOL LC FM lubricants are processed with the thickener of lithium-calcium soap of highly purified medical petroleum jelly.
The ITMOL LC FM lubricants have passed hygiene tests at the RUE “Scientific practical center of hygiene” of the Republic of Belarus.
These lubricants do not have taste and smell, the colour is white.

Competitive advantages

Use at low-, medium- and high-loaded friction knots of equipment for food and pharmaceutical industries under inevitable contact (access H1 USDA) with derivative products and permissible operating temperature from −30 to +120 °C.

Application spheres

Service of low-, medium- and high-loaded friction knots of equipment for food and pharmaceutical industries under inevitable contact (access H1 USDA) with derivative products and permissible operating temperature from −30 to +120 °C.

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Lubricant ITMOL LC HD 2 – multipurpose

Key points of the innovation

Lithium-calcium lubricant ITMOL LC HD 2 is obtained on the basis of a mixture of highly purified mineral oils with a kinematic viscosity of 80–100 mm^2/s at 40 °C, thickened with lithium and calcium soap of 12-hydroxy-stearic acid.

Competitive advantages

Thanks to mixed type thickener the lubricant is characterized by high mechanical and colloidal stability, improved anti-seize properties and adhesion, and forms a long-term lubricating film, reducing friction unit maintenance costs.

Application spheres

- lubrication of heavy-duty ball bearings, slider and rolling bearings, cardan joints, chassis and other components of vehicles exposed to shock or vibration shock impacts, knots of agricultural machinery and off-road vehicles operating in wet, dusty and/or dry conditions. It is suitable as universal lubricant of general purpose for industrial equipment. Range of working temperatures – from –20 to +140 °C;
- it can be used as universal general purpose lubricant for industrial equipment;
- range of working temperatures is from –20 to +140 °C.

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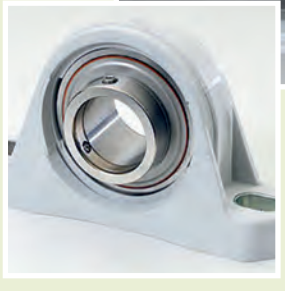
Lubricant OIMOL KL R 2 – running-in



Key points of the innovation

Lubricant OIMOL KL R 2 – running-in is made with thickening of mineral oil with kinematic viscosity of 60–110 mm^2/s at 40 °C with complex lithium thickener.

Competitive advantages

- the lubricant contains unique running-in additive agent – ultra-disperse diamondgraphite detonation synthesis charge;
- it is a new lubricant of increased life with a binary dispersed phase in the form of a spatially crosslinked structure of short fibers with implanted charge particles.

Application spheres

- lubrication of friction knots operating under heavy loads and vibrations, high temperatures, at initial start and preventive maintenance;
- the range of operating temperatures is from –40 to +150 °C (for a short time – up to +180 °C).

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Lubricant OIMOL KL EPR 2 – anti-seize

Key points of the innovation

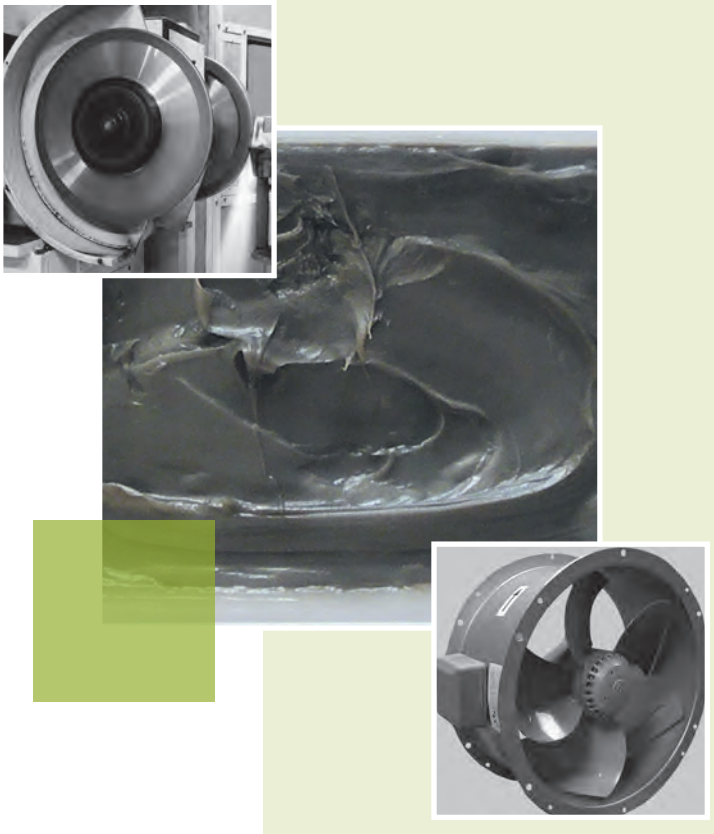
Lubricant OIMOL KL EPR 2 – anti-seize is processed with thickening of mineral oils with a kinematic viscosity of 150–350 mm^2/s at 40 °C with complex lithium thickener. The lubricant contains carefully selected diamondbearing package of anti-wear, anti-seize and anti-friction additives for heavy loaded friction knots.

Competitive advantages

Thanks to the thickener of the mixed type, the lubricant is characterized by high mechanical and colloidal stability, enhanced extreme pressure properties, improved adhesion.

Application spheres

- lubrication of friction knots operating under high loads and vibrations (mining machinery, railway vehicles, construction and agricultural machinery), high temperature (steel rolling mills, pressforging plant, heat-power equipment, heading's ventilator, systems of suctionand-exhaust ventilation, etc.);
- range of working temperatures is from –40 to + 150 °C;
- specific loading in sliding bearings is up to 50 MPa.



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Lubricant OIMOL KL EP 2 – antiwear

Key points of the innovation

Lubricant OIMOL KL EP 2 – antiwear is processed on the basis of the mixture of highly purified mineral oil with a kinematic viscosity 80–100 mm^2/s at 40 °C, thickened with lithium complex soap of 12-hydroxystearic acid and one/two low-molecular acids.

Competitive advantages

- it contains specially selected EP-additives (extreme pressure) improving antiwear, anti-scuffing, anti-oxidation and anticorrosion properties;
- it has high mechanical stability, resistance to high temperature and water;
- it is compatible with lubricants based on lithium, lithium-calcium and complex lithium thickeners.

Application spheres

- lubrication of friction knots operating at temperatures from −30 to +155 °C;
- it is recommended for long-term filling of various friction knots, including working at conditions of high temperatures and loads:

hub bearings of vehicles, throw-out bearings, stressed bearings of buildings machinery, bearings of air blower for hot air displacement, electromotor bearings, etc.

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Lubricants ITMOL LC FN – environmentally safe

Key points of the innovation

Environmentally safe lubricants ITMOL LC FN are processed with thickening of lithium-calcium soap with highly neutral mineral oil.
Lubricants ITMOL LC FN have passed sanitary tests in RUE “Scientific practical center of hygiene” of the Republic of Belarus.
Lubricants ITMOL LC FN do not have smell and taste, the color is light-yellow.

Competitive advantages

Due to the thickener of the mixed type, the lubricant is characterized by a high mechanical and colloidal stability, increased antiseize properties, improved adhesion.

Application spheres

Service of low, medium and heavy friction units of equipment for food and pharmaceutical industry under possible exposure (access H2 USDA) with derivative products and allowed operational temperature from −30 to +120 °C.

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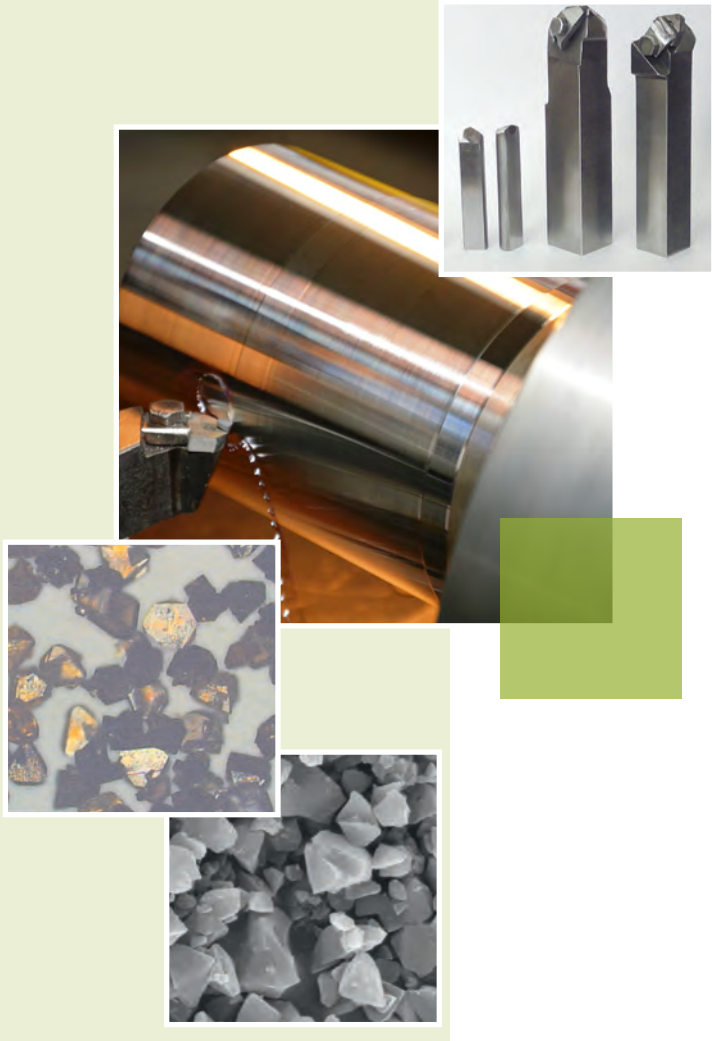
Micro- and grinding powders of cubic boron nitride



Technical characteristics of powders of cubic boron nitride

- granularity of grinding powders, μm – 40...160;
- compressive strength of grinding powders, H – 6...60;
- granularity of micropowders, microns – 1...40;
- abrasive ability, rel. units – 1...2.

Technical characteristics of superhard composite material based on cubic boron nitride

- ultimate compressive strength, GPa – 2,6–3,2;
- coefficient of fracture toughness, $MPa \cdot m^{1/2}$ – 9,0–11,0;
- Knoop hardness, GPa – 32–45.

Application spheres

- for grinding and polishing of parts made of cast iron, steel, non-ferrous metals, glass, ceramics;
- for manufacture of superhard composite materials used for blade processing of cast irons and steels including hardened to 45–60 HRCe.

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Studies of microstructure, mechanical and tribological properties of substances and materials

Test equipment

- Hydraulic universal testing machine INSTRON Satec 300LX

Designed to conduct tensile, compression, bending, disbonding tests at room and high temperatures.

- X-ray diffractometer D8 ADVANCE

Designed to conduct X-ray diffraction studies of materials structure-phase state.

- Microhardnessmeter DuraScan 20 Struers (Austria)

Designed to measure hardness and microhardness according to Vickers.

- Atomic-force microscope NT-206

Designed to measure and analyse surfaces of micro- and submicrorelief, micro- and nanometer range subjects with high resolution, conduct nanolithography.

- Friction test machine in corrosion environment MTAS
- Test container with samples and sample holder
- Recording system of MTAS machine's sliding distance
- Vacuum furnace BC-16-22-3

Designed to conduct thermal processing in vacuum.

- Automated tribometer ATVP equipped with the system of digital recording and data processing

Designed to measure materials tribotechnical characteristics under conditions of reciprocating motion, to evaluate statistical and dynamic frictional coefficients.

- Metallographic microscope Altami MET1MT (Russia–Italy)

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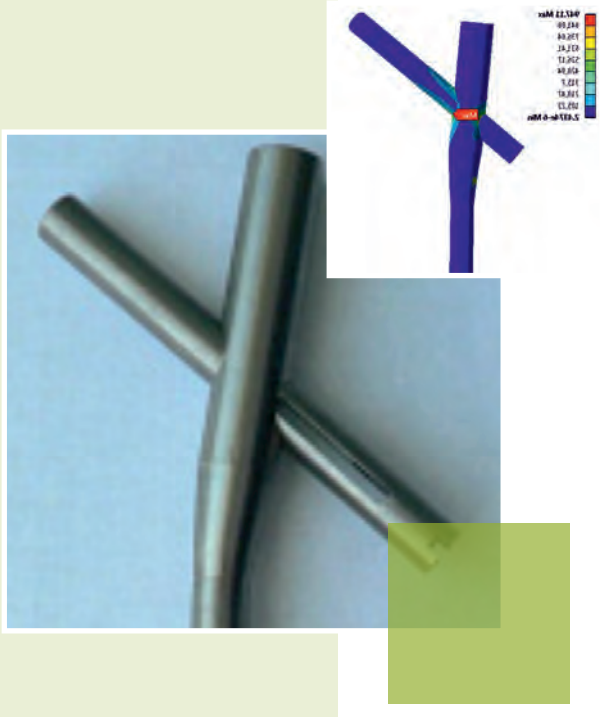
Model of the titanium implant of the proximal femur



Key points of the innovation

A prototype of the design of the domestic intramedullary titanium implant-fixator of the proximal femur was developed jointly with the State Institution “Republican Scientific and Practical Center for Traumatology and Orthopedics” and the Republican Computer Center of Mechanical Engineering of the Joint Institute of Mechanical Engineering of the National Academy of Sciences of Belarus.
A device for fatigue testing of experimental implant-fixation specimens has been developed.

Competitive advantages

- allows conducting minimally invasive osteosynthesis of proximal fractures of the femur;
- provides an increase in the effectiveness of surgical treatment of patients with this pathology;
- helps to reduce the level of possible complications.

Application spheres

The developed design will significantly improve the fixity of fixing fractures of the proximal femur, especially in unstable fractures in conditions of osteoporosis, which will ensure earlier and full mobilization of age patients.

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Titanium implant of the proximal tibia

Key points of the innovation

The design of the domestic anatomically prebent titanium implant-fixator of the proximal tibia was developed, and a stand for the fatigue tests of the fixator was made jointly with the State Institution “Republican Scientific and Practical Center for Traumatology and Orthopedics” and the Republican Computer Center of Mechanical Engineering of the Joint Institute of Mechanical Engineering of the National Academy of Sciences of Belarus. Endurance tests confirming the operability of the developed fixators were carried out. A medical technology for minimally invasive osteosynthesis of fractures of the proximal tibia was developed.
The implant is used for minimally invasive osteosynthesis of fractures of the proximal tibia and increases effectiveness of surgical treatment of patients with this pathology.
It is designed for surgical treatment of fractures of the proximal tibia.

Competitive advantages

- estimated cost of the developed design, according to preliminary calculations, is at least 2–3 times lower than the level of the world analogues;
- it is planned to reduce the average duration of hospital treatment of patients 1,5–2 times, reducing the need for repeated interventions to 5 %;
- reduction of the need for repeated interventions is up to 5 %.

Application spheres

The implant is used for minimally invasive osteosynthesis of fractures of the proximal part of the tibia and increasing of the efficiency of surgical treatment of patients with this pathology.

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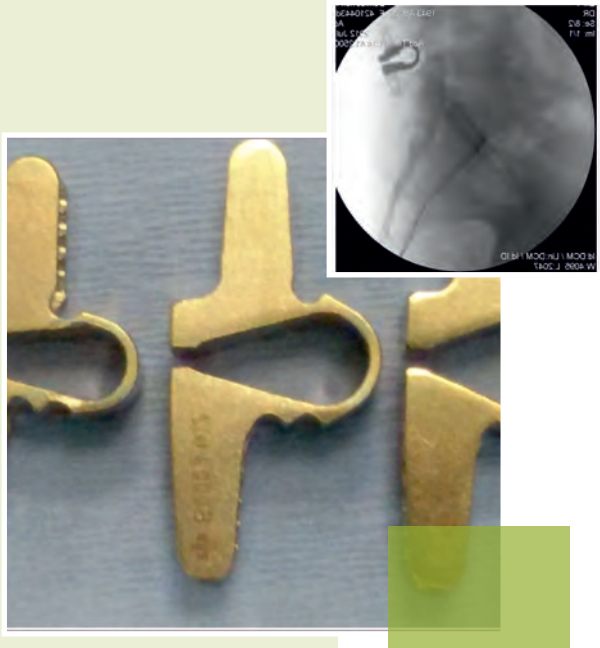
Titanium interspinous implant of the lumbar spine



Key points of the innovation

The design of the interspinous implant for fixing the vertebrae of the lumbar spine was developed jointly with the Research and Clinical Center of Neurology and Neurosurgery, and the tests for the cyclic longevity of the developed implants were carried out.
The copyright certificate for the useful model "Titanium interspinous implant" was obtained.
The implant is used in the treatment of patients with degenerative diseases of the lumbar spine segments.

Competitive advantages

- the estimated cost of the developed design is lower than the level of the world's analogs is no less than 3 times;
- decrease in the intensity of the pain syndrome – 70 % at the end of the observation;
- an average number of bed days – 10,7;
- absence of inflammatory complications and postoperative liquorrhea.

Application spheres

The implant is used in the treatment of patients with degenerative diseases of the lumbar spine: spinal stenosis, herniated intervertebral disc, intervertebral instability, degeneration of adjacent segments.

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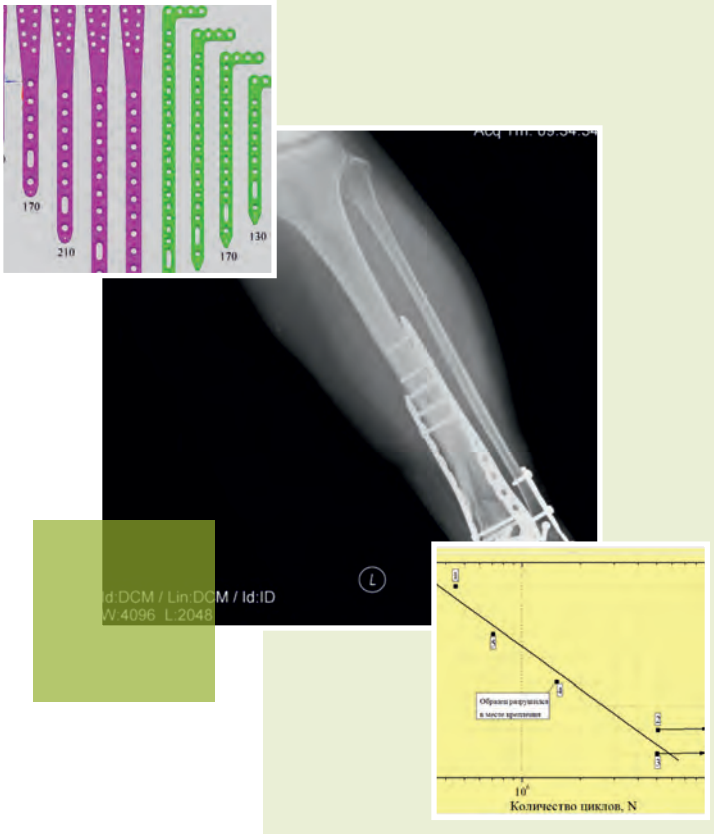
Titanium implants of the distal part of the tibia

Key points of the innovation

The design of domestic titanium implants for fixing the distal part of the tibia has been developed jointly with the Research and Clinical Center of Neurology and Neurosurgery and the Republican Computer Center of Mechanical Engineering of the Joint Institute of Mechanical Engineering of the National Academy of Sciences of Belarus. Surgical treatment of fractures of the distal part of the tibia can be performed with the help of these implants. The tests for the cyclic longevity of the developed implants were carried out.



Competitive advantages

- the estimated cost of the developed implants is lower than the level of the world's analogs at least 2,5 times;
- it is planned to reduce the average length of inpatient treatment of patients 1,3–1,5 times, reduction of necessity of repeated interventions – up to 5 %;
- as a result, the costs of inpatient treatment of patients with these traumas will be reduced by 30–50 % (taking into account the cost of the implant).

Application spheres

Implants are used for minimally invasive osteosynthesis of fractures of the distal part of the tibia and increase of surgical treatment efficiency of patients with this pathology.

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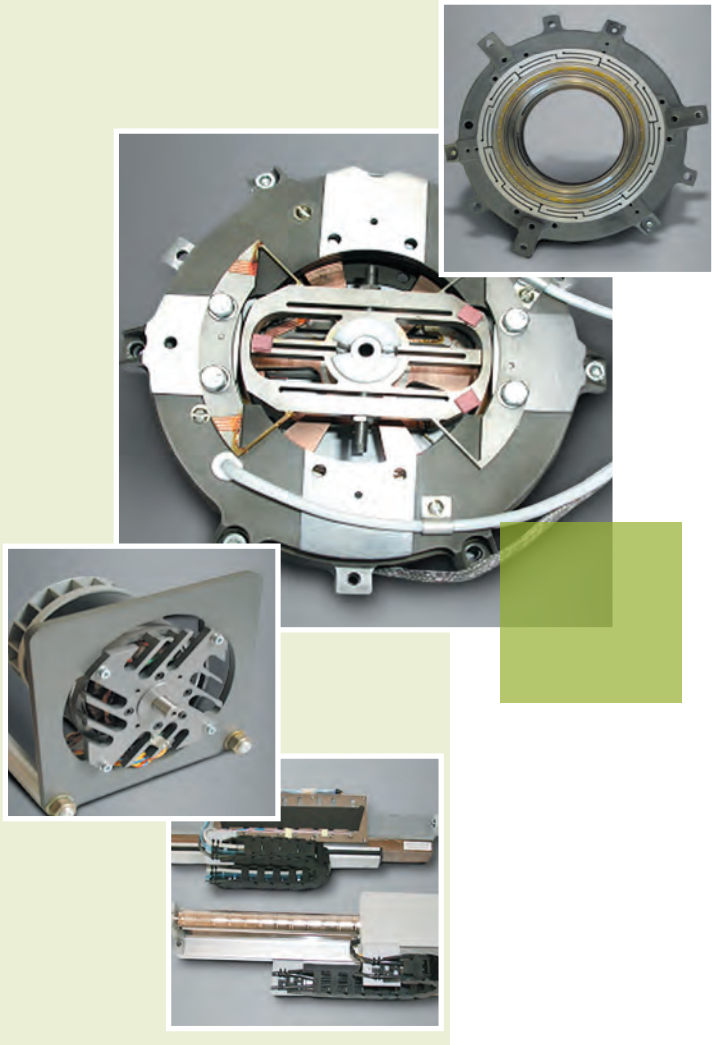
High-torque linear and rotary actuators of direct action of mechatronic and power systems



Key points of the innovation

High-torque linear and rotary actuators of direct action of mechatronic and power systems (joint developments of the Joint Institute of Mechanical Engineering of the NAS of Belarus and OAO (OJSC) “Planar”).

Competitive advantages

- absence of gearboxes, which provides increased reliability, service life and functionality in extreme conditions with the use of solid lubricating materials or in the absence of lubrication (vacuum, increased radiation, reduced to –150 °C and elevated to 120 °C (in some cases 150...180 °C);
- smooth control of the speed in a wide range of values of this parameter;
- possibility of coordinate linear and rotary movements;
- providing a specific power of 0,5...0,9 kW/kg at relatively high speeds.

Application spheres

- precise electronic engineering;
- aerospace engineering (joint development of the Joint Institute of Mechanical Engineering of the NAS of Belarus, OAO (OJSC) “Planar”, V.A. Belyi Metal-Polymer Research Institute of the NAS of Belarus and the Physical-Technical Institute of the NAS of Belarus);
- special purpose machinery;
- equipment operating under high radiation, extreme temperatures, vacuum, etc.;
- processing equipment and testing equipment.

Potential consumers

Precision engineering, mining equipment, special equipment, robotic production for various purposes enterprises.

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Magnetic sorter MS-3

Key points of the innovation

Magnetic sorter MS-3 is designed for:

- sorting of ferromagnetic steels differing in coercive force according to their grades;
- sorting cast-iron products by structure (it is possible to confidently reject castings with the structure of gray cast iron from castings of high-strength cast iron, identify products and zones containing chill).

Sorting is performed by the gradient of the normal component of the remanent magnetization field above the surface of the monitored object after its magnetization by the pole of a high-coercive small-sized permanent magnet.

Competitive advantages

- light weight;
- operation both off-line and with AC power;
- embedded mode with correcting factor, which provides interchangeability of the sensors;
- intended for use at workshops and warehouses of metal of industrial enterprises.

Application spheres

The device can be used to measure the magnetic field strength gradient when controlling the residual magnetization of industrial products, etc. The device automatically informs the operator about the measured value by indicating the message “ACCEPTED” or “DEFECTIVE”, as well as the discharge of the batteries of the power source. Synchronously with the message “DEFECTIVE” a beep sounds.

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Magnetic structure quality analyzers MAXI

Key points of the innovation

Magnetic quality analyzers for the structure of products MAXI (MAXI-U, MAXI-D, MAXI-R) are designed for magnetic non-destructive testing of physical and mechanical properties and structure of mass production products (including those from medium-carbon steels) and their automated sorting according to control results.

Competitive advantages

The control is carried out in the mode of contactless magnetization of products in an open magnetic circuit during the movement through a region with a stationary magnetic field of a given spatial configuration, a noncontact measurement of the magnetic state of the product as it moves through this area, processing measurement results by mathematical algorithms and automatic sorting of products. According to the main indicators - the possibility of 100 % magnetic control with a capacity of up to 3 articles per second of physical and mechanical properties of critical engineering parts from medium-carbon alloy steels, their blanks having unstable or changing dimensions – MAXI instruments outperform the known analogues.

Application spheres

The devices are designed for magnetic control of physical and mechanical properties (hardness, tensile strength, quality of surface chemical-thermal hardening) of critical engineering products including medium-carbon alloy steels. Due to the choice of the magnetization regime and the measured magnetic parameters, it has an increased sensitivity to the surface properties of the controlled parts, which makes it possible to control the quality of surface hardening. The instruments provide automated 100 % control of volumetric and surface thermally processed critical parts.

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Automated line of control and automatic sorting by machinability of not turned castings of nipples from malleable cast iron on the basis of MAXI-P devices

Key points of the innovation

The control is carried out in the mode of contactless magnetization of unmachined nipple castings in an open magnetic circuit during the moving in a direction perpendicular to the direction of motion, contactless measurement of the residual magnetic flux in the casting when it moves outside the area with a magnetizing field and automatic sorting of the castings.
Sorting of products by acceptability and defectiveness by the results of control is carried out by single-piece feeding of the workpieces to MAXI-P instruments by operators.
The productivity of the line is up to 70,000 castings per day.

Competitive advantages

Use of the method and the devices provides:

- guarantee of the admission to the machining operation only of workpieces of the specified hardness range (i.e. prolongation of the service life of the cutting tool, exclusion of cases of its emergency failure);
- exception of rejection of workpieces of normal hardness;
- possibility of additional heat treatment (not remelting) of workpieces of increased hardness;
- reduction of rejects for nonconformity of dimensions of the processed castings;
- efficiency of the instrument and reducing fault time of threading machines.

Application spheres

The line is intended for magnetic control of physical and mechanical properties (hardness, tensile strength, annealing quality, etc.) and automated sorting of parts and blanks from steels and cast irons.
It provides automated 100 % quality control of the annealing (hardness, machinability) of castings of 1 1/4" nipple from ductile cast iron 30-6 and the structure of nipples 1 1/4" of high-strength cast iron 35...60.

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Key points of the innovation

Selection and justification of optimal parameters of ringrolling complexes.

Competitive advantages

- obtaining of ring blanks with a shape as close as possible to the shape of the finished part;
- grouping of ring blanks according to the principles of optimization of tooling;
- development of heating modes for annular blanks with minimization of energy costs;
- achievement of maximum geometric accuracy of ring blanks;
- provision of improved operational properties of parts such as rings (crown gear, crown of the flywheel).

Specifications

- outer diameter of the rings – from 200 to 3000 mm;
- height of rings – up to 1000 mm;
- weight of rings – up to 1000 kg;
- material of rings – all grades of structural alloy steels.

Consumers

OAO (OJSC) “Minsk Bearing Plant”
OAO (OJSC) “Kuzlitmash”
OAO (OJSC) “BELAZ”

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Dynamic stabilization of friction discs

Key points of the innovation

Use of dynamic stabilization in the technological process of manufacturing of friction discs for mobile wheeled and tracked vehicles.

Competitive advantages

- the final result on the accuracy of the flattening is achieved regardless of the size of the original error, no preliminary measurements of the discs are required and the process of dynamic disk stabilization is most convenient for automating the editing process;
- the achieved deviation from flatness within 0,3 mm for disks with a diameter of up to 950 mm and a thickness of up to 5 mm, which is 25...50 % more precise than the accuracy achieved with such known methods of straightening and stabilization of disks as vibration control and thermal fixing;
- reduction of residual stresses and ensuring a stable geometric accuracy of the friction discs during operation, which positively affects the increase in the life and reliability of the friction units of mobile wheeled and caterpillar vehicles.

Technological solution

The range of complexes for dynamic stabilization of friction disks with CNC (patents BY (11) 4014 U 2007.12.30 IPC (2006) In 21B 1/10 and BY (11) 5618 U 2009.10.30 IPC (2006) In 21B 1/10). Program for calculating the stress state of a friction disk Disco: registration certificate No. 203 of July 28, 2010, the Republic of Belarus.

Parameters

- accuracy of straightening – not less than 0,15 mm with an allowable error of 0,3 mm;
- performance - not less than 15 disks/h;
- maximum outer diameter of the disc is 950 mm.

Consumers

OAO (OJSC) “BELAZ”
AO NPK (JSC) “Research and Production Corporation “Uralvagonzavod”
OAO (OJSC) “Muromteplovoz”

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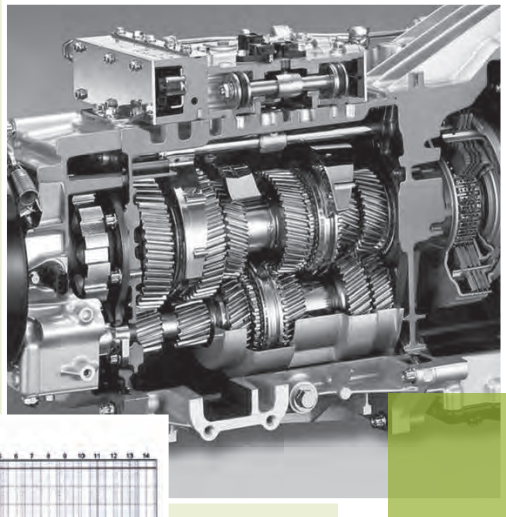
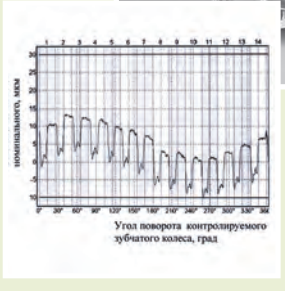
Automated dual-profile control of cylindrical gears





Key points of the innovation

- use of automated dual-profile control for the selection of gears for low-noise transmissions;
- use of automated two-profile control for preassembly selection of planetary gears.

Competitive advantages

- when using automatic dual-profile control for the selection of cylindrical gears for transmission, it is possible to reduce the noise of a cylindrical gear train up to 5...6 dBA without additional process costs;
- using automatic dual-profile control for preassembly selection of satellites of planetary gears, an increase in accuracy is achieved by the norms of the contact spot by one degree, and contact stresses are reduced to 9 % without additional technological costs.

Introduction method

With the use of the Eurasian Patent No. 028499 “Method for monitoring the norms of smooth operation of a cogwheel” B1. The patent holder is the Joint Institute of Mechanical Engineering of the National Academy of Sciences of Belarus.

Consumers

OAO (OJSC) “Minsk Automobile Plant”
OAO (OJSC) “Minsk Wheel Tractor Plant”
OAO (OJSC) “Minsk Tractor Works”

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Dynamic stabilization of low-rigid rod-shaped items

Key points of the innovation

The use of dynamic stabilization in the technological process of manufacturing of low rigid items with a ratio of length to diameter of more than 20.

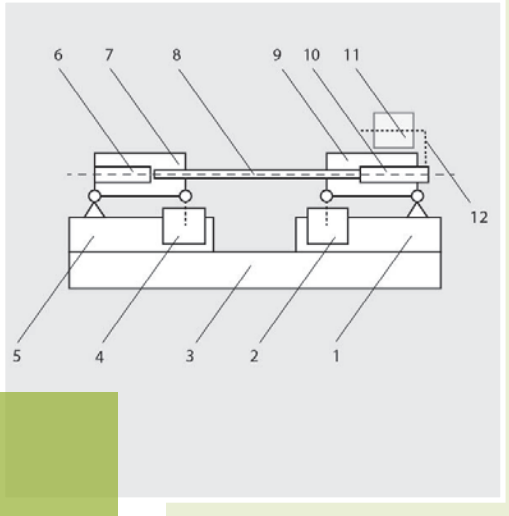
Competitive advantages

- obtaining of accuracy of the geometrical axis of 0,05...0,10 mm per 1000 mm of the length of the item;
- reduction of residual stresses and ensuring stable geometric accuracy during operation.

Technological concept

Installation for dynamic stabilization of lowrigid items with CNC.

Constructive diagram of the installation for dynamic stabilization for a shaft type low-rigid rod-shaped item:



1 – shifting head;
2 – turning mechanism for the shifting head;
3 – body;
4 – the mechanism of rotation of the fixed head;
5 – fixed head;
6 – drawbar mechanism of the left end of the item;
7 – left non-drive spindle head;
8 – shaft;
9 – spindle head right drive;
10 – drawbar mechanism of the right end of the item;
11 – electric drive of right spindle head rotation;
12 – rotation transmission from the electric drive to the right spindle head.

Consumers

OAO (OJSC) “BELAZ”
OAO (OJSC) “Minsk Tractor Works”
AO (JSC) “Concern Kalashnikov”
OAO (OJSC) “Kovrov Plant named after V.A. Degtyarev”

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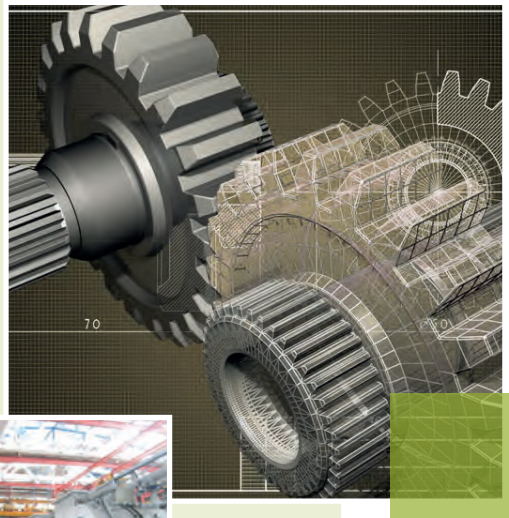
Economically-alloyed steel for gearboxes of mobilemachines



Key points of the innovation

Brand: Steel 21ХГНММБР (21KhGNMMBR).
Patents № 20471 RB, № 025921 EA
“Lowalloy steel for cemented parts”.

Competitive advantages

- high hardening characteristics of the cemented layer and core parts in a wide range of thermal and chemical-thermal treatment modes;
- high resistance to contact fatigue of the surface layers of parts;
- possibility of widespread thermal equipment use;
- reduction of energy consumption of heat treatment processes.

Application sphere

Gear wheels with a module of up to 8 mm transmissions of mobile machines.

Results

A pilot industrial check in production conditions at all stages of manufacturing gears in quantities of more than 3,000 units was made:

- preliminary heat treatment;
- machining by modern technology at the site “Niles Simmons”;
- chemical-thermal treatment according to two corrected technological processes: Ipsen furnaces and ALD vacuum heat treatment line.

It is recommended for use in the transmission of tractors “Belarus” with a power of 130–300 hp. while providing a resource of not less than 10 thousand machine hours.

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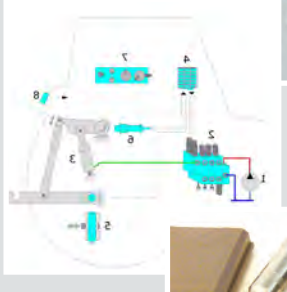
CONTROL SYSTEMS

Electrohydraulic automatic tractor control system



Purpose

The system is designed to control the tractor hitch attachment in manual mode (lifting of the attachment from the lower to the transport position and its lowering) and automatic modes (positioning of the attachment according to the traction resistance or coordinating it according to the tractor's body), and also for active damping of the vertical oscillations of the tractor, with a hinged attachment, during transportation.

Key points of the innovation

The system contains two magnetoelastic force measuring sensors installed in the hinges of the lower links of the attachment, a contactless angular position sensor of the attachment pivoting shaft, a microprocessor controller, an electrohydraulic valve-spool controller electrically and hydraulically connected, respectively, to the controller and hydraulic power cylinders of the attachment drive, and primary and remote-position control.

Competitive advantages

High operational reliability due to the noncontact principle of measuring the position of the pivoting shaft of the attachment. The use of the system improves the quality of soil processing operations while reducing fuel consumption.

Application sphere

Agricultural and road building machinery.

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Set of technical tools for building transmission control systems with multi-disc friction clutches

Key points of the innovation

Designed for control of the automated mechanical transmissions of various types.

Competitive advantages

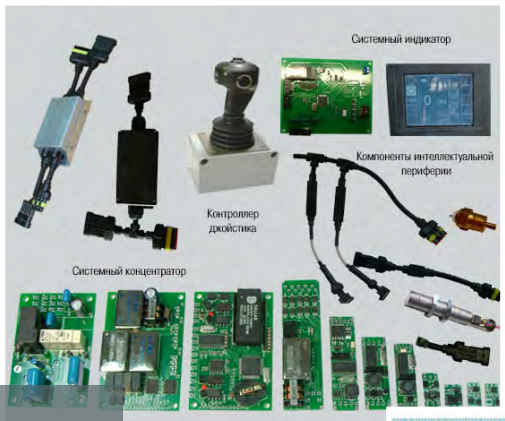
- implements control algorithms for multi-disk friction clutches in transient operation modes;
- provides faultless gear change without interruption in torque delivery in the entire service-load spectrum.

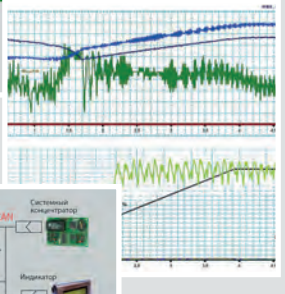
Results

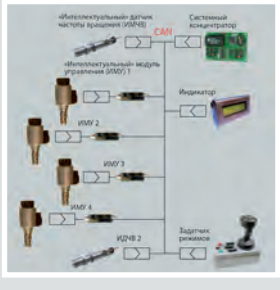
- On the basis of the proposed set of technical means it is possible to create modern transmission control systems for the Customer as soon as possible (no more than 6 months).
- The development is designed using a modern circuit technology and its technical characteristics correspond to the best domestic and foreign analogs.
- The use of intelligent peripherals in the system makes it possible to optimize the system composition for a particular task, as well as significantly improve its durability and maintainability.

Structural difference

The architecture flexibility makes it easy to adapt it to any configuration of sensors and actuators of mechatronic transmission control system.







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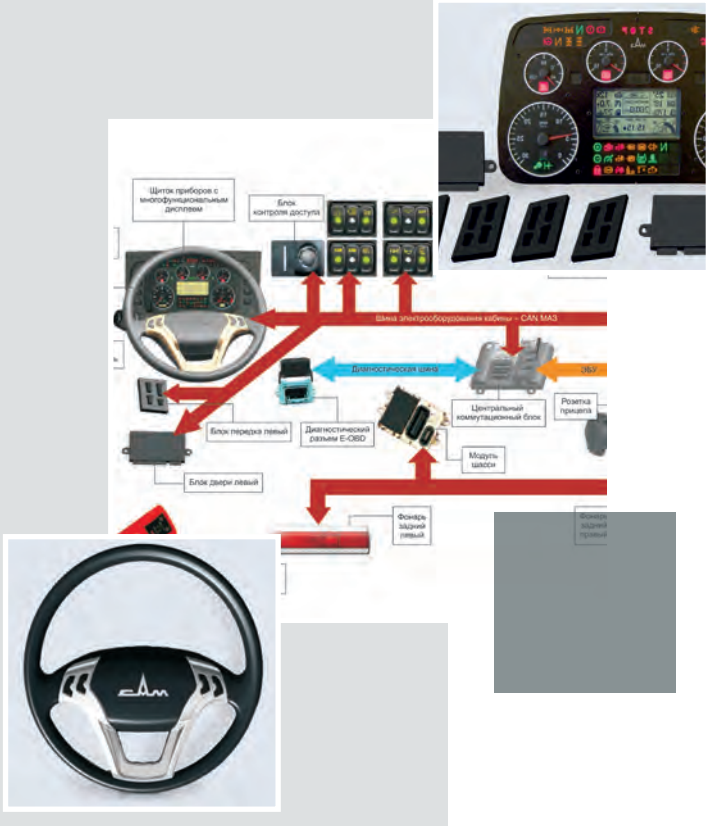
Network control system of vehicle electric equipment



Key points of the innovation

- provides information exchange and control through network;
- forms commands for controlling vehicle units and systems;
- provides automatic control of the operability of all components and the output of information about failures to external devices.

The network system includes an onboard integrated information management system (IIMS), intended for using on MAZ buses.

The subsequent versions of the system are equipped with universal ICM units (information control module).

High functional reliability of the system for a long service life (patent of the Republic of Belarus No. 7576 “Multifunction Steering Wheel”, patent of the Republic of Belarus No. 17208 “Power Source of Vehicle Embedded Electronic Modules”).

IIMS provides:

- control over connected to it nodes of bus electrical equipment;
- automatic detection of its location in the system when power is on;
- receipt of control commands from the multiplexed panel of devices through the CAN channel to switch on/off nodes of electric equipment;
- decoding commands and turning on/off actuators;
- transmission of messages about the signals state at the inputs of IIMS;
- function of door drive control units;
- output of diagnostic and operation information on the display of the multiplexed panel of devices, and also on the monitor of the laptop by means of the interface module connected to the CAN-network.

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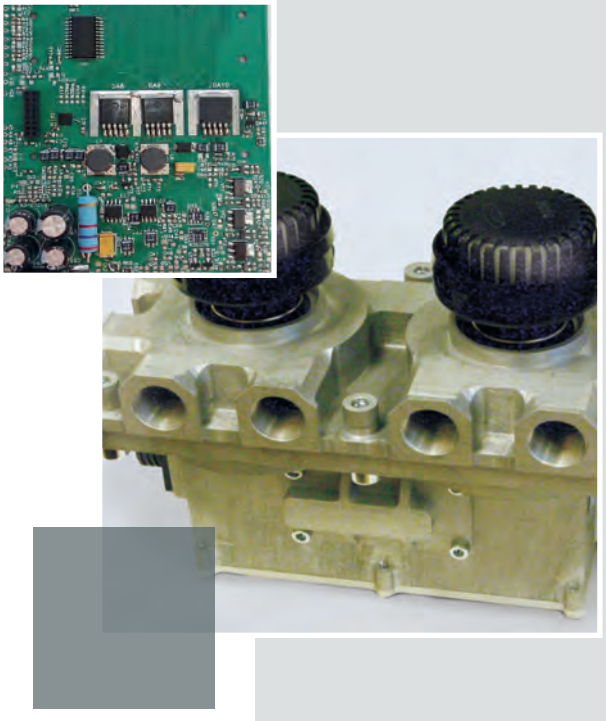
ABS / TCS with road holding and anti-rollover function

Key points of the innovation

Provides requirements for active safety of heavy-duty road-trains.

Competitive advantages

Meets the international standards and requirements for the stabilization of path of motion of the vehicle. Patent of the Republic of Belarus No. 7571 “Electronic Control Unit for Vehicle Brake System”. The control system of longitudinal stability (road holding) increases the braking properties of the vehicle, improves stability when driving and maneuvering, therefore, increases the active safety of the vehicle.



The system provides:

- compliance with the requirements of Annex 21 to UNECE Regulation 13;
- stability of the vehicle when braking and driving on winding roads and around bends;
- stability of the vehicle when maneuvering on the road.

Specifications

- the number of controllable elements of the system – not less than 4;
- the number of controlled elements of the system – not less than 8;
- power supply voltage of the embedded network – 18-32 V;
- interfaces: diagnostic ISO-9141-1; data CAN J1939 – not less than 2.

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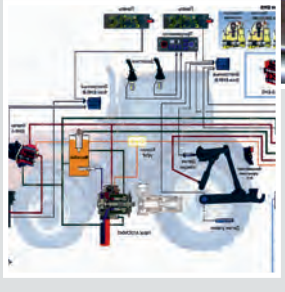
System of automatic control of hitches of tractor “BELARUS”



Key points of the innovation

The system is designed to control the hydrofocated hitches of high horsepower tractors in manual and automatic modes.

System structure

- programmable microprocessor-based controller, remote control (joysticks) and display units, connection cable;
- the system provides continuous control of four distribution sections of tractor hitches according to the specified algorithm with the possibility of indication of the control functions performed by the program.

Competitive advantages

High functional reliability of the system operation and easy control due to simplification of the design of primary magnetomodulation displacement transducers and placement of an additional button for fixing the flow of power fluid on the joystick.

Application spheres

Agricultural and road-building machinery.

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Mechatronic control system of hydromechanical transmission of dump trucks

Key points of the innovation

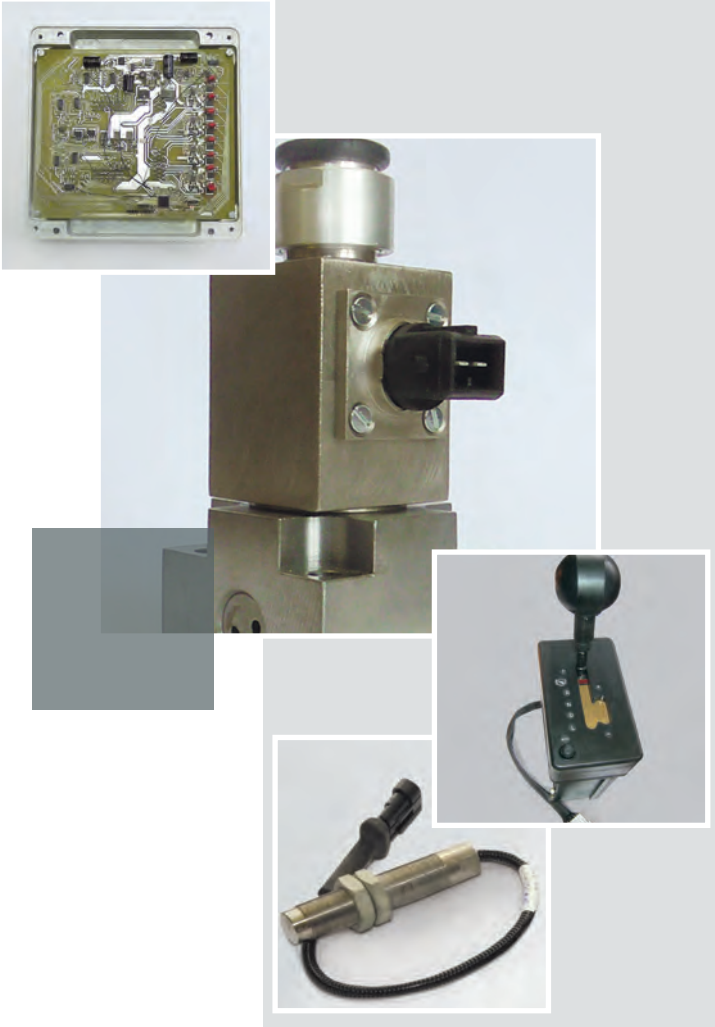
- regulation of pressure of power fluid in cavities of friction clutches at a gear change;
- torque converter lockup.

Competitive advantages

- reduction of dynamic forces in the transmission;
- enhance of traffic safety;
- improvement of ergonomic performance;
- implementation of optimal control algorithms.

Economic efficiency

- enhanced productivity;
- reduction of fuel consumption;
- increase of overhaul life.



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ELECTROMECHANICAL AND HYBRID POWER UNITS

Robotic platform based on mini-tractor “BELARUS 132N”

Key points of the innovation

For delivery of remotely controlled technological tools of various functional purposes to the zone of their operation.

Standalone platform management

is executed by the on-board electronic control system according to:

- received task;
- real field position of the platform;
- information about the environment.

Remote control

is performed through a wired channel or by radio.

Control over the movement of the platform is carried out by means of remote visual surveillance or video cameras installed on the platform.

Competitive advantages

- wide range of application;
- autonomous power source;
- low maintenance and repair costs;
- possibility to use different hydraulic technological tools.

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Technical means of development of electromechanical and hybrid power units

Key points of the innovation

Developing, producing and testing experimental samples of components of electromechanical power units and creating on their basis an experimental sample of an electric vehicle using domestic technologies.
Localization of design and production technologies for a typical range of components of power units for electric transport.

Electric traction drive

- synchronous electric motor with permanent magnets;
- rated torque – 250 N · m;
- maximum torque – 300 N · m;
- average efficiency – at least 85 %;
- configuration – front with inter-wheel differential.

Accumulator – lithium-ion battery

- lithium-ion battery capacity – 32 A · h (11,8 kW · h);
- maximum DC link voltage – 390 V;
- maximum discharge current – 480 A.

Controlled converter

- converter power – 3 kW;
- low-voltage part – 12 V;
- converter type – switching with galvanic isolation.

Specifications

- curb weight – 1300 kg;
- passenger capacity – 5 people;
- maximum velocity – 110 km/h;
- 0–100 km/h acceleration dynamics – less than 9,5 s;
- maximum distance run – up to 100 km.

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Electromechanical drive of the new generation of BelAZ

Drive axle

is designed to equip dump trucks with articulated frame of BELAZ 7528 model with axle configuration 6x6 and load capacity of 36 tons.

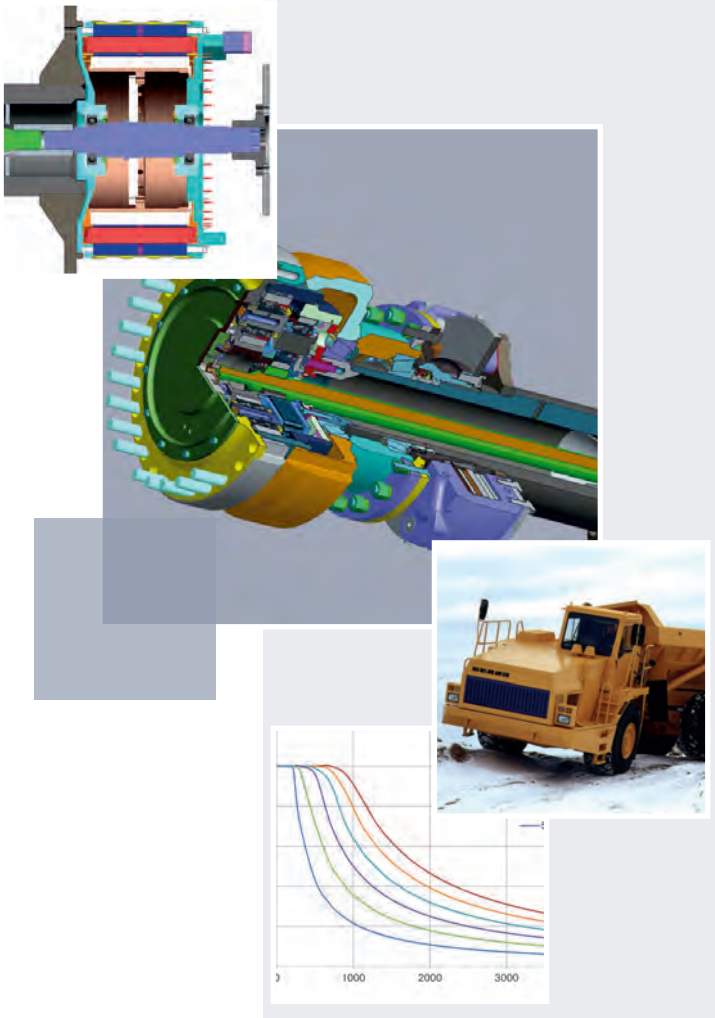
Provides

- particularly high cross-country capacity of the dump trucks (ability rating 0,55);
- high coefficient of efficiency (85 %);
- increase of drive life and its reliability by 15 %;
- reduction of hydrocarbon fuel consumption and hazardous emissions;
- increasing productivity and competitiveness.

Electromechanical drive

with permanent magnet motor for BelAZ dump trucks provides:

- maximum tractive effort;
- maintainance of maximum power in the entire speed range;
- smooth running of dump trucks;
- minimum wearout of parts while braking;
- high specific torque on a rotor shaft (12–16 Nm/kg);
- operation at low speeds without performance degradation;
- effective liquid cooling;
- elimination of circulating parasitic power in the drive.



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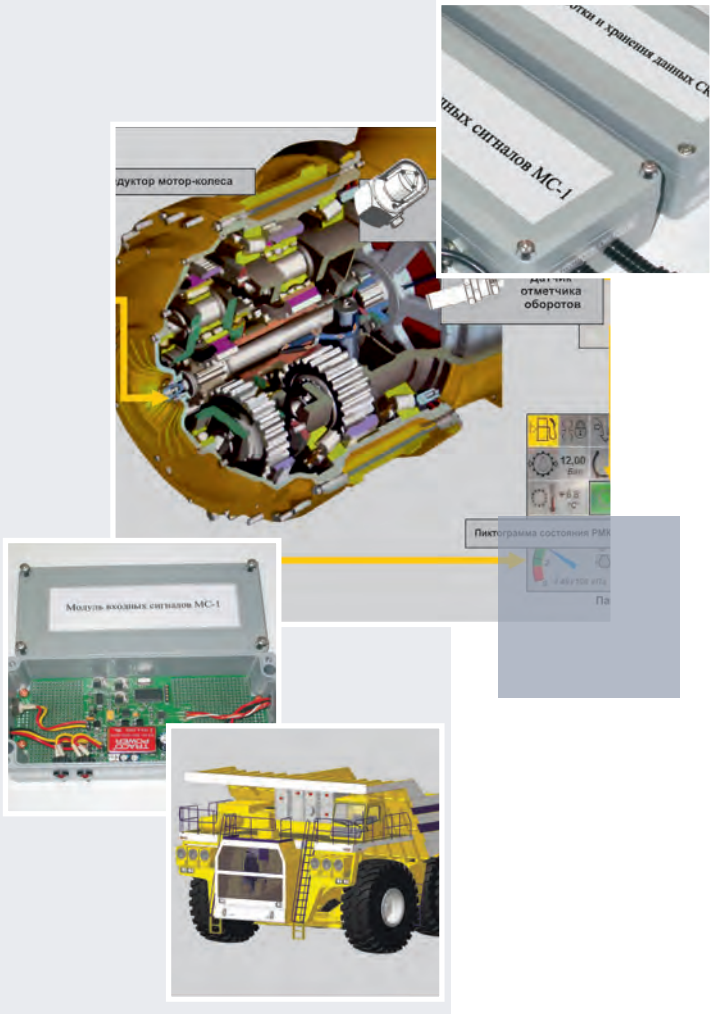
Vibration monitoring system for motor-wheels reducing gears of BelAZ mining dump trucks



Key points of the innovation

The system provides periodic information on current vibration parameters, their processing, analysis and output of diagnostic results to the instrument panel of a mobile device for timely informing the driver about the current technical condition of the transmission gears.

Competitive advantages

- prevents accident-caused failures of transmissions;
- provides increased technical availability of mobile equipment;
- reduces machines maintenance time by 15...17 %;
- reduces troubleshooting time 1,5...2 times;
- increases mean time between failures by at least 10...15 %.

Consumers

The enterprises of the BelAZ holding.

Domestic and foreign analogs are absent.

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