ADVANCED R&D AND TECHNOLOGIES

THE NAS OF UKRAINE

MACHINE-BUILDING AND INSTRUMENT ENGINEERING

ADVANCED R&D AND TECHNOLOGIES

THE NAS OF UKRAINE

SPECIAL ISSUES

ENVIRONMENT AND NATURE PROTECTION

FOOD INDUSTRY

FUEL, LUBRICANTS,
AND TECHNOLOGIES

INDUSTRIAL AGRICULTURE
AND LANDSCAPE GARDENING

INFORMATION AND SENSOR SYSTEMS
AND DEVICES

INFORMATION TECHNOLOGY

MACHINE-BUILDING AND INSTRUMENT ENGINEERING

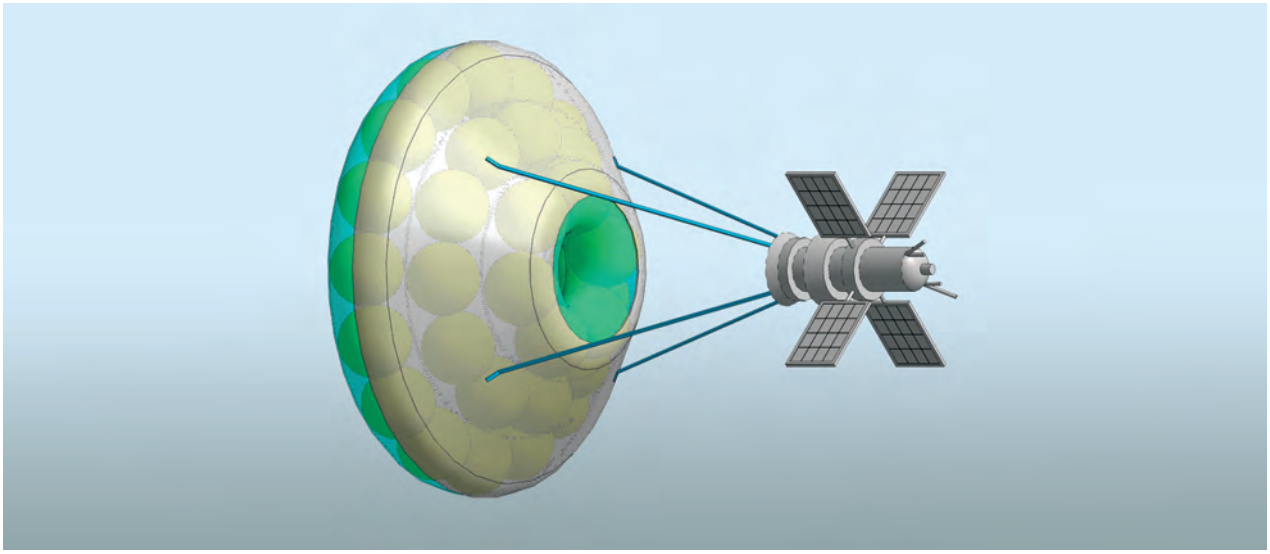
MEDICAL PRODUCTS
AND MEDICAL DEVICE ENGINEERING

POWER ENGINEERING
AND ENERGY EFFICIENCY

TECHNOLOGIES AND EQUIPMENT
FOR EXPLORING, ESTIMATING,
AND EXTRACTING MINERAL RESOURCES

TECHNOLOGIES FOR CONSTRUCTION
AND FUNCTIONAL MATERIALS

AERODYNAMIC SYSTEMS FOR SPACECRAFT DEORBITING



Areas of Application

The system is to be used for deorbiting waste spacecraft, large modular space structures, and uncooperative fragments of space debris

Specification

The system contains thin-walled conic film and inflatable ring toroidal envelopes in which inflatable thin-walled spherical film envelopes are placed. If waste spacecraft needs to be deorbited, the system is deployed with aerodynamic resistance increasing and the debris carried away to dense atmosphere. The failure of 40% envelopes does not impair the system working capacity

Advantages

As compared with counterparts, this system enables to reduce the overall weight of deorbiting system from 893 kg to 205 kg and the aerodynamic element diameter from 180 m to 34 m. The use of conical aerodynamic trap raises the effectiveness of capture and deorbiting of uncooperative fragments of space debris, which extends the service life of the system

IPR Protection

IPR3

Stage of Development. Suggestions for Commercialization

IRL3, TRL3
Patent license for design solutions for deorbiting waste spacecraft, large modular space structures, and uncooperative space debris

Contact Information

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ALTEC-13005 MACHINE TOOL FOR CUTTING SEMICONDUCTOR MATERIALS

Areas of Application

The tool is designed for cutting semiconductor materials into legs. Cutting is made by diamond-coated wires. The wires are placed on a replaceable frame which serves as a cutting tool. The distance between the wires is set by replaceable dimension strips

Advantages

The machine tool shows a high performance as it is capable of simultaneous cutting of 4 work pieces at a rate of 0.4—0.8 mm/min. The effect of harmful vibration is minimized. During 8-hour working day, the tool can make 210000 legs of Bi_2Te_3 based materials, which have dimensions of 1.4 × 1.4 × 1.5 mm

Specification

Maximum dimensions of work piece to be cut, mm	50 × 50 × 15
Number of work pieces that can be cut simultaneously	4
Nominal frequency of cutting frames motion, Hz	25
Cross-section of resulting legs, mm	
minimum	0.4 × 0.4
maximum	4 × 4
Number of wires on the frame, minimum	14
Minimum diameter of cutting wire, mm	0.18
Weight, kg	≤150
Power consumption, kW	1.5
Power supply	380 V ± 10%, 50 Hz
Dimensions, mm	1600 × 1000 × × 500

Stage of Development. Suggestions for Commercialization

IRL7, TRL6
Manufacture, supply, warranty service, and staff training, upon request

IPR Protection

IPR3

Contact Information

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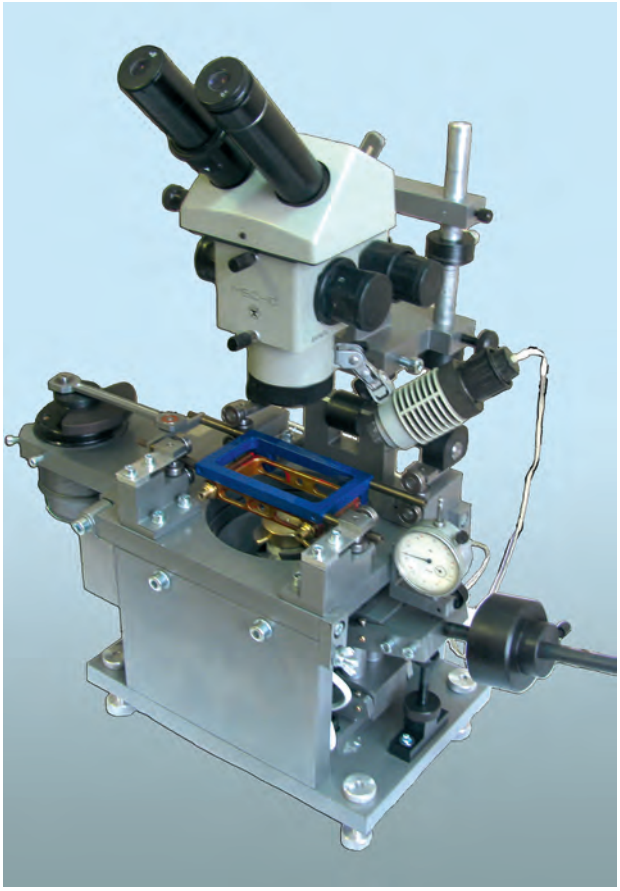
ALTEC-13009 COMPACT MACHINE TOOL FOR CUTTING SEMICONDUCTOR MATERIALS

Areas of Application

The tool is designed for cutting semiconductor materials, glass, quartz, graphite, lead, tin, and other materials into square and rectangular blanks



Specification

Maximum dimensions of work piece to be cut, mm	40 × 40 × 15
Minimum number of strings on the frame.	1
Maximum number of strings on the frame	95
Width of diamond-coated cut, mm	0.22
Width of loose abrasive cut, mm	0.15
Weight, kg	≤12
Power consumption, W	15
Power supply	24 DC
Dimensions, mm	340 × 690 × 630

Advantages

Cutting accuracy with the use of diamond-coated strings, mm	±0.02
Cutting accuracy with the use of loose abrasive strings, mm	±0.01
Cutting depth control accuracy, mm	±0.01

Stage of Development. Suggestions for Commercialization

IRL7, TRL6
Manufacture, supply, warranty service, and staff training, upon request

IPR Protection

IPR3

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BITR-M TYPE TRITIUM MODIFIED SOURCES OF BETA RADIATION

Areas of Application

The sources are to be used in ion generators (neutralizers)

Specification

Sealed source of ionizing radiation. The designed service life is 8 years

Advantages

The ionizing radiation sources have as good physical and engineering characteristics and as long service life as the world best analogs

Modification	Parameter	
	Ionization current, nA, at least	Activity, GBq (Ci), at most
BITR-M1	41.7	17.4 (0.47)
BITR-M2	101.8	42.5 (1.15)
BITR-M3	216.2	90.3 (2.44)
BITR-M4	342.6	143.1 (3.87)
BITR-M5	37.9	15.8 (0.43)
BITR-M6	140.6	58.7 (1.59)
BITR-M7	9.8	4.1 (0.11)
BITR-M7a	4.9	2.05 (0.055)

Stage of Development. Suggestions for Commercialization

IRL6, TRL8
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR3

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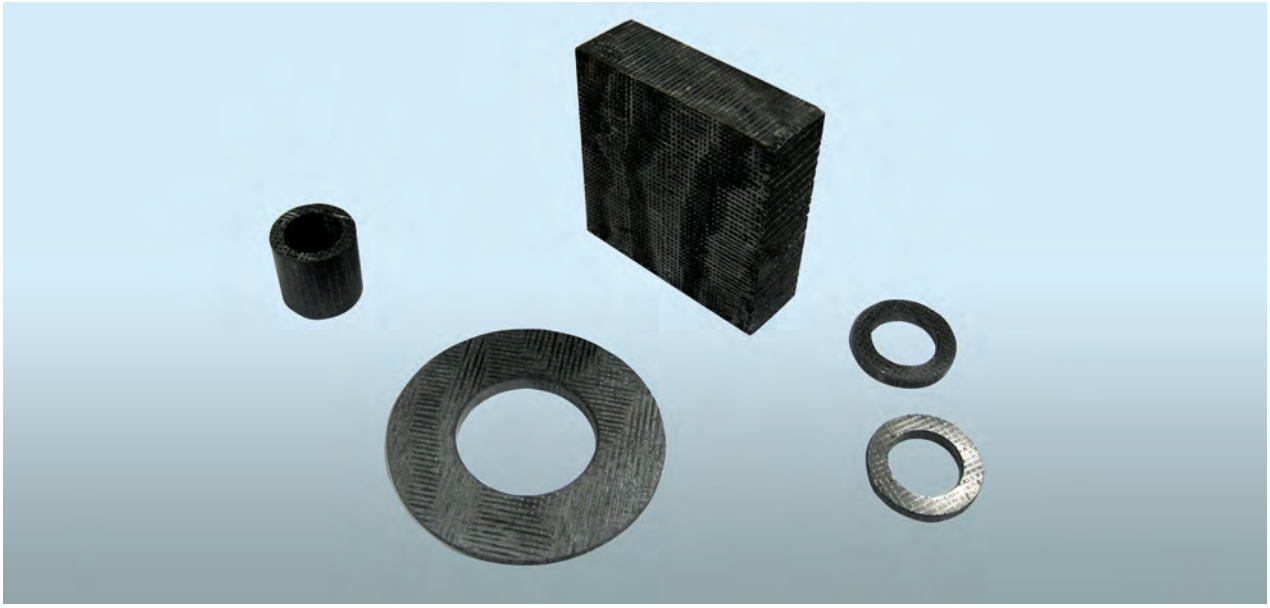
BRAKE DISKS MADE OF CARBON-CARBON COMPOSITE MATERIALS (CCCM)



Brake disks made of carbon-carbon composite materials

Areas of Application

The product is to be used in mechanical engineering, aircraft industry, highway and railway transport

Specification

Low specific density; the discs ensure safe operation at a temperature over 1000 °C.

Density g/cm^3	1.5—1.85
Mechanical strength, MPa	100—400
Friction coefficient	0.25—1.5
Low open porosity, %	From 3—4 to 8—12

Advantages

The brake discs are made on the basis of PAN (polyacrylonitride) and rayon carbon fibers using the original thermogradient gas-phase method for CCCM manufacture. Methods for welding the disc frictional materials on metal elements have been developed. The friction coefficient is stable or increases as temperature grows.
The brake discs can withstand considerable thermal and mechanical shocks; are corrosion-resistant

Stage of Development. Suggestions for Commercialization

IRL7, TRL5
Manufactured and supplied, upon request

IPR Protection

IPR1

Contact Information

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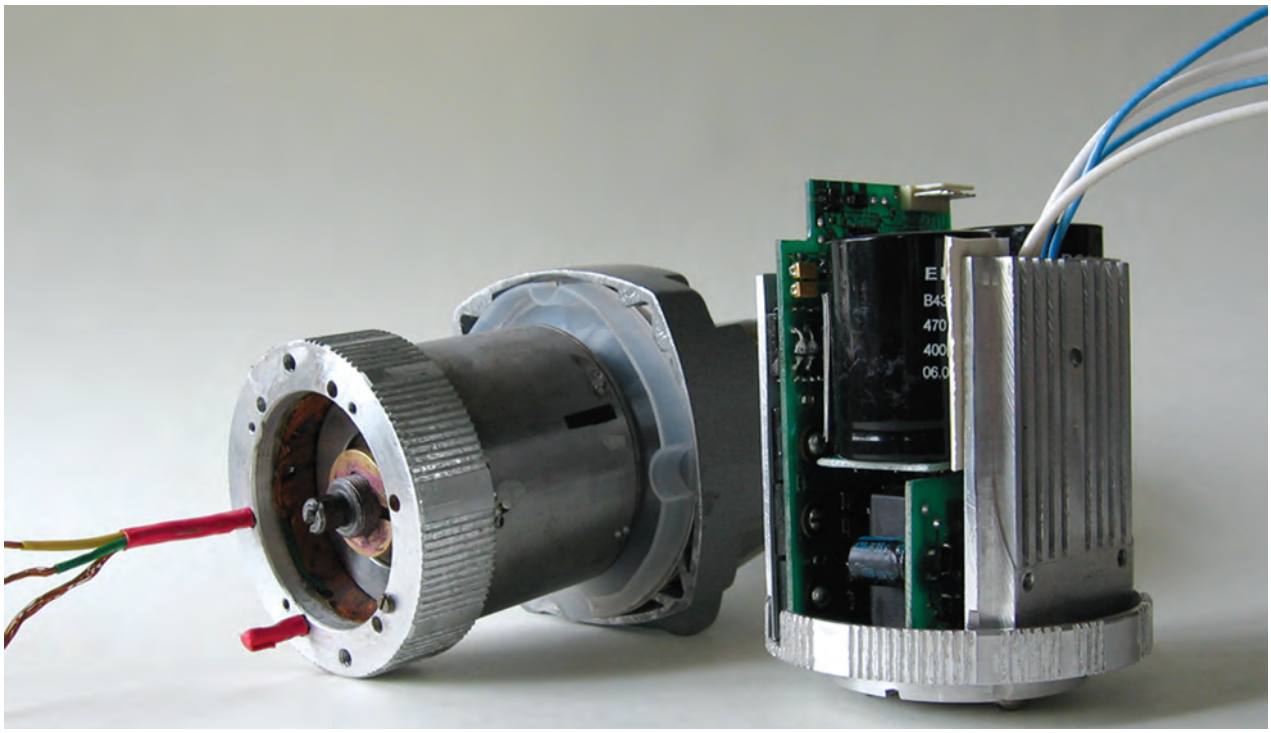
BRUSHLESS ELECTRICAL MACHINES (BEM)



Brushless power tool drive

Areas of Application

The machines are to be used in instrument engineering, aviation, automobile, and military industries, space engineering, household appliances, medical equipment, electro-driven tools, etc.

Specification

Rotor speed range, rpm: 0—60000 and more.
BEM useful power, W: 1—30000

Advantages

In comparison with conventional synchronous and induction motors, the brushless electric machines are more reliable, have a higher efficiency, a simpler manufacturing technology, smaller dimensions and weight, and are notable for a low loss due to the absence of magnetic cores in the stator

IPR Protection

IPR3

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Customized design, manufacture, delivery, and warranty service, upon request

Contact Information

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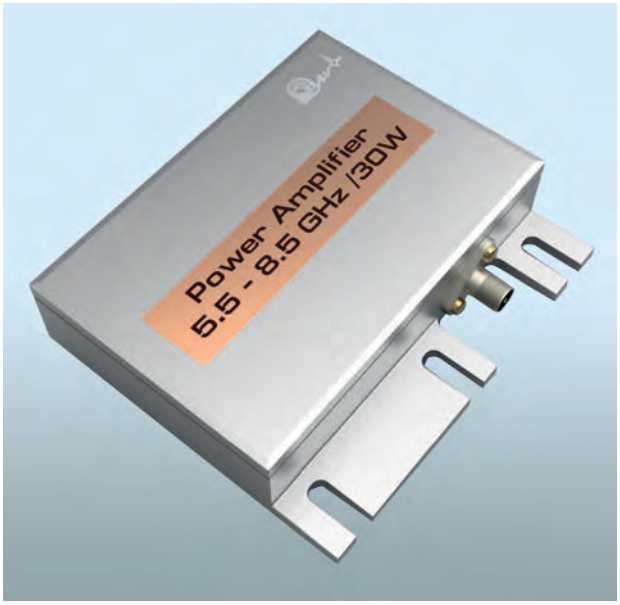
C-BAND POWER AMPLIFIER

Areas of Application

Radar and communication systems



Specification

Operating mode	CW or pulse
Cooling	conductive
Frequency range, GHz	5.5…8.5
Narrowband mode, any sub-band, MHz	±200
Output power, W	
narrowband mode	>30
wideband mode	20
Full power gain, dB	>17
Dimensions, mm	100 × 100 × 20
Weight, kg	0.25
Power consumption (max. CW mode), W	110
Supply voltage, V	+28 ± 1
Operation temperature range, °C	–40…+55

Advantages

Small size and low weight; the amplifier can be configured either for narrowband or wideband mode; fully mismatched operation is admitted in the narrowband mode; the amplifier contains an internal bias generator and protection circuits enabling its safe operation, including reverse battery and overvoltage protection up to ±60 V

Stage of Development. Suggestions for Commercialization

IRL8, TRL7
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1

Contact Information

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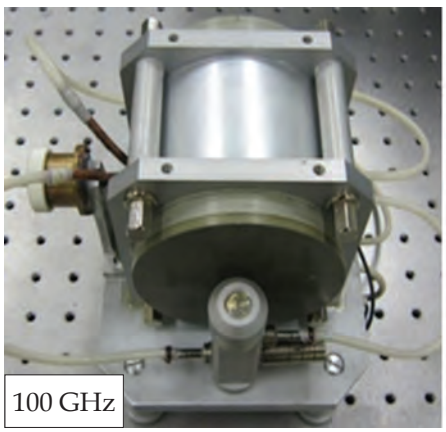
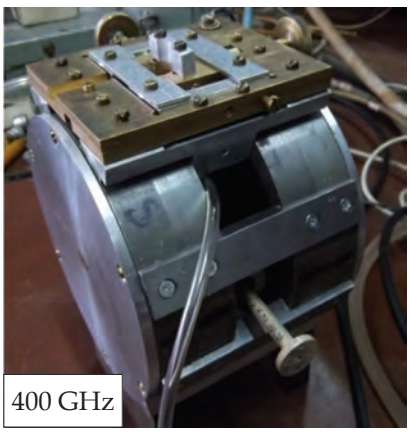
CLYNOTRONS AS SOURCES OF CONTINUOUS ELECTROMAGNETIC RADIATION IN MILLIMETER AND SUBMILLIMETER RANGES





Clynotrons operating on various frequencies

Specification

Operating wave, mm	Anode voltage, kV	Anode current, mA	Operating magnetic field, T	Output power, W
8—9	2—3	120—180	0.35	10—30
2—3	2—4	120—140	0.45	3—10
0.8—0.9	4—5	130	0.85	0.4—0.6
0.5—0.6	5—6	120	1.10	0.1

Areas of Application

Medicine and biology.
Radio and telecommunication

Advantages

As compared with the conventional O-type BWT, the clynotrons provide a significant (by an order) gain in the output power and a wideband frequency tuning — from several per cent to the central frequency. The clynotrons operate in millimeter and submillimeter ranges, reach an output power of about 30 W in the 8-mm range and several ten/hundred milliwatts in the submillimeter range

Stage of Development. Suggestions for Commercialization

IRL6, TRL5
Manufactured and tested in customer operational environment as an integral part of extensive technological infrastructure

IPR Protection

IPR1, IPR2

Contact Information

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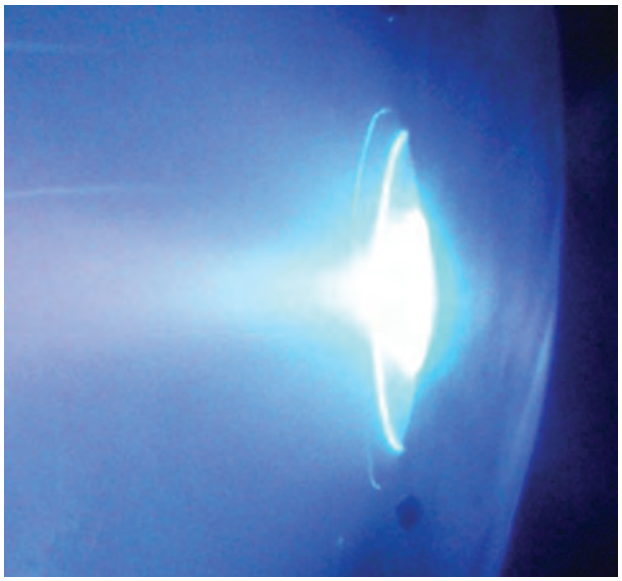
COMBINED TECHNOLOGY FOR EXTENDING THE SERVICE LIFE OF FRICTION COUPLES



Unbalanced planar magnetron

Autonomous ion source

Areas of Application

The technology is designed to modify service properties of outer and inner work surfaces of reciprocating and revolving friction couples to improve their strength, tribological properties, wear and corrosion resistance in the course of manufacture and repair

Advantages

Enables treating of hard-to-access inner surfaces and performing all process steps within a single vacuum cycle; simplified manufacture, lower cost and operating expenses as compared with similar technologies based on vacuum arc devices

IPR Protection

IPR3

Specification

Enables to treat parts with a diameter over 25 mm. The technology consists of several process steps to be performed in vacuum chamber during a single vacuum cycle, in particular, ion-beam etching and polishing of work surfaces to remove the strain stressed layer and to reach optimal abrasiveness; ion-plasma (or ion-current) nitrogen hardening of work surface for adhesion to the functional coating layer, and application of respective coating

Stage of Development. Suggestions for Commercialization

IRL4, TRL4
Technology; treatment of surfaces of any configurations

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COMPACT SCANNING POLARIMETRIC DOPPLER RADAR

Specification

Frequency, GHz	34.8 ± 0.15
Peak power, kW	2.5
Max. range, km	60
Range resolution, m	15 — 60
Antenna diameter, m	0.5
Antenna beam width, deg.	1.2 × 1.2
Polarization isolation, dB	–40
Receiver noise factor, dB	3.5
Dynamical range, dB	90
Range gates	1000
FFT length	128; 256; 512; 1024
Count of averaged spectra	1–32768
ADC sampling rate, MHz	125
Calibration accuracy, dB	±0.5
ADC resolution, bit	16
Host PC OS	Linux
Azimuth scanning	–180°...+180°
Elevation scanning	0° — 90°
Scanning rate, deg./s:	90
Positioning accuracy, deg.	0.1
Power supply, Hz	50
Power consumption (max), W	400
Weight, kg	190
Dimensions, mm	1800 × 1200 × × 1000
Temperature operating range, °C	–40...+50

Areas of Application

Real-time measurements
of micro- and macroscopic characteristics
of clouds and precipitations, including
simultaneous co- and cross polarization
time-range profiles of reflected signal intensity,
Doppler velocity, and Doppler spectra

Advantages

Unattended operation at any remote site;
continuous auto-calibration functionality;
remote monitoring, diagnostics, and real-time
data acquisition via the TCP/IP

IPR Protection

IPR1

Stage of Development. Suggestions for Commercialization

IRL8, TRL7
Manufacture, delivery, warranty service,
and staff training, upon request

Contact Information

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COMPACT UHF GENERATORS

PC adapter for generator remote control

Compact Ka-band generator

Areas of Application

Theses signal generators produce UHF oscillations within X-, Ku-, and Ka- frequency bands

Specification

Параметр	HSG-X	HSG-Ku	HSG-Ka
Frequency range, GHz	8—9.5	16—19	34.5—37.5
Frequency tuning step, MHz	2	5	10
Output power, dBm	>50	>50	>10
Output power adjustment step, dB	0.5	—	—
Modulation	AM	—	—
Modulation depth, dB	>40	—	—
Modulation frequency range, kHz	0.4—400	—	—
Power supply, DC, V	8—33	—	—
Power consumption, W	7	—	—
Built-in local control	*Keyboard + OLED display*		
Wireless remote control (optional), m	>500	—	—
Dimensions, mm	150 × 100 × 50	—	—
Weight, kg	<0.5	—	—
Operation temperatures range, °C	–20...+50	—	—
RF interface	SMA	SMA	WR-28

Advantages

Suitable for long-term unattended use in lab or field conditions; lightweight and compact; can be powered from 8—33 V DC power supply or from battery; equipped with built-in controls and wireless ZigBee interface for remote control; rain protection

Stage of Development. Suggestions for Commercialization

IRL8, TRL7
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1

Contact Information

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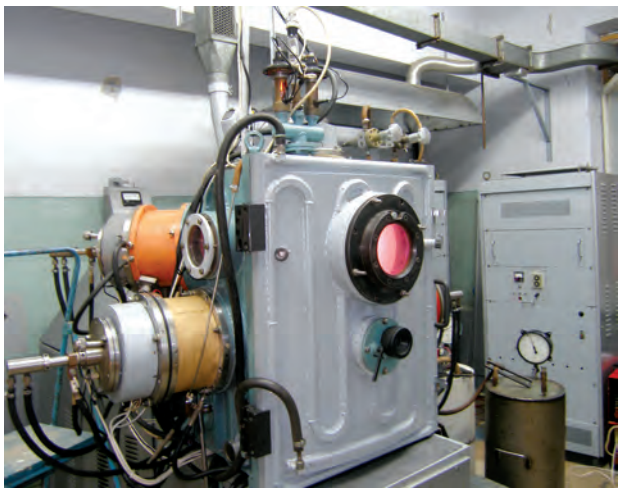
COMPREHENSIVE ION PLASMA TECHNOLOGY FOR SURFICIAL REINFORCEMENT (NITROGEN HARDENING + COATING) OF STEEL PARTS



Ion-plasma equipment for surficial reinforcement

Areas of Application

The technology is designed to reinforce parts of machines and mechanists in turbine- and machine-building industries

Specification

Weight of treated part, kg	≤20
Nitrogen hardening mode at an ion current density, mA/cm^2	≤2
Pressure inside vacuum chamber, torr	~$2 \cdot 10^{-3}$
Rate of nitride coating deposition, μm/h	≤20
Coating thickness, μm	~10
Nitrogen hardening depth (steel 25H1MF: t ≥100 μm at N≥5GPa), μm	≥100
Treatment duration	≤3

Advantages

Ensures a high adhesion of protective coating and base modified by the ion-plasma method. One process consists of two process operations, nitrogen hardening and application of coatings. The full cycle of hardening is one order shorter than the duration of furnace (atmospheric) nitrogen hardening. The technology extends 1.5—2 times the service life of friction couples of turbine steam distribution units

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Reinforcement works.
Manufactured upon request

IPR Protection

IPR1

Contact Information

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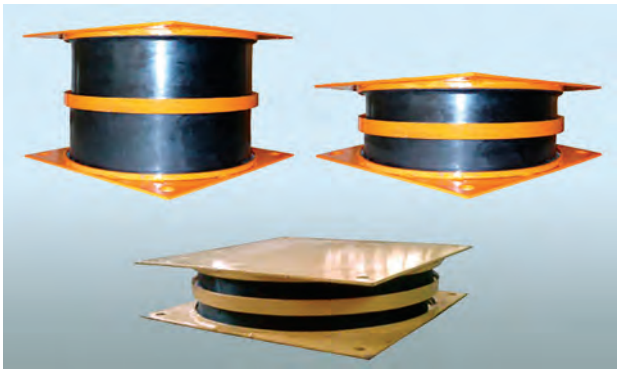
COST-EFFECTIVE PROTECTION OF CIVIL ENGINEERING AND INDUSTRIAL FACILITIES FROM VIBRATION AND SEISMIC LOADS



Configurations of rubber seismoblocks

Areas of Application

The system is designed for ensuring vibration and seismic stability of buildings and structures using special construction elements — rubber and rubber-and-metal blocks

Specification

The protection system is based on the use of rubber vibroseis blocks and has a compression strength of 300—1000 kN at a horizontal shake fundamental frequency of 0.5—1.6 Hz. The seismic protection is governed by European and national standards EN 1998 1:2004 Eurocode 8 and SBN B.1.1 12:2014 Construction Works in Seismic Regions of Ukraine

Advantages

The protection system enables to provide safety of buildings and structures during manmade shocks and earthquakes; to reduce the cost of construction works; to reduce consumption of materials for construction of buildings and structures; to raise safety and reliability of buildings and structures; and to widen choice of construction sites

27-floor house at Obolonskiy Avenue in Kyiv with shock isolation system (situated in 100 m from shallow subway line)

Stage of Development. Suggestions for Commercialization

IRL8, TRL9
Manufacture, supply and author's supervision, upon request

IPR Protection

IPR3

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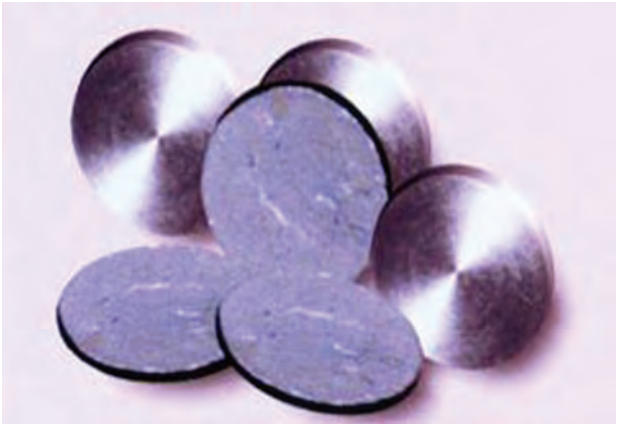
DEVICE FOR ACCELERATED START OF DIESEL ENGINES AT LOW TEMPERATURE



Ferroelectric semiconductor heating elements

Areas of Application

The devices based on high-performance ferroelectric-semiconductor heating elements (PTCR) are used to accelerate the start of diesel engines at low temperature, in wintertime

Specification

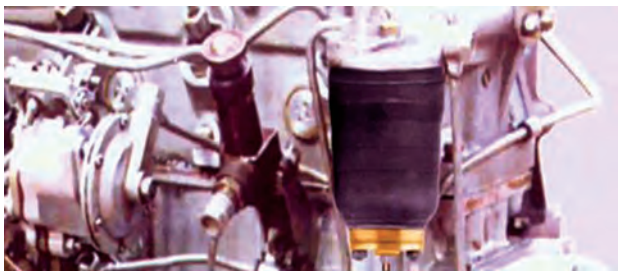
The devices reduce the minimal temperature of diesel engine start by 10 °C with the use of vehicle power source and by 15—20 °C in the case of external power sources

Stage of Development. Suggestions for Commercialization

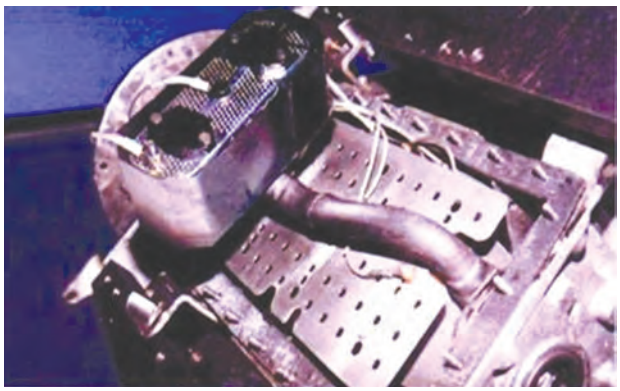
IRL7, TRL7
Manufacture, tests, and delivery, upon request

IPR Protection

IPR1, IPR3



Heated fuel filter



Heated oil intake compartment

Advantages

The PTCR heaters have significant advantages as compared with conventional electric heaters as they consume the minimum required power from the source (accumulator); they do not require any electronic control schemes; the PTCR heater automatically maintains a certain temperature independently on ambient temperature and voltage supply. Such heaters are reliable because they have no moving parts of any kind. The required temperature is set by ceramics chemical composition and manufacturing conditions. The heaters can take arbitrary shape, which enables heating in the hard-accessible places. Heat transfer from PTCR heater can be effected through both heat conduction and convection. The PTCR ceramic heaters can operate in various environments, including in motor oil and diesel fuel due to their high chemical resistance

Contact Information

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DEVICE FOR MOBILE QUICK TESTING OF HOLLOW WARES LEAK INTEGRITY

Areas of Application

The leak-detection device defines with a high accuracy the actual leakage rate for various hollow wares without using indicating gases, vacuum chambers or reference leaks

Specification

The device enables to control the leak integrity within the range from 10^{-5} W to 10^{-3} W, depending on the ware volume varying from 0.01 m^3 to 100 m^3, at a low pressure up to 0.3 MPa taking into account actual changes in parameters of external air environment

Advantages

The device has no analogs in the world. Unlike the known methods, the device quickly tests the wares to detect mini-leaks in large volumes or if the outer surface is hard-to-reach. The device provides a high accuracy and reliability of gas micro-leak detection; controls the leak integrity in wares of any configuration; determines the leakage rate based on micro variations of environment pressure and temperature and records them; performs tests in a short period of time

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1, IPR3

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DOPPLER POLARIMETRIC SCANNING RADARS

Meteorological radar with a scanning antenna

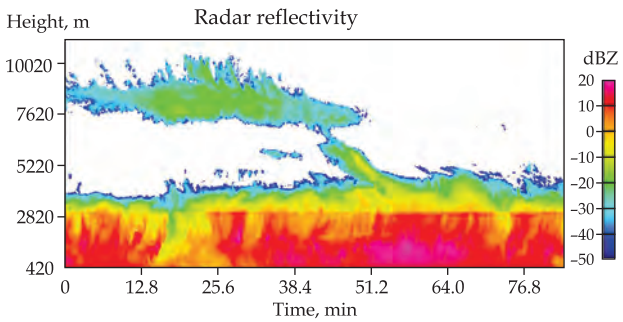
Vertically pointed meteorological radar

Areas of Application

The devices are designed for measuring micro- and macroscopic characteristics of clouds and precipitations

Specification

Operating frequency, GHz	36
Peak power, kW	30
Transmitter type	Magnetron
Spatial resolution, m	15—60
PRF, kHz	2.5; 5; and 10
Receiver noise factor, dB	3.2
ADC sampling rate, MHz	125
ADC resolution, bit	14
Range gates count (max)	512
Doppler velocity resolution, m/s	0.05
Antenna diameter, m	1.2
Side lobes level, dB	–25
Antenna positioning accuracy	0.1°
Sensitivity at a range of 15 km (average time 0.1 s), dBZ	–45
Scanning rate (in both directions), deg./s	10
Polarization isolation, dB	–40



Real time measurements of intensity profiles of signal reflected from clouds and rain

Advantages

High-sensitive and high-resolution measurements of thin low-dense clouds; real-time measurements of cloud density, droplet velocity, precipitation intensity, depolarization ratio, etc.; long-term, unattended operation at any remote site; and continuous auto-calibration of radar sensitivity

Stage of Development. Suggestions for Commercialization

IRL8, TRL7
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1

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DOUBLE-AXIS SCANNING PLATFORM

Areas of Application

The double-axis scanning platform is designed for mounting antennas, radars, and other equipment, which require controlling the transmitting/receiving direction of RF signals

Specification

Max. weight of installed equipment, kg	100
Nominal angular momentum along the azimuth and elevation axes, Nm	100
Max. scanning rate, °/s	90
Max. elevation acceleration, °/s^2	200
Max. backlash in azimuth and elevation:	≤0.1°
Azimuth scanning range	N × 360°
Elevation scanning range	–10°…+90°

Advantages

The platform enables continuous circular azimuth scanning; the elevation scanning range is from –10° up to +90°; the platform is operable in severe climatic conditions; compliance with MIL-STD-810G can be provided optionally; embedded controller enables remote user control via various interfaces and is integrable with the equipment installed using standard physical layer interfaces; control data rate reaches 1Gb/s

IPR Protection

IPR1

Stage of Development. Suggestions for Commercialization

IRL8, TRL7
Manufacture, delivery, warranty service, and staff training, upon request

Contact Information

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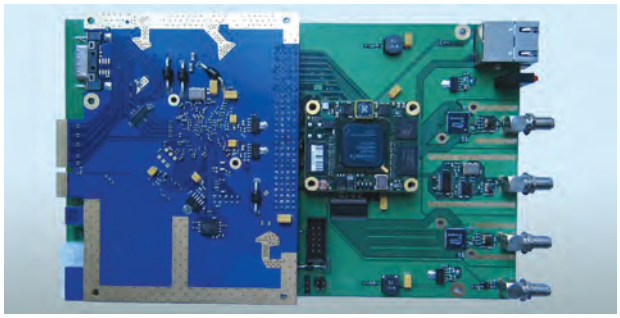
DUAL-CHANNEL DIGITAL RECEIVER

Dual-channel digital receiver



DSP board

Areas of Application

The receiver is designed for digitization and preliminary data processing of wideband analog signals with a high dynamic range in radars, communications, image processing, and in various scientific applications, particularly, in radio telescopes

Specification

Number of ADC channels	2
Time marker input	1
External/internal clock, MHz	≤ 160
Input signal bandwidth, MHz	180
ADC resolution, bit	16
Data interface	10 Gbit and 1 Gbit Ethernet
Dimensions, mm	220 × 150 × 22
Weight, g	270
Power consumption, W	25
Operating temperature range, °C	0…+70

Receiver integration with the host PC

Advantages

Both standalone and built-in configurations are available; the device enables autocorrelation and cross-correlation real-time processing of wideband signals with a bandwidth up to 80 MHz; fast receiver mode reprogramming; data synchronization with high precision time sources (like GPS and others); synchronous operation of several receivers in multichannel systems; фтв raw data saving at a speed up to 640 MB/s

Stage of Development. Suggestions for Commercialization

IRL8, TRL7
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1

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ELECTROMECHANICAL SYSTEMS BASED ON DOUBLY-FED ELECTRIC MACHINE

Adjustable electric drive of 750 kW pump based on doubly-fed electric machine

Areas of Application

The electromechanical systems based on doubly-fed electric machine are designed for wind turbines and adjustable electric-drive systems

Specification

Power output ranges from 100 to 1000 kW

Advantages

As compared with the conventional adjustable electric drives (that use the asynchronous engine with squirrel-cage rotor), the systems based on doubly-fed electric machine are notable for lower cost of voltage converter; adjustable reactive power consumed by the electromechanical system from power supply network; higher efficiency of the entire system; sinusoidal stator and rotor currents; the ability to generate electric power with given parameters at a variable speed of the primary mover

Stage of Development. Suggestions for Commercialization

IRL7, TRL6
Design, manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1

Contact Information

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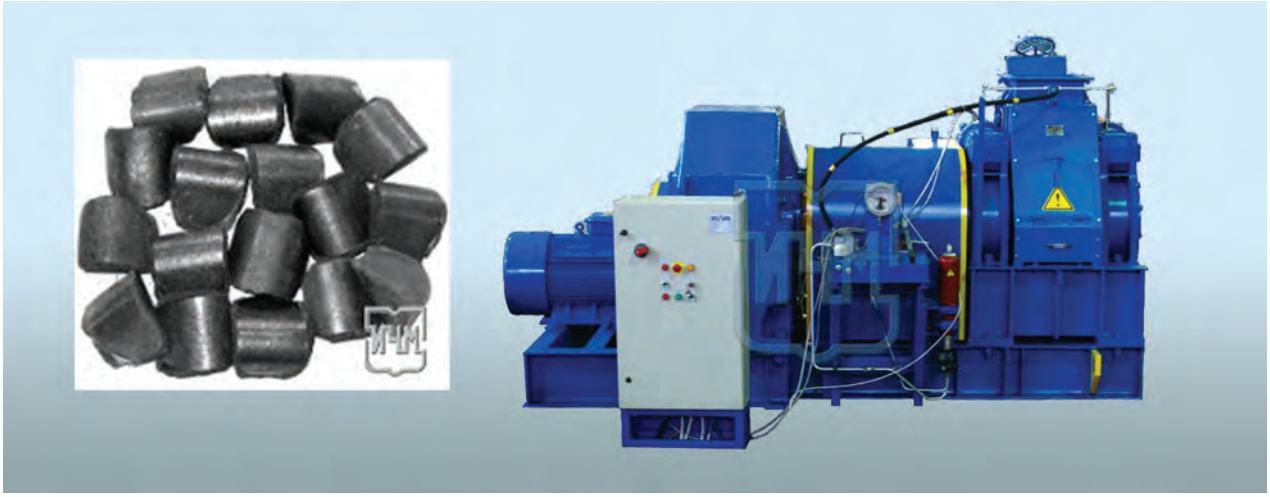
EQUIPMENT FOR BRIQUETTING FINE MATERIALS



Roll briquetting

Areas of Application

The equipment is to be used for briquetting fine raw materials and industrial waste

IPR Protection

IPR3

Specification

Model	Maximum roll separating force, kN	Maximum pressing force, MPa	Roll dimensions, mm		Roll rotational speed, rpm	Roll drive, kW	Transmission torque, Nm	Weight, kg
			diameter	width				
19PS	1200	100	647	360	1.8—9.2	30.0; 55,0	35 500; 56 000	≈8500
21PS	1500	120	647	360	1.8—9.2	55.0	56000	≈8200
22PS	2000	150	647	360	5.5—9.2	75.0	85000	≈12500
23PS	750	100	504	202	2.3—4.6	18.5	17000	≈4000
24PS	1200	120	647	202	1.8—9.2	30.0; 55.0	35500	≈6500

Advantages

This equipment is as compact, lightweight, durable, and structurally rigid as the world analogs and has higher operational characteristics. There are two options of press capacity: up to 1 ton per hour and up to 70 tons per hour

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
На замовлення здійснюється виготовлення
Manufacture, delivery, warranty service, and staff training, upon request

Contact Information

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EQUIPMENT FOR BUTT WELDING OF POLYMERIC PIPES

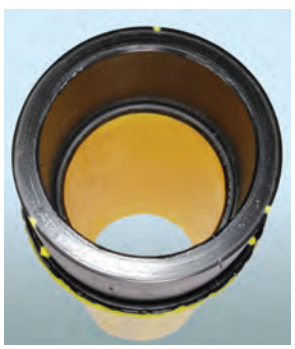
Innovative welding equipment prototype

Areas of Application

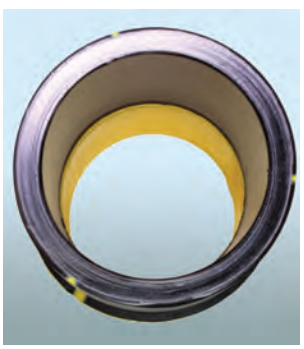
The innovative equipment is to be used for construction, reconstruction, and repair of plastic pipelines, including vacuum sanitary ones

Specification

The technology and equipment are used for heat butt welding of polymeric pipes without butt mechanical parting-off and internal rag formation



Conventional weld joint



Innovative weld joint

Advantages

Weight and cost of semiautomatic welding equipment are about 50% less as compared with the conventional manual equipment. Improves joint quality

IPR Protection

IRP3

Stage of Development. Suggestions for Commercialization

IRL7, TRL6
License sale and transfer of technical documentation for equipment manufacture; in the case of investments — incorporation of a venture and launch of a production line. Manufactured upon request

Contact Information

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EQUIPMENT FOR FAST OIL AND SORBENT REGENERATION

Areas of Application

Regeneration of transformer oil and sorbent using HF magnetic field, in power engineering

Advantages

As compared with the method for heater or hot air drying, the equipment enables to increase the zeolite initial sorption capacity by 15—20%; to increase the number of cycles of zeolite use from 3—4 to 8—10; to decrease the time of sorbent regeneration from 15—20 h to 4—6 h; to decrease the total energy consumption about 4 times (the sorbent regeneration mode)

Specification

Oil regeneration mode (after one pass)

Performance, m^3/h	1.5
Moisture content, mg/kg	5
Contamination, mg/kg	10
Power of oil heater, kW	30
Maximum total power consumption, kW	35

Sorbent regeneration mode

Weight of NaA zeolite in the cartridge, kg	40
Time of regeneration, h	6—7
Temperature of regeneration °C:	
new	300
used	180
Air pressure in the cartridge, kPa	10
Residual moisture, %	0.4
Microwave power, kW	≤2
Total power consumption, kW	6

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1, IPR3

Contact Information

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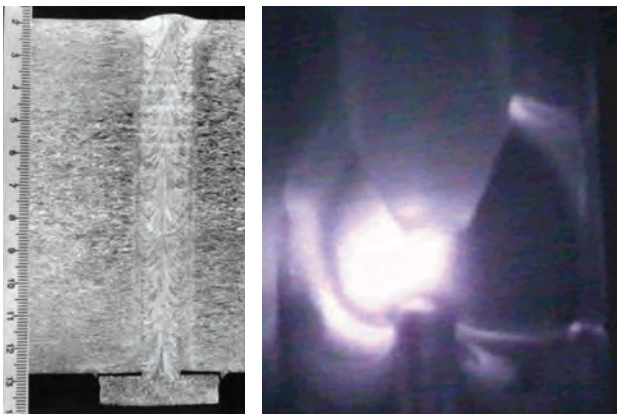
EQUIPMENT FOR NARROW-GAP ARGON TITAN WELDING WITH MAGNETOCONTROLLABLE ARC



Macrosection of 110 mm thick weld joint (left)
TV surveillance system that provides control over welding (right)

Narrow-gap argon titan welding equipment with magnetocontrollable arc

Areas of Application

The technology and equipment are designed for welding butt joints of titan and titan-based alloys (the thickness of elements welded ranges from 20 to 110 mm)

Specification

Dimensions of weld products, mm	
thickness	20—100
length	≤4000
Tungsten electrode diameter, mm	4.0; 5.0
Welding current, A	150—500
Welding rate, m/h	2.5—15
Welding stick diameter, mm	2.0; 2.5; 3.0

Advantages

As compared with the known techniques for thick titan welding (immersed arc, ESW), this welding technology has a lower heat input, a reduced area of thermal action, and, as a result, a lesser deformation of products; a simpler butt joint preparation, a shorter pretreatment, and a lower cost of pre- and welding works; a much lower argon consumption, a lower titan rod and power consumption; provides a high quality of welds, irrespective of thickness of elements welded

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufactured upon request

IPR Protection

IPR1

Contact Information

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EQUIPMENT FOR ULTRASONIC FINISHING TREATMENT

USFT equipment (an instrument with a tungsten carbide tip; US generator)

Areas of Application

The equipment is designed for ultrasonic finishing treatment (USFT) of high-strength and quenched components to reduce their roughness and to increase their wear resistance and fatigue strength

Specification

USG voltage, V	170 – 240
Output power, W	≤800
USG weight, kg	4.6
Instrument weight, kg	1.2
Vibration amplitude of instrument tip, μm	10 – 20
Static pressing force	≤500

Stage of Development. Suggestions for Commercialization

IRL5, TRL6
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR3

Advantages

The equipment has significant advantages over the conventional surface plastic deformation methods. It is notable for a high performance, a low power consumption, and the ability to handle high-strength components. It provides a lower surface roughness and enables to create the so-called "white layer" ensuring a high resistance to corrosion and wear and an increased fatigue strength of components

Contact Information

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EQUIPMENT FOR ULTRASONIC IMPACT TREATMENT OF METALS

Areas of Application

The equipment is designed for ultrasonic impact treatment (UIT) of welded joints in responsible constructions, metallic surfaces of cast products, as well as for various machine-building products for their strengthening, redistribution of residual stress, reduction of stress concentrators, reduction of surface roughness and improvement of corrosion resistance during operation and maintenance

Equipment for UIT of metallic products (an impact instrument and USG)

Advantages

There are no analogs of such equipment in Ukraine. It enables UIT while manufacturing various products and weld structures.
Its high performance is achieved due to a high frequency and a high energy of impacts.
The power consumption is 1.3 times less as compared with shot-blasting and 1.7 times less than in the case of pneumatic treatment

Specification

The equipment is air-cooled.

USG voltage, V	170—240
Output power, W	≤800
USG weight, kg	4.6
Instrument weight, kg	3.8
Vibration amplitude of instrument tip, μm	10—25

Stage of Development. Suggestions for Commercialization

IRL5, TRL6
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR3

Contact Information

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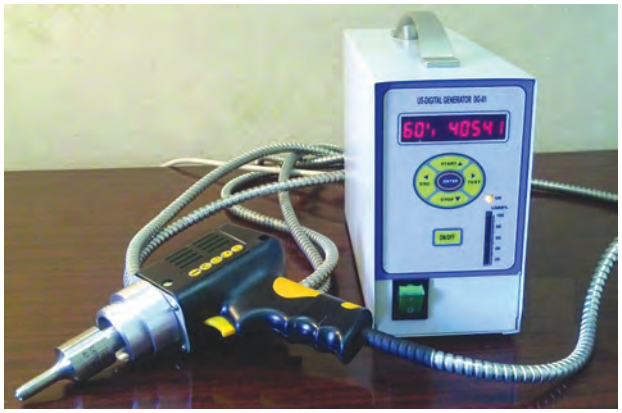
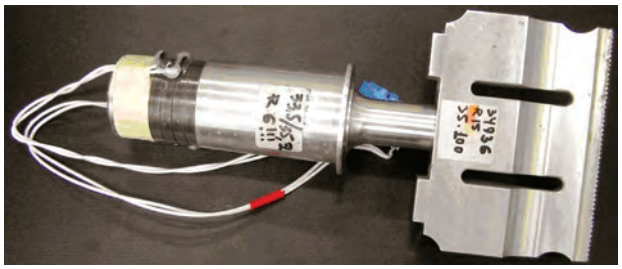
EQUIPMENT FOR ULTRASONIC WELDING OF PLASTICS



Equipment for ultrasonic point welding of plastics



USG with a flat concentrator for welding longitudinal joints

Areas of Application

The equipment is to be used in technological processes for welding of plastics both in manual and automatic modes, in various industries

Specification

Various concentrators of ultrasonic oscillations are used for the production needs.

USG electric voltage, V	170—240
Output power, W	2000
USG weight, kg	4.2
Weight of instruments, kg	1.2—2.5
Frequency range, kHz	20—40
Vibration amplitude of instrument tip, μm	15—65

Advantages

The equipment can be adjustable for an output power from 0.5 to 2.0 kW. It enables welding a broad class of dissimilar polymers. In Ukraine, it is the only ultrasonic generator (USG) having digitally adjustable welding parameters, which costs considerably lower than the foreign counterparts

Stage of Development. Suggestions for Commercialization

IRL5, TRL6
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR3

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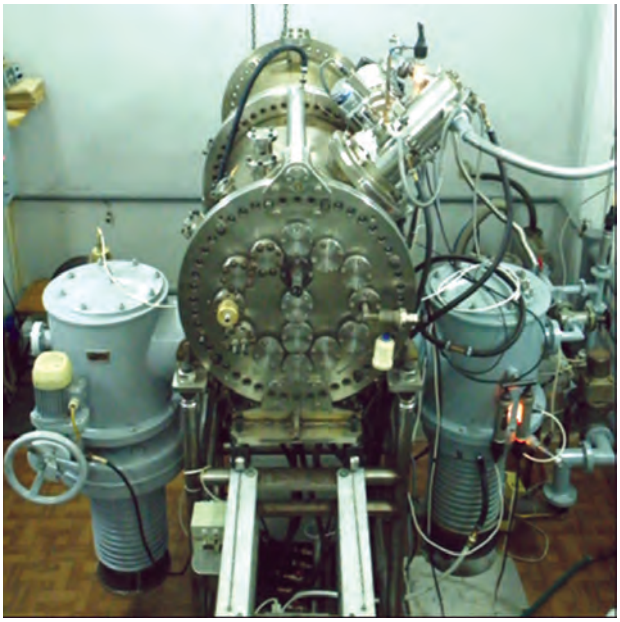
FACILITY FOR APPLICATION OF EROSION- AND CORROSION-RESISTANT COATINGS ONTO TURBINE BLADES

Areas of Application

Application of erosion- and corrosion-resistant coatings onto rotor turbine blades of thermal and nuclear power plants to enhance their reliability and efficiency



Specification

Coating technique: electron-beam evaporation, atomic-ion scattering.

Ion beam current, μA	1—1000
Electron energy, keV	60
Vacuum in chamber, Pa	10^{-4}
Power consumption, kV	1—60

Advantages

Unlike the conventional technologies for strengthening the rotor turbine blades (for example, soldering of stellite plates or application of superhard coatings in air environment), the suggested technology and facility for applying the double-layer erosion- and corrosion-resistant coating onto the turbine blades in vacuum increase their service life considerably (by 25—30%)

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Manufacture of single equipment samples by ourselves or jointly with potential partners

IPR Protection

IPR1, IPR2

Contact Information

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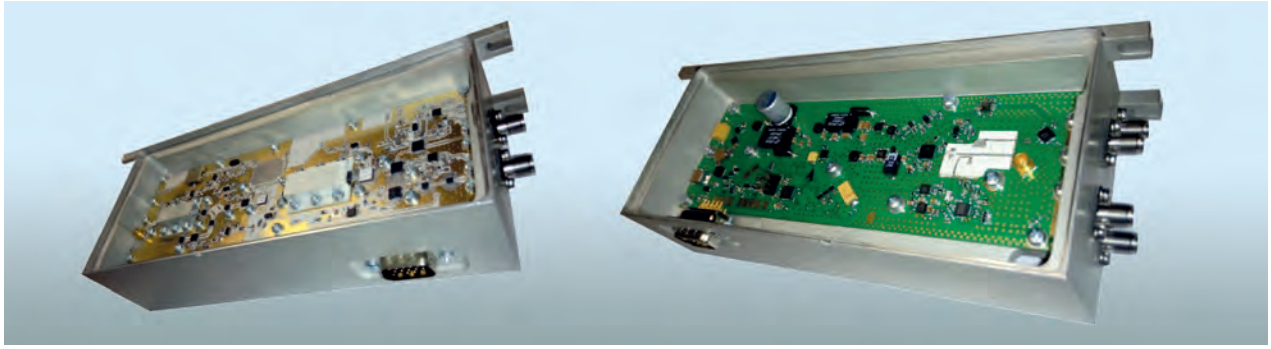
FREQUENCY CONVERTERS OF MICROWAVE AND MILLIMETER WAVELENGTH FREQUENCY RANGES



Ku-band downconverter

Areas of Application

The multifunctional highly integrated RF modules are to be used in radars and communications operating within the 1…40 GHz frequency range

Ku-band upconverter

Specification

(by example for Ku-band)

Frequency Downconverter	
Input frequency range, GHz	16.5—17
Noise factor, dB	<4
Gain, dB	20±1
Input compression point, dBm	>–5
Image rejection, dB	>50
Local oscillator power, dBm	10 ± 3
Absolute acceptable input power, dBm	
CW	<30
peak	<45
Supply voltage, V	+6
Frequency Upconverter	
Output frequency range, GHz	16.5—17
Output peak power, dBm	>25
Input IF power, dBm	3 ± 3
Local oscillator	Built-in, synthesized
phase noise at 10 kHz offset, dBc/Hz	<–87
frequency step, MHz	20
switching speed at 500MHz step, μsec	<200
Supply voltage, V	+18…32

Advantages

A high integration and excellent electrical performance enable simplifying and speeding up the design of radar and communication systems and reducing their size and weight

Stage of Development. Suggestions for Commercialization

IRL8, TRL7
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1

Contact Information

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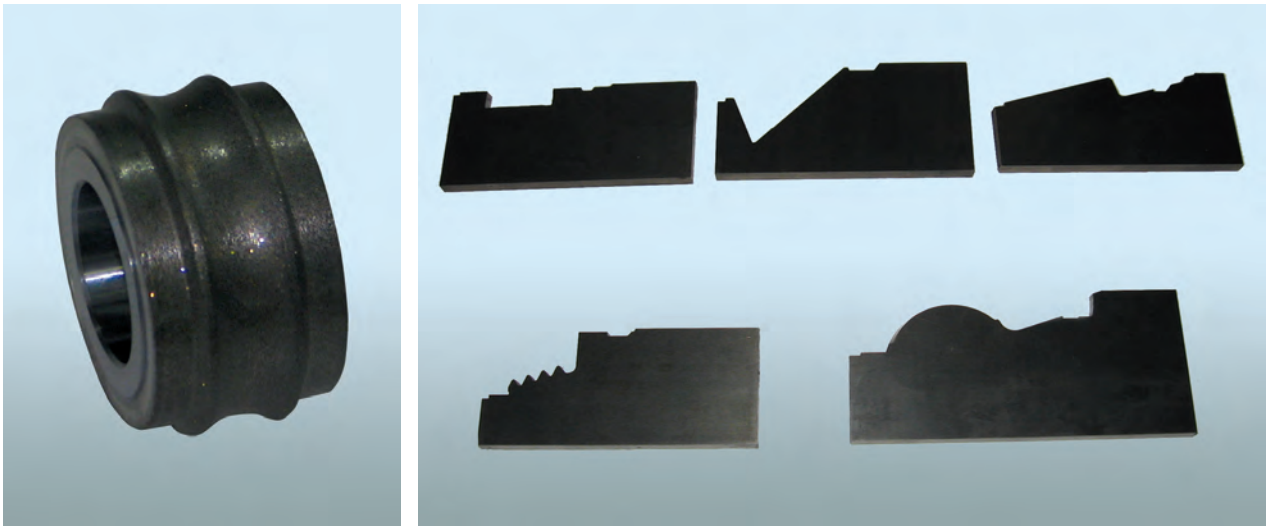
GEOMETRICALLY COMPLICATED DIAMOND DRESS ROLLERS



Geometrically complicated diamond dress roller (left) and profiles obtained with the use of diamond rollers (right)

Areas of Application

Precision diamond dress tool
for profile grinding and polishing operations
in various fields of engineering

Specification

The body parameters: bore tolerance H3;
radial runout tolerance 0.002 mm,
axial runout tolerance 0.002 mm.
The profile parameters:
length tolerance 0.005 mm,
height tolerance 0.002 mm;
cylindricity tolerance 0.002 mm;
linearity tolerance 0.002 mm;
surface profile tolerance 0.002 mm;
dimension tolerance 0.02 mm;
radius tolerance 0.15 mm;
angle tolerance 3′

Advantages

The tool has as good technical
characteristics as the imported counterparts
and is much cheaper

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Manufacture, delivery, warranty service,
and staff training, upon request

IPR Protection

IPR1, IPR3

Contact Information

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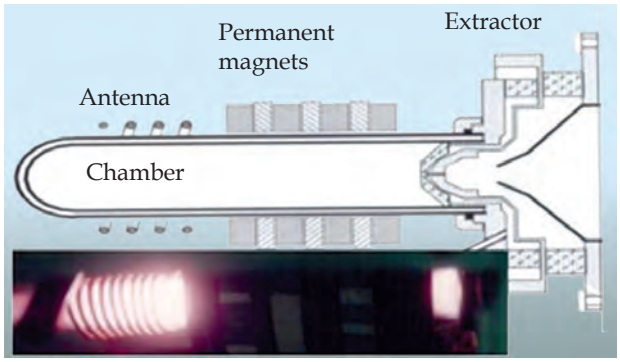
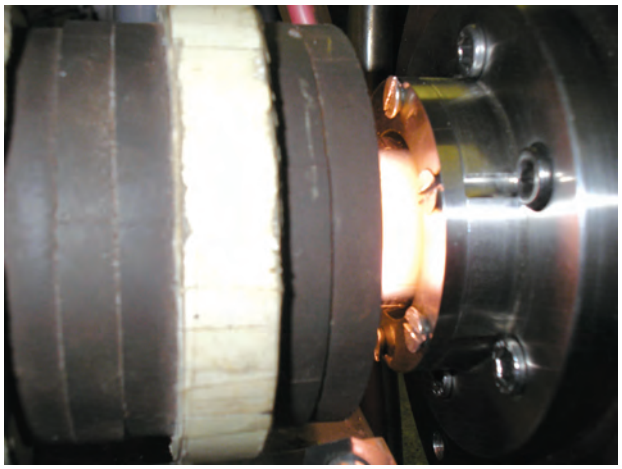
HELICON ION SOURCE



Helicon ion source configuration scheme



Helicon ion source

Areas of Application

The product is to be used in plasma technology for nano- and micro-analytical analyzers, and mass spectrometers with inductively coupled plasma

Specification

Compact plasma generators with magnetic systems on permanent magnets have been developed.

Type of beam ions:	H^+, He^+, Ar^+
Beam brightness, $A/m^2 \cdot rad^2 \cdot eV$	300
Plasma concentration, cm^{-3}	$n \sim 10^{13}$
Operating gas pressure, mTorr	10
RF power consumption, W	<300

Advantages

The ion sources consume ten times less power under the same parameters of ion current, as compared with the existing analogs. High plasma density in the source is reached due to the creation of effective RF discharge enhanced by external magnetic field

IPR Protection

IPR3

Stage of Development. Suggestions for Commercialization

IRL5, TRL4
Single-piece manufacture and maintenance, upon request

Contact Information

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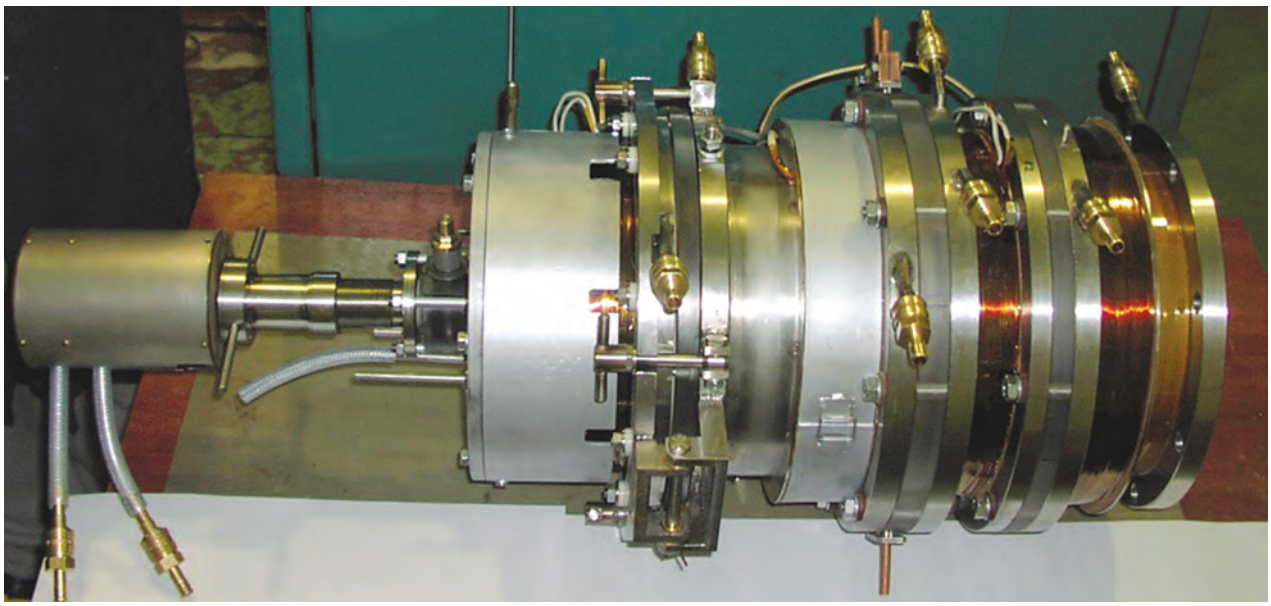
HIGH-PERFORMANCE LINEAR VACUUM ARC CATHODE PLASMA SOURCE WITH MACROPARTICLES FILTRATION



Areas of Application

The device is to be used for application of functional coatings to elements of machines and mechanisms in machine-building, instrument engineering, textile, aviation, and chemical industries, optical engineering, and electronics

Advantages

Effectiveness and degree of macroparticles separation from plasma are 1.5—2 times higher than those of existing analogs; uniform thickness of coating over large surfaces; surface polishing after coating deposition is not required; stability of the source parameters does not depend on cathode burnout; simple configuration

IPR Protection

IPR3, IPR5

Specification

Multicomponent wear resistant coatings based on nitrides, carbides, oxides or their mixes. Optically transparent, dielectric, chemically inert, biologically inert, and decorative coatings.

Output ion current (at an arc current of 100 A), A	5
Coating diameter, is 180 mm at a thickness tolerance, 180%	±5
Ti coating deposition rate at a distance of 150 mm from the exit filter, μm/h	20

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
License sale; manufacture upon request; joint development of coating deposition technology

Contact Information

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HIGH-PERFORMANCE MACHINES FOR ELECTRON-BEAM WELDING OF CRITICAL STRUCTURES

Specification

Welded materials: steels, high-tensile and heat-treated alloys, non-ferrous and light alloys, reactive and refractory alloys.

Vacuum chamber volume, m^3	0.2—100
Vacuum chamber evacuation time, min	3—20
Chamber operating vacuum, mm Hg	2×10^{-4}
Welded metal thickness, mm	0.5—200
Power of generating units, kW	6—120
Accelerating voltage of power generating units, kV	60—120

Areas of Application

The machines are designed for welding assembly units in aerospace industry, power and chemical engineering, instrumentation and medicine and for implementing the technology for electron-beam repair of assembly units of aircraft engines and gas turbines

Advantages

The machines have an intra-chamber mobile electron-beam gun with 3—5 degrees of freedom and positioning accuracy of, at least, 0.08 mm. The box-structured walls and doors of the vacuum chamber provide a twice higher inertia moment at the same thickness. The machines are controlled using distributed computer systems

Stage of Development. Suggestions for Commercialization

IRL9, TRL9
Manufacture, commissioning, warranty and post-warranty maintenance of electron-beam equipment are provided in accordance with customer's specifications and intended use of the product

IPR Protection

IPR1

Contact Information

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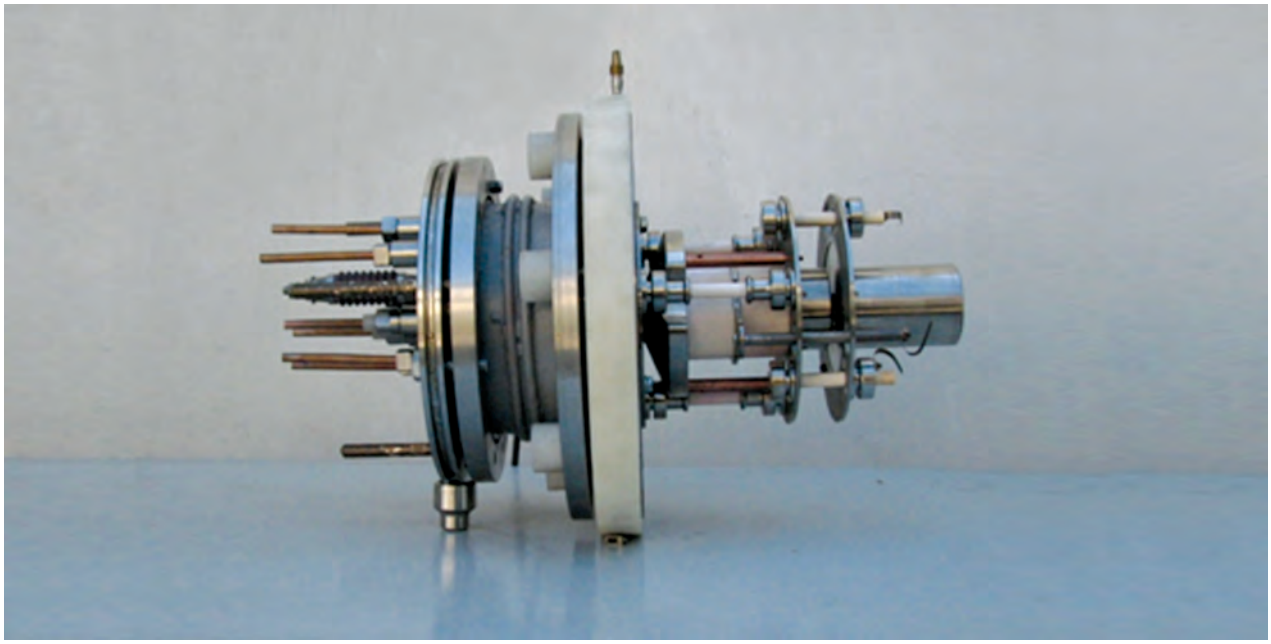
HIGH-PERFORMANCE SOURCE OF MULTIPLY CHARGED METAL IONS



Areas of Application

The device is to be used for ion implantation of materials with single/double-charged metal ions (Be, Fe, Cr, Ni, Zr, Mo, W, etc.) and simulation studies of ion irradiation effects on construction materials of nuclear and thermonuclear industry

Specification

Ions	Be, Fe, Cr, Ni, Zr, Mo, W
Ion current, μA	10—200
Ion energy, keV	30
Ion charge	+1, +2
Power consumption, W	1000

Advantages

The metal ion source enables to generate beams of single- and double-charged metal ions based on ion-plasma sputtering.
The technique applied for creation of operating environment enables forming an atomic concentration and a high-density plasma of almost all metals (Be, Fe, Cr, Ni, Zr, Mo, W and others) without high-temperature heating of the source

IPR Protection

IPR1, IPR2

Stage of Development. Suggestions for Commercialization

IRL3, TRL4
Manufacture of single samples by ourselves or jointly with potential partners

Contact Information

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HIGH-PRESSURE ELECTROLYZER

Specification

Power consumption to produce 1 m^3 hydrogen and 0.5 m^3 oxygen, kW · h	4.0—4.1
Gas pressure, MPa	15.0—20.0
Efficiency, %	75—77
Hydrogen yield, m^3	1.0—6.0
Oxygen yield, m^3	0.5—3.0
Water consumption for generation of 1 m^3 hydrogen, g	840 ± 20

Advantages

The electrolyzer generating the gases at a pressure up to 20.0 MPa, there is no need to use the compressor technique; no need to use rare-earth and platinum group metals for activation of electrodes materials; its energy transformation factor is by 12—15% higher than that of the existing analogs; operates in the automatic mode

Areas of Application

The device is designed to produce high-purity hydrogen and oxygen by the water electrolysis method. The electrolyzer can be used in power engineering, chemical, metallurgical, and food industries, etc.

IPR Protection

IPR1, IPR3

Stage of Development. Suggestions for Commercialization

IRL7, TRL6
Customized manufacture, delivery, and designer's supervision, upon request

Contact Information

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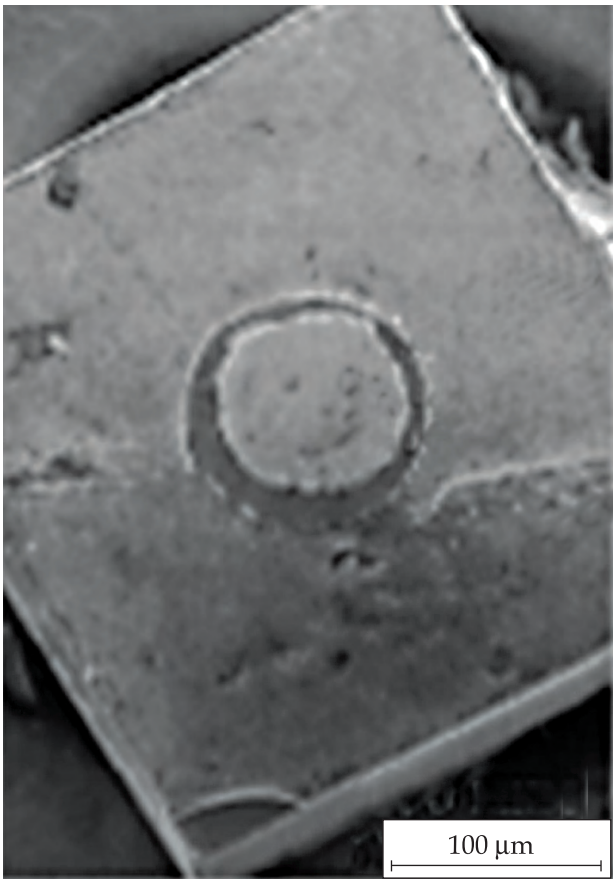
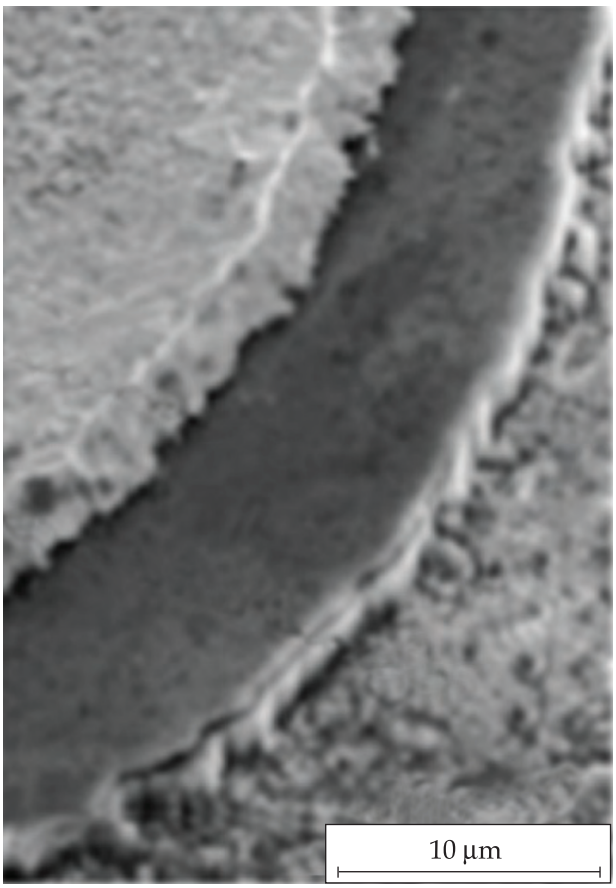
HIGH-SPEED DIODE





Areas of Application

To switch signals in microwave devices

Specification

The *p-i-n* type diode is based on carbide-silicon mesostructured; switches microwave signals with a power up to 2 kW. The diodes can operate at a temperature up to 500 °C.
The diode reverse voltage is 630 V, at a room temperature, and 250 V, at 500 °C

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufacture and supply in cooperation with *Orion* R&D Institute

Advantages

The diode surpasses the foreign counterparts in capacity and operating temperature

IPR Protection

IPR1

Contact Information

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IVA-T AERODYNAMIC AIR IONIZER

Areas of Application

The device is designed to form required concentrations of negative and positive ions with a given degree of unipolarity, in enclosed space. It can be used for air ionization chambers in incubators, buildings for livestock, and farm houses, etc.

Specification

Output ionization current is, at least, 50 nA

Stage of Development. Suggestions for Commercialization

IRL6, TRL8
Manufacture, delivery, warranty service, and staff training, upon request

Advantages

Easily operable; the service life is over 8 years; environment friendly; high-performance; due to the mentioned advantages surpasses the ionizers of other types

IPR Protection

IPR3

Contact Information

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JET GRINDING OF LOOSE MATERIALS WITH ACOUSTIC MONITORING

Areas of Application

Fine and superfine jet grinding of materials with different physical properties for ore processing, metallurgy, chemical industry, construction works, and food industry

Specification

Grading of material to be ground: less than 3.5 mm; achievable fineness is 5 μm; ongoing monitoring of product quality and control of grinding process to raise its efficiency. The designed technology and business component are adaptable to customer technical requirements

Advantages

There are no counterparts in Ukraine. Enables opening minerals without excessive grinding, improving the quality of concentrate in the course of enrichment of ground product, and monitoring fine and superfine grinding in order to ensure that the final product is free of impurities

Plant prototype

IPR Protection

IPR3

Stage of Development. Suggestions for Commercialization

IRL5, TRL4
Services and comprehensive marketing analysis, consultations, trial grinding of materials, upgrade of existing manufacture, upon request

Contact Information

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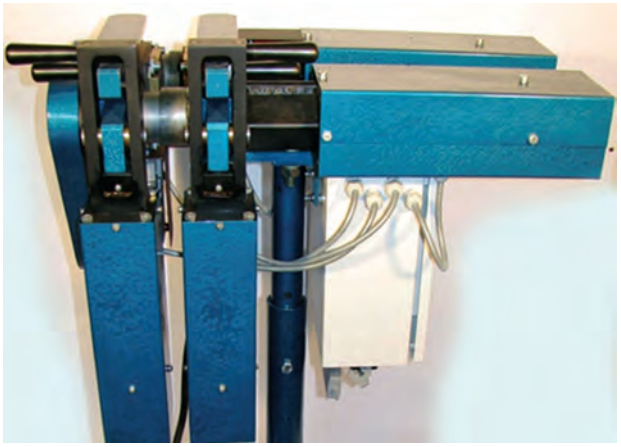
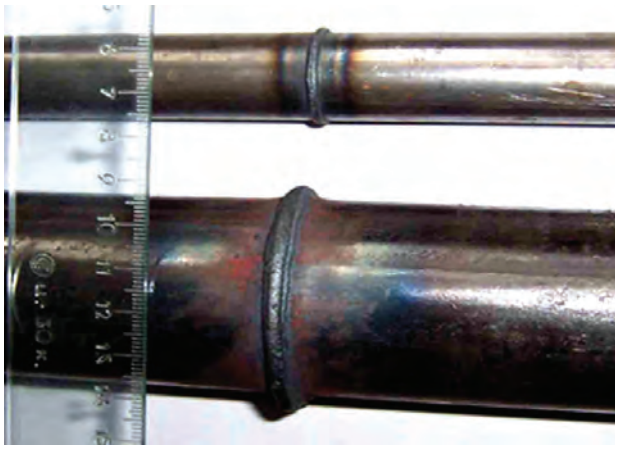
MD1 MOBILE MACHINE FOR PRESSURE PIPE WELDING



MD1 mobile machine



Weld joints , ∅25 × 2 mm, ∅42 × 4 mm

Areas of Application

The machine can be used for gasification of villages, construction of pipelines, and soil stabilization systems; for welding of pipes with fittings, plugs, sleeves, shafts, etc.; for welding of air ducts of railway wagons

Types of weld joints

Specification

Maximum pipe diameter, mm	76
Maximum welding force, kN	40
Supply voltage, V	220
Power consumption, kW	50
Weight, кg	90
Overall dimensions, mm	800 × 600 × × 400

Advantages

Steel pipes are welded in air environment. The mechanical properties of weld joints match those of the base metal welded. No need for qualified welders. Welding consumables and protective gas are not used. No metal stuck to the pipe inner surface. Precise control of upsetting allowance. Control and record of basic parameters while welding. Time of welding ∅42 × 4 mm pipe is 14 s

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Manufacture, supply, warranty service, and staff training, upon request

IPR Protection

IPR3

Contact Information

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MD205 MACHINE FOR PRESSURE PIPE WELDING

Hydraulic cylinder body, ∅110 × 7.5 mm

Weld joint, pipe ∅120 × 7 mm

Areas of Application

The machine can be used for construction of gas, oil, and water pipelines; for welding of pipes with fittings, plugs, sleeves, shafts, etc.; for welding of hydraulic cylinder housings

Specification

Maximum pipe diameter, mm	220
Maximum welding force, kN	300
Supply voltage, V	380
Power consumption, kW	130
Weight, кg	1500
Overall dimensions, mm:	1500 × 990 × × 1200

MD205 machine

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Manufacture, supply, warranty service, and staff training, upon request

IPR Protection

IPR3

Advantages

Steel pipes are welded in air environment. Mechanical properties of welded joints match those of the base metal welded. No need for qualified welders. Welding consumables and protective gas are not used. No metal sticking to the inner surface. Accurate control of allowance during pipe upset. Control and record of basic parameters while welding.
Time of welding 120 × 7 mm pipe is 27 s

Contact Information

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MULTIELEMENT LASER RADIATION RECEIVER

Areas of Application

The device is designed to measure energy distribution in cross sections of powerful laser radiation beams

Advantages

The use of ceramic materials resistant to powerful laser radiation for the receiving components and special semiconductor material for the thermopiles enables to cover the energy range from $5 \cdot 10^{-2}$ to 50 J/cm^2

IPR Protection

IPR3

Specification

Spectral range, μm	0.4—11.0
Pulse duration, s	10^{-3}—$5 \cdot 10^{-9}$
Energy range, J/cm^2	$5 \cdot 10^{-2}$—50
Elementary platform area, mm^2	1×1—16×16
Conversion ratio, mV/J	≥100
Time of keeping the measurement results at the level of 0.99 maximum amplitude, s	≥0.1
Period between two measurements, s	≤5.0

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufactured and supplied, upon request

Contact Information

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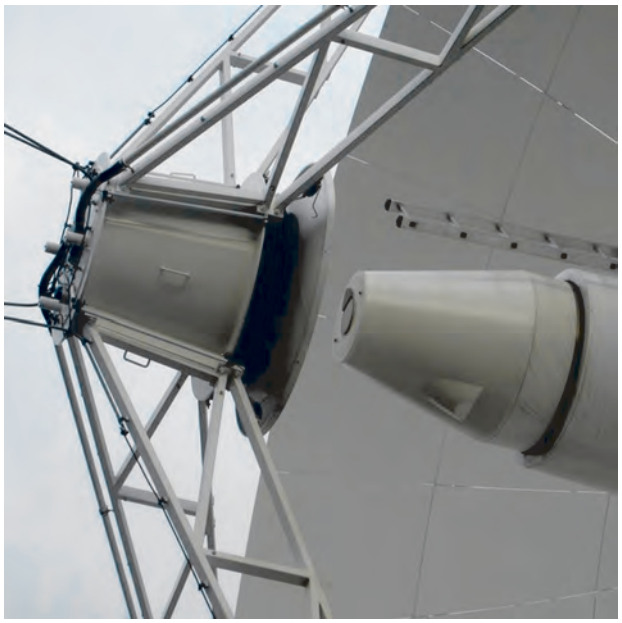
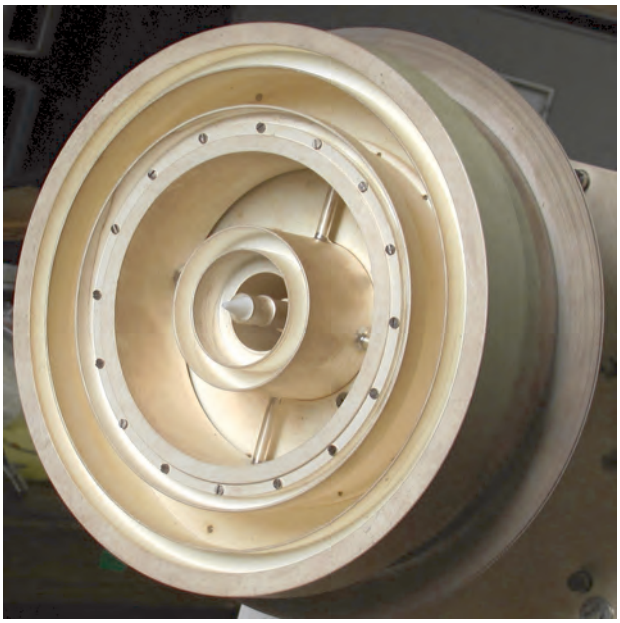
MULTIFREQUENCY REFLECTOR FEED FOR CRYOGENIC RECEIVING FOCAL UNITS OF RADIO TELESCOPES



Reflector feed



Aperture node

Areas of Application

Irradiation of VLBI2010-compatible radio telescope reflector antennas

Specification

Beam pattern width at operating circular polarization of –16 dB is 130° ± 5°; beam pattern level at cross circular polarization does not exceed –22 dB with respect to the beam pattern level at operating polarization along the feed axis; phase deviation of integrated beam pattern in the sector ±65° with respect to feed phase center does not exceed 20°; return loss does not exceed 20 dB

Advantages

Unlike the analogs in CIS countries, this device employs a new configuration of the S-band feed, which provides desired operating frequency range and beam pattern width in the S-band; uses a multilayer infrared filter and a vacuum window specially designed to provide a desired low level of return loss in the three S/X/Ka bands of the feed; uses a ring that absorbs radiation, which addresses the problem of raising cross radiation in the Ka band

Stage of Development. Suggestions for Commercialization

IRL5, TRL5
Manufacture of device and equipment of radio telescopes, upon request

IPR Protection

IPR1

Contact Information

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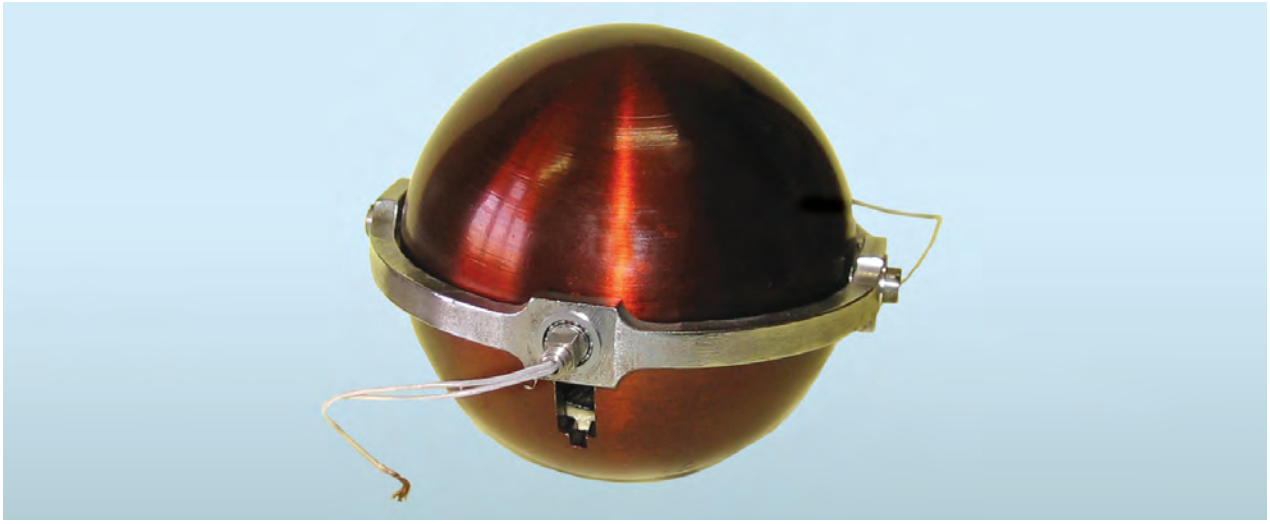
+38 057 315 20 09, e-mail: logvinov@ire.kharkov.ua

MULTIPLE MAGNETOELECTRIC SYSTEMS (MMS)



Double motor for surveillance system

Areas of Application

MMS is designed to orient moving elements of systems for surveillance, target location, and guidance used in military and space equipment

Specification

The triple motor system:	
outer diameter, mm	≤70
stabilized rotor speed, rpm	≤10000
Rotor slope relative to transverse axes, deg	≤ ±30
The double motor system:	
outer diameter, mm	≤150
rotor angular range, deg	≤ ±60
slope of torque curve, Nm/A	≤1

Advantages

The MMS can be a substitute for combination of two or three conventional electric motors. Having the same dimensions and energy consumption the MMS possesses a 3—5 times higher electromagnetic moment and 7—20 times higher speed as compared with the conventional combination. These advantages are achieved due to the full employment of device volume for placing the electromagnetic core, a decrease in inertia moments of the intermediate moving elements, and an increase in electromagnetic torque

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Customized design, manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR3

Contact Information

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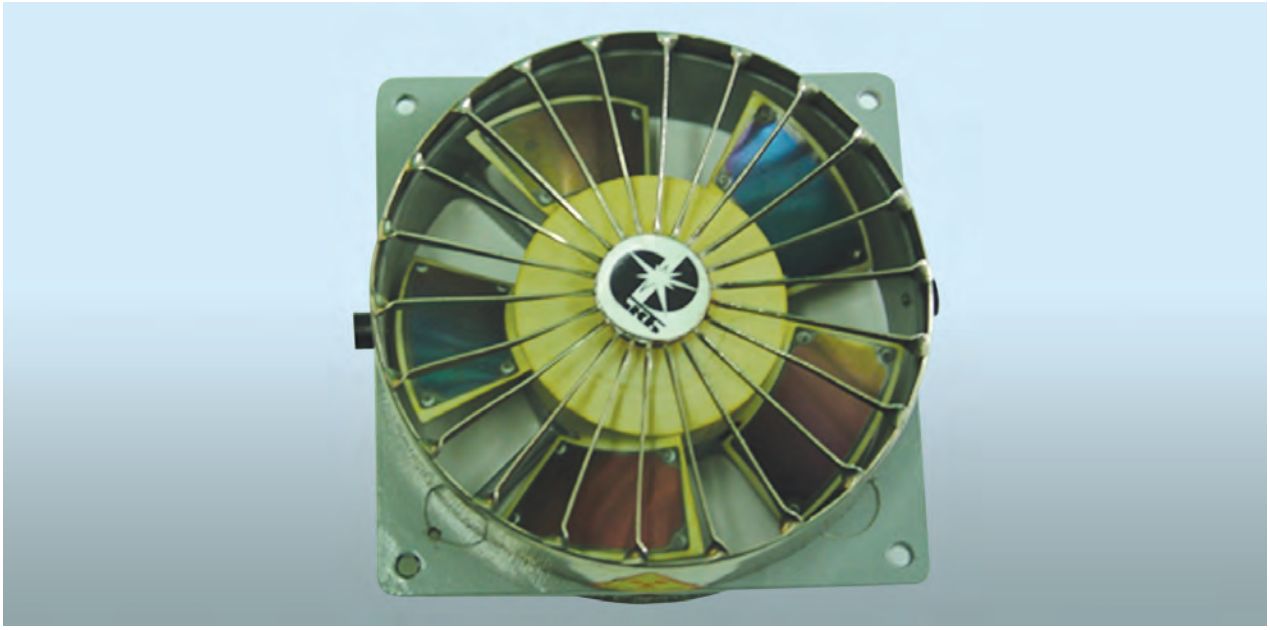
NTAD-TYPE TRITIUM AERODYNAMIC STATIC ELECTRICITY NEUTRALIZER



Specification

Output ionization current, mA	≥50
Total activity of installed sources, TBq (Ci)	0.296 – 0.555 (8 – 15)
Power supply, V	220^{+22}_{-33}
Power consumption, W	≤18
Current, mA	≤95
Dimensions, mm:	
length	≤130
width	≤133
height	≤50
Weight, kg	≤0.75
Service life, years	8

Areas of Application

The aerodynamic neutralizer is designed to remove electrostatic charges from photosensitive materials in the places where passive neutralizers cannot be installed for technical reasons

Stage of Development. Suggestions for Commercialization

IRL6, TRL8
Manufacture, delivery, warranty service, and staff training, upon request

Advantages

The device is high-performance, compact, easy-to-use, and reliable; has a long-term service life and a wide application scope, is cost-effective and environment friendly

IPR Protection

IPR1, IPR2

Contact Information

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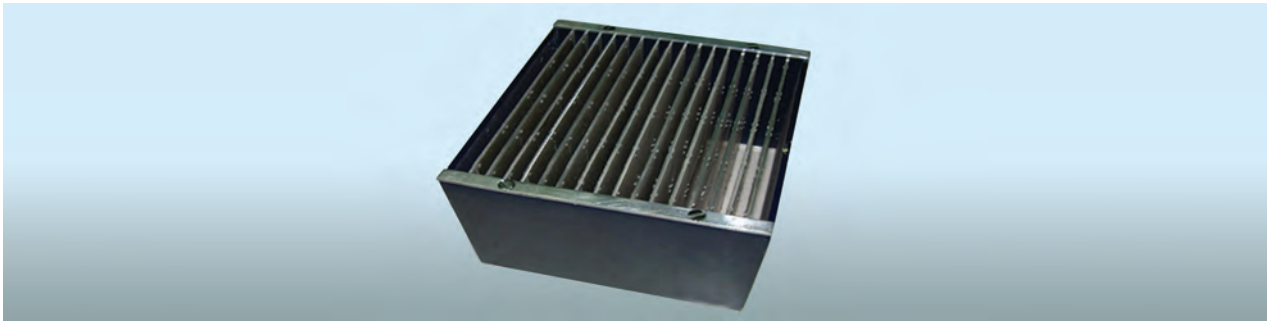
NTP-TYPE TRITIUM BLOW STATIC ELECTRICITY NEUTRALIZER



Specification

Parameters	NTP neutralizer version		
	NTP-8	NTP-16	NTP-24
Output ionization current, mA	≥25.9	≥51.9	≥77.8
Total activity of installed sources, TBq (Ci)	≤10.84 (293)	≤21.70 (586)	≤32.51 (879)
Dimensions, mm:			
length	≤56	≤96	≤136
width	≤146	≤146	≤146
height	≤194	≤194	≤194
Service life, years	8	8	<8

Areas of Application

The neutralizer is designed to remove electrostatic charges that appear while handling electrifiable loose bulk materials

IPR Protection

IPR1, IPR2

Advantages

The device is high-performance, self-sufficient (unlike the high-voltage and induction devices), compact, easy-to-use, and reliable;
has a long-term service life and a wide application scope; is operable in fire-exposed and explosive environments, cost-effective and environment friendly; does not require power supply sources

Stage of Development. Suggestions for Commercialization

IRL6, TRL8
Manufacture, delivery, warranty service, and staff training, upon request

Contact Information

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+38 044 525 26 14, e-mail: akovalenko@kinr.kiev.ua

NTSE-TYPE TRITIUM STATIC ELECTRICITY NEUTRALIZER

Areas of Application

The neutralizer is designed to remove electrostatic charges that appear on film and sheet-like materials, fabrics, paper, etc.

Specification

The neutralizer is configured as case covered with protective mesh, which contains boards with BITR-M type tritium sources of beta radiation fixed on them (TU U 05540132015-97). The ionization current from work surface of NTSE-1…-50 neutralizer (the digits show the number of sources) is, at least, 0.216—10.81 μA. The designed service life is 8 years

Advantages

The device is high-performance, self-sufficient (unlike the high-voltage and induction devices), compact, easy-to-use, and reliable; has a long-term service life and a wide application scope; is operable in fire-exposed and explosive environments, cost-effective and environment friendly; does not require power supply sources

Stage of Development. Suggestions for Commercialization

IRL6, TRL8
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1, IPR2

Contact Information

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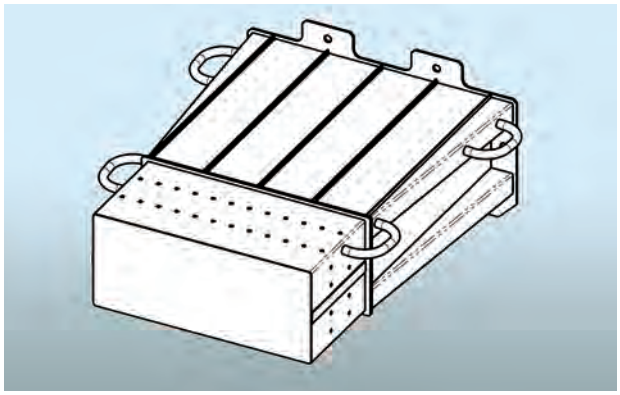
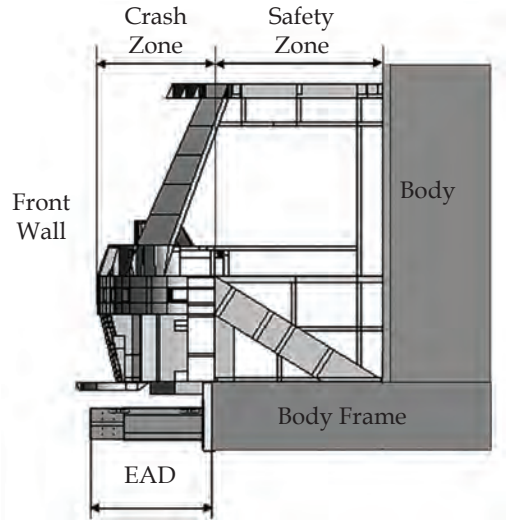
PASSIVE SAFETY SYSTEM FOR PASSENGER TRAINS



EAD configuration

EP20 locomotive with designed PSS



Locomotive driver cabin with PSS elements

Areas of Application

The passive safety system (PSS) is designed to protect the train passengers and crew and to minimize severe consequences of railroad accidents due to controllable deformation of the replaceable energy absorption devices (EAD) and the train crash zone

Specification

The use of PSS enables to ensure the train safety at a 36 km/h velocity of collision with similar train or with 80-ton freight train and at a 72 km/h velocity of collision with an obstacle lighter than 10 tons at the railway crossings. The PSS has a working stroke of 300—700 mm and an energy absorption capacity of 0.3—1.1 MJ for passenger carriages and locomotives

Stage of Development. Suggestions for Commercialization

IRL9, TRL9
Simulation, design, and calculation of parameters for EAD and driver cabin, upon request

IPR Protection

IPR3

Advantages

There are no counterparts in Ukraine and in the countries using 1520 mm track gages. The use of PSS enables to ensure the train safety at a collision velocity up to 36 km/h

Contact Information

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PLASMA CHEMICAL REACTOR WITH CONTROLLABLE ION ENERGY

Areas of Application

The device is designed
for precision processing
of micro- and nanoelectronics,
UHF and computing appliances

Specification

Controllable ion energy ranges
from 20 to 800 eV. Can process plates
with a diameter up to 200 mm.
Anisotropic etching rate, μ/min:
Si — 0.7; W — 0.2; Au — 0.03; Al — 0.4;
SiO_2 — 0.2; SiC — 0.15; Ti — 1.0;
Pt — 0.015; Ge — 4.0; GaAs — 0.1;
$Si3N_4$ — 0.2; TiN — 0.2; GaN — 0.07.
Isotropic etching rate, μ/min:
GaAs — 0.5; one Si plate — 3.
Operating pressure ranges
from 10^{-3} to 10^{-1} mm Hg.
Etching anisotropy — 10.
Etching unevenness — ±5 %.
Magnetic field strength: 20—200 E

Advantages

The device has no counterparts.
A technology for plasma chemical etching
of the majority of materials used
in various microcircuits and chips,
including silicon carbide and gallium nitride,
and other nano- and microstructures
has been developed

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufactured, delivered,
and serviced within the warranty period,
upon request

IPR Protection

IPR1

Contact Information

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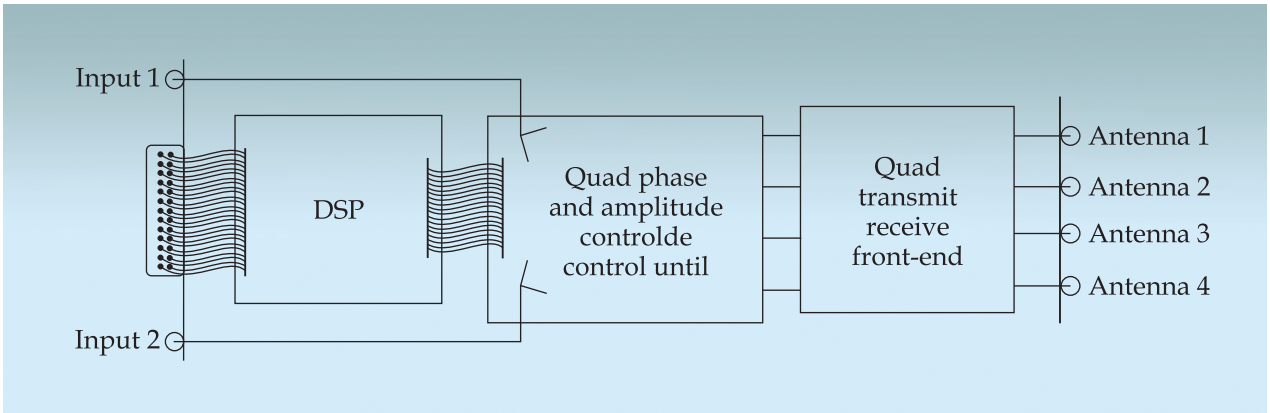
QUAD X-BAND TRANSMIT RECEIVE MODULE



Block-diagram of module

Areas of Application

The transmit receive module
is to be used in antenna phased arrays;
enables to develop both 1D and 2D arrays

Specification

Operating frequency range, GHz	9—10
Peak input power, W	2
Receiver noise factor, dB	3
Phase control range and resolution	0°—360°; 6 bit; 5.625°
Attenuation range and resolution	24 dB; 7 bit; 0.25 dB
Supply voltage, V	+28; +6; –6

Stage of Development. Suggestions for Commercialization

IRL8, TRL7
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1

Module appearance

Advantages

Embedded DSP and FPGA available for user programming; built-in circuits for safe module operation; separate programmable control input and possibility to pre-set several user-defined phase and amplitude profiles enable fast beam scanning; array dimension is scalable by adding modules without reconfiguration of the control circuits; ITAR free design; use of integrated GaN solid power amplifiers; the module enables fully unmatched operation; half-duplex RS-485 interface for control and monitoring

Contact Information

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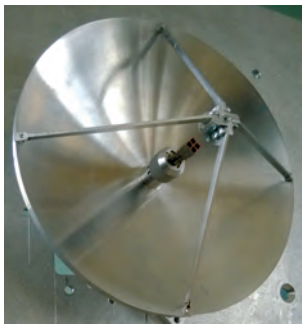
REFLECTOR AND OTHER TYPES OF ANTENNAS



Ka-band Cassegrain antenna (1 m diameter, 49 dBi, 0.6 × 0.6°, SLL<–18, 2 polarizations) (left) and W-band Cassegrain antenna (0.2 m diameter, 40 dBi, 1 × 1°, monopulse) (right)

Areas of Application

Weather radars, etc

Specification

Frequency range from 1 to 100 GHz; customized configuration

Advantages

The Cassegrain dual reflector antennas produce axially-symmetric beam with a high gain within a relatively wide frequency band. The antennas can be equipped with orthomode transducer for polarimetric application or configured for monopoles operation; various types of the horn antennas produce stable and well-reproducible antenna pattern; the broadband (0.4—18 GHz) omnidirectional coverage combined antenna system is used in advanced

Omnidirectional coverage broadband antenna system (0.4–18 GHz)

Stage of Development. Suggestions for Commercialization

IRL8, TRL7
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1

Contact Information

Dmytro M. Vavriv, Institute of Radio Astronomy of the NAS of Ukraine;
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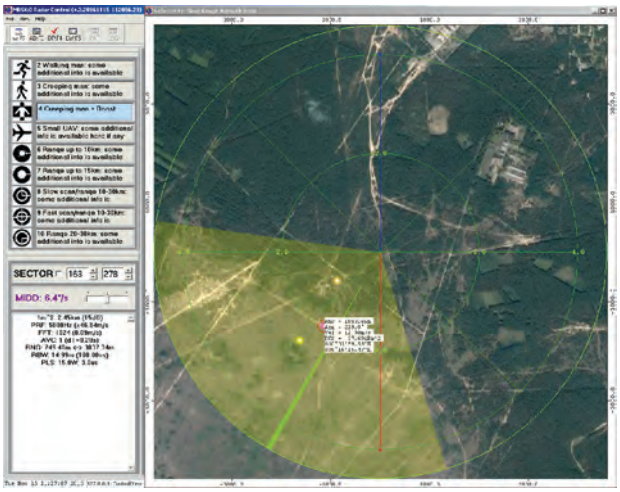
RLS-**X**1-**M** *OKO* PERIMETER SURVEILLANCE RADAR



User interface: data view and radar control

Specification

Instrumental range, km	0.3—30
Antenna type	waveguide slotted
Peak power, W	30 °
Elevation span	20 °
Azimuth scanning	360
Scan rate (max), deg./s	90
Targets coordinates	azimuth-range
Azimuth accuracy	1 °
Range accuracy, m	5
Radial velocity accuracy, m/s	0.1
Min. detectable radial velocity, m/s	0.2
Max. radial velocity, m/s	60
Coordinate system	WGS-84 or polar
Dimensions, m	1.2 × 0.5 × × 0.75
Weight, kg	65
Power consumption (max), W	300

Sensitivity

Target with typical RCS	Detection range provided by SNR>15dB, km
UAV, 0.01 sq. m	7
Man, 0.5 sq. m	18
Car, airplane, 1 sq. m	25

Areas of Application

The radar is designed to detect low-speed ground targets in the clutter environment; to detect UAVs with a low radar cross section (RCS) at low heights; to determine 2D coordinates (range, azimuth) of the targets, RCS, radial velocity, and Doppler spectrum moments

Advantages

Capability of detecting small-sized and slowly moving targets in the conditions of strong terrain echo; radar can be mounted on the mobile platform (car, track, trailer etc.)

Stage of Development. Suggestions for Commercialization

IRL8, TRL7
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1

Contact Information

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SIMULATION TESTS OF REACTION HYDROMACHINES AT ENERGY-CAVITATION TRIAL STANDS

Areas of Application

The hydromachine laboratory includes two closed hydrodynamic trial stands ECS-15 and ECS-30 designed for comprehensive experimental research while designing high-performance flow passages of hydromachines; research studies of working process in hydromachines; and for acceptance tests of all types of vertical reaction hydromachines

Specification

The hydrodynamic laboratory stands meet all recommendations of the IEC 60193 international standard.

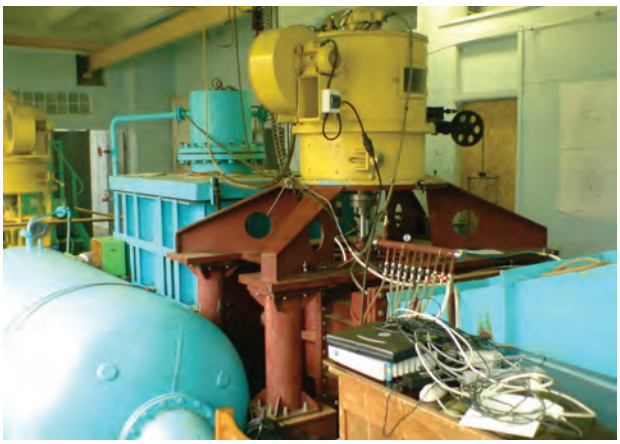
	ECS-15	ECS-30
Diameter of the model rotor, mm	350—380	350—400
Height of lift, m	≤ 12 (15)	≤ 25 (30)
Consumption rate, m^3/s	≤0.56 (≤0.7)	≤0.3 (≤0.5)
Power of DC drive motors of circulating pumps, kW	≤160	≤160
Power of balanced engine, kW	≤200	≤180

Advantages

The hydrodynamic trial stands are unique installations that surpass the existing analogs in Ukraine in terms of all basic indicators

Stage of Development. Suggestions for Commercialization

IRL7, TRL5
Researches and acceptance tests of all types of vertical reaction hydromachines



Model unit of rotary blade hydroturbine PL30 installed on the ECS-15 energy-cavitation trial stand

Installation for testing micro-HPP on the ECS-30 stand

IPR Protection

IPR2

Contact Information

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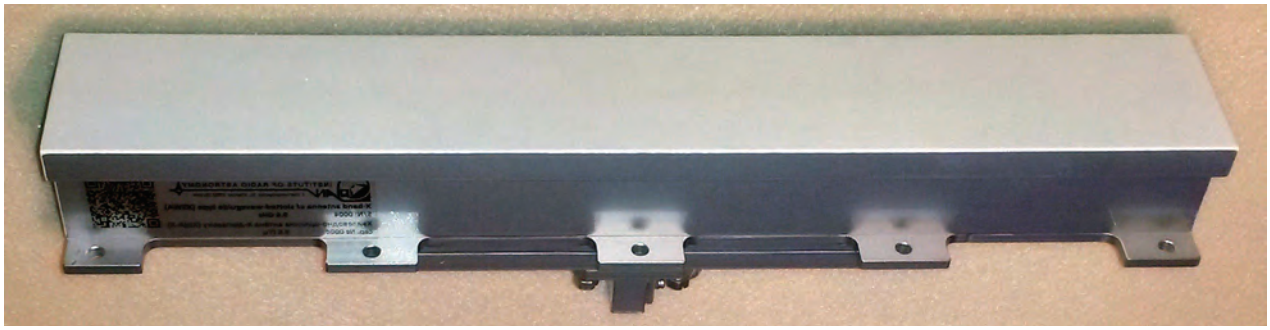
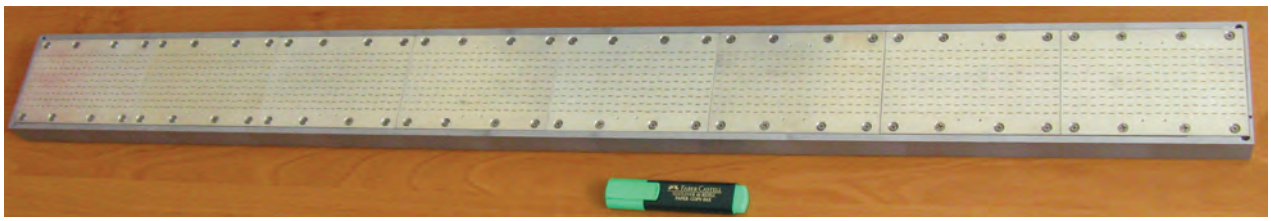
SLOTTED WAVEGUIDE ANTENNAS



X-band slotted horn antenna (21 dBi, 5 × 40°, SLL <–20, radome)



Ka-band slotted waveguide antenna (36 dBi, 0.5 × 10°, SLL <–22)

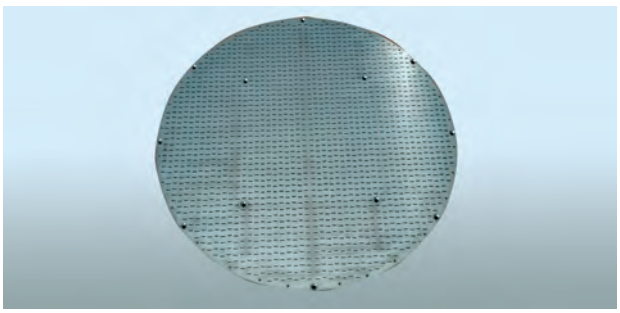
Areas of Application

For ground-based and airborne radars

Specification

The beam shape: pencil (axially symmetric), fan beam, special (cosec, etc.).

Frequency band, GHz	6—40
Operating frequency band, %	<10
Efficiency, %	>90



Ka-band slotted waveguide antenna.
(39 dBi, 1.7 × 521.7°, SLL <–22, monopulse)

Advantages

Compactness and lightness; linear polarization with high cross-polarization isolation; optional low-profile radome; single-axis or dual-axis monopulse configuration

Stage of Development. Suggestions for Commercialization

IRL8, TRL7
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1

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SOUND SUPPRESSORS FOR SMALL GUNS

Conventional sound suppressors

Over-barrel sound suppressors

Areas of Application

To suppress the report noise when shooting from small hand guns (including automatic weapon) and to reduce other negative factors associated with shooting

Advantages

A highly effective suppression of the report noise due to the use of advanced materials and technologies. The sound suppressors are competitive and yield to no foreign counterparts in their qualities

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Manufactured and supplied, upon request

Mechanical sound suppressors

Specification

The devices effectively reduce the noise signature (by 30—36 dB); the most effective are the over-barrel silencers for sniper sets (a report reduction up to 36 dB). The sound suppressor models have been designed for various modifications of 5.45 mm, 7.62 mm submachine guns; 7.62 mm, 8.6 mm sniper sets; 5.45 mm, 5. 56 mm, and 7.62 mm rifles and carbines. Designs: conventional, over-barrel, and mechanical. Material: titanium and aluminum alloys, stainless steel

IPR Protection

IPR3

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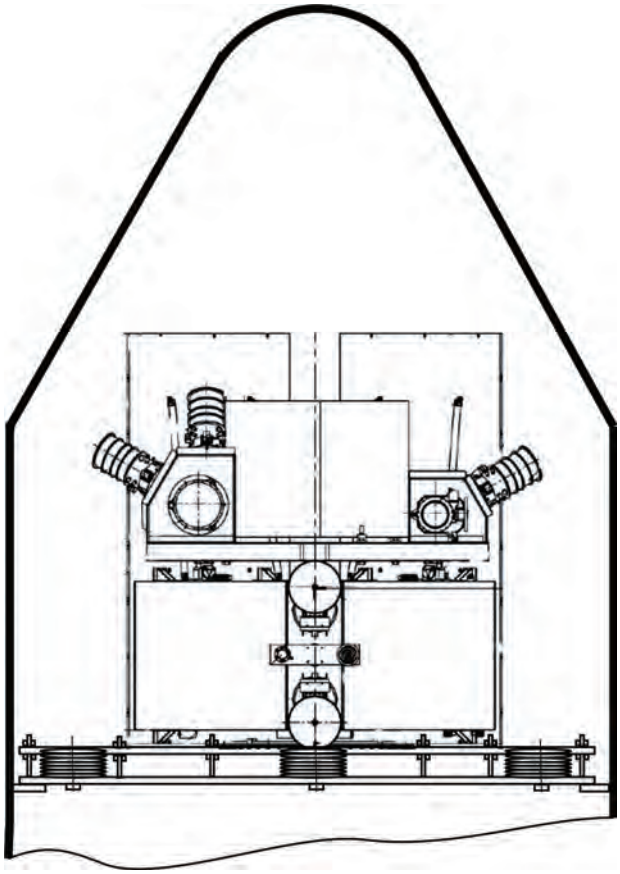
SYSTEM FOR SPACECRAFT PROTECTION FROM LONGITUDINAL VIBRATION LOADS DURING ITS ORBITING



Design layout

Specification

The proposed vibration protection is an autonomous passive system installed between the upper stage of carrier rocket and the spacecraft adapter. Its main element is an elastic dissipative module. One-dimensional motion of the vibroprotective system along the longitudinal axis is ensured by special guide rods

Advantages

The proposed system is lightweight and compact and damps the longitudinal vibrations in a wider frequency range as compared with the known counterparts. It reduces a longitudinal vibration load on Sich-2M spacecraft over twice at a frequency ranging from 5 to 10 Hz and 10 times within the range from 10 to 100 Hz

Areas of Application

The system is to be used for reducing vibration loads on the spacecraft

Stage of Development. Suggestions for Commercialization

IRL2, TRL2
Principal diagram, sketch, and mathematical model of system for spacecraft protection from longitudinal vibration load during its orbiting are proposed

IPR Protection

IPR1

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TECHNOLOGY OF HIGH-STRENGTH RAILWAY WHEEL MANUFACTURE

Areas of Application

Manufacture of steel wheels for rail transport

Specification

The steel composition for railway wheel manufacture and modes of thermal hardening provide the following mechanical properties:

$\sigma_в$, MPa	1170
δ, %	9.8
Ψ, %	14.0
KCU, J/cm^2	30
HB	336

Advantages

The optimal composition of wheel steel and improved heat treatment of wheels ensure a hardness of ≥ 320. The products manufactured using the technology surpass the well-known brands in plasticity and toughness: elongation by 41.5%, contraction by 68%, and impact strength of disc and tread by 70%

Stage of Development. Suggestions for Commercialization

IRL8, TRL8
Terms of reference for railway wheel heat treatment and steel composition

IPR Protection

IPR3

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THERMOELECTRIC AIR CONDITIONER FOR VEHICLES

Areas of Application

The air conditioner is designed to ensure comfortable climate conditions (air conditioning) in various-purpose vehicles. Due to the absence of movable parts and freon-containing cooling agents, these air conditioners are indispensable components in the manufacture of environment friendly air conditioning systems

Specification

Cooling performance (Q_0), kW	≥3.0
Heating performance (Q), kW	≥3.0
Temperature difference (T1–T2) between working and auxiliary circuits, °C	25
Flow rate of fluids in both circuits (G), 1/h	3000
Power consumption from DC power supply, voltage, V	27
Overall dimensions, mm	≤230 × 250 × × 500

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufactured and supplied, upon request

IPR Protection

IPR3

Advantages

The most attractively to employ these air conditioners in the vehicles where power supply, i. e. their power consumption, is not a critical issue. They can be widely used in trolleybus and tram driver cabins, in steamboats, electric trains, and special-purpose vehicles

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THERMOELECTRIC BATTERIES FOR GUIDED MUNITIONS

Areas of Application

The device is designed for power supply to electronic circuits of guided munitions (artillery and aviation projectiles, bombs, and rockets) on the flight path

Specification

Power output, W	0.1—2
Time of response, s	0.2—1
Operation time, s	20—120
Shock resistance, thousand g	5—80
Storage life, years	≥30

Advantages

Ability to generate electric power irrespective of ambient temperature, high speed of response, enhanced reliability under conditions of heavy mechanical and climatic loads, long period of unattended storage

Stage of Development. Suggestions for Commercialization

IRL7, TRL6
Manufactured and supplied, upon request

IPR Protection

IPR3

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THERMOELECTRIC COOLING MODULES FOR SPACE APPLICATION

Areas of Application

The modules are designed for cooling and thermal stabilization of CCD arrays used in attitude control systems of low-orbit and geostationary satellites

Specification

The modules provide thermal stabilization of CCD arrays at –10 °C at a cooling capacity of 0.65 W and an operating temperature of +65 °C. The modules withstand shock loads with a negative acceleration up to 1900 g

Advantages

The designed service life is 20 years.
The thermoelectric modules outperform the known world analogs in key parameters.
There are no analogs in Ukraine.
Due to their high quality and improved reliability, the modules can find application in terrestrial telecommunication systems as well

Stage of Development. Suggestions for Commercialization

IRL7, TRL6
Manufactured and supplied, upon request

IPR Protection

IPR3

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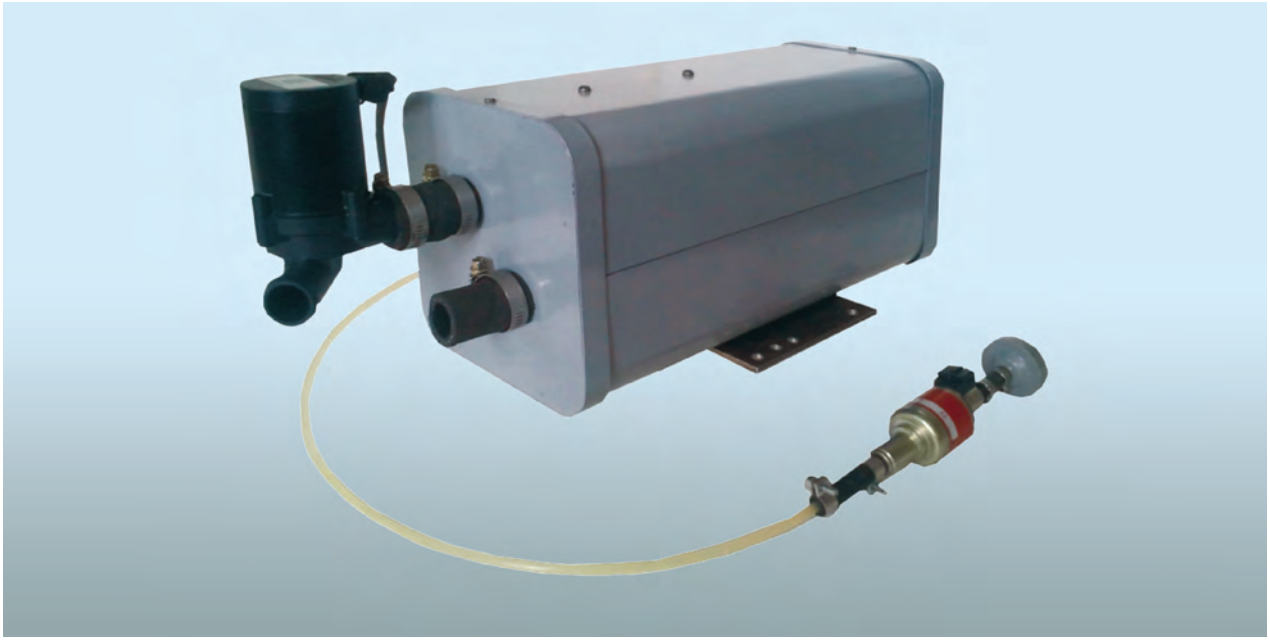
THERMOELECTRIC HEATER FOR VEHICLES



Areas of Application

The device is designed for warming up the engine and heating the passenger compartment at low ambient temperature due to a direct conversion of thermal energy of diesel fuel combustion to electric power. The generated thermal energy is used to warmup the engine and to heat the car passenger compartment, whereas the electric power goes for power supply to heater components and battery recharge

Specification

Thermal power, W	1300—1500
Electric power, W	70—90
Heat carrier heating temperature, °C	30—70
Electric voltage, V	12
Heater weight, kg	8
Overall dimensions, mm	150 × 200 × 390

Advantages

No world analogs, autonomous operation, does not require power storage device. Excessive electric energy of thermal generator enables both recharging the battery and supplying power to the heating equipment

Stage of Development. Suggestions for Commercialization

IRL6, TRL6
Manufactured and supplied, upon request

IPR Protection

IPR3

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THZ QUASI-OPTICAL RADIO MEASURING DEVICES AND CIRCUITS

Some elements of the set

Specification

The elements and circuits are based on oversized low-loss waveguides with dielectric walls and consist of such devices as attenuators, phase shifters, polarization plane rotators, etc. The operating wave is characterized by plane phase front, linear polarization, and axially symmetric amplitude distribution that has a maximum on the waveguide axis and smoothly decreases towards the walls. F = 100—1000 GHz

Areas of Application

This set of quasi-optical elements is to be used for designing radio measuring schemes for plasma diagnostics in radio detection and ranging, industry, spectroscopy, nondestructive testing, and biomedicine, as well as for educational purposes

Advantages

The product has no analogs in Ukraine and abroad

Stage of Development. Suggestions for Commercialization

IRL7, TRL8
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1, IPR3

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TRIPLE-CHANNEL DIGITAL RECEIVER

Areas of Application

The digital receiver performs analog to digital and digital to analog conversions, preprocessing of wideband signals.
It can be used in radars, communications, electronic countermeasure and for high-resolution image acquisition and processing

Specification

Number of ADC channels	3
Input signal bandwidth for ADC channels	
1 channel	400 MHz
2 channels	125 MHz each
Number of DAC channels	1
Frequency bandwidth for DAC channel, MHz	400
Bit capacity 800 MHz ADC, bit	11.2
Bit capacity 250 MHz ADC, bit	6.2
Reconfiguration time for digital receiver, ms	400
Interfaces	2 × RS422, Ethernet 100 Mbit, 20 LVDS GPIO, 28 CMOS GPIO
Memory	2 × 4 MByte, 36 bit QDR SRAM, banks at 250 MHz; 32 kByte FRAM
Dimensions, mm^3	160 × 100 × 22
Weight, g	170
Power consumption, W	25
Operation temperature range, °C	–40…+85

Advantages

Real-time processing of wideband signals with a bandwidth up to 400 MHz;
fast reconfiguration of operating mode;
low jitter clock sources for ADCs and DAC are in the digital receiver;
signal acquisition and processing for similar digital receivers can be synchronized to create multichannel systems

IPR Protection

IPR1

Stage of Development. Suggestions for Commercialization

IRL8, TRL7
Manufacture, delivery, warranty service, and staff training, upon request

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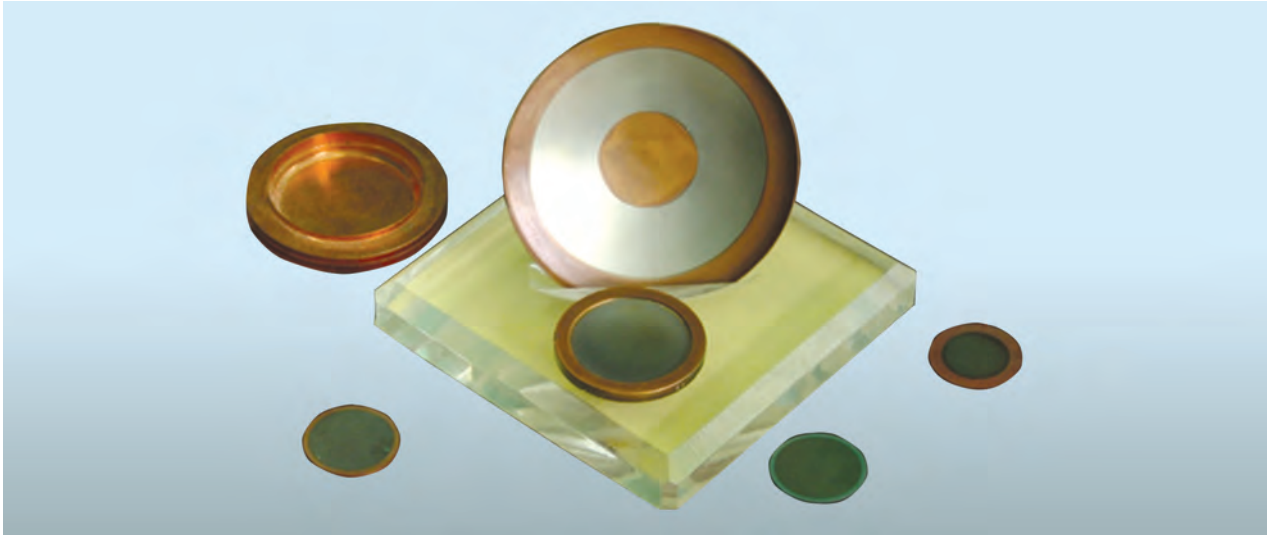
UNIFIED SETS OF MT AND MD TRITIUM AND DEUTERIUM TARGETS



Areas of Application

The devices are designed to obtain neutron fluxes in accelerators of charged particles

Advantages

The targets have as good physical and technical parameters as the best world counterparts and are much cheaper as compared with them

Stage of Development. Suggestions for Commercialization

IRL6, TRL8
Manufacture, delivery, warranty service, and staff training, upon request

Specification

	Norm
Sorbent surface mass density, mg/cm^2	0.25 ± 0.025
	0.50 ± 0.050
	1.00 ± 0.100
	2.00 ± 0.200
	3.00 ± 0.300
Tritium specific activity in the active part of sorbents, GBq/mg (Ci/mg):	
Titan	39.257 ± 5.587 (1.061 ± 0.151)
Scandium	41.829 ± 5.939 (1.131 ± 0.161)
Zirconium	20.646 ± 2.886 (0.558 ± 0.078)
Gaseous deuterium volume absorbed per sorbent mass unit, cm^3/mg:	
Titan	0.410 ± 0.0583
Scandium	0.435 ± 0.0620
Zirconium	0.215 ± 0.0301

IPR Protection

IPR3

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VIBRATION PROTECTION SYSTEM (VPS) OF VEHICLE DRIVER SEAT

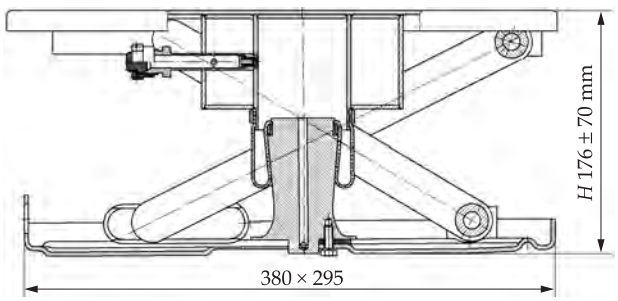
Areas of Application

Protecting the vehicle driver
from shock and vibration loads while driving

Specification

This multipurpose vibration protection system has a quasi-zero rigidity in the effective range of static curve and a progressively increasing rigidity during compression and rebound. The perturbation frequency at which the seat VPS protects the driver from shock and vibration loads varies from 0.50 to 80 Hz. Its dimensions (176 × 380 × 295 mm) enable to install it in confined space of vehicles

Driver seat with vibration system installed



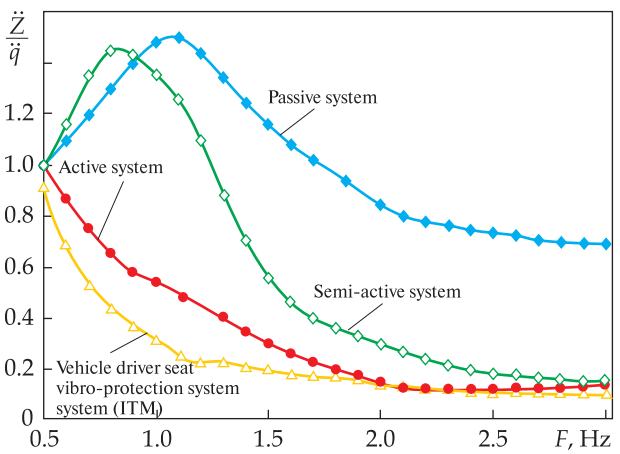
General configuration of driver seat
with vibration system installed

Advantages

Passive vibration protection system;
no independent shock absorbers;
no air preconditioning system.
The dynamic characteristics match and, in some cases, surpass those of world passive, semi-active, and active vibration protection systems

Stage of Development. Suggestions for Commercialization

IRL7, TRL4
Customized manufacture; seeking partners for mass production



Dynamic parameters of VPS for vehicle driver seat as compared with those of the best world passive, semi-active, and active counterpart systems.
$\ddot{Z}$ — vibration acceleration transmitted to driver,
$\ddot{q}$ — perturbing vibration acceleration

IPR Protection

IPR3, IPR4

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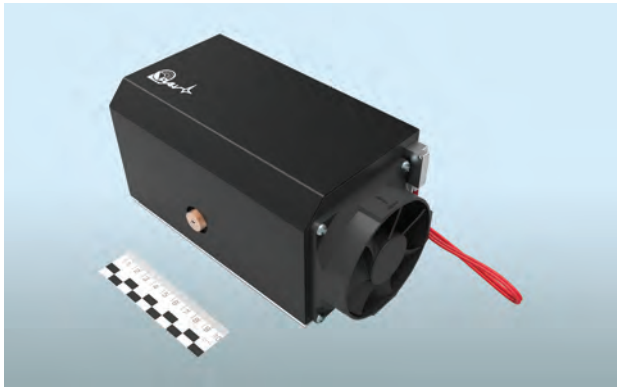
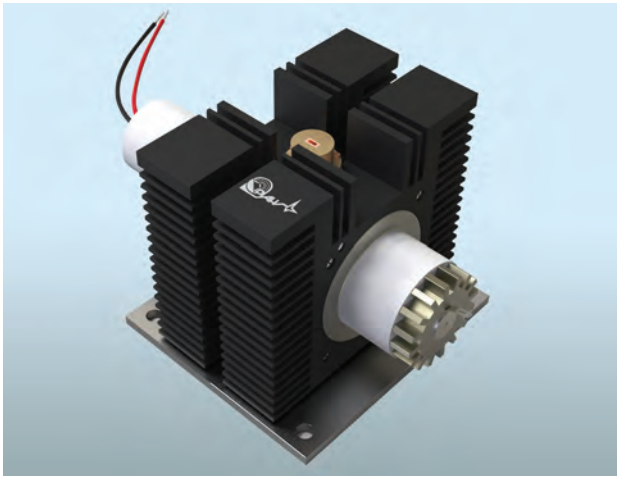
W-BAND MAGNETRONS





95 GHz W-band magnetron with a 1 kW power output

Areas of Application

Radar transmitters and plasma diagnostics

Specification

Parameters	AM310/1-1	AM310/3-1	AM310/10-1
Peak power, kW	1.0	3.0	12.0
Peak anode voltage, kV	6	10	15
Peak anode current, A	4.5	10	17
Frequency, GHz	94.0—95.5	94.0—95.5	94.0—95.5
Filament voltage, V	1.1	2.5	2.6
Filament current, A	3.8	4.0	4.3
Pulse duration, ns	50—100	50—200	100—200
Duty cycle, max, %	0.1	0.1	0.1
Lifetime, h	5000	5000	5000
Weight, kg	0.6	1.4	1.8
Dimensions, mm	135 × 70 × 70	150 × 95 × 88	200 × 95 × 87

Advantages

Highly stable, low-jitter RF pulsed source; platinum cold secondary-emission cathode; samarium-cobalt magnets; high peak and average power

Stage of Development. Suggestions for Commercialization

IRL8, TRL7
Manufacture, delivery, warranty service, and staff training, upon request

IPR Protection

IPR1

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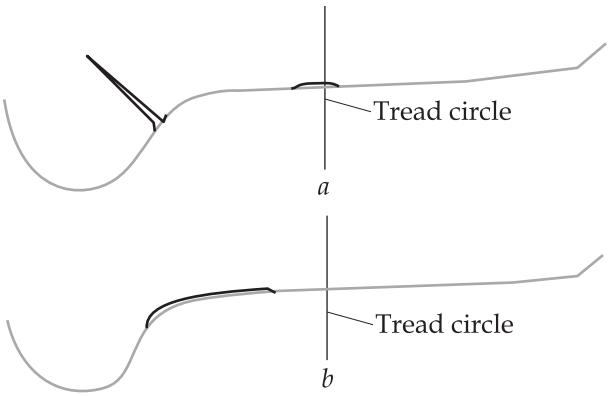
WEAR-RESISTANT RAILWAY WHEEL RIM PROFILE



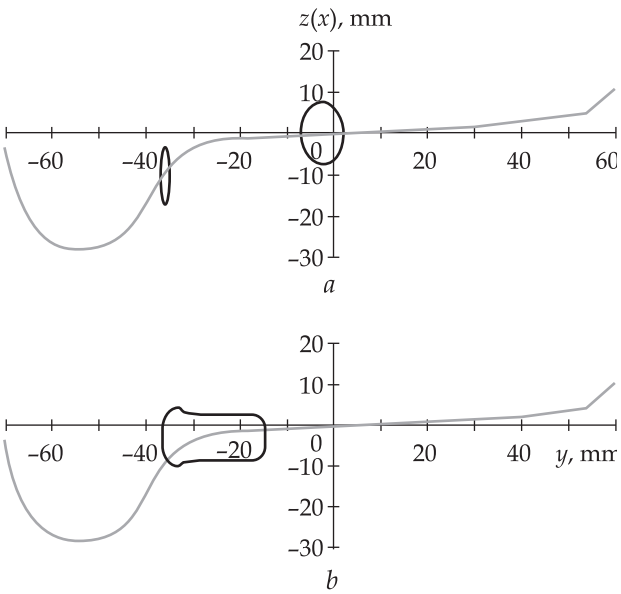
Contact patches of wheels with a standard profile (*a*) and with ITM-72-02 profile (*b*)

Areas of Application

To be used in the freight railway cars with constant contact bearings, which operate on 1520 mm gage railroads in Ukraine; the CIS countries and the Baltic States

Specification

The use of rim profile can increase the contact patch area and ensure a conformal wheel contact



Distributions of tread running surface wear over the contact patches in meridian plane for wheels with a standard profile (*a*) and ITM-72-02 (*b*) profile

Advantages

The offered wheel rim profile extends the wheel life (in terms of wheel flange wear) 4—5 times as compared with the conventional wheel profile (GOST 9036-88), which significantly reduces the intensity of wheel tread wear and adds 350—400 thousand km mileage between flange re-turnings

IPR Protection

IPR3

Stage of Development. Suggestions for Commercialization

IRL3, TRL3
Manufacturing license is proposed

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INNOVATION READINESS LEVEL (IRL) SCALE

IRL	Innovation Readiness Level	Definition
IRL1	Inventor or team with a dream	The lowest level of readiness where the intention transforms into an idea of space system application or the space technology transforms into a business venture
IRL2	Paper studies produced	Once the basic ideas have been formulated, they are put down on paper in studies and analyses of business opportunities
IRL3	Experimental evidence of business opportunity	Active research and development are initiated, including analytical / laboratory studies to validate predictions regarding the market, the competition, and the technology
IRL4	Capability to implement limited-scope programs with project teams	Basic technological and business components have been developed to establish that they will work together; an initial business plan is available
IRL5	Capability to support project engineering development and design (no product, no revenues)	The basic technological and business components have been integrated with reasonably realistic supporting elements. The business plan is credible, but still needs to be validated against the final product characteristics
IRL6	Capability to support development and design with a market-driven business team (product, no revenues)	The representative prototype system has been tested in a relevant environment. The business team is still incomplete and the venture is not yet ready for commercialization. A full business plan including the market, the operational, the technological, and the financial aspects is available
IRL7	Capability to support limited production; full business team in place (product and limited revenues)	The business can run on a limited scale. The full team is in place
IRL8	Capability to advance to full production and distribution (product and revenues)	The technology has been proven to work and the venture structure has proven to be able to support growing market shares
IRL9	Fully articulated business with appropriate infrastructure and staffing (growing market share)	The offering incorporating the new technology has been used in operational conditions and the business is running with a growing market share

Intellectual Property Rights Protection[1] Levels

IPR codes	Protection Level
IPR1	Technical solutions are know-how[2]
IPR2	Applications for copyright protection of IPR objects are expected to be or have been submitted
IPR3	The copyright protection of IPR objects as established by the applicable law of Ukraine has been obtained and is kept in force
IPR4	International industrial patent application(s) (according to the PCT system, etc.) has (have) been submitted. Application(s) for industrial patents has (have) been submitted in foreign country(ies) under national procedure
IPR5	The industrial patent(s) in foreign country(ies) has (have) been obtained and is/are kept in force

[1] The IPR protection measures are implemented by R&D institutions in accordance with the applicable legislation of Ukraine and the requirements of paragraphs 5, 8, and 9 of the Regulations for the use of intellectual property objects at the NAS of Ukraine as approved by Resolution of the Presidium of the NAS of Ukraine No.15 of January 16, 2008, on the Structural Units Responsible for Technology Transfer, Innovation Activities, and Intellectual Property (as revised)

[2] Know-how is technical, organizational, or commercial data obtained with the use of experience and upon trials of technology and its components, which are: closely held (not a part of general knowledge or available for public) on the date of license agreement; essential, i.e. important and useful for manufacture of products, manufacturing process, and/or provision of services; and elaborate i.e. detailed and complicated enough to verify their compliance with the criteria of being never-before-known and essential (Clause 1 of the Law of Ukraine on the State Regulation of Technology Transfer Activities)

TECHNOLOGY READINESS LEVEL (TRL) SCALE

Stage	TRL	Interpretation	Definition and Description
Invention	TRL1	Basic principles observed	Basic scholarly research is translated into potential new basic principles that can be used in new technologies
	TRL2	Technology concept formulated	Potential areas of application of basic (technological) principles, including the technological concept are identified. Basic manufacturing principles are elaborated and potential sales markets are identified. A small research team is established to assess the project feasibility
Concept validation	TRL3	First assessment of concept and technology effectiveness	Based on preliminary study, actual research is conducted to assess technical and market feasibility of the concept. This includes active R&D works at the lab and first negotiations with potential customers. The research team expands. Market feasibility is assessed
	TRL4	Prototype validation at lab	Basic technological components are integrated to assess early feasibility by testing in laboratory environment. Manufacture options are studied with basic manufacturing principles identified. Key markets are researched to study demand. The organization is ready to scale up, possible services are analyzed. Comprehensive marketing analysis is made
Prototyping and incubation	TRL5	Prototype testing in user environment	The system is tested in user environment with broader technological infrastructure involved. The actual use is tested and validated. Production-support works and pre-production tests are done in lab environment. Trial batches of prototypes enter the key markets. The organization starts activities to further distribute the prototypes and to enter the sales markets
Pilot production and demonstration	TRL6	Pre-production, including tests in user environment	The product and manufacturing technologies are completely ready for launch of a pilot line/pilot plant (low-scale manufacture). The product and manufacturing technologies are assessed and finalized. This may include additional R&D works. The early products and manufacturing technologies are tested in the key markets with simultaneous organization of manufacture (marketing research, logistics, production facilities, etc.)
	TRL7	Low-scale pilot production demonstrated	The product manufacture is fully operational at low rate. Actual commercial products are manufactured. The final products are verified in the key markets. The organizational component is completed (comprehensive marketing strategy, all components of manufacturing activities). The products are formally launched in test markets
Initial market introduction	TRL8	Manufacture fully tested, validated, and certified	The manufacturing flow charts, product final version, production organization, and marketing tools are completed. The full-scale manufacture has been launched. The final product is sold in majority of domestic and international markets
Market expansion	TRL9	Manufacture and products fully operational and competitive	The full-scale manufacture is sustainable, with the product gaining new markets. Minor modifications and improvements create new versions. The technology and product output are optimized through implementing innovative concepts on manufacturing process. The product is fully customized to the key markets

Reference book

THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE

R&D AND TECHNOLOGIES

THE NAS OF UKRAINE

IN 11 SPESIAL ISSUES

Issue
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