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USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS  
ENGINEERING AND EQUIPMENT

No. 38

This serial publication contains abstracts of articles and news items from USSR and Eastern Europe scientific and technical journals on the specific subjects reflected in the table of contents.

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	CONTENTS	PAGE
ENGINEERING		
Acoustical & Ultrasonic .....		1
Aeronautical & Space .....		9
Atomic & Nuclear .....		15
Construction .....		20
Heat, Combustion, Detonation .....		27
Hydraulic & Pneumatic .....		29
Industrial .....		32
Materials .....		39
Metrology, Mapping, Surveying .....		47
Mining, Petroleum, Geology .....		61
Precision Mechanical & Optical .....		67
Stress Analysis & Stability Studies .....		70
Turbine & Engine Design .....		85
EQUIPMENT		
Aeronautical & Space .....		88
Gyroscopic .....		89
Industrial & Mining .....		90
Measuring, Testing, Calibrating .....		96
Optical .....		111
Photographic .....		112
Vacuum .....		113

ENGINEERING  
Acoustical & Ultrasonic

USSR

UDC 534.232

ON THE THEORY OF STIMULATED EMISSION OF SOUND IN A LIQUID HALF-SPACE WITH UNEVEN BOUNDARY WHEN Q-SWITCHED LASER RADIATION IS ABSORBED

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 23, No 3, May/Jun 77 pp 411-419  
manuscript received 4 Aug 76

LYAMSHEV, L. M. and SEDOV, L. V., Acoustics Institute, Academy of Sciences USSR

[Abstract] The article is based on materials of a report by L. M. Lyamshev that was delivered at the Eighth All-Union Conference on Coherent and Non-linear Optics ["Concerning the Influence of an Uneven Boundary on Optical Stimulation of Sound in a Liquid," Abstracts of Reports to the Conference, Tbilisi, "Metsniyereba," 1976, No 2, p 196]. The influence that an uneven boundary has on the emission of sound stimulated when Q-switched laser radiation is absorbed in a liquid half-space is considered in the small perturbation approximation. It is assumed that the irregularities are gently sloping, statistically homogeneous and isotropic, and that their height is low compared with a wavelength of sound. It is assumed that the mechanism of acoustic stimulation is thermal in nature, and the steady-state mode of emission is considered. Expressions are derived for calculating the dispersion of fluctuations in the intensity of the sound field for different kinds of spatial distribution of irregularities in the boundary. For some limiting cases, simple formulas are given that relate the average sonic field to the Rayleigh parameter, mean square value of the height and three-dimensional radius of correlation of the irregularities. Irregularities of the boundary have a double influence on fluctuations of the acoustic field: in the first place the field of volumetric heat sources is scattered by random irregularities of the boundary, and in the second place the intensity of these sources fluctuates since the optical length of the path of the laser beam varies randomly in the liquid. References 8 Russian.

USSR

UDC 534.121.1

EXPERIMENTAL INVESTIGATION OF OSCILLATIONS AND ACOUSTIC RADIATION OF A PLATE IN A FIELD OF TURBULENT PRESSURE PULSATIONS

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 23, No 4, Jul/Aug 77 pp 584-590  
manuscript received 24 Jan 75, after final revision 12 Aug 76

YEFIMTSOV, B. M. and SHUBIN, S. YE.

[Abstract] An experimental study is done on vibrations and acoustic emission of a plate in a field of pseudo-acoustic turbulent pressure

pulsations. The working part of the experimental installation was a channel with rectangular cross section of 21 x 221 mm about 3 m long. In one of the wide walls was an opening for mounting either a rigid plate carrying pressure pulsation sensors, or an experimental panel (a thin plate in a rigid frame). The plate or the panel was mounted strictly flush with the inside wall of the channel. A collector was provided with smooth transition from circular to rectangular cross section with area ratio (degree of flow compression) of about 12. Air was supplied by a squirrel-cage blower with head of up to 300 mm water gage. Maximum flow velocity in the working section was 47 m/s. The experiments were done to determine the main probability characteristics of the pressure pulsations that act on the plate. The results agree with relations predicted on the basis of theoretical analysis for vibrations and acoustic radiation of a plate in a turbulent pressure pulsation field [B. M. Yefimtsov, "Oscillations and Acoustic Emission of Plates in a Turbulent Boundary Layer," Trudy Tsentral'nogo nauchnoissledovatel'nogo instituta aerogidrodinamiki imeni N. Ye. Zhukovskogo, 1971, No 1371, pp 39-46]. The authors thank G. P. Karashev for assistance in setting up the experimental installation and doing the measurements. Figures 5; references 8: 3 Russian, 5 Western.

USSR

UDC 535.537.29

INVESTIGATION OF ACOUSTIC PHENOMENA IN POCKELS CELLS ON MKP AND DKP CRYSTALS WITH HIGH SWITCHING FREQUENCY

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 42, No 4, Apr 77 pp 687-692 manuscript received 23 Oct 75

KUZOKOVA, T. A. and NILOV, YE. V.

[Abstract] The Pockels cell is currently in wide use for Q-switching solid-state lasers. This paper investigates the optical characteristics of a Q-switch based on using the longitudinal electro-optical effect in MKP and DKP operating in the pulse frequency mode. It is shown that acoustic vibrations of the crystal cannot be completely eliminated at pulse recurrence rates far from the resonant frequency. It is also difficult to avoid resonant vibrations of the "beat" type even when the frequency mismatch is as high as 10 kHz. The frequency ranges of 100-150 kHz are of particular interest at present for pulse-emitting lasers, and acoustic vibrations are especially troublesome at these frequencies. One way to deal with this difficulty is to use special mountings for the crystals that damp out acoustic vibrations. Tests of rubber and glass mountings show that they are very effective up to pulse recurrence rates of 250 kHz. Figures 3, references 6: 5 Russian, 1 Western.

USSR

UDC 534.231

CONCERNING DEFOCUSING OF THE ACOUSTIC FIELD OF BOTTOM REFLECTIONS IN A  
NONHOMOGENEOUS ANTICHANNEL

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 23, No 1, Jan/Feb 77 pp 19-23  
manuscript received 26 Jan 76

BARKHATOV, A. N. and GORSKAYA, N. V., Gor'kiy State University imeni N. I.  
Lobachevskiy

[Abstract] In anti-waveguide sound propagation a shadow zone arises in which energy can penetrate via reflections from the bottom. In continuously layered media with a negative vertical gradient of the speed of sound (a homogeneous antichannel) the beams reflected from the bottom as a result of diffraction in upper layers may form caustics. These are observed in the acoustic field of bottom reflections as regions of increased concentration of acoustic energy. However, if the medium contains regular horizontal nonhomogeneities that reduce the vertical gradient of sound in the direction of propagation (nonhomogeneous antichannel), the caustics of the bottom beams will be broken up. To study this effect, the authors did experiments on the sonic field in a homogeneous and in a nonhomogeneous antichannel by the method of physical scale modeling. The effect of beam defocusing is confirmed by plots of beam patterns and by calculations of the focusing factor. The results show that the bottom rays form a caustic in a nonhomogeneous antichannel only after the first reflection from the bottom when the hydrological conditions of sound propagation at the beginning of the path are the same for homogeneous and nonhomogeneous antichannels. Figures 6, references 3 Russian.

USSR

UDC 534.232

ACOUSTIC FIELD OF A SYSTEM OF INFINITE CYLINDRICAL ELLIPTICAL RADIATORS  
WITH MIXED BOUNDARY CONDITIONS

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 23, No 1, Jan/Feb 77 pp 9-13  
manuscript received 19 Jan 76

ANDEBURA, V. A., LEYKO, A. G. and SILETSKIY, S. M.

[Abstract] The authors generalize the integral method of least squares to a solution of problems of emission of an arbitrary system of harmonically oscillating cylindrical radiators with mixed boundary conditions on their surface. The configuration chosen is to a great extent universal as it

covers shapes from a circular cylindrical surface to a flat strip. Specifically, a system of infinite elliptical radiators is considered, the velocity potential being given on a part of the lateral surface of each radiator that is bounded by two generatrices, while the vibrational velocity is given on the remainder of the surface. The radiation field is determined with consideration of the mutual influence of the radiators. Amplitude radiation patterns are given for systems of two, three and four radiators. It is found that a system of emitters in which part of the surface is acoustically soft has pronounced monodirectional action, the level of lateral radiation being no more than 20% of the main lobe. The authors thank V. I. Mayatskiy for interest in the work and discussion of the results. Figures 2, references 6 Russian.

USSR

UDC 534.232

ON THE THEORY OF STIMULATED ACOUSTIC RADIATION WHEN Q-SWITCHED LASER EMISSION IS ABSORBED IN A LIQUID WAVEGUIDE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 23, No 1, Jan/Feb 77 pp 91-95  
manuscript received 22 Mar 76

LYAMSHEV, L. M. and SEDOV, L. V., Acoustics Institute of the Academy of Sciences USSR

[Abstract] A simple method is given for evaluating the acoustic power of waves stimulated in a liquid waveguide when Q-switched laser emission is absorbed. It is assumed that the mechanism of acoustic generation is purely thermal, and the steady-state mode of stimulated emission is considered. The field in the waveguide is represented as a sum of normal waves. Finite expressions are derived for the amplitudes of these waves, assuming gaussian distribution of the intensity of optical emission. It is shown that normal waves on certain harmonics can be more effectively stimulated by changing the parameters of the laser beam. An estimate is made of the influence that random fluctuations of transverse distribution of intensity in the laser beam have on the acoustic field in the waveguide. References 4: 3 Russian, 1 Western.

USSR

UDC 535.525.2:534.322.3

ON A DISCRETE COMPONENT IN THE NOISE SPECTRUM OF A SUPERSONIC JET

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 23, No 2, Mar/Apr 77 pp 185-192  
manuscript received 22 Dec 75, after revision 16 Jun 76

ANTONOV, A. N., GORBUNOV, V. N. and SHALAYEV, S. P.

[Abstract] Previous research has shown that the absorption of acoustic energy in air depends on relative humidity. However, it is still not clear to what extent the absorption of acoustic energy in one of the components of a self-oscillatory system will influence the acoustic characteristics of a jet. The absorption of sonic energy in two-phase media should be greater than in one-phase media because a greater number of relaxation processes contribute to the dissipation of energy in such a system. In this paper an experimental study is done on the influence that temperature and the presence of a second phase in the working fluid of a jet as a consequence of water vapor condensation in the combustion products of fuel made up of air + alcohol, as well as the two-phase nature of the ambient atmosphere have on the emission of discrete components in the spectrum of supersonic jet noise. Experiments were also done to determine the influence of a small barrier on the level of a discrete noise component. It is shown that a needle in the jet can reduce the level of emission of a discrete component. Figures 5; references 12: 7 Russian, 5 Western.

USSR

UDC 534.833

SYNTHESIS OF SYSTEMS FOR COMPENSATION OF ACOUSTIC AND VIBRATION FIELDS

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 23, No 2, Mar/Apr 77 pp 242-248  
manuscript received 30 Jun 75, after revision 7 Jun 76

VYALYSHEV, A. I., GAVRILOV, A. M., LYUBASHEVSKIY, G. S., TARTAKOVSKIY, B. D.,  
and CHONI, YU. I., Acoustics Institute, Academy of Sciences USSR, Kazan'  
Aviation Institute

[Abstract] The authors consider the problem of active damping of acoustic and vibration fields by using additional compensating sources. Previous research has shown that a single compensating source is not enough to produce the required effect in the case of complex fields. A method is proposed for synthesis of an optimum compensating system based on successive addition of new sources followed by recalculation of all excitation potentials resulting in minimization of the energy of the residual field. It is shown that three different criteria can be used for determining the

coordinates of placement of the compensating sources, depending on the requirements made on the compensating system and the kind of field to be compensated. Theoretical examples are given of synthesis of a system for compensating the field of flexural vibrations of a plate. Figures 2, table 1, references 9: 7 Russian, 2 Western.

USSR

UDC 534.2.008

MEASUREMENT OF THE SPECTRAL DENSITY IN ACOUSTIC-EMISSION STUDIES

Moscow METROLOGIYA in Russian No 7, Jul 77 pp 59-65

LYKOV, YU. I.

[Abstract] Knowing the spectral density can be very helpful not only in the design of optimal systems for recording weak acoustic-emission signals but also in such problems as determining the duration of microprocesses involved in the formation of an integral continuous acoustic-emission signal and determining the parameters of pulse signals generated by cracks. The spectral power density at the terminals of a receiving transducer does not depend on the signal dispersion and its frequency characteristics is

$$G_y(\omega) = G_x(\omega) |H(\omega)|^2$$

where  $G_x(\omega)$  is the spectral density of the acoustic-emission signal and  $|H(\omega)|^2$  is the modulus of the frequency characteristic of the "transducer - solid sample" system. With the spectral density known, one can determine the power of an acoustic-emission signal within a finite frequency band as well as over the entire frequency range, the energy of an acoustic-emission signal, and the amplitude as well as the width of acoustic-emission pulse signals. Experiments have confirmed the feasibility of detecting signals which carry information about flaws in a sample, the method being based on the difference between the spectral densities of acoustic-emission and interference (friction) signals. Figures 3, references 9: 6 Russian, 3 Western.

USSR

UDC 535.42+534

DIFFRACTION OF A DIVERGING BEAM ON INTENSIVE ACOUSTICAL WAVES

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 42, No 3, Mar 77 pp 533-539 manuscript received 23 Jul 75

MAGDICH, L. N. and MOLCHANOV, V. YA.

[Abstract] A theory is suggested for the diffraction of a diverging light beam on an acoustical wave excited by a flat transducer, which is correct for all intensities of the diffracted field. It is assumed that the field of the incident wave is cylindrical and distributed normally in the diffraction plane. This assumption allows significant simplification of the problem. The amplitude of the incident wave is distributed in the angular spectrum according to the planes of waves, each of which forms an angular diffraction field spectrum when it interacts with the ultrasound. The theory of Bragg diffraction of the cylindrical light beam is correct with all intensities of the diffracted wave. An expression is produced for the diffracted field in the case of normal distribution of the incident wave intensity. The theoretical conclusions agree with experimental results. References 5 Western.

USSR

UDC 535.371

STUDY OF LIGHT DAMPING LUMINESCENCE BY MEANS OF A PHOTOACOUSTICAL RECORDING METHOD

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 42, No 3, Mar 77 pp 489-494, manuscript received 27 Feb 76

RAZUMOVA, T. K. and STAROVOGATOV, I. O.

[Abstract] This work is dedicated to the study of a new method of investigation of light damping of luminescent liquid media, based on the use of the photoacoustical impulse effect. This effect is studied in fluorescent organic solutions by nonlinear damping of the fluorescence by means of laser radiation. The solution of the balance equations shows that different types of nonlinear damping of fluorescence caused significantly different variations in acoustical pressure as a function of damping radiation power. "Bottom" damping leads to a decrease in acoustical pressure, "top" damping - to an increase. Model experiments are performed on solutions of organic dyes, the fluorescence of which is excited and damped by the radiation of single-pulse dye-solution and ruby crystal lasers. Qualitative and quantitative agreement

of calculated and experimental results are produced. The possibility is demonstrated of photoacoustical determination of the parameters of nonlinear damping, as well as the yield of fluorescence and of photochemical processes. References 10: 7 Russian, 3 Western.

USSR

UDC 534.26

SCATTERING OF SOUND BY SPHEROIDAL BODIES LOCATED AT AN INTERFACE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 23, No 3, May/Jun 77 pp 404-410  
manuscript received 17 May 76

KLESHCHEV, A. A., Leningrad Shipbuilding Institute

[Abstract] The author considers the problem of scattering of sound by a solid prolate spheroid in an ideal inviscid compressible fluid near an interface with an isotropic solid. It is assumed that the axis of rotation of the spheroid is parallel to the plane of the interface. The problem of scattering of a plane monochromatic sound wave propagating in the fluid is reduced to the problem of diffraction by two interacting bodies, the liquid-solid interface being taken as the coordinate surface in spheroidal coordinates. The solution is given on the basis of an addition theorem for spheroidal wave functions. Figures 4, references 6: 5 Russian, 1 Western.

USSR

UDC 533.6.011.32

## CALCULATION OF NONLINEAR AERODYNAMIC CHARACTERISTICS OF A WING OF COMPLEX SHAPE IN PLAN CONSIDERING THE NOSE VORTEX SHEET

Moscow IZVESTIYA AKADEMII NAUK SSSR MAKHANIKA ZHIDKOSTI I GAZA in Russian No 2, Mar/Apr 77 pp 107-111 manuscript received 17 Aug 76

APARINOV, V. A.

[Abstract] A study is presented of the characteristics of wings with complex shape in plan. The peculiarities of the method are described and examples of digital computer solution are presented for delta wings, short-span wings with breaks in the leading edge and swept wings with influxes. The method allows the distribution and total loads on the wing to be calculated, as well as the moments, and allows the flow structure to be determined in the form of the shape of the vortex sheet and the vector velocity fields calculated in any cross section. The results produced agree well with experimental data. References 4: 3 Russian, 1 Western.

USSR

UDC 533.6.013.42

## MATHEMATICAL APPARATUS FOR CALCULATING THE AEROELASTIC CHARACTERISTICS OF AN AIRCRAFT WITH TRANSIENT STREAMLINING TAKEN INTO ACCOUNT

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA TVERDOGO TELA in Russian No 3, May-Jun 77 pp 109-117 manuscript received 25 Nov 76

BELOTSEKOVSKIY, S. M., MOROZOV, V. I., and NOVITSKIY, V. V.

[Abstract] Exact equations of aeroelasticity are constructed in the linear formulation from data pertaining to an ideally elastic aircraft flying through a continuous medium. The aircraft mass-inertia characteristics, the technological characteristics and the mechanical properties of aircraft materials, and the geometry of the aircraft and the control system serve as input data from which first the mass-elastic characteristics and the aerodynamic characteristics are calculated. There follows the calculation of generalized forces and aeroelastic characteristics parallel in terms of transfer functions in the frequency domain and in terms of transient functions in the time domain. Nonsteady streamlining during perturbed motion is thus taken into account. For the derivation of the fundamental equations, it is assumed that the average motion of the aircraft occurs at a constant velocity and follows a straight line without tilting or sliding. All steps in the calculation procedure are coordinated in a flow chart for use on a digital computer. For illustration, this procedure is applied here to the specific case of a short-period forward flight of a

heavy aircraft at the altitude  $H = 1000$  m and at the velocity  $v = 0.5$  Mach. The integrodifferential equations are solved by approximating the transient components with linear combinations of exponential functions. In this case the aerodynamic characteristics can also be calculated approximately, on the basis of either the steady-state or the quasisteady-state hypothesis. Figures 3; references 6: 5 Russian, 1 Western.

USSR

UDC 629.7.01:62-50

AN ALGORITHM FOR AUTOMATED DESIGN OF CHANNEL AND TROUGH SURFACES

Kazan' IZVESTIYA VUZov, AVIATIONNAYA TEKHNIKA in Russian No 1, 1977  
pp 89-94 manuscript received 5 May 75

OSIPOV, V. A. and MYAZINA, L. I.

[Abstract] A base algorithm is considered for automated design and reproduction of channel and trough surfaces. The channel (trough) surface of general type is defined by a continuous shell of transverse closed (open) generatrices that are oriented in a definite way relative to the stream line or directrix. The transverse generatrix is one whose construction or calculation is completely independent of the position or shape of the stream line (directrix), but depends on its length measured from the coordinate origin. In aircraft and engine construction, channel surfaces are all outer and inner aerodynamic enclosures in aircraft, the gas-air ducting of jet engines, tubing and so forth. The trough surfaces include fairings, cabin enclosures and other complicated streamline surfaces. Software and designing programs are developed for special cases of channel and trough surfaces that could be the basis for the most general automated design systems using computers, service devices and printers. Figures 2; references 16 Russian.

USSR

UDC 532.529

PHENOMENA OF VIBRATORY MIXING AND OF FORMING PERIODIC STRUCTURES UNDER NEAR ZERO-GRAVITY CONDITIONS

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA TVERDOGO TELA in Russian No 2, Mar-Apr 77 pp 56-59 manuscript received 14 Nov 75

GANIYEV, R. F., LAKIZA, V. D., and TSAPENKO, A. S.

[Abstract] In an experimental study concerning the stable equilibrium modes and the dynamic behavior of solid containers with liquid, gas, and solid

particles under near zero-gravity conditions there were discovered two new phenomena peculiar to and resulting from weightlessness. These are intensive mixing of two fractions immiscible on earth and subsequent formation of periodic structures by stratification, within a sharp range of excitation frequencies. The experiments were performed on board of a space-flight laboratory orbiting along a Keplerian trajectory. As the model test specimen served a translucent cylindrical shell 50 mm in diameter and 100 mm high, partly filled with water, poppy seeds, and capacitor oil in various ratios. The free liquid surface broke down most effectively under forced axial vibrations at 38 Hz during acceleration at the rate of 5.25 g, the water-oil interface broke down at an excitation frequency within 1-2 Hz. A higher liquid level, i.e., a larger liquid mass resulted in a lower mixing frequency, with stratification then occurring within the 37-49 Hz frequency range. The solid particles formed an almost uniform suspension in the mixture as well as in the subsequent layers. These phenomena could be utilized for various technological purposes such as manufacture of foam materials or laminates with any kind of reinforcement in outer space, when such processes on earth are hardly feasible. Figures 5; references 3: Russian.

USSR

UDC 539.3

#### AXISYMMETRICAL BENDING OF A THREE-LAYER SPHERICAL SEGMENT

Kiev PRIKLADNAYA MEKANIKA in Russian Vol 13, No 6, Jun 77 pp 3-11  
manuscript received 10 Nov 75

GRIGOLYUK, E. I. and LOZHKIN, O. B., Moscow Aviation Institute

[Abstract] A study is made of a three-layer spherical segment of symmetrical structure under the influence of a surface load. Assuming the load to be even over the surface, the authors use a calculation plan with moment external layers and a rigid filler. A precise analytic solution is constructed in a form convenient for computer processing. The influence of eight versions of boundary conditions and certain parameters on the stress state is investigated. Figures are presented characterizing the relationship between maximum bending and zero-moment stresses, as well as meridional and circular normal forces in the layers. The circular bending stresses are less in comparison to the circular zero-moment forces than are the meridional stresses. References 4: 3 Russian, 1 Western.

USSR

UDC 532.525.2

PENETRATION OF A FAN-SHAPED JET INTO A DRIFTING WHIRLED STREAM

Minsk IZVESTIYA VUZOV, ENERGETIKA in Russian No 7, Jul 77 pp 96-103  
manuscript received 28 Mar 77

BOGOMOLOV, YE.N., Chair of Aircraft Engines, Riga Aviation Engineering  
Institute

[Abstract] The trajectory of an axisymmetric whirled fan jet penetrating a drifting whirled annular stream of incompressible fluid is determined here analytically, on the basis of the equation of motion for an annular jet element normal to the jet axis and by application of d'Alembert's principle. Into account is taken the rarefaction within the vortex zone forming between the curved jet surface and the channel boundary on the jet inlet side. For a numerical solution one needs the value of the rarefaction ratio, which has been obtained from experimental data. An analysis of the results indicates that the relative depth of penetration is not appreciable and, therefore, the magnitude of the injection effect depends mainly on the pattern of turbulent mixing. Figures 4; references 5: Russian.

USSR

UDC 532.517.4:532.522.2

CHARACTERISTICS OF TURBULENCE WITH FLOW OF PLANE WAKES IN A CLOSED CHANNEL

Moscow IZVESTIYA AKADEMII NAUK SSSR MEKHANIKA ZHIDKOSTI I GAZA in Russian No 2, Mar/Apr 77 pp 175-178 manuscript received 28 Jun 76

VINOGRADOV, YU. V., GRUZDEV, V. N., POSTNOV, V. F. and TALANTOV, A. V.

[Abstract] Results are presented from an experimental study of the characteristics of turbulence upon mixing of a flat jet with a limited wake. The study was performed in the range of velocity ratios  $m = 0.2-2.0$ . The influence of the initial velocity difference of the streams mixed on the level of intensity of turbulence in the mixing layer in the main section over a length of up to 100 diameters is established. The experiments qualitatively determine the results previously produced on the variation of intensity of turbulence with velocity ratio. It is found that the turbulence generated in the boundary layer at the wall penetrates to the depth of the flow to approximately one-half of the width of the flow, leading to intensive mixing. References 8: 7 Russian, 1 Western.

USSR

UDC 533.695.7.001.2

EXPERIMENTAL STUDY OF ASYMMETRICAL LAVAL NOZZLES

Moscow IZVESTIYA AKADEMII NAUK SSSR MAKHANIKA ZHIDKOSTI I GAZA in Russian No 2, Mar/Apr 77 pp 123-128 manuscript received 29 Jan 76

BOBOVICH, A. B., KORNILOVICH, V. B., MASLOV, B. N., and SHISHKOV, A. A.

[Abstract] The transverse force resulting from the asymmetry of the pressure field in asymmetrical nozzles is determined experimentally. Three basic series of asymmetrical nozzle experiments were performed: a nozzle with  $M_a = 1$  ("window nozzle") and with various subsonic parts, the nature and value of the asymmetrical distortions of the profiles of which vary over broad limits; various supersonic nozzles with asymmetrical subsonic parts, differing only in angle of rotation of their axes and distance from the point of the break in the curve to the minimum cross section; and, a nozzle with asymmetrical supersonic and axisymmetrical subsonic parts. It is found that when the axis of the subsonic portion is deflected from the supersonic portion by angle  $\beta_1$ , the transverse force oscillates with an amplitude proportional to the angle of deflection in the range  $\beta_1 = 0-4^\circ$ . The variation in transverse force with the same degree of expansion and radius of curvature as a function of length of supersonic portion has a maximum in the range studied. References 11: 7 Russian, 4 Western.

USSR

UDC 629.78.015.001

QUALITATIVE STUDY OF RELATIVE MOVEMENT OF SPACE CRAFT WITH VARIABLE ANGULAR VELOCITY OF THE LINE OF SIGHTING

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian No 1, Jan/Feb 77 pp 16-23 manuscript received 19 Feb 75

IVANOV, V. A.

[Abstract] A study is made of the phase space of states and possible nature of trajectories of coplanar relative motion of space craft in the vicinity of an orbiting space station moving in a circular orbit. The possibility is demonstrated of using the guidance method suggested for approach, departure, flight together and flyby, including "soft" contact over a broad range of initial conditions with orientation of the vector of the controlling acceleration only perpendicular to the sighting line. The study is based on a qualitative theory of dynamic systems. For the case of approach of space craft, the area of initial values of phase coordinates corresponding to soft contact is found to represent a significant portion of the phase

surface. The boundary of this area for each case is known. In the method of variable angular velocity of the sighting line, the entire area of possible initial conditions of approach of the spacecraft is divided by a limiting cycle or separatrix into two parts, one of which corresponds to soft contact, the other corresponding to a certain minimum approach distance, at which point relative velocity becomes equal to zero. Analysis of the types of phase trajectories shows that this division into two parts also occurs for departure trajectories, so that departure trajectories can be selected which also terminate with zero relative velocity. References 5 Russian.

USSR

UDC 528.34:629.78]:681.3.06

A PROGRAM FOR REFINEMENT OF THE ORBITS OF GEODETIC EARTH SATELLITES ON THE BASIS OF RESULTS OF OPTICAL OBSERVATIONS

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 4, Apr 77 pp 21-25

SURNIN, YU. V., ASHCHEULOV, V. A., DEMENT'YEV, YU. V., YEGOROV, N. N., KUZHELEV, S. V. and TOKAREV, A. M.

[Abstract] A description is presented of a program, written in ALGOL-60, for computation of the orbital elements and prediction of the motion of geodetic satellites. The solution of the problem consists of the following main stages: selection of a model of space most completely reflecting the true space in which the geodetic satellite moves; selection of the optimal coordinate system for construction of trajectories of the satellite most simply connected to the systems of notation in which the results of measurement are produced and the parameters of space are fixed; selection of a theory of satellite motion and a method for construction of an orbit; and, development of an algorithm suitable for use on various computers. The correctness of calculations using the program developed was checked on a model using an orbit described in an earlier work. The results of the test confirmed the assumption that over a short arc (1 or 2 revolutions) the relative accuracy of determination of the orbit using the algorithm is on the order of  $10^{-7}$ , corresponding to an error in position of the satellite of approximately 1 m. References 9: 6 Russian, 3 Western.

USSR

UDC 624.074.4:621.311.25:621.039

DESIGN OF A HERMETIC LINING FOR THE PROTECTIVE SHELL IN AN ATOMIC ELECTRIC POWER PLANT

Moscow BETON I ZHELEZOBETON in Russian No 6, Jun 77 pp 9-11

KIRILLOV, A. P., MIKHAYLOV, O. V., and NIKOLAYEV, YU. B., Scientific Research Department, All-Union Planning, Surveying, and Scientific Research Institute, BELOKHIN, S.L. and KLONITSKIY, M. I., All-Union State Institute for the Planning of Electrical Equipment for Heat Engineering Structures

[Abstract] A hermetic lining has been designed for the protective shell in the Block-5 Novosibirsk Atomic Electric Power Plant. Grade VStps6 carbon steel was selected for its best performance characteristics under worst load conditions and for its best compatibility with concrete. On the basis of welding requirements, the lining thickness should be at least  $h = 6$  mm. The lining, actually 8 mm thick, is reinforced with Class A-III vertical rigid angle brackets (50x5 mm) spaced at most 60h or actually 450 mm apart, so as to prevent buckling, and is anchored to the concrete wall with Class A-III flexible tie rods (12 mm in diameter) spaced 400 mm apart along the angle brackets. For adequate corrosion resistance, the lining surface is coated with aluminized epoxide varnish. The strength of this structure, the critical deformation and the critical load, has been evaluated on the basis of a stress and strain analysis of experimental models partly under compression and partly tension, with the results properly extrapolated according to the principle of similitude. Figures 3; no references.

USSR

UDC 621.384.6

PRODUCTION OF HIGH-CURRENT ELECTRON BEAMS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 2, Mar/Apr 77 pp 7-32  
manuscript received 3 Dec 76

SMIRNOV, V. P.

[Abstract] This review of the literature presents the most important results of the development of high-current accelerators with currents of 10 kA and greater, pulse lengths of up to about 100 ns and described their basic elements: pulsed power supplies based on banks of capacitors, the dielectrics of shaping lines, shaping and transport lines, switching shaping lines, inductive storage devices, the insulators of accelerator tubes and diodes. Experiments in recent years have demonstrated the

possibility of self-focusing beams with current densities of up to  $10^7$ - $10^8$  A/cm<sup>2</sup> propagating over distances of several meters. A combination of these characteristics with high energy characteristics (over 1 MJ, power range  $10^{14}$  W) has provided unique capabilities for various areas of science and technology. Analysis of the techniques for production of high-current beams of relativistic electrons indicates that in spite of the intensive development of this area and the significant successes achieved, there is still a great deal of work to be done in a number of important areas, including the task of increasing the dielectric strength of dielectric materials, particularly of the surface of dielectrics in a vacuum, and also the task of utilizing inductive accumulators. The problems of converting installations with peak powers of  $10^{10}$ - $10^{11}$  W to the frequency mode remain unsolved. Our concepts of the dynamics of electron beams in plasmas and in diodes also need refinement. References 160: 96 Russian, 64 Western.

USSR

UDC 621.11.620.197

THERMORADIATION STABILITY OF PYROGALLOL IN WATER SOLUTION FOR USE IN THERMAL POWER APPARATUS

Minsk IZVESTIYA VUZOV, ENERGETIKA in Russian No 7, Jul 77 pp 52-56  
manuscript received 25 Jan 77

MARTYNOVA, O. I., MIKLSHEVSKAYA, YE. P., and TODOROV, V. KH. Chair of Engineering Thermophysics, Order-of-Lenin Moscow Power Engineering Institute

[Abstract] A study was made to determine the suitability of pyrogallol for use in thermal power apparatus of atomic electric power plants exposed to both high temperature and ionizing radiation, in the presence of oxygen and in an inert argon atmosphere. The electrical conductivity of an aqueous pyrogallol solution was measured before treatment, whereupon the pH and the optical density as well as the pyrogallol concentration and the organic products were measured after treatment. In an argon atmosphere the thermoradiolytic breakdown of pyrogallol in dilute solutions ( $4 \cdot 10^{-3}$  M) was found to be additive with respect to thermolysis and radiolysis. In higher concentrations ( $8 \cdot 10^{-3}$  M) the breakdown ceases to be additive and becomes synergetic. Highly conductive dissociated acidic products of pyrogallol thermoradiolysis appear at  $T = 390$  K. At higher temperatures these products are converted to less acidic and less conductive products. No solid products appear within the 323-623 K temperature range under exposure to radiation doses from 0.3 to 0.4 M at the 13 rad/s power level. Brownish resinous products appear as a result of the postthermoradiation effect. Figures 4; references 3: Russian.

## HEATING OF IONS WHEN A HIGH-CURRENT ELECTRON BEAM INTERACTS WITH A PLASMA AND PART OF THE BEAM IS CAPTURED IN A MAGNETIC MIRROR TRAP

Leningrad ZHURNAL TEKHNIЧЕСКОY FIZIKI in Russian Vol 47, No 1, Jan 77  
pp 83-92 manuscript received 27 Aug 75

KOLYADA, YU. YE., KORNIKOV, YE. A., FAYNBER, YA. B. and KIYASHKO, V. A.

[Abstract] An experimental study is done on heating of the ion component of a plasma by a powerful electron beam (with transverse velocity component) in a magnetic field of mirror configuration, and it is also found how the space charge formed by the beam electrons captured in the magnetic trap influences the heating efficiency and plasma containment. It is found that as the beam passes through the plasma it stimulates powerful high-frequency oscillations and also a broad spectrum of low-frequency waveforms that lie in the vicinity of lower hybrid resonance -- the ion plasma frequency. These oscillations heat the ions in the plasma. The temperature reaches 200 eV at an ion density of  $5 \cdot 10^{12} \text{ cm}^{-3}$ . The low-frequency oscillations are apparently stimulated as a result of development of parametric instabilities. As the beam interacts with the plasma, a certain percentage of the particles are trapped, producing a space charge. The trapped particles are localized on the periphery, forming a hollow cylinder with inside radius of  $\approx 3$  cm, outside radius of  $\approx 4$  cm and length of  $\approx 20$  cm inside of which is plasma. The calculated electric field strength in the layer (averaged with respect to thickness) is 100 kV/cm. In forming a cloud, the plasma ions located in the region occupied by the field are accelerated in the radial direction and enter the plasma surrounded by the electron layer. As a result, a group of accelerated particles shows up on the distribution function of the plasma ions in the 3-4 keV energy region. It is the presence of this accelerated group of ions in the plasma that leads to the development of double-humped instability and excitation of waveforms lying in the region of lower hybrid resonance. As this happens, the energy content of the high-energy ions decreases and the temperature of the main (low-temperature) group increases, reaching 500 eV in the given experiment. Thus the space charge produced in the plasma is conducive to further heating and containment of the ion component, and could be used for controlled thermonuclear fusion. Figures 6, references 19: 15 Russian, 4 Western.

USSR

UDC 533.9.082.5

THE PART PLAYED BY HIGHER DIFFUSION MODES IN EARLY AFTERGLOW

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 42, No 4, Apr 77 pp 618-623 manuscript received 1 Apr 76

RED'KO, T. P. and KALIKIN, A. M.

[Abstract] Processes of transfer of excited and charged particles are important in a medium-pressure plasma. It is often necessary to know how diffusion contributes to particle decay. In this paper the authors consider the contribution of higher diffusion modes to the rate of particle decay. Two types of radial distribution of the particles are considered in a plasma with infinite cylindrical geometry. The first type of distribution is flatter than the usual Bessel distribution. This type is typical of cases where particle decay by diffusion is accompanied by processes of electron collisions with excited particles and recombination of charged particles. The second type of distribution shows a steeper drop than Bessel distribution. This type is observed in a positive discharge column under conditions of contraction, in pulse breakdown of gas, and with optical pumping by a laser beam. It is shown that depending on the spatial distribution of the particles, the higher diffusion modes may either accelerate or decelerate decay as compared with the ground diffusion mode, and the difference in the rate of decay may amount to orders of magnitude. Experiments are done to follow the change in radial distribution of excited atoms in the afterglow of a discharge both for the case of pure diffusion decay of the atoms, and in the case where volumetric losses are not spatially uniform. The authors thank P. P. Penkin for interest in the work and for discussing the results. Figures 8; references 7: 6 Russian, 1 Western.

USSR

UDC 621.374.2

A POWERFUL, HIGH VOLTAGE NANOSECOND GENERATOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 2, Mar/Apr 77 pp 129-131 manuscript received 1 Apr 76

AVDIYENKO, A. A., BULUSHEV, A. F., GRISHANOV, B. I. and MATVEYEV, YU. G., Institute of Nuclear Physics, Siberian Affiliate, Acad. Sci., USSR

[Abstract] A powerful high-voltage square-pulse generator is described. The generator was developed for the control of beams of charges particles

in accelerators and storage rings with one-revolution input and output. The generator produces square pulses of positive polarity with adjustable amplitude and duration and can operate into a mismatched load with the following parameters: voltage at open output up to 300 kV, wave impedance 50 ohms, pulse length up to 50 ns, rise time into active load not over 3 ns, repetition frequency from individual pulses to 25 Hz, instability of pulse timing no worse than 2-3 ns. References 4 Russian.

USSR

UDC 624.073.01.46

THIN PRESTRESSED ELEMENTS OF BUILDINGS AND STRUCTURES

Moscow BETON I ZHLEZOBETON in Russian No 7, Jul 77 pp 26-27

GAMBAROV, G. A., Moscow Construction Engineering Institute imeni V. V. Kuybyshev and GITLEVICH, M. B., Scientific Research Institute of Concrete and Reinforced Concrete

[Abstract] A study was made to determine the behavior of prestressed thin slabs during manufacture, transport, and assembly. The state of stress and strain due to the tension force being transmitted from the reinforcement elements to the concrete as well as the strength, the resistance to cracking, and the deformability under a bending moment were all tested on one batch of model-size specimens 6,000x1,200x40 mm. The technological factors and the performance under actual conditions of hoisting, shipping, and bending were examined on another batch of true-size specimens 18,000x1,200x30 mm and 12,000x1,200x30 mm. As a result, thin plates with continuous reinforcement have been found suitable for buildings and structures. Centrally applied compression loads form curved surfaces without cracking. The use of such elements results in an economy of material and simplifies the construction. Figures 3; references 1.

USSR

UDC 624.152.63:624.131.531.3

USE OF ANCHORS IN THE SOIL FOR BRACING THE WALLS IN THE UNDERGROUND PART OF A MOSCOW GARAGE

Moscow OSNOVANIYA FUNDAMENTY I MEKHANIKA GRUNTOV in Russian No 4, Jul-Aug 77 pp 12-14

KON'KOV, N. K., MATYASHEVICH, I. A., and SOLODOVNIKOV, A. A., State Institute for the Planning of Foundations and Substructures

[Abstract] The use of anchors in the soil for bracing has contributed to a more economical use of metal in structures, while improving their quality and lengthening their life. Class A-III tie rods 40 mm in diameter were laid in drive pipes, after the latter had been embedded in the soil first. Then a 1:1 water-cement mix was poured and subsequently compressed with a pneumatic punch under 15 atm, whereupon the drive pipes were removed. An evaluation of such a structure has revealed that this method yields a high bearing capacity, but is feasible only in sandy soils without gravel 10-15 m deep. Tests with preloading of the anchors have revealed that 20-25% of the initial tension gets lost during anchor installation, which must be taken into account in the design of the structure, and that the residual tension does not remain

constant thereafter: it first decreases prior to excavation of the foundation pit and then increases again, as the pit becomes deeper, to a level about 25% below the initial one. Figures 3; no references.

USSR

UDC 666.972.16

MECHANISM BY WHICH ELECTROLYTIC ADDITIVES AFFECT THE STRUCTURE OF CEMENT STONE AND THE PROPERTIES OF CONCRETE

Moscow BETON I ZHELEZOBETON in Russian No 7, Jul 77 pp 6-9

ROZENBERG, T. I., All-Union Scientific Research Institute for the Construction of Trunk Pipelines; KAPLAN, A. S., Latvian Scientific Research Institute of Construction and YAMBOR, YA. YA., Institute of Construction and Architecture, Slovak Academy of Sciences

[Abstract] Calcium chloride nitrite-nitrate serves as an excellent model of an electrolytic additive affecting the structure of cement stone and the properties of concrete. Its presence in the pores accelerates the hydration of silicates, as a result of changes in the ionicity of the solution. Studies based on porometry, thermography, x-ray diffraction, chemical analysis, and electron microscopy have revealed that the increase in the specific surface of cement stone in the presence of an electrolyte such as one used in antifreeze is caused by the dispersing effect of the latter and by the sealing effect of double salts. The overall result is a higher strength and a higher frost resistance. Figures 5; tables 1; references 3: Russian.

USSR

UDC 627.838:532.539.2

LINKING OF WATER RACES BY MULTIPLE JET THROWING WITH QUENCHING OF THE STREAM ENERGY AT FLIPPERS THROUGH COMPRESSION OF DISSOLVED AIR

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No 7, Jul 77 pp 50-53

KHLOPENKOV, P. R.

[Abstract] The most critical problem to be solved in the design of high- or medium-head hydroelectric power plants is the quenching of excess energy built up in the stream during passage through spillways and over flippers. Curvilinear flow along flippers is characterized, at high velocities, by the appearance of an extra inertial pressure due to centrifugal forces.

This pressure by far exceeds the gravitational pressure and causes compression of the air dissolved in the water. This results in loss of energy and momentum, with a shortening of the range of throw and an overall change in jet trajectories. This process is analyzed here in terms of water-air hydraulics and the fundamental equations of curvilinear motion. In order to increase the range of throw and reduce the force of the stream eroding the river bed as well as the water spray into the surrounding atmosphere, especially where the climate is severe, it seems most expedient to the design the spillway system with jet throwing and energy dissipating elements separately. Figures 2; tables 2; references 4: Russian.

USSR

UDC 691.327:666.972.53:666.972.16

ADDITIVES IN THE MANUFACTURE OF FROST RESISTANT CONCRETE

Moscow BETON I ZHELEZOBETON in Russian No 7, Jul 77 pp 9-11

GLADKOV, V. S., Central Scientific Research Institute of Construction

[Abstract] As the mobility of a concrete mix without additives increases, the density of the cement stone increases proportionally (at a constant water-cement ratio) and, because the air retention ability decreases, the frost resistance will decrease. The nonuniform cracking of concrete of a given constitution within the zones subject to repeated freezing and thawing is due to the nonuniform pore structure formed during mixing and curing. A complex additive which includes a plasticizer with an aerating or gas evolving agent has been evaluated as to its effectiveness in increasing the overall frost resistance of subzero-grade concrete and making the frost resistance less dependent on various technological factors. The proper use of this additive will also make the production of concrete more economical. Figures 1; tables 2; references 5: Russian.

USSR

UDC 624.131.55.313

A METHOD OF PREDICTING THE VIBRATION LEVEL OF BUILDINGS AND GROUNDS ON  
THE BASIS OF TEST RESULTS

Moscow OSNOVANIYA FUNDAMENTY I MEKHANIKA GRUNTOV in Russian No 4, Jul/Aug 77  
pp 18-21

IL'ICHEV, V. A. and TARANOV, V. G., Scientific Research Institute of  
Foundation Engineering

[Abstract] A method is proposed for predicting the vibration level of buildings and grounds which interact with one another. It utilizes test data on the harmonic vibrations of a small model punch-base system, these data being used for solving the appropriate integral equation of the first kind and thus determining the transfer function as well as the complex vibration amplitudes of such a system. An important step in the solution is the calculation of dynamic contact stresses and application of the collocation technique, it having been established that at no time will these stresses be zero over the entire foundation footing. Figures 5; references 9: 8 Russian, 1 Western.

USSR

UDC 627.83:627.516

PASSAGE OF ICE THROUGH THE STRUCTURES OF THE ZEYA HYDROELECTRIC POWER  
PLANT DURING CONSTRUCTION WORK

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No 8, Aug 77 pp 7-11

KOZHEVNIKOVA, T. YE.

[Abstract] The problem of ice passage through the dams of the Zeya hydroelectric power plant in spring, during the 1973-1974 construction period, was solved by providing passageways through the "comb" on top on the headwater side and openings in the bottom on the tailwater side. Holding the ice for some time, to allow its volume and its strength to decrease, has proved beneficial. The design of these ice passages was based on ice flow, ice accumulation, and meteorological data pertaining, especially, to critical days in April and May. Figures 5; tables 6; no references.

USSR

UDC 691.32:539.371

ELASTIC CHARACTERISTICS OF CONCRETE WITHIN THE BULK OF A STRUCTURE

Moscow GIDROTEKHNIKESKOYE STROITEL'STVO in Russian No 8, Aug 77 pp 15-18

PUKHOV, I. YE.

[Abstract] Data on the characteristics of concrete are most reliable when obtained in the field. Accordingly, elasticity and creep measurements were performed in the dam structure of the Toktogul'sk hydroelectric power plant. Specimens of a 1:3.5:7.3 mix using grade 300 Portland cement were placed and put under compressive load in horizontal molds cut out in the bulk of the dam structure, 50x50 cm in cross section and 200 cm long. The modulus of elasticity was calculated from stress and strain data, according to standard formulas, at various ages ranging from 3 days to 2 years. The strength and the Poisson ratio were also calculated as well as the exothermic heating. A statistical analysis indicates that  $E_{max}$  and  $E_{min}$  may each vary within  $\pm 13\%$  of the mean value of the modulus of elasticity, probably due to qualitative and quantitative changes in the concrete during the dam construction period. Therefore local readings of the modulus of elasticity rather than its mean value over the entire bulk should be used in the performance analysis. Taking this into consideration, the method described here appears more reliable and much less laborious than laboratory testing of large specimens. Figures 3; tables 7; references 4: Russian.

USSR

UDC 691.327:666.972.53

MAGNITUDE AND SHAPE OF THE ELASTIC-COMPLIANCE DIAGRAM FOR BACKFILL SOILS

Moscow GIDROTEKHNIKESKOYE STROITEL'STVO in Russian No 7, Jul 77 pp 43-44

YEVDOKIMOV, P. D.

[Abstract] This is a response to the article by V. Kh. Gol'tsman "Values and depthwise distribution of the coefficient of resistance of backfill soils to displacements of vertical walls" (GIDROTEKHNIKESKOYE STROITEL'STVO, No 11, 1975) and to the article by V. Kh. Gol'tsman and L. B. Sheynman "Design of basin structures for sluices on the basis of data obtained from prototype measurements" (GIDROTEKHNIKESKOYE STROITEL'STVO, No 10, 1976). Sluice walls do undergo deformation while in service, due to heat and due to sinking, and these deformations correspond to forces much weaker than theoretically calculated according to the Construction Norms and Regulations

II-I.10.65. It is also necessary to compact the backfill scale, which would require pouring them in thin layers. The criticism of these Construction Norms and Regulations is, therefore, justified. It does not seem correct, however, that the compression modulus of backfill soils under practically existing stresses cannot vary appreciably over the depth and should be assumed constant, corresponding to low pressures which react to the lateral pressure on a wall. Rather, it appears entirely unnecessary to relate the compliance coefficient to the size of the active soil zone and to the dependence of this size on the mean pressure against the wall. This statement is proved by a simple force analysis, namely the equations of equilibrium for horizontal components, vertical components, and moments. Figures 1; references 5: Russian.

USSR

UDC 624.152.634.3:627.8:621.311.21

BRICKWORK WITH EXTERNAL REINFORCEMENT FOR ENCASEMENTS IN STATE REGIONAL ELECTRIC POWER PLANTS

Moscow BETON I ZHELEZOBETON in Russian No 6, Jun 77 pp 7-9

PEREYASLAVTSEV, N. A., Kiev Branch, All-Union State Institute for the Planning of Electrical Equipment for Heat Engineering Structures

[Abstract] Brickwork with external reinforcement has been designed and built for encasing the 800-MW generators in Zaporozhe and Uglegorsk State Regional Electric Power Plants. The brick columns are 65 m high and carry a load reaching 5,000 tons, which is unique for a reinforced-concrete structure. Hanger beams project at this height, supported by the columns, and on them is suspended a boiler weighing 16,000 tons. The concrete bricks for this structure are either 400x600 mm or 600x600 mm in size, reinforced with angle brackets ranging in size from 100x100x10 mm to 200x200x30 mm and class A-II stirrups 10 mm or 14 mm in diameter spaced 100-150 mm apart, both angle brackets and stirrups made of grade 10KhSND steel. The encasements were designed by computer, taking into consideration the dynamic effects of wind. The basic feature of each structure is that it contains only 16,332.8 tons of steel and 4,258.4 m<sup>3</sup> of concrete, as compared with 21,648 tons of steel in a metallic encasement, at a cost saving of 707 thousand rubles. Figures 2; tables 1; no references.

USSR

UDC 627.82:624.042.5

STATE OF THERMAL STRESS IN LARGE CONCRETE SLABS

Moscow GIDROTEKHNIЧЕСКОYE STROITEL'STVO in Russian No 7, Jul 77 pp 15-18

TSAREV, A. I., KAZACHENKO, M. S., and MIRZAK, YU. YE.

[Abstract] The concrete of the dam in the Toktogul'sk hydroelectric power plant was poured in layers without taps. The applicability of this method had been established on the basis of experimental and theoretical studies, mainly concerning the state of thermal stress in large slabs, to ensure monolithicity of the structure. Tensometric data and temperature readings taken throughout all stages of laying, exothermic heating, cooling, and curing indicate that slabs 80x30 mm large in layers 0.75 m thick have sufficient thermal stability during summer and winter periods under conditions of surface or pipe cooling. Maximum tensile stresses (16 kgf/cm<sup>2</sup>) appear during the second cooling stage within the center region of a slab laid in spring, but they do not exceed the tensile strength of concrete. Figures 4; references 9: Russian.

USSR

UDC 624.046:5:519.2

OVERLOADS AND THEIR COMBINATIONS

Moscow STROITEL'NAYA MEKHANIKA I RASCHET SOORUZHENIY in Russian No 4, Aug 77 pp 11-15

RZHANITSYN, A. R., Moscow Institute of Construction Engineering

[Abstract] The concept of an overload as a random event of random duration is introduced. The probability of appearance of an overload over the course of a fixed period of time is determined. A simple formula is produced for the expected value of combined duration of several overloads. Formulas are presented for determination of the probability of combined action of several overloads, allowing the influence of combinations of loads to be considered in the design of structures. The method described can also be used for combinations of variable loads with constant loads, as well as variable strength factors. The expected duration of the overload and the expected duration of decreased strength should, in this case, be taken equal to infinity. References 2 Russian.

USSR

UDC 536.7; 541.11; 621.45

INFLUENCE THAT ERRORS IN THERMOCHEMICAL QUANTITIES AND THERMODYNAMIC PROPERTIES OF INDIVIDUAL SUBSTANCES HAVE ON CALCULATED PARAMETERS OF COMBUSTION PRODUCTS

Kazan' IZVESTIYA VUZov, AVIATIONNAYA TEKHNIKA in Russian No 1, 1977  
pp 5-10 manuscript received 15 Apr 76

ALEMASOV, V. YE., DREGALIN, A. F. and LYASHEV, A. S.

[Abstract] A method is proposed for determining the error of thermodynamic calculation of combustion products due to errors in the thermochemical and thermodynamic properties of individual components of the combustion products. Reference data on errors in the thermochemical and thermodynamic properties of substances are used to evaluate the errors in calculating the thermodynamic temperature in the combustion chamber, and specific impulse in vacuum for a group of chemical fuels. It is shown that a fuel component can make a rather high contribution to computational errors even though it is present in small amounts. The proposed method can be used to formulate requirements for the permissible error of thermochemical and thermodynamic properties of individual components of the combustion products, and also shows the advisability of accounting for any given individual components. Tables 3; references 11: 7 Russian, 4 Western.

USSR

UDC 621.01

TEMPERATURE FIELD IN A SEMITRANSSPARENT ANISOTROPIC POROUS WALL

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 8, Aug 77 pp 77-81  
manuscript received 12 Jul 76

REZNIK, S. V., SOLOVOV, V. A., and SINITSYN, YE. P., Moscow Higher Technical School imeni N. E. Bauman

[Abstract] The temperature field in a semitransparent anisotropic porous plane wall is considered, taking into account the absorption of radiation by the material and subsequent heat evolution inside the volume. The fundamental differential equation of total heat transmission across the wall, with cooling and with radiation scattering in the pores, is solved by the method of finite integral rather than Fourier transformation. Upon elimination of differentiations with respect to the width coordinate, the problem is reduced to the Sturm-Liouville system and solved as such. Numerical results, obtained on a high-speed computer in ALGOL, indicate that varying the ratio of thermal conductivities across the thickness and

across the height respectively is equivalent to varying the thermal resistance of the wall in the respective directions. Increasing this ratio results in a higher wall temperature on the coolant side and in lower temperatures as well as larger temperature gradients across the thickness, while the dimensionless temperature on the heater side remains constant. Figures 3; references 7: Russian.

USSR

UDC 533.6.011.72:538.4

PROPAGATION OF SURFACES OF STRONG DISCONTINUITIES IN A CHANNEL THROUGH AN AREA OF A HETEROGENEOUS ELECTROMAGNETIC FIELD

Moscow IZVESTIYA AKADEMII NAUK SSSR MAKHANIKA ZHIDKOSTI I GAZA in Russian No 2, Mar/Apr 77 pp 112-122 manuscript received 26 Jul 76

GRIGORENKO, V. L. and MAREYEV, V. A.

[Abstract] A study is made of the influence of an electromagnetic field of finite length on the movement of an ionized gas behind a detonation wave with strong and weak MHD interactions. The results presented were produced by means of an explicit finite-difference plan. The propagation of a detonation and shock wave in a channel of constant cross section with an open end in an external magnetic field is studied when potential differences are induced on the walls of the channel (electrodes) and closed electric currents arise in the area of the flow. Unstable one-dimensional flows are studied, arising at the closed end of a channel filled with a combustible mixture of gases with concentrated application of energy and subsequent formation of a detonation wave when external electric and magnetic fields are present. The results show that the influence of the electromagnetic field on the movement of the conducting gas behind the detonation wave is significant even at rather great distances from the zone of interaction when the detonation wave propagates in the stable mode. The velocity of its movement, depending on the amount of energy applied to the gas, may either decrease or increase in comparison with the case when there is no electromagnetic interaction. References 15: 14 Russian, 1 Western.

USSR

UDC 532.525.6:031+539.3

## JET FLOW AROUND AN ELASTIC ENVELOPE

Moscow IZVESTIYA AKADEMII NAUK SSSR MEKHANIKA ZHIDKOSTI I GAZA in Russian  
No 2, Mar/Apr 77 pp 24-32 manuscript received 8 Jul 76

KISELEV, O. M. and RAPOPORT, E. F.

[Abstract] A study is made of steady potential flow of an incompressible fluid in the plane  $z = x + iy$ , limited by a solid polygon, an elastic cylindrical shell and a free surface, along which the velocity modulus retains a constant value. With certain limitations on the form of the envelope, it is proven that the problem can be solved unambiguously, and a method of solution is suggested. Certain calculation results are presented. The reciprocal problem of static hydroelasticity is also stated and solved. References: 4 Russian.

USSR

UDC 532.517.3+536.25:518.5

## NONLINEAR INTERACTION OF CONVECTIVE WAVE MOTIONS AND THE INTERACTION OF TURBULENCE IN A ROTATING HORIZONTAL LAYER

Moscow IZVESTIYA AKADEMII NAUK SSSR MEKHANIKA ZHIDKOSTI I GAZA in Russian  
No 2, Mar/Apr 77 pp 9-15, manuscript received 10 May 76

GERTSENSHTEYN, S. YA. and SHMIDT, V. M.

[Abstract] A study is made of the stability of a horizontal layer of fluid limited by parallel planes  $z=0$  and  $z=d$  and evenly rotating relative to the vertical  $z$  axis at angular velocity  $\Omega$ . The temperature  $T_1$  at the boundaries of the layer is fixed, the temperature at the lower boundary is equal to  $T_0$ , at the upper boundary -  $(T_0 - \Delta T)$ . Two-dimensional convection equations are used in the Boussinesq approximation written in a rotating system of coordinates; the centrifugal convective force is ignored. The convection equations are solved by direct methods. The evolution of a perturbation consisting of the superimposition of two waves with different wave numbers  $\alpha_1$  and  $\alpha_2$  is studied. The appearance of harmonics such as  $n\alpha_1 \pm m\alpha_2$  is considered, when  $n$  and  $m$  are integers. Particular attention is given to the problem of development of turbulence. Numerical experiments demonstrate that the analysis of the interaction of a limited number of harmonics (from 23-500) allows certain characteristic peculiarities of the movement occurring when turbulence develops to be reproduced. References 22: 15 Russian, 7 Western.

USSR

UDC 532.526.3.014.4

PAIRED INELASTIC INTERACTIONS OF SCHLICHTING WAVES IN BOUNDARY-LAYER-TYPE STREAMS

Moscow IZVESTIYA AKADEMII NAUK SSSR MEKHANIKA ZHIDKOSTI I GAZA in Russian No 2, Mar/Apr 77 pp 33-37 manuscript received 25 Feb 76

VOLODIN, A. G. and ZEL'MAN, M. B.

[Abstract] A study is made of the combined evolution of a pair of Schlichting waves as a function of R numbers and frequencies for a boundary-layer-type flow by the phase plane method. For sufficiently small amplitudes in the first order of magnitude, the asymptotic theory predicts both 3-wave resonances and "nonresonant" interaction - self-interaction and competition of waves. The study of paired interactions in flows of this type is of interest in connection with the question of the influence of forced oscillations on the transition area. In particular, it is possible to explain the effects observed when an acoustical field acts on a stream, consisting in the assumption that the sound induces vortex perturbation of the same frequency in the layer, and that this perturbation interacts nonlinearly with the Schlichting wave. It was found that the excitation of sufficiently intensive oscillations within and near the upper branch of the neutral curve of linear stability leads to redistribution of the spectrum of increasing waves. These conclusions agree qualitatively with earlier observations if we assume that the effects observed result from the interaction of perturbations induced by the sonic field with the Schlichting wave of maximum amplitude. References 9: 7 Russian, 2 Western.

USSR

UDC 517.9-532.593

A MODIFICATION OF THE VARIATIONAL METHOD FOR SOLVING THE PROBLEM OF NATURAL VIBRATIONS OF A LIQUID IN A CONTAINER

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 13, No 7, Jul 77 pp 83-89 manuscript received 25 Nov 75

BARNYAK, M. YA. and LUKOVSKIY, I. A., Institute of Mathematics, Academy of Sciences of the Ukrainian SSR, Kiev

[Abstract] An analysis of small natural vibrations in the case of a finite volume of ideally compressible fluid reduces to the solution of a boundary-value eigenvalue problem. An algorithm for solving this problem by the variational method is shown here with which the boundary condition at the

free surface of the liquid can be satisfied exactly and, therefore, only the boundary condition at the wetted container surface will be satisfied approximately. Thus the accuracy of the resulting solution can be estimated in the differential sense and the eigenvalues of the original boundary-value problem can be estimated from below. The application of this algorithm is illustrated on a numerical example. Tables 4; references 3: Russian.

USSR

UDC 661.1.031.2:536.2

CALCULATION OF COMPLEX HEAT EXCHANGE IN GLASS MAKING FURNACES WITH DIRECT HEATING

Moscow STEKLO I KERAMIKA in Russian No 7, Jul 77 pp 11-13

SHKLYAR, YA. V., Vitebsk Technological Institute for Light Industry, LEBEDEV, V. I., Moscow Institute of Construction Engineering, and FEL'DMAN, M. A., "Tekhnergokhimprom" Production Union

[Abstract] Stanton numbers are developed, characterizing the intensity of complex heat exchange in the flame space of direct heating glass making furnaces. The introduction of this quantity allows coefficients of complex and convective heat exchange to be calculated on the basis of known values of resultant radiat flux. Introduction of a special temperature simplex is used to demonstrate the possibility of determining the coefficient of convective heat transfer in industrial furnaces on the basis of the results of blowing of air through a model. A comparative evaluation is given of the use of these methods for calculation of the convective component of complex heat exchange in directly heated glass making furnaces.

USSR

UDC 666.1.0341.2.666.1.031.16:666.151

INFLUENCE THAT WATER COOLERS IN SHEET GLASS FURNACES HAVE ON THE SOLIDIFICATION CAPACITY AND THERMAL UNIFORMITY OF A GLASS BATCH

Moscow STEKLO I KERAMIKA in Russian No 6, Jun 77 pp 4-6

PAVLOV, V. S., (deceased), candidate of technical sciences, FOKIN, V. V., engineer, KHOVANSKAYA, N. A., engineer, and MESSEL', G. YU., VNIItekh-stroysteklo [expansion not known]

[Abstract] The authors consider the influence that the design and placement of cooling bars in sheet glass production furnaces have on the solidification capacity of the furnace and on the thermal uniformity of a glass melt as it enters the forming section. The studies were done in operating furnaces and in a transparent model. It was found that the temperature uniformity of the glass melt before forming is considerably dependent on the distance between the line of draw (cooling bar) and the workout point (bridge in vertical drawing, or pour spout in horizontal drawing). The optimum distances are found for different types of furnaces. It is found that the cooling bar should be located at least 170 mm beneath the glass level. Figures 5; tables 3; references 3: Russian.

USSR

UDC 666.122.2:66.046

HEAT TREATING QUARTZ SAND IN A DENSE MOVING LAYER

Moscow STEKLO I KERAMIKA in Russian No 6, Jun 77 pp 14-16

KORNARAKI, V. V., candidate of technical sciences, FINASHKIN, A. I., engineer, Odessa Technological Institute of the Food Industry, and NAUMOV, L. A., engineer, Rybinsk Design Office of Special Machine Building, Ministry of Machinery for Light Industry and the Food Industry

[Abstract] Comprehensive experimental studies are done to develop a vibration and gravity-feed kiln for drying quartz sand. The research included determination of the effective thermophysical characteristics, investigation of heat exchange of dry and wet sand with transverse flow through the cylinder, and the process of drying of wet sand in a stationary layer in the case of simulation of conditions corresponding to a moving layer, as well as calculation of the drying process in a moving layer. A kiln is developed with the following characteristics: productivity 300 kg/hr, moisture content differential 10%, average surface temperature 150°C for heating and 20°C for cooling, installed power of the heaters 46 kW, cooling water flowrate 1 cu. m per hour, vibration drive IV-2A, overall dimensions 5720x250x340 mm, heat-transfer surface 4.4 sq. m for heating and 1.4 sq. m for cooling. Equations are given for calculating processes of heat treating charges for glass production. Figures 3; references 5 Russian.

USSR

UDC 621.4/6:533.6

DESIGN OF LIQUID-GAS JET-FLOW DEVICES

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 8, Aug 77 pp 81-86  
manuscript received 16 Jul 76

CHERNUKHIN, V. A., TSEGEL'SKIY, V. G., and GLUBOKOVSKIY, S. I., Moscow Higher Technical School imeni N. E. Bauman

[Abstract] The equations of ejection, for the design of liquid-gas and liquid-vapor(gas) jet-flow devices with a small  $K(1-C)$  index within the  $10^{-2}$ - $10^{-3}$  range ( $K$  denoting the ejection factor and  $C$  denoting the degree of gas condensation), are solved on the basis of the following assumptions: 1) the flow of both components through the nozzle is uniform and steady, 2) the temperature coefficients of the coherence factor for both components are equal to unity at the exit from the mixing chamber, 3) the coherence

factors for the gas, both dynamic and kinetic, are equal to unity at the exit from the mixing chamber, 4) there is no friction along the wall of the mixing chamber, 5) the forces of surface tension in both components have a negligible effect on the performance of the jet-flow device, and 6) a mixture forms at the chamber exit which is thermodynamically in equilibrium with respect to the average-in-time temperature and mechanically in equilibrium with respect to the mean-flow-rate velocities. Each of these assumptions has been tested by numerical analysis and found valid for determining the parameters of the mixture at the chamber exit, when the parameters of both components as well as the device geometry and the coherence factors (dynamic and kinetic) for the liquid are given. Typical performance characteristics and throttle characteristics of such a device are shown; calculated curves are compared with test values. Figures 3; references 3: Russian.

USSR

UDC 621.9

STABILITY OF THE DYNAMIC SYSTEM OF A MACHINE TOOL WITH VIBRATIONS UNDER  
IDLE CONDITIONS TAKEN INTO ACCOUNT

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 8, Aug 77 pp 157-162  
manuscript received 7 Feb 77

YESAYAN, M..A. and SARKISYAN, ZH. V., Armenian Agricultural Institute

[Abstract] The stability of the dynamic system of a machine tool is analyzed theoretically. The system is then subdivided into an elastic component and a nonlinear component representing the cutting operation. External perturbations are regarded as a random process, perturbations due to idling are regarded as a stationary process, and spontaneous vibrations in the system are assumed to occur. The fundamental system of equations and the dispersion equation for this two-component system are solved for the general case and also for the special case of no external perturbations. Numerical results have been obtained for 13 model 1K62 machine tools in the experimental part of this study, on the basis of test data and their statistical evaluation. In this particular case, with external perturbations occurring, the spontaneous vibrations are found to stabilize toward the end of the transient process. Figures 3; references 7: 6 Russian, 1 Western.

USSR

UDC 66.047.75.002.237.001.5

AERODYNAMICS AND OPTIMIZATION OF VORTEX CHAMBERS IN A SPRAY-TYPE DESICCATOR

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 8, Aug 77 pp 34-38

MIKHAYLENKO, A. A., All-Union Scientific Research Institute of Starch Products and KOSMODEM'YANSKIY, YU. V., Moscow Technological Institute of the Meat and Dairy Industry

[Abstract] Vortex chambers for spray-type desiccators of starch syrups and similar products have been developed which aerodynamically resemble cyclone chambers for drying loose grain products, but feature some major design modifications necessitated by the different product characteristics. Distinguishing features are tangential injection of drying gas and top discharge of exhaust gas, so that the dry product can be separated from the latter directly inside the chamber. The maximum tangential velocity in the main stream is 4-7 times higher than the minimum tangential velocity in the boundary layer. Radial and axial velocities are very low, within 3-6% of the tangential velocity, throughout most of the chamber volume. They are higher near the axis and especially the radial velocity becomes very high in the conical bottom zone as well as on top under the exhaust nozzle. The direction of the radial velocity is toward the center, while in cyclone chambers it is indeterminate. The design of the chamber geometry and of the raw-product intake system have been optimized for a maximum percent yield of the end product. The design is based on a mathematical model and results of a fractional-factorial experiment ( $1/4^{2^5} = 2^{5-2}$ ). Figures 5; References 10: Russian.

USSR

UDC 539.374:621.7.04

IDEALLY VISCOELASTIC AXISYMMETRIC FORMING OF THIN SHELLS

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 13, No 7, Jul 77 pp 3-8 manuscript received 4 Nov 75

KOSHUR, V. D. and NEMIROVSKIY, YU. V., Institute of Hydrodynamics, Siberian Division, USSR Academy of Sciences, Novosibirsk

[Abstract] The problem of axisymmetric forming is considered in the case of thin shells made of an ideally viscoelastic material. According to this rheological model, the original shell has been made plastic by some preliminary loading or heating and subsequent changes in the stress field will depend on the forming rate. This model applies to "hot forming" of metals as well as to plastic materials. The fundamental relations for a quasi-static zero-moment low-inertia process, written in Lagrangian coordinates,

are applied here to a shell whose thickness is uniformly decreasing under internal pressure. The problem is solved analytically. References 7: 4 Russian, 1 Polish, 2 Western.

USSR

UDC 621.181.62.001.24:669

CALCULATING THE PERFORMANCE CHARACTERISTICS OF A BOILER-COOLER FOR CONVERTER GASES

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 8, Aug 77 pp 32-34

TSIGANKOV, S. A. and FUKS, V. N., Central Scientific Research, Planning, and Design Boiler and Turbine Institute imeni I. I. Polzunov

[Abstract] The performance of boiler-coolers in steelmaking converters is characterized by a cyclic variation of the thermal load on the heating surface. A method is proposed for calculating the performance so as to take into account the dynamics of the converter process. The heat balance and the hydraulic parameters are calculated for individual time subintervals of a cycle, according to conventional relations and in the following sequence: 1) heat of evaporation, 2) steam volume, 3) volume of steam-water mixture entering the drum, 4) quality of steam, 5) steam volume entering the drum, 6) water volume entering the drum, 7) steam rate of the boiler, 8) change in the water volume in the drum. Calculated is also the total heat necessary for heating up the metal structure of the entire boiler. On the basis of these calculations, performance curves are then plotted for the entire "blow" period. Figures 3; references 1: Russian.

USSR

UDC 666.221.001.5.031

THE PROCESS OF DESTRUCTION OF A CARBON-GRAPHITE REFRACTORY MATERIAL BY A MELT OF FLUOROPHOSPHATE OPTICAL GLASS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 5, May 77 pp 38-40 manuscript received 14 Jan 75

GARIBIN, YE. A., BORISOV, B. A., MEL'NIKOVA, I. G. and PETROVSKIY, G. T.

[Abstract] Electron microscopy is used to study the interaction of a vitreous polymer of carbon with a melt of optical fluorophosphate glass.

A suggestion is made concerning the mechanism of the process of destruction and its influence on the technology of manufacture of optical fluorophosphate glass in vitreous carbon vessels. It is confirmed that destruction of the vitreous carbon involves the participation of the gas phase. The dual nature of destruction of the carbon results from structural peculiarities of the material. It changes with increasing contact time with the fluorophosphate melt. For the first 1-3 hours, there are no carbon inclusions in the glass. Increasing the contact time leads to the formation of globules - the most stable elements in the structure of the vitreous carbon. The quality of optical glass produced in vessels of vitreous carbon is directly determined by the nature of destruction of the refractory. The duration of use of a crucible depends on the time required to break down the surface film, which has a packet-layer supermolecular structure. References 15: 11 Russian, 4 Western.

USSR

UDC 624-752

#### THE EFFECTIVENESS OF PASSIVE VIBRATION DAMPERS IN ROTOR SYSTEMS

Moscow MASHINOVEDENIYE in Russian No 4, 1977 pp 40-46 manuscript received 7 Dec 76

KRABTSOVA, YE. V. and POZNYAK, E. L.

[Abstract] Using a rotor system as an example, the effectiveness of the use of vibration dampers to decrease vibrations due to rotor imbalance is studied. The influence of the parameters of the vibration damper, parameters of the external shock absorption and degree of mistuning on effectiveness is studied. Only passive vibration dampers which reduce the level of vibration by their own elastic and inertial properties are investigated. The results produced explain the cases observed in practice of failure of elastic elements, as well as cases in which the effectiveness of a system with several vibration dampers is less than a system with a smaller number of vibration dampers of equivalent mass or a single vibration damper. References 11 Russian.

USSR

UDC 666.1.056:535.4

METAL-DIELECTRIC INTERFERENCE MIRROR COATINGS OF HIGH MECHANICAL STRENGTH

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 5, May 77  
pp 41-43 manuscript received 17 Aug 76

FURMAN, SH. A. and VVEDENSKIY, V. D.

[Abstract] A method is described for production of highly reflective mirrors based on aluminum, silicon dioxide and titanium dioxide, applied in a vacuum onto unheated substrates by means of an electronic evaporator. It is shown that the coatings are simple to manufacture, have high mechanical strength and a reflection factor of over 86%. In addition to their outstanding usage of optical properties, Al-Al<sub>2</sub>O<sub>3</sub>-TiO<sub>2</sub> mirrors have significant shortcomings: they are difficult to manufacture by the usual thermal method of evaporation of titanium dioxide which requires, furthermore, later anodic oxidation. It is difficult to produce reflectors over 500 mm in diameter with R > 95% by this method. The method described in this article is free of these shortcomings. References 6: 2 Russian, 4 Western.

USSR

## CRYSTALLIZATION OF ZIRCONIUM IN POLYBORIC ZIRCONIUM GLAZES

Moscow STEKLO I KERAMIKA in Russian No 6, Jun 77 pp 21-23

GRUM-GRZHIMAYLO, O. S., candidate of geological and mineralogical sciences, KVIATKOVSKAYA, K. K., candidate of technical sciences and SAVVATEYEVA, L. M., engineer, State Scientific Research Institute of Building Ceramics

[Abstract] The mechanism of crystallization of zirconium in polyborate glazes was studied by infrared spectrometry, thermography and x-ray thermography. It is found that the formation of zirconium is preceded by structural rearrangement of the glass accompanied by polymerization of boric groupings  $BO_3$ , after which tetragonal zirconium dioxide  $t-ZrO_2$  crystallizes. The latter enters into reaction with  $SiO_2$  and forms zirconium. Depending on the composition and conditions of annealing, the  $t-ZrO_2$  may be retained in the final product, or may be converted to baddeleyite (a monoclinic form of  $ZrO_2$ ). Figures 3; table 1; references 6: 5 Russian, 1 Western.

USSR

## COMPOSITION OF A DIAMOND SURFACING FOR TOOLS

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 24, 1977 p 34, Authors' Certificate No 563280 filed 15 Oct 74, published 30 Jun 77

NAYDICH, YU. V., LAVRINENKO, I. A., VOLK, G. P., SHCHERBACHENKO, N. I., and BREYEV, B. I., "Order of the Red Banner of Labor" Institute of Problems in the Science of Materials, Academy of Sciences UkrSSR

[Text] A diamond surfacing composition for tools, chiefly for ultrasonic drilling of very hard materials. The composition includes copper and gallium. As a distinguishing feature of the patent the productivity and wear resistance of tools are improved by adding titanium and one metal from the following group: vanadium, niobium, tantalum. The components are taken in the following proportion (vol.%): diamond--12.5-50.0; gallium--6.0-15.0; titanium--5.0-15.0; metal from the given group--2.0-5.5; and the remainder copper.

USSR

UDC 539.214

RESISTANCE OF CERTAIN STRUCTURAL MATERIALS TO VISCOELASTIC DEFORMATION  
UNDER VARIOUS MODES OF LOADING

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA TVERLOGO TELA in Russian  
No 3, May-Jun 77 pp 89-96 manuscript received 22 Jul 75

MEL'SHANOV, A. F., Moscow

[Abstract] An experimental study was made to determine the viscoelastic behavior of two titanium alloys (grades VT1-0 and OT-4) as well as of soft steel (grade St. 3) loaded uniaxially at a constant rate at room temperature. The VT1-0 tension specimens were cylinders (7 mm diameter, 12 mm gage length), the OT-4 tension specimens were plates (30x6x2 mm), and the St. 3 compression specimens were cylinders (8 mm diameter, 20 mm height). The test data are evaluated here so as to fit the equations of creep theory, hardening theory, and aftereffect theory. In the case of steel, moreover, the sharp yield drop is also taken into account. Some discrepancy between theoretical and experimental values is attributed to the constant rate of loading. Figures 8; tables 4; references 9: 8 Russian, 1 Western.

USSR

UDC 548.74

DETERMINATION OF THE CRYSTAL STRUCTURES OF CHAPMANITE AND BISMUTH-FERRITE  
BY THE METHOD OF HIGH-VOLTAGE ELECTRON DIFFRACTION

Moscow KRISTALLOGRAFIYA in Russian Vol 22, No 4, Jul/Aug 77 pp 731-738  
manuscript received 7 Jul 76

ZHUKHLISTOV, A. P. and ZVYAGIN, B. B., Institute of Geology of Ore Deposits,  
Petrography, Mineralogy and Geochemistry, Academy of Sciences USSR

[Abstract] High-voltage electron diffraction (350 kV) was used to study the structure of chapmanite from Czechoslovakia and bismuth-ferrite from East Germany. The specimens were taken from the Mineralogical Museum of the Soviet Academy of Sciences, and data on chemical composition were taken from the reference literature for deposits from the corresponding geographic areas. The crystal structures were decoded by three-dimensional Patterson maps with deconvolution by the peak rhombus method. Parameters of the monoclinic cells:  $a = 5.19$ ,  $b = 8.99$ ,  $c = 7.70 \text{ \AA}$ ,  $\beta = 100^\circ 40'$  for chapmanite, and  $a = 5.21$ ,  $b = 9.02$ ,  $c = 7.74 \text{ \AA}$ ,  $\beta = 100^\circ 40'$  for bismuth-ferrite,  $z = 2$ , space group Cm. It is found that chapmanite and bismuth-ferrite consist of

two-level kaolinite-like layers of composition  $\text{Fe}_2\text{Si}_2\text{O}_8(\text{OH})$  arranged in a sequence  $\sigma_6\tau_0\sigma_6$ . In the normal projection on plane  $ab$ , contiguous grids of adjacent layers are superimposed in such a way that an empty octahedron of the layer is over a hexagonal loop of silicon tetrahedra. The atoms of antimony in chapmanite and bismuth in bismuth-ferrite are located in the interlayer gap, adjacent to the bases of the empty octahedra as a fourth vertex of a triangular pyramid. The structures of chapmanite and bismuth-ferrite are unique examples of realization of laminar silicates of kaolin-like layers with  $\text{Fe}^{3+}$  cations in the octahedra. Figures 5; tables 4; references 12: 8 Russian, 4 Western.

USSR

UDC 548.52

INFLUENCE THAT ORIENTATION OF THE DIRECTIONS OF GROWTH HAS ON DOPANT DISTRIBUTION IN NICKEL SINGLE CRYSTALS AND ON THEIR SUBSTRUCTURE

Moscow KRISTALLOGRAFIYA in Russian Vol 22, No 4, Jul/Aug 77 pp 824-830  
manuscript received 28 Jul 75, after revision 25 May 76

KRALINA, A. A. and SAZONOVA, V. A., Institute of Physics of Metals, Ural Science Center, Academy of Sciences USSR

[Abstract] The problem of formation of line substructures in metal single crystals is important for development of crystal growing techniques. Investigation of this problem hinges on two basic points: 1) origin of dislocations; 2) principles of incorporation of dislocations into sub-boundaries. In contrast to the traditional approach to the study of line structure via analysis of thermal conditions of growth, the authors approach the issue in terms of crystallographic analysis of sub-boundaries and the dislocations that make up these boundaries. To relate a specific type of sub-boundaries to the orientation of the axis of growth and to the particulars of the interface between solid and liquid phases, the authors determine the nature of the sub-boundaries of nickel single crystals that form during crystallization from a melt. The analysis is based on radiographic determination of the structure of the sub-boundaries, as well as metallographic and chemical determination of the dopant distribution in crystals grown by the Czochralski method with growth axes in directions  $[100]$ ,  $[110]$  and  $[111]$ . It is shown that dopant distribution close to the crystallization surface is cellular-dendritic. The form and crystallography of the cells is determined by the crystallographic orientation of the axis of growth. The results are discussed from the standpoint of the realization of the mechanism of formation of low-angle sub-boundaries as a result of the gradient of dopant concentration. Figures 5; references 24: 10 Russian, 14 Western.

USSR

UDC 536.35

CHARACTERISTICS OF RADIATIVE HEAT TRANSFER IN COMPOSITE MATERIALS

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 7, Jul 77 pp 50-54  
manuscript received 12 Jun 76

TOVSTONOG, V. A., Moscow Higher Technical School imeni N. E. Bauman

[Abstract] Some structural composites such as glass-textolite containing quartz fiber and epoxide binder are highly transparent to thermal radiation, and this characteristic is an important factor in design and application. An approximate general analytical solution to the equation of radiative heat transfer, obtained by the method of moments, is compared here with the optical characteristics of grade GTEF-20 material which have been measured on 12 specimens and then statistically evaluated. The results indicate that nonhomogeneity and semitransparency of a material affect the temperature field, especially in thin plates, and thus the accuracy of expressions for absorption and scattering coefficients. Figures 3; references 3: Russian.

USSR

UDC 539.4

MODEL OF A LINEARLY REINFORCED COMPOSITE MATERIAL WITH RIGID FIBERS AND AN ANISOTROPIC MATRIX

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 13, No 7, Jul 77 pp 59-67  
manuscript received 10 Nov 75

KOLESNIKOV, V. P., Novosibirsk Electrotechnical Institute and FIL'SHTINSKIY, L. A., Sumy Branch of the Kharkov Polytechnic Institute

[Abstract] A composite material is considered consisting of an anisotropic matrix linearly reinforced with rigid fibers. The problem of determining the state of stress and strain is reduced here to a two-dimensional bi-periodic problem in the theory of elasticity for an anisotropic medium with rigid inclusions. This boundary-value problem is solved as a Fredholm integral equation of the second kind with respect to the structural period. The relation between mean stresses and strains is thereupon interpreted in terms of a macromodel: a homogeneous anisotropic medium governed by the same Hooke law. The results are tested on a typical example of Textolite. Figures 5; references 6: Russian.

## EPITAXIAL INTERGROWTH AS AN INDICATOR OF THE THERMODYNAMIC CONDITIONS OF DIAMOND FORMATION

Moscow IZVESTIYA AKADEMII NAUK SSSR, SERIYA GEOLOGICHESKAYA in Russian No 5, May 77 pp 84-95 manuscript received 9 Jun 76

MAL'KOV, B. A., Ukhta Industrial Institute

[Abstract] The conditions of natural diamond formation in kimberlite magma are very close to those of synthetic diamond formation by spontaneous crystallization under high pressure and temperature from metal-catalyst melts saturated with carbon. This has been confirmed by the sum total of geological and mineralogical data, but various authors differ on the pressure and so the latter could range from 50 to 160 kbar. A more refined estimate of the diamond formation pressure is undertaken here, by analyzing the epitaxial intergrowth process of quasihomogenization with syngenetic inclusions such as olivine, pyrope, and chromite. The process occurs in three stages: 1) simultaneous growth of diamond and the syngenetic inclusion minerals under high pressure (50-100 kbar) and high temperature (about 1500°C), producing uniform stresses throughout, 2) fast decrease of the pressure down to atmospheric and slow decrease of the temperature down to 1000°C, with the inclusions expanding and diamond behaving like a brittle material, 3) cooling down to 0°C under constant nearly atmospheric pressure, with diamond and the inclusions thermally compressed. A formula is proposed for the pressure necessary to eliminate the noncongruence between intergrowing crystal lattices. Calculations are shown, accordingly, for a few typical modes of epitaxial intergrowth such as: (111)-plane in diamond superposing on (010)-plane in olivine, (001)-plane in diamond superposing on (011)-plane in olivine, and (111)-plane in diamond superposing on (011)-plane in pyrope. Plastic stress relaxation around solid inclusions does not affect the accuracy of these calculations, but still more refined data on the anomalies of diamond and its syngenetic inclusions must become available for a sufficiently accurate evaluation of the thermodynamic parameters of natural diamond crystallization. Figures 1; tables 1; references 36: 24 Russian, 12 Western.

USSR

UDC 621.922.079

ABRASIVE MIX FOR POROUS TOOLS

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 28, 30 Jul 77 Authors' Certificate No 566724, 27 Feb 76

FEDOTOVA, S. M., GRISHANOVA, N. I., VORONOV, S. G., EFROS, M. G., KAZANSKAYA, V. F., NOSAYEV, G. A., and BEZBORODKO, G. L., All-Union Scientific Research Institute of Abrasives and Grinding

[Text] A mix on a ceramic binder base containing abrasive material, a moistener, an adhesive additive, and a filler, with the distinguishing feature that, for improving the technology of abrasion tool manufacture, as the filler in this mix serves the product of styrene polymerization in the presence of benzoyl peroxide and tertiary butyl perbenzoate in suspension, with the following composition of ingredients (wt.pct):

Abrasive material	55.0-96.0
Ceramic binder	1.5-20.0
Moistener	0.5-5.0
Adhesive additive	0.2-2.0
Water	0.5-1.1
Product of styrene polymerization in the presence of benzoyl peroxide and tertiary butyl perbenzoate in suspension	1/3-16.9

USSR

UDC 691.327:666.972.124:539.4

CONCRETE BASED ON GRANULAR SLAG SAND OF THE NICKEL INDUSTRY

Moscow BETON I ZHELEZOBETON in Russian No 6, Jun 77 pp 33-34

ZAROVNYATNYKH, V. A. and ROZOVSKIY, A. L., Ural Scientific Research Institute for the Planning of Construction Materials

[Abstract] A study was made to determine the feasibility of using the granular slag sand from nickel manufacturing plants as the fine ingredient for heavy concrete. Resilience, shear, and life tests performed on samples of a 1:1.8:1.2 sand-water-cement mixture have yielded satisfactory results. The optimum grain-size fraction for this purpose is shifted toward the fine-grain range 1.9...2.3 mm mesh. Up to 20% of sand with grains smaller than 0.14 mm improves the homogeneity, the plasticity, and the cement economy, without significantly decreasing the strength of concrete. Figures 3; references 1: Russian.

USSR

UDC 778.342+621.735

THE PROPERTIES OF PHOTOGRAPHIC EMULSIONS BASED ON COMPLEX PALLADIUM OXALATE AND POTASSIUM FERRIOXALATE WHEN A NICKEL PHYSICAL DEVELOPER IS USED

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian No 4, Jul/Aug 77 pp 241-244 manuscript received 20 Dec 73

MAL'CHENKO, S. N., SVIRIDOV, V. V., PETRUSHKINA, Z. L., and LYUBIMOVA, Z. I., Belorussian State University; State Scientific Research Institute for Chemical Photographic Process Planning, Leningrad

[Abstract] The purpose of this study was to produce information on the question of the influence of the nickel compounds on the photographic properties of a palladium-containing emulsion used in a photographic process with silver-free development, which usually contains a small quantity of a palladium compound and a light-sensitive iron oxalate. The spectral sensitivity of photographic emulsions containing potassium ferrioxalate was studied, and their general sensitometric characteristics were studied. The results produced indicate that the palladium-containing emulsions have relatively low photographic sensitivity and that the potassium ferrioxalate acts to a certain extent as an optical sensitizer in the near ultraviolet area, causing no significant increase in sensitivity in the area of spectral sensitivity of the complex palladium oxalate. It is found that heating of the emulsion before and after exposure leads to an increase in sensitivity, with heat treatment after exposure being most effective. This apparently results from localized thermolysis of complex palladium oxalates in the emulsion. Relatively high temperatures can be used without fogging. References 5 Russian.

USSR

UDC 535:546.3

OPTICAL PROPERTIES OF THE ALLOY Fe-45Al IN THE DISORDERED AND ORDERED STATES

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 42, No 3, Mar 77 pp 517-521 manuscript received 12 Aug 75

KUDRYAVTSEV, YU. V. and LEZHSNENKO, I. V.

[Abstract] A study is made of the regularities of change of the electrical and optical properties of the alloy Fe-45Al in the infrared area of the spectrum upon transition of the alloy from the disordered to the ordered state, the first time the influence of this transition on the optical

properties of alloys in the infrared spectrum has ever been studied. The work also calculates the effective concentrations of conductivity electrons and their relaxation frequency for various structural states of the alloy. The disordered alloy specimens are produced by application of a film of the alloy to liquid nitrogen cooled substrates by the "flash" method. The transition to the ordered state is made by annealing, and is accompanied by a sharp decrease in resistivity, a decrease in index of refraction and an increase in index of absorption. The high frequency conductivity  $\sigma$  in the ordered state shows a greater dispersion with wave length than in the disordered state. References 8: 5 Western, 3 Russian

USSR

UDC 666.762.4/.5

PROPERTIES OF ELECTRICALLY FUSED CHROMIUM-ALUMINUM-ZIRCONIUM REFRACTORIES AS FUNCTIONS OF THE CONCENTRATION OF  $\text{Cr}^{3+}$  IN THE  $(\text{Cr},\text{Al})_2\text{O}_3$  SOLID SOLUTION

Moscow STEKLO I KERAMIKA in Russian No 7, Jul 77 pp 7-9

FEDOROVA, R. A., BONDAREV, K. T. and SHVORNEVA, L. I., State Research Institute for Glass

[Abstract] The search for development of new structural materials for glass making furnaces has demonstrated the promise of electrically fused chromium-containing refractories. This promise has been confirmed by studies of the corrosion resistance of chromium-aluminum-zirconium materials synthesized in the system  $\text{Cr}_2\text{O}_3 - \text{Al}_2\text{O}_3 - \text{ZrSiO}_4$  with the addition of  $\text{Na}_2\text{O}$  by the method of melting in an electric-arc furnace. The data produced indicate that corrosion resistance can be doubled and tripled in comparison with traditional baddeleyite-corundum refractories. The present article is dedicated to an investigation of the interrelationship between the phase composition and properties of chromium-aluminum-zirconium refractories in order to provide a basis for recommendations for the selection of compositions of such materials to achieve optimal properties. Analysis of the materials produced indicates that increasing the concentration of  $\text{Cr}^{3+}$  in the solid solution has an obvious positive influence on the life of the refractories synthesized. The area of optimal compositions of the refractories is limited by 30-40%  $\text{Cr}_2\text{O}_3$  and 20-30%  $(\text{ZrSiO}_4 + \text{Na}_2\text{O})$ . Within this area, refractories are produced with lives 4-5 times as long as the life of traditional refractories in glass-making use.

USSR

UDC 535.34(206.2)

## ONE-PHOTON AND TWO-PHOTON SPECTROSCOPY OF LIQUID MEDIA USING THE PULSED ACOUSTICO-OPTICAL EFFECT

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 42, No 1, Jan 77 pp 82-87  
manuscript received 20 Oct 75

BONCH-BRUYEVICH, A. M., RAZUMOVA, T. K. and STAROBOGATOV, I. O.

[Abstract] The pulsed electro-optical effect involves excitation of ultrasonic waves in a closed volume of liquid due to one-photon or many-photon absorption of a laser radiation pulse. The effect has been used for measuring the spectra of one-photon absorption of gaseous media. In this paper the authors experimentally demonstrate the feasibility of using the pulsed electro-optical effect for registration of one-photon and two-photon absorption of liquids. A dye laser with tunable wavelength is used to measure the spectra and to determine the cross sections of one-photon and two-photon absorption in organic dye solutions. The results show satisfactory agreement with data found for these objects by other techniques. In anthracene solutions, new bands of two-photon absorption are observed in the region that overlaps with the fluorescence spectrum of anthracene. These bands do not show up in the spectrum of one-photon absorption of the solution. The proposed method of spectroscopy can be used to measure very low absorption densities and also the cross sections and spectra of one-photon and many-photon absorption of non-fluorescing objects. The amount of absorbed energy is measured when the pulsed acoustico-optical effect is used, i.e. sensitivity can be improved not only by increasing the path of the light beam in the medium, but also by increasing the energy of the probing pulse. However, the sensitivity of the method depends on the attenuation constant of ultrasound in the solution and on the yield of non-radiative transitions. Thus the measurement circuit must be precalibrated under conditions of total absorption of radiation for liquids with strongly differing acoustical characteristics and quantum yields of luminescence. However, it is noted that the dependence on quantum yield is appreciable for registration by the luminescence method as well. Figures 6; references 18: 12 Russian, 6 Western.

USSR

UDC 539.184.2:546.295

INVESTIGATION OF THE STRUCTURE OF TRANSITIONS  $5d[7/2]_{3,4} \rightarrow 6p[5/2]_{2,3}$   
OF XENON BY METHODS OF LASER SPECTROSCOPY AND DOUBLE RESONANCE

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 42, No 4, Apr 77 pp  
609-613 manuscript received 18 Nov 75

ALEKSANDROY, YE. B., PRILIPKO, V. K. and KHARTUNG, K.

[Abstract] The structure of two xenon lasing transitions with wavelengths of 3.51 and 5.57  $\mu\text{m}$  is studied on a single-frequency laser with adjustable length. The laser cell is a 5 mm discharge tube 10-20 cm long with fluorite windows at the Brewster angle in the ends. The cavity is 15-20 cm long and is formed by a flat mirror and a spherical mirror with radius of 2 m. The DC discharge was produced in xenon at  $2-5 \cdot 10^{-3}$  mm Hg. Measurements were made by a combination of laser spectroscopy, magnetic scanning and the double radio-optical resonance technique. The experimental arrangement was such that emission power was obtained as a function of cavity length. The tunable frequency range was extended by applying an axial magnetic field across the discharge tube. The structure of the two transitions is shown in a diagram. The conclusions of this work are in strong contradiction to previous studies [see K. Samurai, K. Shimoda, J. Phys. Soc. Japan, Vol 21, p 6, 1966] based on the natural isotope mixture and without consideration of the mode makeup of the emission. It is found that in the case of Zeeman splitting of the upper level of states  $5d[7/2]_{3,4}$  equal to 107 MHz the deviation from equidistant splitting does not exceed a value of the order of  $10^5$  Hz. This gives a lower estimate for splitting of  $\delta W > 6 \cdot 10^9$  Hz. In future research this value can be more exactly determined by measurements of isotope shifts of the lines on 3.51 and 5.57  $\mu\text{m}$ . Figures 4, references 6: 3 Russian, 3 Western.

USSR

UDC 539.194

METHOD OF DETERMINING THE LIFETIME OF THE TRIPLET STATE OF SOLUTIONS OF  
ORGANIC COMPOUNDS

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 42, No 4, Apr 77 pp 645-  
650 manuscript received 9 Feb 76

RUBINOV, A. N. and ASIMOV, M. M.

[Abstract] A new sensitive method is proposed for determining the probability of deactivation of the triplet state of high-yield laser dyes. The procedure does not require the use of short stimulating pulses. The

proposed technique is used to determine the triplet state of Rhodamine 6G in different solvents. This method is based on measuring the time behavior of amplification in a dye solution during the period of stimulation by a light pulse that is tailored so that its peak has an extended flat section. The results of the study show that there are at least two different processes leading to induced absorption in Rhodamine 6G. These types of absorption differ in both spectral and time characteristics. When the stimulating pulse is shorter than 1  $\mu$ s, absorption is chiefly due to the faster process; when the pumping pulses are longer than 1  $\mu$ s, it is apparently the absorption measured in the proposed technique that has the main influence on stimulated emission. Figures 3; table 1; references 13: 7 Russian, 6 Western.

USSR

UDC 535.36

DETERMINING THE COEFFICIENT OF SCATTERING OF BENZENE AND CHLOROFORM OF AN ABSOLUTE METHOD

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 42, No 4, Apr 77 pp 656-661 manuscript received 18 Feb 76

ROZHDESTVENSKAYA, N. B., GORBACHYOVA, E. N. and RYABININ, A. N.

[Abstract] The coefficient of scattering of benzene and chloroform is measured by a technique proposed by Vuks and Rozhdestvenskaya [M. F. Vuks, N. B. Rozhdestvenskaya, Doklady Akademii Nauk SSSR, Vol 147, p 573, 1962]. The liquid to be studied is matched to an auxiliary medium with the same index of refraction, but with light diffusion several times greater than that of the pure liquid. The auxiliary medium was taken as a dilute solution of low-molecular polymer in the investigated liquid. The scattering curve of the solution is symmetric. The experimental procedure consists in measuring and comparing the attenuations of luminous fluxes with transmission through the auxiliary medium and pure liquid, and the intensities of light scattered at 90° to the incident beam by the auxiliary medium and the pure liquid. The light sources were a helium-neon laser ( $\lambda = 6328 \text{ \AA}$ ) and a helium-cadmium laser ( $\lambda = 4400 \text{ \AA}$ ). Exact photometric measurements were made by the zero-modulation method [V. A. Kovalevskiy, Pribory i tekhnika eksperimenta, No 3, p 98, 1959]. The experimental values of the coefficients of scattering found for chloroform and benzene by the proposed method agree with theoretical predictions and confirm the lower values of calculations by Vuks's formula. Figures 3; table 1; references 25: 6 Russian, 19 Western.

USSR

UDC 535.321+535.341

SPECTROPHOTOMETRIC INVESTIGATION OF NONHOMOGENEITIES IN ANODIZED OXIDE FILMS OF TANTALUM

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 42, No 4, Apr 77 pp 677-680 manuscript 24 Oct 74, after final revision 7 Oct 76

BUGNIN, G. A.

[Abstract] Changes in the absorption coefficient and index of refraction were investigated with changes in the thickness of oxide films of  $Ta_2O_5$  produced by galvanostatic anodizing of tantalum in aqueous electrolytes of different concentration based on sulfur acid. The reflectivity of the film-substrate system was measured as a function of the wavelength of the incident light for near-normal angle of incidence. The wavelength of the light source ranged from 2800 to 6000 Å. The region of appreciable absorption in the wavelength range of 4500-6000 Å is determined for thin films that give the two first interference orders. It is shown that the coefficient of absorption of the oxide decreases with increasing film thickness. Thick films can be treated as weakly absorbing throughout the entire investigated spectral interval. Figures 2; references 5: 3 Russian, 2 Western.

USSR

UDC 531.768

SYSTEMATIC ERRORS OF PENDULUM-TYPE SENSING ELEMENTS DUE TO LINEAR VIBRATIONS OF THE BASE

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA TVERDOGO TELA in Russian No 2, Mar-Apr 77 pp 33-39 manuscript received 22 May 75

YEVGEN'YEV, V. S. and PAVLOVSKIY, M. A., Kiev

[Abstract] For a determination of the systematic errors of pendulum-type sensing elements due to linear vibrations of the base, the conditions of convergence of successive-approximation series are established here by the method of harmonic equilibrium. The fundamental differential equation of motion for this system is first solved after linearization and then in nonlinear form. The constant component of the error is calculated for a physical pendulum at various vibration frequencies relative to resonance. In the case of very weak attenuation and very high frequency above resonance these results are found to agree closely with those obtained by the averaging method. In the case of oblique vibrations, as a special case, the error is found by expansion into a binomial series. Figures 1; tables 1; references 13: 12 Russian, 1 Western.

USSR

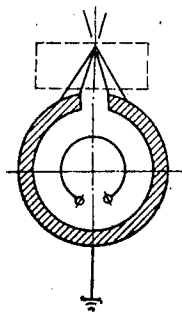
UDC 621.791.75.037

METHOD OF MEASURING THE DISTANCE FROM THE TIP OF THE WELDING TORCH TO THE JOINT BETWEEN WELDED EDGES

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 28, 30 Jul 77 Authors' Certificate No 566697 29 Dec 75

SERGEYEV, YU. YE., CHUSHKIN, V. N., RIKUR, E. A., and KHALFIN, R. N., Ufa Aviation Institute imeni S. Ordzhonikidze

[Text] A method in which one compares the high-frequency components of the welding current due to a high-frequency voltage applied across the arc, with the distinguishing feature that, for better measuring accuracy and reliability, the high-frequency voltage is applied across the arc segment which lies in the plane of the welded edges.



USSR

UDC 532.522.2

THERMOANEMOMETRIC METHOD OF MEASURING SUBSONIC JET FLOW

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 8, Aug 77 pp 69-72 manuscript received 11 Jun 76

MOSKALENKO, V. O. and KHOLODNOV, S. K., Moscow Higher Technical School imeni N. E. Bauman

[Abstract] When a jet interacts with a drifting stream, then the flow pattern becomes complex on account of large velocity gradients, separations, and recirculation. On the basis of earlier experimental studies, a method is proposed here for measuring such a flow, in the subsonic range, with thermoanemometric probes so as to reveal backcurrents, determine the dimensions of the stagnation zone, and determine the velocity profiles

throughout the entire flow region. This method of "perpendicular wires" has been successfully applied with a constant-temperature model DISA 55D01 instrument and found to be simpler as well as more precise than other conventional methods. It is particularly effective in probing the separation zone, with ejection of the outer stream. Figures 3; references 2: 1 Russian, 1 Western.

USSR

UDC 681.2.008:519.27

TIME STABILITY OF INSTRUMENT ERROR DISTRIBUTIONS

Moscow METROLOGIYA in Russian No 7, Jul 77 pp 8-15

RABINOVICH, S. G. and YAKOVLEVA, T. L.

[Abstract] A study was made to determine the stability of instrument error distributions with time, on the basis of a large lot selected from various laboratories after acquisition, after periods of service, and after maintenance. A preliminary examination revealed wide discrepancies within the same type and model, suggesting that not only the performance parameters change with time but also the mode of error distribution. The nonparametric Wilcoxon and Siegel-Tukey criteria were selected for testing the hypothesis of sample uniformity with respect to mathematical expectation and dispersion. As a result, it has been found that the error distributions of instruments are often unstable. In a typical example of model TN-7 thermometers changes can occur within one year. The implications are that one sample does not provide sufficient data about the error distribution and that an error distribution established from several samples within a certain period of time will not necessarily remain the same thereafter. Tables 3; references 8: 7 Russian, 1 Western.

USSR

UDC 535.338.334:541.182.08:519.24

SOLUTION OF THE FREDHOLM EQUATION OF THE FIRST KIND WITH A LORENTZ KERNEL IN PROBLEMS OF DOPPLER SPECTROSCOPY

Moscow METROLOGIYA in Russian No 7, Jul 77 pp 26-30

GURARI, L. M., RUKMAN, G. I., and TOLPINA, S. P.

[Abstract] In spectroscopy there often arises the problem of decoding the measured spectrum into the spectra of individual components. A case in

point is the spectrum of photocurrent due to a polydisperse system of particles with Brownian motion, which is represented by an integral with a Lorentz kernel with respect to the half-widths distribution of suspended particles. The problem thus reduces to the appropriate Fredholm equation of the first kind. It is an ill-conditioned one, however, because of instability against small fluctuations of the input data. It is shown here that the problem can be made well-conditioned with additional quantitative information which will narrow down the class of solutions. Positive-definiteness and finiteness of the solution are sufficient requirements for this in the case of Doppler spectroscopy. Figures 1; references 6: 5 Russian, 1 Western.

USSR

UDC 531.781.2.088.6:624

TEMPERATURE ERRORS IN DEFORMATION MEASUREMENTS WITH MECHANICAL STRIAN GAUGES

Moscow METROLOGIYA in Russian No 7, Jul 77 pp 33-37

VAYNBERG, I. M.

[Abstract] A method has been developed for measuring the deformation of structures with strain gauges, but so as to appreciably reduce the temperature error. Considering a linear state of stress, one uses two identical gauges: a main one oriented in the principal direction and a compensating one as close as possible and perpendicular to the latter, so that both are subject to almost the same temperature changes. In experimental measurements under tension at a constant temperature and with heating-cooling ( $22^{\circ}\text{C}-50^{\circ}\text{C}-22^{\circ}\text{C}$ ) without load or under load yielded a mean error of 24% and a maximum error of 50% when made with a single strain gauge, but a mean error of only 1.8% and a maximum error of only 3.1% when made with two strain gauges. Figures 1; tables 1; references 3: Russian.

USSR

UDC 389:621.317.44:621.318.12

METROLOGICAL ASSURANCE OF INSTRUMENTS FOR QUALITY INSPECTION OF MAGNETICALLY HARD MATERIALS AND PERMANENT-MAGNET PRODUCTS

Moscow METROLOGIYA in Russian No 7, Jul 77 pp 37-47

ARTEMOVA, M. A., GROBOVITSKIY, M. I., ZINGERMAN, V. I., and PODOL'SKIY, I. D.

[Abstract] The quality of permanent magnets depends largely on the correct selection of the magnetically hard materials they are made from. Instruments

for quality control must reliably measure various magnetic characteristics, the demagnetization curve being a most important one among them, and metrological assurance is needed for this in accordance with Government Standards. The latter have been revised since 1973 to account for new developments in materials and in products with special consideration of sizes and shapes. While unified principles of such a metrological assurance have already been established by now on a sound technical and economic basis, it still remains necessary to plan their implementation and to coordinate the activities in this regard of manufacturers, users, and service agencies. References 7: 6 Russian, 1 Czech.

USSR

MEASUREMENT OF THE INTENSITY VECTOR OF THE CONSTANT ELECTRIC FIELD BY THE KOSMOS-484 SATELLITE

Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian No 1, Jan/Feb 77 pp 94-101  
manuscript received 16 Dec 75

AGARKOV, V. F., ANTONOV, N. M., VAYSBERG, O. L., ZHURCHEV, V. I., KLIMOV, S. I., KOREPANOV, V. YE., MASLOV, V. D., PESOTSKIY, L. V., ROZHANKOVSKIY, I. V., SINITSYN, V. M. and SHAKHOV, V. K.

[Abstract] The methodology is described of measurement of three components of the stress vector of the constant electric field by means of a system of double probes and the method of transmission of the data through a telemetry channel providing for a relative signal measurement error of  $10^{-1}$ . The experiment was conducted on the Kosmos-484 satellite and utilized a double probe with a floating potential. This experiment differs from previous experiments in that all three orthogonal components of the stress intensity vector of the constant electric field were measured. Based on the results of measurement in the middle latitudes, estimates are made of the contribution of induced electric field, probe floating potential, electron work function from the surface of the probe, distribution of potential in the zone of flow around the satellite and resistance of the plasma envelope surrounding the probe. References 10: 4 Russian, 6 Western.

USSR

UDC 621.396.2.029.67

ACCURACY OF DETERMINATION OF THE TIME POSITION OF OPTICAL PULSE SIGNALS  
WITH CERTAIN TYPES OF CORRELATED NOISE

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 77  
pp 10-12 manuscript received 15 May 76

SHEMSHEDINOV, R. B. and KHAYTUN, F. I.

[Abstract] The influence of the shape of optical pulses of predetermined energy and peak power on accuracy of determination of their time position with uneven spectral density of noise is estimated. It is shown that asymmetry of pulses leads to an increase in this influence, and that their form is more significantly reflected in the accuracy of fixation of signals on the basis of the leading edge than on the basis of the maximum. Analysis of the data produced shows that when the noise has uneven spectrum, the shape of the signals generally has a greater influence on the potential accuracy of estimating their time position than on actual detection of the signals, while increasing asymmetry of the signal decreases the accuracy of time positioning. References 5 Russian.

USSR

UDC 53.082.5;621.373.8

MEASUREMENT OF FREQUENCY CHARACTERISTICS OF A LASER AMPLIFICATION LINE  
EXPANDED BY THE DOPPLER EFFECT

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 2, Mar/Apr 77 pp  
189-190 manuscript received 28 Jan 76

DANILEYKO, M. V., ROZHDESTVENSKAYA, T. V. and FEDIN, V. P., Institute of  
Physics, Acad. Sci. Uk., SSR, Kiev

[Abstract] A new method of measurement of frequency characteristics of laser amplification lines expanded by the Doppler effect is described. The parameters of the line studied are determined from an oscillogram, the scale of which is fixed by frequency marks produced by a resonant amplifier from the beat signal of the laser being studied and a second laser. The limits of measurement are 50 KHz-20 MHz, measurement error not over 5%. The method described was used to measure the frequency characteristics of the amplification line of an He + Ne laser with non-linear absorption at the wave length  $\lambda = 3.39 \mu\text{m}$ . The maximum frequency difference which can be measured is determined primarily by the time resolution of the photodetector, while the minimum is determined by the width of the timing marks. The use of photodetectors with high resolution

and high-Q resonant filters would allow significant expansion of the range of frequencies and a significant increase in accuracy. References 3: 1 Russian, 2 Western.

USSR

UDC 533,9.01

ESTIMATION OF THE ERROR OF OPTICAL METHODS OF DIAGNOSIS OF AXISYMMETRICAL PLASMA OBJECTS

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 42, No 3, Mar 77 pp 439-445 manuscript received 30 Jul 76

GRIGOR'YEVA, L. Z., KOSTOMETOV, G. P., LEONOV, S. N., LIUKONEN, R. A. and FLEGONTOV, YU. A.

[Abstract] The task of optical diagnosis of an axisymmetrical plasma can be reduced to determination of the particle density distribution function or plasma temperature distribution. The primary diagnostic method is transillumination of the plasma with a beam of light. The measured quantity is either the angle of deflection or the attenuation of the beam passing through the plasma or the optical path difference of an electromagnetic wave in the plasma and in a vacuum, expressed as a number of wave lengths. The relationship between the radial distribution of absorption factor and the attenuation of the diagnostic light beam is assigned by an Abelian equation. Piecewise-linear approximation of the experimental function  $u(x)$  is used to produce a computer solution of the integral equation. Based on the a priori condition of limitation of the first derivative of the solution, a formula is found for estimation of the error in the solution of the equation. This estimate is calculated for several values of dispersion and interval. The absorption factor function calculated and the experimentally measured distribution of the spectral brightness of the plasma are used in a computer calculation of the radial distribution of plasma temperature. The theoretical estimates and experimental data show great instability as concerns dispersion of the results of measurement; therefore, preliminary smoothing of experimental curves and reduction of errors by averaging are quite important. References 6: 5 Russian, 1 Western.

DETERMINING THE FREQUENCY OF SELF-OSCILLATIONS IN A FLUIDIC-ACOUSTIC OSCILLATOR

Kazan' IZVESTIYA VUZov, AVIATIONNAYA TEKHNIKA in Russian No 1, 1977  
pp 31-36 manuscript received 13 Oct 75

VLASOV, I. I.

[Abstract] The author considers the fluidic-acoustic oscillator shown in the diagram of Fig. 1.

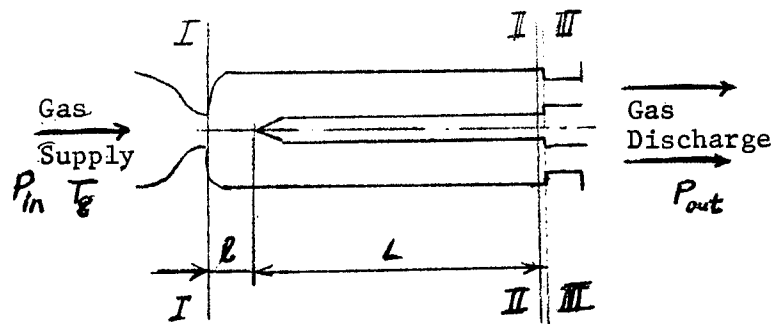


Fig. 1

When used as a gas-temperature measurement transducer, the sensing element of the device is the gas filling the channels. The gas temperature is proportional to the pressure pulse recurrence rate. The quality factor of the device in this case is taken as the ratio of the measured temperature to the actual temperature. To determine this factor, an analytical relation must be found between the pressure pulse recurrence rate, the temperature, and the parameters that determine the working conditions of the transducer. An approximation is found for the frequency of natural oscillations of the fluidic-acoustic oscillator with the following assumptions: 1) gas flow in the oscillator channels is isentropic; 2) outflow through the discharge jets is transcritical; 3) the amplitudes of pulsations in pressure and velocity are small compared with constant components; 4) the distance between the feed nozzle and wedge is small compared with channel length; 5) the characteristic of the fluidic amplifier formed by the main jet and the feedback wave is of the relay type with hysteresis (Fig. 2); 6) the "linear" part of the fluidic oscillator has the property of a filter. The initial system of partial differential equations of the problem yields a

homogeneous equation in operator form that describes the free motion of one of the components of the solution, which is used to derive an expression that relates the frequency of self-oscillations to the main geometric dimensions, the properties of the gas and the working conditions as determined from the Mach number in the channels of the oscillator. Figures 3; references 7 Russian.

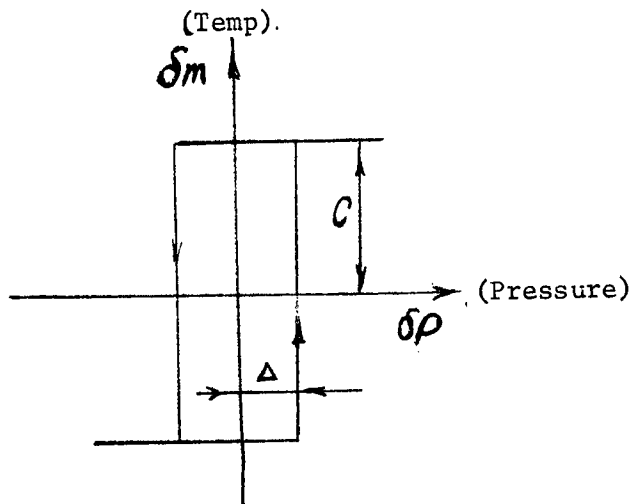


Fig. 2

USSR

UDC 528.48.088.2:516.3

THE ACCURACY OF DETERMINATION OF A CHORD BY THE METHOD OF VYAYSYAL'

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 2, Feb 77 pp 34-37

ZHELEZNYAK, V. A.

[Abstract] Formulas are suggested for a priori estimation of the accuracy of determination of a chord on the basis of known values of directions to sighting targets and their errors. The question of optimization of the construction of a figure considering the reduction and elimination of the influence of light refraction in the lower layers of the atmosphere is studied. The dependence of the angle of intersection of circles on the assigned accuracy of determination of the desired direction is demonstrated when the measurements of azimuth and zenith distances are not of identical accuracy. References 4 Russian.

USSR

UDC 528.48:69

DETERMINATION OF A STABLE GROUP OF LEVELING POINTS

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 2, Feb 77 pp 43-46

BOKOV, M. A., PUPKOV, YU. A., and PODOYNIKOV, A. L.

[Abstract] In local leveling that works, created for installation and observation of the deformations of large engineering structures, for which it is essential that the mutual positions of their parts be determined with high accuracy, it is frequently necessary to select the most stable possible group of geodetic points. This work suggests a method for selecting such a group. The initial data for stability investigations are the height of the points in successive cycles of leveling, calculated relative to any initial bench mark. A group of points is considered stable if the surface (or broken line in the case of a line or chain of points) passing through them remains unchanged from cycle to cycle of leveling within the limits of accuracy of determination of the levels of the points. Constant shape of the surface means that deformation of the earth does not occur in this location. The method suggested was developed and used in the observation of settling of an experimental complex at a scientific research institute. Eighty elevation points were located around a 350 meter perimeter of a circular structure. The results of thirteen cycles of measurement between July of 1973 and November of 1975 were processed. One stable group of 7 points was thus found. References 6: 5 Russian, 1 Western.

USSR

UDC 528.41:[528.516-182.73+531.787.2]

EXPERIENCE IN CONSTRUCTION OF A SURVEYING BASE USING THE "LUCH" RADIO DISTANCE FINDER AND MICROBAROMETERS

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 2, Feb 77 pp 54-59

MIT'KOVETS, N. N.

[Abstract] When a class-2 reference geodetic network is constructed by the method of trilateration using the "Luch" radio distance finder, it is desirable to perform geodetic tie-in of reference points at the same time. This article studies one version of construction of a surveying base for topographic surveying in 1:10,000 scale in both flat and hilly (open or semi-open) terrain. The reference points are tied in by the method of linear intersections using a microbarometer for determination of altitudes. A description is presented of the most effective method of organization of operations. The expected accuracy of determination of both plan and altitude positions of points is calculated. This system completely eliminates angle measurements, thus speeding up the work. References: 2 Russian.

USSR

UDC 528.932:516

MODEL OF A RELIEF FOR PROJECTING AND COMPOSITION OF PLANS

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 4, Apr 77 pp 50-55

GINZBURG, V. I.

[Abstract] A principle is presented for construction of a piecewise linear model in the form of a system of nonequilateral triangles for a terrain area considering the following requirements: simultaneous and precise processing of a large quantity of initial information; the minimum quantity of data for an assigned accuracy of surface image; processing of sectors with contours where the relief is not shown (lakes, areas of construction, etc.). Upon transition from the digital model of the relief to a plan, the condition of generation of horizontals of natural form (without breaks and intersections) by means of a small number of simple operations is also added.

References: 6 Russian.

USSR

UDC 551.242.3+622.11(235.222)

STRUCTURE OF RUDNYI ALTAI AND REGULARITIES OF PLACEMENT OF POLYMETALLIC DEPOSITS

Moscow GEOTEKTONIKA in Russian No 3, May/Jun 77 pp 70-77 manuscript received 18 Jun 75

GORZHEVSKIY, D. I., KARAULOV, V. B., MIKUNOV, M. F. and FILATOV, YE. I., Central Scientific Research Institute for Geological Prospecting, Moscow Geological Prospecting Institute

[Abstract] An analysis is presented of the location of polymetallic deposits in Rudnyy Altai with respect to large consedimentation tectonic structures and geologic formations of the geosynclinal stage of development of the territory. It is shown that the overwhelming majority of the deposits of productive pyrite-polymetallic formations are located in the edge portions of residual anticlinal upthrusts and on the slopes of superimposed synclinal downwarps. Most of the large polymetallic deposits of Southwestern Altai are collocated not so much with basalt-liparite formations in general as with individual varieties of these formations, particularly contrast basalt-liparite subformations in the residual anticlinal upthrusts. All commercial polymetallic deposits are located in the peripheral portions of residual anticlinal upthrusts and the edge portions of synclinal downwarps. References 13 Russian.

USSR

UDC 553.0.61.3

OIL FORMATION IN THE PROCESS OF LITHOGENESIS IN THE LIGHT OF THE SYSTEMS APPROACH

Moscow IZVESTIYA AN SSSR, SERIYA GEOLOGICHESKAYA in Russian No 3, Mar 77 pp 113-121 manuscript received 12 Oct 76

LOPATIN, N. V., All-Union Scientific Research Institute for Nuclear Geophysics and Geochemistry

[Abstract] It is suggested that systems analysis techniques be used to reproduce the actual historical process of oil formation as a part of the overall system of a sedimentary rock basin, in order to determine the conditions of transition of one stage of development of the object to another, determine interrelationships between elements of the system and peculiarities of its functioning, provide a detailed description of the mature stage of the process - the primary phase of oil formation - by partial solution of the problem and formulate the new problem of recognition of oil formation, closely related to the search for deposits of oil. The systems

approach is a modern methodological orientation which, though it does not guarantee the production of true knowledge, since a great deal is determined by the reliability of the empirical basis of data, skill of the researcher and even such materialistic factors as intuition and creative imagination, does provide the possibility for creation of a single theoretical picture and development of mathematically founded concepts in this area of research. References 6 Russian.

USSR

UDC 553.98.061.32:552.578.3(571.53)

EPIGENETIC CEMENTATION OF TERRIGENOUS COLLECTOR STRATA, AND PARTICULARS OF THE OCCURRENCE OF BITUMOIDS ON THE SOUTH SLOPE OF THE NEPSK ANTICLINE

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 2, Feb 77 pp 18-25

SAMSONOV, V. V., RYB'YAKOV, B. L., VSGU [expansion not known], BUDDO, L. A. and ODNITSOVA, T. V., East Siberian NIIGGIMS [expansion unknown]

[Abstract] The article gives geological data relating to lithologically shielded beds of petroleum and gas in terrigenous formations on the south slope of the Nepsk anticline near the Yarakhtinsk and Markovsk deposits of the Irkutsk oil and gas fields. It is shown that processes of epigenetic mineral formation in collector strata on the Nepsk anticline and zoning in the distribution of epigenetic minerals are due to a great extent to tectonic disturbances. These strata are characterized by an appreciable development of secondary minerals in the interstitial spaces. The patterns of distribution of the zones of secondary mineral formation are established, as well as their possible relation to fractures. The particulars of distribution of bitumoids in the rocks of productive members of the strata are studied, and it is shown that the intrusion of these hydrocarbons has had several phases, both diagenetic and epigenetic. The results may be useful as guidelines for further prospecting in this region. Figures 3; table 1; references 4 Russian.

USSR

UDC 533.981

INFLUENCE OF HYDRATE FORMATION ON THE INFORMATION CONTENT OF INDICATORS OF OIL-BEARING AND GAS-BEARING POTENTIAL

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 2, Feb 77 pp 29-32

YAKUTSENI, V. P. and BARKIN, YE. S., All-Union Petroleum Scientific Research Institute of Geological Exploration

[Abstract] The authors consider the formation of gas deposits under permafrost conditions where the gas occurs in the solid (hydrate) form. Analysis of thermodynamic and geological conditions has shown that such hydrates may form in the Soviet Union in Western and Eastern Siberia, and in Yakutia. It is shown that hydrate formation reduces the information content of data on the gas factor and gas diffusion aureole as indicators of oil-bearing and gas-bearing potential in low-temperature regions. Based on calculations of the change in gas composition as a result of hydrate formation it is found that the reliability of such indicators as the ratio of heavy hydrocarbons to methane and the ratio of n-butane to i-butane is distorted. When using any data on gases (both dissolved and free) as prospecting criteria for oil-bearing and gas-bearing potential in the northern and eastern part of the Soviet Union it is advisable to take the possibility of hydrate formation into account. Table 1; references 8 Russian.

USSR

UDC 553.21/.24(571.54)

PHYSICAL AND CHEMICAL CONDITIONS OF DEVELOPMENT OF GOLD ORE DEPOSITS IN NORTHERN BURYATIA

Moscow IZVESTIYA AN SSSR, SERIYA GEOLOGICHESKAYA in Russian No 6, Jun 77 pp 5-17 manuscript received 19 Aug 75

LYAKHOV, YU. V. and POPIVNYAK, I. V., L'vov University

[Abstract] A study of the regularities of the distribution of physical properties and chemical composition of gas-liquid inclusions in gold-bearing solutions in quartz with both space and time is presented. Analysis of the data indicates that the most important factors facilitating the development of commercial concentrations of gold in Northern Buryatia have been: 1) optimal temperature conditions for mineral formation in the 210-260 C range; 2) high content of carbon dioxide in metal-bearing aqueous solutions; 3) high heterogeneity of solutions as a result of pressure changes in the ore-forming system. Data which indicate the influence of these factors can be used as positive criteria in evaluating gold-bearing mineral formations.

Their specific expression is found in a high content of CO<sub>2</sub> in inclusion; appearance of liquid CO<sub>2</sub> when inclusions are cooled to 15-17 C; extremely uneven relationship of phases (gas-aqueous solution-liquid CO<sub>2</sub>) in inclusions of heterogeneous origin; an interval of full homogenization of inclusions close to 210-260 C; increased activity of quartz (over 150-200 pulses). Most of these indicators can be easily seen upon microscopic examination, which will facilitate their broad utilization for the study of gold fields and for their evaluation. References 28: 27 Russian, 1 Western.

USSR

UDC 551.243(470.6)

THE ROLE OF COMPACTING OF SEDIMENTARY COMPLEXES IN THE FORMATION OF LOCAL UPTHURSTS IN THE EASTERN PRECAUCASUS

Moscow GEOTEKTONIKA in Russian No 1, Jan/Feb 77 pp 67-73 manuscript received 3 Jul 75

MALKIN, S. P. and SPEVAK, YU. A., All-Union Scientific Research and Geological Prospecting Institute for Petroleum

[Abstract] The regularities involved in the formation of thirteen local upthrusts in the Eastern Precaucasus are described and the role of compacting of clay rock in their formation is analyzed. Four versions of structure formation are differentiated, based on the degree of influence of tectogenesis and processes of gravitational compacting of clay rock. The time of formation of the local upthrusts is determined more precisely by analysis of sedimentary complexes considering corrections for compacting of clay rock than by existing geological-structural methods. Analysis of the spatial distribution of deposits of oil and gas within the limits of the large area of the Eastern Precaucasus studied and comparison of earlier produced materials on the formation of local upthrusts in this territory indicates that the upthrusts of earlier origin contain primarily gas and gas-condensate deposits, while upthrusts with repeated phases of formation may contain both gas condensate and petroleum deposits, and upthrusts of later formations contain primarily petroleum deposits. References 7 Russian.

USSR

UDC 550.838(262.5)

THE POSSIBLE NATURE OF THE ALUSHTA-BATUMI MAGNETIC ANOMALY IN THE BLACK SEA

Moscow GEOTEKTONIKA in Russian No 1, Jan/Feb 77 pp 74-79 manuscript  
received 30 Sep 75

OSIPOV, G. V., SVISTUNOV, YU. I., and TEREKHOV, A. A., Gelendzha Division  
of Scientific Research Institute for Marine Geophysics; Central Geological  
and Geophysical Expedition, Scientific-Production Society "Yuzhmorego"

[Abstract] A quantitative interpretation of materials from hydromagnetic research in the Alushta-Batumi magnetic anomaly demonstrates that in post-paleogenic time, processes of injection of mantle material into the upper layers of the earth's crust occurred here. Analysis of the mutual placement of the Alushta-Batumi zone and the varied surroundings of the depression, as well as the use of material produced by other geophysical methods, leads to the conclusion that a linear continental rift-type structure developed in this portion of the Black Sea depression in the neogenic. Formation of the structure coincided with a great increase in subsidence of the Black Sea depression and fold-formation processes in neighboring areas. The linearity of the zone in question, its position in relationship to the surrounding structures and its geophysical characteristics indicate that the Alushta-Batumi anomalous zone controls a unique crustal structure, including the rift, which continues to develop at the present time. References 21 Russian.

USSR

UDC 553.98:550.834

NEW POSSIBILITIES OF DIRECT SEARCH FOR DEPOSITS OF OIL AND GAS BY THE SEISMIC METHOD

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 4, Apr 77 pp 54-59

TIMOSHIN, YU. V. and YAKUBETSKAYA, N. I., Ukrainian Scientific Research  
and Geological Prospecting Institute

[Abstract] An attempt was made by the Kiev department of the authors' institute to develop an effective method of direct search for deposits of oil and gas based on diffraction (holographic) conversion of seismic recordings into images of the subterranean medium. This achieves more effective attenuation of noise, correlation of diffracted waves, increased accuracy and superior detail of the resultant materials. Shapes and other characteristics of the subterranean boundaries are more accurately reflected. This method allows reliable detection of anomalies corresponding

to deposits 15-20 m or more thick at depths of up to 4-4.5 km. The method can, therefore, be recommended for testing for use in contouring of deposits already found by drilling; testing of newly found structures in order to determine the most promising ones for drilling; search and prospecting of deposits not related to anticlinal folds; and restudy of areas where oil and gas deposits have not been found by drilling but where other indications point toward their presence. References 3 Russian.

USSR

UDC 553.981:551.812.003 (470.62)

RESULTS AND EFFECTIVENESS OF GAS PROSPECTING OPERATIONS IN THE MAIN AREAS OF THE WESTERN PRECAUCASUS

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 4, Apr 77 pp 15-20

NAUROL'NYY, I. K.

[Abstract] The effectiveness of search and prospecting drilling during the Ninth Five Year Plan in the Western Precaucasus was significantly higher than in the Eighth Five Year Plan. The main prospects for finding gas in the Western Precaucasus are related to the Jurassic deposits of the Eastern Kuban' depression and the Adygeyskiy Ridge, at depths of 6-8 km. As concerns general geological characteristics, the Mesozoic deposits are promising for gas in other regions of the Western Precaucasus, such as the Western Kuban' downwarp and Taman'. However, these areas have almost never been studied by drilling due to the great depths involved. References 8 Russian.

USSR

UDC 535.019.2

## A METHOD OF USING A PHOTOELECTRIC POLARISCOPE TO DETERMINE THE PARAMETERS OF INHOMOGENEOUS OPTICALLY ANISOTROPIC MEDIA

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 42, No 2, Feb 77 pp 376-380  
manuscript received 9 Feb 75

IDNURM, S. I.

[Abstract] Inhomogeneous optically anisotropic models of three dimensions such as those in which there is rotation of the main directions of birefringence, or models of optically active and birefringent material are optically completely characterized by three parameters. In this paper the azimuths of the light ellipse emanating from the model are used to determine the characteristic quantities. The proposed technique can be used without a compensator to determine the following three characteristic parameters: primary characteristic direction, characteristic angle and characteristic phase difference. In the case of a planar model or crystal plate, the method can be used to find the principal directions of birefringence and the phase difference. The main formulas are derived and the accuracy of the method is analyzed. The most advantageous positions of the polarizer are determined for minimizing the error in determination of phase difference. The proposed azimuthal method is very convenient for use with photoelectric polarimeters where the analyzer can be set by a servosystem in the position that determines the principal axes of the light ellipse. The accuracy of the method can be improved by making several azimuth measurements and using the method of least squares. One advantage of the method is that it can be realized without using optical elements whose parameters depend on the wavelength of light. Figures 4; references 9: 5 Russian, 1 Western.

USSR

UDC 535.317.1.06

## DEFINITION ENHANCEMENT OF BLURRED IMAGES IN COHERENT EMISSION FIELDS

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 42, No 4, Apr 77 pp 700-703  
manuscript received 19 Nov 75

VANYAN, A. R., GARIBASHVILI, K. A., KLIMCHUK, V. V., MUMADZE, V. V.,  
RAMISHVILI, N. M. and CHAVCHANIDZE, V. V.

[Abstract] A method of image enhancement is proposed that is based on the effect of self-reproduction. The authors have given a detailed description of the effect in previous papers as applied to two-dimensional objects of the transparency type. In coherent emission fields along the optical axis one observes (without the use of lenses or holographic methods) periodically

repeated images behind the object, not only of the initial object, but also of a whole set of diffraction patterns of this object that are transformed in accordance with a regular rule. These diffraction patterns contain all the information on the initial object, and under the appropriate conditions they can give a reconstruction of that object, even if it is a color half-tone. A blurred photograph is a diffraction pattern of the initial object, and also contains fairly complete information on that object. In the proposed technique, a two-dimensional regular matrix is created from this photograph and illuminated with a collimated laser beam, incident along the normal to the surface. At regular distances behind the matrix on the propagated beam there will be images of the matrix with enhanced sharpness. The matrix was produced by an optical tunnel of the mirror corridor type with square cross section. It was found that the method considerably improves sharpness and is not dependent on the amount or method of defocusing. The technique also gives information on the defocusing distance. The diagram shows the experimental setup. Figures 4; references 11: 7 Russian, 4 Western.

USSR

UDC 539.122.154.08

#### OPTIMIZATION OF THE PARAMETERS OF A RASTER-FOCON LIGHT GUIDE

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 77  
pp 6-7 manuscript received 26 Aug 76

OSYKA, B. V. and RUSYN, B. P.

[Abstract] A method is presented for calculation of the parameters of a plexiglass Raster-focon light guide for transmission of the radiation of a point light source to the entire area of the photocathode of a photomultiplier, allowing the influence of nonuniformity in the sensitivity of the photocathode on the output signal to be eliminated. It is shown that the maximum coefficient of light transmission of the light guide is provided at the optimal Raster cone angle, equal to  $60^\circ$ . The special Raster-focon light guide developed in this article consists of a focon in the form of a truncated cone which expands in the direction of propagation of the light in which the diameter of the input end is matched to the output aperture of the scanning element, while that of the output end is matched to the diameter of the photocathode of the photomultiplier. The light guide is located immediately after the rotating, resolving element and its output end contacts the photomultiplier. Laboratory tests of the light guide with  $D_1 = 40$  mm,  $D_2 = 70$  mm,  $L = 70$  and a Raster grating step of  $\Delta S = 1$  mm, manufactured by hot stamping of type SOL organic glass, showed that unevenness of distribution over the output end of the light guide was not over 12%, the light energy transmission factor was independent of the input aperture of the conical pencil of rays and amounted to 88-90% depending on the degree of polishing of the surfaces of the light guide. References 8: 6 Russian, 2 Western.

USSR

UDC 681.7.067:223.2:661.1

GRAPH-ANALYSIS METHOD OF SELECTING GLASSES FOR THE DESIGN OF A FOUR-ELEMENT,  
THREE-COLOR APOCHROMATIC LENS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 77  
pp 22-24 manuscript received 4 Jun 76

MOZHAROV, G. A.

[Abstract] A study is made of a method for selecting glasses for the design of a four-element, three-color apochromatic lens with a finite air gap between the last two elements by means of a diagram on which each type of glass corresponds to a definite point in a rectangular system of coordinates with the abscissa equal to the reciprocal dispersion coefficient  $\nu$ , and the ordinate equal to the relative partial dispersion decreased by a factor of  $\nu$ . An example is studied in which it is required to design telescopic lenses with correction of the secondary spectrum for rays of spectral line  $g$  and chromatism of position for lines F and C with  $\bar{d}$  equal 0.45 and  $\bar{s}'$  equal 0.25.

USSR

UDC 533.6.0.13.2.011.5:629.7.025.73

## CONCERNING THE SHAPE OF COMPRESSION SHOCKS THAT ACCOMPANY BENDING AND TWISTING VIBRATIONS OF A FOIL

Tashkent IZVESTIYA AKADEMII NAUK UZBEKSKOY SSR, SERIYA TEKHNICHESKIKH NAUK in Russian No 4, 1977 pp 43-46 manuscript received 18 Mar 76

VARNAVSKIY, A. N., VINOGRADOV, B. I. and YAKUBOV, I. R., Tashkent Polytechnical Institute imeni Abu Raykhan Beruni

[Abstract] The authors study the shape of shock waves with combined rotational and translational oscillations of a submerged foil that simulate forced bending and twisting vibrations. The experiments were done in a hydrochannel in which the model was pulled through a shallow layer of water. The tests were done on a rhombic foil with chord of 250 mm and acute angle of  $20^\circ$ . The flow structure was recorded by still and motion-picture photography. The oscillations were produced by a special mechanism with separate crankgears for rotational and translational components. The results of the studies showed that the deformation of the main shock wave front and the onset of the auxiliary compression shock are related to definite values of the Mach number  $M_\infty$  and the parameter  $p^* = \frac{pb}{V_\infty}$ , where  $p$  is angular frequency,  $b$  is the chord and  $V_\infty$  is the velocity of motion of the model. With increasing  $p^*$  the auxiliary shocks are intensified, and the deformation of the main shock waves becomes more pronounced. The influence of the auxiliary compression shocks begins to show up when  $p^*$  becomes greater than 0.6, and their role increases with increasing  $p^*$ . Deformation of the main shock waves increases with  $M_\infty$ . Figures 2; references 6 Russian.

USSR

UDC 539.3

## USE OF OPERATOR MATRICES FOR THE DESIGN OF THREE-LAYER CYLINDRICAL SHELLS WITH REINFORCEMENT HOOPS

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA TVERDOGO TELA in Russian No 3, May-Jun 77 pp 74-80 manuscript received 26 Nov 76

ALFUTOV, N. A. and POPOV, B. G., Moscow

[Abstract] A method is shown of solving the ordinary linear differential equations and the elasticity relations for such complex asymmetric shell structures as a three-layer one consisting of two load-carrying sheaths and a "rigid" filler between them. The equations are constructed in the form of operator matrices, which greatly simplifies the notation and facilitates

a computer-aided numerical solution. The method is illustrated on a three-layer cylindrical shell with a reinforcement hoop at one particular section. The strain distributions in all three layers, including a strong edge effect, are calculated and presented graphically for typical shell dimensions and material characteristics. Figures 1; references 3: Russian.

USSR

UDC 622.235.5

EXPERIMENTAL DETERMINATION OF THE PARAMETERS OF DETONATION WAVES AND OF THE VISCOELASTIC CHARACTERISTICS OF SOILS

Kiev PRIKLADNAYA MEKhanIKA in Russian Vol 13, No 7, Jul 77 pp 96-103  
manuscript received 12 Dec 75

VOVK, A. A., KRAVETS, V. G., LYAKHOV, G. M., PLAKSIY, V. A., SALITSKAYA, V. I., and SULTANOV, K. S., Institute of Hydromechanics, Academy of Sciences of the Ukrainian SSR, Kiev. Scientific Research Institute at the Moscow State University

[Abstract] A study was made near the city Gayvoron (Ukraine) to develop an experimental method of determining the parameters of detonation waves and the viscoelastic characteristics of soils. A test specimen of forest soil was poured into a foundation pit  $1 \times 1 \text{ m}^2$  in area and 1.8 m deep. Stresses were measured with conventional high-frequency tensometers, strains were determined from the displacements of two thin metallic plates buried in parallel soil layers normally to the direction of wave propagation. On the basis of the stress-time and the strain-time data were then plotted stress-strain diagrams and were estimated the propagation characteristics of detonation waves. On the basis of the viscoelastic model, with two extreme strain rates tending to infinity and to zero respectively, were also semigraphically calculated four soil parameters which, in addition to the density  $\rho_0$ , describe the sought characteristics: dynamic compression modulus  $E_D = 26 \cdot 10^6 \text{ N/m}^2$ , static compression modulus  $E_S = 1/4 E_D$ , unloading  $E_U \approx 2.5 E_D$ , and viscosity index

$$\mu = \frac{E_D E_S}{(E_D - E_S)^2} \approx 1000 \text{ s}^{-1} \text{ (dynamic viscosity)}$$

The process of soil compacting and displacement was also analyzed on the basis of these data. Flat charges have been found most effective when placed on the surface. Figures 6; tables 2; references 10: Russian.

RESOLVENT EQUATIONS OF THERMOELASTICITY FOR TRANSVERSELY ISOTROPIC SHELLS  
IN COMPLEX FORM AND THEIR APPLICATION TO STRESS CONCENTRATION PROBLEMS

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 13, No 7, Jul 77 pp 22-27  
manuscript received 19 Dec 75

PELEKH, B. L. and PLEVOY, B. N., Lvov Branch of Mathematical Physics,  
Institute of Mathematics, Academy of Sciences of the Ukrainian SSR

[Abstract] Resolvent equations of thermoelasticity for transversely isotropic thin shells are derived from the fundamental equations in complex forces. The solution is obtained with the aid of a complex stress function and an auxiliary real function, both of which satisfying the original equations. The general result in analytical form is applied to the specific case of a spherical shell with a circular hole in a temperature field. The concentration of thermal stresses is calculated accordingly and, moreover, the distribution of the stress concentration factor as well as its dependence on the ratio of elastic modulus to shear modulus are shown. Figures 1; references 5: 4 Russian, 1 Western.

## INTERACTION BETWEEN A TRANSIENT PRESSURE WAVE AND A SYSTEM OF TWO SPHERICAL SHELLS

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA TVERDOGO TELA in Russian  
No 2, Mar-Apr 77 pp 135-141 manuscript received 12 Apr 76

BABAYEV, A. E. and KUBENKO, V. D., Kiev

[Abstract] A system of two thin concentric spherical elastic shells is considered inside an infinitely large volume of ideally compressible fluid (characterized by density  $\rho_1$  and acoustic velocity  $c_1$ ), the volume between the outer shell and the inner shell also being filled with a fluid (density  $\rho_2$  and acoustic velocity  $c_2$ ). The effect of a transient plane pressure wave impinging on this system is analyzed on the basis of the fundamental linear equations of motion in the theory of elastic shells. The calculation of velocity potentials involves Legendre polynomials and a Laplace transformation, reducing the problem eventually to a system of two equations for the deflections of both shells. Subsequent application of the convolution theorem and inversion according to the theory of residues yield Volterra integral equations of the second kind, which have been evaluated numerically upon discretization of the system. The results are quite different from the

results for a simple hollow shell in that the velocity increases to a maximum and then decreases, instead of increasing monotonically, and that large negative accelerations appear whose magnitude changes appreciably upon incidence of secondary reflected waves. Figures 5; references 7: Russian.

USSR

UDC 539.3

STATE OF STRESS AND STRAIN OF AN ORTHOTROPIC CYLINDRICAL SHELL WITH CIRCULAR HOLES

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 7, Jul 77 pp 5-8  
manuscript received 16 Dec 76

SALO, V. A., Kharkov Polytechnic Institute

[Abstract] An orthotropic cylindrical shell with a uniformly spaced array of circular holes is under a uniformly distributed centrifugal load, but its edges and the contours of its holes are free of forces and moments. The developed shell surface appears as a parallel strip and, by virtue of symmetry, only one period of holes needs to be considered. Its state of stress and strain is determined in accordance with the general theory of anisotropic shells of finite stiffness in shear, and on the basis of Reissner's variational principle where the displacement vector and the stress tensor are varied independently. With the given boundary conditions, an approximate solution is obtained which describes the elastic equilibrium. The results are applied to a shell of glass-plastic with known characteristics, indicating that the maximum flexural stresses increase with increasing hole size and eventually the lateral surface becomes most stressed. Across the shell thickness there also appears a zone of negative deflection, and this zone becomes wider with increasing hole size. Figures 2; tables 1; references 2: Russian.

USSR

UDC 621.791.052.011:539.0.011.25

STRESS CONCENTRATION DUE TO SUBSURFACE PORES

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 7, Jul 77 pp 14-18  
manuscript received 26 Jun 76

MAKAROV, I. I., LUTSUK, O. A., and ZAVALISHIN, S. I., Moscow Higher  
Technical School imeni N. E. Bauman

[Abstract] Chains of spherical subsurface pores are the most common technical flaw in welded joints involving aluminum alloys and titanium alloys. In lieu of an analytical solution to the three-dimensional problem, the stress concentration around a chain of two holes at different depths below the free surface is determined here empirically from measurements made on models with "frozen" strains. The results indicate that such a stress concentration become negligible when the distance of an embedded pore or pore chain from the surface exceeds one pore diameter. In specifying the minimum permissible distance between pores, a fraction of the diameter of the smaller rather than the larger pore ought to be the standard nomenclature in welding practice. Figures 2; references 7: 3 Russian, 4 Western.

USSR

UDC 539.319

DEFLECTION OF AN INFINITELY LARGE PLATE ON AN ELASTIC BASE

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 8, Aug 77 pp 23-27  
manuscript received 23 Sep 76

LOPATUKHIN, I. M. and MIRKIN, I. L., Azerbaydzhan Polytechnic Institute

[Abstract] An infinitely large plate rests on an elastic base and is under a load uniformly distributed over a circular area. An analysis of the plate deflection, in coordinates whose origin lies at the point of maximum deflection, reveals that the latter can be reduced by distributing the same load over an annulus or several annuli of equivalent area but, naturally, with larger radii. This conclusion has been confirmed experimentally, by the optical polarization method, on a large 16x200x200 mm plate consisting of two layers of optically passive glass separated by a layer of optically active grade ED6-M material. It has thus been established that the maximum deflection under an axisymmetric load can be minimized by optimizing the annular area over which the load acts. Figures 3; references 3: 2 Russian, 1 Western.

USSR

## EQUATIONS OF FORCED VIBRATIONS FOR A CORRUGATED MEMBRANE

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 8, Aug 77 pp 28-31  
manuscript received 8 Dec 76

NARAYKIN, O. S. and TULEGENOV, M. U., Moscow Higher Technical School imeni  
N. E. Bauman

[Abstract] Corrugated membranes find many applications as elastic elements in various devices. Their design is largely determined by their dynamic characteristics. Equations are derived here which describe axisymmetric forced vibrations of such a membrane with a heavy rigid hub at the center and the axis parallel to a uniform inertia (linear acceleration) field acting on it. The membrane is treated as a shell of revolution of uniform thickness which does not close on itself meridionally. The derivation is based on the Kirchhoff-Love hypotheses and, because of the complexity of the fundamental equations, requires the use of approximate methods. A truncated finite system of linear differential equations with constant coefficients is finally obtained here by the Galerkin method. Figures 1; references 5: Russian.

USSR

## VIBRATIONS OF A BEAM DUE TO A RANDOM INERTIA FIELD

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 8, Aug 77 pp 32-36  
manuscript received 12 Nov 76

ZYABLIKOV, V. M., Moscow Higher Technical School imeni N. E. Bauman

[Abstract] An elastic element in measuring devices is regarded here as a beam in a random inertial field. Its transverse vibrations are analyzed in the most general case of a device mounted on a moving object so that the cantilever beam is additionally loaded by axial (drag) forces as well as rotational and translational inertia forces. Both the fundamental equation and the dispersion equations for this case are derived, also the error of the elastic-beam approximation is calculated as a function of the beam height/length ratio. Figures 3; references 4: Russian.

USSR

UDC 539.3

DESIGN OF ORTHOTROPIC MULTILAYER VARIABLE-THICKNESS SHELLS ON THE BASIS OF A PRECISE MODEL

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 13, No 7, Jul 77 pp 28-36  
manuscript received 9 Jul 76

VASILENKO, A. T., Institute of Mechanics, Academy of Sciences of the Ukrainian SSR, Kiev

[Abstract] Fundamental equations for orthotropic multilayer variable-stiffness shells are derived on the basis of a precise theory, with the distribution of transverse shearing stresses defined in a general form. The stress distribution in such a cylindrical shell under internal pressure is calculated according to this model, assuming a rigid contact between adjacent layers, and the results are compared with those based on the exact solution, on the classical theory, and on the straight-line theory. It is found, generally, that the stress distribution over the shell thickness is nonlinear only within the maximum-load zone and becomes nearly linear farther away from it. Figures 3; tables 3; references 11: Russian.

USSR

UDC 539.3

DYNAMIC INSTABILITY OF A REINFORCED CYLINDRICAL SHELL WITH AN ATTACHED MASS

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 13, No 7, Jul 77 pp 42-50  
manuscript received 4 May 76

PALAMARCHUK, V. G. and NOSACHENKO, A. M., Institute of Mechanics, Academy of Sciences of the Ukrainian SSR, Kiev

[Abstract] A cylindrical shell is considered which, in addition to reinforcing stringers and hoops, carries a mass attached at some point. Longitudinal vibrations are excited kinematically so that stresses in both the shell and in the reinforcement structure alternate periodically with time, vary linearly along the generatrix, and remain uniform around the circumference. The problem of critical frequencies and dynamic instability is solved analytically, taking into account the discreteness of reinforcing elements and the fact that the tangential stiffness by far exceeds the radial stiffness so as to render the inertia forces in a tangential plane negligible. The motion of the adjoining mass is considered separately and its effect on the shell represented by a concentrated force. Calculation of kinetic and potential energy yields

even and odd regions of dynamic instability, as indicated in the case of a shell with a dense reinforcement lattice whose elements are subject to bending and twisting. An experimental study of such a shell structure has yielded two slightly different first critical frequencies, corresponding to a phase shift between identical vibration modes, evidently owing to a distortion of the cyclic symmetry by initial deflections and by the presence of a welding seam. Figures 4; references 5: Russian.

USSR

UDC 539.385

CIRCULAR ROD WITH AN ECCENTRIC CYLINDRICAL CAVITY UNDER TORSION

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 13, No 7, Jul 77 pp 132-134  
manuscript received 9 Nov 75

GUR'YEVA, T. N., Poltava Military Command College of Communication

[Abstract] The state of stress is determined in a compound rod with an eccentric cylindrical cavity under torsion. The solution is obtained analytically from the boundary conditions, in terms of two regular functions  $F_1(z)$  and  $F_2(z)$  of the complex variable  $z$  in the two regions  $S_1$  and  $S_2$ . The problem is eventually reduced to a Fredholm integral equation and then to an infinite system of linear algebraic equations, the latter being necessarily truncated for the purpose of evaluation. Numerical calculations indicate that insertion of a hollow cylinder of a different material with a higher shear modulus into the hole in the rod tends to relieve the load on the latter and to reduce the level of stresses in it. Figures 1; tables 1; references 8: Russian.

USSR

UDC 539.319

METHOD OF CALCULATION OF STRESSES AND STRAINS IN TURBINE WHEELS WITH UNSTABLE OPERATING MODES

Moscow MASHINOVEDENIYE in Russian No 4, 1977 pp 82-89 manuscript received  
3 Jan 77

KABELEVSKIY, M. G. and GETSOV, L. B.

[Abstract] The purpose of this work was to develop a method of calculation of the stress and strain state of a turbine wheel subjected to cyclic

nonisothermal plastic deformation and creep, considering the influence of the accumulated plastic deformation on the creep rate. The task is so stated that problems of local stress concentration are not studied. These problems can be solved only after the nominal forces and deformation factors are established, for example, by means of the method of finite elements for a small section of the wheel. The statement of the problem of cyclic stresses and strains of the wheel as a whole, with simultaneous consideration of local stress concentrations so that it can be solved on existing digital computers, is not possible. An example illustrates that in order to use the method suggested, it is necessary to have information on a large number of different characteristics of the material. These include the one-time and cyclical stress-strain diagrams, creep rates at several temperatures and several significantly different stresses at each temperature and, finally, the variation in creep rate with the number of cycles and preliminary plastic deformation. References 12: 11 Russian, 1 Western.

USSR

UDC 539.43:621.822.6

AN APPROXIMATE MODEL OF THE AREA OF PLASTIC SHEAR BEFORE THE FORMATION OF PITTING IN ROLLING-SURFACE BEARING PARTS

Moscow MASHINOVEDENIYE in Russian No 4, 1977 pp 110-115 manuscript received 10 Nov 76

CHERMENSKIY, O. N.

[Abstract] It is suggested that theoretical solutions, particularly the solutions of Prandtl and Hill for the intrusion of a rigid stamp into a semi-infinite space, be used to determine the depth of the area of plastic shear formed in the process of operation of the rings and rolling bodies in bearings. The depth of the area of plastic shear determined by theoretical calculation is compared with the results of measurement of the depth of chipping pits in bearing parts and specimens tested in contact fatigue stress. The experimental data and results of theoretical analysis based on approximate solution presented indicate that the load corresponding to the bend point on the experimental curve is limiting in the sense that this (minimal) load, the theoretical field of slip lines is fully realized with plastic shear reaching the free surface. Materials studied include SHKH-15 and 18 KH GT internal roller bearing rings, 70 G steel, brass, bronze, SHKH-15, 55 SMA, and 20 KH<sub>2</sub>N<sub>4</sub>A test specimens. References: 5 Russian.

USSR

UDC 539.3

THE STRESS STATE OF A HETEROGENEOUS SMOOTH SPHERICAL SHELL WITH A CRACK

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 13, No 6, Jun 77 pp 52-59  
manuscript received 5 Sep 75

OSADCHUK, V. A., TRUSH, YE. I. and FEDYUK, YE. M., L'vov Affiliate for  
Mathematical Physics, Institute of Mathematics, Acad. Sci. Uk, SSR

[Abstract] Using the method of incompatible deformations, the problem of the stress state of a smooth spherical envelope of variable thickness with a crack which is rectangular in plan is reduced to the solution of a system of singular integral equations. The heterogeneity of the envelope consists in that the elastic characteristics  $E$  and  $\nu$  change with changing coordinate perpendicular to the surface of the envelope in such a way that the material follows the generalized law of Hooke and the hypothesis of undeformable perpendiculars remains in force. As the modulus of elasticity of the outer layers of the shell increases, the membrane stress intensity factor decreases, while the bending stress intensity factor increases. References 5 Russian.

USSR

UDC 539.374

ONE PRECISE SOLUTION OF A DYNAMIC COUPLED PROBLEM OF THERMOVISCOELASTICITY

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 13, No 6, Jun 77 pp 86-89  
manuscript received 28 Jul 75

GROMOV, V. G. and MIROSHINKOV, V. P., Rostov State University

[Abstract] A study is made of a polymer rod of length  $l$ , at one point of which (at the end where  $x = 0$ ) mass  $M$  is attached, oscillating along the  $x$  axis under the influence of an external force  $P(t)$ . The rod is thermally insulated on the side surface and at end  $x = l$ , and is exposed to a constant temperature at  $x = 0$ , considered the zero temperature. The problem is stated of determining the stable heat mode in the rod with periodic perturbation of mass  $M$ . The only simplifying factor is that  $M$  is considered much greater than the mass of the rod, allowing the rod to be considered weightless. References 5 Russian.

USSR

UDC 539.385

THE NATURE OF STRESS NEAR THE EDGE OF THE CONTACT SURFACE OF A TWISTED ANISOTROPIC ROD

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 13, No 6, Jun 77 pp 90-96  
manuscript received 29 Sep 75

ALEKSANYAN, R. K. and CHOBANYAN, K. S., Computer Center, Acad. Sci. Arm SSR;  
Yerevan State University

[Abstract] This article analyzes a rod consisting of prismatic anisotropic bodies and twisted by moments applied to its ends, when the generatrices of the cylindrical surface of full contact and the side surfaces are parallel. The elastic properties of the materials are symmetrical relative to the plane of the transverse cross section of the rod. Conditions determined by the elastic deformation properties and direction of isotropy of the materials and effecting the geometry of the joint near the contact face are established, which, when fulfilled, cause the stresses to decrease near the edge of the contact surface; when they are not fulfilled, the stresses increase without limit or are at least finite but not equal to zero. References 14: 12 Russian, 2 Western.

USSR

UDC 539.3+534.231.1

TRANSFORMATION OF A LONGITUDINAL ELASTIC WAVE IN A COMPOSITE ROD WITH ELASTICALLY SUSPENDED CONCENTRATED MASSES

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 13, No 6, Jun 77 pp 97-101  
manuscript received 30 Sep 75

FABIZHEVSKIY, K. V., All-Union Scientific Research Institute for Construction and Installation Tools, Moscow

[Abstract] An earlier work suggested a plan for numerical calculation of the process of propagation of longitudinal waves in composite rods with elastically suspended masses. Based on a one-dimensional model of a composite rod with an elastically suspended concentrated mass, transformation of a longitudinal elastic wave in a cylindrical envelope reinforced by a rib was analyzed. However, the solution produced using a Laplace transform, was presented in a form inconvenient for practical applications. This work continues that investigation, and allows this shortcoming to be eliminated to some extent, producing a number of new equations describing the process of transformation of the wave in the one-dimensional model.

It can be shown that in a composite rod with a finite number of intermediate sections and elastically or rigidly suspended masses, the total reflected and transmitted pulses are independent of the intermediate elements, but rather are determined by the properties of the final sections of the rod. Equations are presented for determination of the pulses for semiinfinite final sections. References 3 Russian.

USSR

UDC 539.3

THEORETICAL AND EXPERIMENTAL STUDY OF THE STRESS-STRAIN STATE OF RIBBED SHELLS WITH LARGE RECTANGULAR APERTURES

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 13, No 6, Jun 77 pp 117-120  
manuscript received 29 Sep 76

DLUGACH, M. I., GAVRILENKO, G. D. and POLYAKOV, P. S., Institute of Mechanics, Acad. Sci. Uk SSR, Kiev

[Abstract] A stringer-reinforced shell with four rectangular apertures, the edges of which are reinforced by ribs, is designed using the method of grids. Boundary conditions are studied under which the ends of the shell approach each other evenly. An experimental study of this shell is undertaken and, using a special processing program, the forces in the shell and stringers are calculated. Comparison of their theoretical and experimental values is satisfactory for the middle portions of the sections of the shell between the apertures. The calculation method used leads to improved agreement between the experimental and theoretical values of forces. The differences for radial bending determined theoretically and measured experimentally are found to be significant, the theoretical values being lower than the experimental values. Further development of the theory should move in the direction of consideration of initial irregularities always present in real shells, as well as nonlinear effects. References 3 Russian.

USSR

UDC 624.074.4.04:681.3

DESIGN OF SHELLS BY THE METHOD OF FINITE ELEMENTS USING THE MIXED REISSNER POTENTIAL

Moscow STROITEL'NAYA MEKHANIKA I RASCHET SOORUZHENIY in Russian No 4,  
Aug 77 pp 21-27

MILEYKOVSKIY, I. YE. (Central Scientific Research Institute of Construction Structures, Moscow) and TRAYNIN, L. A. (Leningrad Industrial Construction Planning Institute)

[Abstract] An earlier work formulated an algorithm for the composition of thirteen initial equations from the theory of smooth shells containing as unknowns eight generalized forces and five movements at points on the field of the shell. It was recommended that the problem be solved by the method of grids. It is demonstrated in this work that the initial equations of the theory of shells, as well as the static and kinematic boundary conditions, are Euler-Ostrogradskiy mixed potential equations similar to Reissner equations. In contrast to earlier works, in this article all forces and displacements of the shells satisfy the condition of continuity between elements. An algorithm is presented for numerical realization of the mixed method in the form of the method of finite elements when both forces at the nodes of the shell and displacements are used as the unknown coordinate functions. The mixed form of the method of finite elements suggested is distinguished by the rapid convergence of the solutions, convenience of programming and continuity of the field both of displacements and of forces provided, although the structure of the matrix of equations is complicated in comparison with the solution expressed in displacements alone due to the edge effects. References 11: 7 Russian, 4 Western.

USSR

UDC 624.074.4.042.8:534.014.1

NATURAL OSCILLATIONS OF SUPPORTED CONICAL SHELLS

Moscow STROITEL'NAYA MEKHANIKA I RASCHET SOORUZHENIY in Russian No 4,  
pp 39-43

MANEVICH, L. I. and PISANKO, A. N., Dnepropetrovsk State University

[Abstract] A study is made of shells which are eccentrically reinforced by longitudinal ribs. An analytic solution of the problem with averaged coefficients is constructed in the lower portion of the spectrum, corresponding to a structurally orthotropic plan. The theory of perturbations is used to produce frequencies and forms of natural oscillations. Approximate analytic solutions can be used as the zero approximations in determining

the frequencies and forms of natural oscillations of reinforced conical shells. The method used is quite effective and yields results which are acceptable for practice. It is also noted that approximate analytic solutions constructed in this work can be used to consider the discrete nature of the placement of ribs in determining the frequencies and forms of the natural oscillations of reinforced conical shells. References 13: 12 Russian, 1 Western.

USSR

UDC 629.11.012.57-752:62-567.12

FORCED VIBRATIONS OF A CATERPILLAR TRACTOR WITH FRICTIONAL SHOCK ABSORBERS

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 7, Jul 77 pp 78-82  
manuscript received 4 Jun 76

AVRAMOV, V. P., ALEKSANDROV, YE. YE., and TRUSHKIN, V. N., Kharkov  
Polytechnic Institute

[Abstract] Forced vibrations of a caterpillar tractor on a torsional suspension operating in parallel with wear-resistant frictional shock absorbers are analyzed by the method of harmonic linearization, the compression of the disk stack assumed to be proportional to the twist angle of the torsion shaft. As a result, relations are obtained between the amplitude of tractor and the tractor speed. A numerical example with various values of the absorber stiffness indicates that the dynamic characteristics of this kind of absorbers are not worse than those of conventional hydraulic ones. Figures 2; references 3: Russian.

USSR

UDC 534.1

DYNAMIC STABILITY OF BALANCED ROTOR SYSTEMS CONNECTED BY A GEAR CLUTCH

Moscow MASHINOVEDENIYE in Russian No 4, 1977 pp 24-28 manuscript received  
15 May 75

GORDON, YE. YA., YAMPOL'SKIY, I. D. and PAL'CHENKO, V. I.

[Abstract] A study is made of the dynamic stability of balanced rotor systems connected by a gear clutch. It is shown that the forces of friction in the clutch cause the forced oscillations in the system, evoked by the skew of the shafts, as well as the position of static

equilibrium to lose their stability, leading to the excitation of oscillations in the form of forward precession. Stability diagrams are presented. Instability is possible only in the supercritical area. The miscentering of the shafts and damping have the greatest influence on the position of the boundaries of stability. The area of small miscentering for flexible systems, represents the danger of loss of stability. An increase of miscentering and damping can actually eliminate forced oscillations in the system and thus increase the stability of the position of static equilibrium. References: 5 Russian.

USSR

UDC 531.36

SELF-EXCITED VIBRATIONS OF ROTORS WITH MANY DEGREES OF FREEDOM

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA TVERDOGO TELA in Russian  
No 2, Mar-Apr 77 pp 40-49 manuscript received 26 May 75

POZNYAK, E. L., Moscow

[Abstract] Self-excited vibrations of a simple rotor with many degrees of freedom are determined in the first-harmonic approximation and their stability is analyzed by an extension of the variational method. The general results for a single-frequency and a two-frequency mode are applied to a rotor of uniform cross section moving either on sleeve bearings with a liquid or a gas in the small clearance space, or on ball bearings. Numerical results have been compared with and found to reasonably agree with "exact" result of numerical integration by the Runge-Kutta method. Figures 4; references 11: 10 Russian, 1 Western.

USSR

UDC 621.438;536.244

## GENERALIZATION OF THE RESULTS OF EXPERIMENTS ON HEAT TRANSFER FROM THE GAS TO THE TURBINE HOUSING BEHIND THE RUNNER

Kazan' IZVESTIYA VUZov, AVIATSIONNAYA TEKHNKA in Russian No 1, 1977  
pp 78-82 manuscript received 15 Oct 75

LUKAY, V. I., KARIMOVA, A. G. and TKACHENKO, N. S.

[Abstract] A generalized equation is found for calculating localized coefficients of heat transfer from the gas to the housing in the vicinity of the flow section of a turbine behind the runner. The experiments were done on an air turbine under conditions close to isothermal. A diagram of the flow section of the turbine is shown in the figure. The local values of the Stanton number were calculated on the basis of experimental measurements of localized heat-transfer coefficients ( $\alpha_x$ ) and the temperature, specific heat and pressure in the core of the flow:

$$St_x = \frac{\alpha_x}{\rho_2 C_{2a} C_{p2}}$$

where  $\rho_2$ ,  $C_{2a}$  are the density and axial velocity behind the runner, and  $C_{p2}$  is the true isobaric specific heat at the temperature in the core of the flow. The localized values of the Reynolds numbers in the thermal boundary layer  $Re_T^{**}$  are calculated from the experimental data on the basis of the formula

$$Re_T^{**} = \frac{\alpha_x \cdot x}{C_{p2} \cdot \mu_2}$$

where  $x$  is the coordinate from the beginning of the experimental section to the point of installation of the heat flux sensor, and  $\mu_2$  is dynamic viscosity. The final equation takes the form

$$St = 0.039(1+1.92\cot^{0.8}\alpha_2)^{0.8} Re_x^{-0.2}$$

Figures 3; references 5 Russian.

USSR

UDC 629.7.036

ON SOME CASES OF DEVELOPMENT OF 'ANOMALOUS' SELF-OSCILLATIONS

Kazan' IZVESTIYA VUZOV, AVIATIONNAYA TEKHNIKA in Russian No 1, 1977  
pp 140-143 manuscript received 20 Jan 76

PAVLOVSKIY, V. P. and DROBYAZKO, B. S.

[Abstract] An analysis is made of possible causes of self-oscillations in the combustion chambers of liquid rocket engines that are difficult to explain within the framework of the phenomenological theory of instability based on discharge and intrachamber mechanisms. Correlation analysis showed that these self-oscillations are weakly dependent on the working parameters of the engine. An explicit relation is found between cases of self-oscillations and parameters of the static law of distribution of the depth at which the oxidizer injectors are set relative to the fuel injectors in two-component injection systems. Based on the strong influence that the depth of setting of the oxidant injectors has on development of self-oscillations, it is suggested that the mechanism responsible for this effect is associated with interaction of the spray cones within the limits of a single injector when there are pressure oscillations. Figure 1; tables 3; references: 4 Russian.

USSR

UDC 621.515-253

TWO-ROW BLADING FOR A TURBOMACHINE

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI  
in Russian No 28, 30 Jul 77 Authors' Certificate No 566938 3 Oct 74

BEDIM, V. G., Tula Polytechnic Institute and BELOPOL'SKIY, V. A., Scientific Research, Planning and Design, and Technological Institute of Heavy Electric Machinery at the Kharkov "Elektrotyazhmash" Plant imeni V. I. Lenin

[Text] A turbomachine blading which consists of main blades and auxiliary blades mounted in the grooves of the former, with a higher diffuser effectiveness, and shifted relative to them in the direction of the stream, with the distinguishing feature that, for improving the aerodynamic characteristics of the turbomachine, the profile centers of the auxiliary blades are located at distances  $(-0.1 \text{ to } +0.8)b_1$  and  $(0.2 \text{ to } 0.6)b_1$  respectively from the corresponding coordinates of the main blades along the front and the axis of the array, where  $b_1$  is the chord of the profile of a main blade.

## INFLUENCE THAT THE DESIGN PECULIARITIES OF A COMBUSTION CHAMBER HAVE ON THE OUTPUT OF TOXIC COMPOUNDS

Kazan' IZVESTIYA VUZov, AVIATIONNAYA TEKHNIKA in Russian No 1, 1977  
pp 60-65 manuscript received 5 Aug 76

IVLIYEV, A. V., KNYSH, YU. A. and LUKACHEV, V. P.

[Abstract] An analysis is made of the influence that design changes in the combustion chamber of a gas turbine engine have on the completeness of combustion of the fuel, and also on the formation and output of toxic compounds with the exhaust gases. The fuel studied was purified natural gas comprised of more than 90% methane. The calculations were based on the results of analysis of samples. Two combustion chamber models were tested in different combinations with three types of fuel injectors: multiple-nozzle jet type, and two centrifugal injectors with swirling of the fuel flow to the right and to the left. One modification had higher drag due to alteration of the fire tube connection to provide a more effective protective air layer near the wall. This combustion chamber combined with a centrifugal fuel injector with swirling to the left was found to be the best for reducing the NO<sub>2</sub> toxicity of emissions from the NK-12ST engine. Substituting centrifugal for jet fuel injectors in this combustion chamber reduces the content of nitrogen oxides in the exhaust by 40-50%. Figures 6; references 5.

EQUIPMENT  
Aeronautical & Space

USSR

UDC 621.43.037

SELECTION OF THE ATOMIZER AND ITS WORKING CONDITIONS TO REMOVE ICE DEPOSITS,  
FROST AND FROZEN SNOW FROM AIRCRAFT SURFACES

Kazan' IZVESTIYA VUZov, AVIATIONNAYA TEKHNIKA in Russian No 1, 1977  
pp 137-140 manuscript received 26 Mar 75

MOROSHKIN, M. YA., SMOLIN, V. N., SKOBEL'TSYN, YU. A. and KOMLEV, A. F.

[Abstract] An investigation is made of jet atomizers for spraying water solutions of "Arktika-400" fluid on the surfaces of aircraft to remove ice, frost and snow at temperatures down to 50°C below zero. Two nozzle designs are considered; these are shown in a diagram, one of which is made with a cylindrical insert. The atomizers were tested with variation of the internal dimensions and fluid flow conditions. Ratios of the length of the cone with cylindrical insert to nozzle diameter  $l/d$  were varied from 1 to 7, ratios of the length of the cone to the nozzle diameter  $l_k/d$  were varied from 0.05-0.95, the angles of the cone  $\beta$  were varied from 10 to 90°, and the nozzle diameter  $d$  -- from 8 to 10 mm. The results show that when the ambient air gets as cold as -50°C it is advisable to shorten the cylindrical insert, and that at temperatures of -25-30°C the insert can be lengthened somewhat. A reduction in the angle of the cone lengthens the jet. Figures 4; reference 1.

USSR

UDC 531.383

## ANGULAR ERRORS IN A GYROSCOPICALLY STABILIZED INDICATOR SYSTEM

Moscow IZVESTIYA AKADEMII NAUK SSSR, MEKHANIKA TVERDOGO TELA in Russian  
No 2, Mar-Apr 77 pp 3-17 manuscript received 15 Apr 76

NOVOZHILOV, I. V., Moscow

[Abstract] Angular errors of orientation in a gyroscope-stabilized indicating system are analyzed without the conventional simplifying assumptions of a negligible gyroscope-object interaction and of either "fast" or "slow" perturbations. The analysis pertains to a system of two three-stage gyroscopes mounted on the stabilizable object and precessing in space due to moments developed by torque sensors on the axes of the gimbals. All structural elements of the system are assumed to be perfectly rigid, with both devices having identical mass distributions and dynamic characteristics. The fundamental system of equations of kinetic moments is solved by series expansion of the analytic functions, retaining only linear and quadratic terms, and appropriate normalization. The perturbation method is applied and asymptotically stable solutions are found over averaging time intervals of not necessarily "short" span. The results suggest at least two possible ways of reducing the systematic errors. Figures 2; references 6: 5 Russian, 1 Western.

USSR

UDC 62-50

## OPTIMUM REVOLUTION AND STABILIZATION OF THE VELOCITY VECTOR OF A BODY OF VARIABLE MASS

Tashkent IZVESTIYA AKADEMII NAUK UZBEKSKOY SSR, SERIYA TEKHNICHESKIKH NAUK  
in Russian No 4, 1977 pp 35-39 manuscript received 2 Dec 76

SHUL'GIN, A. M. and LEVCHENKO, YU. V., Tashkent "Order of the Red Banner  
of Labor" State University imeni V. I. Lenin

[Abstract] An optimum control problem is solved for a body of variable mass with gyroscopic structure. Motion is controlled by varying the angle of turn of the moment of reactive forces with constant amplitude. It is assumed that the principal vectors of the reactive and perturbing forces are equal to zero. By assuming that the perturbations actively oppose the aim of the control, the problem is reduced to a form that can be handled by the differential game methods. In other words, the worst possible case is considered, and payoffs can be improved for any other perturbations. The equations for the optimum control are given for stabilization of rotation of the angular velocity about the axis of dynamic symmetry of the body. Reference: 1 Russian.

USSR

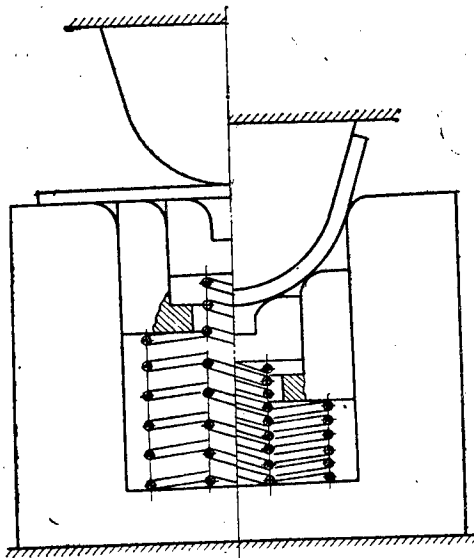
UDC 621.981.07

## BENDING STAMP

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI  
in Russian No 28, 30 Jul 77 Author's Certificate No 566653 3 Feb 76

YERSHOV, V. I., Moscow Institute of Aviation Technology imeni K. E.  
Tsiolkovskiy

[Text] A stamp consisting of a plunger with a curved active surface engaging the die and a clamp inside the die cavity, with the distinguishing feature that, for improving the quality of produced part, this clamp is made of spring-mounted segments one inside the other and each with an active surface generated by intersection of planes forming an angle whose bisector passes through the center of curvature of the plunger surface.



USSR

UDC 621.983.3

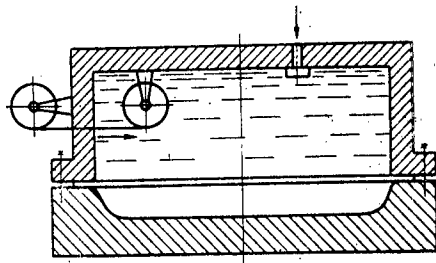
## STAMPING TOOL

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI  
in Russian No 28, 30 Jul 77 Authors' Certificate No 566656 16 Feb 76

VOLKOV, YU. V., GORBAN', V. P., ZORIK, V. YA., NESTERENKO, V. A.,  
PAVICHENKO, V. P., SABEL'KIN, V. P., and SOLODYANKIN, S. N., Kharkov  
Aviation Institute

[Text] A stamping device consisting of a chamber with a built-in inlet valve for the active medium and a die, with the distinguishing feature

that, for extending the range of its engineering applications and improving its operational safety, the device is also equipped with a mechanism for rewinding the flexible element, namely two drums, one inside the chamber and one outside the chamber, and the flexible element passing through a hole in the chamber wall.



USSR

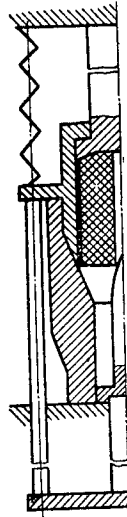
UDC 621.774.7

#### STAMP FOR PRODUCING PARTS FROM TUBING STOCK

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI  
in Russian No 28, 30 Jul 77 Authors' Certificate No 566652 6 Feb 76

PASHKEVICH, A. G., OREKHOV, A. V., KASHIRIN, M. F., and TYUPICH, YU. P.,  
Moscow Institute of Aviation Technology imeni K. E. Tsiolkovskiy

[Text] A stamp consisting of a plunger, a die, and an ejector inside the active die cavity, with the distinguishing feature that, for improving the quality of produced parts, it is furnished with an insert fastened to the ejector, tappets, and elastic clamp mounted on the plunger and engaging the insert, and a ring yoke embracing the clamp and mounted on the plunger so as to be vertically movable by the tappets and having an external profile which matches the profile of the active die cavity.



USSR

UDC 921.979:621.762.4.06

A DEVICE FOR PRODUCING HIGH TEMPERATURE AND PRESSURE

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI  
in Russian No 24, 1977 p 14, Authors' Certificate No 563184 filed 8 May 75  
published 30 Jun 77

SHIPILO, V. B. and SHISHONOK, N. A., Institute of Solid State Physics and  
Semiconductors, Academy of Sciences BSSR

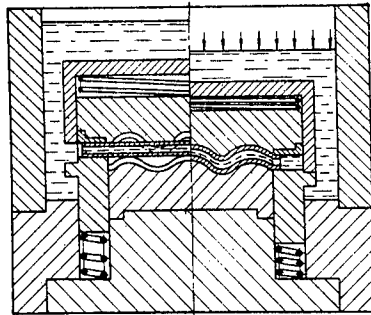
[Text] A device for producing high temperature and pressure that contains two hard alloy inserts with depressions in the center holding a container of reaction mass located close to a graphite heater. As a distinguishing feature of the patent, in order to reduce the temperature gradient of the heater, increase its efficiency and prevent burnup of the inserts, graphite washers are installed on the end faces of the tubular heater and are in contact with disk electrodes that touch the surface of the inserts around the outside diameter. In the cavity between the washers, electrodes and the surface of the depressions in the inserts are liners of a thermally nonconductive material such as the material of the container.

## TOOL FOR BENDING TUBING STOCK

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 28, 30 Jul 77 Authors' Certificate No 566646 4 Jan 76

VORONOV, A. I., Kharkov Aviation Institute

[Text] A tool consisting of a case filled with a force transmitting medium, two parts of a punch with forming grooves, one stationary and rigidly fastened to the case and the other inside it movable by hydraulic impact, also lateral detents on both sides of the punch with holes engaging the ends of a tube stock filled with a force transmitting medium, and a shutter set for covering these holes, with the distinguishing feature that, as a simplification of the tool construction, the lateral detents are made with protrusions and are connected to the movable part of the punch and are spring-mounted in the case, while the shutter set constitutes a lid spring-mounted on the movable part of the punch and engaging the protrusions.



## GAS BURNER

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 28, 30 Jul 77 Authors' Certificate No 567021 14 Nov 75

PIRALISHVILI, SH. A. and NOVIKOV, N. N., Rybinsk Institute of Aviation Technology

[Text] The burner described in Patent No 540110, except that, for improving the process of mixture formation and reducing the pressure of the hot gas, the crosspiece is made hollow, this cavity adjoining around its periphery the collector part of the combustible feed system and at its center, through a nozzle facing the diaphragm, the vortex chamber.

USSR

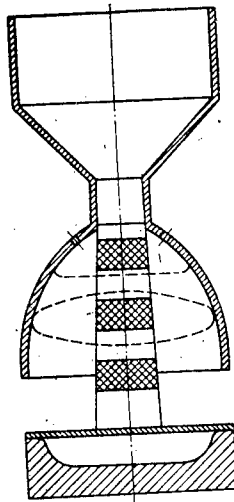
UDC 621.984

STAMPING TOOL

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY I TOVARNYYE ZNAKI  
in Russian No 28, 30 Jul 77 Authors' Certificate No 566659 16 Feb 76

BORISEVICH, V. K., SABEL'KIN, V. P., SOLODYANKIN, S. N., and ISAYENKO, V. I.,  
Kharkov Aviation Institute

[Text] A device for thermal breakup of rocks as a stamping tool.



USSR

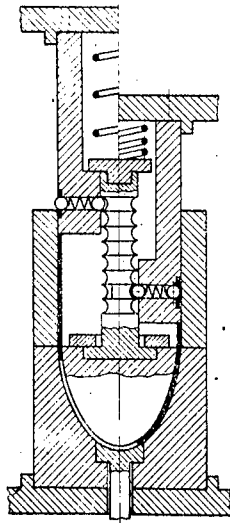
UDC 621.774.7

STAMP FOR SQUEEZING THIN-WALLED SHELLS

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI  
in Russian No 28, 30 Jul 77 Authors' Certificate No 566663 6 Feb 76

GORBUNOV, M. N., PASHKEVICH, A. G., KASHIRIN, M. F. and OREKHOV, A. V.,  
Moscow Institute of Aviation Technology imeni K. E. Tsiolkovskiy

[Text] A stamp consisting of a die and coaxially arranged yoke, clamp, and plunger, with the distinguishing feature that, for reducing the necessary deforming force, the clamp has a stem with annular flutes and the plunger has radial holes with two balls in each separated by a spring, fitting into the respective annular flutes in the clamp, and engaging the inside surface of the yoke.



USSR

UDC 621.565.58

#### REVOLVING HEAT PIPE

Moscow OTKRYTIYA IZOBRETIENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 28, 30 Jul 77 Authors' Certificate No 567073 7 Feb 73

BORISENKO, A. I., KOSTIKOV, O. N., CHUMACHENKO, V. I., and YAKOVLEV, A. I.,  
Kharkov Aviation Institute

[Text] 1. A revolving heat pipe which consists of a hermetically sealed sheath, with an evaporation zone and a condensation zone, filled with a heat carrier, with the distinguishing feature that, for raising the thermodynamic efficiency by an improvement of the conditions of boiling and condensation as well as by a reduction of the temperature head and by a uniform distribution of the condensate around the sheath circumference, on the inside surface of the sheath are provided longitudinal fins split by annular grooves into separate segments. 2. The same heat pipe, except that the height of the fins varies over the sheath length, increasing in the direction from the evaporation zone to the condensation zone.

USSR

UDC 533.95

INVESTIGATION OF THE DYNAMICS OF A THIN LAYER IN A PULSED PLASMA ACCELERATOR  
BY THE METHOD OF OPTICAL INTERFEROMETRY ON A WAVELENGTH OF 10.6  $\mu\text{m}$

Leningrad ZHURNAL TEKHNIЧЕСКОY FIZIKI in Russian Vol 47, No 4, Apr 77  
pp 787-794 manuscript received 5 Aug 75

KALMYKOV, A. A. (deceased), NIKOL'SKIY, I. K., PAVLICHENKO, O. S. and  
SHEVCHUK, B. A., Khar'kov Physicotechnical Institute, Academy of Sciences  
UkrSSR

[Abstract] The authors study the dynamics of a thin layer in a pulsed coaxial plasma accelerator. The experimental setup is shown in a diagram. Before discharge, the accelerator was filled with gas through pulsed electrodynamic valve. Hydrogen or helium was used as the working gas. Density distribution was practically steady during plasma acceleration. The distribution of magnetic field and current were measured by small magnetic probes with free axial and radial movement in the accelerator. To measure density, 3-mm slits were cut in the outer electrode of the accelerator lengthwise and covered with NaCl windows transparent to the laser wavelength of 10.6  $\mu\text{m}$ . The illuminator was a cw CO<sub>2</sub> laser. A gold-activated germanium photodiode was used as the detector in the interferometer. Spatial resolution was about 1 mm, and time resolution was about 0.1  $\mu\text{s}$ . The current velocity of electrons in the discharge was calculated on the basis of measurement results. It is shown that for the fast mode of accelerator operation the current velocity considerably exceeds the critical values for excitation of current instability. Figures 8; references 9: 5 Russian, 4 Western.

USSR

UDC 533.697.2

INVESTIGATION OF THE PROCESS OF THE INFLOW OF AN AIRSTREAM INTO A SCREENED  
SCOOP BY THE METHOD OF ELECTROHYDRODYNAMIC ANALOGY

Kazan' IZVESTIYA VUZov, AVIATSIONNAYA TEKHNIKA in Russian No 1, 1977  
pp 134-137 manuscript received 1 Mar 77

GRISHIN, I. A., IVANNIKOV, V. F. and NESTEROV, YE. D.

[Abstract] The EGDA-9/60 electrohydrodynamic simulating integrator is used to study the flow pattern of air into a screened air scoop. The flow patterns show up on the electrically conductive paper as grids of stream lines and equipotentials. Flow velocities are calculated at grid intersections. By analyzing this velocity field, an estimate is made of the effect of suction that draws objects into the intake, and it is shown that this effect can be reduced by moving the lower lip of the air scoop. Figures 4; references 1 Russian.

USSR

UDC 62-522/525

ON EVALUATING THE QUALITY OF A FLUIDIC-ACOUSTIC GAS TEMPERATURE MEASUREMENT TRANSDUCER

Kazan' IZVESTIYA VUZov, AVIATSIONNAYA TEKHNKA in Russian No 1, 1977 pp 37-41  
manuscript received 13 Oct 75

VLASOV, I. I., ZISER, I. G. and YAVKIN, V. B.

[Abstract] A method is proposed for evaluating the quality of an instrument for gas temperature measurement by converting temperature to a gas pressure pulse train with  $p$  proportional to gas temperature. The unit contains a primary measurement transducer (fluidic-acoustic oscillator), an intermediate converter in which the pressure pulses are changed to an electric signal, and a computer-output module. An analysis is made of the overall error of temperature measurement by such a device due to components of a thermal nature and to errors that arise in the conversion process. The procedure utilizes the solution of a thermal mathematical model of the transducer and data of experimental studies. Figures 4; references: 7 Russian.

USSR

UDC 536.244:532.517

HEAT EXCHANGE AND FLUID FLOW CONDITIONS IN A CLOSED ROTATING ANNULUS

Kazan' IZVESTIYA VUZOV, AVIATSIONNAYA TEKHNKA in Russian No 1, 1977  
pp 54-59 manuscript received 29 May 75

ZYSINA-MOLOZHEN, L. M. and SALOV, N. N.

[Abstract] An experimental study is done on the way that the rate of rotation and the magnitude of the heat flux influence heat exchange in a closed cylindrical cavity. Still and motion-picture photographs were taken of the flow of turbine oil as a heat-transfer agent in the closed annulus between coaxial cylinders rotating at speeds from 0 to 2500 rpm. The bounding cylindrical surfaces were held at different temperatures. The differential was produced by applying electric heat along a generatrix of the larger cylinder. The photographs demonstrating motion of the heat-transfer agent were taken through a plexiglas disk spacer. The flow was made visible by adding a little aluminum dust to the fluid. It was found that the nature of flow in the annulus depends both on the density of the heat flux and on the rate of turn. The experimental data of heat measurements were analyzed in accordance with the dimensionless formula  $Nu = f(Gr \cdot Pr)$ . It was found that the influence of heat flux density on

heat exchange during rotation is analogous to heat exchange accompanying free convection in a gravity field. Two characteristic modes of heat exchange were observed in the experiments, and the dimensionless formulas describing them are given. The intensity of heat transfer in the annulus is characterized by the combined action of thermal and centrifugal convection and depends on the Prandtl and Grashof numbers, on the rotational Reynolds number  $Re_{rot} = \frac{U \cdot R}{\nu}$  ( $U$  is the average rate of rotation on the average radius of the annulus  $R = R_{out} - R_{in}$ , and  $\nu$  is kinematic viscosity), and on  $\frac{Gr}{Re_{rot}}$ . Figures 5; references 5: 3 Russian, 2 Western.

USSR

UDC 621.1:053.2:534-8

#### A DEVICE FOR MEASURING THE DEPTH OF IMMERSION OF A SHIP

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 24, 1977 p 45 Authors' Certificate No 563320 filed 30 Dec 74 published 30 Jun 77

BELOV, YU. I. and KUKS, I. A.

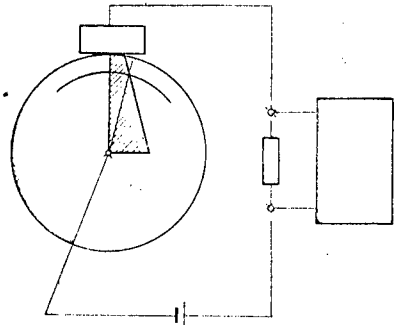
[Text] A device for measuring the depth of immersion of a ship. The device contains a measurement tube installed in the diametral plane of the ship, the lower part of the tube being open to the water. The main measurement channel of the device consists of a series circuit comprising a carrier frequency oscillator, a power amplifier in the keying mode, a radiator and a receiver that are installed on the top of the tube. The device also contains a resonant preamplifier, a reverberation suppressor, an amplifier with AGC and output detector, a shaper, and a display. As a distinguishing feature of the patent, in order to improve accuracy in measuring immersion of ships, a reference signal channel is added that consists of a series circuit comprising a trigger flip-flop, peak pulse oscillator in the slave mode, and a radiator and receiver that are installed on the tube close to the converters of the main measurement channel a fixed distance apart. The series circuit also includes an amplifier, a shaper-detector connected to the display inputs and a peak pulse oscillator. In the main measurement channel, a series circuit is added that includes a prf oscillator and a synchronizing multivibrator that are connected in such a way that the pulse recurrence oscillator is connected in parallel to the input of the carrier frequency oscillator, the flip-flop and the display, while the synchronizing multivibrator is connected in parallel to the shaper output and the flip-flop input.

## A METHOD OF MEASURING WEAR OF ABRASIVE TOOLS

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI  
in Russian No 24, 1977 pp 109-110, Author's Certificate No 563601 filed  
23 May 75 published 30 Jun 77

SAVANEYEV, V. P., Joint Institute of Nuclear Research

[Text] 1. A method of measuring wear of abrasive tools that consists in applying an indicator material on part of the tool face, periodically plotting the characteristic of this layer during wear, and evaluating the wear from the change in this characteristic. As a distinguishing feature of the patent the sensitivity is increased by applying a current-conducting layer as the indicator material and judging the wear from the change in the ratio of the time of contact between the layer and the machined work-piece to the period of revolution of the tool. 2. A modification of this method distinguished by the fact that provision is made for measuring the nonuniformity of wear of an abrasive tool by applying the current-conducting layer in several radial directions. 3. A modification of the method covered in points 1 and 2 that is distinguished by the fact that nonuniformity of wear of the faces of an abrasive tool is determined by applying the abrasive layer on both faces of the tool.

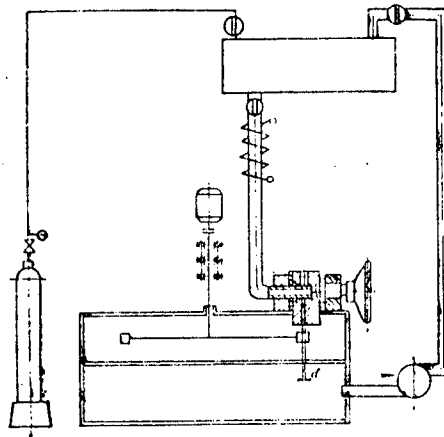


## AN INSTALLATION TO TEST MATERIALS FOR CAVITATION-EROSION STABILITY

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 24, 1977 pp 110-111, Authors' Certificate No 563605 filed 4 Jan 76 published 30 Jun 77

FOMENKO, V. D., SHAKIRO, G. F., RUDYCHEV, A. S. and KOVBASYUK, V. S., State Specialized Construction and Repair Trust "Ukrtsvetmetremont"

[Text] An installation to test materials for cavitation-erosion stability that contains a test chamber accommodating a rotor with terminals for holding specimens around the periphery. The installation also contains a drive for turning the rotor in the horizontal plane, a tank for the fluid, tubing for feeding the fluid to the specimen with a nozzle on the end of the tubing. As a distinguishing feature of the patent, testing productivity is increased by making the tubing in the form of an L, and the nozzle in the form of a disk that has an eccentric orifice whose axis coincides with the axis of the horizontal part of the tubing while radially arranged channels of different diameters communicate with the orifice.

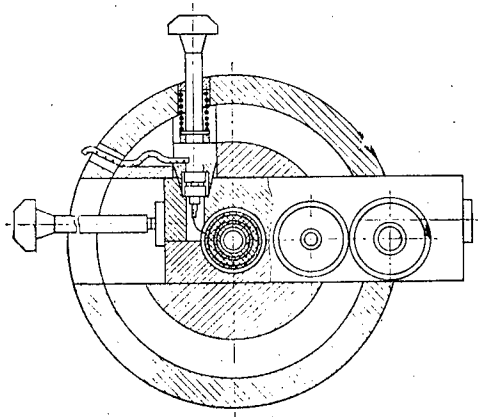


## A FEED-THROUGH EDDY-CURRENT CONVERTER FOR AN ELECTROMAGNETIC FLAW DETECTOR

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI  
in Russian No 24, 1977 p 112, Authors' Certificate No 563611 filed 3 Jul 73  
published 30 Jun 77

DOLGOMIROV, B. A., FEDOSENKO, YU. K. and YUDIN, I. I.

[Text] A feed-through eddy-current converter for an electromagnetic flaw detector. The converter contains a cylindrical housing made in the form of a closed magnetic circuit with longitudinal opening. Enclosed in the housing are a magnetizing coil and an insert with longitudinal opening, and coaxial with the housing are a field coil and a flip coil. As a distinguishing feature of the patent the range of diameters of objects that can be checked is expanded by adding field coils and flip coils of different diameters, and a rod that is spring-loaded in the axial direction with a plug connector. A diametric hole is made through the side surface of the housing and perpendicular to it and communicating with it is a radial hole. The insert is placed in the diametric hole and is made with openings whose axes are parallel to that of the longitudinal opening. The field coils and flip coils of different diameters are accommodated in these openings, and the rod is accommodated in the radial hole.

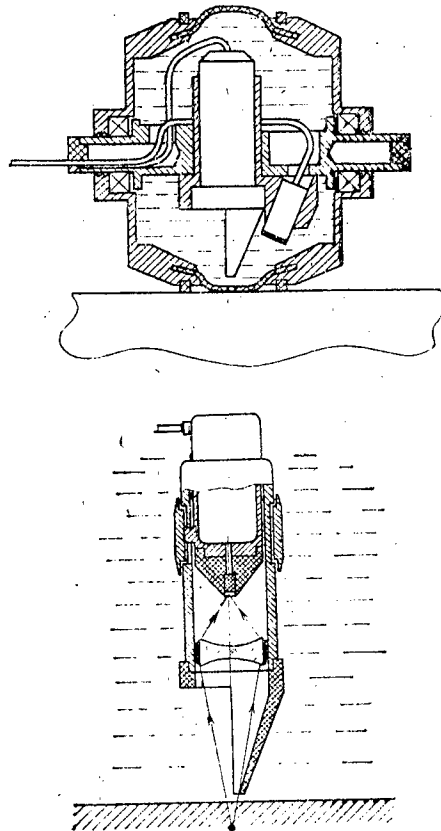


## A DEVICE FOR ULTRASONIC INSPECTION OF MATERIALS

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI  
in Russian No 24, 1977 p 114 Authors' Certificate No 563619 filed 5 Mar 74  
published 30 Jun 77

TUKKAYEV, A. A., SLYUSARENKO, N. V., GUROV, S. V. and BAULIN, YU. A.

[Text] A device for ultrasonic inspection of materials that contains a liquid bath in which a cylindrical housing is secured. Accommodated in the housing is a piezoelectric receiver made in the form of a flat disk and a focusing element. As a distinguishing feature of the patent the sensitivity of inspection is improved by equipping the device with an emitter fastened to the outside of the housing, a tube that moves along the housing and has a reflector on the end made in the form of a half-cone, and a focusing element fastened to the tube, and the piezoelectric receiver is placed in the focal plane of the focusing element and has dimensions equal to the focal spot of the element.



USSR

UDC 620.179.16

AN ULTRASONIC FLAW DETECTOR

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI  
in Russian No 24, 1977 p 115, Authors' Certificate No 563624 filed  
4 May 75 published 30 Jun 77

SHAPOVALOV, P. F., KARELIN, A. V. and LERNER, V. S., All-Union Scientific  
Research Institute on Development and Nondestructive Methods and Means of  
Checking the Quality of Materials

[Text] An ultrasonic flaw detector that contains a receiving and transmitting module, a horizontal scanning module, an exposure module, a cathode-ray tube, an automatic signalling module, and a synchronizer that is connected to the horizontal scanning module, the exposure module and the receiving and transmitting module, which is connected by the output to the vertical deflecting plates of the CRT, and to the automatic signalling module, which is connected by the input to the synchronizer. As a distinguishing feature of the patent, visual monitoring of the operating threshold of the automatic signalling module is provided by equipping the flaw detector with a unit for setting the operating limits which is connected by the input to the synchronizer and by the output to the automatic signalling module and to the vertical deflecting plates of the cathode ray tube, and with an OR gate connected by the inputs of the exposure module and the synchronizer, and by the output to the control electrode of the CRT.

USSR

UDC 621.313

A DEVICE FOR NON-CONTACT MEASUREMENT OF THE VELOCITY OF ELECTRICALLY  
CONDUCTIVE BODIES

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI  
in Russian No 24, 1977 p 117, Authors' Certificate No 563633 filed  
3 Dec 75 published 30 Jun 77

ZININ, V. A., DANILOV, S. P., MOLOTOV, P. YE. and SHATERNIKOV, V. YE.,  
Kuybyshev "Order of the Red Banner of Labor" Aviation Institute imeni  
Academician S. I. Korolev

[Text] A device for non-contact measurement of the velocity of electrically conductive bodies that contains an eddy current sensor with field winding connected to a high-frequency oscillator. The device also contains a

measurement circuit. As a distinguishing feature of the patent, provision is made for measuring the velocity vector and for improving measurement accuracy. The eddy current sensor is made with two pairs of orthogonal measurement probes, and the measurement circuit is made with two identical channels of series-connected amplifiers, nonlinearity autocompensators and instruments to measure the sign of the projections of the velocity vectors. Added to the measurement circuit is a control channel made in the form of a controllable high-frequency oscillator. Connected to the output of this channel are the inputs of the nonlinearity autocompensators of the instruments to measure the sign of the projections. The control channel also includes a ratio box connected to the outputs of the projection sign measuring instruments, and a multiplier box with inputs connected to the outputs of the ratio box and to the output of one nonlinearity autocompensator. The output of the multiplier box is connected to the input of the controlled oscillator.

USSR

UDC 621.317.325

#### A DEVICE FOR MEASURING THE PARAMETERS OF NANOSECOND PULSES

Moscow OTKRYTIYA, IZOBRETIENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 24, 1977 pp 121-122, Authors' Certificate No 563651 filed 21 Aug 75 published 30 Jun 77

YEMNOV, YE. YE., OS'MAK, M. YE. and KOSINOV, N. V.

[Text] A device for measuring the parameters of nanosecond pulses. The device contains an attenuator with first input connected to the input terminal, second input connected to the output of a synchronizer, and the output connected to the first input of a record scanning unit, and through a vertical deflection amplifier to the first input of a cathode-ray memory tube module. The second input of the CRT is connected to the first output of the record scanning unit, the third input is connected through a light pulse shaper to the second output of the record scanning unit, the fourth input is connected to the output of a readout scan oscillator, and the output of the CRT module is connected through a readout amplifier to the first input of a pulse duration modulator. The second input of the modulator is connected to the output of the pulse oscillator, and the modulator output is connected through a counter-register, number register and conjugation unit to a computer. The first output of the vertical coordinate counter is connected to the first input of the readout scan oscillator, which is connected by its second input to the output of the conjugation unit. Six outputs of the synchronizer are connected to the synchronization inputs of the record scanning unit, pulse duration modulator, counter-register, vertical and horizontal

coordinate counters and number register. As a distinguishing feature of the patent, speed is increased by equipping the device with a unit for measuring the sign of the derivative, a unit for measuring rise time, and a code-shaping module with first output connected to the second input of the counter-register, the first input connected to the second output of the counter-register and the inputs of the derivative sign measuring unit and the rise time measuring unit. The second and third inputs of the code-shaping module are connected to the outputs of the derivative sign and rise time measuring units, and the fourth input is connected to the eighth output of the synchronizer. The second output of the code-shaping module is connected to the first input of the vertical coordinate counter, and the second output of this counter is connected to the third input of the pulse duration modulator.

USSR

UDC 543.27

#### A FAST-ACTING GAS SAMPLER

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 6,  
Jun 77 pp 20-21

KISLER, S. YA.

[Abstract] For measuring the purity of air supply in metallurgical or chemical plants, a special-purpose low-inertia gas sampler has been developed at the Kharkov All-Union Scientific Research and Planning Institute of Power and Purification for the Ferrous Metals Industry. It processes samples of dry or moist dusty gas, insoluble or hardly soluble in water, for subsequent testing in a standard analyzer. Its essential components are a set of drop collectors and a miniature venturi (throat diameter 3 mm). The interaction between air and water is different here than in conventional venturis because of the peculiar characteristics of film flow along the tube surface. The sampler can process as much as  $2 \text{ m}^3/\text{h}$  air with a 2 liters/ $\text{m}^3$  water trickle. An ejector is furnished for discrete or continuous measurement of the dust content. The time lag of the entire system does not exceed 20-30 s. Figures 1; no references.

USSR

UDC 624.131.542:558.835

RADIOISOTOPIC METHOD OF MEASURING THE SAG OF A FOUNDATION

Moscow OSNOVANIYA FUNDAMENTY I MEKHANIKA GRUNTOV in Russian No 4, Jul-Aug 77  
pp 21-23

ZAVAL'NYY, A. P., LAVRIYENKO, I. K., SARATOV, I. YE., GOLOVCHENKO, B. I.,  
and OSMACHKIN, B. P., Kharkov Branch of the All-Union Scientific Research  
Institute of Water Supply, Sewer Systems, Hydraulic Engineering Structures,  
and Engineering Hydrogeology, Voroshilovgrad Branch of the Scientific  
Research Institute of the Construction Industry

[Abstract] A radioisotopic depth gauge has been developed for measuring the sag of various compressible foundation layers. A probe connected to an indicating instrument above ground slides into the main well, detecting gamma radiation from sources dropped into control wells which have been drilled around the main well at various depths and at distances within the range of adequate detectability. Such a gauge is much cheaper to install and to use than a set of mechanical depth gauges, each capable of measuring the sag at only one point. Its worthiness has been proved in testing a quarry 40 m deep around a manganese ore mine. The power of the radiation source must be high, at least 1 MeV, and the isotopes Fe<sup>59</sup> or Zn<sup>65</sup> have been found most suitable without causing health hazards. Figures 1; references 4: Russian.

USSR

UDC 535.6:535.33:518.5

A COLOR INTEGRATOR

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 5, May 77  
pp 29-32 manuscript received 22 Jul 76

ZAYTSEV, L. F. and BERDNIKOV, N. B.

[Abstract] In the instrument described in this article, color is determined in the process of the measurement of a specimen on a spectrophotometer on the basis of its spectral transmission or reflection coefficient. The color coordinates X, Y and Z of specimens are calculated as they are illuminated with sources having predetermined spectral distribution. The integrator is intended for combined operation with the series produced SF-10, SF-14 and SF-18 instruments. References: 4 Russian.

USSR

UDC 531.787

DIFFERENTIAL PRESSURE GAUGE

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI  
in Russian No 28, 30 Jul 77, Authors' Certificate No 567104 18 Feb 76

BATURIN, YU. N., KOSTINA, T. A., NADEZHINA, N. I., and PISHES, K. I.

[Text] A differential pressure gauge consisting of a case split by a rigid partition into a positive compartment and a negative compartment, and an elastic sensing element made in the form of two membranes, for instance, one of which is connected to the core of an inductive transducer, with the distinguishing feature that, for a more accurate and reliable inspection of contaminated and aggressive media under external mechanical perturbations and internal pulsations, each membrane divides its respective compartment into two isolated cavities, namely cavities between the membranes and the rigid partition which connect to the supply ducts and cavities between the membranes and the case walls, the latter cavities filled with a neutral fluid and connected to one another through a duct with a throttle.

USSR

UDC 535.242.2

AN AUTOMATIC INFRARED HYGROMETER

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 77  
pp 25-27 manuscript received 17 May 76

TOGULEV, V. P., USTIMOV, YU. N., GROSS, L. G. and PETROV, YU. A.

[Abstract] A description is presented of the IFO-459 infrared hygrometer, a dual-beam photometer with one radiator and one receiver. The humidity of the air is determined by photometry of radiation passing through a layer of air in two close areas of the spectrum lying inside and outside the band of absorption of water vapor. Comparison of the beams of radiation is by the zero modulation method with compensation in the optical channel. The instrument is sealed, eliminating the influence of fluctuations in humidity, pressure and temperature of the external medium. The cuvette, which is filled with the air being studied, is made of a material with a low coefficient of heat conductivity and hygroscopicity. The basic technical characteristics of the instrument are: operating spectral area 1.4-2.1  $\mu\text{m}$ ; range of measurement of optical density 0.002, 0.05, 0.2; basic error of measurement in ranges 10%, 4% and 3% respectively; powered by 220 V + 10%-15%, 50  $\pm$  1 Hz; power consumption 100 w; maximum pressure in cuvette, -1  $\pm$  0.05 atm; time constant not over 10 s. The instrument has a differential output. References 6 Russian.

USSR

UDC 681.84.083.84+771.534.52

SENSITOMETRY OF THIN-FILM MAGNETIC OPTICAL IMAGE RECORDERS

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian No 4, Jul/Aug 77 pp 276-279 manuscript received 7 Oct 75

NOZDRIN, V. V., PAN'SHIN, I. A., and PODPALIY, YE. A., Moscow Institute of Railroad Transport Engineers

[Abstract] Considering that magnetic optical image recorders of stripe-domain type were developed for quantitative photography of rapidly occurring radiative processes (lengths of a few microseconds), the sensitometer here described was constructed using the principle of changing the exposure by an optical wedge which dissects the initial beam into a number of spatially separated beams with calibrated intensity ratios. The calibrated source of radiation used is a pulsed laser based on glass with  $Nd^3$ . In order to increase the accuracy of absolute measurements, an intermediate standard specimen was used which had been preliminarily calibrated. This combined method allowed measurements to be performed with an accuracy of 5%, eliminating the cumbersome operation of measurement of the angle of rotation of the domain in local sectors on the film. References: 2 Russian.

USSR

UDC 681.3

APPLICATION OF A "MIR-2" COMPUTER FOR AUTOMATION OF PHYSICAL MEASUREMENTS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 2, Mar/Apr 77 pp 69-71 manuscript received 12 Apr 76

BREYEV, I. M., DEMIN, S. V., MARTSINOVSKIY, A. M. and REVENKO, V. S., Institute of Physics and Technology, Acad. Sci. USSR

[Abstract] A description is presented of a multipurpose automated system for collection and processing of data based on a MIR-2 computer. The system described occupies an intermediate position between modular systems based on modern computers, used to automate large-scale experiments, and devices for automatic collection of information, used in the performance of a single type of measurement. The system is used for experiments with information content  $10^3$ - $10^5$  bytes, with information arrival rates of up to  $10^3$  bytes per second. The advantage of the system, in addition to its simplicity and universality, is the possibility of its further development, both by expansion of the number of quantities recorded (by signal switching) and by the creation of a channel for control of an experimental

installation. Universality is achieved in the system by switching of discrete output signals from measurement instruments, and also by rapid and convenient toggle-switch selection of programs for interrogation of instruments, with the instrument-interrogation frequency adjustable over broad limits (0.1-100 Hz). References 12 Russian.

USSR

UDC 621.317.341

AUTOMATED SYSTEM FOR CONDUCTING EXPERIMENTS USING SUBNANOSECOND PULSES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 2, Mar/Apr 77  
pp 74-77 manuscript received 14 May 76

KRYLOV, V. V. and PONOMAREV, D. M., Gor'kiy Polytechnical Institute

[Abstract] A description is presented of an automated system for recording and processing of the data of experiments conducted by means of subnanosecond electromagnetic pulses. The composition of the hardware of this system and its software are described. The digital stroboscopic converter used as the pulse recorder, providing a sensitivity of 0.2 mV/bit and a time resolution of 20 ps, is described. The point display, based on a series-produced oscilloscope with a long persistence tube and the picosecond rise time pulse generator, directly connected to the system interface, are also described. The system can be used to conduct many different types of experiments involving measurement of the electrophysical properties of substances in the process of chemical conversion, under the influence of acoustical and electromagnetic effect, shock loads, thermal shock, etc. References 4: 3 Russian, 1 Western.

USSR

UDC 537.533.8

INSTALLATION FOR AUTOMATIC RECORDING OF THE SECONDARY ELECTRON EMISSION COEFFICIENT OF METALLIC MATERIALS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 2, Mar/Apr 77  
pp 169-171 manuscript received 24 Feb 76

SAVITSKIY, YE. M., BUROV, I. V. and KAPUSTIN, V. I., Institute of Metallurgy Acad. Sci. USSR

[Abstract] Several instruments have been developed for automatic measurement of the secondary electron emission coefficient of metallic materials  $\sigma(E_p)$ .

However, these instruments are not sufficiently universal and the block diagrams presented in the descriptions of them in the literature are not specific, making it difficult to reproduce them directly. Figure 1 of this article presents a block diagram of an installation developed by the authors. The installation includes a split experimental chamber allowing several experimental specimens to be installed simultaneously. A high vacuum system creates a vacuum of  $3-5 \cdot 10^{-10}$  mmHg. The recording system of the installation can automatically record the secondary electron emission coefficient and its first derivative as a function of the energy of primary electrons in the energy range of 50-2,000 eV on a two-coordinate potentiometer. The automatic recording of the function  $\sigma(E_p)$  is based on the principle of automatic compensation. References 8: 6 Russian, 2 Western.

USSR

UDC 539.186.2:546.49

MEASUREMENT OF THE CROSS SECTIONS OF EXCITATION OF LINES OF A MERCURY ATOM BY ELECTRON IMPACT

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian No 5, May 77 pp 827-831  
manuscript received 25 Sep 75

SEMENOVA, I. V. and SMIRNOV, YU. M.

[Abstract] Seventy-eight excitation functions of lines of the mercury atom by electron impact are measured in the 2270-7730 Å spectral interval with variation in the energy of the electrons from the threshold energy by up to 400 eV. The experimental installation was designed by the authors, and consisted of a cylindrical experimental tube of stainless steel with a branch tube containing the mercury and surrounded by a water cooling jacket. This system is evacuated to  $4 \cdot 10^{-4}$  mmHg by a pair of oil-vapor pumps connected in tandem through a metal valve and a nitrogen trap. An optical quartz window allows operation in the 2-2.5 μm spectral range. The probability of transitions was determined for 22 lines, and the excitation cross sections were determined for 13 levels of the mercury atom. The lifetime was determined for three levels, based on the transition probabilities produced. The variation in excitation cross section with the main quantum number of the upper level was established for six spectral series. References 5: 3 Russian, 2 Western.

USSR

UDC 621.378.35

AN OPTICAL MODULE BASED ON AN INJECTION SEMICONDUCTOR LASER MATED TO A LIGHT GUIDE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 2, Mar/Apr 77  
pp 185-186 manuscript received 20 May 76

ALYAB'YEV, B. V. and MATSVEYKO, A. A.

[Abstract] An optical module is described, consisting of a laser diode exciter generator and a tuning device. The module utilizes a semiconductor laser, which is in series production. The design of the instrument allows rapid changing of the laser and light guide and minimum losses of radiation at the boundary between the laser and the light guide. An adjusting device has been developed to mate the laser to the light guide. The laser produces pairs of light pulses 10 ns in length with arbitrary relative delay and repetition frequency up to 1 MHz. Adjustment of the mating device allows the radiation of the laser to be input to the light guide with losses at the boundary between the two devices of not over 3 dB. References 2: 1 Russian, 1 Western.

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UDC 621.378

PARAMETERS OF A CONICAL FIBER OPTICAL QUANTUM AMPLIFIER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 2, Mar/Apr 77 pp  
187-189 manuscript received 11 Feb 76

KONAREV, V. P., MATVEYEV, I. N. and TRUBETSKOY, YU. V.

[Abstract] An experimental study is presented of the parameters of a conical fiber optical quantum amplifier made of glass with an admixture of nb operating at a wave length of 1.06  $\mu\text{m}$ . The gain, sensitivity, aperture angle and effective diameter of the input sensing area of the amplifier are experimentally studied. When the energy input to the pumping flash tube is about 200 J, the power gain is about 37 dB. A sensitivity of about  $8 \cdot 10^{-9}$  W is recorded with a pulse length of about 15 ns and a half width of the interference filter installed between the amplifier and photodetector of about 10 A. The effective diameter of the input sensing area and aperture angle are about 1 mm and about 30' respectively. References 3: 2 Russian, 1 Western.

## A PHOTOGRAPHIC UNIT FOR DETERMINING THE PARAMETERS OF MOTION OF SOLID AND LIQUID PARTICLES IN A GAS FLOW

Kazan' IZVESTIYA VUZov, AVIATIONNAYA TEKHNIKA in Russian No 1, 1977  
pp 132-134 manuscript received 17 May 76

BEREZIN, G. V. and KUDRINSKIY, V. Z.

[Abstract] Analysis of existing experimental methods of studying two-phase flows indicates that the simplest, more informative and adequately precise procedure is photomicrography of the particles on a stationary film in reflected light beams. The authors propose a photographic unit based on this principle. A figure shows a diagram of the device. The two main components are the camera and the pulse illuminator. The FK-13x18 camera has a built-in shutter and special attachment with cassette. The attachment is designed for making a series of images of the particle speed by definite time intervals, which is achieved by periodic transmission of the light rays reflected from the particle to the film. To do this, a motor-driven disk with uniformly spaced radial slits is placed in front of the cassette. The axis of rotation of the disk is displaced relative to the window of the attachment. Crosshairs determine the position of the film relative to the center of the disk. A flashing lamp is placed on the optical axis of hyperbolic reflector so that the rays are focused in the photographic plane. A conical shield prevents scattering of the light rays. The device gives an image with 1-7x magnification. It is shown how the velocity of a particle can be calculated from known parameters of the installation. Figures 2; references: 4 Russian.

## HIGH SPEED ROTATING VACUUM VALVE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 2, Mar/Apr 77 pp 213-215 manuscript received 7 May 76

BELORUSOV, A. A. and KARCHEVSKIY, A. I.

[Abstract] A description is presented of a high speed vacuum valve for sampling of gas or plasma with high space and time resolution in a pulsed discharge. The valve can open an aperture with a cross section of  $1.5 \times 10 \text{ mm}^2$  in a time of about  $150 \mu\text{s}$ . The shaft of the valve is moved by the impact of a bullet. The quantity of gas taken for analysis is proportional to the pressure before the collector and is about  $0.2 \text{ cm}^3$  for air and room temperature. The moment of sampling of the gas from the discharge can be regulated by electronic delay circuits within limits of 10 ms. A cross sectional diagram and photograph of the valve are presented. In a test, the gas collection system including the valve, withstood over 500 operating cycles with no repair or maintenance. References 4: 1 Russian, 3 Western.

## ESCAPE OF GAS THROUGH AN APERTURE INTO A VACUUM

Leningrad ZHURNAL TEKHNIЧЕСКОY FIZIKI in Russian Vol 47, No 1, Jan 77 pp 199-202 manuscript received 25 Jul 75

BARASHKIN, S. T., PORODNOV, B. T. and SUYETIN, P. YE., Ural Polytechnical Institute imeni S. M. Kirov, Sverdlovsk

[Abstract] The authors give the results of an experimental study of discharge of carbon dioxide, hydrogen and argon into vacuum through a hole with ratio of length to diameter equal to 0.021 and range of Knudsen numbers of  $40-6 \cdot 10^{-3}$ . The experimental setup and technique for detecting the molecular beam are described in a previous paper by the authors and A. A. Tarin [Zhurnal tekhnicheskoy fiziki Vol 46, p 162, 1976]. Gas pressure was held constant within 1-1.5% and the error in measurement of total gas flow was no more than 2%. The angular distribution (radiation pattern) of the molecular beam formed with discharge of the gas through the opening was studied by a modulation detection method. The modulator was a four-vaned impeller wheel rotated by a synchronous motor fed by an audio-frequency oscillator. Maximum error of beam intensity measurement was no more than 4-5%. The hole was made by a drill through tantalum foil about 0.02 mm thick. The average diameter of the hole

as found by several measurements was 0.952 mm. The experimental results agreed satisfactorily with theoretical data. The radiation patterns of hole-formed molecular beams are described by Troitskiy's formula for viscous flow and by Clausing's formula for free-molecular flow. The agreement between theoretical and experimental data shows that the proposed method can be used to study gas discharge from channels of different geometry. Figures 3; table 1; references 15: 9 Russian, 6 Western.

USSR

UDC 620.179.13

### AN INSTALLATION FOR HEAT CYCLING OF ARTICLES

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 24 1977 p 110 Authors' Certificate No 563603 filed 28 Jan 76 published 30 Jun 77

GORODYSKIY, N. I., NOVIKOV, N. V. and STASYUK, S. Z., Institute of Strength Problems, Academy of Sciences UkrSSR

[Text] An installation for heat cycling of articles that includes a chamber accommodating a heating device. Under the chamber is a vessel for liquid coolant. The installation also includes a holder for the articles to be tested and an attachment for relative displacement of the holder, heating device and coolant tank. As a distinguishing feature of the patent, to save on coolant when cooling items to cryogenic temperatures the installation is equipped with several shields installed perpendicular to the axis of the chamber between the heating device and the coolant tank. These shields each have a recess in the shape of the holder, and are located one above the other with displacement of the recess along a circle. The installation is also equipped with an attachment for rotating the holder about the axis of the chamber.

