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USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

ENGINEERING AND EQUIPMENT

No. 33

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ENGINEERING
Aeronautical & Space

USSR

UDC 629.735.025.015.4

ON DESIGNING A MONOLITHIC WING

Kazan' IZVESTIYA VUZOV AVIATSIONNAYA TEKHNIKA in Russian No 4, 1976 pp 17-22
manuscript received 16 May 75

BOLGOMOL'NYY, M. A.

[Abstract] Author treats the problem of an analytic design of a monolithic swept wing with longitudinal wall-spars. The external configuration and type of load are given. A gradient slope algorithm is used to find the number of walls and wall and skin thickness variables with respect to sweep, in which the weight, sag, stresses generated in the skin and shear stresses in the walls of the wing satisfy given limitations of a type of inequality. The results are given of a numerical solution of the problem of analytical design, and a way of reducing the computer time for a solution is demonstrated. Ill 3; Tab 1; Biblio 8.

USSR

UDC 629.735.33.025:534.1

STABILITY AND SNAP-THROUGH OSCILLATIONS OF A TAIL UNIT IN A SUPERSONIC FLOW

Kazan' IZVESTIYA VUZOV AVIATSIONNAYA TEKHNIKA in Russian No 4, 1976 pp 75-78
manuscript received 27 Feb 75

PAVLOV, V. A.

[Abstract] The stability and snap-through oscillations are studied for a tail unit with multi-articulated rudder in a supersonic flow. Energywise nonlinear differential equations are derived and solved by the Bubnov-Galerkin method. A trigonometric series is used, each term of which does not satisfy all the boundary values. The solution of the oscillation equations, which depend only on time and the equations of stability, is used to find the critical flow velocity at which oscillatory instability is possible, i.e., at the snap-through oscillations. Ill 3; Biblio 5.

ON ONE POSSIBLE METHOD OF SOLVING THE EQUATIONS OF A SUPERSONIC TURBULENT BOUNDARY LAYER ON A NONADIABATIC SURFACE

Kazan' IZVESTIYA VUZOV AVIATIONNAYA TEKHNIKA in Russian No 4, 1976 pp 88-91
manuscript received 31 Jan 75

SAVEL'YEV, YU. P.

[Abstract] The system of equations of a turbulent boundary layer is reduced to a system of ordinary differential equations within the variable similitude

$$\eta = \frac{y}{x} \sqrt{\frac{R_{ex}}{2}} \quad \text{for the laminar sublayer and within the variable similitude}$$

$$\eta_1 = \frac{1y}{k^2x} \quad \text{for the turbulent core. Interchanging of the equations occurs at}$$

the boundary of the laminar sublayer. Computed data are given for coefficients of restitution of friction, which are analogous to the Reynolds numbers.

Velocity profiles are plotted for a wide range of Mach numbers of the external flow, and values of the form parameter $H = \frac{\delta^*}{\delta^{**}}$ are computed in relation to

Mach number and temperature factor T_w/T_e , where T_w is the wall temperature and T_e is the temperature of the external flow. Ill 3; Tab 1; Biblio 2.

ON CALCULATING BEYOND THE LIMITS OF PROPORTIONALITY OF A SLIGHTLY CONICAL WING OF LOW ASPECT RATIO

Kazan' IZVESTIYA VUZOV AVIATIONNAYA TEKHNIKA in Russian No 4, 1976 pp 106-111
manuscript received 16 Oct 75

SHATAYEV, B. G. and KRETOV, A. S.

[Abstract] An earlier work by G. G. Shatayev (IVUZOV AVIATIONNAYA TEKHNIKA No 4, 1974) presented a variation method of computing ununiformly heated cylindrical, thin-walled, airfoil-type and fuselage-type beams in the physically nonlinear sense. Here the authors extend the same method to the case of slightly conical structures in their study of the influence of the number and type of forms of plane displacement on the designing of a wing beyond the limits of proportionality. It is assumed that the contour of the cross sections is not changed in the process of deformation. The skin and walls of the spars operate only with respect to shear, and the ribs with respect to tension and compression. Beyond the limits of proportionality there is a considerable redistribution of stresses which are impossible to account for in determining the bearing capacity of the structure. It is shown, however, that the accuracy of the approximate solution increases with increased plastic deformations. Ill 3; Tab 1; Biblio 7.

ACCELERATION OF ORBITAL CRAFT WITH THE AID OF JET ENGINES

Moscow TRUDY 3-IKH CHTENIY, POSVYASHCHENNIKH RAZRABOTKE NAUCHNOGO NASLEDIYA I RAZVITIYU IDEY F. A. TSANDERA. SEKTSIYA 2. TEORIYA I KONSTRUKTSIYA DVIGATELEY I LETATEL'NYKH APPARATOV [Works from the Third Lecture Devoted to the Development of Scientific Heritage and to the Ideas of F. A. Tsander] in Russian 1975 pp 5-19

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 3, 1977 Abstract No 3.34.106 by resume]

MERKULOV, I. A.

[Text] The author makes an attempt to determine the possibility of aircraft movement in the upper atmosphere at a speed greater than orbital velocity. The difference between these cases of flight is that in the first one an engine is used to increase flight speed and altitude, and in the second one it is necessary to increase the speed of the aircraft without allowing it to reach the more rarefied layers of the atmosphere, where the thrust from the jet engine disappears. Consequently it is necessary to determine if the aircraft having orbital velocity can accelerate further using a jet engine in such a comparatively short segment of the path where the increase in altitude caused by increase in flight velocity still does not bring it out of the atmospheric layers in which the jet engine is capable of developing thrust and ensuring acceleration of the craft. If one can prove for any simplest case the possibility of aircraft acceleration using a jet engine in the velocity range above orbital velocity, then a positive answer will be found to the investigated question and the feasibility of further research is justified in this direction including a search for optimum methods of aircraft acceleration using a jet engine in the range of orbital flight velocities. This question is clarified on an example of aircraft acceleration in the velocity range from orbital to escape velocity. Figures 8; references 9.

EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF CHANGE IN THE DEGREE OF DOUBLE VARIABILITY ON THE CHARACTERISTICS OF A TURBOFAN BLOWER

Kiev GAZODINAMIKA I KHARAKTERISTIKI AVIADVIGATELEY [Gasdynamics and Characteristics of Aircraft Engines, Collection of Works] in Russian No 2, 1976 pp 61-76

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 3, 1977 Abstract No 3.34.81 by resume]

PEREVEZENTSEV, V. T. and YANKO, L. K.

[Text] The authors give the results of an investigation on the parameters of flow in characteristic cross sections of the flow part of a blower-type

double-variable stage with change in the double variability. They examine the features of the characteristics of the blower at lowered values of the rotation frequencies of the operating wheel. They cite the results of investigations on the variations in velocity in front of the operating wheel with different choke loops, obtained with the aid of a thermoanemometer apparatus. Figures 8; table 1; references 9.

USSR

UDC 629.7.036.3

SELECTING PARAMETERS AND SINGULARITIES OF COMPUTING THE ALTITUDE-VELOCITY CHARACTERISTICS OF ENGINES FOR SHORT TAKEOFF AND LANDING AIRCRAFT (STLA) WITH AIR SAMPLING

Kiev GAZODINAMIKA I KHARAKTERISTIKI AVIADVIGATELEY [Gasdynamics and Characteristics of Aircraft Engines, Collection of Works] in Russian No 2, 1976 pp 25-35

KAZANDZHAN, P. K. and ROGAL'SKIY, YU. N.

[Text] The authors examine the features of power plants designed for STLA with air sampling in a system of increasing the lifting power of a glider. They suggest a procedure for computing the altitude-velocity characteristics of the STLA with allowance for the characteristics of its individual elements. Figures 3.

USSR

UDC 533.6.011

ON A SOLUTION TO THE DIRECT PROBLEM OF FLOW AROUND HYDRODYNAMIC GRIDS OF CONVENTIONAL SOLID PROFILES USING THE METHOD OF DISCRETE-DISTRIBUTED SINGULARITIES

PROBLEMY MASHINOSTROYENIYA. RESPUBLIKANSKIY MEZHVEDOMSTVENNY SBORNIK [Problems of Machine Construction. Republic Interdepartmental Collection] in Russian No 3, 1976 pp 75-78

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 3, 1977 Abstract No 3.34.27 by resume]

AVDEYEV, V. B., KOKHMANYUK, S. S. and SMOLYAKOVA, L. A.

[Text] The authors developed an algorithm and wrote a program to compute the distributed aerodynamic characteristics of the grids of conventional solid profiles. They cite the results of an investigation of the dependence of velocity distribution of streamlining over the contour of the grid profile

on the assigned number of vortex sources by which the profiles are changed. For comparison they give the results of designing a test grid by the familiar method (used in slightly curved profiles) and the experimental data obtained by the method of draining the blade at 38 points. Figure 1; references 6.

USSR

UDC 533.6

COMPUTATION OF THE CHARACTERISTICS OF A VORTEX TUBE

Kuybyshev VIKHREVOY EFFEKT I YEGO PRIMENENIYE V TEKHNologii [The Vortex Effect and its Application in Technology, Collection of Works] in Russian 1976 pp 131-134

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 3, 1977 Abstract No 3.34.7 by resume]

VOLOV, V. T., KOLYSHEV, N. D. and SHAKHOV, V. G.

[Text] It is known that vortex apparatus have a low efficiency. At fixed geometric parameters of the vortex apparatus the quality of operation of a self-pumping vortex tube will depend entirely on the quality of the untwisted diffuser. This paper is concerned with the question of improving the characteristics of the radial-annular diffusers and decreasing their dimensions. The authors developed a procedure for constructing isogradient radial-annular diffusers and experimentally proved their combined operation with the vortex tube. Figure 1; references 5.

USSR

UDC 621.311.25:621.039

OPTIMIZATION OF THE HEAT AND POWER PORTION OF A NUCLEAR POWER PLANT WITH WATER-GRAPHITE REACTORS

Irkutsk METODY MAT. MODELIR. I OPTIMIZ. PARAMETROV, VIDA TEKHNOL. SKHEMY I PROFILYA OBOUD. ATOM. KONDENSATSION. I TEPLOFIKATSION. ELEKTROSTANTSIY in Russian 1976 pp 5-14

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 3, 1977 Abstract No 3U104 by G. I. Korotkina]

IVANOV, A. A., NAUMOV, YU. V. and POPYRIN, L. S.

[Text] A study is made of the thermal power portion of a unit of a nuclear electric power plant with a channel-type water-graphite NR with constant thermal power. A description is presented of the mathematical model of the thermal power portion of the nuclear power plant with water-cooled NR developed at the Power Institute, Siberian Affiliate, Academy of Sciences USSR. The input parameters for the model of the thermal power portion of the nuclear power plant, connecting it to the reactor portion, are the parameters of the heat transfer medium at the inlet and outlet of the NR and the thermal power of the NR. In analyzing a nuclear power plant with nuclear superheating of steam, the steam generating installation is included in the model of the reactor portion of the nuclear power plant; therefore, the input parameters of the model of the thermal power portion of the nuclear power plant are the parameters of steam before the turbine, parameters of feed water and thermal power of the NR. The nuclear power plant is divided into parts and the composition of the model of the thermal power portion is presented. Initial data are presented from the model of the reactor portion of the nuclear power plant (thermal power of NR (net) assumed equal to 3000 MW, annual hours of use of the installed power capacity 7000, total cost of electric power 1.2 kop/kW·hr). Results are presented from the studies. Figures 4; references 6.

USSR

UDC 536.2.01

CALCULATION OF THE TEMPERATURE FIELD IN A FUEL ELEMENT WITH A ROD CORE AND A PEELING SHEATH

Moscow VOPROSY TEPLOFIZIKI YADERNYKH REAKTOROV [Problems in Thermophysics of Nuclear Reactors, Collection of Articles] in Russian, Atomizdat, No 2, 1976 pp 9-13

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 2, 1977 Abstract No 2G70]

KORSUN, A. S., KUDROVA, L. G. and PETROVICHEV, V. I.

[Text] The problem of steady-state heat conduction is solved for cylindrical fuel elements where the conductivity of the thermal contact between sheath

and core is a function of the angle. The solution is found by the Fourier method. For determining the Fourier coefficients, the infinite system of equations is replaced by a finite one and the latter solved by iterations. The temperature field in the core and in the sheath is now calculated for the case of a step variation of the thermal conductivity around the circumference (with the sheath peeling angle varied from 20° to 120°). Data are shown on the effect of the peeling angle on the maximum core temperature and its radial coordinate. Figures 7; references 1.

USSR

UDC 621.311.25:621.039

BEHAVIOR OF RADIOACTIVE CORROSION PRODUCTS IN A CHANNEL-TYPE BOILING-WATER NUCLEAR POWER REACTOR OF A SINGLE-LOOP NUCLEAR POWER PLANT

Moscow TEPLOENERGETIKA in Russian No 1, 1977 pp 70-72

GRUZDEV, N. I., SHCHAPOV, G. A., BOGUSLAVSKIY, V. B. and PETUKHOV, YU. I.

[Abstract] At a single-loop nuclear plant with AMB-2 type boiling-water reactor both test-bench and industrial-scale studies were made on the behavior of radioactive corrosion products in the main circulation loop depending on the water-chemical mode and on the technological conditions of station operation. Structural materials used in nuclear plants (stainless steel, zirconium alloys, carbon steel) were tested for their capability to absorb and adsorb radioactive isotopes present in the coolant. Results showed that with the ammonia-water and the uncorrected water modes the specific radioactivity of deposits of Co⁶⁰ and Zn⁶⁵ during stationary reactor operation was approximately one order of magnitude less than the specific radioactivity of these same isotopes formed during start-stop reactor operation. After 1,700 hours of operation the amount of radioactive contaminants from the isotopes of corrosion products Co⁶⁰, Zn⁶⁵, and Cr⁵¹ was highest in the case of zirconium, somewhat less in carbon steel and least in the stainless steel. Ill 2; Tab 2.

USSR

UDC 621.039.543:621.039.58

TEMPERATURE CHARACTERISTICS OF FUEL ELEMENTS OF REACTORS WITH WATER UNDER PRESSURE DURING A COOLANT-LOSS EMERGENCY

TR. MOSK. ENERG. IN-TA in Russian No 293, 1976 pp 11-17

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 3, 1977 Abstract No 3U163 by G. I. Korotkina]

KABANOV, L. P. and KARIM, S. CH.

[Text] The nature of the change in flow rate through the core of type PWR and type VVER*-1000 nuclear reactors after a coolant-loss emergency and the

temperature characteristics of fuel envelopes in the most highly stressed cross section after such an emergency are shown. The results of a coolant loss emergency include loss of the coolant from the primary loop of the reactor and a drop in pressure. It is assumed that heat liberation from the NR core after failure will occur in the following heat exchange modes: bubble boiling until development of a crisis; post crisis heat exchange; film boiling in large volumes; heat transfer to superheated and saturated steam; heat transfer with free convection of steam; radiation heat exchange. The results of calculations of the temperature characteristics of the fuel elements in the most heavily stressed section of the PWR reactor with thermal power 2758 MW are presented. The maximum temperature in the most heavily stressed section of the PWR and VVER*-1000 nuclear reactors are about 1400 and 1325 K respectively. Figures 3; references 8.

(* - VVER = water-moderated, water-cooled)

Construction

USSR

UDC 624.074.4.012.35.04

ON THE STRENGTH OF REINFORCED-CONCRETE SHELLS OF POSITIVE CURVATURE SUBJECTED TO CONCENTRATED LOADS

Moscow STROITEL'NAYA MEKHANIKA I RASCHET SOORUZHENIY in Russian No 1, 1977
pp 63-67

KOROBV, L. A., Scientific-Research Institute of Concrete and Reinforced Concrete, Moscow

[Abstract] Because of the lack of information on determining the bearing capacity of smooth shells of positive curvature (dome shapes) and because such determinations are a primary step toward the study of more complex ribbed structures, the author has devised a method of determining the strength of such shells during failure at the zone of compression. It is assumed that the cross sections at the failure sites act as eccentrically contracted areas with large eccentricities. The boundaries of the failure zones are found from joint solutions of the equations that determine the value of the load limit by kinematic and static methods. The solutions are confirmed by experiment. The author proposes the method for designing smooth reinforced concrete dome-type shells. Ill 6; Tab 1; Biblio 5.

USSR

UDC 624.074.012.4.042.7:699.841

DETERMINING SEISMIC LOADS ON ONE-STORY REINFORCED-CONCRETE FRAMEWORKS

Moscow STROITEL'NAYA MEKHANIKA I RASCHET SOORUZHENIY in Russian No 1, 1977
pp 55-58

BOLTUKHOV, A. A. and CHURILOV, V. A., Central Scientific-Research Institute of Industrial Structures, Moscow

[Abstract] The free oscillations are considered for a framework in which the roof acts as an inelastic disk. A nonlinear elastic system with one degree of freedom is taken as a dynamic model. Determining the period of the free oscillations of the roof affords the possibility of finding the value of the horizontal loads on the framework during seismic action. An example calculation shows that, according to the SNiP standard, the dynamic coefficient for the amplitudes in the elastic state can be reduced, thus allowing the seismic load value to be reduced from the computed value for the framework in the elastic stage. It is pointed out, however, that seismic loads make up only one factor of many that determine total reliability of a structure. Thus, in certain cases the seismic load may be reduced only after additional factors have been determined. Ill 3; Biblio 3.

USSR

UDC 624.07.042.8

DESIGNING STRUCTURES FOR WITHSTANDING THE LOAD OF AN EXPLOSIVE COMBUSTION

Moscow STROITEL'NAYA MEKHANIKA I RASCHET SOORUZHENIY in Russian No 1, 1977
pp 11-18

RAZDOL'SKIY, L. G., Moscow Construction Engineering Institute

[Abstract] A study is made of physically nonlinear systems at a stage close to collapse with the aid of corresponding "fictitious" linear systems. For a given physically linear system the parameters are obtained for the "fictitious" linear system so that at any fixed moment of time the total energy of the linear and nonlinear systems will be equal. It is assumed that the actual form of motion of the structure at the moment prior to collapse transmits the extreme value of the total energy of the system. By applying the theory of optimum control the author presents a new method of designing beamed structures that operate according to an inelastic-plastic scheme for an explosive fire load. For the case of a uniformly distributed load a definitive result is obtained in analytical form. This result is generalized for the case of a system with a finite number of degrees of freedom. The method simplifies the designing of structures in the inelastic-plastic stage and affords a possibility of obtaining analogous results for the case of elastic-plastic behavior of the material. Ill 3; Biblio 7.

USSR

UDC 624.01.46:620.191.33

CRACK FORMATION IN PRESTRESSED STRUCTURAL ELEMENTS OF LITHOIDAL PUMICE
CONCRETE UNDER AXIAL TENSION

Moscow BETON I ZHELEZOBETON in Russian No 2, 1977 pp 20-22

SEMENOV, A. I., KOTEL'NIKOV, YU. S. and KORNEV, N. A.

[Abstract] Because of the lack of information on the combined performance characteristics of light concrete with porous fillers and stranded reinforcement, particularly with respect to axial tension of prestressed elements, the Rostov branch of the All-Union Planning Institute of Industrial Construction conducted tests on crack formation and growth in such structures. Sixty-six M-300 and M-400 concrete (with M-500 portland cement binder) square and rectangular columns 1.5 to 2.5 m long, reinforced with one or two K-7-class strands from 6 to 15 mm diameter were tested. It was found that by completion with ordinary concretes the light weight concretes M-300 and M-400 with lithoidal pumice base have lower tensile strength and higher deformability than ordinary concretes with the same cubic strengths. This has considerable influence on crack formation. Design formulas are given that take this circumstance into account by reducing the stress in the reinforcement to a value of its elongation corresponding to the moment of formation of 0.02-0.03 mm cracks. Ill 4; Tab 2; Biblio 2.

USSR

UDC 624.131.53 -- 54.001.6

EXPERIMENTAL STUDIES OF THE STRESS-STRAIN CONDITION OF A LAYER OF WEAK SOIL
ON AN UNDERLYING SLIGHTLY COMPRESSED STRATUM

Moscow OSNOVANIYA, FUNDAMENTY I MEKHANIKA GRUNTOV in Russian No 1, 1977
pp 26-30

VYALOV, S. S. and MINDICH, A. L.

[Abstract] At the Scientific-Research Institute of Foundations and Underground Structures the authors conducted research on the stress-strain condition that results when a flat stamp is forced into a layer of weak argillaceous soil ($W = 36\%$) lying on a slightly compressed stratum. The tests were conducted in a special box $1,940 \times 820 \times 600$ mm with stamps 150, 225, and 300 mm wide and 826 mm long. Four soil-layer thicknesses were used (75, 150, 300 and 450 mm). The ratio of soil thickness to stamp width was varied from 0.25 to 3.0. Load was applied in 15-20-kPa steps to 120-160 kPa (8 steps). Each step was held until strains stabilized. Time effects were not taken into consideration. The arrangement of pressure sensors and stress-strain diagrams are illustrated. The tests show that the stress-strain diagrams differ considerably from calculations based on elasticity theory: for a thin compressed layer the diagrams become abruptly curvilinear, rather than nearly rectilinear as required by elasticity theory, the ordinates exceeding theoretical by a factor of 1.2 to 1.5. The smallest main stresses exceed the theoretical by a factor of 2.3 to 3.5, and the largest by a factor of 1.2 to 1.7. Ill 6; Biblio 7.

USSR

UDC 69.057.124

THE MODULAR PANEL BUILDING

Moscow BETON I ZHELEZOBETON in Russian No 1, 1977 pp 21-23

PONORMARENKO, B. N., KHARENKO, V. G. and KOPOL', S. P.

[Abstract] In 1974 in a rural area of Krasnodarskiy Kray construction was begun on 18-room, 3-story housing units of modular design. The main structural cell is a three-dimensional block of the "overturned glass" type comprising a room 2.52 m high, 3.08 m wide and 6 m (or 5.4 m) long. The partition walls are 120-135 mm thick and the bearing walls 250 mm. The modules are placed one on top the other. Tests on special modules of type M-130 light-weight ($1,600 \text{ kg/m}^3$) keramzit concrete showed compressive strengths of up to 166 kg/cm^2 , indicating that buildings as high as nine stories could be erected with such modules. The methods of attaching the modular sections to one another are illustrated. Ill 4; Tab 1.

USSR

UDC 627.82.06--15.001.52

EXPERIENCE AND METHOD OF STUDYING THE INTERACTION OF DAMS WITH THEIR ROCK BASES

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No 1, 1977 pp 29-33

MOLOKOV, L. A.

[Abstract] For the problem of determining the area of interaction of concrete dams and the contiguous rock masses during construction and the long period of operation the author gives examples of a determination by means of on-site data collected during and up to 8 years after construction. The need for further development of on-site surveys and improvement of their methods is apparent. It is shown that a thorough study of the configuration and limits of dam-rock massif interaction and the nature and intensity of the processes involved in such interaction is a necessary requirement for the development of more efficient methods of geological engineering survey as a basis for siting and more economical engineering designs of dams. Ill 3; Tab 1; Biblio 11.

USSR

UDC 627.824.7.624.044:539.383

EVALUATION OF THE STRENGTH OF THE COMPRESSED ZONE OF A HOLLOW-TYPE GRAVITY DAM

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No 1, 1977 pp 22-25

KARAVAYEV, A. V.

[Abstract] In the period 1973-1975 the Laboratory of Concrete and Reinforced Concrete Structures at the All-Union Scientific-Research Institute of Hydraulic Engineering conducted experiments on the stressed condition, failure pattern, and safety factor of a concrete gravitation dam with an apron on the discharge side. Ten flat-faced gypsum 1:100-scale models and three concrete 1:50-scale segment models of the most highly stressed portion were tested. All of the segment models and some of the full models were coated with concrete. The most highly stressed portion of the compressed zone of a lightened (hollow-type) gravity dam lies in the area where the straight and curved portions of the apron meet. The test compressive loads in this zone reached 50-60 kg/cm². The structure fails when the principal compressive loads in the most heavily stressed part reach the prism strength of the concrete. All models failed by brittle fracture. According to the test data a lightened (hollow-type) gravity dam of type-200 concrete would have a safety factor of 2.7-3 under normal operating loads. Ill 2; Tab 3.

USSR

UDC 624.139.264:518.5

REACTION PRESSURES OF A THAWING SOIL BED

Moscow OSNOVANIYA, FUNDAMENTY, I MEKHANIKA GRUNTOV in Russian No 2, Mar 77
pp 20-23

POZOVSKAYA, V. G., LenZNIIEP

[Abstract] The pressure distributing capacity of a soil bed decreases when the bond between frozen particles loosens during thawing. This and the curving of the bed surface must be taken into account in the design of structures resting on a bed subject to freezing and thawing. Treating the deformation kinetics of the ground from the standpoint of the consolidation-by-filtration theory, while disregarding any creep effects, one can describe the behavior of a given ground during thawing as a succession of quasisteady states. The corresponding equations of the sag diagram and the reaction diagram can be solved for any point of contact between the bed and a structure on it. These equations representing an elastoplastic behavior have been solved here numerically for various values of three characteristic parameters, namely: the strength (ultimate pressure on the ground), the stiffness (coefficient of resistance of the bed), and the set. The results, expressed in terms of bending moments and vertical deflections, indicate the beneficial effects on a structure design of local stress risers, uniform thaw depth, and low ultimate reaction pressures. Various means of achieving these conditions within a sound overall design format are recommended and, for illustration, a typical compatibility nomogram has been constructed. Figures 4; references 5: all Russian.

USSR

UDC 539.3

THE INVERSE PROBLEM OF NONLINEAR STABILITY OF A SPHERICAL ENVELOPE OF VARIABLE THICKNESS

Kiev PRIKLADNAYA MEKHANIKA in Russian No 2, Feb 77 pp 9-14 manuscript received
4 May 75

GAYDAYCHUK, V. V., GOTSULYAK, YE. A. and GULYAYEV, V. I., Kiev Construction Engineering Institute

[Abstract] A study is made of the problem of determination of the geometric characteristics of an envelope corresponding to assigned upper or lower critical loads. It is considered that the variable characteristics of the envelope depend on a parameter. The solution flowing from this statement of the nonlinear boundary value problem is constructed by reducing it to a Cauchy problem based on inclusion of the leading parameter in the initial equations. The solutions of inverse problems of envelope stability found allow determination of optimal distribution of thickness. References 3: all Russian.

A LABORATORY STUDY OF THE STABILITY OF A SAND BED DURING VIBRATIONS

Moscow OSNOVANIYA, FUNDAMENTY, I MEKHANIKA GRUNTOV in Russian No 2, Mar 77
pp 26-28

STAVNITSER, L. R. and KARPENKO, V. P., Scientific-Research Institute of Soil
Beds

[Abstract] A laboratory study was made to determine the effect of vibrations on the stability of a sand bed under a rigid covering structure. The apparatus, a metallic shaking tray with translucent glass walls for visual inspection, had been designed to simulate both static and dynamic loading conditions. Vibrations were induced in the horizontal plane with accelerations of seismic magnitudes, under an either centrally or eccentrically acting static load. The vertical set of the cover, the slip surfaces in the bed, and the crush pattern could be established and evaluated with the aid of color strips and a photographic camera. Figures 3; tables 1; references 3: 2 Russian, 1 Western (in translation).

USSR

UDC 662.61:662.642

FIRING OF EKIBASTUZK COAL IN FURNACES OF THE BARNAUL BOILER PLANT

Alma-Ata VOPROSY PROYEKTIROVANIYA I EKSPLOATATSII MOSHCHNYKH PAROGENERATOROV NA EKIBASTUZKIKH UGLYAKH [Problems of Designing and Operating Heavy-Power Steam Generators on Ekibastuzk Coal, Collection of Articles] in Russian 1976 pp 24-28

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 2, 1977 Abstract No 2R18]

LITINETSKIY, V. YA., OSADCHIY, L. G. and PAVLOV, N. V.

[Text] Most effective for Ekibastuzk coal is a counterflow arrangement of whirlpool-type burners. A parallel-flow arrangement cannot be very well recommended, because in the 160-100F unit of the Barnaul Boiler Plant using such burners the losses due to mechanical underfiring are as high as 2-3% (even with the system of pulverizers, interstage hoppers, and hot-air feed of the coal dust). The persistently increasing ash content in Ekibastuzk coal reduces the operational reliability of boiler sets and lowers their technoeconomic indicators. References 3.

USSR

UDC 662.613.5:662.642:620.193

CORROSIVE CHARACTERISTICS OF THE COMBUSTION PRODUCTS FROM EKIBASTUZK COAL WHEN EXHAUSTING THROUGH PIPES

Alma-Ata VOPROSY PROYEKTIROVANIYA I EKSPLOATATSII MOSHCHNYKH PAROGENERATOROV NA EKIBASTUZKIKH UGLYAKH [Problems of Designing and Operating Heavy-Power Steam Generators on Ekibastuzk Coal, Collection of Articles] in Russian 1976 pp 229-232

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 2, 1977 Abstract No 2R22]

PETROV, V. A.

[Text] The corrosive characteristics of combustion products from Ekibastuzk coal, when exhausting through pipes, have been determined and found to follow the general trends of low-temperature corrosion which characterize fine-grain grades of coal. The temperature of a pipe wall remains 7-10°C below the theoretical level, which is attributed to ash deposits. The clogging of pipes by ash deposits becomes more severe when the wall temperature is 55°C. Preventative removal of ash deposits reduces pipe corrosion most effectively. Figures 2; references 2.

USSR

UDC 662.61:662.642(47+57)

EFFECT OF HIGH-TEMPERATURE FIRING OF PULVERIZED NAZAROV COAL IN AN
EXPERIMENTAL APPARATUS ON THE RATE OF COHESIVE PRECIPITATION

Tomsk IZVESTIYA TOMSK. POLITEKH. INST. in Russian Vol 226, 1976 pp 34-39

[From REFERATIVNYY ZHURNAL, TEPLONERGETIKA No 2, 1977 Abstract No 2R27 by
Yu. A. Mironova]

MOSIN, YE. A. and ZAKOURTSEV, G. N.

[Text] The firing of Kansk-Achinsk Lignite Coal Basin coal and, particularly, of Nazarov coal in furnaces of steam boilers encounters operational difficulties, which have become evident during the starting of the 150 MW power units in the Nazarov State Regional Electric Power Station. Experiments made on a test stand have confirmed that the firing temperature for pulverized Nazarov coal is related to the rate of cohesive precipitation. The maximum precipitation corresponds to firing temperatures within the 1250-1300°C range. It is twice as high at 1300°C than at 900°C, but above 1300°C it decreases fast. Precipitation temperatures -1400°C are found least hazardous with respect to contamination of surfaces at which convective heating takes place during firing of pulverized Nazarov coal. Figures 2; tables 2; references 4.

USSR

UDC 621.181.7.001.24

ANALYSIS OF THE RESULTS OF CALCULATIONS PERTAINING TO A FURNACE CHAMBER WITH
TANGENTIALLY ORIENTED ORIFICE-TYPE BURNERS WITH HOT-AIR FEED OF COAL DUST

Alma-Ata VOPROSY PROYEKTIROVANIYA I EKSPLOATATSII MOSHCHNYKH PAROGENERATOROV
NA EKIBASTUZKIKH UGLYAKH [Problems of Designing and Operating Heavy-Power
Steam Generators on Ekibastuzk Coal, Collection of Articles] in Russian 1976
pp 143-145

[From REFERATIVNYY ZHURNAL, TEPLONERGETIKA No 2, 1977 Abstract No 2R38]

POLISHCHUK, L. G.

[Text] Calculations have shown that placing the burners at a lower level drops the temperature of flue gases leaving the furnace by insignificant 25-30°C, approximately, which may be attributed to an about 15-20°C lower temperature of the superheated steam in the rebuilt boiler. After conversion of the boiler to hot-air feed of coal dust and with a tangential orientation of the parallel-flow burners, the efficiency of the shielding surfaces in the furnace increased and the temperature of the flue gases leaving the furnace dropped by 150-160°C. The standard efficiency of 35-40% for Ekibastuzk coal differs from the test values obtained with various burner arrangements and, particularly, with the close to 60% in the case of orifice-type burners grouped in the corners of the furnace chamber and having their axes oriented tangentially to a circle around an imaginary center for hot-air feed of coal dust. Figures 1.

USSR

UDC 621.311.22:536.7

INCREASING THE EFFICIENCY OF THERMOELECTRIC POWER PLANTS WITH STEAM-TURBINE SETS OPERATING IN THE MAXIMUM-REGENERATION MODE BY MEANS OF ADIABATIC PHASE SEPARATION WITHIN THE TURBINE HEAD SPACE

Tomsk IZVESTIYA TOMSK. POLITEKH. INST. in Russian Vol 226, 1976 pp 3-8

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 2, 1977 Abstract No 2S10 by Yu. V. Rzhaznikov]

POLOZHIY, S. V.

[Text] In the author's view, modern power technology is to gain from his proposed steam-turbine cycle with adiabatic phase separation. According to his calculations, the specific fuel consumption for a turbine set of this type would be 314 g/kWh referred to input conditions 230 kgf/cm² at 380°C and with interstage superheat to 565°C under 45 kgf/cm². The boiler in such a proposed power plant must also be constructed simpler and with a better metal economy. Installation of steam-turbine sets with adiabatic phase separation throughout the USSR power system and, especially, in Siberia is recommended. References 11.

USSR

UDC 662.61:662.613

FORMATION OF NITROGEN OXIDES IN THE COMBUSTION PRODUCTS FROM NATURAL GAS

TRUDY VSESOYUZ. NAUCH.-ISSLEDOV, INST. EKONOMII, ORGANIZ. PROIZVODSTVA, I TEKH.-EKONOM. INFORMATSII V GAZOVOY PROMYSHLENNOSTI in Russian Nos 1-2, 1974 pp 183-190

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 2, 1977 Abstract No 2T182 by Yu. A. Mironova]

KONYUKHOV, V. G.

[Text] A comparative analysis is made of calculated and measured concentrations of nitrogen oxides in large boilers heated with natural gas and heavy oil. The qualitative relation between the combustion products, under conditions of thermal equilibrium should be

$$|NO| = c \sqrt{N_2 O_2} = \frac{8}{\sqrt{3}} \sqrt{N_2 O_2} \frac{21,400}{T}$$

The heat generated by combustion of such a fuel only raises the temperature of the O₂-N₂ mixture, which is convincingly proved by the fact that the equilibrium constant c in this equation depends only on the temperature, and in this mixture then occurs the reversible reaction triggered by the high temperature. It also

appears that the equilibrium concentration of NO_x is greatly affected by the temperature and by the presence of oxygen. The attainable maximum temperature coincides with the maximum concentration. Consequently, lowering the temperature of the furnace chamber and the O_2 -content within the high-temperature zone will lower the NO_x concentration and, if realized in practice, may serve as a method of reducing the exhaust of nitrogen oxides into the atmosphere. Figures 3; references 3.

USSR

UDC 697.34:621.482.001.3

CHARACTERISTICS OF RESIDENTIAL HEATING WITH GEOTHERMAL WATER AND ELECTRIC POWER

Petropavlovsk-Kamchatskiy VSESOYUZ. SIMPOZ. "IZUCHENIYE I ISPOLZOVANIYE GLUBINNOVO TEPLA ZEMLI V VULKANICNOY OBLASTI", TEZISY DOKLADOV [All-Union Symposium on "Study and Utilization of the Geothermal Energy of Earth in Volcanic Regions", Collection of Reports] in Russian 1976 pp 148-150

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 2, 1977 Abstract No 2S201]

BADAVOV, B. G. and SULTANOV, YU. I.

[Text] Five million cubic meters of geothermal water are annually extracted in Dzhaghestan. The wells yield 50-100 tons/h and the water temperature is 60-110°C at the overall mineralization level of 10 g/liter. The cost of one well is 300-500 thousand rubles. The well utilization factor is determined by the utilization of its yield, by the temperature drops to be overcome, and by the annual well utilization index. Systems with straight geothermal heating are characterized by a low utilization factor. More efficient are thermoelectric systems where geothermal water from a well supplies the base demand on the load curve. The well utilization factor increases then from 0.42 to 0.57. The hours of well utilization increase then from 3680 to 4990 annually.

USSR

UDC 532.135.001.24

THE VISCOSITY OF THE SYSTEM N_2O_4 -NO IN THE COMPRESSED GAS STATE

Minsk DISSOTSIIRUYUSHCH. GAZY KAK TEPLONOSITELI I RABOCHIYE TELA ENERG. USTANOVOK. CH. I in Russian 1976 pp 85-90

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 3, 1977 Abstract No 3G53]

MAKSIMOV, B. G. and PODKORYTOVA, L. I.

[Text] The results of calculation of the dynamic viscosity coefficient of the system N_2O_4 -NO in the 300-1000 K temperature interval and 1-300 bar

pressure range as a function of mass fraction of nitrous oxide are presented. At low temperatures in the area where the first stage of the reaction of dissociation $N_2O_4 \rightleftharpoons 2NO_2$ occurs, addition of NO increases (here we observe the maximum deviation, particularly near the saturation line), while at higher temperatures in the area of occurrence of the second stage $2NO_2 \rightleftharpoons 2NO + O_2$ slightly decreases the viscosity of the entire system. Figure 1; references 11.

USSR

UDC 536.2.022.001.5

EXPERIMENTAL STUDY OF HEAT CONDUCTIVITY OF POTASSIUM AND RUBIDIUM VAPORS

TR. MOSK. ENERG. IN-TA in Russian No 294, 1976 pp 131-134

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 3, 1977 Abstract No 3G55]

MAKHROV, V. V. and REUTOV, B. F.

[Text] A study is performed by the hot-wire method with a zero sector for corrosive substances. The heat conductivity factor of the potassium vapors is studied at the 800, 900, 1000 and 1050 K isotherms in the pressure interval from 10^{-4} to 0.8 bar, of rubidium vapor at the 900, 1000, 1100 K isotherms in the pressure interval from 10^{-3} to 1.3 bar. 201 experimental values of heat conductivity coefficient are produced. Table 1; references 3.

USSR

UDC 536.2.022

EMPIRICAL EXPRESSION FOR CALCULATION OF HEAT-PHYSICAL PROPERTIES OF SEA WATER

Baku 2-OYE VSES. NAUCH.-TEKHN. SOVESHCH. PO TEME "ISPOL'Z. MOR. I SOLONOVAT. VOD NA TES I ZADACHI NAUCH. ISSLED." 1976. TEZISY DOKL. in Russian 1976 pp 64-66

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 3, 1977 Abstract No 3G58]

BELYY, A. M. and GUDAKOV, G. A.

[Text] Results are presented from studies of the heat conductivity coefficient of sea water (λ_{sw}) in the 20-170 C temperature range at 1-17 mass % concentration range. As a result of processing of experimental data by the method of least squares, an expression of the form $\lambda_{sw} = \lambda_w (1.00 - 0.49 \cdot 10^{-2} \cdot s - 0.114 \cdot 10^{-4} \cdot s - 0.089 t^2)$ is obtained, where λ_w is the heat conductivity of water, W/(m·K); s is the salt content in mass %, t is the temperature, C.

USSR

UDC 621.187.123:628.165.048.003.1

ANALYSIS OF TECHNICAL AND ECONOMIC INDICATORS OF A DESALINIZATION INSTALLATION OF A HEAT AND ELECTRIC POWER PLANT IN THE PROCESS OF ITS UTILIZATION

Baku 2-OYE VSES. NAUCH.-TEKHN. SOVESHCH. PO TEME "ISPOL'Z. MOR. I SOLONAVAT. VOD NA TES I ZADACHI NAUCH. ISSLED." 1976. TEZISY DOKL. in Russian 1976 pp 158-159

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 3, 1977 Abstract No 3R134]

MITLITSKIY, G. A., YEVLAKH, A. YE., SAVCHENKO, V. V., KEGAMYAN, YU. SH., and UMANSKIY, A. M.

[Text] During the period of operation of the desalination installation at the Krasnovodsk Heat and Electric Power Plant (greater than 10,000 hr), the effectiveness of operation of individual apparatus and of the installation as a whole has been evaluated. The use of seed crystals has prevented the formation of scale on the heat exchange pipes of the evaporation apparatus. At the same time, in the regenerative section after 3-4 months' of operation the intensity of heat transfer drops to half. Under heating of the initial water in the regenerative heaters due to the formation of scale increases by the end of an operating run (1500-2000 hr) to 20 C, corresponding to a specific heat consumption of 0.135-0.145 Gcal/t as opposed to 0.118-0.125 Gcal/t during the initial period.

USSR

UDC 662.997

REGIONAL CONDITIONS AND THE FEASIBILITY OF USING LOW-TEMPERATURE SOLAR HEATERS IN THE MINES OF YAKUTIA

Tashkent GELIOTEKHNICA in Russian No 1, 1977 pp 70-75 manuscript received 1 Oct 75

KIM, V. P., Yakut Affiliate of the Institute of Physical and Technical Problems of the North, Siberian Department of the Academy of Sciences, USSR

[Russian abstract provided by the source]

[Text] The author calls attention to the urgency of the problem of regulating heating conditions in mines in permafrost regions. Conditions for using solar technology in Yakutia are examined. Possible systems for storing solar energy in the rocks surrounding mine openings are described. It is shown that solar air heaters are more efficient than pipe heaters for controlling air temperature in mines. Tables 6; references 9: all Russian.

USSR

UDC 621.181

IGNITION OF ANTHRACITE IN THE COMBUSTION CHAMBER OF THE TPP-210 STEAM GENERATOR WHEN THE DRYING AGENT IS FED THROUGH THE UPPER TIER OF MAIN BURNERS

Moscow TEPLOENERGETIKA in Russian No 3, Mar 77 pp 19-24

SHNITSER, I. N., candidate of technical sciences, YUR'YEV, L. V., candidate of technical sciences, SHAPOVALOV, YU. I., engineer, and PLASKIN, O. T., engineer, Central Scientific Research Institute for Boiler and Turbine Design imeni I. I. Polzunov, Turbine-Boiler Shop, Zmiyevsk State Regional Electrical Power Plant

[Abstract] The paper gives the results of testing and research on the anthracite ignition process in the combustion chamber of the TPP-210 steam generator when the drying agent is fed through the upper tier of main burners instead of using special nozzles. The results show stable operation over a wide range of loads. Little dust separates out onto the sole, and there is no disruption of liquid slag removal, which ensures slag-free operation of all heating surfaces. The excess air ratio is reduced from 1.25-1.3 to 1.15-1.17 and the net efficiency of the steam generator is improved by 0.4-0.5% when the drying agent is fed through the main burners instead of through nozzles, while the temperature at the outlet from the chamber is about 50°C lower. More research is needed to determine the optimum arrangement for feeding in the drying agent through the main burners. Figures 7, tables 3; references 12: all Russian.

USSR

UDC 621.036.2

INTENSIFICATION OF HEAT EXCHANGE IN A DUCT WITH SPHERICAL HEAT-LIBERATING ELEMENTS

Minsk IZVESTIYA VUZOV ENERGETIKA in Russian No 1, 1977 pp 132-135 manuscript received 20 Jan 76

BARYSHEV, YE. G., RATNIKOV, YE. F. and PUDOVKIN, A. YU., Ural Polytechnic Institute

[Abstract] Results are given of an experimental study of convective heat exchange from a column of spheres with attached filament-type heat-exchange intensifiers to an air flow within the range $Re = (5.5-15) \cdot 10^3$. The 30-mm diameter spheres are contained in a vertical 49-mm diameter pipe. The area of thermal stabilization is determined, and an equation is derived for determining the coefficient of heat exchange. A study of the conditions for the thermal stabilization of the flow shows that the use of the spheres with attached heat-exchange intensifying filaments brings flow stabilization initiation considerably sooner than with smooth spheres. Only 4-5 intensifier-spheres are required to produce the same stabilization of heat exchange of the flow as 6-8 smooth spheres under equal conditions. The use of the intensifiers affords the possibility of increasing the heat exchange coefficient by 20-25%.
Ill 3; Biblio 1.

SOME PECULIARITIES OF THE MOTION OF FUEL ON THE SURFACE OF A COMBUSTION CHAMBER

Moscow IZVESTIYA VUZOV MASHINOSTROYENIYE in Russian No 1, 1977 pp 119-122
manuscript received 18 Feb 76

DRAGUNOV, G. D. and YEGOROV, V. V.

[Abstract] The motion of fuel on the surface of a combustion chamber is investigated by means of a theoretical analysis of the influence of mass forces on evaporation and mixing. A film of fuel is considered that lies on a solid surface in a field of mass forces with intensity j (e.g., combustion chamber of the Central Scientific-Research Diesel Institute). For $D \gg \delta$ the film surface area $S = \pi D^2/4$, its volume $V = S \delta$. It is assumed that under the influence of the mass forces the film begins to spread, and its surface area increases by dS . Then, with constant volume, $dS = -S d\delta/\delta$. The free surface energy of the film increases by $\Delta W_f = (\sigma_{12} - \sigma_{23} - \sigma_{13}) \times \delta S$, where σ_{12} , σ_{23} , and σ_{13} are the coefficients of surface tension at the phase boundaries. The study indicates that mass forces have a considerable influence on the motion of fuel along the surface of the combustion chamber and must be taken into account in any analysis of the processes of evaporation, mixing, and combustion. Ill 2; Biblio 3.

USSR

UDC 621.777.01.001.2

HIGH TEMPERATURE HYDRAULIC FORGING OF METALS AND ALLOYS

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 1, 1977 pp 9-11

KOSTAVA, A. A. and MURAV'YEV, V. K.

[Abstract] In order to estimate the temperature reduction in the workpiece during hydraulic forging with a liquid medium for pressure transmission consisting of tar oil and graphite, the authors made a temperature field study on specimens of 1Kh18N9T steel in sizes $\varnothing 60 \times 250$, $\varnothing 32 \times 200$, and $\varnothing 14 \times 150$ mm. Thermocouples were placed equidistant from the ends of the specimens, one on the surface, the other in the center. The specimens were heated to $1,200^{\circ}\text{C}$ in an electric furnace and forged in the special test device. Changes of temperature with time were plotted during cooling of the specimens in air at room temperature and then in the liquid medium at 250°C . Relationships are obtained which can be used to estimate the coefficient of heat exchange at the surface of the forging during cooling in the tar oil-graphite medium under conditions close to those that prevail during actual forging operations. Ill 4; Biblio 4.

USSR

UDC 621.187.12:628.16.087.002.5

DEVELOPMENT OF DESIGNS FOR ROLL-TYPE HYPERFILTRATION APPARATUS AND RESULTS OF ITS TESTING

Baku 2-OYE VSES. NAUCH.-TEKHN. SOVESHCH. PO TEME "ISPOL'Z. MOR. I SOLONAVAT. VOD NA TES I ZADACHI NAUCH. ISSLED." 1976. TEZISY DOKL. in Russian 1976 pp 259-262

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 3, 1977 Abstract No 3R150]

KOSMINSKIY, A. B. and KARELIN, F. N.

[Text] Roll-type apparatus are most convenient for manufacturing technology, simple to assemble and reliable to use and have high membrane packing capacity-- up to 800 m^2 per m^3 of apparatus volume. Drainage abroad is achieved using lavsan fabric with slots for longitudinal filtration, while in the USSR metal or capron screens are used. If there is no substrate between the membrane and the metal screen type 0071 at 50 kg/cm^2 , the selected properties of the membrane deteriorate after 100-200 hr operation as a result of mechanical damage to the membrane. Testing of roll-type filter elements using tap water to which 5 g NaCl/kg has been added has shown that a sediment is formed in the pressure chamber. Washing with a solution of trylon B, hydroxylaminesulfate and oxalic acid in tap water at $\text{pH} = 2.1$ for 0.5 hr increases the productivity of the apparatus from 40 to 52 kg/day, the degree of desalinization from 91 to 93.4%. Based on a technical request by "VODGEO" Scientific Research Institute, the

Scientific Research Institute for Chemical Machine Building has created a machine for the manufacture of roll elements with total membrane area 8 m^2 . One apparatus consists of 6 elements and has a productivity of $1 \text{ m}^3/\text{hr}$. For a thermal electric power plant with a flow rate of supplementary water of $100 \text{ m}^3/\text{hr}$, 100 such apparatus are required, located over an area of 50 m^2 . The cost of processing of water in reverse osmosis apparatus will be 15 kop/ m^3 water.

USSR

UDC 662.6:620.91(47+57)

EFFICIENT TRENDS IN FUEL ECONOMY IN THE UKRAINE

Kiev II RESP. NAUCH.-TEKHN. KONF. "SOVREM. PROBL. ENERG." 1976 SEKTS. I. TEZISY DOK. I SOOBSHCH. in Russian 1976 pp 69-72

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 3, 1977 Abstract No 3T17]

KOMKOV, S. M.

[Text] The utilization factor of fuel in industrial furnaces averages about 25%. From 50 to 75% of the heat losses in industrial furnaces are the losses with the stack gases. In the UkSSR, these losses are equivalent to tens of millions of tons of standard fuel. Some 20 million tons of standard fuel are expended in industrial and regional boilers in the UkSSR, of which over 50% is natural gas and fuel oil. Elimination of the use of these valuable types of fuel in steam generating plants would be facilitated by the use of waste heat from the exhaust gases for the production of steam. It is particularly important to utilize the heat of cupola gases in order to save fuel and protect the environment.

USSR

UDC 681.2.08:621.822-192.001.24

CALCULATION OF DURABILITY OF HIGH-SPEED INSTRUMENT BEARINGS AS A FUNCTION OF BASIC OPERATING CONDITIONS

TR. VSES. N.-I. KONSTRUKT.-TEKHNOL. IN-TA PODSHIPNIK. PROM-STI in Russian No 3 (89) 1976 pp 62-74

[From REFERATIVNYY ZHURNAL 32. METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 3, 1977 Abstract No 3.32.159 from the resume]

RUZHAL'SKIY, V. Z., BAUER, A. V. and ZHEVTUNOV, V. P.

[Text] Results are presented from an experimental study of the durability of high-speed instrument ball bearings (with internal ring diameters of 1 to 10

mm) and a method is presented, developed on the basis of the experiments, for calculation of the durability of such bearings operating with one-time injection of plastic lubricant, with maximum contact stresses of up to 300 kg/mm², rotating speeds of up to 70,000 rpm and temperatures of up to 160 C. Figures 3; tables 4; references 9.

USSR

UDC 621.784.4.621.921.34:669.295

SOME TECHNOLOGICAL METHODS OF INCREASING THE DURABILITY OF HEAVILY LOADED FRICTION PAIRS OF TITANIUM-BRONZE

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 2, 1977 pp 19-22

KHVOROSTUKHIN, L. A., DYAKIN, S. I., IL'YIN, N. N., KOVALEV, A. P., LIMONCHIKOV, V. D., MIKHAYLIK, V. I. and TORPACHEV, V. A.

[Abstract] In view of the high sensitivity of titanium alloys to design and technological stress concentrators, which necessitates various surface finishing and hardening procedures, and the high cohesive properties of titanium alloys, which makes diamond polishing possible only under certain conditions, the authors conducted experiments on the antifriction properties of the friction pair, VTZ-1 titanium and BrAZhMts 10-3-1.5 bronze, in simulated performance of a heavily loaded hinge-bolt combination. It is shown that a preliminary formation of a gas-saturated layer or chromium-plated surface of titanium alloys followed by diamond polishing represents the most effective technological method, since it removes the cohesive tendency of the titanium alloy during the diamond polishing, optimizes surface quality, and enhances the antifriction properties of titanium alloys used with bronze in friction pairs subjected to heavy loads. Ill 5; Tab 2; Biblio 3.

USSR

UDC 621.721

HIGH-SPEED HOT ROLLING OF PRECISION REFRACTORY ALLOYS

Moscow IZVESTIYA VUZOV MASHINOSTROYENIYE in Russian No 1, 1977 pp 155-158
manuscript received 2 Mar 76

NIKITIN, G. S., ROSTOV, G. I., ZHUCHIN, V. N., SHVARTSBART, YA. S., VLASOV, T. F. and GRIBACH, YU. F.

[Abstract] The Chair of Automatic Machines and Rolling at the Moscow State University in conjunction with the Zhdanov Metallurgical Institute and the Elektrostal works conducted research on the influence of increased rolling rate (up to 30 m/sec) of precision alloys 29NK, 79 NM, and EI-435 at various

temperatures. The 10 X 50 X 500-mm specimens were heated in an electric oven before rolling. During the rolling process measurements were made of reduction in cross section, force, and temperature. Each alloy was rolled at two temperatures: 1,423°C and 1,273°C for the 79NM and 29NK, and 1,423°C and 1,323°C for the EI-435. Each was rolled at rates of 9.5 and 15.7 m/sec (29NK alloy also rolled at 30.1 m/sec). It was found that the increased rate caused a more intensive increase in mean pressure in the precision alloys than, for example, in carbon steels. The expression $p_m = f(\epsilon, t^0, V_r)$ was obtained for determining mean pressure. The study conclusively shows that there is a real possibility of high-speed rolling of precision alloys (up to 30.1 m/sec) without impairment of their physical and mechanical properties. Ill 3; Biblio 4.

USSR

UDC 666.11.01

INFLUENCE OF OXIDES OF ALKALI METALS ON THE OPTICAL STRESS FACTOR OF SILICATE AND PHOSPHATE GLASSES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 9, 1976
pp 22-24 manuscript received 4 Nov 75

SHCHAVELEV, O. S., MOLEV, V. I. and YELINA, N. N., candidates of sciences

[Abstract] There has been considerable interest in recent years in studying the relationship between the photoelastic properties of glasses and their composition, with a view toward the development of so-called athermal glasses. This paper gives the results of studying the change in the optical stress factor of glasses based on silicates and phosphates when adding to them oxides of lithium, sodium, potassium, rubidium, and cesium. Different authors have obtained conflicting results when adding oxides of alkali metals to these glasses, the optical stress factor being increased in one instance and reduced in the other. The method used in this paper was to add the oxide in increasing quantities to a number of starting glasses with different initial optical stress factors. The silicate and phosphate glasses here had a range of properties close to those of quartz and metaphosphates. The test glasses were prepared from broken fragments of the parent glasses and the appropriate nitrate in a platinum crucible in a silite electric furnace, with intense stirring. The optical stress factor was measured by uniaxial compression of specimens measuring 30 X 10 X 10 mm. From the data obtained a determination was made of average increments in the optical stress factor when adding 1 mol.% of the oxides listed above to the parent glasses. The conflicting results of other authors are explained by the fact that one used a quartz glass with a high optical stress factor as the parent glass, and the other glasses with very low optical activity. The data of the present study demonstrates that the optical stress factor is reduced when the concentration of alkali metals in the parent glasses is increased. It is shown that the reason for this reduction is a lowering of the atomic effect while the lattice effect remains constant, in keeping with Mueller's theory of photoelasticity (1938). With initial optical stress factors higher than 0.1 to 0.5 nm·cm·kg⁻¹ increments in this factor in the altered glasses are negative. Figures 2; references 11: 8 Russian, 3 Western.

USSR

UDC 535.345.67

STRUCTURAL FEATURES OF THE FROSTED LAYER OF GROUND SURFACES OF LITHIUM FLUORIDE AND CRYSTALLINE QUARTZ

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 9, 1976 pp 34-37
manuscript received 5 Feb 76

GORODINSKIY, G. M., doctor of sciences, and KLIYENTOV, YU. N.

[Abstract] In this paper a study is made of the structure of the frosted layer of ground surfaces of LiF (cubic system) and alpha-SiO₂ (hexagonal system)

crystals employed widely in the optics and electronics industries. Specimens of LiF and α -SiO₂ were prepared in the form of plane-parallel rectangular wafers. The LiF crystals were oriented along three crystallographic lines: [100], [110], and [111]. The α -SiO₂ wafers were cut so that the crystal's z axis was parallel to the ground surface and coincided with the direction of the short side of the specimen. Both surfaces of wafers of both specimens were first polished and then one side was ground with M40, M28, and M10 powdered electrocorundum, in that order. The ground surfaces were compared with a standard and the frosted surfaces were microphotographed with an MBI-3 microscope furnished with a KF-4 phase-contrast attachment. An aqueous solution of glycerine acted as the immersion fluid. The structure of frosted surfaces with different orientations is not identical. The microstructure of α -SiO₂ differs substantially from that of LiF. Distinctive microstructural features can be explained by differences in both crystal systems and hardness values. A study was made of the distribution of irregularities in the frosted layer formed on the surface of the crystals after being treated with electrocorundum. A universal profilometer was used for this purpose. Histograms are shown for the surface profile for specimens ground with M40 corundum. It was shown that the distribution of irregularities of the frosted layer by height for LiF and α -SiO₂ crystals after treatment with a free abrasive does not depend on their crystal system and crystallographic orientation and obeys the normal distribution law. Luminance curves were also plotted, typifying the distribution of the scattering area with respect to angles of inclination. It was demonstrated in a previous study that these curves depend under specific conditions on the wavelength of the incident light and the crystallographic orientation. Here luminance curves were plotted from measurements in the ultraviolet region of the spectrum to enable a more detailed study of the scattering properties of frosted surfaces. These curves also showed a difference in the structure of the frosted layers and in the hardness of quartz and α -SiO₂. A determination was also made of the relationship between the scattering properties of frosted surfaces of LiF and the angles between the photometry plane and the main lines in the crystals. It was shown that the shape of luminance curves depends on the angles between the scanning plane and the main lines in the crystals for all orientations. This is explained by the difference in the distribution functions of microareas, with respect to angles of inclination in the lines studied. The results of this paper make possible further study of the reflection spectra of rough surfaces of LiF and α -SiO₂ and can be utilized by technicians in selecting optimum grinding conditions for crystals. Figures 4; tables 1; references 13: 12 Russian, 1 Western.

STUDY OF THE INFLUENCE OF CREEP ON RESISTANCE TO DEFORMATION AND SHORT-TIME FATIGUE OF 20KhML CAST STEEL DURING PURE SHEAR

Kiev PROBLEMY PROCHNOSTI in Russian No 12, 1976 pp 21-25 manuscript received 28 Nov 75

TRUKHNIY, A. D. and STEPNOV, YE. V., Moscow Power Engineering Institute

[Abstract] The main purpose of this paper was to make a study of the influence of alternating processes of short-time plastic deformation and relaxation on regular patterns of deformation and failure under conditions of pure shear at a steady temperature of 560°C with a specific deformation cycle, for 20KhML steel used widely for turbine parts. Specimens for testing were made of plates measuring 300 X 150 X 35 mm which were poured and heat treated together with the housing of a steam turbine. The steel had the following chemical composition, in percent: 0.24 C, 0.32 Si, 0.6 Mn, 0.02 S, 0.021 P, 0.58 Cr, 0.5 Mo, and Fe for the remainder. Tests for short-time fatigue and short-time creep were made with the same experimental unit, described in an earlier paper. Numerous studies of the cyclic relaxation process have shown that the cyclic deformation curve can be changed owing to the creep process in a deformation cycle with relaxation, as the result of which cyclic stabilization is observed. In addition, straight summation of values for failure from fatigue and creep, often used in calculations, is valid only for certain materials and certain deformation cycles, though the resulting accuracy seems to be satisfactory for practical purposes. These questions were studied in relation to 20KhML steel. Tests for short-time fatigue demonstrated the complex cyclic behavior of 20 KhML steel. Strengthening occurred with a large number of cycles (approx. 10^4) during the first cycles (10 to 15% before failure), but this strengthening did not exceed 20 percent of the stress range in the first cycle. With low levels of endurance (less than 10^2 cycles) there was essentially no stable segment on the curve. The degree of weakening amounted to five to seven percent. With a medium number of cycles (3×10^3 to 6×10^3) the material is practically ideally stable. Thus, with an increase in the degree of deformation for 20KhML steel a gradual transition is observed from a hardening and stabilizing material to a weakening and stabilizing material. Experiments with ageing demonstrated the same pattern of cyclic instability. It was concluded that 20KhML steel is a stabilizing material with a slight degree of strengthening with a small deformation range and a slight degree of weakening with a wide deformation range. Stabilization has been observed both in straight short-time tests and in cyclic tests with stress relaxation as part of the cycle. Cyclic relaxation as part of the cycle shows a strengthening influence on the resistance of 20KhML steel to short-time cyclic deformation. The rule for straight summation of values for failure due to fatigue and creep holds sufficiently well for practical applications in the case of 20KhML steel with the type of deformation cycle described here. Figures 7; references 6: 6 Russian.

COMPARATIVE ESTIMATE OF THE LONG-TIME STRENGTH OF ALLOY KhN77TYuR AND Kh18N10T STEEL AT 700°C UNDER CONDITIONS OF EXPOSURE TO RADIATION INSIDE A REACTOR

Kiev PROBLEMY PROCHNOSTI in Russian No 12, 1976 pp 30-34 manuscript received 25 Nov 75

VOTINOV, S. N., PROKHOROV, V. I. and FIN'KO, A. G., Dimitrovgrad

[Abstract] Kh18N10T and OKh16N15M3B steel are the main materials used at the present time for fuel element and packet jackets for fast reactors. They satisfy the criteria of satisfactory durability when using a sodium coolant and show acceptable results in radiation tests for tendency to high-temperature embrittlement and worsening of long-time strength and creep characteristics at operating temperatures of about 650°C. Their disadvantage lies in the fact that considerable swelling of austenitic stainless steels leads to a pronounced alteration of the jacket's profile, which can impose a decisive limitation on achieving high burnup in fuel elements. Alloys based on nickel have been tested for this purpose because they are less subject to swelling from radiation. One of these alloys is alloy KhN77TYuR, which, in addition, is more heat-resistant than steel and might make it possible to raise the temperature of the jacket. On the other hand alloys of this type have been shown to be subject to considerable high-temperature radiation-induced embrittlement after exposure. In this paper an attempt is made to compare the characteristics of Kh18N10T steel and alloy KhN77TYuR under conditions of long-time loading both in and outside a reactor, using specimens in the form of thin-walled tubes, at 700°C, with a view toward evaluating the capabilities of these jacket materials. Curves are plotted for the long-time strength of both materials when not exposed and after exposure in a reactor. The microstructure of the specimens is shown. It is concluded that under the experimental conditions used the long-time strength of Kh18N10T steel and alloy KhN77TYuR is approximately the same if the period prior to failure does not exceed 500 h. After 500 h the strength of the alloy is less than that of the steel, and this difference grows with time. Preference should therefore be given to a steel jacket, from the viewpoint of this characteristic. When the size of the grain in the alloy is reduced from 35 to 50 microns to 10 to 25 microns its long-time plasticity under exposure increases within a change in long-time strength. It is recommended that tests for creep be conducted inside a reactor to explain the effects of exposure observed here. Figures 5; tables 2; references 8: 5 Russian, 3 Western.

INFLUENCE OF UNDESIRABLE IMPURITIES ON THE MECHANICAL PROPERTIES OF NIOBIUM AND ITS ALLOYS

Kiev PROBLEMY PROCHNOSTI in Russian No 12, 1976 pp 45-50 manuscript received 20 Feb 76

TSVILYUK, I. S., PYL'NIKOV, V. A. and MEN'SHIKH, V. A., Kiev and Moscow, Institute of Problems of Strength of the Ukrainian SSR Academy of Sciences

[Abstract] Niobium and its alloys are highly reactive and, therefore, in assessing its feasibility as a structural material under specific conditions it is necessary to study its interaction with active gases which are present as impurities in the environment, as well as the influence of impurities on the mechanical properties of materials of this sort over a wide temperature range. In this paper a quantitative estimate is made of the influence of slight variations in the content of nitrogen and oxygen in the material of specimens on their mechanical properties. Specimens were made out of sheet material one to two millimeters thick. Specimens from the thinner sheet were subjected to static tensile testing, and those from the thicker sheet to impact tests. The difference in oxygen and nitrogen content was achieved either by using different production methods or by specially adding oxygen to the specimens under study. Additional tests for long-time strength at 1500°C were also made, along with tensile and impact tests at room temperature. The following mechanical properties were determined: Tensile strength, yield point, percentage elongation after rupture, impact strength at 20, -70, -196, and -253°C, and 15-min strength at 1500°C. The influence of nitrogen and oxygen impurities was evaluated by comparing the mechanical properties of specimens from batches of niobium of different purity. Results are presented in graphic and tabular form. The strength of the specimens increased substantially with an increase in nitrogen and oxygen content. Metals with a body-centered cubic lattice showed a drastic increase in yield point with lowering of the test temperature. It was shown that the 15-min long-time strength of niobium obtained in different ways (electron-beam and arc refining) increased by adding oxygen and nitrogen. Tests of niobium materials were also made while ageing in vacuum, to estimate the degree of saturation of niobium alloys with oxygen. The particular alloy used for this purpose was 5VMTs. A picture is shown of the microstructure of this alloy after ageing for 500 h in a 2-to-5 X 10⁻⁵ mm Hg vacuum at 1100°C. Reduction of percentage elongation at rupture resulting from ageing is explained by the presence of an oxide film on the surface of the specimen, this film hampering the access of oxygen to the inner layers of the alloy and reducing the chemical activity of the surface and thereby the oxidation rate of the alloy. It is concluded that the mechanical properties of niobium and its alloys depend substantially on the content of "undesirable" impurities in them both at high and low temperatures. This fact can be exploited by doping finished parts made of niobium and its alloys with these impurities to achieve an optimum combination of strength and ductility for a given case. Figures 6; tables 2; references 13: 11 Russian, 2 Western.

USSR

UDC 62 - 761

FORMATION AND PROTECTIVE PROPERTIES OF VACUUM COATINGS OF AN IRON-NICKEL-CHROMIUM ALLOY ON STEEL

Moscow VESTNIK MASHINOSTROYENIYA in Russian No 2, 1977 pp 68-69

ROYKH, I. L., KOSTRZHITSKIY, A. I., LEBEDINSKIY, O. V. and SNITKOVSKAYA, L. M.

[Abstract] Vacuum applied coatings of Fe-Ni-Cr alloys can be used to protect low carbon steels from corrosion in sea water, in humid tropical climate, and in certain foodstuffs (particularly tomato paste). Gravimetric analysis has shown that steel 12Kh18N9T, because of its relatively porous surface, should no longer be used under such corrosive conditions; it can be replaced by low carbon steel with vacuum coatings of Fe-Ni-Cr alloy in structures and parts that operate in sea water, particularly in floating fish factories. Tab 2; Biblio 3.

USSR

UDC 691.32:621.643

IMPROVING THE WATER TIGHTNESS OF CONCRETE PIPES

Moscow STROITEL'NYYE MATERIALY in Russian No 1, 1977 pp 23-26

TOPIL'SKIY, G. V., BEREZNITSKIY, L. V., DMITRIYEV, A. I., KRIKUNOV, O. I., BUTT, YU. M., BUYANOV, V. N. and YELKIN, V. V.

[Abstract] At several USSR concrete pipe factories the breakdown of technological discipline, use of faulty equipment, improper preparation of fillers, cements, and other unfavorable circumstances have resulted in the rejection of 40-60% of concrete pipe production because of unsatisfactory water tightness. The authors explain how the impregnation of free-flow pipes with solutions of nitrated sulfitic grain alcohol and water glass reduces the water penetrability of the concrete as a result of chemical action of the solution with the cement and coagulation of the water glass in the defective portions of the pipes. In the concrete the content of pores less than 300 microns in size is reduced to less than one half by the impregnation. Procedures for the impregnation process are described. Ill 1; Tab 1; Biblio 2.

CZECHOSLOVAKIA

SURFACE PROTECTION OF THE KOVAR (Ni-Fe-Co) ALLOY AND ITS DESTRUCTION BY CORROSION

Prague JEMNA MECHANIKA A OPTIKA in Czech Vol 22, No 2, Feb 77 pp 43-45
manuscript received 30 Sep 76

KOPRIVA, Miroslav; Department of Accurate Mechanical Engineering and of Optical Electronics, Palacky University, Olomouc

[Abstract] The Czechoslovak alloy KOVAR (Ni 28.5, Co 18.2, U 0.6, Si 0.3, Fe balance) is similar to the West German alloy Vacon 10 (Ni 29, Co 17, U 0.3, Si 0.2, Fe balance). Both are used in the manufacture of surgical instruments. Usual corrosion protection is provided by thin layers of gold. Experimental work indicates that this layer should be applied to a surface which is accurately machined and annealed before it is introduced into the metal deposition bath. It is advantageous to coat the machined surface with a very thin layer of a metal oxide different from the main metal body. Nickel is one of the suitable metals. Figures 10; tables 2; references 5: all Czech.

CZECHOSLOVAKIA

MICROSCOPIC STRUCTURE OF CERMET LAYERS

Prague JEMNA MECHANIKA A OPTIKA in Czech Vol 21, No 11, Nov 76 pp 333-335
manuscript received 11 Jun 76

KUZEL, Radomir; HOSCHL, Pavel; Faculty of Mathematics and Physics, Charles University, Prague

[Abstract] The authors studied structures of layers prepared from various electrically resistant mixtures applied to ceramic supporting plates by screen printing. The resistance mixtures were made of metal or semiconductor powders, fritted glass and organic binders. The glass was of a low melting point variety with $PbO-B_2O_3-SiO_2$ components. The metals were Ag, Au, Pd, Pt. Powdered cadmium oxide was present in all resistant mixtures. During the firing of these mixtures electrically conducting chains are formed; their type and resistance stability are a function of the nature of the glass used. Best results were obtained with a glass containing 90 percent PbO , 8 percent B_2O_3 and 2 percent SiO_2 mixed at a ratio of 80 to 20 with CdO . Firing was conducted at about $640^\circ C$. Other glass investigated was composed of $PbO - B_2O_3 - ZnO$ at ratios of 60 - 35 - 5. Figures 9; references 2: 1 Czech, 1 Western.

USSR

UDC 621.693.411.4.001.2

EFFECT OF THE FLUX COMPOSITION ON THE IMPACT STRENGTH OF 16G2SAF STEEL
PIPE WELDS

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 2, 1977 pp 23-24

BENDER, V. S., and TOKAREV, V. S., Institute of Electrowelding imeni
Ye. O. Paton, Kiev; SHCHERBACHENKO, S. V., and SPIRIDONOV, V. D., Pipe
Plant, Novomoskovsk

[Abstract] Welds on large-diameter cold-resistant high-strength pipes
of 16G2SAF steel are required to have an impact strength of 5 kg-m/cm²
at -60°C. Test showed that the requirement can be met by using
Sv-10NMA, Sv-08GNM1, or Sv-08GNM1B welding wires with No 13 flux; or
Sv-08GNM1 or Sv-08GNM1B wires with No 14 or No 66 flux. None of the
welds using the standard AN-60 flux met the requirement. No 13 and
No 14 fluxes have less SiO₂ and MnO and more Al₂O₃, CaO, and MgO than
the No 66 and AN-60 fluxes. Metallographic studies showed that the
contamination of the weld with nonmetallic inclusions should be kept
to less than 0.25 volume percent for Sv-10NMA wire and to less than
0.5 volume percent for Sv-08GNM1 and Sv-08GNM16 wires in order for
the weld to have the required impact strength.

USSR

UDC 532.135

VISCOSITY OF DISSOCIATING NITROGEN TETROXIDE WITH ADDED WATER AND NITRIC
ACID

Minsk DISSOTSIIIRUYUSHCH. GAZY KAK TEPLONOSITELI I RABOCHIYE TELA ENERG.
USTANOVOK. CH. I in Russian 1976 pp 122-125

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 3, 1977 Abstract No 3G54]

MAKSIMOV, B. G. and MOISEYENKO, V. V.

[Text] The viscosity of the system N₂O₄-HNO₃-H₂O depends little on changing
concentration of the impurities. The maximum influence of the impurities is
observed at 450 K and atmospheric pressure and amounts to about 4% (con-
centration of impurities 11%). Figure 1; reference 1.

USSR

UDC 669.017.13

CHANGE IN STRUCTURE AND PROPERTIES OF THE MATERIAL OF BLADES OF TURBINES IN THE PROCESS OF THEIR USE

Moscow ZHAROPROCHNOST' I ZHAROSTOYKOST' METAL. MATERIALOV in Russian Nauka Press 1976 pp 101-103

[From REFERATIVNYY ZHURNAL 49. TURBOSTROYENIYE No 3, 1977 Abstract No 3.49.114]

GAYDUK, V. V., MOROZOV, L. V., OMEL'CHENKO, V. V. and PUT', V. F.

[Text] It is established that the structure of an alloy, for example EI437BVD, after operation for 1200-1600 hr, includes chains of carbides Me_2C_6 coagulated on the grain boundaries. It is shown that after operation of the alloy for 2500 hr and more, up to 3500 hr, restructuring occurs, as well as the development of fragmentation and the formation of large γ' phase segregations.

USSR

UDC 621.753

INCREASING THE DURABILITY OF THREADED GAGES BY EQUIPPING THEM WITH HARD ALLOYS WITHOUT TUNGSTEN

Kuybyshev POVERKHNOST. UPROCHNENIYE DETALEY MASHIN I INSTRUMENTOV in Russian 1976 pp 126-133

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 3, 1977 Abstract No 3.32.247]

YERMOKHIN, N. A. and SAGALOVICH, S. YA.

[Text] Results are presented from an experimental study of the efficiency of type A2P diamond discs produced by pressing and electroplating, in grinding of threads in hard alloys without tungsten. The studies, performed on a special installation modeling the conditions of friction of threaded plug gages, show that the wear resistance of tungsten-free hard alloys KNT-16 and TNM-25 is 1.5-1.7 times higher than that of alloy VK6. It is concluded that it is possible to use tungsten-free alloys to replace scarce tungsten-cobalt hard alloys. Figures 10; table 1;

USSR

UDC 531.781.2

GLUING OF TENSORESISTORS BY MEANS OF FREE CALIBRATED GLUE FILMS

Moscow OSNOVN. NAPRAVLENIYE I PROBL. SOZDANIYA ISPYT. MASHIN, VESO-I
SILOIZMERITEL'N. PRIBOROV in Russian 1976 pp 152-154

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 3,
1977 Abstract No 3.32.439]

BAZZHIN, YU. M. and KURILOVA, L. G.

[Text] A method is described for manufacturing a free film of BF-2 adhesive of predetermined thickness. The adhesive film produced is used as a substrate on the elastic element of a tensoresistor sensor and replaces the adhesive layer applied normally by brush or blade. The thickness of the adhesive layer can be varied from 10 to 40 μm with an accuracy of 1-2 μm . The use of thickness-calibrated films to glue on tensoresistors decreases the total thickness of the substrate by a factor of 1.5-2, helping further to reduce elastic imperfections and increase the metrologic qualities of the force-measuring sensors. Figure 1; references 3.

USSR

UDC 666.112.4:537.311.3

ELECTRICAL CONDUCTIVITY OF MELTS OF LEAD-SILICATE OPTICAL GLASSES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 1, Jan 77
pp 35-38 manuscript received 3 May 76

MAKSIMOV, N. N., GRIBKOVA, V. I. and SHASHKIN, V. S.

[Russian abstract provided by the source]

[Text] The paper gives the results of an investigation of the electrical conductivity of melts of lead-silicate glasses type LF, F and TF. It is shown that the electrical conductivity of melts of these glasses at the same viscosity is proportional to the content of alkali oxides in the glass. The governing principle is found for the influence that the viscosity of melts of these lead-silicate optical glasses has on their electrical conductivity. Computational formulas are proposed for rough estimation of electrical conductivity of these melts. Figures 4; tables 3; references 5: 4 Russian, 1 Western.

Metrology

USSR

UDC 681.2:62-192:665.6

METROLOGICAL RELIABILITY OF MEASURING DEVICES AND THE QUALITY OF PETROLEUM REFINING

Moscow METROLOGIYA in Russian No 3, 1977 p 64-69

CHEL'TSOV, A. V. and LINDENBAUM, Ya. M., Leningrad Branch of the Special Design Office for Automation in Petroleum Refining and Petrochemistry

[Abstract] Inaccuracies and malfunctions in the measuring devices in an automated process control system [APCS] can negate the improvements that are expected from the use of the system. Application of statistics have been used to optimize the tolerance specifications for the measuring devices and the maintenance schedule to improve both efficiency and product quality. The APCS can be expressed as the maximization of a "goal" function $Z(X,Y)$ (e.g., the yield of high-octane gasoline) for specified values of the quality indices $V_j(X,Y)$ (e.g. octane number or ignition temperature), where X is the vector of raw measurements and Y is the vector of control parameters. The means $M(\Delta V_j)$ and standard deviations $\sigma(\Delta V_j)$ of the deviations ΔV_j of V_j from the optimum values are determined by a linear error propagation formula using average values of the derivatives $\partial Z/\partial X$ and $\partial V_j/\partial X$. The analysis determines the metrological reliability from the probability that $\sigma^2(\Delta V_j)$ exceeds specified values. Here $\sigma^2(\Delta V_j) = \sigma_1^2 + \sigma^2(\Delta X)$, where σ_1^2 results from random and systematic deviations that arise in the APCS for $\Delta X = 0$, and $\sigma^2(\Delta X)$ arises from measurement errors. It is found that there are regimes where the reduction in ΔV_j and ΔZ are small as either the allowable measurement tolerances are reduced or the maintenance schedule is intensified.

USSR

UDC 519.24

RATIONAL DISTRIBUTION OF MEASUREMENTS IN THE POLYNOMIAL REGRESSION PROBLEM

Novosibirsk AVTOMETRIYA in Russian No 1, 1977 pp 36-40 manuscript received 14 Apr 76

MALITSKIY, A. A., Khar'kov

[Abstract] The coefficients a_j in an n -th order polynomial regression of a function $s(t)$ are to be determined from a set of measurements ω in the interval $[A,B]$, where the cost of the measurements is the integral of a function $\psi(t)$ over ω . The total cost of all the measurements is bounded

by a known constant C . The optimum set of points ω_0 has been chosen when the determinant of the Fischer information matrix, with elements

$$a_{ij}(\omega) = \int_{\omega} \phi(t) t^{i+j} dt,$$

is maximized, where $\phi(t) = 1/\sigma^2(t)$ and $\sigma^2(t)$ is the measurement dispersion function. The optimization is done by writing a function

$$f(t, \omega) = \frac{\phi(t)}{\psi(t)} \sum_{k=0}^{2n} C_k(\omega) t^k$$

where $C_k(\omega)$ is the sum of elements $\tilde{a}_{ij}(\omega)$, which are proportional to $a_{ij}(\omega)$, such that $i+j=k$; $i, j=0, n$. The necessary condition for ω_0 to be optimum is for $f(x, \omega_0) \geq f(y, \omega_0)$ for almost all x in ω_0 and almost all y in $[(a, b)/\omega_0]$. If x' is a point chosen in the interval (a, x'') , such that $x'' < b$, with a cost $\ell \leq C$, then the sufficiency condition is that $f(x', \omega_0(x')) \geq f(y', \omega(y'))$.

USSR

UDC 620.179.15

AN OPTIMAL ALGORITHM OF INFRARED DEFECTOSCOPY BY CONTACTLESS TEMPERATURE MEASUREMENT

Sverdlovsk DEFEKTOSKOPIYA in Russian No 1, Jan-Feb 77 pp 71-76 manuscript received 22 Sep 75

TIKHOMIROV, V. A. and TROITSKIY, I. N.

[Abstract] An algorithm for the detection of defects by contactless temperature measurement is shown here, based on the different temperature-time characteristics of defective and nondefective objects as well as on a probability analysis of error-free instrument readings. The temperature has been assumed to be an exponential function of the cooling time in either case. The mean and the dispersion characterizing the temperature fluctuations during this infrared defectoscopy as well as the signal-to-noise ratio in the instrument are taken into account in deriving the needed relation between defect detection probability and length of inspection time as well as the optimum length of a measurement. Figures 2; tables 1; references 5: all Russian.

USSR

UDC 620.179.16

CRITERIA FOR THE SIZE CLASSIFICATION OF DEFECTS DURING AUTOMATED ULTRASONIC INSPECTION OF THIN-WALL LARGE-DIAMETER PIPES

Sverdlovsk DEFEKTOSKOPIYA in Russian No 1, Jan-Feb 77 pp 81-86 manuscript received 14 Aug 76

GOLOVKIN, A. M. and MATVEYEV, A. S., "Giprotsvetmetobrabotka," Moscow

[Abstract] In conventional automated ultrasonic inspection the size classification of defects is based on the amplitude of the echo signal, with the sensitivity threshold of the defectoscope adjusted so as to remain above that of the echo signal from acceptable defects and below that of the echo signal from unacceptable defects. Another criterion for a size classification is the conditional width of defects. The method of defectoscopy on the basis of this latter criterion is analyzed here and illustrated in the case of defects of one type but different sizes, embedded at the same depth in relatively thick inspection samples. Such a classification is found to be equally valid and as reliable, without requiring a modification of serially built instruments. Defectoscopy on this basis is more efficacious, and the calibration of instruments relative to two reference reflectors is more accurate, because of the smaller subjective errors involved here. Figures 3; tables 1; references 4: all Russian.

USSR

UDC 541.24.082

ON THE POSSIBILITIES OF AUTOMATIC MEASUREMENT OF THE MOLECULAR WEIGHT OF ACRYLAMIDE POLYMER BY A VISCOSIMETER METHOD

L'vov VESTNIK L'VOVSKOGO POLITEKHNICHESKOGO INSTITUTA in Russian No 6, 1976 pp 96-98

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 2, 1977 Abstract No 2.32.866 by V. L. M-B.]

KURILKO, B. M., RUDENKO, V. I. and SVISTELIN, M. P.

[Text] On the basis of a viscosimetric method of measuring the molecular weight of polymers the authors measure the characteristic viscosity, which is defined as the limit approached by the reduced viscosity with infinite dilution of a solution of the polymer. An equation is presented for calculating the molecular weights of polymers that is based on the ratio between the characteristic viscosity and molecular weight of the polymer. A block diagram is given with a description of the design of the device used for automatic measurement of the molecular weight of a polymer. The device includes viscosimeters, concentration meters, a batcher pump and an analog computer that calculates the molecular weight from the given equations. Figure 1; references 4.

USSR

UDC 536.532

INFLUENCE THAT THE HEAT CONDUCTIVITY OF THERMOELECTRODES HAS ON THE READINGS OF THERMOCOUPLES IN A HIGH-TEMPERATURE GAS FLOW

Moscow TEPLOENERGETIKA in Russian No 2, Feb 77 pp 65-68

REKIN, A. D., candidate of technical sciences

[Russian abstract provided by the source]

[Text] A solution is found for the problem of temperature distribution along thermoelectrodes of constant diameter with a junction in the form of a ball with consideration of the actual construction of the thermocouple. The author determines the way that the junction temperature is influenced by cooling of the thermocouple housing and the dimensions of the insulating tubes that carry the junction away from the cooled housing. A simple equation is derived for determining the lengths of free exposure of thermoelectrodes outside of the insulating tubes to prevent heat leakage along the thermoelectrodes from the thermocouple junctions. Figures 4; references 9: 8 Russian, 1 Western.

USSR

UDC 531.727.521

MEASURING THE THICKNESS OF SINGLE-CRYSTAL WHISKERS ON THE MII-4 MICROINTERFEROMETER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 76 pp 194-195
manuscript received 18 Feb 76

GOLYAMINA, YE. M. and PUDALOV, V. M., Physics Department, Moscow State University; All-Union Scientific Research Institute of the Metrological Service, Moscow

[Abstract] The authors describe modifications in the optical arrangement of the MII-4 microinterferometer to adapt it for measurement of the thickness of metal single-crystal whiskers in a range of 10^{-3} - $10\text{ }\mu\text{m}$. The specimen is placed broadside downward on a plane-parallel fused quartz plate polished to 0.01λ . The specimen is securely held against the plate by van der Waals forces. To compensate for the increased length of the optical path, the same plate is placed in the second arm of the interferometer, and the etalon mirror is moved by the appropriate amount by using spacers. The method used for determining the gap between the whisker and plate due to twinning outgrowths is described. A resolution of about $0.002\text{ }\mu\text{m}$ can be achieved with a shock-mounted instrument. The authors thank Yu. P. Gaydukov for interest in the work, and G. S. Chernyshev for technical assistance. Figures 2; references 3 Russian.

METHOD OF MEASURING THE TEMPERATURE OF GAS STREAMS

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI
in Russian No 13, 1977, Cert. No 553481 8 Dec 74

KRASS, B. M.

[Text] Method of measuring the temperature of gas streams with a contactive heat probe, by heating the latter from an auxiliary energy source, with the distinguishing feature that, for reducing the effect of radiative and convective heat transfer on the measurement accuracy, one heats this probe to a temperature known to be higher than the temperature of the gas stream and simultaneously measures its temperature changes, whereupon one cools the probe by turning off the auxiliary energy source and again simultaneously measures its temperature changes; as the temperature of the gas stream one assumes that same instantaneous temperature through which the probe passes when heated (T_1) and when cooled (T_2) and for which the relation

$$\frac{dT_1}{d\tau} + \frac{dT_2}{d\tau} = \frac{P}{C G}$$

holds true, where $\frac{dT_1}{d\tau}$ and $\frac{dT_2}{d\tau}$ are the speeds at which the respective

temperatures have been measured during heating and cooling, P is the power with which the probe is heated from the auxiliary energy source, C is the thermal capacity of the probe, and G is the weight of the probe.

METHOD OF DETERMINING THE PARAMETERS OF MULTIHARMONIC VIBRATIONS OF ROTOR VANES IN A TURBOMACHINE

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI
in Russian No 12, 1977, Cert. No 552534 16 Jun 70

DOROSHKO, S. M. and TOYBER, M. L., Lenin-Komsomol Red-Army Riga Institute of Civil Aviation Engineers

[Text] Method of determining the parameters of multiharmonic vibrations of rotor vanes in a turbomachine, based on establishing the instants of time at which a given vane passes by at least three stationary points around the housing, with the distinguishing feature that, for higher accuracy, the time intervals between these instants are measured and from the readings are then calculated the amplitude and the frequency corresponding to the given vane.

METHOD OF ACOUSTIC WELL LOGGING

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 13, 1977, Cert. No 553560 22 Oct 75

DZEBAN', I. P., KARUS, YE. V., KUZNETSOV, O. L., and YAGODOV, G. N., All-Union Scientific Research Institute of Nuclear Geophysics and Geochemistry

[Text] Method of acoustic well logging, where acoustic waves are radiated in the well, the waves which have traversed the well are measured, and transverse waves extracted through filters yield information about the rock structure, with the distinguishing feature that, for a better resolving power of this method, the operating frequency is set within the band separating the cutoff frequencies of longitudinal and transverse head waves, and the filtration frequency for signal recording is set below the cutoff frequencies of longitudinal head waves, a cutoff frequency being determined from the relation

$$f_c = \frac{V_L(S)}{K_{\pi R}},$$

where f_c is the cutoff frequency,
 $V_L(S)$ is the velocity of longitudinal (transverse) waves,
 R is the well radius,
 and K is the collector factor, equal to unity.

METHOD OF INFORMATION RETRIEVAL FROM DRIFT CHAMBERS

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 13, 1977, Cert. No 553559 21 Oct 75

SINAYEV, A. N., Joint Institute of Nuclear Research

[Text] Method of information retrieval from drift chambers, including a measurement of the time in which primary-ionization electrons have drifted to a signal wire and a determination of the consecutive number of this wire, with the distinguishing feature that, for simplifying the measurement of the coordinates of a point in the chamber through which particles pass, and for simplifying the electronic circuitry, a pulse from a signal wire is transmitted to separate outputs and with time delays proportional to the distances from the given signal wire to these outputs, the time of appearance of a pulse at each output is measured from the reference time zero, whereupon from two time measurements are determined: the drift time after which electrons have arrived at the given signal wire as well as the consecutive number of this wire.

USSR

UNIVERSAL METHOD OF REVEALING PRIMARY STRUCTURE IN CAST Fe-Ni-Cr AND Ni-Cr
BASE ALLOYS

Moscow ZAVODSKAYA LABORATORIYA in Russian No 2, 1977 pp 195-196

AKIMOVA, YE. P., KRYLASHCHENKO, Z. A. and LIVITAN, ZH. S., All-Union Scientific-
Research and Design-Technological Institute of the Pipe Industry, Dnepropetrovsk

[Abstract] In an effort to select a reliable etching method among the many
known methods for revealing primary structure, 10 X 15 X 20-mm specimens of
nine alloys with different degrees of alloying (EP350, EP337, EI702, EP51,
4Kh25N35S2, EI435, EI437B, EI868, and EP375), cut from ingots and centrifugal-
cast pipe, and polished, were film-etched at 550-650°C. In all nine cases,
out of six etching methods only thermal film etching successfully revealed
primary structure in all of the tested alloys. Maximum contrast was obtained
by heating at 580-600°C and holding in air for 3-5 min. Ill 1; Tab 1;
Biblio 6.

USSR

UDC 621.039.8(047.1)

DIRECT PROBLEM OF GAMMA-GAMMA-DENSITOMETRY

Moscow IZOTOPY V SSSR in Russian No 47, 1976 pp 8-15

RODE, L. G., "Orgenergostroy," Moscow

[Abstract] The use of radioisotope densitometers in meteorology has been
impeded so far by the low information content of direct experimental data.
Studies have also demonstrated, however, that this difficulty can be overcome
by reducing the theoretical gist of gamma-gamma-densitometry to the solution
of the direct problem of establishing the relation between some characteristic
of an object (density of its material, geometrical dimensions, chemical compo-
sition, etc.) and the parameters of radiation scattered by it, or to the
solution of the reverse problem. Only a minimum amount of test data is then
required for any practical application, with the final results based essen-
tially on calculation and calibration. The direct problem of gamma-gamma-
densitometry is solved here according to the principle of a single scatter.
This approach is justified both theoretically for homogeneous and some non-
homogeneous materials as well as by the fact that the variability of the
chemical composition influences the density readings, especially in the case
of materials with $Z \geq 30$ and radiation sources up to 2.0 MeV. The analytical
solution obtained here in the form of absorption and scatter functions con-
verted to density count applies to both probe-type and surface-type instruments.
Figures 5; references 23: 22 Russian, 1 Western.

USSR

UDC 389:001.1

STATISTICAL REGULARIZATION AND CERTAIN NEW METHODS OF SOLUTION OF CONDITIONALLY CORRECT PROBLEMS

Novosibirsk NEKORREKTNYYE OBRATNYYE ZADACHI ATOM. FIZ. in Russian 1976 pp 17-33

[From REFERATIVNYY ZHURNAL 32. METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 3, 1977 Abstract No 3.32.10 by M. I. M.]

[Text] It is noted that many problems of experimental physics and technology, primarily inverse problems, fall in the class of poorly defined or incorrect problems. The incorrectness of such problems is manifested primarily as very high sensitivity to experimental errors. Presently, methods of solution of this class of problems and creation of a qualitatively new theory of measurement are undergoing intensive development. Successful development of methods of solution of certain incorrect problems will facilitate more effective solution of old, traditional problems of experimental physics (for example, the spectral problem of reduction to an ideal instrument, local diagnosis of a plasma by methods of emission and interferometry, etc.), as well as the statement of new problems of physics and technology, economic and control, identification and synthesis. Methods of regularization developed by the school of A. N. Tikhonova are studied, as well as certain other approaches based on dynamic models. It is noted that progress in the solution of a large number of experimental and theoretical problems of contemporary science depends to a great extent on further development of computer technology and creation of improved algorithms on this basis. References 43.

USSR

UDC 620.179.152

THE EXPEDIENCY OF CREATING AUTOMATED COMPLEXES FOR RADIATION DEFECTOSCOPY

Moscow VOPR. ATOM. NAUKI I TEKH. RADIATS. TEKH. in Russian No 13, Atomizdat Press 1976 pp 297-304

[From REFERATIVNYY ZHURNAL 32. METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 3 1977 Abstract No 3.32.191]

AKOPOV, V. S., VORONIN, S. A. and MESHALKIN, I. A.

[Text] The optimal productivity for automated radiation defectoscopy complexes produced up to 1990 will be 90,000 pictures per year. Methods must be developed to increase the sensitivity of radiation testing to 1.5% by 1990. Between 1973 and 1990, the volumes of testing of products by various methods of radiation defectoscopy will change: the volume of products tested by the radiosopic method will increase (from 6 to 24%), while the volume of products tested by the radiographic method will decrease (from 90 to 70%). It is desirable to use a small universal computer to interpret the results of radiation testing.

USSR

UDC 531.768[083.78] [083.74]

STATE SYSTEM FOR PROVIDING STANDARD TIME. STATE PRIMARY STANDARD AND ALL-UNION TESTING SYSTEM FOR EQUIPMENT FOR MEASUREMENT OF CONSTANT LINEAR ACCELERATION OF A SOLID BODY IN THE 0.01-200 m/s² RANGE

USSR STATE STANDARD GOST 8.179-76

[From REFERATIVNYY ZHURNAL 32. METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 3, 1977 Abstract No 3.32.490C]

[Text] This standard extends to the State Primary Standard and All-Union Testing System for equipment for measurement of constant linear acceleration of a solid in the 0.001-200 m/s² range and establishes the State Primary Standard for a unit of constant linear acceleration of a solid in the 0.001-200 m/s² range -- the meter per second squared (m/s²), the complex of primary measurement equipment included in it, the basic metrological parameters of the standard and the sequence for transmission of measurement of a unit of constant linear acceleration on the primary standard by means of standard means of measurement by measurement equipment with an indication of error and basic methods of testing.

USSR

UDC 532.57:621.375.826

STUDY OF ACCURACY OF THE METHOD OF DISCRETE MEASUREMENT OF THE SIGNAL FREQUENCY OF A LASER DOPPLER VELOCIMETER

TR. TSENTR. AERO-GIDRODINAM. IN-TA in Russian No 1750, 1976 pp 129-134

[From REFERATIVNYY ZHURNAL 32. METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 3, 1977 Abstract No 3.32.781]

ZLENKO, YU. A.

[Text] A study is made of the accuracy of the method of discrete measurement of the frequency of the signal of an LDV. Approximate analytic formulas are produced for determination of the dispersion of estimates of the velocity of air flow. The optimal value of measurement time is determined. References 6.

USSR

UDC 621.482(47+57)

PROSPECTS FOR UTILIZATION OF THE POWER RESOURCES OF THE MUTNOVSKIY GEOTHERMAL REGION

Petropavlovsk-Kamchatskiy VSES. SIMPOZ. "IZUCH. I ISPOL'Z. GLUBIN, TEPLA ZEMLI V VULKANICH. OBL." TEZISY DOKL. in Russian 1976 pp 26-28

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 3, 1977 Abstract No 3S97]

VAKIN, YE. A. and PILIPENKO, G. F.

[Text] The Mutnovskiy geothermal region is located 50 km south of the city of Petropavlovsk. A multistage plan for utilization of the region is suggested: 1. Prospecting of the deposits at Zhirovskiy and Rudnoye and construction of power plants with a total capacity of up to 2-25 MW. Their power would then be used for transmission to the villages on the southern shore of Avachinskiy Bay, for prospecting and operation of rare metal-polymetallic deposits and to bring in the northern Mutnovskiy deposit. 2. Prospecting of the northern Mutnovskiy deposit and construction of a power plant with a capacity of 50-75 MW with transmission of power to Petropavlovsk and Yelizovo. 3. Construction of a power plant in the northern Mutnovskiy deposit of 300 or more MW by extraction of heat from rock with possible further increase in power by utilization of the resources represented by Mutnovskiy Volcano.

USSR

PECULIARITIES OF THE FLOW OF A VISCOELASTIC SEPARATOR USED FOR CEMENTING OF OIL AND GAS WELLS

Novosibirsk ISSLED. PO GIDRODINAMIKE I TEPLOOBMENU in Russian 1974 pp 178-185

[From Moscow REFERATIVNYY ZHURNAL MEKHANIKA No 2, 1977 Abstract No 2B855 by the author]

BAKHTIYAROV, S. I.

[Text] A buffer fluid with the composition of a viscoelastic separator prepared on the basis of polyacrylamide is suggested to improve the quality of cementing of oil and gas wells. Information on the properties and peculiarities of the flow of this liquid is not presently available.

This work presents a study of the rheological properties of a viscoelastic separator at various shear velocities as a function of its composition and temperature. Stroboscopic stream visualization is used to study the peculiarities of the flow of the viscoelastic separator in a rectangular channel with a cavity (30 x 60 x 40 mm). For comparison, in addition to these separators, a Newtonian fluid (65% water-glycerine mixture) and a 0.8% aqueous solution

of polyacrylamide were used. The studies were performed at Reynolds numbers $Re = 1-492$. Both the qualitative picture of flow of the fluids in the cavity, and certain quantitative characteristics of motion are produced. References 17.

USSR

UDC 621.643.411.4.001.24

PORE FORMATION IN SEAMS DURING WELDING OF PIPES OF LOW CARBON AND LOW ALLOY STEELS

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 3, Mar 77 pp 20-22

TARLINSKIY, D. V. and SBARSKAYA, N. P., All-Union Scientific Research Institute for Construction of Pipelines

[Abstract] Gas pores are one of the most widespread defects arising during welding of main line pipelines. Pores are formed during welding primarily by carbon monoxide, hydrogen and nitrogen. Practice has shown that pore formation also depends on the type of welding materials used. The appearance of pores in welded seams depends on many thermodynamic and kinetic parameters of the welding process. Data are presented on the chemical composition and gas content of seam metal produced by welding of the steels most frequently used in the construction of pipelines with electrodes with cellulose coating type VSTS-4 and electrodes with calcium fluoride coating type UONI-13/55. Hydrogen is found to be primarily responsible for the pores resulting. Recommendations are formulated for avoidance of pore formation. References 8.

USSR

UDC 621.375.82

DAMAGE TO TRANSPARENT DIELECTRICS FROM LASER EMISSION

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 9, 1976
pp 55-66 manuscript received 28 Mar 76

KHODAKOV, G. S., doctor of sciences, and TSESNEK, L. S., doctor of sciences

[Abstract] This article is devoted to a survey of studies on the general problem of the optical strength of transparent dielectrics, with specific emphasis on the mechanism of the absorption of dangerous doses of radiation and finding ways to increase optical strength. The ultimate goal of such studies is to find ways of influencing optical strength by creating new materials with the required properties and of creating the conditions for the effective utilization of lasers. It has been possible in recent years to increase the optical strength of a number of materials by improving methods of treating their surfaces and by making exceptionally pure and homogeneous laser materials. A summary is made of the content of studies devoted to the following questions: Statistical aspects of interaction between laser emission and transparent dielectrics; light-related damage to the surface; the mechanism of optical breakdown of transparent dielectrics; the influence of phase inclusions on total optical strength; optical damage to organic materials; and some features of the effect of intense radiation on transparent dielectrics. The general conclusion is that breakdown of transparent dielectrics under the effect of high-intensity laser pulses takes place on account of built-up avalanche-type absorption of light energy and can be due both to the formation of an avalanche and to spreading of a network of cracks and microflaws at the speed of a shock wave. It is concluded that both of these phenomena occur owing to intense heating of microscopic absorbing phase inclusions or, in their absence, because the r.m.s. value of the electric field strength of the light wave exceeds the electrical breakdown strength. It has been demonstrated that the breakdown threshold and other specific characteristics of the process of the action of high-power laser emission on transparent dielectrics are determined by the conditions for the origin and development of avalanche-type absorption and depend but slightly on their mechanical strength. Figures 4; tables 4; references 77: 61 Russian, 16 Western.

USSR

UDC 539.4

STUDY OF ELECTRICALLY ASSISTED PLASTIC DEFORMATION OF A METAL

Kiev PROBLEMY PROCHNOSTI in Russian No 12, 1976 pp 88-93 manuscript received 19 Dec 75

TROITSKIY, O. A., Institute of Physical Chemistry of the USSR Academy of Sciences, Moscow

[Abstract] New possibilities in studying sudden deformation of metallic crystals are afforded by the new technic of inducing plastic deformation

in a metal with brief current pulses. This technic applied to a deformed metal increases the homogeneity of shear formations in crystals and converts deformation of the crystals from naturally sporadic and inhomogeneous to ordered and discrete. In this paper a study is made of electrically assisted plastic deformation by the stress relaxation and creep method. A precise determination is made of the contribution of the pinch effect and of the current's thermal effect to the total result, and a study is also made of the influence of the frequency and strength of the pulsed current, as well as of pulse width, on the magnitude of the effect. In addition, a study is made for the first time of the polarity of the current effect on plastic deformation of a metal, making it possible to obtain information on the true electroplasticity of metals. Stress relaxation was studied in experiments using crystals of zinc 16 mm long and approx. 1 mm in diameter. Two-part specimens were used, one half serving as the active section to be deformed and the other half being used only to pass current through and to create a pinch effect in the specimen. Curves are shown expressing the relationship between stress relaxation rate and load when passing current through each half. The joint effect of current and the pinch effect results in greater relaxation of stresses than with the pinch effect alone. Simple specimens were used to study the influence of heating induced by industrial-frequency alternating current on stress relaxation. It was demonstrated that under the conditions prevailing here the heating influence of the current was a secondary factor and did not determine weakening of the metal. An increase in pulse repetition frequency resulted in an increase in stress relaxation with different applied loads. A study was also made of the influence of changing the current's polarity on the magnitude of stress relaxation in crystals at -196°C , in order to make it possible to single out the portion of true electroplastic deformation of the metal related to the electron-dislocation effect. A study was also made of the influence of changing the current's polarity on the creep rate of crystals of zinc, cadmium, and lead when loaded slightly beyond the yield point. A drawing and description are given of the device used to make this measurement. It was demonstrated that changing the polarity of the current causes a change in both the total creep of the crystals and the steady-state creep, at the temperature of liquid nitrogen. It is concluded that plastic deformation of a metal stimulated by current pulses is made up of true electroplastic deformation minimally associated with the heat effect of the current and of deformation dependent on the pinch effect of the current. The influence of pulsed current is intensified with an increase in its frequency and pulse width. Changing the polarity of the current in crystals undergoing deformation results in a change in their resistance to deformation, displayed by a change in stress relaxation rate and creep rate. This fact is explained by a change in the intensity of electron-dislocation interaction with reversal of the sign of microstresses from the electronic wind in crystals undergoing deformation. The lack of a relationship between the current's heat effect and pinch effect and the direction of the current can be used as reliable proof of true electroplasticity in a metal. Figures 7; tables 1; references 23: 22 Russian, 1 Western.

USSR

UDC 620.178.3

EFFECT OF VARIOUS MODES OF MECHANICAL TREATMENT ON THE DISTRIBUTION OF RESIDUAL STRESSES IN AND OF THE FATIGUE STRENGTH OF GRADE ShKh15 STEEL SPECIMENS

Kiev PROBLEMY PROCHNOSTI in Russian No 2, Feb 77 pp 23-28 manuscript received 27 Jul 75

SMAGLENKO, F. P., GRYAZNOV, B. A. and GORODETSKIY, S. S., Institute of Superhard Materials, Academy of Sciences Ukrainian SSR, Kiev

[Abstract] A study was made concerning the effect of various grinding and surface hardening techniques on the distribution of residual stresses in quenched grade ShKh15 steel (for ball bearings), on the initiation and the development of fatigue fracture centers, on the equation of the stress-cycle diagram, and on other characteristics. The specimens were ground with various abrasive wheels, or polished with various abrasive belts, or rolled. The stress distribution over the case depth, according to the test data, indicates that treatment with a diamond wheel or belt produces compressive residual stresses at depths down to 0.05 mm and thus improves the endurance characteristics of this steel 25-28% more than treatment with other abrasives. Rollers produce compressive residual stresses at depths down to 20.0 mm and thus also improve the endurance characteristics of this steel, but only 10-12% more than conventional grinding. These compressive stresses remain rather stable under cyclic flexure during rotation. Centers of fatigue fracture are initiated and developed within the zone of maximum total stresses in a cycle and, depending on the surface finish, may be superficial or embedded in a specimen. Figures 6; tables 2; references 7: all Russian.

USSR

UDC 539.3

SOLVABILITY AND APPROXIMATE METHODS OF SOLVING BOUNDARY PROBLEMS IN THE THEORY OF ELASTICITY, PLATES AND SHELLS UNDER RANDOM LOADS

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 13, No 3, Mar 77 pp 17-23 manuscript received 12 Jun 75

GONCHARENKO, V. M., Kiev State University

[Abstract] The author introduces the concept of a generalized solution to the mathematical expectation of energy which minimizes the functional for a number of problems concerned with the statics of elastic bodies under a random load. He proves the theorems of existence and singleness to such a solution. He makes the study according to a single scheme which allows using for proof the properties of the corresponding determined boundary problems. A study is made of the planning methods for approximate finding of the probability characteristics of the solution. The suggested method permits estimating the rate of convergence and the error in the approximate solution in the corresponding energy norms. References 15: all Russian.

USSR

UDC 539.374

ON THE STABILITY OF DEFORMATION OF A STOCHASTICALLY HETEROGENEOUS STRENGTHENED ELASTO-VISCO-PLASTIC MEDIUM

Kiev PRIKLADNAYA MEKhanika in Russian Vol 13, No 3, Mar 77 pp 24-32 manuscript received 1 Jul 75

SPORYKHIN, A. N. and CHIGAREV, YU. V., Voronezh State University

[Abstract] The authors use a quasistatic formulation to investigate the stability of deformation of a stochastically heterogeneous elasto-viscoplastic medium. They establish for a homogeneous subcritical state that common solutions can be constructed for the three-dimensional equations of stability in invariant form. They investigated the phenomenon of instability of the half-space from a compressed composite material. The authors present the graphic dependences. Figure 1; references 7: all Russian.

USSR

UDC 539.3

HETEROGENEOUS ISOTROPIC HALF-PLANE WITH A NONSYMMETRICALLY FASTENED EDGE

Kiev PRIKLADNAYA MEKhanika in Russian Vol 13, No 3, Mar 77 pp 48-56 manuscript received 4 May 75

MARTYNOVICH, T. L. and YURINETS, V. YE., L'vov State University

[Abstract] Using the method of integral Fourier transforms the authors solve the problem on the stressed state of a semi-infinite heterogeneous isotropic plate whose rectilinear edge along the entire length is nonsymmetrically fixed to an elastic rod of constant cross section. The shift modulus of the plate varies by exponential law, and the Poisson coefficient is assumed to be constant. The plate is joined to the rod on the actual plane of their joint. Figures 5; references 3: all Russian.

USSR

UDC 539.3

ANTIPLANAR DEFORMATION OF A REGULAR TYPE ISOTROPIC LAMINAR HALF-SPACE ACTED ON BY A VIBRATION LOAD

Kiev PRIKLADNAYA MEKhanika in Russian Vol 13, No 3, Mar 77 pp 33-37 manuscript received 23 Mar 76

SHUL'GA, N. A. and YAMKOVOY, A. I., Institute of Mechanics, Academy of Sciences Ukrainian SSR, Kiev

[Abstract] The authors give a precise analytical solution to the problem of antiplanar deformation acted on by a vibration load of a laminar half-space formed by two alternating layers of different thickness and mechanical properties. Using the obtained results they explain the possibilities of approximate approaches to analyzing the stress-strain state in laminar composite materials on the basis of continuum theory. Figures 3; references 4: all Russian.

USSR

UDC 539.376:612.979.07

CYCLICAL CREEP OF A CONTAINER FOR PRESSING ALUMINUM ALLOYS

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 3, 1977 pp 33-37 manuscript received 6 Apr 76

KLEBANOV, YA. M.

[Abstract] The author develops a method to use a computer for calculating a round multilayer container for a pressing instrument based on a nonlinear hereditary model of creep. The results of the investigation demonstrate that because of the creep of the material the container operating conditions deteriorate and its strength is reduced. Taking into account the creep of instrument steels is essential even at the planning stage, thus facilitating an increase in strength and productivity and a savings in expensive alloyed steels. Figures 3; references 4: all Russian.

USSR

UDC 625.534.011

DYNAMICS OF COAXIAL ROTORS

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 3, 1977 pp 60-65
manuscript received 1 Apr 76

BOGORAD, E. YE.

[Abstract] The author examines transverse oscillations of a system of two concentric rotors, rotating at different angular velocities. He demonstrates the possibility of reaching self-centering of the outer rotor in the zone of working velocities for two dynamic schemes with elastic installation of the outer rotor and elastic or rigid fastening of the inner rotor. A comparative analysis is made of the dynamic reactions of the inner rotor in the zone of self-centering. It is demonstrated that with elastic fastening of the inner rotor its reactions are virtually independent of the angular velocities of the rotors, whereas with rigid fastening of the inner rotor its dynamic reactions are proportional to the squares of the angular velocities of the rotors. Figures 3; references 2: both Russian.

USSR

UDC 621.98.011

METHOD FOR COMPUTING THE PARAMETERS OF PLANE PLASTIC DEFORMATION

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 3, 1977 pp 136-140
manuscript received 18 Mar 76

SMIRNOV-ALYAYEV, G. A., Doctor of Technical Sciences, Professor, KUZNETSOV, D. P., Candidate of Technical Sciences, Assistant Professor and LYASNIKOV, A. V., Candidate of Technical Sciences, Assistant Professor, Leningrad Mechanical Institute

[Abstract] The authors use the distortion of the coordinate grid to discuss a method of computing the parameters of the deformed and stressed states of a metal body undergoing finite monotonic plane deformation. It is based on determining the functional bond of the current coordinate, i.e., the Euler variables, of the material points of a deformed body with initial coordinates, i.e., Lagrange variables. The method was developed by using a computer and it fully satisfies the conditions of machine computation. Figures 2; references 2: both Russian.

USSR

UDC 539.374

INFLUENCE OF HYDROSTATIC PRESSURE ON RESISTANCE TO SHIFT UNDER PLANE PLASTIC FLOW

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 3, 1977 pp 140-143
manuscript received 23 Mar 76

RENNE, I. P., Doctor of Technical Sciences, Professor and MYASISHCHEV, A. A.,
Student, Tula Polytechnic Institute

[Abstract] The authors determine the stress field under the plane plastic flow of a material for which the special condition of plasticity is valid which takes into account the dependence of resistance to shift on hydrostatic pressure (average stress). The solution is found by the method of characteristics with respect to the process of pressing by allowing for contact friction obeying Coulomb law. They find that for the majority of metals and alloys the value of the parameter ϵ lies in the range from 0.05 to 0.12. Figures 3; references 8: all Russian.

USSR

UDC 534.131:629.7

DETERMINATION OF NATURAL FREQUENCIES OF A CYLINDRICAL ENVELOPE OF VARIABLE THICKNESS

Kiev PRIKLADNAYA MEKHANIKA in Russian No 2, Feb 77 pp 21-25 manuscript received 18 Mar 75

YERSHOV, V. V. and KRETOV, A. D., Voronezh Polytechnical Institute

[Abstract] The problem is stated of determining the natural frequencies of axisymmetrical oscillations of a thin circular closed envelope of variable thickness. The problem is solved by an energy method. The primary differential equation is solved by the method of perturbations (method of the small parameter). The self-similar boundary value problem is studied. References 2.

USSR

UDC 539.3:624.074.4

THE INFLUENCE OF COMPRESSIBILITY OF THE FILLER ON BENDING OF A THREE-LAYER
CYLINDRICAL ENVELOPE

Kiev PRIKLADNAYA MEKhanika in Russian No 2, Feb 77 pp 26-34 manuscript
received 19 May 75

PISKOVITINA, I. A.

[Abstract] The parameter of transverse compressibility of the filler is introduced and formulas presented for determination of displacements and the stress state of a fine three-layer envelope as a function of this parameter. The study is made of a three-layer cylindrical envelope in which the load-bearing layers are made of metal, while the layer between them is filled with an epoxy-based compound. The kinematic broken line hypothesis is accepted, and it is considered that the structure of the envelope is symmetrical in thickness and that the Poisson coefficient of materials of all layers are identical. The loads studied include hydrostatic external pressure as well as transverse pressure on the envelope alone. The envelope is considered freely supported at its ends. References 7.

USSR

UDC 534.1

RESONANT PROPERTIES OF A FROUDE PENDULUM WITH VIBRATION OF THE SUSPENSION AXIS

Kiev PRIKLADNAYA MEKhanika in Russian No 2, Feb 77 pp 102-107 manuscript
received 23 Jan 76

KOBAL'CHUK, P. S. and PAPUSHA, A. N., Institute of Mechanics, Academy of
Sciences UkSSR, Kiev

[Abstract] The purpose of this article is to study approximately the influence of two mechanisms of generation of oscillations--parametric and self-oscillating--on the formation of resonant states of a physical pendulum with friction on its axis, upon vibration of this axis. In the first approximation, two resonances are found in the system: at the primary frequency and half the frequency of external excitation. Qualitative conclusions reached on the basis of the theoretical results are confirmed by electric modeling. References 4:
3 Russian, 1 Western.

USSR

UDC 621.822

DYNAMIC RIGIDITY OF AN OPEN HYDROSTATIC BEARING WITH CONTROLLER

Moscow MASHINOVEDENIYE in Russian No 1, 1977 pp 15-20 manuscript received 16 Sep 74, revised 11 Dec 75

INGERT, G. KH. and LUR'YE, B. G.

[Abstract] Dynamic rigidity was determined for an open hydrostatic bearing equipped with a pressure-feedback regulator with slotted spring. The experiments were conducted on a stand for testing the dynamic characteristics of hydrostatic bearings. The influence of mass of moving parts is neglected. If the time constant, which is proportional to the compressibility factor of the oil, is increased, the dynamic rigidity is decreased. A hydrostatic bearing with a compliance function $e = 3.4 \cdot 10^{-4} \text{ cm}^3/\text{kg}$ has a static rigidity of $200 \text{ kg}/\text{u}$. Its minimum dynamic rigidity however at a compressible volume of oil $v_1 = 30 \text{ cm}^3$ is $150 \text{ kg}/\text{u}$, and only $70 \text{ kg}/\text{u}$ at $V_1 = 80 \text{ cm}^3$; thus an increase of compressible volume of oil (between slots in regulator) reduces the minimum dynamic rigidity. A hydrodynamic bearing in which air has accumulated can have a high static rigidity but very low dynamic rigidity. It is also shown that a decrease in gap size increases dynamic rigidity. Ill 2; Biblio 6.

USSR

UDC 621.3.019:519.2

APPROXIMATION METHOD OF DETERMINING THE RELIABILITY OF PARTIALLY RESTORABLE SYSTEMS WITH NONLOADED RESERVE IN THE PRESENCE OF A TIMEWISE REDUNDANCY

Moscow NADEZHNOT' I KONTROL' KACHESTVA in Russian No 11, 1976 pp 40-46

ZHURAVLEV, V. A.

[Abstract] Isothermal, motive energy supply systems may include main and reserve groups consisting of elements whose failure can be corrected in the operation as well as elements which cannot be restored in operation; these latter systems also have a timewise redundancy that is conditioned by the circumstance that their nonoperation does not lead to the loss of the controlled parameter (temperature) beyond the limits of a given range of control. For such difficult to analyze systems the author presents an algorithm for an approximate estimate of reliability based on gamma-distribution properties. It is shown that the reliability of complex reserved systems can be estimated by means of semi-Markov processes. In a numerical solution a probability of 0.9955 for 2,000 hours of reliable operation is obtained as a high estimate, and 0.9900 for 1,333 hours as a low estimate. Ill 2; Biblio 6.

USSR

UDC 539.3.01

GENERALIZED PLANE STRAIN IN THE NONLINEAR THEORY OF ELASTICITY

Kiev PRIKLADNAYA MEKhanika in Russian No 1, 1977 pp 3-20 manuscript received 22 Apr 75

CHERNYKH, K. F., Leningrad State University

[Abstract] The author proposes a new approach to generalized plane strain in the nonlinear theory of elasticity wherein the nondeformed configuration of the body is taken as a reference and the tensor of the elongation factor as a measure of strain. Stress functions are not employed. The approach provides sufficiently general compact relationships that are suitable for practical use. In its statement portion the suggested variant approach contains all the analogs of the relationships in the nonlinear theory of elasticity. Some of the relationships were apparently not known earlier, even in the linearized form. To explain the structure of the obtained relationships the author solves some axisymmetrical problems for an elastic material with the Bartenev-Khazanovich elastic potential. Ill 6; Biblio 9.

USSR

UDC 539.3

ELASTIC-PLASTIC DEFORMATION OF FLEXIBLE RIBBED SHALLOW SHELLS

Kiev PRIKLADNAYA MEKhanika in Russian No 1, 1977 pp 33-39 manuscript received 29 Apr 75

ABOVSKIY, N. P., YENDZHIYEVSKIY, L. V. and PETUKHOVA, I. YA., Krasnoyar Polytechnic Institute

[Abstract] Within the theory of elastic-plastic deformations of flexible shallow ribbed shells the authors present a variation that is based on the deformation theory of plasticity. Total and composite functionals of the technical theory of shallow shells with narrow and wide ribs are linearized by a method of elastic solutions (supplementary loads). Variational formulations are obtained for constructing the variation-difference method. An example solution is given for a square shallow shell reinforced by a crosswork of narrow ribs, shell and ribs of 35Kh steel. The uniformly distributed load $q=1.7q_s$, where $q_s=343 \cdot 10^4 \text{ N/m}^2$, corresponding to the occurrence of fibrous creep at the most heavily stressed point, the crosswork of ribs. Plastic deformations occur in the ribs and in the corner zones of the body of the shell. Ill 2; Biblio 6.

USSR

UDC 534.13.014.1:530.3-215

USE OF A NUMERICAL METHOD FOR COMPUTING THE FREE OSCILLATIONS OF COMPOSITE SHELLS OF REVOLUTION PARTIALLY FILLED WITH A LIQUID

Kiev PRIKLADNAYA MEKHANIKA in Russian No 1, 1977 pp 81-85 manuscript received 22 Apr 75

BOGADITSA, E. S., BRUCILOVSKIY, A. D. and SHMAKOV, V. P.

[Abstract] Formulas are given for computing the free oscillations of elastic composite shells of revolution partially filled with an ideal incompressible fluid. The hydrodynamic problem is solved by the Ritz method. The natural frequencies are calculated as eigenvalues of a certain matrix the elements of which are quadratures of functions determined from a solution of boundary-value problems for the displacement potentials of the liquid particles in a completely and a partially filled shell. The formulas allow for a transition to shells without liquid. The solution of the boundary-value problem for the elastic shell is obtained on the basis of the method of the orthogonal screw die. The oscillations of a cylindrical shell with hemispherical bottom are considered in an example calculation. Ill 3; Tab 1; Biblio 3.

USSR

A STUDY OF THE LAWS WHICH GOVERN THE DEVELOPMENT AND THE INHIBITION OF FAST CRACKS DURING FRACTURE OF MULTILAYER METALLIC MATERIALS

Kiev PROBLEMY PROCHNOSTI in Russian No 1, Jan 77 pp 9-13 manuscript received 20 Feb 76

PODGORNIY, A. N., GUZ', I. S. and MILESHKIN, M. B., Institute of Problems in Machine Design, Academy of Sciences Ukrainian SSR, Kharkov

[Abstract] Copper, a ductile material with a monophase structure without phase transformations and insensitive to changes in the deformation rate, was selected for a study concerning the development and the inhibition of fast cracks during fracture of multilayer metallic materials. The test specimens consisted of fluxless Cu+ 8.4% P solder as the brittle base and a 0.5 mm thick annealed, degreased pure copper strip as the straight sloping or wavy interlayer. Plasticizing the solder with Zn (1.0%, Sn (2.5%), Pb (1.0-3.0%), and Ag (13%) in various combinations effected changes in the cracking rate. The cracking process was recorded with a high-speed photographic camera and the fracture surfaces were examined by optical fractography. The test results, interpreted according to theory, indicate that stress relaxation effects are the main ingredients of the crack inhibiting mechanism and that the energy of plastic deformation may serve as a measure of the resistance of a material to cracking. The test results indicate also, more specifically, that a wavy interlayer of ductile copper contributes to the strength of a soldered joint. Figures 6; tables 1; references 15: all Russian.

USSR

UDC 620.178.3

SOME PROBLEMS IN DETERMINING THE LIFE OF TURBINE BLADES EXPOSED TO HEAT CYCLES AND VIBRATIONS IN A GAS STREAM

Kiev PROBLEMY PROCHNOSTI in Russian No 1, Jan 77 pp 28-33 manuscript received 20 May 75

PETRENKO, A. I., Institute of Strength Problems, Academy of Sciences Ukrainian SSR, Kiev

[Abstract] A complete strength analysis of turbine blades requires data pertaining to the effect of heat cycles and vibrations in a gas stream on their bearing capacity, so that the blade life can be evaluated as a function of simultaneous thermal fatigue, mechanical fatigue, and corrosion-erosion effects. A study in this area was undertaken, using a set of nine blades made of grade EP220 steel with the characteristic height and width dimensions 45 mm and 27.5 mm respectively. These blades were subjected to loads vibrating at 50 Hz and to either $350 \rightleftharpoons 900^{\circ}\text{C}$ or $425 \rightleftharpoons 800^{\circ}\text{C}$ temperature swings at the leading edge, with heating time 5 seconds and cooling time 10 seconds in each cycle. The temperature distribution over a blade profile was measured with thermocouples and the thermal stresses at the same points were calculated from axial displacements, at several instants of time throughout a cycle. The data are further evaluated in terms of fatigue curves and an analytical interpretation in the form of theoretical equations with empirical coefficients is attempted. It is still necessary to establish the blade life depends on the cycle form-factor, i.e., the ratio of the vibrational strain range to the total (vibrational and thermal) strain range. Figures 6; references 7: all Russian.

USSR

UDC 620.1

THERMODYNAMIC METHOD OF EVALUATING THE LIFE OF TAPERED MACHINE ELEMENTS OPERATING UNDER HEAT CYCLES

Kiev PROBLEMY PROCHNOSTI in Russian No 2, Feb 77 pp 3-9 manuscript received 1 Jul 76

TRET'YACHENKO, G. N. and BARILO, V. G., Institute of Strength Problems, Academy of Sciences Ukrainian SSR, Kiev

[Abstract] Tapered machine elements such as tips of blades in a gas turbine and ribs of pistons in an internal-combustion engine act as concentrators of thermal stresses and, during heat cycles, fracture not only because of stress reversals but also as a result of physicochemical effects of corrosion and erosion in the aggressive gaseous atmosphere. The problem of evaluating the defectiveness of a material is approached here from the thermodynamic standpoint, namely in terms of the entropy increase as a criterion of life expectancy. Such an analysis is made for grades 1Kh18N9T, IE607A, and EI10 of steel. The entropy

increase due to dissipative plastic deformation is calculated on the basis of test data, with this entropy increase assumed proportional to the defectiveness of the material. This entropy increase as well as the work of dissipative forces and the plastic strain are all expressed as functions of the number of cycles, with the average temperature assumed the same in all cycles, leading to relations analogous to Coffin's equation and found linear for the three given materials. There are also entropy increases due to diffusion and oxidation of alloying elements, chromium in this case, and these are also evaluated here as functions of the chromium content in steel. The chromium content in the steel is related to the sulfur content in the gas stream and to the number of cycles: $C_{Cr} = C_0 e^{-(b \ln C_S + a)N}$. The final relations for these entropy increases $N^m \Delta S_{dif} = K_2$ and $N \Delta S_{chem} = K_3$, obtained here seem paradoxical in that they depend neither on the chemical composition of the material nor on its thermal and mechanical behavior. This needs further confirmation, but it is pointed out that chromium is the only alloying element added for protection against corrosion. Figures 8; tables 1; references 7: all Russian.

USSR

UDC 539.4

PROBABILISTIC MODEL OF LIFE UNDER FATIGUE BASED ON CONCEPTS OF LINEAR FRACTURE MECHANICS

Kiev PROBLEMY PROCHNOSTI in Russian No 2, Feb 77 pp 10-15 manuscript received 1 Jul 76

KHAZANOV, I. I. and POLITOV, V. A., Moscow

[Abstract] An analysis based on energy relations in fracture mechanics and confirmed experimentally yields a power-law relation between the rate of crack development and the range of stress concentration factors: $\frac{d\ell}{dn} = A(\Delta K)^m$.

The constants A and m are evaluated here statistically from experimental data in terms of parameters characterizing the material. From this relation is then derived an equation for the life of a specimen as a function of also the stress amplitude, the yield point of the material, and the crack geometry. This equation, transformed to logarithmic coordinates, is analyzed in terms of mean values and dispersions, with the distribution found to be a log normal one and thus the same as in the case of a constant load. Figures 6; tables 1; references 3: all Russian.

STUDY OF THE STABILITY OF SHELLS UNDER THE COMBINED ACTION OF STATIC AND DYNAMIC LOADS

Kiev PRIKLADNAYA MEKHANIKA in Russian No 1, 1977 pp 27-32 manuscript received 21 Apr 75

MANEVICH, L. I., MIKHAYLOV, G. V., PAVLENKO, I. D. and PROKOPALO, YE. F.,
Dnipropetrovsk State University

[Abstract] Results are given of a study of the instability region of a smooth cylindrical shell during impulsive loading by an external pressure in combination with an external (or internal) transverse static load. Cold-rolled Kh18N9-n sheet steel shells prepared by spot welding on a special device that guaranteed constant shell geometry were tested. Each hermetically sealed shell was placed in a water-filled test chamber consisting of a thin-walled cylinder one meter high and 0.5 m diameter. The impulsive load was applied by electrohydraulic discharge. The transverse load, both external and internal, was produced by compressed air. Six shells were first tested for external static pressure, then eight shells were tested to determine the critical pressure impulse. Then shells were tested for the combined effects. Shells were also tested in air. Stability regions were plotted by the coordinates, "static pressure" and "critical impulse." Maximum deviation of theoretical and experimental values of the areas of stability was 40%. Dependencies of the numbers of the harmonics on static pressure and critical impulse are derived. Ill 5; Biblio 7.

USSR

UDC 621.438.001.5

EFFECT OF THE RELATIVE ORIENTATION OF THE INTAKE PIPE AND THE EXHAUST PIPE ON THE PERFORMANCE OF A GAS TURBINE

Leningrad ENERGOMASHINOSTROYENIYE in Russian No 2, 1977 pp 35-37

GOGOLEV, I. G., D'YAKONOV, R. I. and ZAIKIN, I. D.

[Abstract] The performance of an air-turbine in a Diesel set was studied with three different configurations of intake pipe and exhaust pipe. In the first case (conventional) their planes of symmetry and respective directions of air flow were perpendicular to one another (L-turn). In the other two cases both had a common plane of symmetry, with the air flow in parallel directions (Z-turn) or in opposite directions (Π -turn). All other turbine design parameters were the same. The internal turbine efficiency and the total loss coefficient in the exhaust pipe were measured as functions of the air velocity, and the variation of relative static pressure was measured around the inter-stage gap. According to the test results, the efficiency with a Π -turn is higher and the efficiency with a Z-turn is lower than that with a conventional L-turn, the maximum difference in efficiency reaching a rather significant 2%. This is attributed to differences in the air stream pattern and attendant differences in the power losses along each component throughout the entire turbine. These factors must, therefore, be taken into account in the future design of such air and gas turbines for Diesel applications. Figures 3; no references.

USSR

UDC 621.165.003.13

INFLUENCE OF REGENERATIVE STEAM BLEEDING ON THE ECONOMY OF LOW-PRESSURE STAGES IN STEAM TURBINES

Moscow TEPLOENERGETIKA in Russian No 2, Feb 77 pp 35-39

SIMOYU, L. L., candidate of technical sciences, LAGUN, V. P., candidate of technical sciences, NAKHMAN, YU. V., candidate of technical sciences, and MARKOZOV, N. D., candidate of technical sciences, All-Union "Order of the Red Banner of Labor" Scientific Research Institute of Heat Engineering imeni F. E. Dzerzhinskiy, LMZ Production Association

[Abstract] Since bleeding changes the flow in low-pressure steam turbine stages, optimization of stage operation is needed. The paper gives the results of studies on a scale model bleeder turbine. Regenerative steam was extracted through an annular gap between the third and fourth stages. Stage economy was investigated with regenerative bleeding of 0, 10 and 13% of the steam flow through the turbine. Speeds were 8800 (rated speed), 8000 and 6500 rpm. Input steam pressure and temperature as well as the counterflow pressure were held approximately constant for all modes of operation. The

radial distributions of flow parameters (stagnation temperature and pressure, static pressure and direction of the velocity vector) were measured following the third and fourth stages. The results show that regenerative bleeding can appreciably reduce the economy of the stage preceding the bleed point if consideration of the influence of bleeding is not considered in designing the stage. One should also expect some deterioration of performance due to increased steam leakage through the radial clearance over the working blades because of the drop in static pressure at the periphery and reduced economy of the root sections of the blading as the streamline is elevated. Analysis shows that the efficiency of stages preceding and following the bleed point can be improved by adapting stage design to bleeder conditions, principally by improving flow in the peripheral and root regions. Figures 6; references 5 Russian.

USSR

UDC 621.165.018

INVESTIGATION OF THE ECONOMY OF THE LOW-PRESSURE CYLINDER IN THE LMZ K-200-130 TURBINE BEFORE AND AFTER MODERNIZATION

Moscow TEPLOENERGETIKA in Russian No 3, Mar 77 pp 46-51

MARCHENKO, YU. A., engineer, KHRABROV, P. V., candidate of technical sciences, ROZENBERG, S. SH., candidate of technical sciences, SANDOVSKIY, V. B., engineer, YEFIMOV, A. I., engineer, and SOROKIN, N. A., candidate of technical sciences, Central Scientific Research Design and Planning Boiler and Turbine Institute imeni I. I. Polzunov, LMZ Production Association

[Abstract] A report on updating the LMZ K-200-130 turbine to improve the efficiency of the low-pressure cylinder. The cylinder design before modernization had a one and one half exhaust and low economy due to inattention to steam expansion processes during the design stage (1958). Modifications included improvement of the aerodynamic design and technological manufacture of the guide blading and partitions between tiers of the diaphragm in the Bauman stage. The updated turbine shows an efficiency improvement of 3.8%. Figures 5; table 1; references 7 Russian.

USSR

UDC 621.165.620.193.23

FORMATION OF COARSELY DISPERSED MOISTURE ON THE TRAILING EDGES OF GUIDE VANE ASSEMBLIES IN WET-STEAM TURBINES

Moscow TEPLOENERGETIKA in Russian No 2, Feb 77 pp 31-35

ABRAMOV, YU. I., candidate of technical sciences, SILIN, A. V., engineer, University of People's Friendship imeni Patrice Lumumba

[Abstract] The reliability of any method of predicting erosion and calculating losses due to moisture content and other characteristics in a turbine stage depends on the accuracy of estimating the concentration, size and distribution of moisture droplets. It has been found that such droplets form from the film of moisture on the guide vane assemblies, and that the largest drops appear where the film runs off the trailing edge. In this paper, a high-speed motion picture technique is used to study the dynamics of runoff and moisture-film fractionation. The photographically recorded pattern is supplemented by probe measurements of dispersity based on spectral analysis of samples of droplets collected on a special plate.

It is found that the degree of dispersity of droplet flows following the vanes depends on the geometric parameters of the guide vane assemblies, the shape of the trailing edge of the vane, the density of the steam and the heat transfer to the nozzles. The lift/drag ratio of the vane profile also has an appreciable effect. Edge droplets are smallest for a sharp trailing edge, and therefore it is recommended that the trailing edges of guide vanes should be sharpened. The most important cascade parameters for droplet size is the relative pitch. Increasing the relative pitch from 0.5 to 1.0 can reduce the degree of dispersion of moisture droplets by a factor of 1.5-2.0. Figures 7; references 4 Russian.

USSR

UDC 621.438.001.5

INFLUENCE OF THE DEGREE OF PARTIALITY ON THE AXIAL FORCE IN A TURBINE STAGE

Minsk IZVESTIYA VUZOV ENERGETIKA in Russian No 1, 1977 pp 128-131 manuscript received 19 Feb 76

D'YAKONOV, R. I., DROKONOV, A. M. and SIVAYEV, V. M., Bryansk Institute of Transportation Machine-Building

[Abstract] The Turbine Laboratory at the Bryansk Institute conducted research on the influence of the degree of partiality on the magnitude of the axial force in a turbine stage in one and one-half sections. The experiments were conducted at $M_{c1} \approx 0.75$ and $Re_{c1} \approx 4 \cdot 10^6$. The initial model was a turbine stage with $d/l = 21.6$, with converging rings at the inlet that provided practically uniform flow into the flow section. The degree of partiality of

the first diaphragm was measured in the range of $\epsilon = 0.33-10$. The second diaphragm had full intake. The degree of partiality of a stage clearly has an influence on the reaction rate, which should be taken into account in heat and low calculations. The axial force in a stage is reduced with reduced partiality; in the investigated model it can assume a negative value beyond $\epsilon \approx 0.7$, which indicates the necessity in such a case of using a runner disk without load-relief orifices. Ill 4; Biblio 2.

USSR

UDC 621.165.018.7.004.6

ANALYSIS OF THE IMPULSIVE LOAD-RELIEF CHARACTERISTICS OF LARGE STEAM TURBINES

Minsk IZVESTIYA VUZOV ENERGETIKA in Russian No 1, 1977 pp 74-79 manuscript received 18 Jun 75

KUCHUMOVA, YE. O. and YEKIMOVA, M. M.

[Abstract] Results are given of calculations of impulsive load-relief characteristics of the K-300-240 turbine and an analysis from the point of view of improving the electromechanical transient processes. When the open control principle is used for emergency load-relief through an EGP-1 electro-hydraulic converter it is best to select the one adjustment of the program channel that meets the requirements for the minimum dependence $t_p = f(\Delta M_T)$, where t_p is the duration of load relief and ΔM_T is the extent of load relief, provided the control is by maximum-amplitude pulses. Use of emergency control medium-pressure-component valves through a second EGP-2 greatly enhances the possibility of optimum control and allows the average load-relief time to be reduced to 0.1 sec for $\Delta M_T = 0.3-0.6$. Reducing the time constant for opening the servomotors of the medium-pressure-component valves from 2.0 to 0.5 sec allows the load-relief time to be reduced to 0.1 sec. Ill 3; Tab 1; Biblio 6.

USSR

UDC 621.438.001.5

OPTIMIZATION OF THE INLET GAS TEMPERATURE OF A PEAKING GAS TURBINE POWER PLANT

Leningrad ENERGO MASHINOSTROYENIYE in Russian No 1, 1977 pp 19-22

SHELUD'KO, L. P., OBMOIN, V. V. and CHIRKIN, V. L.

[Abstract] With the main design characteristics and operational modes of the gas turbine power plant taken into account, the authors present a method of computing the economically optimum inlet gas temperature and safe life. An example is given that shows the influence of the start-stop modes on the total service life of the turbine blading. Here the service life of the blades for a steady-state plant mode of operation is 20,000 hours. If a

total of 15,000 start-stop operations are made at the rate of 300 starts per year and 1,000 hrs of operation per year the total service life is reduced to 11,500 hrs; if 5,000 starts are made at the rate of 700 starts per year the service life drops to 3,000 hours. Results are plotted graphically of a calculation of the economically optimum gas temperature and service life of a 60-Mw peaking gas turbine plant with first stage runner of EI 929 and EI893 steels and final stage of EI612K steel. Ill 5; Biblio 4.

USSR

UDC 621.515-253.001.5

ANALYSIS OF A THREE-DIMENSIONAL BOUNDARY LAYER IN THE CENTRIFUGAL WHEEL OF A TURBOMACHINE

Leningrad ENERGOMASHINOSTROYENIYE in Russian No 1, 1977 pp 14-16

SHKARBUL', S. N. and VAL'CHUK, V. S.

[Abstract] The authors discuss the problems and results to date of experimental and theoretical studies of the flow of a viscous fluid in rotating rotors. A model of the flow is given. They conclude: an improved method is available for computing the three-dimensional boundary layer at the confined disks of centrifugal wheels; an algorithm and program are available for computing the boundary layer on the BESM-4M computer for a given field of velocities; a device and method have been developed for studying the boundary layer by injecting dye into the flow; the method of visualization has revealed the strong influence of the rotation of flow on the flow characteristics at the disks and at the blades; this visualization method can be used for both qualitative and quantitative studies. Ill 4; Biblio 9.

USSR

UDC 62-135:533.6.011

INFLUENCE OF BLADE HEIGHT ON SECONDARY FLOW AND LOSSES IN TURBINE CASCADES

Moscow TRUDY MOSKOVSKOGO ENERGETICHNOGO INSTITUTA [Works of the Moscow Energy Institute] in Russian No 294, 1976 pp 8-10

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 2, 1977 Abstract No 2.49.18 by L. P. A.]

MIKESH, IRZHI

[Text] For investigation of secondary flow in cascades at supersonic velocities the author tested the active supersonic flat cascade R-2424 V-1. The experimental investigation revealed that the duration and intensity of

the separation depends on relative height (b/l). So with $b/l = 0.6$ and a flow velocity of $M = 1.4$ one can observe a separation which in the area of maximum curvature of the channel is $0.6 l$. At this velocity and $b/l = 1.2$ the flow is separation-free. The separation is observed at $M = 1.85$ and has a significant height. With further decrease in b/l the separation takes place at higher Mach numbers and the separation spot is decreased. At $b/l = 1.75$ the separation is observed at $M = 1.83$ and is 0.21 on the back of the blade. The separation had a low intensity, and at maximum channel curvature the flow is separation-free. The experiment showed that the pattern given for the separation zone in the interblade channel is directly proportional to the total losses in the cascade. The author examined losses over the cascade height. It was noted that with supersonic separation flow around the impulse cascade the expanse and intensity of the separation zone is reduced with decrease in relative height b/l . The dependence of total cascade losses on relative height is not a monotonically increasing one and has a more complex character that involves the influence of secondary flows on the separation zone. Figures 3.

USSR

UDC 621.165:553.6.011

EFFECT OF TAPER ON OPERATION OF THE STAGES IN PARTIAL REGIMES

Moscow TRUDY MOSKOVSKOGO ENERGETICHNOGO INSTITUTA [Works of the Moscow Energy Institute] in Russian No 294, 1976 pp 3-5

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 2, 1977 Abstract No 2.49.20]

BOGOMOLOVA, T. V.

[Text] The author examined the characteristics of three steam turbine stages in partial operating regimes, matched for identical heat differential, frequency of rotation and low for twisting of the nozzle array $\alpha_1 = \text{const}$ and $\rho_c = 0.2$, but differing in taper. The d/l ratio is 3.3, 2.75 and 2.4. Figures 3.

USSR

UDC 621.43:629.113

THE WORKING PROCESS IN AN ENGINE WITH LAYERED MIXTURE FORMATION AND FORECHAMBER-FLARE IGNITION

Moscow IZVESTIYA VUZOV, MASHINOSTROYENIYE in Russian No 3, 1977 pp 97-102
manuscript received 15 Apr 76

MEKHITIYEV, R. I., Candidate of Technical Sciences, Assistant Professor

[Abstract] The author explains the features of the working process of an engine with an injection system for injecting the fuel into the cylinder and

with flare ignition. He examines the theoretical aspects of the process of mixture formation in the forechamber thus permitting establishment of laws for changing the composition of the ignition and cylinder mixtures in different velocity and load operating regimes of the engine. Figures 2; references 7: 6 Russian, 1 Western.

USSR

UDC 621.165.001.5

INFLUENCE OF HUB RATIO OF A CIRCULAR GRID ON FORMATION OF AN AREA OF ROTATING FLOW SEPARATION

PROBL. MASHINOSTROYENIYA, RESP. MEZHVED. SB. in Russian No 3, 1976 pp 98-104

[From REFERATIVNYY ZHURNAL 49. TURBOSTROYENIYE No 3, 1977 Abstract No 3.49.21]

GOLOSHCHAPOV, V. N.

[Text] A study is made of an experimental investigation of the development of an area of hub separation beyond the compressor of a turbine with a decrease in the d_{av}/l ratio from 18.8 to 1.2. The influence of d_{av}/l on distribution of static pressure and position of lines of equal flow beyond the compressor is demonstrated. The influence of d_{av}/l on the position of the boundary line $\bar{G} = 0$ between the area of the main flow and of the circulation zone is studied. The variation in elementary angular momentum for initial sector of the main flow is established when there is a circulation flow area in the rotating flow beyond the turbine compressor. Figures 4; references 3.

EQUIPMENT
Atomic & Nuclear

USSR

UDC 621.311.25:621.039:697.34

OPTIMIZATION OF THE PROFILE AND CHARACTERISTICS OF NUCLEAR POWER PLANT
EQUIPMENT

Irkutsk METODY MAT. MODELIR. I OPTIMIZ. PARAMETROV, VIDA TEKHNOL. SKHEMY I
PROFILYA OBOUD. ATOM. KONDENSATSION. I TEPLOFIKATSION. ELEKTROSTANTSIY in
Russian 1976 pp 82-89

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 3, 1977 Abstract No 3U103 by
G. I. Korotkina]

ZYKOV, S. A., BUDNYATSKIY, D. M. and KUZ'MIN, V. M.

[Text] The basic characteristics of a nuclear heat and electric power plant are presented for type T-160/220-60 and TK-450/500-60 turbines: the specific exhaust load, number of exhausts, cooling surface of condenser, flow rate of cooling water, area of sprinkling of cooling towers, design temperature of cooling water, design pressure in the condenser, nominal power of turbine, thermal load of turbine, specific production of electric power (net) for thermal consumption; specific consumption of heat (gross) in the condensation mode. Analysis is presented of the expediency of creating nuclear power plants for heat supply. Initial data are presented for this analysis: thermal loading of the region of power consumption $Q_t = 1600-2000$ Gcal/hr, climatic region -- central European USSR, calculated cost of organic fuel replaced 20-25 rubles/ton of standard fuel. The analysis shows that the optimal heat supply factor α for a nuclear heat and electric power plant with 200-500 MW turbines is about 0.6, the difference in economic effectiveness of corresponding versions of a nuclear power plant with $\alpha = 0.6$ and 1.0 being over 100 rubles per year. Results of calculations are presented. The analysis is performed for the following conditions: composition of nuclear power plant equipment -- double blocks with 1000 MW nuclear reactor and K-500-60 or K-500-65 turbines; nuclear power plant equipment -- type VVER-1000 nuclear reactor (RBMK-1000) and K-500-60 (K-500-65) turbines with heat loads of up to 125 Jcal/hr; composition of standard heat and power plant equipment -- units with 980 t/hr steam generators and type T-250/300-240 turbines operating at steam parameters $p_f 240$ kg/cm², 540/540 C; composition of equipment of steam generating plants burning organic fuel -- gas-fuel oil water-heating boilers; composition of equipment of regional electric power plants replaced -- units of 800 MW with K-800-240 turbines; heat supply system from nuclear and conventional power plants and boilers by two-pipe system, from nuclear electric power plant single-pipe system. Table 1; references 3.

USSR

UDC 621.311.22:621.039.001.5

ANALYSIS OF FAULT MODES IN ATOMIC THERMOELECTRIC POWER PLANTS WITH BOILING WATER REACTORS

Leningrad ENERGOMASHINOSTROYENIYE in Russian No 2, 1977 pp 21-24

ALFEROV, N. S., RYBIN, R. A., BALUNOV, B. F., DAVYDOV, S. S., SPIRIDONOV, N. V., PAKHK, E. E. and BAZHANOV, V. V., Planning Department, "Izhorsk" Works

[Abstract] The safety of a two-stage reactor plant with a model VK-100 boiling water reactor, with natural circulation of the coolant, and with two steam generators of the evaporator-condenser type is considered under the two most severe fault conditions: steam leakage in the first stage, or loss of power supplying the plant auxiliaries. First of all, the sequence of events in any such emergency is traced and analyzed. The response and the performance of the protective equipment is then evaluated, on the basis of design and test data. This type of reactor system is found more reliable than one with forced circulation and, therefore, suitable for atomic thermoelectric power plants installed in remote regions of Eastern and Far-Eastern Siberia. Figures 4; references 3: all Russian.

USSR

UDC 539.1.075:681.142.333

AN INSTRUMENT FOR AUTOMATICALLY EVALUATING THE RESULTS OF IONIZATION MEASUREMENTS WITH MULTILAYER DETECTORS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 77 pp 59-61
manuscript received 7 Jan 76

BASHINDZHAGYAN, G. L., PRONIN, V. V. and SINEV, N. B., Scientific Research Institute of Nuclear Physics, Moscow State University

[Abstract] The accuracy of determining the ionization ability of high-energy particles is limited by fluctuations of the ionization loss. The arithmetic mean of multiple readings has been found to be an ineffective estimator, inasmuch as its dispersion is almost as wide as that of the original loss distribution. The use of multilayer detectors for improving the accuracy requires also more intricate evaluation methods. An instrument has been developed which operates on the principle of rank statistics. It automatically processes inputs from 12 or, theoretically, any number of proportional-counter or scintillator layers. There are some practical limitations on the number of channels, to ensure a reliable performance, which is constrained mainly by the instability of the discrimination threshold at the output as well as by the width of the sawtooth voltage pulses triggering the comparator in each channel and by the time constant of the storing capacitor in the memory circuit of each channel. Figure 1; references 9: 5 Russian, 4 Western.

CHARACTERISTICS OF THE $1.5 \times 1.0 \text{ m}^2$ LARGE DRIFT CHAMBER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 77 pp 38-40
manuscript received 21 Jan 76

GOLOVATYUK, V. M., ZANEVSKIY, YU. V., KURYATINKOV, B. K. and PESHEKHONOV, V. D.,
Joint Institute of Nuclear Research, Dubna

[Abstract] The recently developed drift-type ionization chamber has a high time and space resolution ($0.5 \mu\text{s}$ and $\pm 0.1 \text{ mm}$ respectively), a very short dead time ($1.0 \mu\text{s}$) resulting in a high response speed, and the ability to operate in strong magnetic fields. It is feasible to build a large chamber at a relatively low cost, including that of the electronic recording instruments. The drift chamber built at the Joint Institute of Nuclear Research has an active area equal to $1.5 \times 1.0 \text{ m}^2$. It consists of two duralumin holding frames and four electrodes on glass-plastic boards. The interelectrode gap is 6.0 mm wide from cathode to anode, the drift gap is 24 mm wide. This chamber was tested with a Ce^{144} source of β -radiation. The voltage to each of the two cathodes was applied from a separate source so that $V_{\min}$ (at the signal wires) and $V_{\max}$ (at the anode wires) could be varied independently. The efficiency as a function of $V_{\min}$ was measured with $V_{\max}=5.6 \text{ kV}$, the drift time as a function of the path length was measured with $V_{\max}=5.6 \text{ kV}$ and $V_{\min}=1.2 \text{ kV}$, and the drift time as a function of $V_{\max}$ was measured with $V_{\min}=1.2 \text{ kV}$. The threshold level of the signal amplifier-shaper used in this experiment was about $6.0 \mu\text{A}$. Figures 5; references 8: 5 Russian, 3 Western.

USSR

UDC 531.383

EXPERIMENTAL DETERMINATION OF THE REACTION OF A GYROSCOPE IN A GIMBAL SUPPORT TO VIBRATION

Kiev PRIKLADNAYA MEKhanika in Russian No 2, Feb 77 pp 114-118 manuscript received 13 May 75

PAVLOVSKIY, M. A., PETRENKO, V. YE. and SELLER, B. A., Kiev Polytechnical Institute

[Abstract] The purpose of this work is to determine experimentally the frequency range and intensity of translational vibration for which a model of a gyroscope without clearances can qualitatively correctly describe the motion of an actual gyroscopic instrument. To do this, the reactions of a gimbaled gyroscope were studied with input vibration accelerations at 2 g and 6 g in the 40-2000 Hz range. The experimental studies showed that the effect of vibration on gyroscopes in gimbal supports with ball bearings with clearances on the axes of rotation of the frames of the gimbal supports cause single-frequency oscillation only outside the resonant zone. The complex nature of the oscillations of the outer frame in the 120-840 Hz frequency range in these experiments is explained by the presence in actual gyroscopic instruments of significant nonlinearities, the most important of which are clearances in the axes of rotation of the gimbal frames. References 4.

USSR

UDC 534.014:531.383

STUDY OF THE OSCILLATIONS OF A GYROMOTOR ROTOR WITH SMOOTH RESONANCE IN THE AXIAL DIRECTION

Moscow MASHINOVEDENIYE in Russian No 1, 1977 pp 40-45 manuscript received 1 Apr 75, revised 7 May 76

PAVLOVSKIY, M. A. and PETRENKO, V. YE., Kiev

[Abstract] For the translational motion of a gyromotor rotor supported on ball bearings the authors derive equations that take contact deformations and hysteresis-type friction into account. The parameters of the hysteresis loop are determined, and it is shown that the type of simplified curve obtained experimentally for arbitrary deformation values can explain the simultaneous treatment of the nonlinear hertzian relationship and the hysteresis-type friction. It is demonstrated that the values of the portions of soft and hard types of elastic characteristics depend not only on the preload of the ball bearings but also on the parameters of the hysteresis-type friction. Thus the nature and intensity of the resonance oscillations of the rotors of gyromotors are influenced primarily by two nonlinear factors, hysteresis-type friction and elastic characteristics of the rotor bearing. Ill 5; Tab 4; Biblio 11.

USSR

UDC 627.8

BUREYA HYDROPROJECT ON THE BUREYA RIVER

Moscow GIDROTEKHNIЧЕСКОYE STROITEL'STVO in Russian No 1, 1977 pp 14-18

BOYARSKIY, V. M., GRIGOR'YEV, YU. A. and TELESHEV, V. I.

[Abstract] A brief description is given of the engineering and economic fundamentals for the Bureya hydroelectric power plant to be built on the Bureya River, the tributary that flows into the Amur River below Blagovershchensk in the Soviet Far East where the permafrost extends down 25 meters and the air temperature drops to -58°C in winter, reaches 41°C in summer and averages -3.8°C for the year. Annual flow at the site is 27.6 km^3 ; maximum expected flow rate is $31,100 \text{ m}^3/\text{sec}$. Some 80-90% of total annual flow occurs from May to September, and the water level fluctuates 16-13 meters. Two designs are considered: an arch-gravitation dam and a rock-earth dam. The rock-earth dam would be 142 m high and 74 m long at the crest. The penstocks would be 115 m long and 17 x 22 m in cross section to take $14,600 \text{ m}^3/\text{sec}$ of water safely. The penstocks would be lined with 1-meter-thick reinforced concrete. The powerhouse is expected to accomodate six 350-Mw individually operated sets, two in a 220-kw network and four in a 500-kw network. Three transmission lines would carry power to Khabarovsk, Ural-Komsomol'sk and the local area. Preliminary site work was begun in 1976, and the project is to be completed during the Ten-Year-Plan period. The economic and engineering requirements for realization of the project are summarized. Ill 5; Tab 1.

USSR

UDC 62-363

AIR DISTRIBUTION FOR PNEUMATIC POWER DRIVES

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 12, 1977, Cert. No 552458 27 May 75

GAVRILOV, A. N., GODIN, E. M., KEBETS, L. N., BEREGOVY, I. Z., MATSKEVICH, V. I. and KORF, YA. O., Sergo Ordzhonikidze Order-of-Lenin Moscow Institute of Aviation

[Text] 1. Air distributor for pneumatic power drives inside the housing of which are mounted several terminal and one intermediate gate valve, all coupled through a common stem, with the distinguishing feature that, for increasing the efficiency of the drive by eliminating the leakage through the valves, the air duct has been designed so as to allow for independent movement of the terminal gate valves relative to the intermediate one.

2. Same air distributor, except that, for facilitating the said movement of the terminal gate valves, blind axial holes are provided in the last one under the stem and a spring is seated in one such hole to separate the end of the stem from the bottom of this hole.

USSR

UDC 53.07/.08+53.001.89

A RADIATION-RESISTANT CdS(Cu) γ -DOSIMETER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 77 pp 62-63
manuscript received 20 Feb 76

GALUSHKA, A. P., MAK, V. T. and ZASLAVSKIY, YU. I., Institute of Nuclear Research, Academy of Sciences Ukrainian SSR, Kiev

[Abstract] A radiation-resistant semiconductor γ -dosimeter is described here which retains its sensitivity of $6 \cdot 10^{-7}$ - $3 \cdot 10^{-8}$ As/R above 10^{10} R from a Co^{60} source. It is built on a CdS single crystal with copper impurity ($2 \cdot 10^{16}$ - $1 \cdot 10^{17}$ atoms/g) and these copper atoms, situated in cadmium nodes of the lattice, act as the sensitive r-center. The dosimeter current is proportional to the $\frac{6}{5}$ th power of the exposure dose at temperatures within the +15 to -40°C range, but the threshold level varies with the temperature. The measurement error is within 1.0%. The instrument is very stable, its parameters have changed by only 2.0% or less, after 2.5 years of operation. Figures 2; references 4: all Russian.

USSR

UDC 621.039.8(047.3)

UNIFIED SERIES OF γ -DEFECTOSCOPES

Moscow IZOTOPY V SSSR in Russian No 46, 1976 pp 3-9

KODYUKOV, V. M., GRACHEV, A. V. and MAYOROV, A. N., All-Union Scientific-Research Institute of Radiation Engineering, Moscow

DENISOV, YU. G. and ZYUKOV, YA. G., "Baltets" Works, Narva

[Abstract] X-radiography is a method widely used in laboratories and factories for simple and reliable nondestructive quality inspection of materials and products. The recent demand for γ -defectoscopes in the Soviet Union has made it necessary to replace existing instruments by a new series of models which use isotopes Ir^{192} and Cs^{137} as radiation sources in the medium-energy range ("Gammarid 20 to 29", 400-800 keV) and also includes models with low-energy isotopes Tm^{170} , Se^{75} , Sr^{90} , or others ("Gammarid 10 to 19", below 400 keV) as well as models with high-energy isotopes Co^{60} ("Gammarid 30 to 39", 800-1500 keV). The development of the intermediate models "Gammarid 20 to 26" has been completed in and is available since 1973. All these instruments are built with standard components and designed to standard performance specifications (national as well as international standards). They compare well with the better foreign models. Figures 2; tables 2.

USSR

UDC 621.039.8(047.1)

A NEUTRON-TYPE THICKNESS GAUGE FOR COATINGS

Moscow IZOTOPY V SSSR in Russian No 47, 1976 pp 34-36

PEKARSKIY, G. SH., KURAPOV, V. N., D'YAKOV, YU. G., and YEFIMOV, P. V., Scientific Research Institute of Electronic Penetroscopy, Tomsk

[Abstract] A neutron-type gauge has been designed for contactless measurements of the thickness of thin coatings with an anomalously large cross section for absorption of thermal neutrons on any conventional structural material with a small cross section for the absorption of these neutrons. The attenuation of the neutron flux in such coatings (lithium, boron, silver, cadmium, indium, samarium, europium, gadolinum, dysprosium, erbium, hafnium, gold) may be considered exponential. The instrument consists of a shield-moderator unit that contains a neutron source (Cf^{252} , $1.4 \cdot 10^7$ neutrons/s), a detector of slow neutrons with an emitter follower, and a data processing unit which includes a recording device and a power supply. The instrument operates in the discrete mode. One measurement requires 60 seconds, its precision ranges from $\pm 1.0 \mu\text{m}$ (gadolinum coatings 0-20 μm thick) to $\pm 20 \mu\text{m}$ (lithium, rhodium, silver, indium, erbium, hafnium, gold 3.0-4.0 mm), and covers an area of 1.0-600 mm^2 . Figures 2; tables 1.

USSR

UDC 620.179.16

A LOW-FREQUENCY ACOUSTIC DEFECTOSCOPE FOR INSPECTION OF REINFORCED PLASTICS AND GLUED STRUCTURES

Sverdlovsk DEFEKTOSKOPIYA in Russian No 1, Jan-Feb 77 pp 115-119 manuscript received 2 Apr 76

VINOGRADOV, N. V., TSORIN, YE. I., FILIMONOV, S. A., LANGE, YU. V. and MURASHOV, V. V., All-Union Scientific Research Institute of Nondestructive Inspection, Kishinev; Scientific Research Institute of Penetroscopy, All-Union Scientific Research Institute of Aviation Materials, Moscow

[Abstract] A universal acoustic defectoscope, model AD-10U, has been developed for the inspection of glued joints in multilayer metallic or nonmetallic structures and for the detection of peeling in products made of laminated plastics. Unlike the existing continuous-mode model UVFD-1 instrument it replaces, it operates with a source of pulsed elastic vibrations so that interference effects are greatly reduced. The model AD-10U instrument is designed for three modes of acoustic defectoscopy, depending on the test objects, namely: 1) amplitude method of detection in the case of shallow defects and pores as well as zones with deficient or excessive glue content, 2) phase method of detection in the case of deeper defects such as in glued joints with a uniform-thickness top layer, and 3) time method of detection

with bilateral access. The minimum detectable defect area is 1.5 cm^2 , the maximum depth of detectable defects is 25 mm, the dead edge zone is 10 mm wide, the transducers operate at the frequencies of 25, 40, and 60 kHz. Figures 1; references 6: all Russian.

USSR

UDC 531.14.087.92-522.6

A FLUIDIC DISPLACEMENT SENSOR

Moscow STRUYNAYA TEKHNKA. SHESTAYA MEZHDUNARODNAYA KONFERENTSIYA. TEZISY DOKLADOV [Fluidics. Sixth International Conference. Abstracts of the Reports] in Russian, "Nauka," 1976 pp 359-363

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNKA No 2, 1977 Abstract No 2.32.273 by P. N. A.]

PEREDREY, YU. M., GANTMAN, S. A. and KASIMOV, A. M.

[Text] Metal-cutting machine tools require displacement sensors that ensure positioning of working elements or automatic monitoring equipment within $1 \mu\text{m}$, and an error of no more than $0.1-0.01 \mu\text{m}$ in the linear displacement sensor. The authors consider the problem of designing a displacement sensor based on fluidic modules, and in particular using the operating peculiarities of a bistable fluidic module constructed on the basis of the Coanda effect. A fluidic microdisplacement sensor is developed with adjustable zone of insensitivity, which is especially important when designing systems for active control of the machining of workpieces on metal-cutting machine tools. The sensor is based on fluidic module 33-1 of the SMST-2 system developed at the Institute of Control Problems, Academy of Sciences USSR. A schematic is given along with a diagram of operation of the sensor. Figures 6; references 2.

USSR

UDC 531.14.087.92:62-522.6

A NON-CONTACT FLUIDIC MEASUREMENT DEVICE FOR TECHNOLOGICAL EQUIPMENT

Leningrad PRIBORY I USTROYSTVA STRUYNNOY TEKHNIKI [Fluidic Instruments and Devices, Collection of Works] in Russian 1976 pp 60-64

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNKA No 2, 1977 Abstract No 2.32.274]

MAMICHEVA, V. A. and POCHTAR', YU. S.

[Text] Two types of fluidic non-contact sensors are described: with a focused annular flow, and with focused jets. An analysis of the static

characteristics of these sensors showed that for selected sensor parameters and supply pressures a working range of 5-6 mm is feasible for the sensor with annular flow, and 8-9 mm for the sensor with focused jets. The studies showed that the sensor with annular flow gives more stable characteristics. Figures 3.

USSR

UDC 681.121.089.6

A BELL-JAR INSTALLATION FOR PRECISION REPRODUCTION AND MEASUREMENT OF LARGE RATES OF GAS FLOW

Moscow SOVREMENNYYE METODY I PRIBORY AVTOMATICHESKOGO KONTROLYA I REGULIROVANIYA TEKHNOLIGICHESKIKH PROTSESSOV [Modern Methods and Equipment for Automatic Monitoring and Control of Technological Processes, Collection of Works] in Russian 1976 pp 56-59

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 2, 1977 Abstract No 2.32.607]

BRODIN, I. S., KALICHAK, O. V. and SEREDYUK, O. YE.

[Text] Based on a gas measurement bell jar with a volume of 25 cu. m, a system is developed for precision reproduction and measurement of large rates of gas flow up to $2.2 \text{ m}^3/\text{s}$ ($8,000 \text{ m}^3/\text{hr}$). The system is designed for graduating and checking industrial gas counters and flowmeters. The system is made so that the measurement range can be varied, and so that a digital computer can be used for processing measurement data. Figure 1.

USSR

UDC 681.121.089.6

A FLOWMETER INSTALLATION WITH FLUID DISPLACEMENT OF GAS AT HIGH PRESSURES

Moscow SOVREMENNYYE METODY I PRIBORY AVTOMATICHESKOGO KONTROLYA I REGULIROVANIYA TEKHNOLIGICHESKIKH PROTSESSOV [Modern Methods and Equipment for Automatic Monitoring and Control of Technological Processes, Collection of Works] in Russian 1976 pp 51-55]

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 2, 1977, Abstract No 2.32.608]

PODKOPAYEV, K. P., KIVILIS, S. S. and DANILOV, M. A.

[Text] Several types of master flowmeter installations for gases are being developed and have already been made. They have an error of 0.3-0.5% with

consideration of scaling of the gas state parameters. For low pressures, one can use gas flowmeter arrangements of open type that operate on the principle of filling a measurement vessel with the gas, and displacement of the gas from the vessel by a fluid piston. The use of master fluid flowmeter installations of closed type enables extension of the range of static gas pressures to 10 MN/m^2 and raises the upper limit of reproducible gas flowrate to $3.0 \text{ m}^3/\text{s}$. Figure 1; table 1; references 6.

USSR

UDC 536.532(088.8)

A TEMPERATURE SENSOR

USSR Author's Certificate No 494627, filed 3 Jun 74, published 3 Aug 76

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 2, 1977 Abstract No 2.32.804P]

GODIN, YU. G. and BARANOV, V. G., Moscow Engineering Physics Institute

[Text] A temperature sensor is proposed with a two-electrode sensing element. To improve sensitivity and measurement precision in the range of $500\text{--}1600^\circ\text{C}$ the electrodes are made from materials that have different partial pressures of oxygen, e.g. from $50\% \text{ Fe} + 50\% \text{ FeO}$, and from $50\% \text{ Ni} + 50\% \text{ NiO}$, and between the electrodes is a solid electrolyte with oxygen-anionic conductivity, such as $99\% \text{ ThO}_2 + 1\% \text{ CaO}$. Figure 1.

USSR

UDC 532.57:621.325.826

FREQUENCY TRANSFORMATION UNIT FOR AN LDV

TR. TSENTR. AERO-GIDRODINAM. IN-TA in Russian No 1750, 1976 pp 265-269

[From REFERATIVNYY ZHURNAL 32. METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 3, 1977 Abstract No 3.32.782]

SEMEYKIN, N. P. and FIL', V. A.

[Text] The design of frequency transformation unit of a laser doppler velocimeter is analyzed. The use of this unit in the measuring system of the LDV with automatic frequency tuning allows tracking of the doppler signal from 1 to 200 MHz in a single band. The use of the block diagram of the unit with double frequency conversion is justified and recommendations are given for selection of the operating frequencies in order to produce the minimum level of combined interference frequencies. Problems of the realization of

USSR

UDC 621.375.826:535.37

LUMINESCENT RADIATION ENERGY METER FOR A Q-MODULATED LASER

Moscow METROL. OBESPECHENIYE IZMERENIY OPTIKO-FIZ. PARAMETROV IZLUCH. OKG in Russian 1976 pp 105-108

[From REFERATIVNYY ZHURNAL 32. METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 3, 1977 Abstract No 3.32.1346 by P. N. A.]

ARTEMENKO, V. A., KRIVCHIKOV, A. P., RUBINSHTEYN, B. I. and SOLOV'YEV, V. S.

USSR

UDC 621.317.39:536.53

A DEVICE FOR MEASUREMENT OF TEMPERATURES IN WELLS

Moscow AVTOMATIZ. KHIM. PROIZ-V in Russian No 5, 1976 pp 61-64

[From REFERATIVNYY ZHURNAL 32. METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 3, 1977 Abstract No 3.32.874]

KON'KOV, V. F., KHOMCHENKO, A. I., YELISEYEV, V. I. and CHEKALIN, G. M.

[Text] A device is suggested, consisting of a surface and vibration and shock-resistant immersible parts for the measurement of temperatures in wells up to 200 C with a measurement error of ± 0.1 C, having high reliability. The operation of the device is based on the use of the linear variation of resonant frequency of elastic mechanical oscillations of a thermally sensitive quartz resonator with temperature. Figures 2; references 4.

USSR

UDC 621.375.826

INSTALLATION FOR RELATIVE MEASUREMENTS OF THE WAVE LENGTH OF HIGHLY STABLE LASERS

Moscow METROL. OBESPECHENIYE IZMERENIY OPTIKO-FIZ. PARAMETROV IZLUCH. OKG in Russian 1976 pp 75-78

[From REFERATIVNYY ZHURNAL 32. METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 3, 1977 Abstract No 3.32.1344 by P. N. A.]

BIKMUKHAMETOV, K. A., BOBRIK, V. I. and TOROPOV, A. K.

[Text] At the present time, the stability and reproducibility of the radiation frequency of certain lasers is 10^{10} - 10^{14} . The accuracy of the method of absolute measurement of wavelengths is $2 \cdot 10^8$ and is limited by the reproducibility of the primary standard wavelength of radiation of krypton 86. There are no such limits on relative measurement and they can be performed with an accuracy of 10^{10} and higher. The Siberian Scientific Research Institute for Metrology has developed a model test installation for measurement of the ratio of wavelengths of two lasers. The installation described allows the ratio of wavelengths of lasers to be measured with an accuracy determined by the stability of the radiation frequency of the lasers being compared. Figures 4; references 6.

LUMINESCENT RADIATION ENERGY METER FOR A Q-MODULATED LASER

Moscow METROL. OBESPECHENIYE IZMERENIY OPTIKO-FIZ. PARAMETROV IZLUCH. OKG in Russian 1976 pp 105-108

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 3, 1977 Abstract No 3.32.1346 by P. N. A.]

[Text] A pulsed laser radiation energy meter is described, using the effect of resonant luminescence and operating at 694-mm wavelength. The principle of transformation of pulsed radiation energy with transformation of length consists in the following. The laser pulse, with a length of less than 10^{-2} s, strikes a ruby crystal and practically instantly excites it at 2 wavelengths. After completion of excitation, luminescence is observed, the intensity of which decreases exponentially. The energy of the luminescence is equal to the energy absorbed by the crystal and, consequently, is proportional to the energy of the laser pulse. Ordinary photoreceptors can be used to record the luminescence without the danger of their breaking. The ruby converter can withstand a power density on the order of 10^8 - 10^{10} W/cm². The instrument developed is described, and has the following technical characteristics: measurement range $31.4 \cdot 10^6$ -31.4; radiation pulse length 10^{-9} - 10^{-6} s; wavelength 6943 ± 3 Å; maximum radiation energy density 10 J/cm²; digital indication. The instrument is calibrated using a standard instrument. Mean square error is 4.2%. Figures 3.

A PNEUMATIC ANEMOMETER

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 12, 1977 pp 18-19

SHKATOV, YE. F., candidate of engineering sciences

[Abstract] Different types of hot-wire anemometers are ordinarily used to measure slight rates of gas flow in industrial equipment, but readings are considerably distorted when using these types for flows of dispersed media, as the result of interaction between solid and liquid particles and the meter itself. The different methods of mechanically separating particles distort the nature of movement of the flow at the measuring point. In this paper a description is given of an anemometer which does not have these disadvantages. Its operating principle is that of a pneumatic jet output amplifier. Since it is necessary that the output signal of its primary transducer depend solely on the rate of flow of the gas being measured, it is necessary to eliminate the influence of the temperature of the gas flow being measured. This is achieved by designing the device so that the

discharge of compressed air from the feed nozzle is turbulent and through the controlled nozzle laminar. The anemometer consists of three concentric tubes with an overall outside diameter of 10 mm, in a jacket, on which is placed a choke-type transducer of unbalanced bridge design. The anemometer is supplied with compressed air from the control and measuring instrument system via a control. A detailed description and sketch are given of the probe and choke-type transducer. A differential fluid manometer graduated accordingly can be used as the second instrument. An anemometer of this type must be calibrated individually. Equations are derived and a table is given when make it possible to determine the main parameters of a pneumatic anemometer. The rate of flow of a gas is determined by removing the protective cap from the probe's measuring heat and inserting the probe into the gas stream perpendicular to the oncoming flow. This anemometer was assigned to precision class two as the result of industrial tests and in 1976 it was awarded the bronze medal at the USSR Exhibition of Economic Achievements. It is now being used to make dust and gas measurements in gas purification systems. Introduction of this anemometer in industry has resulted in an annual savings of 12,000 rubles per year.

USSR

UDC 536.531

THE KRION 1-2 INSTRUMENT FOR MEASURING LOW TEMPERATURES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 76 p 237

DANILEVICH, R. I., ZARUBIN, L. I. and NEMISH, I. YU., Institute of Semiconductors, Academy of Sciences UkrSSR, Kiev

[Text] The instrument is designed for measuring temperatures in the range of 4-300 K. Temperature readout is direct. The display is a meter with a pointer. Different modifications may have even narrower intervals of temperature measurement.

The sensor of the instrument is a miniature semiconductor resistance thermometer connected in a three-wire circuit. The power dissipated by the sensor at 4.2 K is about 10^{-6} W. A magnetic field of up to 60,000 oersteds introduces an error of no more than 1% of the absolute value of the temperature being measured.

Power supply is from an internal source or a 220 volt line. The instrument measures 195 x 135 x 135 mm. Figure 1

DEVICE FOR MEASURING THE THRUST OF A TURBOJET ENGINE

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 12, 1977, Cert. No 552535 12 Dec 75

ASKOL'DOV, V. V., FEDOSEYEV, V. N., NIKITIN, V. G., POPOV, G. A., LYUBAVIN, YU. A., CHUMAKOV, A. V., RADER, E. I. and PERLOVSKIY, M. I.

[Text] 1. Device for measuring the thrust of a turbojet engine, consisting of a set of instrument transducers which include inlet-temperature and nozzle-area transducers, this set being coupled to a computer whose output is connected through a matching mechanism to an indicator, with the distinguishing feature that, for higher accuracy and more universal applicability, this set of transducers includes also Mach-number and pressure-drop transducers in the nozzle, while the computer is also coupled to a set of comparators and the latter is coupled through a set of relays to the thrust-coefficient meter, the inputs of this meter being connected to the Mach-number transducers and the inlet-temperature transducers and the outputs of this meter being connected to a memory unit, with the input of the latter connected to the nozzle area and pressure-drop transducers through a stage in which the constant term of the thrust equation is computed. 2. Same device, except with the thrust-coefficient meter and the constant-term computing stage coupled to a control unit.

DIFFERENTIAL STRING TRANSDUCER FOR MEASURING ACCELERATION

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 13, 1977, Cert. No 553540 31 Dec 74

SHIROCHENSKIY, A. YE., S. Ordzonikidze Order-of-Lenin Moscow Institute of Aviation

[Text] 1. Differential string transducer consisting of a sensing element, two self-excited oscillators whose tank circuits are connected to the sensing element, a difference-frequency generator (difference between the two oscillator frequencies), a vibroprobe, a magnetoelectric mechanism whose coil is placed on the sensing element and connected to the vibroprobe output, and a frequency-pulse servomechanism connected to the difference-frequency generator, this servomechanism consisting of a controlled frequency divider with diodes, OR-logic elements, and a reversible counter, with the distinguishing feature that, for extending the range of measurements, this differential transducer also incorporates a decoder whose output connected to the coil of the magnetoelectric mechanism and whose inputs connect to the outputs of triggers for the preceding digits on the reversible counter. 2. Same differential transducer, except

that, for producing a frequency-pulse output signal, it is provided with an additional OR-logic element whose inputs connect to the output of the main OR-logic element and to the outputs of the diodes, the latter being coupled to the triggers of the reversible counter controlling the decoder.

USSR

UDC 531.788

VACUUMETER

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI
in Russian No 13, 1977, Cert. No 553507 22 Dec 75

MOLOTOV, P. E., YELISEYEV, A. P. and SEN'KEVICH, V. G., S.P. Korolev Order-of-Red-Star-Labor Kuybyshev Institute of Aviation

[Text] Vacuumeter consisting of a housing inside which a spherical rotor is freely suspended, an inductor for electromagnetically untwisting the rotor, and a device for measuring the angular rotor speed, with the distinguishing feature that, for increasing the accuracy of measurements and extending them into the low-pressure range, current-conducting electrodes with hermetic leads for connection to a dc voltage source have been mounted on the inside spherical surface of the housing made of a translucent dielectric material.

USSR

UDC 681.121.4

DEVICE FOR MEASURING THE FLOW RATE OF A LIQUID OR A GAS

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI
in Russian No 12, 1977, Cert. No 552510 11 May 75

MEZNEV, A. V., CHUMAKOV, A. G. and SPEYSKIY, S. L.

[Text] Device for measuring the flow rate of a liquid or a gas, consisting of a multijet cylindrical tangentially mounted chamber and a rotor inside which constitutes the sensing element free to rotate unsupported, and a signal receiver, with the distinguishing feature that, for ensuring a higher measurement accuracy and obtaining a more stable calibration curve, the rotor has been designed in the shape of a ball whose diameter is not smaller than 75% of the inside diameter of the cylindrical chamber and with a hermetically closed cavity in the top part, while the end surfaces of this cylindrical chamber are spherically concave with a radius 10-15 times larger than the rotor radius.

USSR

UDC 535.215.4:537.312

A METALLIC ULTRA-HIGH-VACUUM APPARATUS FOR PHOTOELECTRICAL MEASUREMENTS WITHIN THE $h\nu \leq 10.9$ eV RANGE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 77 pp 178-179
manuscript received 26 Mar 76

ADAMCHUK, V. K., FEDOSEYENKO, S. I. and ALEKSANDROV, V. M., Leningrad State University

[Abstract] A versatile laboratory apparatus including a chamber of stainless steel has been developed for studying thin films and single crystals under deep vacuum (10^{-10} - 10^{-12} torr) by means of optical and photoelectronic spectroscopy. Monochromatic light (1000-3600 Å) is produced and controlled by a system of optical devices, prevacuum is attained within 16 h without heating, and full vacuum is attained in 20 h with heating to 350°C. Both bulk and surface properties such as, for instance, the work function can be measured here with suitable electrodes and the formation of various interphase boundaries can be examined by barrier measurements. Figures 1; no references.

USSR

UDC 621.521

A TITANIUM SORPTION PUMP FOR A DETECTOR OF MOLECULAR BEAMS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 77 pp 174-176
manuscript received 28 Nov 75

AKIMOV, V. M., VOLKOV, A. I. and RUSIN, L. YU., Institute of Chemical Physics, Academy of Sciences USSR, Moscow

[Abstract] Chemical reactions in crossed molecular beams are studied with the aid of a detector which usually consists of a buffer chamber, an ionization chamber, and a mass analyzer with a differential suction system. For reducing the residual pressure inside the ionization chamber, so as to ensure a high signal-to-noise ratio, a small high-speed vacuum pump has been developed with a titanium anode. The latter is bombarded with electrons from the surrounding ring cathode and its surface is cooled with liquid nitrogen to 77°K. Under typical operating conditions (anode voltage 1.0 kV and emission current 90 μA) titanium evaporates at the rate of 10 mg/h and 3.5 g of it will ensure continuous service for 350 h. At the deepest attainable vacuum of $5 \cdot 10^{-10}$ torr the residual gas contains water vapor, nitrogen, and argon, no hydrocarbons. The pumping capacity (air 170 l/s, nitrogen 190 l/s, hydrogen 550 l/s) remains constant within the 10^{-6} - $5 \cdot 10^{-10}$ torr range of pressures. Figures 2; references 8: 4 Russian, 4 Western.

USSR

UDC 620.179.14:669.14.018.24

DEVELOPMENT AND STUDY OF AN AUTOMATIC DEFECTOSCOPE FOR TESTING OF BALING WIRE OF ShKh15 STEEL

TR. VSES. N.-I., KONSTRUKT.-TEKHNOL. IN-TA PODSHIPNIK. PROM-STI in Russian No 4(90), 1976 pp 73-84

[From REFERATIVNYY ZHURNAL 32. METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 3, 1977 Abstract No 3.32.184]

SOLOMATIN, N. A. and PRESNYAKOV, E. B.

[Text] The DT-901 combined defectoscopic installation, developed at the All-Union Scientific Research Institute for the Bearing Industry is described. This instrument is designed for testing of cold-drawn baling wire of ShKh15 steel, and consists of a scanning device with an eddy current transducer, an electronic instrument, mechanical sections for cleaning and straightening the wire. The design and block diagram of the main units of the defectoscopic installation type DT-901 are analyzed, as well as their operating principles. Results are presented from production testing and introduction of the installation at an industrial plant. Table 1; references 5.

USSR

UDC 535.2

A SCANNING INSTRUMENT FOR VISUALIZING TRANSVERSE DISTRIBUTION OF SUBMILLIMETER RADIATION FIELDS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 76 pp 102-104 manuscript received 22 Jan 76

ZAV'YALOV, V. V. and VORONIN, V. I., Institute of Physical Problems, Academy of Sciences USSR, Moscow

[Abstract] The paper describes a scanning instrument for obtaining a visible image of the transverse distribution of microwave fields. The device uses semiconductor photocells and scans the submillimeter beam with a 23 cm Nipkow disk 1 mm thick made of duralumin with 15 apertures 3 mm in diameter located on a single-turn Archimedes spiral. In addition the disk has a row of 15 apertures for horizontal sync, and one aperture for vertical sync located between a light source and synchronizing photodiodes. The trapezoidal frame measures 40 mm in height with bases of 30 and 45 mm. Scanning frequency is 75 frames per second. The photocell is cooled in a cryostat with a resultant improvement in threshold sensitivity to $0.1 \mu\text{W}/\text{cm}^2$. Boron-doped germanium is used for the 50-130 μm wave band, and indium antimonide is used at wavelengths of 130-300 μm . The output signal is amplified and combined with the Y-coordinate of an oscilloscope, giving a relief image of the beam cross section. The electronic part of the device is described, and examples are given showing the power distribution of a laser beam cross section. The authors thank G. D. Bogomolov for useful discussion. Figures 2; references 4: 1

Russian, 3 Western.

USSR

UDC 621.314.26

INVESTIGATION OF THE CHARACTERISTICS OF INFRARED SENSORS WITH OPTICAL
FREQUENCY CONVERSION BASED ON LiIO_3 AND LiNbO_3 CRYSTALS

Moscow PRIBORY I TEKNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 76 pp 155-157
manuscript received 11 Feb 76

BARASHKOV, M. S., DUGIN, V. S., MATVEYEV, I. N., PSHENICHNIKOV, S. M. and
UMNOV, A. F.

[Russian abstract provided by the source]

[Text] An investigation is made of the following characteristics of infrared sensors with frequency conversion: conversion efficiency, sensitivity, angle of field of view and resolution in the image reception mode. LiIO_3 and LiNbO_3 crystals were used as the converters. For a sensor based on a lithium iodate crystal the conversion efficiency is 20%, sensitivity 1 nW, angle of view 40° , resolution 15 lines/mm; for a sensor based on a lithium niobate crystal the conversion efficiency is 11%, sensitivity 3.6 nW, angle of view $1^\circ 30'$ and resolution 25 lines/mm. Figures 3; references 12: 8 Russian, 4 Western.

USSR

UDC 531.741

A SYSTEM FOR PRECISION CONTROL OF ANGULAR DISPLACEMENTS WITH INERTIALESS
SHAPING OF THE MISMATCH SIGNAL

Moscow PRIBORY I TEKNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 76 pp 215-219
manuscript received 15 Dec 76

SURAMANOV, R. F., Physicotechnical Institute, Academy of Sciences USSR,
Leningrad

[Russian abstract provided by the source]

[Text] The paper describes an automated system of angular displacement that uses a shaft rotation to digital code converter and a light-beam control device. The system permits control of displacements of several mechanically unconnected objects about a common axis over a wide range of angles. An inertialess mismatch signal shaping device for the light-beam control unit improves the accuracy of automatic control of angular displacements of objects without loss of stability of the system. When a multidigit converter of shaft rotation to digital code is used, the error of setting objects in predetermined angular position does not exceed a fraction of a minute of arc. Figures 4; references 2 Russian.

USSR

UDC 620.179.163

IMAGE ECHO METHOD OF ULTRASONIC TESTING

Moscow ZAVODSKAYA LABORATORIYA in Russian No 2, 1977 pp 206-209

GOLODAYEV, B. G. and RAZUMOVSKIY, A. F.

[Abstract] Experimental verification and experience in the image echo method of flaw detection at 2.5 MHz have shown that when the DUK-6V defectoscope and the ASD-4V signalling device are used it is possible to reveal flaws 1.5-2.0-mm in diameter situated 2.0 mm and more from the surface of the ultrasonic probe. Parts made of aluminum and titanium alloys can be tested in cross sections up to 100 mm; the cross sections of stainless steel parts should not be greater than 30-40 mm because of their higher attenuation factors. Biblio 6.

CZECHOSLOVAKIA

A DEVICE FOR MEASURING BEAM-LEAD CHIPS

Prague JEMNA MECHANIKA A OPTIKA in Czech Vol 21, No 9, Sep 76 pp 282-283
manuscript received 28 Apr 76

LIS, Vladimir; TESLA - A. S. Popov's Research Institute for Telecommunication
Research, Prague

[Abstract] Testing of chips is made very difficult because of their very small dimensions; therefore they must be handled by devices designed specifically for this purpose. Handling of the chips is achieved by a vacuum needle. The chip is located on a metal plate under the microscope, and its position is fixed magnetically. Individual parts of the device are moved hydraulically. The hydraulic system is very sensitive and accurate. Figures 11.

USSR

UDC 528.722.6

DEVICE FOR AUTOMATIC RECOGNITION OF IDENTICAL POINTS ON COLOR PHOTOGRAPHS OF A STEREOCOUPLE

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI
in Russian No 13, 1977, Cert. No 553444 27 Feb 76

ZHURKIN, I. G. and SHAVEN'KO, N. K., Moscow Institute of Geodetic, Aerial
Photographic, and Cartographic Engineers

[Text] Device for automatic recognition of identical points, consisting of two identical photoelectric transmitter sets, the latter including a cathode-ray tube and a photograph holder each, both movable relative to one another and separated by an optical projection system, and a photoelectric receiver set, also of an analyzer set whose input connects to the outputs of the two photoelectric receiver sets and whose output connects to the drive mechanism which moves the photograph holders and the cathode-ray tubes relative to one another, with the distinguishing feature that, for a more accurate and reliable recognition of points, the photoelectric receiver set in each photoelectric transmitter set comprises an optical focusing system with a dispersing element optically coupled to it and with a three-channel photoelectric converter mounted behind, each channel including a photomultiplier, an interference filter placed in front, and a normalizing amplifier whose input connects to the photomultiplier and whose output connects to the analyzer set, the gain of each normalizing amplifier being determined from the relation

$$K \cdot P_{\lambda} \cdot C_{\lambda} = \text{const},$$

where K is the gain, P_{λ} is the sensitivity of the cathode-ray tube to wavelength λ , and C_{λ} is the sensitivity of the photomultiplier to wavelength λ .

USSR

UDC 621.375.826

A 0.63 μm LASER WITH NEON ABSORPTION CELL

Moscow METROL. OBESPECHENIYE IZMERENIY OPTIKO-FIZ. PARAMETROV IZLUCH. OKG
in Russian 1976 pp 128-133

[From REFERATIVNYY ZHURNAL 32. METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 3,
1977 Abstract No 3.32.1350 by P. N. A.]

KOLOMNIKOV, YU. D.

[Text] An Ne-Ne laser with a neon absorption cell operating at 0.63 μm is the first laser in which radiation frequency is stabilized by means of the peak of output power. The laser with nonlinear absorption cell allows

production of high frequency stability and high reproducibility of frequency (wavelength) of laser radiation, exceeding the reproducibility of the wavelength of the krypton standard. The laser light source has tremendous coherence length and great brightness of radiation, allowing it to be used in various measurement devices. The properties of the instrument, developed at the Siberian Scientific Research Institute for Metrology, are described. The reproducibility of the frequency of the laser is at least 10^{-9} , the radiated power 0.3-0.2 mW. The wavelength is $0.63299151 \pm 3 \cdot 10^{-8} \mu\text{m}$. The output characteristics correspond to the requirements of GOST 8.101-73 for an operating standard for a unit of length for spectroscopy. Figures 2; references 16.

USSR

UDC 621.378.33

INVESTIGATION OF THE RADIATION SPECTRUM OF A GAS LASER WITH A METHANE CELL FOR $\lambda = 3.39 \mu\text{m}$.

Novosibirsk AVTOMETRIYA in Russian No 1, 1977 pp 75-79 manuscript received 14 Jul 75

BORISOVSKIY, S. P., TESELKIN, V. V., and SHLYKOVA, S. P., Ryazan'

[Abstract] A He-Ne laser was constructed with a flat mirror with 70% reflectivity and a spherical mirror ($R=2\text{m}$) with 98% reflectivity. For a methane partial pressure $P_m = 0.02 \text{ mm Hg}$, He:Ne = 17:1, a resonator length $L = 300 \text{ mm}$, which was adjusted so that $c/2L = 200 \text{ MHz}$, a second peak that was displaced from the main peak by a frequency difference of $c/4L$ was observed at a He+Ne partial pressure above $P_n = 2.8 \text{ mm Hg}$. Here the length of the methane cell was $\ell = 300 \text{ mm}$. For longer resonators ($L = 400 \text{ mm}$) with He:Ne = 10:1, $P_m = 0.02 \text{ mm Hg}$, $c/2L = 125 \text{ MHz}$, a third peak was observed for P_n above 2.1 mm Hg . The third peak was generated by the TEM_{01} mode. For $P_n = 2.8 \text{ mm Hg}$, the contrast of the first two peaks is greatest for $P_m = 0.02 \text{ mm Hg}$ for $\ell = 300 \text{ mm}$ ($L = 400 \text{ mm}$), but for $P_m = 0.04 \text{ mm Hg}$ for $\ell = L = 400 \text{ mm}$. The behavior of the radiation spectra can be explained by adding the contributions of the various characteristic frequencies of the resonator at different instants of time. The results can be used to obtain a precision stabilization of the gas laser radiation spectrum at $\lambda = 3.39 \mu\text{m}$, not only in the single-frequency regime, but also in the double and triple frequency regimes. Moreover, the frequency dependence of the radiation power in the double-frequency regime can be used for a more exact centering of the methane absorption line with the neon amplification line, which in turn will improve the stability and reproducibility of the laser in the single-frequency generation regime.

USSR

UDC 621.398.694.4-531.4

A PHOTOELECTRONIC INSTRUMENT FOR STUDYING THE ANGULAR FLUCTUATIONS OF LIGHT

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 77 pp 207-210
manuscript received 11 Feb 76

SEBKO, S. YE., KLIMASHIN, V. P. and MATVEYEV, I. N.

[Abstract] A photoelectronic instrument is described here which makes it possible to study the angular fluctuations of light over a wide frequency range. The output signal does not, within certain limits, depend on the intensity of the light coming through an aperture into the xy-photoreceiver. This instrument operates according to the sum-difference method of extracting a mismatch signal along both coordinates. The photoelectric angle transducer is a four-quadrant photoreceiver. It is followed by a summing stage, a summing-and-subtracting stage, two phase detectors, a detector with automatic gain control, and a dc amplifier (amplifier of the envelope of light-intensity fluctuations). The electrical circuit components include 4 transistors, 6 diodes, 6 field-effect transistors, and 12 operational amplifiers. The performance of this instrument was checked on a light beam with 30% modulation at 50 kHz. Its direction finding characteristic has also been established, with the following parameters: sensitivity to displacement $0.135 \text{ V}/\mu\text{m}$ at a modulator input power equal to 0.8 mW, and less than 3.0 dB nonuniformity over the 0-5000 Hz frequency range. The amplification of the electric signal is at least 350, the error of signal extraction is within 8.0% during intensity fluctuations within 20 dB. The instrument is suitable for short ranges within which atmospheric turbulence shifts the energy center "of gravity" of the light spot by not more than $\pm 65 \mu\text{m}$ in the focal plane of the optical system. Figures 4; references 9: 7 Russian, 2 Western.

USSR

UDC 681.7.064.4

STUDY OF NEUTRAL GLASS LIGHT FILTERS

TR. METROL. IN-TOV SSSR. VNII METROL. in Russian 1976 No 193(253) pp 56-58

[From Moscow REFERATIVNYY ZHURNAL 32. METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 1, 1977 Abstract No 1.32.1362]

GRIGOROVICH, N. N., KIR'YANOVA, G. N. and NIKONOVA, YE. I.

[Text] Results are presented from comparison of photometric and spectrophotometric installations by the All-Union Scientific Research Institute for Metrology using standard neutral glass light filters with nominal values of transmission factor 0.9, 0.5, 0.2, 0.08, 0.04 and 0.02. A brief description is presented of the installations compared. The values of the total transmission factors determined by the photometric installation agree within the limits of error of measurement with the values produced by calculation based on spectrophotometric measurements. Table 1.

CZECHOSLOVAKIA

A BIREFRINGENT FILTER FOR TWO SELECTABLE WAVE LENGTHS

Prague JEMNA MECHANIKA A OPTIKA in Czech Vol 21, No 9, Sep 76 pp 279-281
manuscript received 8 Sep 75

SOLC, Ivan; Astronomical Institute of the Czechoslovak Academy of Sciences,
Developmental Group for Optics, Turnov

[Abstract] Advantages of birefringent filters are their stability and reproducibility of measurements. It is frequently advantageous for a single filter to operate at two selected wave lengths. Change of operation from one wave length to another is fast and easy. The author describes a filter which he developed for the H_α line and for the green line of the sun corona. Figures 2; tables 4; references 5: all Czech.

USSR

UDC 621.165-226.001.5:620.178.3

COMPARATIVE FATIGUE TESTING OF BLADES FOR THE MODEL PT-25-90 STEAM TURBINE

Leningrad ENERGOMASHINOSTROYENIYE in Russian No 2, 1977 pp 8-9

BOGOYAVLENSKIY, K. N., PRUSS, L. V., KAPRIN, YE. B. and TSITSERUK, A. N.,
Kaluga Turbine Plant

[Abstract] Eight batches of blades for the model PT-25-90 steam turbine were subjected to fatigue tests. All batches had been made of grade 1Kh13Sh steel quenched from 1050°C and tempered at 720°C. Four of these batches were finished by manual grinding and buffing with wheels, the four others were finished by cold rolling. Of each four of these batches, one was not further heat treated and the other three were again tempered for four hours at 700°C, 640°C, or 300°C respectively. According to the test results, ground or rolled blades with a high temper were most resistant to fatigue, with $\sigma_{-1}=1000-1200$ kgf/cm². Residual stresses in the 20-30 μ m surface layer (tensile stresses in ground blades, compressive stresses in rolled blades) had been reduced appreciably by the temper at 640°C, without any detrimental effect on other mechanical characteristics. This temperature must, therefore, be regarded as the optimum for raising the fatigue strength of these steel blades. Figures 3; tables 1; references 3: all Russian.

USSR

UDC 621.437.226.2

VANE FOR A TURBOMACHINE

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI
in Russian No 13, 1977, Cert. No 553344 29 Dec 75

LOKAY, V. I., TKACHENKO, N. S., and SHARAPOV, A. V., A. N. Tupolev Order-of-Red-Star-Labor Kazan Institute of Aviation

[Text] Vane for a turbomachine, especially a gas turbine, with vents cut through the body and with a device generating pulsations of the cooling air stream, with the distinguishing feature that, for a more intensive heat exchange, acoustic flappers have been built into it to which the cooling vents are pairwise connected.

USSR

UDC 621.515

CENTRIFUGAL COMPRESSOR

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 13, 1977, Cert. No 553362 1 Nov 74

TSIPLINKIN, G. YE. and KOSTROV, YE. B.

[Text] Centrifugal compressor with a feedthrough segment which the axioradial blade wheel forms with an unbladed diffuser and with a bladed diffuser, the outlet diameter of the two diffusers being respectively equal to 1.02-1.20 and 1.50-1.70 times the outside wheel diameter, with the distinguishing feature that, for extending the range of high-efficiency performance, the throat diameter of the passageway between blades on the wheel is made equal to 0.60-0.68 times the blade pitch (both referred to the inlet diameter), the inlet diameter and the axial length of the feedthrough segment of the wheel are made respectively equal to 0.60-0.72 and 0.30-0.42 times the outside wheel diameter, the outlet area of the wheel is made equal to 0.60-0.76 times its inlet area, the width of the bladed diffuser is made equal to 1.00-1.05 times the wheel width at the outlet, and the throat diameter of the passageway at the inlet to the bladed diffuser is made equal to 0.28-0.50 times its blade pitch (referred to the inlet diameter).

USSR

UDC 621.182.26

DEVICE FOR CONTROLLING THE CIRCULATION SYSTEM OF A CONDENSER IN A SHIPBOARD STEAM-TURBINE AGGREGATE

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 12, 1977, Cert. No 552491 6 Oct 75

BERKOV, YE. KH., KAIPOV, R. A. and IL'IN, A. G.

[Text] Device for controlling the circulation system of a condenser, equipped with a command unit which includes controls for the circulation-pump motor and the gate-valve servomotors installed in the delivery line of the pump and in the natural-circulation piping, with the distinguishing feature that, for improving the reliability of the condenser performance by simplifying the transition from natural to forced circulation or vice versa, it is also equipped with a functional command unit whose inputs connect to the main command and to a position indicator placed on the gate valve on the delivery side of the pump and whose outputs connect to the controls for the pump motor and the servomotors.

USSR

UDC 621.528

THE AVED 40/800 HIGH-VACUUM ELECTRIC-ARC SORPTION PUMP

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 76 p 230

SABLEV, L. P., GOL'DINER, YE. G., DOLOTOV, YU. I., KRUGLOV, S. A., GET'MAN, L. I., LUTSENKO, V. N., STUPAK, R. I. and TOLMACHEV, M. F., Khar'kov
Physicotechnical Institute, Academy of Sciences UkrSSR

[Abstract] The technical specifications are given on the AVED 40/800 vacuum pump. Starting pressure is $5 \cdot 10^{-2}$ mm Hg, and the limiting residual pressure is 10^{-7} mm Hg. Pumping speed in the pressure range of 10^{-7} - 10^{-5} mm Hg is 40,000 l/s nitrogen, 25,000 l/s for air and 80,000 l/s for hydrogen. Maximum capacity in 1 mm Hg/s is 0.9 for nitrogen, 0.7 for air and 2.0 for hydrogen. Partial pressure of heavy hydrocarbons in the residual gas spectrum is no more than 10^{-9} mm Hg. Gas sorption is by electric-arc vaporization of titanium. Power supply is three-phase 380/220 VAC 50 Hz with maximum power consumption of 4.5 kW. The pump unit weighs 800 kg and the power supply and control panel weigh an additional 200 kg. The plan dimensions of the pump are 1.135 x 2.850 m. The unit is water-cooled. Figure 1.

USSR

UDC 621.527.8

HIGH-VACUUM DIFFUSION PUMP

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 3, 1977, Cert. No 553366

SHMELEV, I. F. and BELIKOV, A. S.

[Text] High-vacuum diffusion pump consisting of a housing with a vapor duct along the axis and a trap above, the latter comprising a vessel with a reflecting shutter fastened to it, with the distinguishing feature that, for a higher-speed performance, to the vessel base and to the lower part of the shutter are fastened guide vanes made of a material with a low thermal conductivity.

USSR

UDC 621.527.8

CRYOGENIC CONDENSATE PUMP

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI
in Russian No 13, 1977, Cert. No 553357 27 Jun 75

KOVALENKO, V. A. and MARTYNNENKO, V. G.

[Text] Cryogenic condensate pump same as covered by Cert. No 392268, except that, for reducing the time taken to attain ultimate vacuum, the cooled shield is placed inside the cavity of the hood and the coolant is poured in through a tube, while in the bottom part of the vessel is mounted a diaphragm which makes thermal contact with the hood and fits inside the main diaphragm.

USSR

UDC 621.671.001.24

DEVELOPMENT OF HIGH-CAPACITY PUMPS FOR DIVERTING THE RUNOFF OF NORTHERN RIVERS
TO SOUTHERN REGIONS OF THE COUNTRY

Leningrad ENERGOMASHINOSTROYENIYE in Russian No 2, 1977 pp 3-6

VARLAMOV, A. A. and YABLONSKIY, G. A., Turbine Planning Department, Leningrad Metal Plant

[Abstract] Land reclamation and conditioning as well as a more effective utilization and distribution of water resources in the Soviet Union calls for a program which includes diversion of river runoffs through a system of water pumping and storage plants, with a total power of close to $1.5 \cdot 10^6$ kW to ensure the transfer of huge quantities of water at flow rates up to $6,000 \text{ m}^3/\text{s}$ under pressure heads ranging from 1.0 to 20 m. This project requires a great deal of scientific research as well as engineering and technological development. For the design and the installation of pumps with runner diameters from 5.5 m up, new solutions must be found in the areas of cavitation, dimensional analysis, transient analysis, conversion from pump to turbine operation, i.e., reversibility, and in computer application. Furthermore, various conventional suction and discharge systems must be reconsidered. Preliminary estimates indicate a preference for horizontal casings with axial-flow impellers and vertical spiral casings with diagonal-flow impellers in high-head pumping stations. Several design versions of such pumps and their performance, including startup and controls, are discussed here. It is recommended that one or two prototypes be built and tested, allowing 3-4 years before full-scale production of such large pumps can begin. Figures 2; references 6: 3 Russian, 3 Western (two in translation).

Refrigeration, Air-Conditioning

USSR

UDC 621.512.001.5

MECHANICAL LOSSES OF HIGH-SPEED HERMETIC COMPRESSORS

Moscow KHOLODIL'NAYA TEKHNIKA in Russian No 12, 1976 pp 7-10

DOROSH, V. S.

[Abstract] A study of one- and two-cylinder high-speed hermetic compressors for self-contained shipboard air-conditioning systems showed that the moment of friction of the compressors at 50°C oil temperature depends essentially on the pressure of the freon-22. When the freon pressure corresponds to a 10°C boiling temperature the maximum friction will occur when the oil temperature is in the 25°-35°C range. The lower the freon pressure, the lower the temperature. In compressors with more than two cylinders and higher speed rates the mean frictional pressure increases from $0.1 \cdot 10^2$ to $0.72 \cdot 10^2$ kPa in the 1,500-4,020 rpm range when the oil temperature reaches the 50°-90°C range. The greater portion of the mechanical loss (frictional) in high-speed hermetic compressors occurs at the shaft and lubricating pump. Ill 2; Biblio 5.

USSR

UDC 697.94

AIR CONDITIONING APPARATUS

Moscow OTKRYTIYA, IZOBRE'TENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 13, 1977, Cert. No 553401 8 Aug 74

IONOV, L. P. and IONOV, A. L., "Aeroprojekt" State Design Research and Scientific Research Institute of Civil Aviation

[Text] Air conditioning apparatus consisting of a circulation loop with heat exchangers installed at the consumers' sites, and in parallel branch lines a cooler and a heater with shutoff and regulating fixtures, with the distinguishing feature that, for increasing the thermodynamic efficiency and the reliability, salt solutions are used as the coolant and the cooler inlet and outlet segments of the loop are made of a dielectric material, with electromagnets and vibrators installed along these segments.

USSR

UDC 628.84:656.211

AIR CONDITIONING IN MAIN HALL OF THE KURSK RAILROAD STATION IN MOSCOW

Moscow KHOLODIL'NAYA TEKHNIKA in Russian No 3, 1977 pp 19-22

SELEDKOV, N. T., KUCHERYAVENKO, L. I., Mosgioprotrans and RUNOVA, A. F.,
All-Union Scientific Research Institute of Railroad Hygiene

[Abstract] The authors developed an air conditioning system designed for the main hall of the Kursk Railroad Station in Moscow; the system is capable of producing 320,000 m³/hr of air. They also give the technical characteristics of the system and compare the design and real data. Their investigations revealed that the air conditioning system has the necessary efficiency, and that the deficiencies which exist in air distribution and the temperature regime can be eliminated by the appropriate regulation and adjustment of the system and the proper organization of servicing. Figures 4; tables 2.

USSR

UDC 628.84

NEW AUTONOMOUS CONDITIONER

Moscow KHOLODIL'NAYA TEKHNIKA in Russian No 3, 1977 pp 24-25

PROSKURIN, A. F. and ANISIN, L. V., Tyumen' Turbomechanical Plant

[Abstract] The authors describe a new model of an autonomous conditioner, the KTA2-5. They give the technical characteristics and the necessary data to install the equipment. This new conditioner operates without condensor-cooling water. The reserve in total pressure at the output from the air channels is 40.8 kgauss/m². It is capable of humidifying the air and went into series production in 1977. Figure 1; references 3: all Russian.

Transportation, Conveying

USSR

UDC 621.643.002.2

AMMONIA PIPELINE FROM TOL'YATTI TO ODESSA

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 1, 1977 pp 10-11

ALEKSEYEV, A. I.

[Abstract] A brief description is given of the 2,200-km, 355.6-mm diameter, 7.92-mm thick carbon steel ammonia pipeline to be built during the Ten Year Plan in two sections, from Tol'yatti to Panyutino (1,600 km) and from Panyutino to Grigor'yevskiy Liman near Odessa (about 620 km). The operating pressure (liquid anhydrous ammonia) will be 83.16 kg/cm^2 . The branch pipe at Gorlovka will be 273 mm diameter and operate at 98.6 kg/cm^2 . The main line will be welded pipe, and the underwater crossings will be seamless pipe. The pipeline will cross 120 water obstacles, 150 roads and railroads, and 40 other obstacles. There will be 14 pumping stations. Ill 1.

USSR

UDC 621.798.1

COLLAPSIBLE REUSABLE PACKING CASE FOR TRANSPORTING SPARE PARTS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 12, 1976 pp 13-14

GAYBARYAN, M. A., engineer, and BELOV, A. M., candidate of engineering sciences

[Abstract] Spare parts for agricultural equipment are now transported from supplying plants to storage areas in wooden boxes, the manufacturing cost of which is quite high. The All-Union Scientific Research Institute of Furnishing Agriculture with Materials and Equipment is now in the process of introducing a new reusable packing case for transporting spare parts at the Moscow Motor Vehicle Plant imeni I. A. Likhachev. This case is designed for transporting piece goods and consists of a flat wooden pallet, collapsible sides, and a top. The sides consist of sets of wooden boards or particle boards with metal loop-type hinges from the hood of a ZIL-157 or ZIL-164 automobile at their ends, along with hinges designed by the institute and 5-mm-thick rubberized straps. The sides are modular and can be adjusted in height to fit the products packed in the case. The case is assembled by setting up the sides on the pallet, after which the case is packed and the top is put on. The assembled case is banded and sealed, if necessary. Articles can be stacked in the case on top of one another or in sections, with or without separators. This case has a half-ton capacity. When the case has been emptied at its destination it is disassembled, its sides, top, and pallet are stacked on top of one another in a compact package, and it is sent back to the supplier. Three or four cases disassembled and packaged together in this way measure only one meter in height. One worker can assemble the case in one or two minutes. A ZIL-130 and its double-axle trailer can

accommodate six assembled cases in a single tier. These cases are unloaded from trucks or railroad cars by forklift. Experimental use of this packing case has shown that this new case makes possible 100-percent mechanization of loading and unloading operations, considerable speeding up of transfer operations, less transportation facility downtime, faster delivery to the customer, higher labor productivity among loading personnel, longer shelf life for contents, and a considerably reduced demand for lumber. Furthermore, modernization of lifting and transporting equipment is not required.

USSR

EQUIPMENT FOR VACUUM SHAPING OF CASTING MOLDS

USSR AUTHORS' CERTIFICATE No 541572

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 1, 1977 p 35

GREBESHKOV, V. K., VOL', B. YE. and KUZNETSOV, V. P.

[Text] Equipment for vacuum shaping of casting molds, including a mold box, perforated pipes with filtering shell attached to the walls of the mold box and a filtering shell, is distinguished by the fact that to simplify its design and increase the convenience of servicing, a vacuum accumulator is built into the walls of the mold box with a valve control system separated from its working cavity by a filtering envelope.

USSR

UDC 533.581

A CRYOGENIC PRE-EVACUATION PUMP

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 76 p 231

STREL'NIKOV, V. P., Physicotechnical Institute of Low Temperature, Academy of Sciences UkrSSR, Khar'kov

[Abstract] Technical specifications are given on a vacuum pump for operation in the range of $760-10^{-3}$ mm Hg. The coolant is liquid helium. The helium tank is connected to a heat exchanger cooled by helium vapor. The evacuated gas is cooled on this heat exchanger, using the enthalpy of the helium vapor from 4.2 K to the temperature of equilibrium vapor pressure of the gas being evacuated. The pump also has a heat exchanger cooled by liquid nitrogen where the evacuated gas is precooled to about 80 K. The evacuation rate is 300 /s at 0.1 mm Hg, and 60 /s at 0.01-0.001 mm Hg. Liquid helium consumption at 0.1 mm Hg is 16 cc/liter of evacuated gas (nitrogen), and at 0.01-0.001 mm Hg the helium consumption rate is 0.2 liter per hour. The helium tank holds 4 liters. The amount of gas that can be evacuated without regeneration of the pump is 1000 liters. The unit weighs 22 kg and measures 460 x 270 x 860 mm. Figure 1.

CSO: 1861

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