PB 131891 T-47

CENTRAL INTELLIGENCE AGENCY

(5)

SCIENTIFIC INFORMATION REPORT

91

3 June 1960

Distributed Only By
U.S. DEPARTMENT OF COMMERCE
OFFICE OF TECHNICAL SERVICES
WASHINGTON 25, D.C.

Issued semi-monthly. Annual subscription $28.00 ($4 additional for foreign mailing). Single copy $2.75.

Use of funds for printing this publication approved
by the Director of the Bureau of the Budget July 31, 1958.

Approved For Release 1999/09/08 : CIA-RDP82-00141R000100560001-2

PLEASE NOTE

This report presents unevaluated information extracted from recently received publications of the USSR, Eastern Europe, and China. The information selected is intended to indicate current scientific developments and activities and is disseminated as an aid to research in the United States.

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Table of Contents

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I. BIOLOGY

Radiobiology

1. Cotton Seed Oil Yield Increased by Radiation

Moscow, Ogonek, Vol 38, No 3, 17 Jan 60, p 21

"The presowing gamma-ray treatment of cotton seeds increases the cotton yield and the oil content. By virtue of this process, Uzbekistan is capable of producing thousands of tons of additional cotton seed oil annually."

Miscellaneous

2. Soviet Plan Combines Solar Power and Electric Lights for Siberian Gardens

"A Vegetable Factory on One Square Meter," by Istvan Vig; Budapest, Magyar Nemzet, 13 Mar 60, p 5

Soviet research aimed at year-round vegetable gardens in Siberia has reportedly caused a "great sensation" in Hungarian scientific circles, according to a Hungarian feature story, the first half of which is based on a lecture given by Abram Ioffe, Soviet physicist, at the Academy of Sciences USSR "on use of the energy of the sun and on the biophysical problems of plants." The Soviet scientist, who has devoted "almost three decades" to this research, reported that through the use of "gas and vacuum semiconductors" a large percentage of solar energy can be converted into electricity. Thus, the sun becomes a cheaper energy source than coal, petroleum, or water power. He also reported that he had suceeded in determining the light intensity, spectral component, and heat, water, and food needs for the growth of various plants. From this research, he concluded that climate is not of decisive significance from the viewpoint of plant production; the existence of an energy source is decisive. He reported that tomatoes could be grown 2-2.5 times as fast as is now done.

"In one year, nearly 100 kilograms of vegetables could be produced on one square meter of electrically lighted land. 'Vegetable factories,' operable the year-round, could be set up in Siberia through the use of cheap energy sources."

The second half of the article is based on an interview with an unnamed Hungarian biologist who was asked to comment on Ioffe's work. This commentator, noting that Hungary was not equipped to do such work, described

selective light-growth experiments being done in the Soviet Union. "Hungarian biologists have seen phytotrons (fitotron) operating in the Timiryazev Institute in Moscow. These are conditioning apparatus in which temperature, moisture content, air movement, and light can be controlled at will. In these large chambers, the biologists examine what are the optimum conditions for plants."

The Hungarian commentator noted that plants grown in the open use only 1-2 percent of the sun's energy but that the use of semiconductors will permit conversion of more than this into electricity. "These plans will be realized, if not in a few years, then in 10-20 years." In closing, the commentator describes related research throughout the world and notes that Hungarian researchers at the Tihany Biological Institute (Tihanyi Biologiai Intezet) of the Hungarian Academy of Sciences are experimenting with algae, "which use 10-20 percent of the sun's energy."

II. CHEMISTRY

Analytical Chemistry

3. Determination of Traces of Carbon Monoxide in Hydrogen

"Determination of Traces of Carbon Monoxide in Hydrogen," by Gheorghe Ciuhandu, Toxicological Laboratory of the Institute of Hygiene, Timisoara; Bucharest, Studii Si Cercetari de Chimie, Vol 7, No 4, 1959, pp 569-571

An alkaline solution of silver p-sulfamidobenzoate is rapidly reduced at room temperature by carbon monoxide but much more slowly by hydrogen; a deeply colored colloidal solution of silver is obtained.

At 0° C hydrogen completely loses its capacity to reduce the solution, whereas carbon monoxide reduces it as before.

By passing a stream of hydrogen through such a solution, chilled by ice, carbon monoxide down to a limit of 0.0005% can be determined.

Fuels and Propellants

4. Combustion of Liquid Fuels Containing Emulsified Water

"Water and Flame," by A. Merkulov; Moscow, Promyshlenno-Ekonomicheskaya Gazeta, Vol 5, No 46 (654), 17 Apr 60, p 4

Liquid fuel containing 30-50% of water cannot be used when the water occluded in it is in the form of sheets or layers. The water, on getting into the nozzle of the burner, extinguishes the flame. Mazut, tars, and other fuels containing water have hitherto been regarded as waste materials. Hundreds of thousands and even millions of tons of waste fuel of this type accumulated at petroleum refineries and bulk plants for crude petroleum. This waste fuel was often poured onto the ground, forming petroleum lakes.

Scientists were called on to solve the problem of finding a useful application for this waste fuel. A group of scientists at the Institute of Mineral Fuels, Academy of Sciences USSR, consisting of Prof B. Kantorovich, Doctor of Technical Sciences; V. Ivanov and L. Khotuntsev, Candidates of Technical Sciences; and L. Rapiovets, Z. Frenkena, G. Lebedeva, and P. Nefedov, Scientific Associates, undertook to solve this problem.

These scientists established that if the fuel in which the water is contained in the form of layers or sheets is subjected to emulsification by passing the fuel through different types of equipment (dispersers or colloidal mills) or by treating the fuel with steam, air, or ultrasound, this fuel is converted into an emulsion of water in the organic phase.

When the water has been dispersed in the fuel in the form of minute droplets, the fuel burns in any type of furnace as effectively as pure mazut, although it may contain up to 50% of water.

During the combustion of liquid fuel containing emulsified water, droplets of water having a diameter of 1-3 microns expedite combustion by giving rise to minute explosions. These explosions take place because of the difference between the boiling temperatures of the water and mazut. This phenomenon contributes to an intensification of the combustion process, so that the fuel is consumed completely without even the formation of any soot.

The results of experiments which have been carried out in this field are being applied on an industrial scale at present. For instance, the application of water-in-fuel emulsions at the Kulebaki Metallurgical Plant /imeni Kirov/ considerably increased the efficiency of the operation of open-hearth furnaces and heating furnaces.

Fuel that contains dispersed water was burned with good results in locomotive furnaces as well. On ships of the river fleet and at petroleum bulk plants of Rosglavneftesbyt /RSFSR Main Administration of Petroleum Supply/ not only mazut containing water, but also waste fuel obtained by cleaning barges and tanks was burned. Emulsifying the water contained in these fuels yielded good results in all cases.

It was established that by using the procedure described one may decontaminate waste waters of factories and plants, so that these waters are not released into reservoirs, thus contaminating them.

The scientists have developed another way of utilizing fuel in which water has been dispersed. Interesting experiments were carried out on the burning under high pressure of different fuels containing water that has been dispersed in it. By using the method of pressure combustion, it was possible to burn fuel containing up to 90% of water. It was established that combustion /in pressure chambers/ took place with a very high rate of heat liberation, viz., one exceeding by a factor of 1,000 the rates obtained when combustion is carried out in ordinary furnaces. This opens up great economic possibilities, particularly as far as generation of power is concerned. By using fuel containing water, it will be possible to generate steam directly in the furnace during the process of combustion.

Water-fuel emulsions can be converted into technological gas in conjunction with the production of valuable chemical raw materials, specifically ethylene and propylene.

5. Effects of Diffusion and Thermal Conductivity on Chain-Thermal Propagation of Flames

"On Chain-Thermal Flame Propagation; Part 3 -- Effects of the Coefficient of Diffusion and Thermal Conductivity," by L. A. Lovachev, Institute of Chemical Physics, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk, No 3, Mar 60, pp 442-446

A relationship has been derived which expresses the dependence of the rate of flame propagation on the coefficient of diffusion of the leading active center and the thermal conductivity; it has been applied for calculating ratios of the velocity of flame propagation in three methane-oxygen mixtures, one containing nitrogen (a mixture with air), one containing argon instead of nitrogen, and one containing helium instead of nitrogen. The theoretical ratios of the velocities of flame propagation were found to correspond to the experimentally determined ratios.

6. Sensitivity to Pressure Impetus of Mixtures of Organic Substances With Liquid Oxygen

"Sensitivity to a Pressure Impetus of Mixtures of Organic Substances With Liquid Oxygen," by Engr Z. B. Basyrov; Moscow, Kislorod, Vol 12, No 6, Nov-Dec 59, pp 13-23

On the basis of an investigation of the sensitivity to a pressure impetus of mixtures formed with liquid oxygen by organic impurities originally present in the air from which this oxygen had been produced and subsequently contaminating this oxygen, it was found that all of the mixtures in question are more explosive than nitroglycerin. The pressures applied were close to those encountered in the operation of air-separation equipment for the production of oxygen. It was established that mixtures of acetylene with liquid oxygen which have been diluted with carbon dioxide and mixtures of cracking gas with liquid oxygen which have been diluted with the same inert component have the same sensitivity. The lower concentration limits of explosibility have been determined for mixtures of pure hydrocarbons with liquid oxygen. It was found that when the lower concentration limit has been surpassed to even a very small extent, a much smaller initial impetus is needed for bringing about an explosion.

The initiation of an explosion in mixtures by a pressure impetus apparently takes place as the result of an adiabatic compression of gas occlusions. This is indicated by the fact that sensitivity to a pressure impetus takes a course parallel to that of the temperature of spontaneous ignition in the gas phase.

The most dangerous condition encountered at air-separation installations is accumulation in liquid oxygen and in the air of difficultly soluble organic substances the presence of which leads to separation into layers. Under these conditions the composition of the mixture may easily surpass the lower limit of explosibility.

The experiments which were carried out demonstrated that the assumption in regard to the exclusive role played by acetylene in all explosions of air separation equipment is erroneous. When mixed with liquid oxygen, all organic substances that get into the air separation equipment are equally dangerous.

Data are given in the article on the minimum pressures necessary for bringing about explosions of mixtures of liquid oxygen with solid acetylene, solid ethylene, liquid propylene, liquid methane, liquid propane, solid butane, P-28 oil, solid spindle oil No 12, solid light hydrocarbon fractions (homogeneous and nonhomogeneous mixtures), solid acetaldehyde, solid dichloroethane, solid acetone, and gas carbon black.

7. Kinetics of Interaction Between Ammonia and Ozone Dissolved in Carbon Tetrachloride

"Kinetics of Interaction Between Ammonia and Ozone Dissolved in Carbon Tetrachloride," by S. I. Papko (Moscow), Second Moscow State Institute imeni N. I. Pirogov; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 2, Feb 60, pp 387-394

The rate of interaction between ammonia and ozone has been followed by several methods. It was found that the rate is very high in the initial stages and then falls abruptly. Over 50% of the ozone reacts during the first 0.08 sec. The interaction of ammonia and ozone in carbon tetrachloride is not of a chain character. Retardation of the reaction takes place owing to evolution of water and the formation of ammonium ions not subjected to oxidation by ozone.

8. Thermodynamic Investigation of Process of Gasification of Liquid Oxygen

"A Thermodynamic Investigation of the Process of Gasification of Liquid Oxygen," by S. M. Rips; Minsk, Inzhenerno-Fizicheskiy Zhurnal, No 2, Feb 60, pp 41-45

The behavior of oxygen phases (liquid and vapor) in a closed container (Fig 1) is considered. It is shown that as heat is supplied to the system, the latter reaches a state of "crisis" (Fig 2) which is expressed in the reversal of the evaporation process and in the occurrence of reflux.

The reflux involves an increase in the weight of the liquid phase and a decrease in the weight of the vapor phase which may, in certain cases, lead to the deformation of the container.

Therefore, to ensure correct operation conditions it is necessary to provide a very definite "specific charge" of the container (depending on temperature). The "specific charge" will prevent the reverse process and the accumulation of the liquid phase, and is theoretically determined in this paper.

9. Movement of Fine Particles in Twisting Stream

"The Movement of Fine Particles in a Twisting Stream," by M. A. Gol'dshtik, A. K. Leont'yev, and I. I. Paleyev, Polytechnic Institute imeni M. I. Kalinin (Leningrad); Minsk, Inzhenerno-Fizicheskiy Zhurnal, No 2, Feb 60, pp 17-24

A solution is given of the problem of the movement of small particles in a twisting liquid stream.

The area of flow is divided into two zones with distributed speeds determined by relationships (1), (2), and (3). An exact analytical solution of the problem is found for the first zone. For the second zone, by the method of conjugation of asymptotic representations of the solution for long and short periods, an approximate analytical solution is obtained.

A sample calculation is given (Fig 2 and 3).

10. Phase and Volumetric Behavior of Solutions of Acetylene in Acetone

"Phase and Volumetric Behavior of Solutions of Acetylene in Acetone," by D. S. Tsiklis, A. N. Kofman, and L. I. Shenderey. Moscow, Zhurnal Fizicheskoy Khimii, Vol 33, No 9, Sep 59 pp 2012-2016

The solubility of acetylene in acetone has been measured at temperatures ranging from -40 to -80° C and pressures up to 1 atm. The volumes of the solutions under these conditions have been measured. It has been shown that the solubility may be expressed by the Krichevskiy-Il'yinskaya equation. The heats of solution of acetylene in acetone have been calculated.

11. Application of Principle of Corresponding States to Viscosity of Gases at Atmospheric Pressure

"The Application of the Principle of Corresponding States to the Viscosity of Gases at Atmospheric Pressure, by A. A. Tarzimanov, All-Union Heat Engineering Scientific Research Institute imeni Dzerzhinskiy; Minsk, Inzhenerno-Fizicheskiy Zhurnal, No 2, Feb 60, pp 73-77

The temperature relationship between the viscosity of gases at 1 atm is investigated, using the principle of corresponding states and the system of variables

$$\eta_{pr} = \eta V_{kr}^{2/3} \sqrt{MT} \qquad \text{and } \tau = T/T_{kr}.$$

The results of an analysis of experimental data (Fig 1-3) show that the viscosity of most gases is described by a single curve (deviation, as a rule, is not more than 2 - 6%).

The viscosity of gases is calculated according to Formula (3), where $C_1 = 5{,}15.10^{-7}$; $C_2 = 0.88$. In this case, for the calculation of viscosity, it is sufficient to know only T_{kr}, V_{kr} and the molecular weight M of the substance.

12. Kinetics and Mechanism of Methane Oxidation

"The Kinetics and Mechanism of Methane Oxidation; Part 1 -- Basic Macrokinetic Laws," by L. V. Karmilova, N. S. Yenikolopyan, and A. B. Nalbandyan; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 3, Mar 60, pp 550-558

Kinetics of methane oxidation in a quartz stable surface vessel is studied. The relation between maximum rates of initial products consumption and reaction products accumulation is shown. The effective activation energy is found to be 43 ± kcal/mole. The over-all reaction order appears to be 2.7, and the reaction orders with respect to methane and oxygen, 1.62 and 0.96, respectively.

13. Relaxation Mechanism of Propagation of Burning in Heterogeneous Exothermal Systems

"Relaxation Mechanism of Propagation of Burning in Heterogeneous Exothermal Systems, Part 1," by Z. I. Fur (Leningrad), Institute of Chemical Physics, Academy of Sciences USSR; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 3, Mar 60, pp 611-617

The proposed hypothesis relates the rate of propagation of burning in heterogeneous exothermal systems (powders, thermites, etc.) to the rate of heat transfer in the condensed phase. It rests on a new conception, that of the elementary layer, serving as parameter of the system. The existence of an elementary layer follows from the structure of heterogeneous systems.

The chemical kinetics are accounted for indirectly through the flash point T_V and the temperature T_G of the primary reaction products in the reaction layer adjacent to the condensed phase.

The equation obtained for the rate of propagation of burning has been compared with experimental data for two systems, very close agreement being obtained between theory and experiment.

The hypothesis satisfactorily explains qualitatively and in the cases under consideration quantitatively the effect of the dispersity of the system on the rate of propagation of burning.

Herbicides

14. Synthesis of Arensulfoacid Esters of Aryloxyethanols

"The Synthesis of Herbicides. II. Arensulfoacid Esters of Aryloxyethanols," by O. Kh. Vlasova and S. I. Burmistrov, Dnepropetrovsk Chemicotechnological Institute; Kiev, Ukrainskiy Khimicheskiy Zhurnal, Vol 25, No 6, 1959, pp 760-761

The purpose of the research was to study new herbicides. The previously unknown arensulfoacid esters of aryloxyethanols with the general formula $ArOCH_2CH_2OSO_2Ar'$ (where Ar = phenyl and various derivatives of phenyl and Ar' = p-halophenyl, phenyl, tolyl, or carbomethoxyamidophenyl) were obtained by reacting the acid chlorides of sulfonic acids with aryloxyethanols in dioxane in the presence of alkali according to the general equation:

$$ArOCH_2CH_2OH + NaOH + ClSO_2Ar' \longrightarrow ArOCH_2CH_2OSO_2Ar' + H_2O + NaCl.$$

Arensulfoacid esters of aryloxyethanols are colorless crystalline substances, insoluble in water and readily soluble in organic solvents. These esters can be used for identifying axyloxyethanols since they crystallize readily and possess sharp melting points. The esters can be used for introducing aryloxyethyl groups into amines and phenols. The aryloxyethyl iodides are obtained in excellent yields by reacting potassium iodide with the esters in acetone solution:

$$ArOCH_2CH_2OSO_2Ar' + KI \longrightarrow ArOCH_2CH_2I + KOSO_2Ar'.$$

By reacting potassium fluoride with the esters, only a small yield of the corresponding aryloxyethyl fluorides is obtained.

Data on the composition of 21 newly synthesized substances and their physical properties are listed in two tables.

Industrial Chemistry

15. Effect of Structure on Thermal Conductivity of Polymers

"Effect of Structure on the Thermal Conductivity of Polymers," by L. N. Cherkasova; Moscow, Zhurnal Fizicheskoy Khimii, Vol 33, No 9, Sep 59, pp 1928-1932

The experimental findings allow generalizations to be made concerning the nature of the change in thermal conductivity of polymers in the crystalline and amorphous states. Polymers completely in the amorphous

state have a tendency to increase their thermal conductivity with rise in temperature. In the crystalline state they lower their thermal conductivity on approaching the melting temperature. Above the temperature corresponding to complete melting of the crystals the change in the thermal conductivity coefficient obeys the correlations of the amorphous state.

16. Polycondensation of Phosphinyl Dichlorides With Dihydroxy Compounds

"Investigation in Organophosphorus Polymers. Part 9 -- The Polycondensation of Phosphinyl Dichlorides With Dihydroxy Compounds," by V. V. Korshak, I. A. Gribova, and M. A. Andreyeva, Institute of Organoelemental Compounds, Academy of Sciences USSR; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 3, Mar 60, pp 427-432

The polycondensation of phosphinyl dichlorides with hydroquinone in nitrobenzene solution and with diethylene glycol in dichloroethane was investigated. The duration and the temperature of the reaction were found to affect the yield and intrinsic viscosity of the polyester. The degree of the reaction considerably increases with rise in temperature and in the concentration of the reactants.

The kinetics of the polycondensation were obtained by following the evolution of hydrogen chloride in the process of the reaction.

17. Synthesis and Polymerization of Arylphosphophosphonitriles and Alkylphosphonitriles

"Synthesis and Polymerization of Arylphosphonitriles and Alkylphosphonitriles," by V. V. Korshak, I. A. Gribova, T. V. Artamonova, and A. N. Bushmarina, Institute of Organoelemental Compounds, Academy of Sciences USSR; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 3, Mar 60, pp 377-385

The reaction of diaryl- and dialkylphosphotrichlorides and ammonium chloride in organic solvents has been investigated. Various products have been shown to form, depending on the conditions of the reaction. At 175° and excess ammonium chloride, octaphenyltetraphosphonitrile is formed. Based on the results obtained, views have been expressed as to the reaction mechanism.

The polymerization of the phosphonitrile derivatives has been studied over the temperature range 320-500° on the example of octaphenyltetraphosphonitrile. Under these conditions a mixture of tri-, penta- and hexamers is obtained, as well as a product insoluble in organic solvents and softening at 350-450°.

Inorganic Chemistry

18. Chemical Stability of Boron Carbide

"The Chemical Stability of Boron Carbide," by T. N. Nazarchuk, Institute of Powder Metallurgy, Cermets, and Special Alloys, Academy of Sciences Ukrainian SSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 12, Dec 59, pp 2665-2669

The chemical stability of boron carbide in concentrated acids and mixtures of concentrated acids at room temperature and elevated temperatures was investigated. The resistance of boron carbide to the action of dilute acids was also determined. It was established that boron carbide is relatively stable in acidic solutions. In acids diluted in the ratio of 1:1, boron carbide has insignificantly low solubility. Treatment of boron carbide with acids brings aluminum and iron, which may be present as impurities, into solution. However, it is not possible to eliminate acid-soluble impurities completely from boron carbide even by treating this compound twice with acids. It was established that boron carbide is resistant to the action of caustic alkali solutions both at room temperature and elevated temperatures. Oxidizing agents such as hydrogen peroxide and bromine do not impair the stability to caustic alkali.

19. Phase Components of System CeO_2 - ZrO_2

"Investigation of the Phase Components of the System CeO_2 - ZrO_2," by S. N. Guyev, S. I. Alyamovskiy, and E. S. Volzhenkova, Institute of Electrochemistry, Ural Affiliate of the Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 11, Nov 59, pp 2571-2576

The structure and ceramic properties of the system CeO_2 - ZrO_2 have not been investigated adequately hitherto. Only a few investigations on the stabilization of zirconium dioxide by the addition of cerium dioxide have been published. Under the circumstances it was of interest to investigate the structural characteristics and some ceramic properties of the system CeO_2 - ZrO_2. Oxide systems as a rule exhibit semiconductor properties. Investigation of the system mentioned from this standpoint may furnish definite data with regard to that. The phase components of the system including solid solutions at 1550° were investigated in some detail with regard to their composition, the crystallographic characteristics of the components, etc. It was established that the structure of the solid solution of zirconium dioxide in cerium dioxide (cubic phase) is distinguished by imperfections.

The presence of holes at crystal lattice nodes made vacant by the ions Ce^{4+} and O^{2-} is most likely. The holes show a statistically random distribution. It was also established that samples containing 70 mol percent of $Zr\ O_2$ have the greatest hardness and exhibit the greatest mechanical strength.

20. Ternary System Consisting of Fluorides of Sodium, Potassium, and Calcium

"Fusibility Diagram of the Ternary System Consisting of Fluorides of Sodium, Potassium, and Calcium," by G. A. Bukhalova and V. T. Berezhnaya, Rostov-na-Donu Engineering Construction Institute; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 11, Nov 59, pp 2596-2599

The system Na, K, Ca// F was investigated. It was established that the congruently melting compound $KCa\ F_3$ determines to a considerable extent the characteristics of the ternary system.

Insecticides and Fungicides

21. Soviet Researchers Propose Method for Production of Heptachlor

"On Preparing the Insecticide Heptachlor," by S. D. Volodkovich, L. G. Vol'fson, L. M. Kogan, N. N. Mel'nikov, and Yu. N. Sapozhkov, Scientific Institute of Fertilizers and Insectofungicides; Moscow, Zhurnal Prikladnoy Khimii, Vol 33, No 1, Jan 60, pp 227-233

The authors have developed a method for preparing heptachlor, which consists of the condensation of hexachlorocyclopentadiene with pentadiene and then chlorination of the product of this reaction (chlordene) with elemental chlorine.

The optimum conditions for the formation of chlordene in CCl_4 were determined and found to be a 10% excess of C_5H_6, a temperature of 80-85° C, continuation of the process for 30-40 minutes.

The following conditions are recommended for the chlorination of chlordene: the use of diatomaceous earth activated by heating at 120° for 1-2 hours and regulation of the reaction temperature so that it should not vary by more than 5°. The content of heptachlor in the reaction products obtained by this process amounts to about 70%. The yield of heptachlor is determined by the over-all amount of chlorine introduced: within a definite range, it does not depend on the rate of chlorine addition or the duration of chlorination.

22. Researchers Study Shale Tars as Wood Preservative

"Research on the Fungicidal Properties of Shale Tars," by G. Ye. Shaltyko and L. I. Pshedetskaya, Leningrad Institute of Engineers of Railway Transport imeni B. N. Obraztsov; Moscow, Zhurnal Prikladnoy Khimii, Vol 33, No 1, Jan 60, pp 212-215

The results of the investigation demonstrated that Baltic shale tars and shale oils of different types, when used for impregnating crossties, possess low toxicity toward the wood-decaying fungi Coniophora cerebella and Merulius lacrymans and consequently should not be used without the addition of other substances as oil antiseptics for preserving wood by impregnation with them.

Isotopes

23. Separation of Oxygen Isotopes in Process of Electroynthesis of Ozone

"Separation of Oxygen Isotopes in the Process of Electrosynthesis of Ozone," by I. A. Semiokhin, G. M. Panchenkov, V. K. Korovkin, and A. V. Borisov, Moscow State University; Moscow, Zhurnal Fizicheskoy Khimii, Vol 33, No 9, Sep 59, pp 1933-1938

The separation of oxygen isotopes has been accomplished by the method of chemical exchange under electrical discharge conditions. An apparatus has been devised, convenient for determining the coefficient of once-through separation of the isotopes, and experiments have been carried out on the multistage separation of oxygen isotopes in the electrosynthesis of ozone. The steady state in the isotope exchange between oxygen and ozone has been shown to be established within one second. This bears evidence to the high rate of redistribution of the isotopes under electrical discharge conditions. The enrichment of the ozone in the ozonizer with O^{18} isotope practically does not depend on the ozonizer's length and on the methods of the ozone accumulation and of the tests taken. Under one-stage experimental conditions in reactors of different lengths with gas space 1 mm wide the values of the coefficients obtained at 20° C and 750 mm Hg were found to be 1.08-1.10.

Nuclear Fuels and Reactor Construction Materials

24. Leaching-Out of Radioelements From Minerals

"Methods For Determining the Extent of Leaching-Out of Radioelements From Minerals," by K. F. Lazarev; Leningrad, Radiokhimiya, Vol 1, No 5, Oct 59, pp 603-612

Investigation of the leaching-out of a number of radioactive isotopes (Th, U, RdTh, ThX) and rare earths from monazite with solutions of different composition made it possible to establish the following relationships:

(a) During the leaching-out of radioelements from a mineral, the atoms of the element being leached out (Th, rare-earth elements) and the atoms used as a tracer for this element and introduced into the system from the outside ($U\ X_1$, $Eu^{152-154}$) become mixed completely. This makes it possible to investigate with the aid of radioactive tracers processes which take place during the leaching-out.

(b) The distribution of radioelements between the mineral and the leaching-out solution takes place according to the law of distribution.

Methods are proposed for the determination of the quantity of radioactive isotopes present in capillaries and at defects of the crystal lattice of minerals.

25. Effect of Diluents of Extracting Solvent on Hydration of Uranyl Nitrate

"The Hydration of Uranyl Nitrate in Solvent-Diluent Mixtures," by V. M. Vdovenko and Ye. A. Smirnova; Leningrad, Radiokhimiya, Vol 1, No 5, Oct 59, pp 521-529

It was established that addition of benzene, carbon tetrachloride, or chloroform as diluents to extracting solvents (diethyl ether, dibutyl ether, methyl butyrate, ethyl butyrate, or isoamyl butyrate) reduces strongly the capacity of the solvent to extract uranyl nitrate. The degree of reduction of the extracting capacity depends on the nature of the diluent that has been added. It was furthermore established that the degree of hydration of uranyl nitrate drops with an increasing content of the diluent in the solvent.

26. System $UO_2(NO_3)_2$-MOH - H_2O_2-H_2O

"Investigation of the Solid Phase in the System $UO_2(NO_3)_2$-MOH-H_2O_2-H_2O," by A. M. Gurevich and L. P. Polozhenskaya; Leningrad, Radiokhimiya, Vol 1, No 5, Oct 59, pp 567-572

By applying chemical and X-ray diffraction analysis the following compounds were identified and their presence in the system $UO_2(NO_3)_2$-MOH H_2O_2-H_2O (M = Na,K) was established for the first time: $Na_2U_2O_9 \cdot x\,H_2O$; $K_2U_2O_9 \cdot x\,H_2O$; $Na_2UO_5 \cdot 4\,H_2O$; $Na_6U_2O_{13} \cdot 13\,H_2O$; and $Na_8U_4O_{22} \cdot 3\,H_2O$. It was found that the composition of the solid phase depends not only on the molar ratio of components, but also on the absolute contents of uranium and caustic alkali in the system being investigated. The lower limits of the concentrations of uranium and caustic alkali were established at which formation of the compound $Na_2OU_2O_5 \cdot 4\,H_2O$ still takes place. It was established that a complex mechanism operates in connection with the formation of the solid phase. Formation of this phase follows a stage during which easily soluble complexes are formed. It was shown that the temperature exerts a significant effect on the composition of the solid phase, which separates as a result of the decomposition of soluble compounds.

27. Hydrolysis of Plutonyl Nitrate

"Properties of Nitric Acid Solutions of Plutonyl; Part 1 -- Hydrolysis of Plutonyl Nitrate," by M. Ye. Krevinskaya, V. A. Nikol'skiy, B. G. Pozharskiy, and Ye. Ye. Zastenker; Leningrad, Radiokhimiya, Vol 1, No 5, Oct 59, -- 548-553

The reactions taking place in the course of the hydrolysis of plutonyl nitrate were investigated. The equilibrium constants of the individual stages of these reactions (five constants) were calculated. It was found that the assumption in regard to the low tendency of the plutonyl ion toward formation of complexes with nitrate ions at low concentrations of nitric acid made by R. E. Connick, M. Kasha, W. H. McVey, and G. E. Sheline (cf. The Transuranium Elements, 14B, Paper 4.20, New York, 1949) is incorrect.

28. Formation of Complexes by Plutonyl in Nitric Acid Solutions

"Properties of Nitric Acid Solutions of Plutonyl; Part 2 -- Formation of Complexes by Plutonyl in Nitric Acid Solutions," by M. Ye. Krevinskaya, V. D. Nikol'skiy, and B. G. Pozharskiy; Leningrad, Radiokhimiya, Vol 1, No 5, Oct 59, pp 554-561

The complex ions formed by plutonyl in nitric acid solutions were investigated. It was established that the ions $PuO_2(NO_3)_3^-$ and $PuO_2(NO_3)_3(H_2O)_3^-$ are formed. The results obtained indicate that there is gradual replacement of the water of hydration of plutonyl nitrate tetrahydrate with NO_3^- ions.

29. Preparation and Properties of Plutonyl Nitrate

"Preparation and Properties of Plutonyl Nitrate," by M. Ye. Krevinskaya, V. D. Nikol'skiy, B. G. Pozharskiy, and Ye. Ye. Zastenker; Leningrad, Radiokhimiya, Vol 1, No 5, Oct 59, pp 562-566

When nitric acid solutions of plutonyl are evaporated the hexahydrate of plutonyl nitrate $PuO_2(NO_3)_2 \cdot 6H_2O$ crystallizes in the form of hygroscopic crystals of pink coloration. If the hexahydrate is kept above phosphorus pentoxide, 3 molecules of water are lost and the trihydrate of plutonyl nitrate is formed. When the salt is heated to 130°, 4 molecules of the water of crystallization are eliminated and there is successive formation of tetrahydrate, trihydrate, and dihydrate of plutonyl nitrate. When the hexahydrate is kept at 150° for 76 hours, there is formation of anhydrous plutonyl nitrate. Comparison of the absorption spectrum of anhydrous plutonyl nitrate with the spectra of the hydrates showed that the most significant changes take place when the first two molecules of water are added to anhydrous plutonyl nitrate. The changes connected with the addition of the third molecule of water are less pronounced. Addition of the three remaining molecules of water results in still less significant changes. This is explained by the fact that the first two molecules of water enter into the outer sphere of the complex. Accordingly, the formulas of plutonyl nitrate and its hydrates can be represented as follows:

$PuO_2(NO_3)_2$ -anhydrous plutonyl nitrate

$[PuO_2 \cdot 2H_2O(NO_3)_2]$ - plutonyl nitrate dihydrate

$[PuO_2 \cdot 2H_2O(NO_3)_2] \cdot H_2O$ - plutonyl nitrate trihydrate

$[PuO_2 \cdot 2H_2O(NO_3)_2] \cdot 2H_2O$ - plutonyl nitrate tetrahydrate

$[PuO_2 \cdot 2H_2O(NO_3)_2] \cdot 4H_2O$ - plutonyl nitrate hexahydrate

When the concentration of nitric acid is raised from 2 M to 8 M, the solubility of the nitrate in nitric acid drops from 271 grams per kilogram of solution to 137.6 grams per kilogram of solution. The solubility of plutonyl nitrate in 12.91 M nitric acid becomes smaller in time. This is due to formation of the complex $PuO_2(NO_3)_2 \cdot HNO_3 \cdot nH_2O$, the solubility of which is lower than that of plutonyl nitrate. When plutonyl nitrate is kept exposed to air in the presence of moisture, there is slow reduction of the plutonium to the tetravalent state and then the trivalent state.

30. Stability to Radiation to Ion-Exchange Resins Used in Processing of Nuclear Fuels

"Radiation-Chemical Stability of Some Ion-Exchange Resins to the Action of X-Rays and Gamma Radiation," by V. A. Nikashina, M. M. Senyavin, and A. V. Gordiyevskiy; Moscow, Khimicheskaya Promyshlennost', No 7, Oct-Nov 59, pp 573-575

Ion-exchange resins can be used for the recovery and purification of nuclear fuel. By employing ion-exchange resins in nuclear technology, one may successfully carry out such processes as the separation and concentration of individual heavy elements (plutonium, U-235, and U-233) and individual fission products belonging to the group of rare-earth elements. Ion-exchange resins are also of use in the decontamination of large quantities of water containing radioactive wastes. Because ion-exchange resins are used in work with radioactive substances, the stability of these resins to the action of ionizing radiation is of importance. The following USSR ion-exchange resins were subjected to investigation from this standpoint: KU-1, a sulfonated phenolformaldehyde resin which functions as a cation exchanger; KU-2, a sulfonated cation-exchange resin derived from a styrene-divinylbenzene copolymerizate; and KB-4, which is a product of the saponification of a copolymer of methylmethacrylate with divinylbenzene and contains carboxyl (COOH) functional groups.

It was established that ion-exchange resins, just like other high polymers, undergo, under the effect of radiation, processes of deterioration and cross-linking which compete with each other. The radiation-chemical changes in aliphatic resins were found to be more thoroughgoing than those taking place in aromatic resins. Functional groups of the cation-exchange resins investigated were found to be qualitatively stable, although their quantity drops when the dose of radiation is increased. Among the resins investigated, KU-2 was found to be the most stable to the action of radiation.

31. Electrolytic Separation of Europium

"Electrolytic Reduction of Europium," by D. I. Ryabchikov, Yu. S. Sklyarenko, and N. S. Stroganova, Institute of Geochemistry and Analytical Chemistry, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 12, Dec 59, pp 2682-2687

The chemical processes were investigated which take place in aqueous solutions when europium acetate is subjected to electrolysis in the presence of potassium citrate and the europium is isolated in the form of its amalgam. The effect of the initial acidity of the electrolyte on the yield of europium was investigated. Furthermore, the effects of the quantity of potassium citrate, of the initial concentration of europium, and of the temperature on the yield of europium were determined. The results obtained were compared with those pertaining to ytterbium and samarium. As compared with ytterbium and samarium, europium can be separated electrolytically with relative facility. A high yield of this metal is obtained without great difficulty.

32. Double Salts of Zirconium and Hafnium Chlorides With Chlorides of Alkali Metals

"The Thermal Stability of Compounds Formed by the Chlorides of Zirconium and Hafnium With Chlorides of Alkali Metals," by I. S. Morozov and Sung Yin-chou; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 11, Nov 59, pp 2551-2553

The dependence on the temperature of the $ZrCl_4$ vapor tension developed by compounds of the formula Me_2ZrCl_6 and of $HfCl_4$ vapor tension developed by compounds of the formula Me_2HfCl_6 (where Me = Na, K, or Cs) was investigated. It was established that the stability of the compounds in question decreased with diminishing ionic radii of the alkali metal in the following order:

Cs_2ZrCl_6 > K_2ZrCl_6 > Na_2ZrCl_6

Cs_2HfCl_6 > K_2HfCl_6 > Na_2HfCl_6

The stability of the hexachlorohafnates was found to be somewhat higher than the stability of the corresponding hexachlorozirconates. Some thermodynamic functions have been determined, including the average heat effect of reactions of thermal dissociation, changes in free energy, and changes in the entropy of the compounds Me_2 Zr Cl_6 and Me_2 Hf Cl_6.

The data obtained are of importance, because work is being done at present on methods for the production of metallic zirconium and metallic hafnium by the electrolysis of their halides in chloride and fluoride melts (cf. N. Steinberg, M. Sibert, and E. Wainer, Journal Electrochemical Society, Vol 101, 1954, p 63). R. V. Horrigan (cf. Journal of Metals, Vol 10, 1955, p 1118) obtained zirconium tetrachloride by the decompositon of sodium and potassium chlorozirconates.

33. Investigation of Magnetic Properties of Potassium Niobium Sulfate

"The Magnetic Properties of the Salt $K_8[Nb_6 O_3 (SO_4)_{12}]$. 21 H_2O," by Ye. I. Krilov and N. N. Kalutina, Ural Polytechnic Institute imeni S. M. Kirov; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 11, Nov 59, pp 2476-2479

The salt referred to in the title was subjected to magnetochemical investigation in order to establish definitely the valency state of the niobium atom. The salt in question is of importance because it is used for the purification of niobium from tantalum.

34. Organophosphorus Extracting Agents

"Alkyl Phosphonates, Diphosphonates, and Phosphine Oxides as Extracting Agents," by K. A. Petrov, V. D. Shevchenko, V. G. Timoshev, F. A. Maklyayev, A. V. Fokin, A. V. Rodionov, V. D. Balandina, A. V. Yel'kina, Z. I. Nagnibeda, and A. A. Volkova; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 5, No 2, Feb 60, pp 498-502

Work has been conducted on the development, synthesis, and conditions of application of new organophosphosphorus extracting agents. It was established that the esters of alkylphosphonic acids and phosphine oxides extract uranium and plutonium effectively from nitric acid solutions. Zirconium and niobium are not extracted as well by these substances. When the number of carbon items in the alkoxy groups is increased to eight, there is improved extraction of uranium. Introduction of phenyl groups leads to a considerable lowering of the degree of extraction of uranium. Phosphine oxides are more effective than esters of alkylphosphonic acids as far as extraction is concerned; alkylphosphonic acids are more efficient extracting agents than n-tributylphosphate.

35. Separation of Deuterium From Hydrogen by Method of Low-Temperature Distillation

"Separation of Deuterium From Hydrogen by the Method of Low-Temperature Distillation," by M. P. Malkov, Doctor of Technical Sciences; A. G. Zel'dovich, Doctor of Technical Sciences; A. B. Fradkov, Candidate of Technical Sciences; and I. B. Danilov, Candidate of Technical Sciences; Moscow Kislorod, Vol 12, No 6, Nov-Dec 59, pp 1-13

The production of deuterium by distillation of liquid hydrogen is discussed in a review article based on USSR work and non-USSR publications. It is stated that this method for the production of deuterium was first successfully applied on a large industrial scale in the USSR. The development of this method, according to the authors, has progressed further in the USSR than in the Western world. Problems pertaining to the distillation process, heat transfer during the distillation, thermal insulation, and the purification of hydrogen from impurities are discussed in detail. A description of the industrial process applied in the USSR is given. It is stated that in the industrial process applied in the USSR intermediate screens, cooled with liquid nitrogen are used to reduce the thickness of the insulation and consequently the dimensions of the equipment. Hydrogen obtained by electrolysis is used as crude material. Every unit of the installation described processes 4,000 cubic meters of initial gas per hour. The distillation columns, which have a diameter of 1,050 mm, are equipped with 77 plates each. These plates

are of the bubble cap type. The efficiency of the individual plate is 30-35%. At a content of HD in the raw material amounting to 0.03%, a product containing 7-9% of HD is obtained from the still. The degree of recovery of HD comprises 80-90%. The equipment consists of two sections. The first section, comprising the distillation column and heat exchangers operating below 80° K, has thermal insulation jackets filled with liquid hydrogen. The second section consists of heat exchangers and adsorbers operating above 80° K.

The power required for the production of 1 kg of D_2O amounts to 5000-5500 kilowatt-hours.

36. Polymorphism of Beryllium Chloride

"On the Polymorphism of Beryllium Chloride," by O. N. Kuvyrkin, O. N. Breusov, A. V. Novoselova, and K. N. Semenko, Moscow State University; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 2, Feb 60, pp 343-348

The result of this investigation permit assumption of the following mechanism for the polymorphic transformations of beryllium chloride. During the rapid cooling of the melt or crystallization from the gaseous phase, a metastable α' modification analogous in structure to silicon sulfide makes its appearance, passing over on heating to 250° to the cubic β' -modification and on further heating to 340° to the stable β-modification. The last is characterized by a rhombic body centered lattice.

37. Equilibrium Study of High Temperature Reduction of Hafnium Dioxide (HfO_2) by Carbon

"Equilibrium Study of the High Temperature Reduction of Hafnium Dioxide (HfO_2) by Carbon," by V. I. Zhelankin, V. S. Kutsev, and B. F. Ormount, Physical Chemistry Institute imeni L. Ya. Karpov and All-Union Scientific Research Institute of Hard Alloys; Moscow, Zhurnal Fizicheskoy Khimii, Vol 33, No 9, Sep 59, pp 1988-1991

An equilibrium study of the reduction of HfO_2 by carbon has been made over the temperature range of 1743-2003° K and at pressures of 70-1,000 mm Hg by a manometric method. The phases participating in the equilibrium are: HfO_2--monoclinic lattice, carbide--face-centered cubic lattice, graphite and CO.

The equilibrium CO pressure has been determined for the corresponding temperatures.

The dependence of lg P on 1/T and the constant period of the carbide lattice a = 4.626_6 kx and a = 4.627_2 kx at 1743 and 2003° K, respectively, show that the equilibrium composition of the carbide may be considered practically constant in the region of T and p investigated.

Under such conditions the equilibrium is monovariant and in its general form expressed by the equation:

$Q_p = -132 + 3$ kcal (-T = 1743 - 2003°K)

The heat effect of HfO_2 reduction is

$$HfO_2 + (x - y + 2)\,C \rightleftharpoons HfC_x O_y + (2 - y)\,CO + Q_p.$$

38. Chemical Composition of Tetragonal Titanium-Tantalum Niobates

"On the Chemical Composition of Tetragonal Titanium-Tantalum Niobates," by A. I. Ginzsburg, S. A. Gorzhevskaya, E. A. Erofeyeva, and G. A. Sidorenko; Moscow, Geokhimiya, No 1, 1960, pp 11-30

Compounds of a structural type of fergusonite are distinguished by a rather constant chemical composition and belong to rare-earth tantalum niobates with a common formula ABO_4.

In fergusonites of various genetic types of deposits the rare-earth composition varies. These minerals strongly differ from most of the other titanium-tantalum niobates owing to the primary concentration of yttrium and rare earths of the yttrium group.

Minerals of the structural type of fergusonite are most frequently in the metamicit state. As a result of heating, the crystalline structure of minerals deteriorates. After transition from the metamicit stage to the crystalline state, the mineral has a tetragonal structure which on further heating changes to a monoclinic modification.

39. Electroconductivity and Transfer Numbers of System CeO_2 - ZrO_2

"The Electroconductivity and Transfer Numbers of the System CeO_2 - ZrO_2," by S. F. Pal'guyev and Z. S. Volchenkova

(Sverdlovsk), Ural Institute of Electrochemistry; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 2, Feb 60, pp 452-455

The temperature dependence of the conductivity and transfer numbers of solid specimens of the system CeO_2 - ZrO_2 have been determined. The conductivity isotherms and the activation energy curves are of an extremal nature, owing to the semiconductor properties of solid solutions of this system.

From transfer number measurements it has been found that the conductivity of this system at 1,000° is almost entirely electronic, the ionic fraction not exceeding 1%.

Organic Chemistry

40. Synthesis of Vinylphosphinic Acid

"Vinylphosphinic Acid and Several of Its Derivatives," by M. I. Kabachnik and T. Ya. Medved', Institute of Organoelemental Compounds, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR -- Otdeleniye Khimicheskikh Nauk, No 12, Dec 59, pp 2142-2145

The authors found that the acid dichloride of vinylphosphinic acid can be easily obtained by the catalytic dehydrochlorination of the acid chloride of β-chloroethylphosphinic acid. As a result of work done by the authors, the latter compound has become a readily available starting material. Dehydrochlorination was accomplished by passing vapors of the acid chloride of β-chloroethylphosphinic acid heated to 330-340° through a quartz tube filled with barium chloride:

$$ClC_2H_4POCl_2 \xrightarrow[BaCl_2]{-HCl} CH_2{=}CHPOCl_2.$$

The acid chloride was obtained in a yield of about 85% by this method. The ethyl, methyl, isopropyl, and phenyl esters of vinylphosphinic acid were then prepared. Bromination of the ethyl ester led to the ethyl ester of α, β-dibromoethylphosphinic acid as well as the ester of bromovinylphosphinic acid. Several other derivatives and their physical constants are described in the article.

Free vinylphosphinic acid was prepared by the hydrolysis of the acid chloride.

41. Infrared Absorption Spectra Data on Imidophosphates and Imidophosphinates

"On the Imides of Phosphorus Acids. The Infrared Absorption Spectra of Imidophosphates and Imidophosphinates," by M. I. Kabachnik, V. A. Gilyarov, and Ye. N. Tsvetkov, Institute of Organoelemental Compounds, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR -- Otdeleniye Khimicheskikh Nauk, No 12, Dec 59, pp 2135-2141

A number of dialkyl-N-phenylimidoalkylphosphinates and dialkyl-N-phenylimidoarylphosphinates, $(RO)_2R'P{=}NC_6H_5$, and trialkylmethylimidophosphates, $(RO)_3P{=}NCH_3$, were specially synethesized for this study. From a study of the infrared absorption spectra of imidophosphates and imidophosphinates, the authors concluded that absorption in the range of 1325-1385 cm^{-1} can be ascribed to the $=P=N-$ grouping in the substances examined.

42. Rapid, Chloro-Organic Compound Detection Method

"A Rapid Method for Determining Chloro-Organic Compounds in the Atmosphere," by S. F. Yavorovskaya, Institute of Labor Hygiene and Occupational Diseases, Academy of Medical Sciences USSR; Moscow, Khimicheskaya Promyshlennost, No 4, 1959, pp 77-79

An accelerated method had been developed for detecting chlorinated hydrocarbon vapors in the air on the basis of the staining of a colorless flame to a blue-green color in the presence of cupric oxide and chlorine. Samples are collected by adsorption on chlorine-free activated carbon.

To accelerate air sampling, a new type of absorber filled with granulated adsorbents is proposed. This absorber operates on the fluidized solids principle, which ensures complete adsorption at high air velocities (10-15 l/min).

The results obtained coincide sufficiently well with data obtained by the microcombustion method or with samples containing known quantities of chlorine when the chlorine content in the sample is not less than 0.5 mg.

Physical Chemistry

43. Possibilities of Mass-Spectrometric Method in Studies of Thermodynamics of Vaporization

"The Possibilities of the Mass-Spectrometric Method in Studies of the Thermodynamics of Vaporization," by L. E. Levina; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 2, Feb 60, pp 456-459

A review has been made of the work devoted to the mass-spectrometric method of studying the thermodynamics of vaporization. The method allows a study of the structure of vaporized substances under conditions of equilibrium vaporization and determination, from the experimental data, of the partial pressures of the vapor components and the values of the thermodynamic constants.

The specific features of the apparatus and methods used in such studies have been discussed.

44. Rectification of Electric Current at Ion Exchange Membranes Boundaries

"Rectification of Electric Current at Ion Exchange Membranes Boundaries," by V. N. Maslov and A. V. Ovodova (Moscow); Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 2, Feb 60, pp 413-415

Asymmetric electroconductivity has been discovered in double layer ion exchange elements made of membranes of opposite charge. The rectification coefficient attains a value of 30-40. The rectification of electric current at the boundary of ion exchange membranes may be explained by analogy with the action of p-n semiconductor transitions.

45. Electroconductivity of Semiconductors in Chemisorption of Molecules, Atoms, and Radicals

"Electroconductivity of Semiconductors in the Chemisorption of Molecules, Atoms, and Radicals," by I. A. Myasnikov (Moscow) Physical Chemistry Institute imeni L. Ya. Karpov; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 2, Feb 60, pp 395-404

The chemisorption of atoms and radicals on the surface of the n-semiconductor $ZnO.TiO_2$ is accompanied by considerably more ionization (by which is understood the formation of both positive and negative

particles) than that which takes place in the chemisorption of molecules, the degree of ionization of which in a number of cases is evidently determined by the degree of dissociation of the chemisorbed molecule into atoms.

The activation energy of ion formation in the chemisorption of H and N atoms and CH_3 radicals lies within the limits of 2-5 kcal, whereas for the corresponding molecules it is considerably higher: H_2 -- 30 kcal, O_2 -- 8 kcal, N_2 -- no ions are formed (chemisorption of N_2 evidently does not take place on ZnO and TiO_2). Hydrocarbons change the electroconductivity only to a slight extent, indicating that they evidently do not decompose to radicals on chemisorption.

The method of measuring the electroconductivity of semiconductors under conditions of formation of atoms and free radicals may be used to identify the atoms and radicals and in studies of the mechanism of heterogeneous catalytic reactions on semiconductor catalysts. Small crystal indicators of free radicals will presumably find application in various fields of chemistry.

The illustration presented in the present work of detecting on the surface of a catalyst chemisorbed hydrogen atoms formed as intermediately in the dehydrogenation reaction may be extended to investigations of various catalytic reactions proceeding with the formation of radicals. Recently we have shown that semiconductor films reveal the presence of radicals also in liquid systems, for instance during irradiation of liquid hydrocarbons with γ-rays.

46. Effect of Substitution of Hydrogen by Deuterium on Velocity of Sound and Compressibility of Liquids

"The Effect of the Substitution of Hydrogen by Deuterium on the Velocity of Sound and the Compressibility of Liquids," by I. V. Rabinovich (Gor'kiy), Institute of Chemistry, Gor'kiy State University imeni N. Lobachevskiy; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 2, Feb 60, pp 424-431

The temperature dependence of the ultrasonic velocity and density has been determined and the adiabatic compressibility calculated for 12 liquid deuterium compounds and their hydrogen analogs. The results have been discussed from the standpoint of the effect of molecular weight and intermolecular dispersion energy and of the formation of chain associates and three-dimensional lattices by means of hydrogen bonds.

47. Vacuum Cell for Studying Infrared Absorption Spectra of Solids Over Wide Range of Temperatures in Atmospheres of Various Gases

"Vacuum Cell for Studying the Infrared Absorption Spectra of Solids Over a Wide Range of Temperatures in Atmospheres of Various Gases," b N. N. Kaftaradze and V. I. Lygin, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 2, Feb 60, pp 462-463

The design of a cell has been proposed for studying the infrared absorption spectra of solids over the temperature range plus 200° to minus 50° C under vacuum or in atmospheres of various gases.

48. Isotope Exchange Method for Measuring Saturated Vapor Pressures and Diffusion Coefficients

"Isotope Exchange; Method for Measuring Saturated Vapor Pressures and Diffusion Coefficients," by V. I. Lozgachev, All-Union Scientific Research Institute of Mineral Raw Materials; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 2, Feb 60, pp 306-318

Examination of isotopic exchange through the gaseous phase, taking diffusion in the condensed phase into account, leads to the boundary condition at the specimen surface having the form

$$\delta \frac{\partial a(0,\ t)}{\partial t} = h[U - \alpha(0,\ t)] + D\frac{\partial \alpha(0,\ t)}{\partial x},$$

where α is the specific activity, $U = (0, \infty)$, δ is the thickness of the exchange layer, n_0 is the rate of vaporization, $\bar{n}$ is the number of atoms per unit volume, $\Omega(\alpha)$ is the transition coefficient, $h = \Omega(\alpha)\frac{n_0}{\bar{n}}$, and D is the coefficient of diffusion. Solutions of the diffusion problem have been found by different method under the same conditions for a bounded and semi-infinite rod as well as for an unbounded plane. The specific activity of a substance in the x plane at time t is determined by the expression

$$\alpha(x,\ t) = U + \sum_{n=1}^{\infty} a_n \cos k_n (x - j)\, e^{-k_n^2 Dt}$$

for a bounded rod under the conditions

$$\frac{\partial \alpha}{\partial t} = D\frac{\partial^2 \alpha}{\partial x^2} \qquad (0 < x < j),$$

$$\frac{\partial \alpha}{\partial x} = 0 \qquad (x = j),$$

$$\delta \frac{\partial \alpha}{\partial t} = h(U - \alpha) + D\frac{\partial \alpha}{\partial x} \qquad (x = 0),$$

$$\alpha = \alpha(0) \qquad (t = 0).$$

The specific activity of a substance in the x plane at time t is determined by the expression

$$\alpha(x, t) = U + (\alpha(0) - U)\,\mathrm{erf\ c}\left(\frac{x}{2\sqrt{Dt}}\right) - (\alpha(0) - U)\frac{h}{Dr_c}\left[\frac{W_1(x, t)}{q_1} - \frac{W_2(x, t)}{q_2}\right],$$

for a semi-infinite rod where

$$w_i = e^{q_i x + q_i^2 Dt}\ \mathrm{erf\ c}\left[\frac{x + 2q_i Dt}{2\sqrt{Dt}}\right]$$

and q_i and r_c are determined according to an expression given in the text.

49. Comparison of Regularities in Deuterium Exchange and in Other Reactions

"Comparison of Regularities in Deuterium Exchange and in Other Reactions," by A. I. Shatenshtein, Institute of Physical Chemistry imeni L. Ya. Karpov; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 3, Mar 60, pp 595-602

Deuterium exchange in hydrocarbons proceeds as an acid-base reaction. The acids react with the electronegative carbons of the aromatic CH-bond (or with the π electrons of the ring). On deuteroexchange with bases the hydrogen of the CH-bond protonizes. Because of the different mechanism of deutereoexchange with acid and base, on reaction with them one may reveal different aspects of the mutual influence of atoms in the hydrocarbon molecule.

The reason for the similarity in the regularities for deuteroexchange and electrophylic hydrogen substitution in the aromatic nucleus is that hydrogen acids and aprotonic acid-like substances, being electrophylic, react in a like manner with the aromatic ring, participating in the reaction as bases, i. e., electron donors.

The similarity in reaction between deuteroexchange with KNH_2 in NH_3 solution and the metallation, alkylation, isomerization, and dimerization of olefins with participation of bases is that they all proceed according to a protophylic carbanionic mechanism, the hydrocarbon playing the part of an acid.

The rate and selectivity of deuteroexchange depend to a high degree on the polarity of the bond between the substrate and reactant in the activated state. There are intermediate states between the associative and ionization mechanisms of the reaction.

50. Sonic Purification of Air

"Sonic Coagulation of Sulfuric Acid Fog," by M. L. Varlamov, Ye. L. Krichevskaya, G. A. Manakin, L. M. Kozakova, and A. N. Gospodinov; Moscow, Zhurnal Prikladnoy Khimii, Vol 33, No 1, Jan 60, pp 14-20

In an investigation of the sonic coagulation of sulfuric acid fog in a sound field produced by the gas stream generator (siren) GS-2 Constructed at the Odessa Polytechnic Institute, the authors found that frequencies of 16-22 kilocycles were optimal for the range studied. An increase of sound intensity improves coagulation; the effect of the intensity is felt more strongly at low frequencies.

The degree of coagulation depends on the initial concentration of the fog and decreases at both low and high concentrations. A degree of purification over 97% is ensured at an average intensity of sound of 0.2-0.25 W/cm^2 and an initial concentration of fog amounting to 1.7-8.7 g of H_2SO_4/nm^3.

51. Adsorption of Water Vapor on Crystals of Silver Halides

"Investigation of Water Vapor Adsorption on Ionic Crystals. Report 1. Methods and Results of Studying the Adsorption of Water Vapor on Crystals of Silver Iodine and Silver Chloride," by N. N. Moskvitin, M. M. Dubinin, and A. I. Sarakhov, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR -- Otdeleniye Khimicheskikh Nauk, No 12, Dec 59, pp 2080-2087

The authors investigated the isotherms of adsorption and desorption of water vapor in the temperature range from 20 to -20° on crystals of silver iodide and silver chloride which have a unit surface area of the order of 10-100 parts of a mm^2/g.

The adsorption isotherms were reversible over the entire range of pressure investigated, with the exception of the isotherms at -20°, which are reversible only if supersaturation of the water vapors in relation to the stable solid phase is not created in the adsorptive system.

By analyzing the isosterisms of adsorption a difference was established in the condition of the adsorbed water at a temperature lower than 0° on the silver halides studied.

It is stated that investigation of silver halides from this standpoint is of interest, because AgI, and also PbI_2, are used for seeding clouds.

52. Adsorption of Alkalies in Aqueous Solutions Investigated

"Investigation of the Mechanism of the Adsorption of Bases by Activated Carbon in Aqueous Solutions," by L. S. Ivanova and D. N. Strazhesko, Institute of Physical Chemistry imeni V. B. Pisarzhevskiy, Academy of Sciences Ukrainian SSR; Kiev, Dopoviki Akademii Nauk UkSSR, No 8, 1959, pp 869-873

The authors studied the mechanism of the sorption of various strong and weak inorganic and organic bases by activated carbon by means of an electrochemical method, first employed by B. P. Bruns and A. N. Frumkin for this purpose. They determined that as in the case of acids, the electrochemical exchange of ions in the outer coating of a double layer of carbon, acting as a gas electrode, for ions with the same charge in the dissolved electrolyte, does not only completely determine the adsorption behavior of alkaline and alkaline-earth metal hydroxides, but also plays a very substantial role in such fairly well dissociated organic bases as piperidine, diethylamine, etc. Weak surface bases of the aniline type and its derivatives are adsorbed by carbon in the form of whole molecules.

53. Effect of Radioactivity of Solid Phase on Heterogeneous Isotope Exchange

"New Data Concerning the Effect of the Radioactivity of the Solid Phase on Heterogeneous Processes of Isotope Exchange," by N. Ye. Mikhaylenko and Academician V. I. Spitsyn, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 131, No 1, 1 Mar 60, pp 129-132

The authors had established in previous work that the rate of exchange of sulfur isotopes in the system $K_2S^*O_4 - SO_3$ at 840° depends to a significant extent on the specific radioactivity of the $K_2S^*O_4$ that is used (Doklady Akademii Nauk SSSR, Vol 121, 1958, p 319). In the work described at present, the investigation was extended into a range of higher specific activities of K_2SO_4 (up to ~ 130 mCu/g). The data obtained made it possible to clarify to a certain extent the nature of the phenomena observed.

It was established that the rate of isotope exchange remains practically constant at activities of the potassium sulfate of the order of 0.02-0.03 mCu/g. This rate increases after the specific activity has surpassed 0.05 mCu/g and reaches a maximum at 2-2.5 mCu/g. An increase of the specific activity from 3 mCu/g to 35 mCu/g leads to a drop of the degree of exchange from 66% (in 10 minutes) to 25%. At a specific activity of the K_2SO_4 equal to 61 mCu/g, the degree of exchange begins to increase again and reaches 85% at a specific activity amounting to 131 mCu/g.

It may be assumed that the increase in the degree of isotope exchange up to 2-3 mCu/g is due to the formation of positive charges at the surface of the solid K_2SO_4 phase. These charges form because of the steady emission of beta particles. Apparently the exchange of sulfur isotopes takes place by the interaction of SO_3 with SO_4^{2-} ions at the surface of the potassium sulfate. As an intermediate product, $S_2O_7^{2-}$ ions are formed. The conditions for the formation of these ions are most favorable when the greatest number of positively charged active centers is present. The decrease in the degree of isotope exchange from 3 to 35 mCu/g is presumably due to a partial neutralization of the positive charges of the active centers by the greater number of electrons that are emitted.

The sharp increase in the degree of isotope exchange above 35 mCu/g is apparently due to activation of SO_4^{2-} ions, individual atoms of the crystal lattice, and SO_3 molecules by the beta radiation which is emitted.

It has been established that the energy of activation of the reaction of isotope exchange does not remain constant and that it depends on the content of radioactive sulfur in the sulfate. This confirms that different mechanisms of exchange are operative depending on the specific activity of the $K_2S^*O_4$.

The kinetics of sulfur isotope exchange between radioactive sulfur trioxide and inactive potassium sulfate and between inactive sulfur dioxide and active potassium sulfate were studied. It was established that the rates of isotope exchange at 840° in the systems K_2SO_4 - SO_3 and K_2SO_4-SO_2 are practically the same (SO_3 begins to dissociate at 400° with the information of SO_2).

54. Effect of External Radiation on Rate of Isotope Exchange Between $K_2S^*O_4$ and SO_3

"Investigation of the Effect of External Radiation on the Rate of Sulfur Isotope Exchange in the System $K_2S^*O_4$ - SO_3 at High Temperatures," by Academician V. I. Spitsyn, I. Ye. Mikhaylenko, I. V. Vereshchinskiy, and P. Ya. Glazunov, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 131, No 2, 11 Mar 60, pp 360-363

V. I. Spitsyn and I. Ye. Mikhaylenko established that the radioactivity of K_2SO_4 containing S^{35} has a considerable effect on the velocity of sulfur isotope exchange between potassium sulfate and sulfur trioxide gas (Doklady Akademii Nauk SSSR, Vol 131, No 1, 1 Mar 60, pp 120-132; of preceding item in this issue of the SIR). To determine what influence radiation phenomena taking place in the gas phase and on the surface of the salt under the effect of beta radiation have on the rate of isotope exchange, $K_2S^*O_4$ with a low activity was subjected to exchange with SO_3 while being irradiated by an electron beam coming out of a betatron. In the experiments described, $K_2S^*O_4$ with an activity of 4.6×10^{-2} mCu/g was used. It was established that external irradiation of the solid phase in the system K_2SO_4 - SO_3 with

a dose of the order of 10^{15} ev/10 min has practically no effect on the rate of exchange. An increase of the dose to 10^{16} - 10^{17} leads to an increase of the degree of exchange. The degree of exchange increases in direct proportion to the logarithm of the dose.

It was found that external irradiation with electrons has a much weaker effect on the capacity of $K_2S^*O_4$ to exchange S^{35} than irradiation with beta particles emitted because of the radioactivity of the potassium sulfate (at a dose of irradiation amounting to 3.4 X 10^{15} ev/10 min, a degree of exchange equal to 14.7% was obtained, as compared with 66.9% in the case of internal irradiation). Irradiation of the SO_3 gas with an electron beam prior to contact with the solid was also found to have an activating effect on the isotope exchange. However, the effect obtained was still weaker than that resulting from the external irradiation of the solid phase and of the gas in direct contact with the solid phase.

55. Nature of Imperfections Obtained by Irradiation of Alloy Fe_3Al With γ-Rays

"The Nature of Imperfections Obtained by the Irradiation of the Alloy Fe_3Al With γ-Rays," by I. Y. Dekhtyar and A. M. Shalayev, Institute of Metal Physics, Academy of Sciences Ukrainian SSR; Minsk, Inzhenerno-Fizicheskiy Zhurnal, No 2, Feb 60, pp 78-82

"The present article contains data on the effect of a dose of γ-radiation of the magnetic properties of Fe_3Al, Ni, Ni $_3$Mn (Fig 1-3), Changes in the galvanomagnetic effect and coercive force of these metals were observed as a result of the application of a dose of γ-radiation. The authors propose that the change in the galvanomagnetic effect is associated with the formation of Frankel's pair defects and their subsequent relaxation. The change in the coercive force is connected with the formation of dislocation loops."

56. Graft Copolymerization of Methylmethacrylate and Styrene on Gelatine Induced by Ionizing Radiation

"Graft Copolymerization of Methylmethacrylate and Styrene on Gelatine Induced by Ionizing Radiation," by L. Kiss and J. Dobo; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 3, Mar 60, pp 464-465

It has been shown that by the action of ionizing radiation graft copolymers of polymethylmethacrylate and polystyrene on gelatine may be obtained.

57. Oxidation of Chlorobenzene in Aqueous Solutions by Action of Irradiation

"Oxidation of Chlorobenzene in Aqueous Solutions by the Action of Irradiation," by N. P. Krushinskaya and M. A. Proskurnin, Institute of Physical Chemistry imeni L. Ya. Karpov; Moscow, Zhurnal Fizicheskoy Khimii, Vol 33, No 9, Sep 59, pp 1954-1961

"The radiolytic oxidation of chlorobenzene in aqueous solutions has been studied in vacuum and on continuous passage of oxygen. Under vacuum conditions analysis of the gaseous products showed the presence of oxygen and the complete absence of hydrogen. It has been found that in addition to phenol and the isomers of chlorophenol nonphenolic types of compounds representing hydrogenated derivatives of diphenyl are formed. The presence of molecular oxygen leads to a threefold increase in the yield of phenols at the expense of the hydrogenated condensation products. An important part in this process was shown to be played by the radiation hydrolysis of chlorobenzene.

On the basis of the data obtained, the mechanism of hydroxylation of chlorobenzene has been investigated.

58. Coprecipitation of Radioelements With Crystalline Carriers

"Some Relationships Pertaining to the Coprecipitation of Radioelements With Crystalline Carriers," by I. V. Melikhov and M. S. Merkulova; Leningrad, Radiokhimiya, Vol 1, No 6, Dec 59, pp 626-632

It was established that enrichment or depletion of the solid carrier phase with radioelements does not take place during the formation of crystallization nuclei in supersaturated solutions. The quasi-crystalline structure of the liquid adjacent to the surface of the solid makes it possible to represent the surface of the phase boundaries solid-liquid as consisting of three layers: the external layer of liquid, the intermediate layer, and the external layer of the solid phase. On the basis of this assumption, the mechanism of the coprecipitation of radioelements is considered in the stage of dynamic adsorption exchange between the surface and the solution and also in the stage of ordered deposition of a new monolayer on the surface of the carrier crystals. Relationships are derived which describe the distribution of radioelements in the volume of carrier crystals under different conditions of crystallization. The cases of the formation by the radioelements and the carrier of solid solutions with a limited and unlimited miscibility are discussed. It is brought out that the conditions under which the crystals grow exert an effect on the coefficient of crystallization. For instance, when the crystals grow with a constant velocity in a supersaturated solution, the magnitude of the coefficient of crystallization depends on the rate of agitation and the velocity of crystallization.

59. Transfer of Microquantities of Some Elements Into Crystals of Nonisomorphous Carriers

"The Investigation of the Mechanism of the Transfer of Microquantities of Some Elements Into Crystals of a Nonisomorphous Carrier," by I. V. Melikhov and M. S. Merkulova; Leningrad, Radiokhimiya, Vol 1, No 6, Dec 59, p 633-636

On the examples of the systems $NaCl-PbCl_2 - H_2O$ and $NaCl-CdCl_2-H_2O$, it was established experimentally that the process of the formation of crystallization nuclei for all practical purposes is terminated at supersaturations amounting to 73-95% of the initial, and that at this stage almost no enrichment of the solid phase with the impurity phase takes place. Enrichment of the solid phase with the impurity occurs in the stage of the growth of a constant number of nuclei of critical

dimensions. It was shown that when coprecipitation from a supersaturated solution of lead and cadmium isotopes with sodium chloride crystals takes place, an increase in the rate of agitation of the solution results in a reduction of the magnitude of the crystallization coefficient.

60. Method for Determination of Small Quantities of Radioactive α - Emitters by Applying Nuclear Photoemulsions

"Concerning Procedures for the Determination of Small Quantities of Radioactive Substances by Applying Nuclear Photoemulsions," by K. B. Zaborenko and V. I. Korobkov; Leningrad, Radiokhimiya, Vol 1, No 6, Dec 59, pp 724-727

On the example of uranium, it was demonstrated that it is possible to determine quantitatively small quantities of α-emitting radioactive substances by using a nuclear photoemulsion. It was found that when the photoemulsion is impregnated with a solution containing uranium, the absorption of uranium by the emulsion is characterized by a coefficient of penetration (adsorption coefficient) which depends on the pH of the solution. USSR photo emulsions were used in the work described.

61. Investigation of Emanation and Leaching-Out of Radium Isotopes From Monazite

"Investigation of the Emanation and Leaching-Out of Radium Isotopes From Monazite," by K. V. Zaborenko, A. M. Babeshkin, and I. V. Kovalenko; Leningrad, Radiokhimiya, Vol 1, No 6, Dec 59, pp 738-741

Investigation of the emanation and leaching-out of radium isotopes from monazite has shown that the ratio of quantities of individual radium isotopes in solution depends on the time which has passed since the powdering of the sample. It was established that only a small part of the decay products derived from the parent elements of radioactive families gets into the capillary network; the greater part of them is retained in the crystal lattice.

62. Accumulation and Separation of Recoil Atoms in Systems Consisting of Solid Phase and Solution

"Mechanism of the Accumulation and Separation of Recoil Atoms in the Systems Solid Phase-Gas and Solid Phase-Solution," by K. V. Zaborenko, A. M. Babeshkin, and I. S. Aul'chenko; Leningrad, Radiokhimiya, Vol 1, No 6, Dec 59, pp 742-746

Investigation of the mechanism of accumulation and distribution of recoil atoms in powdered substances as affected by the interstices between particles has shown that there is a different effect of the dimensions of the interstices on the amount of thorium X atoms which enter into the interstices from the solid particles, as compared with that of thoron atoms. The experimental results obtained on thorium X are in agreement with the distribution which may be expected on the basis of a mechanism of the separation of recoil atoms that has been proposed earlier.

63. Secondary Reactions of Br-82 and Br-80 m Recoil Atoms in Bromoethanes

"Investigation of Secondary Reactions of Recoil Atoms of Bromine-82 and Bromine-80 m in Bromoethanes," by A. N. Nesmeyanov, Ye. A. Borisov, E. S. Filatov, V. I. Kondratenko, Chang Tze-hsiang, K. Panik, and V. M. Shukla; Leningrad, Radiokhimiya, Vol 1, No 6, Dec 59, pp 712-716

The processes of stabilization of the recoil atoms of bromine-82 and bromine-80 m in the compounds CCl_3Br, CCl_2Br_2, $CHCl_2Br$, $CHClBr_2$, CH_2ClBr, CH_2BrI, CH_2Cl-CH_2Br, and CBr_3NO_2 depending on the concentration of the added bromine or iodine were investigated. It was established that there are differences in the behavior of the two recoil atoms in the following substances: CCl_3Br, CCl_2Br_2, $CHCl_2Br$, $CHClBr_2$, CH_2BrCl, and CH_2BrI. A hypothesis is advanced in regard to the occurrence of superthermal ionic-molecular reactions. The effect of polar and non-polar solvents (nitrobenzene, p-nitrotoluene, benzene, and toluene) on the retention of bromine-82 and bromine-80 m in trichlorobromomethane and iodobromemethane was investigated. The data obtained indicate that the magnitude of the dipole moment of the solvent has a stronger effect on the stabilization of bromine-82 than on that of bromine-80 m. This proves indirectly that superthermal reactions involving charged bromine atoms take place. It was established that application of high-potential electrostatic fields has no effect on the stabilization of the recoil atoms, at least up to potentials of 7 kilovolts per centimeter.

64. Isolation of Radioactive Isotopes by Extracting Them in Form of Their Compounds With Ketones

"Methods for the Separation of Radioactive Isotopes Without Carriers; Part 9 -- Separation of Radioactive Isotopes by Extracting Them in the Form of β-Diketonates," by I. P. Rudenko and I. Stary; Leningrad, Radiokhimiya, Vol 1, No 6, Dec 59, pp 700-705

On the examples of acetylacetone and benzoylacetone some physico-chemical characteristics were studied a knowledge of which is required for the investigation of the extraction of β-diketonates of metals. The conditions were investigated at which an equilibrium distribution of β-diketonates of some metals is achieved between the organic solvents and the aqueous phase. It was established that the coefficients of the distribution of β-diketonates are constant within a wide range of concentrations of the metal. Association constants of some β-diketonates have been determined. The relative contents of different forms of β-diketonates depending on the concentration of the β-diketone anion in the aqueous phase were determined. In the work in question, the extraction of indium, cadmium, tin, scandium, iron, yttrium, strontium, lanthanum, barium, thorium, and uranium by solutions of β-diketones in organic solvents was investigated. Methods were developed for separating without a carrier in a state of high-purity radioactive indium from cadmium and tin, yttrium from strontium, lanthanum from barium, and UX_1 from uranium.

65. Dependence of Coefficient of Distribution of Elements on Concentration of These Elements

"Investigation of the Dependence of the Coefficient of Distribution of Elements Between the Organic Phase and Aqueous Phase on the Concentration of the Elements in Question," by A. K. Lavrukhina and Chu P'ei-chi; Leningrad, Radiokhimiya, Vol 1, No 5, Oct 59, pp 530-537

Investigation of the dependence of the degree of extraction on the concentration of elements for the systems $HBiI_4$ + HI + diethyl ether; $H_2Ce(NO_3)_6$ + HNO_3 + tributyl phosphate + CCl_4; and $Sm(NO_3)_3$ + thiophene-carbonyltrifluoroacetone + benzene has shown that the increase in the degree of extraction observed at relatively high concentrations of bismuth and cerium can be explained by formation in the organic solvent of polymer forms of the compounds being extracted. At concentrations of tetravalent cerium above 0.1 M and of samarium above 0.02 M, there is formation of polymer forms in 8 M HNO_3 in the case of cerium and in solutions of samarium nitrate having a pH = 6.5 in the case of samarium. On the basis of a comparison with theoretical curves of the experimentally found dependence of the degree of extraction of elements on their

concentration, it becomes possible to make conclusions concerning the state of the substance in solutions and to find concentration regions in which polymerization or dissociation of the substances being extracted takes place in the aqueous and also the organic phase. Knowledge of the dependence of the distribution coefficients on the concentration of elements is of great importance in radiochemical analysis of products of nuclear transformations, particularly when very small quantities of elements constituting products of nuclear reactions are present.

(This paper was given at the All-Union Symposium on Radiochemistry held 3-5 March 1959 in Leningrad.)

66. Adsorption of Electrolytes by Zinc Oxide and Chemical Interaction of Electrolytes With Adsorbent

"Radiochemical Investigation of the Adsorption of Electrolytes by Zinc Oxide and of the Chemical Interaction of These Electrolytes with the Adsorbent," by V. M. Chavrova and Ye. V. Yegorov; Leningrad, Radickhimiya, Vol 1, No 5, Oct 59, pp 538-544

By using Na^{24}, Cl^{36}, S^{35}, P^{32}, and Zn^{65} as tracers, processes of adsorption of electrolytes on zinc oxide and the chemical interactions of these electrolytes with zinc oxide were investigated. It was established that the adsorption of anions from solutions of acids, acidic salts, and salts which hydrolyze with an acidic reaction is irreversible and is accompanied by a chemical interaction with the zinc oxide. In the case of zinc sulfate, there is formation of basic zinc sulfate on the surface of the zinc oxide in a definite concentration range at a pH equal to or smaller than 6.5. It was also established that adsorption of sodium ions from solutions of caustic soda is reversible and of the chemical type; it leads to the formation on the surface of the zinc oxide of sodium zincate that is stable only at a pH equal to or larger than 9-9.5. A number of experimental data have been obtained which indicate that there is ion exchange at zinc oxide in the pH range from 6.5 to 9-9.5. Investigation of the adsorption of electrolytes by precipitates is of great importance from the standpoint of application of the results in radiochemistry, inorganic chemistry, catalysis, and other fields.

67. New Book on Application of Radioactive Isotopes in Prospecting for Petroleum and Gas Deposits

Yadernaya Geofizika (Nuclear Geophysics), edited by F. A. Alekseyev, Doctor of Geologic-Mineralogical Sciences; Gostoptekhizdat, 20 printed sheets, 10,000 copies, 11 rubles 50 kopecks; reviewed in Prospekt Knig po Nefti i Gazu Vypuskayemykh v 1960 godu-Geologiya i Razvedka Neftyanykh i Gazovykh Mestorozhdeniy, Gostoptekhizdat, Moscow, Nov 59, p 14

This is a collection of articles on the application of radioactive substances in the prospecting for and surveying of petroleum and gas deposits. It will serve the needs of a wide circle of scientific workers and technologists, specifically those active in the petroleum industry, and of geologists and physicists. Articles on the status and present and future progress of work pertaining to the application of radioactive substances in prospecting are contained in it. The single-channel device RK is described which is to be used in well logging and can be applied at temperatures up to 250°C. Problems are discussed which pertain to the many-sided interpretation of results obtained by applying radioactivity in well logging under conditions involving the presence of riff-building masses and in making determinations of the porosity of rocks on the basis of data obtained by employing the neutron gamma method.

This book will be published in the second quarter of 1960.

68. Transactions of Conference on Use of Ionizing Radiation in Control of Industrial Processes

Radioaktivnyye Metody Kontrolya i Regulirovaniya Proizvodstvennykh Protessov (Radioactivity Methods for the Indication and Control of Industrial Processes), Transactions of a Scientific-Technical Conference, 285 pp, price 12 rubles 80 kopecks (unsigned review); Moscow, Atomnaya Energiya, Vol 8, No 1, Jan 60, p 88

This book, which was published in 1959 by the Publishing House of the Academy of Sciences Latvian SSR in Riga, contains reports presented at the Scientific-Technical Conference on the Use of Radiation Emitted by Radioactive Substances for the Indication of Control of Industrial Processes, held in 1957 in Riga. The reports discuss problems of the theory and design of devices the operation of which is based on the use of nuclear radiation. A number of installations and instruments are described which are used in the industry for measuring different variables of importance in technical processes. They include liquid

level meters, density meters, devices for measuring thickness, etc. Problems are discussed which have a bearing on the use of radiation emitted by radioactive substances in the automation and control of processes in the metallurgical, coal, and petroleum industries.

69. Experimental Determination of Weakening Coefficients of Gamma Radiation in Cylindrical Emitters

"Experimental Determination of the Weakening Coefficients of Gamma Radiation in Cylindrical Emitters," by N. G. Smirnov and K. A. Uspenskiy; Moscow, Zhurnal Fizicheskoy Khimii, Vol 33, No 9, Sep 59, pp 2036-2039

In the paper an experiment has been described and the experimental values have been presented of weakening coefficients in cylindrical emitters filled with cobalt solution of specific gravity 1.3 g/cm^3.

The weakening coefficients have been found to be independent of the distance from the point to the emitter axis.

The values for the weakening coefficients are much greater than those for the self-adsorption coefficients obtained by Dixon for cylindrical emitters, which shows that self-scattering processes in emitters must be accounted for.

70. Relative Abundance of Lithium Isotopes in Uranium Minerals and Meteorites

"The Relative Abundance of Lithium Isotopes in Uranium Minerals and Meteorites," by K. G. Ordzhonikidze; Moscow, Geokhimiya, No 1, 1960, pp 37-44

The relatively frequent occurrence of displacement of the isotopic composition of lithium was investigated in uranium minerals and meteorites, which had not been purified preliminarily. The detected isotopic shifts of lithium in uranium minerals depend on the age of the mineral. In ancient uranium minerals the degree of enrichment in the heavy lithium isotope equals 6.4-7.9%, while in the youngest minerals it is 2.9%. The enrichment of uranium minerals in the heavy lithium isotope may be explained by the transformation of nuclei of the light boron isotope according to the nuclear reaction $^{10}B + n \longrightarrow {}^{7}Li + \alpha$.

The observed variations of the isotopic composition of lithium in meteorites are considerably weaker than in uranium minerals.

III. EARTH SCIENCES

71. Heterogenous Aerosols Dispersed Vertically Studied

"The Role of Vertical Turbulent Dispersion in the Precipitation of Heterogenous Aerosols From the Atmosphere," by A. Ya. Pressman, Institute of Applied Geophysics, Academy of Sciences USSR; Minsk, Inzhenerno-fizicheskiy Zhurnal, No 11, Nov 59, pp 11-19

By comparing two effects causing the vertical dispersion of aerosol particles of heterogenous composition settling from the atmosphere (the effect of vertical turbulent diffusion and the effect of the difference of velocity with which the particles settle), criteria have been obtained by the use of which the effect of vertical turbulence in the settling of heterogenous aerosols may be neglected with determinable error.

72. Chinese Make Use of Telluric Currents in Geophysical Prospecting

"Electrogeophysical Prospecting Work by the Telluric Current Method in the People's Republic of China," by A. V. Kavin; Peiping, Acta Geophysica Sinica, Vol 8, No 2, 1959, pp 138-158

The article is a brief summary of the method of conducting field work by the telluric current method and the means of processing tellurograms which were tried in different geological provinces of China. It was found that the most effective method is a method of conjugate ellipses; however, for a full geological interpretation of the anomalies of the field of telluric currents, it is advisable to conduct a supplementary processing by a method of total changes.

Some methods of simplified processing are examined for preliminary preparations in the field.

Examples of work by the telluric current method are given for solving regional problems and for seeking local structures in Tsaidam, Dzungaria, and Ordos.

73. Chinese Produce DC Amplifier for Use in Geophysical Prospecting

"A Direct Current Amplifier, Modulation Type, for the Telluric Current Method of Geophysical Prospecting," Section of Electrical Prospecting, Institute of Geophysics and Meteorology, Academia Sinica; Peiping, Acta Geophysica Sinica, Vol 8, No 2, 1959, pp 174-186

The article contains a description of the construction of a two-channel direct current amplifier of the modulation type with results of laboratory and field tests. The principles of the amplifier and an account of the experience gained in its construction and testing, especially relating to the effect of noise level and its prevention, are given.

The amplifier has relatively low amplitude and phase distortion to waves with a frequency less than one cycle, a noise level less than 0.5 microvolt, and a zero point drift of less than 5 microvolts per hour. The amplifier is considered suitable for the measurement of very weak and low frequency signals and is recommended for general field use.

IV. ELECTRONICS

Communications

74. Coaxial Television Line Between Moscow and Kiev

"Exchange of Television Programs Between Moscow and Kiev" (unsigned article); Moscow, Vestnik Svyazi, No 3, Mar 60, p 12

"The beginning of the second year of the Seven-Year Plan was marked by an outstanding event; a test exchange of television programs took place in February between the capital's television center and the Kiev television center. The television programs were transmitted over the new coaxial cable line between Moscow and Kiev. A great number of builders, scientific and engineering workers, and organizations and enterprises of the Ministry of Communications USSR and industry participated in building this line.

"The total length of the line is about 1,000 km, with 160 automatically controlled repeater stations.

"A motion picture was transmitted from Moscow to Kiev; the Kiev TV center transmitted to Moscow a concert program. A high-quality image was displayed during this test exchange program. A regular exchange of TV programs between Moscow and Kiev begins in March. It is planned to connect to the Moscow-Kiev coaxial line the TV stations of other cities located along the route.

"The Moscow-Kiev cable line, in addition to two TV channels for duplex exchange of programs, will provide, in the future, a great number of telephone channels which will improve interurban service of populated centers, enterprises, and institutions of Moscow and the Ukrainian Capital."

75. Television Broadcasting in USSR

"Development of Television Broadcasting During 1960," by V. I. Vinogradov, Moscow, Vestnik Svyazi, No 2, Feb 60, pp 5-6

As of 1 January 1960, the following powerful television broadcasting stations were in operation in the USSR; Murmansk, Petrozavodsk, Leningrad, Tallin, Kokhtla-Yarve, Cherepovets, Riga, Kuldiga, Novgorod, Yaroslavl', Kaliningrad, Kalinin, Kostroma, Kirov, Ivanovo, Vil'nyus,

Smolensk, Moscow, Vladimir, Kirov, Perm', Minsk, Bryansk, Kaluga, Ryazan', Gor'kiy, Kazan', Gomel', Orel, Stalinogorsk, Sverdlovsk, Penza, Izhevsk, Tyumen', L'vov, Chernigov, Kursk, Voronezh, Kiev, Ul'yanovsk, Chelyabinsk, Khar'kov, Kuybyshev, Saratov, Ufa, Kishinev, Dnepropetrovsk, Stalino, Stalingrad, Salavat, Odessa, Nikolayev, Zaporozh'ye, Lugansk, Kherson, Rostov-on-Don, Simferopol', Krasnodar, Sochi, Armavir, Pyatigorsk, Nal'chik, Tbilisi, Yerevan, Baku, Vorkuta, Noril'sk, Novosibirsk, Tomsk, Kemerovo, Omsk, Krasnoyarsk, Barnaul, Biysk, Karaganda, Rubtsovsk, Ust'-Kamenogorsk, Tashkent, Alma-Ata, Frunze, Andizhan, Stalinabad, Irkutsk, and Vladivostok.

At present about 50 television centers are in some stage of construction or planning in the following cities: Ashkhabad, Arkhangel'sk, Belgorod, Yoshkar-Ole, Krivoy Rog, Kustanay, Krasnovodsk, Komsomol'sk-on-Amur, Lipetsk, Makhachkal, Magnitogorsk, Magadan, Orenburg, Petropavlovsk-Kamchatskiy, Pskov, Saransk, Tartu, Tambov, Khabarovsk, and others.

There are about 3.5 million television receivers of about 50 different models now in use in the USSR. During the past year, about 1.2 million TV receivers were manufactured, and more than 1.5 million sets are planned for production during the coming year.

One of the plants of the Leningrad Sovnarkhoz has manufactured the first experimental lot of the color TV receiver "Rus'" with the three-beam 53LK4Ts tube.

Materials

76. Possible Application of Electrets in Automation

"Electrets and Their Possible Application in Automation," by V. A. Andryushchenko; Moscow, Avtomatika i Telemekhanika, No 1, Jan 60, pp 139-142

At the Physics Institute imeni P. N. Levedev, Academy of Sciences USSR, the following method was used to polarize inorganic electrets: The samples were placed in an electric field of 20 kv/cm intensity for a period of 20 min at room temperature, then for 2 hours at a temperature of 200°C, and finally cooled slowly (2 hr) to 60°C. Both samples and electrodes were highly polished prior to polarizing. The inorganic electrets can be stored either in short-circuited state or un-shorted state for a period of several years.

The dielectric constant was determined for the following inorganic electrets: $MgTiO_3$ -- 16, $ZnTiO_3$ -- 22, $BaO \cdot 4TiO_2$ -- 28, bismuth titanate -- 80, $CaTiO_3$ -- 150, $SrTiO_3$ -- 175, strontium-bismuth titanate -- 750, and $BaTiO_3$ -- 1,200.

The possibility of utilizing electrets in storage devices of electronic computers was recently suggested. It is also suggested that a very useful device would be produced if electrets could be made into a thin and long tape with the two sides of such a tape having opposite polarity.

77. Thermodynamic Properties of Germanium-Zinc Alloys

"Thermodynamic Properties of Germanium-Zinc Alloys," by G. F. Voronin and A. M. Yvseyev, Moscow State University; Moscow, Zhurnal Fizicheskoy Khimii, Vol 33, No 9, Sep 59, pp 2024-2029

The thermodynamic properties of germanium-zinc alloys have been studied over the temperature range 342-466°C with the aid of an effusion method, employing a continuously weighing balance. The method used permitted the activity of zinc to be determined for any point in the concentration range of the alloys. A negative deviation from the ideal has been found in the system. This deviation is accompanied by a large positive heat of mixing.

A qualitative interpretation of the changes observed in the thermodynamic functions has been presented.

78. Effect of Certain Physicomechanical Properties of Crystals on Their Grinding Process

"The Effect of Certain Physicomechanical Properties of Crystals on Their Grinding Process," by L. F. Grigor'yeva, Institute of Silicate Chemistry (Leningrad); Minsk, Inzhenerno-Fizicheskiy Zhurnal, No 2, 1960, pp 36-39

The process of grinding crystalline materials is determined by a whole series of physicomechanical properties associated with their strength, structure, and especially their brittleness. General features of the brittleness of the crystalline materials and glasses investigated explain the similarity of the laws governing their grinding.

The quantitative relationships obtained between the coefficients of the grinding process of crystalline materials with a brittleness criterion from 4 to 1 and their physicomechanical properties can be used for the calculation and rationalization of technological working conditions of their grinding process.

Data on the physicomechanical properties of Al_2O_3, SiO_2, Si, Ge, GaAs, Ga_2Se_3, SnSe, InAs, CdSe, InSb, In_2Te_3, CdTe, and GaSb are given.

79. Electrical Properties of the beta- Phase of the Tantalum-Tellurium System

"The beta- Phase of the Tantalum-Tellurium System," by Yu. M. Ukrainskiy, L. M. Kovba, Yu. P. Simanov, and A. V. Novoselova; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 12, Dec 59, pp 2820-2822

The dimensions of the unit cell of the beta - phase of the tantalum-tellurium system were determined by the X-ray diffraction method. Furthermore, the electrical properties (the dependence of the conductivity and of the thermal EMF on the composition) were determined. It was established that the compositon of the beta- phase corresponds to $Ta\ Te_{1-5}$ - $Ta\ Te_{2.0}$.

80. Vapor Pressures of Lead Selenide

"Determination of the Vapor Pressure of Solid Lead Selenide," by V. P. Zlomanov, B. A. Popovkin, and A. V. Novoselova; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 12, Dec 59, pp 2661-2664

The pressures of saturated lead selenide vapor were determined in the temperature range of 501-668°. It was established that these pressures vary with the temperature according to the equation:

$$p\ (\text{in mm Hg}) = -\frac{11032}{T} + 10.084\ .$$

The heat of sublimation of lead selenide (ΔH_T) was found to be 50.47 kilocalories per mol. The data in question are of importance from the standpoint of the production of lead selenide photoresistances by evaporation in vacuum. The results obtained are also of value in connection with the isolation of selenium from ores containing this element in the form of selenides of heavy metals, including lead.

81. Surface Tension of Germanium, Silicon and Diamond

"Surface Tension of Germanium, Silicon, and Diamond," by B. V. Belogurov, Institute of General and Inorganic Chemistry, Academy of Sciences Ukrainian SSR; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 2, Feb 60, pp 440-443

Empirical formulas have been proposed for the surface tension of solids. The formulas do not contain arbitrary coefficients and give quite satisfactory results for a large number of elements. Tentative values have been obtained for the surface tensions of germanium, silicon, and diamond, heretofore not to be found in the literature.

82. Rumanian Scientists Propose Radioactivation Method of Analysis for Silicon

"Analysis of Chemically Pure Silicon by Radioactivation," by M. Badanoiu, M. Fiti, and S. Mantescu, Institute of Atomic Physics, Academy of the Rumanian Democratic Republic; Bucharest, Studii Si Cercetari de Chimie, Vol 7, No 4, 1959, pp 573-579

The present work reports the analysis of pure silicon without chemical separations; four impurities were determined simultaneously, which previously had not been possible for silicon.

Even though the material is only "chemically pure," representing an intermediate phase in the purification of silicon for semiconductor uses, the application of the radioactivation method of analysis is a clear advantage in comparison to the classical analytical methods, since four impurities can be determined simultaneously in 0.1 g samples by a very simple method; the proposed method is more reliable than the classical methods because the average errors of determination by the latter are too great to determine with sufficient precision the small amounts of impurities lying within the permissible limits.

83. Hungarian Research in Electroluminescence and Transistors Noted

"Results of Electroluminescence Experiments," by Erzsebet Kun; Budapest, Magyar Nemzet, 10 Apr 60, p 5

This article, by a popular science writer of a Budapest daily, describes research being conducted at the Imre Brody Laboratory of the Signal Technology Industry Research Institute (Hiradastechnikai Ipari Kutatointezet) which operates on the premises of the United Incandescent (Egyesult Izzo) Factory in Hungary. The chief of the laboratory, Kossuth Prize-winning Academician Gyorgy Szigeti, describes the phenomenon of electroluminescence and adds: "The new light source was first patented in Hungary. It was worked out in the Brody Laboratory and went abroad from here. They are now experimenting with it abroad also, but research throughout the world is in initial stages. Unfortunately, for the time being, we know of few luminescent crystals or other similar materials suitable for our purposes...."

The article reports that the other chief theme of the laboratory is transistor research. The article says: "The first transistors of domestic manufacture were designed here. These have since proven themselves outstandingly, and they want now to develop a family, a virtual dynasty of transistors which will dominate the Hungarian market and start a foreign conquest as well. An experimental series of the youngest offspring of the family is now being examined."

The article concludes by noting that three researchers at the laboratory received Kossuth Prizes last year -- Gyorgy Szigeti, Zalan Bodo, and Ivan Szep -- for work in electroluminescence and transistors.

[For additional information on materials, see Chemistry, Nuclear Fuels and Reactor Construction Materials, and Physics, Solid State Physics.]

Wave Propagation

84. Detection of Pulse Packets of Random Duration

"Detection of Pulse Packets of Random Duration by Devices With Limited Memory Capacity in the Presence of Fluctuating Noise," by A. Ye. Basharinov; Moscow, Radiotekhnika i Elektronika, No 3, Mar 60, pp 355-359

The logic problems in the design of devices for processing intercepted signals having pulse packets of a random duration are generally encountered in transmission systems employing feedback. A radar installation is one example of such a system.

The problem of pulse-packet detection in the presence of fluctuating noise can be treated as a successive selection of possible states (signal is present, or signal is absent) on the basis of data received discretely in time, where the time intervals correspond to the "distance" between the components of the packet. The method of binary-threshold sequential (Wald's) analysis is the best procedure for detection of pulse packets with infinite duration.

Since the optimal systems for detection of pulse packets require unlimited memory capacity and a rather complex algorithm, the author suggests a simplified method of processing with a limited memory capacity.

85. Wave Propagation in Plasma

"Propagation of Electromagnetic Waves in Plasma-Filled Wave guides," by V. Ye. Golant and A. P. Zhilinskiy, Leningrad Polytechnic Institute imeni Kalinin; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 1, Jan 60, pp 15-24

The propagation of electromagnetic waves in wave guides filled with a medium of variable conductivity is studied. The analysis is processed by applying the perturbation theory. The phase shift and the damping, introduced by the plasma in the wave guide, are computed in the first and the second approximation of the perturbation theory.

86. Heat Expansion of Electrons

"Effect of the Magnetic Field on the Heat Expansion of a Beam in an Electron Gun," by Yu. V. Troitskiy; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 1, 1960, pp 25-30

An axially symmetric electron gun with magnetic lines of its field coinciding with the electron trajectories is discussed. It is shown that with a sufficiently strong magnetic field, the blurring of the electron beam, due to thermal electron velicities at the cathode, can be avoided. As an example, a Pierce gun with a conical beam is analyzed. An electron gun with a magnetic field may be applied to ultrahigh frequency tubes, together with a magnetic focusing system.

87. On the Kuepfmueller Transient Formula

"Remarks and Additions to the Kuepfmueller Transient Formula," by G. Wunsch, Institute of General Electrical Engineering, Dresden Technische Hochschule; Leipzig, Hochfrequenztechnik und Elektroakustik, Vol 69, No 1, Feb 60, pp 35-39

In the system theory developed by Kuepfmueller (Die Systemtheorie der elektrischen Nachrichtenuebertragung /The System Theory of Electrical Communications/, Stuttgart, 1952), physically nonexistent system properties are often arbitrarily assumed through oversimplification, and other system properties are derived from them. The often resulting physically contradictory conclusions are due to the fact that certain laws of combination, based on the principle of causality, between the various characteristics of a linear system have been neglected. Such laws of combination are, among others, the Hilbert transformation as an expression for the connection between the real and imaginary part of the regular

frequency characteristic of the system in the right frequency half-plane and the Wiener-Paley criterion as an expression of the relationship between time and frequency characteristics.

The author has previously pointed out (Wissenschaftliche Zeitschrift der Technischen Hochschule Dresden, No 1, 1958/59; Nachrichtentechnik, No 6, 1956) that the most salient points of the Kuepfmueller theory can be generalized in such a way that the above-mentioned necessary relationships are automatically expressed.

This article, on the basis of the generalized theory, generalizes and expands the fundamental Kuepfmueller transient formula for low-pass networks. It is also shown that a formula analogous to the Kuepfmueller formula also applies for all-pass delay networks with optimally smoothed transit time.

/For additional information on wave propagation, see "Plasma Behavior" under Physics, Nuclear Physics./

V. ENGINEERING

88. Book on Gas Dynamics and Combustion

Gazodinamika i fizika goreniya (Gas Dynamics and the Physics of Combustion), Power Engineering Institute imeni G. M. Krzhizhanovskiy, Moscow, 1959, 172 pp; Moscow, Vestnik Akademii Nauk SSSR, No 1, Jan 60, p 131

An examination of the hydrodynamic heterogeneities in the theory of combustion and explosions, the propagation of shock waves in the combustion products of hydrogen-oxygen mixtures, certain properties of supersonic flows, laws of the formation of a wave front in a free jet, etc. is made in the book.

89. Czechoslovaks Report on Tests Involving Rocket Motors Operating on the Principle of Recombination of Dissociated Oxygen Molecules

"Utilizing the Energy of the Ionosphere" (unsigned article); Prague, Kridla Vlasti, 29 Mar 60, p 11

A two-column article discusses the theoretical principle of powering a high-altitude vehicle with special motors which would use dissociated oxygen molecules at ionospheric altitudes as a means of propulsion by passing them through a special device lined with a suitable catalyst and thus produce adequate thrust for flight.

The article, which is accompanied by a sketch of a proposed "Recombination Propulsion Unit for Flights in the Upper Layers of the Atmosphere," specifically mentions gold as the most suitable catalyst and discusses at some length the quantities of energy, in the form of heat, which can be released by a given amount of dissociated oxygen molecules.

Although contending that this type of research is essentially in its infancy, the article mentions the experiments performed by A. Kaplan and, later, on a much larger scale, by Soviet scientists Ya. B. Zel'dovich, Tselikov, and others and states that the entire mechanism would naturally have to be boosted into the ionosphere by a rocket "like that which boosted the Sputniks."

In closing, the article claims that "reports in specialized literature permit the assumption that a recombination motor will be flight-tested as early as the end of 1960."

90. Analysis of Steam-Generator Performance in Pressurized-Water Reactor

"Temperature Conditions for Efficient Performance of the Steam Generator of a Nuclear Electric Station," by I. A. Trub, Central Asian Polytechnic Institute; Minsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Energetika, No 3, Mar 60, pp 71-75

A method is described for determining the temperature of feed water, generated steam, and water under high pressure in the primary circuit and other factors influencing the most efficient and economical performance of a steam generator operating in conjunction with a pressurized-water nuclear reactor. To obtain the maximum power output for a fixed amount of heat generated in the reactor, the temperature difference between incoming water and outgoing water in the primary circuit should not be very great; and as a consequence of this, a large quantity of water has to circulate in the primary circuit.

With the described calculation method, it was found that for the stipulated conditions of inlet water temperature at 280°C and outlet temperature at 260°C in the primary circuit, the most efficient and economical performance of the steam generator would occur when the steam is generated at a pressure of 48 atm abs and the feed water is preheated to 143°C.

Since the steam generator in a pressurized-water reactor installation is among the most expensive components, the thermal conditions determining the most efficient performance of the steam generator are often the deciding factor in selecting the general outlay of the whole installation.

91. Unipolar Pulse Generators

"EMF and Current of Unipolar-Commutator Pulse Generator," by I. S. Rogachev and L. D. Perchik; Novocherkassk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Elektromechanika, No 2, Feb 60, pp 88-105

The voltage and current pulses of a unipolar-commutator pulse generator, employed in electric-pulse machining of metals, should be of square shape, and the emf between the pulses should be of a very low value. If the unipolar pulse generator is used for anodic-mechanical cutting of metal, then the emf between the pulses should be maintained at relatively large values. To ensure better commutation of unipolar pulse generators, the interval between two adjacent groups of unipolar pulses should be of a relatively long duration, and the amplitude of the end pulses of each group should be small.

A unipolar pulse generator operating at a pulse repetition rate of about 2,000 pps generally requires that the ratio of its active resistance to the inductive reactance be maintained at about 6. Commutation difficulties might arise if the pulse duration is increased for a given pulse repetition rate.

Data and formulas obtained in this study are useful for design of unipolar-commutator pulse generators.

92. Analysis of Magnetic Circuits With the Aid of Electrical Analogs

"Investigation of the Cooling Process in the Magnetic Circuit of Transformers With the Aid of Electrical Analogs," by A. A. Gurchenok, Tomsk Polytechnic Institute imeni S. M. Kirov; Minsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Energetika, No 3, Mar 60, pp 20-25

In a number of electric devices, such as the betatron, which depend on air cooling of their magnetic circuit, the determination of heating at various points of the magnetic circuit is of great importance for satisfactory performance of the equipment. Analytical calculation of magnetic circuit cooling is difficult because it requires solution of differential equations of the temperature field in an anisotropic medium with internal sources of heat.

A description is given for a solution based on the principle of an electricity-heat analogy. With the aid of an electrical analog, it is possible to determine the actual temperature at various points of the magnetic circuit. The effect of cooling element location within the magnetic circuit on the over-all cooling efficiency has been determined. The values determined with the aid of an electric analog were in fairly good agreement with the values computed by analytical methods.

93. New Xenon Lamps

"Super-High Pressure Type DKSSh1000 and DKSSh1000-1 Xenon Arc Lamps" (unsigned article); Moscow, Svetotekhnika, No 4, Apr 60, p 32

Super-high pressure xenon lamps are now produced at the Moscow Electric Bulb Plant. The production of these lamps will begin at the Riga Electric Bulb Plant in the latter half of 1960.

The type DKSSh1000 xenon lamp is designed for operation on dc current, and the type DKSSh1000-1 is designed for operation on ac current. The xenon lamp consists of a thick-walled quartz glass globular bulb with two closely spaced electrodes of thorium-coated tungsten. The bulb is

filled with xenon at a pressure of 8-9 atm; the pressure of the gas rises to 20-25 atm when the lamp is put into operation. These xenon lamps radiate ultraviolet, visible, and near-infrared. The type DKSSh1000A lamp consumes 1,000 w and has a service life of about 250 hr. The lamp is now priced at 250 rubles.

94. Boundary Value Problems for Degenerating Hyperbolic Equations

"Mixed Boundary Value Problems for Degenerating Linear Hyperbolic Differential Equations of the Second Order," by M. L. Krasnov; Moscow, Matematicheskiy Sbornik, Vol 49(91), No 1, Sep 59, pp 29-32

A mixed problem is considered for several classes of linear hyperbolic differential equations degenerating at the boundary of a region.

In Chapter 1, the mixed problem for hyperbolic equations degenerating for $t = 0$ is considered.

Sections 1-3 of Chapter 1 are devoted to the existence and uniqueness proof for a generalized solution of the mixed problem for an equation of the form

$$L u \equiv \frac{\partial^2 u}{\partial t^2} - \sum_{i,k=1}^{m} \frac{\partial}{\partial x_i}\left(a_{ik}(x, t) \frac{\partial u}{\partial x_k}\right) + \sum_{i=1}^{m} b_i(x, t) \frac{\partial u}{\partial x_i} + \\ + e(x, t) \frac{\partial u}{\partial t} + d(x, t)u = h(x, t), \tag{1}$$

where $x = (x_1, \ldots, x_m)$, $a_{ik}(x, t) = a_{ki}(x, t)$,

$$\sum_{i,k=1}^{m} a_{ik}(x, t)\, \xi_i \xi_k \geqslant c^2 t^{\alpha} \sum_{i=1}^{m} \xi_i^2 \qquad (c^2 = \text{const} > 0, \alpha \geqslant 0),$$

and clarification of the differential properties of the obtained solution. The Cauchy problem for equations of this type was investigated by a series of authors (see I. S. Berezin, "Concerning the Cauchy Problem for a Linear Equation of the Second Order With Initial Data on the Parabolic Line," Matem. sb., Vol 24(66),1949, pp 301-320; K. I. Karapetyan, "Concerning the Cauchy problem for an Equation of the Hyperbolic Type Degenerating on the Initial Plane," DAN SSSR, Vol 106, No 6, 1956, pp 963-966; M. H. Protter, "The Cauchy Problem for a Hyperbolic Second Order Equation With Data on the Parabolic Line," Canad. Journ. Math., Vol 6, No 4, 1954, pp 542-554; and F. I. Frankl', "Concerning the Cauchy problem for Equations of a Mixed Elliptic-Hyperbolic Type With Initial Data on the Transition Line," Izv. AN SSSR, seriya matem., Vol 8, No 5, 1944, pp 195-222).

The mixed problem for equation (1) is considered as follows: to find the solution $u(x, t)$ of equation (1) in the cylindrical region $Q = D \times (0 < t < l)$, where D is a bounded region in E^m with boundary Γ; for example,

applying the null initial conditions

for $t = 0$

$$u\Big|_{t=0} = \frac{\partial u}{\partial t}\Big|_{t=0} = 0$$

and having the equation (1) vanishing on $\Gamma_x(0 \leq t \leq \tau)$.

95. Classification of Singular Points

"Concerning Classification of Singular Points of a Differential Equation of the First Order, Not Solvable With Respect to the Derivative," by A. V. Pkhakadze and A. A. Shestakov; Moscow, Matematicheskiy Sbornik, Vol 49(91), No 1, Sep 59, pp 3-12

In the present work, a classification of the singular points of a differential equation of the first order is given, not solvable with respect to the derivative. The differential equation is assumed to have the form

$$F(x, y, y') = 0.$$

The differential equation is assumed to be of such a form that $F(x, y, y')$ has continuous partial derivatives to the third order inclusively for all arguments in a certain region of the space (x, y, y').

The definition of a singular point of equation (1), given in the present work, differs from the definitions of a singular and essentially singular point of equation (1), given by I. G. Petrovskiy in his work, Lektsii po teorii obyknovennykh differentsialnykh uravneniy (Lectures on the Theory of Ordinary Differential Equations), Moscow-Leningrad, Gostekhizdat, 1950, p 70. In contrast to the definitions of I. G. Petrovskiy, it permits the establishment of a classification of singular points of equation (1) and clarifies the relation of this classification to the classification of singular points given by A. Poincare, O krivykh, opredelyayemykh differentsial'nymi uravneniyami (On Curves Defined by Differential Equations), Moscow-Leningrad, Gostekhizdat, 1947, for an equation solvable with respect to the derivative.

96. Expansion of an Integral Having a Kernel of the δ-Function Type

"Expansion of Integrals in a Parameter With a Kernel of the δ - Function Type," by A. N. Tikhonov and A. A. Samarskiy, Moscow State University im. M. V. Lomonosov; Moscow, Nauchnyye Doklady Vysshey Shkoly, Fiziko-Matematicheskiye Nauki, No 1, 1959, pp 54-61 (printers date is November 1959)

In the present work, integrals of the form

$$J[h, x_0, f] = \int_a^b \Phi(x - x_0, h)\, f(x)\, dx \quad (a < x_0 < b), \tag{1}$$

are considered where

$$\Phi(x - x_0, h) = 1/h\ \omega\left(\frac{x - x_0}{h}\right). \tag{2}$$

It is not difficult to convince oneself of the fact that for appropriate conditions, a limit of integral (1) exists equal to

$$\lim_{h\to 0} J[h, x_0; f] = J_0 = a_0 f(x_0),\ a_0 = \int_{-\infty}^{\infty} (\xi)\, d\xi, \tag{3}$$

since we have the theorem: If the function $f(x)$ is bounded, $|f(x)| < M$ $(a < x < b)$ and continuous at the point $x = x_0$ $(a < x_0 < b)$, and if the function $\omega(\xi)$ is absolutely integrable, $\int_{-\infty}^{\infty} |\omega(\xi)\, d\xi \leq K_0$,

then there exists the limit

$$\lim_{h\to 0} J[h, x_0; f] = J_0 = a_0 f(x_0).$$

For example, the kernel of integral (1) has the character of a δ-function, normalized to a_0 for $h \to 0$.

The purpose of the present work is to find the asymptotic expansion

$$J = J_0 + h J_1 + h^2 J_2 + \ldots + h^n J_n + h^n \rho(h),$$

where $\rho(h) \to 0$ as $h \to 0$.

97. Theorem of Adamar Generalized

"Multidimensional Analog for a Theorem of Adamar," by D. V. Anosov, Mathematics Institute imeni V. A. Steklov; Moscow, Nauchnyye Doklady Vysshey Shkoly, Fiziko Matematicheskiye Nauki, No 1, 1959, pp 3-12 (printer's date is November (1959)

In 1901, G. Adamar proved that the transformation of a plane into itself

$$x \longrightarrow \lambda x + \varphi(x, y),$$

$$y \longrightarrow \mu y + \psi(x, y),$$

where $|\lambda| > 1$, $0 < |\mu| < 1$, and φ, ψ denote factors of order greater than 1, has precisely two invariant curves passing through the origin of coordinates, one of which is tangent to the x axis, and the other is tangent to the y axis. These curves are graphs of certain functions $y = f_0(x)$ and $x = h_0(y)$ which are constructed with the help of a certain process of successive approximations. Let f_n and h_n be successive approximations. In the case in which φ and ψ are analytic functions, it is proved that the $f_n(x)$ are analytic functions of x and that the uniform convergence $f_n(x) \rightrightarrows f_0(x)$ holds in a certain region on the plane of the complex variable x; it follows in that case that the function f_0 is analytic. However, if only the smoothness of φ and ψ is assumed, then the conclusion in the complex region becomes impossible, and for that reason, although smoothness of the functions f_n is easily verified, additional considerations are required for establishment of the smoothness of f_0.

The theorem of Adamar is presented in the work by V. V. Nemytskiy and V. V. Stepanov, Kachestvennaya teoriya differentsial'nykh uravneniy, izd. 2 (The Qualitative Theory of Differential Equations, Second Edition), Moscow-Leningrad, Gostekhizdat, 1949, Chapter 4, section 5. In the present work, its multidimensional generalization is given, and the open problem concerning the smoothness of f_0 and h_0 is solved.

The author thanked L. S. Pontryagin and Ye. F. Mishchenko for the interest they showed in the work.

VII. MEDICINE

Aviation Medicine

98. Interplanetary Flight Possibilities

"Man and the Cosmos," by Prof V. Timakov, Vice-President of Academy of Medical Sciences USSR; Moscow, Sovetskiy Krasnyy Krest, No 1 (49), Jan/Feb 60, pp 12-13

According to this article, great satisfaction is being derived in the USSR from the fact that the first conquerors of interplanetary space were the Soviet people, and that Soviet-designed rockets were responsible for successful flights from the earth to another celestial body. This was made possible because of the outstanding progress that the USSR has made in the field of rocketry. In the author's opinion this is sufficient reason to expect that scientists of the Soviet Union will also assume a prominent role in space medicine as a result of the research now being conducted in this field.

Three artificial earth satellites and three cosmic rockets, the first explorers of interplanetary space, made a great contribution to science and consequently created a revolution in such fields as astronomy, geophysics, biology, physiology, microbiology, and medicine.

Millions of people are excited over the idea that a possibility exists for interplanetary travel by humans and animals. Scientists of various disciplines are searching for ways to overcome obstacles that stand in the way of interplanetary travel. Space medicine is an independent branch of science which has taken shape in the past few years.

Data obtained from the second Soviet earth satellite indicated that the animal within endured acceleration and the subsequent condition of weightlessness very well.

A human occupant of a space ship will first experience acceleration, which causes great gravitational pull. The weight of the human body on earth is approximately 70 kilograms, which increases to several hundred kilograms at take-off. The sensations experienced by the space traveler at take-off are discussed. Several measures of protection against the effects of acceleration have been proposed. One of these measures is adjustment of the position of the body itself, and another involves protective devices.

A human being endures transverse G-forces better at the time of vertical take-off when seated in a tilted position in a spacial chair with a collapsible back. In this position he experiences the effect of G-forces in the chest-to-back direction.

Scientists have designed a special anti-G suit which prevents the flow of blood into blood vessels of the lower parts of the body. Such a suit makes it possible for a human to tolerate G-forces for a time without losing consciousness.

After attaining a speed of 8 or more kilometers per second, the rocket becomes detached automatically, and the cabin is left in free flight through space. Having overcome the gravitational pull of the earth, the human occupants of the cabin are in a state of weightlessness. Perception of vertical and horizontal lines disappear. Perception of "top" and "bottom" also disappears, and the occupant of the cabin appears to be suspended in the air. Loss of weight during weightlessness does not mean loss of mass, however. Collison with the walls of the cabin or articles in it may result in bodily damage or other unpleasant consequences. A human being will not be able to drink water or take a piece of bread from a tray when he is in a state of weightlessness. However, special long periods of training and the installation of a number of gadgets in the cabin will be necessary. Water will have to be forced out of a rubber or plastic bag. Special devices must be invented for the intake of food and water under conditions of weightlessness.

Scientists are now of the opinion that the earth's force of gravity is not a necessary prerequisite for maintenance of life, and that weightlessness produces no ill effects in a living organism. Special measures of protection against weightlessness must be devised, however. Research and development designed to comply with the requirements of a living organism are now in progress. It has been proposed that an artificial weight be placed on a flying vehicle to counter the rotation of the cabin (or of the entire vehicle) around its longitudinal axis. Centrifugal force thereby creates the necessary weight for the human occupant of the cabin, provided that the speed of rotation corresponds to the radius of the rocketed vehicle. Uniform rotation does not cause vertigo, nausea, or vomiting, because it is not the speed itself that affects the human being, but the changes in speed. Other measures such as special footwear and a "magnetic" floor have been suggested to provide the human occupant of a rocket with stability and to counteract the effects of weightlessness.

There are other hazards to confront the astronaut. A human organism is accustomed to existence when the ambient air contains 20% oxygen and 0.03% carbon dioxide. It is understood that such a ratio will be absent in a rocket. Consequently, special devices must be installed to maintain continually the necessary gas composition of the air within the cabin.

A human astronaut must take with him supplies of liquid and chemically bounded oxygen and must utilize the properties of green vegetation capable of taking up carbon dioxide and releasing oxygen. The cabin of a space vehicle must be transformed into a unique greenhouse. Green algae, Chlorella, are best for this purpose.

The human body is 65% water and its boiling point varies depending on external pressure. At an altitude of 20 kilometers, water boils at the temperature of the human body. To prevent unconsciousness and eventual death, the walls of the cabin may be reinforced or an individual protective garment may be used. There is another means of individual protection; a flyer can be dressed in a special suit made of compact material which fits every convolution of his body. The pressure of the material itself may in some cases compensate for the absence of external pressure of the air. An individual protective space garment has been successfully used in the Soviet Union in flights of animals in rockets at altitudes up to 110 kilometers without hermetic cabins.

A space vehicle may be protected from small meteoric particles by a sufficiently durable casing.

There are many ways of regulating the temperature in a space vehicle. One way is to equip the cabin with two walls and passing a current of gas between them by means of special devices. It is possible to regulate heat emission from the internal wall to the exterior by changing the speed of the gas circulation.

Depending on its motion in the prescribed trajectory, the interplanetary space vehicle inevitably enters the zone of cosmic radiation. The upper layers of the atmosphere of the earth are continually bombarded by a stream of atomic nuclei moving with the speed of light. These atomic nuclei do not reach the earth's surface: they move with such great speed that they collide with the nuclei of atoms in the air, and break up and form smaller particles and radiation.

Protection against radiation may be achieved with the aid of special shields or by means of a special type of garment made of fibers that contain lead or tungsten particles.

The biological action of cosmic radiation is not yet well known. The field of microbiology of interplanetary space has been called on to solve some of the remaining mysteries of the universe. No doubt the physiological functions of the human organism will be subjected to changes in the course of flight through interplanetary space. A question arises as to how will these changes affect the vitality of microorganisms which usually exist within the human body without causing harm. Sufficient basis exists for assuming that these microorganisms may change their characteristics when they become exposed to conditions that differ from those they

have been accustomed to on earth. Available scientific data show rather convincingly that saprophytes cannot cause any particular harm in outer space because all the compensating mechanisms within the human organism begin to react simultaneously with the changing conditions.

Pharmacologists have found their place within the ranks of workers in space medicine and biology. Their job consists of conducting a study of the most vulnerable physiological functions of the human organism to find preparations to protect space travelers from adverse conditions. Among such substances are tranquilizers, those substances which tone the circulatory system, and those which aid internal and external respiration.

Bacteriology

99. New Culture Medium for Diagnosing Gas Gangrene

"A Dry Culture Medium for Diagnosing Pathogens of Gas Gangrene," by N. V. Ploskirev, O. A. Komkova, V. F. Grebenkina, and L. G. Ivanova, Institute of Epidemiology and Microbiology imeni Gamaleya; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 31, No 3, Mar 60, pp 40-43

The objective of the research described was to prepare a dry medium from food industry wastes for the rapid diagnosis of gas gangrene; a new method was developed by Komkova to avoid the specific morphological and growth alterations effected on the pathogen by a semiliquid medium in the presence of specific antitoxic sera. The medium used consisted of Pope's bouillon, gelatin, agar, and glucose, which were sterilized by steam; antigangrene sera were added in such amounts that one ml of medium contain at least 200 AE of serum against Cl. perfringens, 300 AE of serum against Cl. oedematiens, and 50 AE against Cl. histolyticum and septicum. Seeding was performed by adding minced tissue infected with gas gangrene. The nitrogenous components were dried fish meal hydrolysate, autolysate of Caspian sprat, and commercial peptone. Eighteen samples of media having different compositions and containing different amounts of nitrogenous substances were tested; results were read after 10-18 hours of incubation at 37°C.

The best results were obtained from three samples, the compositions of which are given. The authors recommend Komkova's method for detecting gas gangrene pathogens.

100. Effect of Brucellosis on Organism

"Effect of Brucellosis on the Menstrual Function," by S. F. Trifonova, Chair of Obstetrics and Gynecology, Omsk State Medical Institute imeni M. I. Kalinin; Moscow, Voprosy Okhrany Materinstva i Detstva, Vol 5, No 2, Mar/Apr 60, pp 62-64

Studies of the effect of brucellosis on the menstrual function were conducted in Omskaya Oblast, where the disease is encountered predominantly among the rural population engaged in the care and breeding of livestock, or as a result of the consumption of dairy foods. The investigations established that the disease has an unfavorable effect on the menstrual function. About 36.1 percent of the patients examined developed an infectious-toxic form of amenorrhea; cytological investigations of the vaginal secretions obtained from patients suffering from brucellosis revealed a decrease in the estrogenic activity of ovaries; the duration of amenorrhea and the decrease in estrogenic activity of the ovaries depends on the stage and severity of the brucellar infection.

101. Invasive Characteristics of Brucella

"Factors in the Distribution of Brucella," by E. G. Mamatsashvili, Scientific Research Institute of Veterinary Medicine, Academy of Agricultural Sciences Uzbek SSR; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 31, No 2, Feb 60, pp 88-91

This article reports special experiments performed on rabbits to explain the relationship between the virulence of microorganisms and factors affecting the penetrability of Brucella through the unbroken skin. Although the presence of hyaluronidase in Brucella had been verified in vitro, no parallelism with the capacity of these pathogens to diffuse in the animal skin had been established.

Four preparations were made from cultures of Br. abortus, melitensis, and suis (two strains of each) which varied in age from one to 35 years. The strains used were Br. abortus No 79 and No 19, Br. melitensis No 238 and No 96, and Br. suis No 1 and No 6; characteristics of these strains, which varied in virulence, are given. The preparations administered to the experimental animals are described as follows: (1) a suspension of a 72-hour agar Brucella culture in physiological solution, which contained 10 billion microbial cells per ml; (2) a lysate of all the cultures in physiological solution, prepared by alternate freezing and thawing for 20 days and then final heating at 58° C for one hour; (3) the aqueous

extract of a 48-hour agar Brucella culture, which was centrifuged and kept at room temperature for 24 hours; and (4) the same aqueous extract, from which the bacteria had been eliminated by filtration through a Chamberland L_3 filter. Physiological solution or the aqueous extract from an unseeded culture medium were used in control experiments. Each rabbit was given 0.4 ml of the test preparation intracutaneously and the same dose of the control fluid at a distance of 9-10 cm from the injection site of the test preparation. The results of the experiments, calculated after one, 3, 6, 24 and 48 hours, are discussed and tabulated.

The author concludes that the penetrability factor is manifested with varying facility depending on the method used to make the preparation. It was detected most decisively in filtrates of aqueous Brucella extract, then in the aqueous Brucella extracts which had not been filtered, then in lysates, and finally in suspensions of microbial cultures. Of the Brucella cultures selected for the experiments, the virulent and recently isolated strain No 238 was inferior to strain No 19 with respect to the activity of the penetrability factor, although the latter had only residual virulence and was isolated 35 years ago. The maximum action of the penetrability factor in the rabbit skin was observed within 3 hours after injection of the preparation, but no later than 6 hours.

Hematology

102. Vitamin B_{12} Level in Blood Plasma and Organs During Leukosis

"Vitamin B_{12} Concentration in Blood Plasma and Organs During Leukosis" (Preliminary Report), by O. V. Kurlov, Materialy 2-go Plenuma Sibirsk. Fil. O-va Patofiziologov (Data From the Second Plenum of the Siberian Affiliate of the Society of Pathophysiologists), Chita, 1958, pp 202-204; (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 6, 25 Mar 60, Abstract No 8490, by M. Piotrovskiy)

"Sixteen patients suffering from various forms of leukosis were observed. In chronic myelosis, the vitamin B_{12} concentration is 10-20 times the normal level. In acute leukosis and in chronic lymphadenosis, the vitamin B_{12} content in the plasma fluctuates within the normal range, or slightly exceeds it. The vitamin B_{12} content in the organs of people suffering from acute leukosis corresponds to the content under normal conditions (0.1 - 1.0 mg/l)."

Immunology and Therapy

103. Simultaneous Inoculation With Live Plague Tularemia Vaccines

"Inoculation Reaction in Humans to the Simultaneous Introduction of Two Live Vaccines--Plague and Tularemia," by N. F. Kalacheva, Scientific Research Institute of Microbiology and Epidemiology of Southeastern USSR; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 31, No 4, Apr 60, pp 64-66

This article reports a study of inoculation reactions in humans who had received plague and tularemia vaccines simultaneously.

After the harmlessness and reactogenicity of these vaccines had been tested on volunteers, a larger group of persons (60 between the ages of 15 and 55 years) was subjected to simultaneous, cutaneous inoculation with dry plague vaccine from the "Mikrob" Institute and dry tularemia vaccine from the Institute imeni Gamaleya. Two control groups were given the corresponding monovaccines. Temperature changes and local reactions were observed in all groups. Immunity to tularemia was checked by the allergic test to tularin 3 weeks after inoculation. Two tables show local and general reactions to the combined vaccines and to the monovaccines.

On the basis of these observations, the author recommends combined vaccination against plague and tularemia according to indications.

104. Tissue Vaccine Against Tick-Borne Encephalitis

"Experimental Study of a Tissue Vaccine for Prophylaxis of Tick-Borne Encephalitis," by A. K. Shubladze and Ye. N. Bychkova, Institute of Virology imeni Ivanovskiy; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 31, No 2, Feb 60, pp 8-13

Experimental Data which substantiate the suitability of a vaccine prepared from tick-borne encephalitis virus cultured on 9-10-day chick embryo fibroblasts are presented. The culture medium contained the following: (1) amniotic liquid from cows, saline solution and bull serum; (2) a 0.5% solution of lactalbumin hydrolysate and bull serum; and (3) synthetic medium 199.

For the actual preparation of the vaccine, the fibroblast tissue cultures were infected with strains Yas_8 and Ukh_{10} of spring-summer tick-borne encephalitis virus; the amount of virus contained was determined by intracerebral infection of white mice. Inactivation of the virus, which the authors consider the most important step in the process,

is effected by a 1:200 concentration of formalin at 18-20° for 5 days. Sterility was ensured by the addition of 100 AE of penicillin and 30 AE of nistatine per ml of culture medium. Eleven series of the vaccine (16 liters) were prepared; harmlessness and immunogenicity were tested in white mice. The vaccine was also tested in rats not susceptible to the virus.

On the basis of the positive results obtained in animal experiments, the vaccine was tested on 24 human volunteers; the program is shown by a table. Another table shows the results of serological investigations following immunization.

Conclusions based on these experiments are as follows:

"1. Results of the experimental study of a tissue vaccine against tick-borne encephalitis permit us to recommend the formalin-inactivated vaccine, prepared from virus cultures on chick embryo cutaneous-muscular tissue, for production and use.

"2. Inactivation of the tick-borne encephalitis virus in the tissue vaccine guarantees that the preparation will be standard and specifically harmless, which has been tested in white mice.

"3. The immunogenicity of the vaccine was well manifested in tests on mice and also following the determination of the increase of virus-neutralizing antibodies in immunized animals and vaccinated volunteers."

105. Inhalation Method of Vaccination Evaluated

"The Problem of the Effectiveness of the Inhalation Method of Vaccination; Report II: The Immunological Effectiveness of Inhalation Immunization With Killed Vaccines When Moderately and Finely Dispersed Aerosols Are Used," by A. I. Maslov, Chair of Microbiology, Military-Medical Order of Lenin Academy imeni Kirov; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 31, No 4, Apr 60, pp 10-15

In a previous report, the author demonstrated that although intense immunity can be conferred on white mice by inhalation immunization with killed S. enteritidis Gartmeri corpuscular vaccine, the procedure requires a large number of long inhalation sessions (about five) and a high concentration of vaccine in the air. In this report, he presents results of attempts to determine the effectiveness of the inhalation method in other laboratory animals, rabbits and guinea pigs. The dynamics of the agglutinin titer increase and the preventive activity of serum from the immunized animals were the criteria used to determine the intensity of immunity. Subcutaneous immunization was performed on control groups for comparison purposes.

An aerosol consisting of particles ranging in size from 10 to 30 microns was used for the first series of experiments, in which three groups of animals were subjected to different periods of exposure, five times with 7-day intervals. In his discussion of this series, the author notes that the penetrability of infectious and vaccinal aerosols has been more precisely determined within the past few years; it has been found that although particles with a diameter of 10 microns can enter the lungs through the nose and mucous membranes of the respiratory tract, only one percent of particles over 8 microns actually do so; about 90% of the particles found in the alveoli have diameters of 3 microns or less.

In the second series of experiments, a finely dispersed aerosol vaccine was administered to rabbits in three 30-minute inhalations at 7-day intervals; the density of the aerosol was 750 million microbial cells per liter. Four rabbits which had been immunized subcutaneously were used as controls. The high immunogenic effect of the inhalation method with finely dispersed particles was shown by tests of the preventive properties of sera from the immunized animals.

Three tables show agglutinin titers in the various species tested following subcutaneous and aerosol immunization, and the preventive properties of rabbit sera. The following conclusions are given:

"1. Inhalation immunization with killed S. enteritidis Gartneri vaccine afforded pronounced immunological reconstruction of the organism, which was manifested by a rapid and high increase in the agglutinin titer and by good indexes of serum preventive properties.

"2. The use of a vaccinal aerosol consisting of particles with dimensions of 4-10 microns (3-7 microns after drying) produced considerably higher immunological indexes than the use of an aerosol containing larger particles.

"3. Under the experimental conditions used, triple inhalation immunization with a finely dispersed vaccinal aerosol was found to be more effective than triple subcutaneous vaccination."

Several possibilities are offered to explain the greater effectiveness of inhalation immunization. Certain of these possibilities will be explored in subsequent research and reports.

106. Combination of Antibiotics for Brucellosis Therapy

"Therapy of Brucellosis Patients With Combined Antibiotics," by K. D. Dzhalilov; Tashkent, Izvestiya Akademii Nauk UzSSR, Seriya Meditsinskaya, No 6, Nov/Dec 59, pp 42-48

The author's testing of combined antibiotic therapy of brucellosis was based on a plan suggested by T. Kh. Nadzhmiddin in 1954 which was found to be highly suitable for practical use. The cycle of therapy with combinations of synthomycin and streptomycin or levomycetin and streptomycin gave relatively good results.

Thirty-four patients with different clinical forms of brucellosis were treated, tested serologically, and observed. These forms were: acute septic (14), septic-metastatic (13), and secondary-chronic (7). Clinical symptoms are discussed. The first and second groups of patients received synthomycin, levomycetin, or terramycin with streptomycin by intramuscular injections. Two patients from the third group were given one course of antibiotic therapy with levomycetin and streptomycin and were then vaccinated according to G. P. Rudnev's two-step method; five patients from the same group were vaccinated first and then subjected to the antibiotic therapy.

The results of these experiments are discussed, and the following conclusions are offered:

"1. The combined use of two antibiotics in the therapy of brucellosis patients has the best effect in the acute septic and septic-metastatic forms, and in certain cases, in exacerbations of chronic brucellosis. Therapy with terramycin and streptomycin and also with levomycetin and streptomycin was most effective.

"2. The use of antibiotic combinations with generally reinforcing procedures (blood transfusion, glucose-vitamin therapy, and diet) led not only to clinical but also to bacteriological recovery.

"3. On exacerbations of chronic brucellosis accompanied by high temperature, a course of antibiotic therapy followed by vaccine therapy and a second course of antibiotics (preferably terramycin with streptomycin) should be carried out.

"4. In chronic brucellosis with normal temperatures, vaccine therapy with two subsequent courses of antibiotics is effective.

"5. The simultaneous administration of two antibiotics in small doses (a 10-day course with an interval) did not particularly suppress immunobiological reactivity of the human organism."

107. Therapy of Brucellosis

"Antibiotics in the Therapy of Brucellosis in Children," by N. K. Talyzina, Chair of Children's Diseases of Omsk Medical Institute imeni M. I. Kalinin; Moscow, Voprosy Okhrany Materinstva Detstva, Vol 5, No 2, Mar/Apr 60, pp 58-62

Although the etiology, epidemiology, pathological anatomy, and diagnostics of brucellosis have been thoroughly investigated, the therapy of the diseases is a problem which has not yet been satisfactorily solved. The generally accepted method of vaccination now used has many shortcomings. A number of Soviet scientists, in their search for new methods of therapy for brucellosis, established that some antibiotics (among them biomycin, levomycetin, synthomycin, streptomycin, and tetracycline) inhibited the growth of brucella in vitro. Further experiments, in which the antibiotics were used as one of the components in the complex therapy of the disease, also established the usefulness of the preparations. On the basis of these experiments, the use of antibiotics in the therapy of brucellosis, particularly in children, is recommended.

108. Levomycetin in Therapy of Dysentery

"Clinical Significance of the Resistance of Dysentery Microbes to Levomycetin," B. G. Zatulovskiy and S. Ya. Nishchaya, Kiev Scientific Research Institute of Epidemiology and Microbiology and Second Children's Infectious Hospital; Kiev, Vrachebnoye Delo, No 3, 1960, pp 289-294

Because of the widespread use of levomycetin in the therapy of dysentery, the study of the acquired resistance of the dysentery microorganism to the antibiotic has become of paramount importance. The sensitivity of 674 strains of dysentery microbes, isolated from dysenteric patients, to levomycetin has already been tested. Of these, 205 (or 30.4 percent) were found to have acquired resistance to levomycetin, with the Flexner and Sonne microbes making up the greatest part of those resistant to the antibiotic. It was established also that the effectiveness of the antibiotic in the therapy of dysentery depends on the sensitivity of the microbes to the preparation.

109. Therapy of Skin Diseases

"Application of Hypnosis in Dermatology," by B. Janousek and J. Vlersky, Ceskosl. Dermat. (Czechoslovakia), 1959, 4, 197-199 (from Meditsinskiy Referativnyy Zhurnal, Section 1, Vol 4, No 3, Mar 60, pp 106-107)

"On the basis of literary data and their own observations, the authors consider that hypnosis may play an important role in the therapy of certain skin diseases. Therepy by hypnosis is indicated in skin

diseases of patients with a psychic trauma in their anamnesis as well as in dermatoses accompanied by pruritus. Positive results obtained in the therapy of eczema by hypnosis are emphasized. When comparing the results obtained in the therapy of skin diseases with medically induced sleep with those obtained in therapy with hypnosis, the authors express a preference for hypnosis. The therapy of 18 patients suffering from psoriasis, eczema, and other dermatoses confirmed the advantage of hypnotic therapy (there are no side effects, and a better therapeutic effect is obtained)."

110. Conditioned Reflex Mechanism Alters Agglutinin Titer

"The Effect of the Conditioned Reflex Mechanism on Changes of Agglutinin Titers," by V. M. Andreyevskiy and T. A. Dvoretskiy, Tr. Leningr. San.-Gigiyen. Med. In-ta (Works of the Leningrad Sanitary-Hygiene Medical Institute), No 45, 1958, pp 56-60 (from Referativnyy Zhurnal--Biologiya, No 23, 10 Dec 59, Abstract No 103659, by Ye. N. Solun)

"Rabbits (four) were immunized with a culture of Merezhkovskiy Bacterium; two received antigen in conjunction with a conditioning stimulus (heating of the ear in water at a temperature of 45° C for 2 minutes). After a 3-week interval when the agglutinin titer was considerably lower, the control rabbits were given antigen, and the experimental animals were exposed to the conditioning stimulus alone. The titer in the experimental animals reached high levels within 2 hours, began to decrease within 36 hours, and dropped lower than the initial level within 2 weeks. The titer in the control animals reached a maximum in 2 weeks. The titer in all the rabbits was stabilized at the same level in 1 1/2 months."

Nutrition

111. Effect of C-Avitaminosis on Organism

"Effect of a Diet-Free of Vitamin C on the Metabolism of Iodine in Guinea Pigs," by A. Sh. Byshevskiy (Lvov), Chair of Nutrition Hygiene, Lvov Medical Institute; Moscow, Problemy Endokrinologii i Gormonoterapii, Vol 6, No 2, Mar/Apr 60, pp 32-35

Guinea pigs were used in the experiments which were conducted to determine: (1) the effect of a vitamin C-free diet on the iodine content of the blood and thyroid gland; (2) the effect of 6-methylthiouracil on the iodine content of the same tissues in animals kept on a scurvy diet; (3) iodine secretion with the urine and feces of animals kept on a vitamin C-free diet; (4) the effect of 6-methylthiouracil on the secretion of iodine in the urine and feces of animals fed food free of vitamin C. The experiments established that a vitamin-C-free diet fed to guinea pigs reduced the iodine content in the thyroid gland; the administration of 6-methyldiuracil decreased the content of iodine in the thyroid gland, especially in animals kept on a diet free of vitamin C; the exclusion of vitamin C from the rations fed to the animals increased the amount of iodine secreted with the urine and feces; a similar effect was produced by 6-methylthiouracil administered to the animals kept on a scurvy diet.

Oncology

112. Cancerogenic Substances

"Cancerogenic Activity of Chemical Substances," by L. M. Shabad (Moscow), Institute of Experimental and Clinical Oncology, Academy of Medical Sciences USSR; Moscow, Gigiyena Truda i Professional'nyye Zabolevaniya, Vol 4, No 3, Mar 60, pp 8-11

This article stresses the importance of the study of a large number of chemical substances now widely used in industry and suspected of cancerogenic action. About 300 chemical compounds, among them hydrocarbons, amincazo compounds, amines, fluorines, and others, have been studied to date. It was established that the cancerogenic activity of many of the substances is linked with their structures and that the least change in their chemical structure may either change the strength and localization of their blastomogenic properties or completely eliminate these properties. On the basis of the character of their action, the blastomogenic substances

fall into the following groups: (a) local action substances; (b) substances of resorptive and selective action; these may develop tumors which locate in parts of the organism which are remote from the place of the administration of the substance; and (c) multiple action substances which can cause the development of tumors in different parts of the organism.

As a result of the investigations, the State Sanitation Inspection Bureau recommends that special measures be adopted for the safe handling of such substances as dichlorobenzidine, dicyclohexamine, 2-acetylaminoflourine, and others. The further systematic study of the substances suspected of having cancerogenic properties to broaden the knowledge of the etiology and pathology of tumors is essential, the author writes in conclusion.

113. Riboflavin as Indicator of Neoplasms

"Determination of Riboflavin in the Urine of Patients Suffering from Malignant Neoplasms," by Ya. A. Kagan, Eye Clinic, Vitebsk Medical Institute; Moscow, Khirurgiya, Vol 36, No 2, Feb 60, pp 103-108

Clinical and experimental observations carried out on many patients suffering from various diseases, including benign tumors, revealed that riboflavin which is usually found in the urine, disappears from the urine of patients suffering from malignant neoplasms, regardless of the localization of these neoplasms. Riboflavin was found also to disappear from the urine of the animals which were inoculated with malignant transplants, and appeared again after the tumors decomposed. On the basis of these observations, it has been concluded that the riboflavin in the organism is utilized by the tumors and therefore is not excreted in the urine. Its subsequent appearance in the urine indicates that the tumor is decomposing. The absence of riboflavin from the urine may serve as one of the diagnostic indicators of the presence of a malignant tumor in the organism.

114. Effect of Sulfathiazole and Elcosine on Sarcoma

"Effect of Sulfathiazole and Elcosine on Sarcoma Cultures Induced by Methylcholanthrene, and on the Culture of Chick Embryo Fibroblasts in vitro," by A. Chetkowski and B. Rembielinski, Folia Morphol. (Poland), 1959, 10, No 2, 173-180 (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 4 25 Feb 60, Abstract No 5688, by the authors)

"The effect of 0.1 percent, 0.25 percent, 0.5 percent, and one percent solutions of elcosine and sulfathiazole on the culture of sarcomas induced in rats by methylcholanthrene and on the culture of normal fibroblasts cultivated from the cardiac muscle of 10-day old chick embryos was studied. It was established that large concentrations of elcosine inhibit, and of sulfathiazole stimulate the growth of the tissue cells."

Pharmacology and Toxicology

115. Tolerance of Thiophos With Repeated Administrations

"On the Reactions of the Organism to Repeated Administrations of Thiophos Experimentally," by N. K. Byalko (Moscow), Institude of Labor Hygiene and Occupational Diseases; Moscow, Gigiyena Truda i Professional'nyye Zabolevaniya, Vol 6, No 3, Mar 60, pp 44-48

White mice were used in experiments conducted to determine the reactions of the organism to repeated administrations of thiophos. Thiophos dissolved in refined sunflower seed oil was subcutaneously administered to the animals in a concentration of one millilgram per milliliter six times a week for periods of 2-4 weeks. The animals were kept under observation in the course of the experiment, with particular attention being paid to the cumulative effect of thiophos on their weight, general condition, and behavior. It was established that repeated administrations of thiophos inhibited weight gain in the animals and depressed cholinesterase activity; at the same time, however, it was found that the animals acquired a tolerance to the chemical, tolerating doses of thiophos which proved to be fatal to control mice.

116. Nerve Stimulant Obtained From Aralia manshurica

"Manchrian Aralia--Aralia manshurica Rupr. et Maxim," by G. A. Kukarin, Khabarovsk, Drug Administration; Moscow, Aptechnoye Delo, Vol 9, No 1, Jan/Feb 60, pp 69-70

Investigations conducted at the All-Union Scientific Research Institude of Medicinal and Aromatic Plants revealed that an infusion of the roots of Aralia manshurica Rupr. et Maxim was beneficial when administered to patients in a state of asthenia and was effective when applied in the therapy of schizophrenia, post-influenza arachnitis, and impotence due to neurasthenia and psychasthenia. The preparations is slightly toxic and produces no side effects. Aralia manshurica Rupr. et Maxim grows in abundance in clearings of coniferous forests.

117. Pharmacology of Neuroplegic and Vasodilating Drugs

"Combined Action of Neuroplegic and Vasodilating Drugs," by V. I. Il'nskiy, Chair of Pharmacology, First Moscow Medical Institute; Kiev, Vrachebnoye Delo, No 3, 1960, pp 273-276

Data accumulated in the experiments which were conducted to determine the combined action of the neuroplegic drugs (aminazine, mepazine, and reserpine) with the vasodilating drugs (papaverine, nitroglycerin, salsoline, tetamone, pentamin, hexonium, and mecamine) are reported. The experiments were carried out on anesthesized and on decerebrated cats. Manometers were used to record the blood pressure and the amplitude and rate of cardiac contractions. The drugs were administered into the vena femoralis. The experiments established that the combined application of mepazine with pentamin and of reserpine and hexonium potentiated the hypotensive effect of each of the drugs; all other drugs when in combinations displayed antagonistic action; combinations in which mepazine and pentamine were used in proportions of 1:3; and reserpine and hexonium in proportions of 1:10 were found to possess a wide therapeutic spectrum.

118. Pyridine Intoxications

"The Clinical Picture of Intoxications by Vapors of Pyridine Hydroxides," by A. G. Zaslavskaya (Stalino), Hospital Therapy Clinic, Stalino Medical Institute imeny Gor'kiy and the Oblast Central Clinical Hospital; Moscow, Klinicheskaya Meditsina, Vol 38, No 4, Apr 60, pp 122-124

The article describes a number of cases of intoxication by the vapors of pyridine, a chemical widely used in the chemicopharmaceutical and dye industries. The clinical pictures of all the intoxications were marked by a rapid unset of asphyxia, nausea, vomiting, depressions, and in some cases loss of consciousness. Manifestations of psychoses were observed in some of the acute cases of intoxications. Blood studies revealed erythropoiesis, low arterial pressure, leukocytosis, and a high hemoglobin content. Because of the widespread use of pyridine in industry, the article urges the adaptation of special safety measures in work with the chemical.

119. Snake Venom Intoxication

"On the Significance of Hemocoagulation in the Mechanism of Snake Venom Intoxication," by Z. S. Barkagan and V. V. Polushkin (Barnaul), Chair of Propedeutics of Internal Diseases and Chair of Pathophysiology, Altay Medical Institute; Moscow, Patologicheskaya Fiziologiya i Eksperimental'naya Terapiya, Vol 4, No 2, Mar/Apr 60, pp 48-54

Rabbits and rats were used in experiments which were conducted to determine the role of hemocoagulation in the mechanism of snake venom intoxication and the effectiveness of heparin when used in the therapy of such intoxication. The venom was administered to the animals intravenously; it produced a strong hemocoagulating effect, causing the complete paralysis of the respiratory organs and the death of the animals. Heparin when administered to the intoxicated animals prevented the development of paralysis of the respiratory organs, saving the animals from death; it also reduced arterial pressure caused by the venom.

120. Thyrotoxicosis as Cause of Hepatic Changes

"On the Problem of the Functional State of the Liver in Patients Suffering From Thyrotoxicosis Before and After Therapy with I^{131}," by V. G. Spesivtseva, L. L. Garkina, N. A. Makarova, and R. P. Zolotnitskaya, Faculty of Therapeutic Clinic, First Moscow Order of Lenin Medical Institute imeni I. M. Sechenov; Moscow, Terapevticheskiy Arkhiv, Vol 32, No 3, Mar 60, pp 44-52

The results of the observations carried out on a number of patients suffering from thyrotoxicosis and treated with I^{131} are reported. The purpose of the observations was to determine the effect of thyrotoxicosis on the hepatic functions before and after the application of I^{131}, and the distribution of I^{131} in the organism. The observations established that thyrotoxicosis has an adverse effect on the hepatic functions, which are restored to normal after therapy with I^{131}. Most of the radioactive iodine when introduced into the organism was found in the thyroid gland; smaller quantities were found in the parenchymatous organs: the liver, kidneys, spleen, and others.

121. Toxicity of Acrylonitrile

"Acrylonitrile. Acute Toxicity and the Mechanism of Its Action," by V. Benes and V. Cerna, Zh. Epidemiol., Mikrobiol., i Immunol. (Czechoslovakia), 1959, 3, No 1, 110-119 (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 4, 25 Feb 60, Abstract No 5715, by I. Chertkov)

"The LD_{50} of acrylonitrile for mice when administered internally and subcutaneously is respectively 27 and 35 milligrams per kilogram of body weight; for rats, when administered internally, it is 78 milligrams per kilogram of body weight. The picture of intoxication by acrylonitrile in mice is similar to that of intoxication by cyanides; this indicates the formation of cyanogen from the nitrile group in the organism. This indication is confirmed by the fact that a repeated administration of cyanide antidotes (sodium thiosulfate, one gram per kilogram of body weight; and sodium nitrite, 50 milligrams per kilogram of body weight) saved the animals which received three LD_{50} doses of acrylonitrile.

The hydrolysis of the nitrile group in rats proceeds at a slower rate. About 20 percent of the cyanogen is liberated on an average (determined in the urine in the form of thiocyanogen). The toxicity of acrylonitrile in rats is conditioned mainly by the whole molecule. Because of this, antidotes for cyanides have only an insignificant protective effect. The detoxication of acrylonitrile in guinea pigs is carried out approximately in the same manner as in rats. After the administration of acrylonitrile to guinea pigs, free acrylonitrile is found in the urine of the animals within 24 hours, an indication of its slow decomposition in the organism."

122. Toxicity of Quizindamone and Its Effect on Organism

"Pharmacological Characteristics of Quizindamone, the Dichloromethylate N-(beta-Dimethylaminoethyl)-4,5,6, 7-Tetrachloroisoindoline. Report II. Effect of Quizindamone on Blood Pressure," by V. Avakyan, Institute of Fine Organic Chemistry, Academy of Sciences Armenian SSR; Yerevan, Izvestiya, Biologicheskye Nauki, Vol 12, No 12, Dec 60, pp 9-16

White mice, rabbits, and cats were used in experiments which were conducted to determine the toxicity and pharmacological action of quizindamone, the dichloromethylate of N-(beta-dimethylaminoethyl)-4,5,6,7-tetrachloroisoindoline. The experiments established that quizindamone possesses a definite hypotensive action surpassing that of pentamin and hexonium; its hypotensive action is also more lasting than that produced by the other two preparations. Quizindamone is slightly toxic; white mice receiving the drug by mouth tolerated a dose of 250 milligrams per kilogram of body weight. The experimental data obtained permit the recommendation of the use of quizindamone as a ganglioblocking substance in the therapy of hypertension.

123. Antitoxic Properties of Thyroxine

"Effect of Thyroxine and Propylthiouracil on the Toxicity on Tertiary Ammonium Antimony Gluconate; Distribution and Excretion of Antimony Following the Ingestion of this Substance," by Lu Shih-ch'ih, Chu Hsiu-yuan, and Sung Cheng-yu, Acta. Physiol. Sinica (China), 1958, 22, No 4, 289-293 (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 4, 25 Feb 60, Abstract No 5700, by K. Maskhuliya)

"The addition of 0.01 percent thyroxine to the food of mice for a period of 2 weeks increased the sensitivity of the animals to ammonium gluconate (1) (LD_{50} is 16.8 milligrams per kilogram of body weight; control, 90 milligrams per kilogram of body weight) [sic]; propylthiouracil noticeably increased the resistance of the mice to (1) (LD_{50} is 166 milligrams per kilogram body weight). When (1) labeled with Sb^{124} was intraperitoneally administered to rats, a high state of radioactivity was found in the liver and gastro-intestinal tract (including the contents). Radioactivity was very low in the kidneys, thyroid gland, blood, spleen, lungs, and other organs. The addition of thyroxine and propylthiouracil had no effect on the distribution of (1) in the organism, and its excretion from the organism."

124. Effect of Cortisone on Anaphylactic Shock

"On the Effect of Cortisone on Anaphylactic Shock in Guinea Pigs of Different Ages," by V. I. Kechker and K. P. Chepalov, Candidates of Medical Sciences (Ryazan), Chair of Pathological Physiology, Ryazanskaya Oblast Dermatological-Venerological Clinic; Moscow, Problemy Endokrinologii i Gormonoterapii, Vol 6, No 2, Mar/Apr 60, pp 52-54

Experiments were conducted to determine the effect of cortisone on anaphylactic shock induced in adult and aged guinea pigs by sensitizating the animals with bovine serum and subsequent administration of a booster shot. The animals were divided into two groups: an experimental group which consisted of guinea pigs which were sensitized with the serum and treated with cortisone; a control group which was sensitized with the serum but received no cortisone treatment. Cortisone was subcutaneously administered to the animals in doses of 10-20 milligrams per 100 grams of body weight.

The control animals of the adult group reacted to the sensitization by the development of anaphylaxis, followed by death. The adult animals of the experimental group developed shock at a considerably slower rate, and death followed considerably later than in the control group. Shock induced in both groups of the aged animals was not always followed by death. The experiments established a basis for the assumption that cortisone alleviates the course of anaphylactic shock, and in some cases prevents death.

125. New Antibiotic

"Celicomycin -- a New Antibiotic," by A. K. Balitskaya, Candidate of Veterinary Sciences; Alma-Ata, Vestnik Akademiin Nauk Kazakhskoy SSR, Vol 16, No 3 (180), Mar 60, p 89

The new antibiotic, celicomycin, previously known under the name of actinomycin K, was isolated from the actinomycetes of the Actinomyces coelicolor group found in the soil of Kazakhstan. Celicomycin is a dark-violet powder, readily soluble in water, and poorly soluble in organic solvents. Chemical investigations established that it consists of substances of a protein nature, carbohydrates, and pigments. It is not toxic. Experimental investigations determined that celicomycin is an effective antibacterial and antifungal preparation. It is used in the therapy of anthrax, emphysematous carbuncles, and skin diseases caused by fungi.

126. Therapy of Dermatomycoses

"Effect of Nitrofungine on Dermatomycoses," by J. Haban, Lek. Obz. (Czechoslovakia), 1959, 5, 276-279 ((from Meditsinskiy Referativnyy Zhurnal, Section 1, Vol 4, No 3, Mar 60, pp 110-111)

"Nitrofungine, a halogenated para-nitrophenol (para-nitrophenol one gram; triethyleneglycol 10 grams, ethyl alcohol 100 milliliters) was given to patients suffering from different mycoses (trichophytosis, 28 persons; epidermophytosis, 155 persons; and trichophyton rubrum infection, 2 persons). The patients were divided into three groups on the basis of the duration of the diseases: 6 months, one year, and longer than one year. Best results were obtained in the first group of patients. Improvement was noted in patients with a longer record of illness. The preparation was ineffective in chronic cases of the disease. When applied to a culture of fungi, nitrofungine was found to possess a fungicidal action."

Physiology

127. Hypothermia Studies Discussed

"Physiologists Are Studying Hypothermia," by M. Mirskiy, Krasnodar; Moscow, Meditsinskiy Rabotnik, 16 Feb 60, No 14 (1866, p 4

The author of this article says that Russian scientists have been entertaining the idea of utilizing reduced body temperature in surgical practice. As long ago as 1863, a Kiev professor of physiology, A. P. Val'ter, wrote that long and painful operations can be performed during a period of sharply reduced body temperature. In 1902, a Russian scientist, P. I. Bakhmet'yev, stated that results of his research showed that it is possible to reduce the temperature of a warm-blooded organism, making it capable of enduring marked variations of cold and heat.

However, 40 years passed before medical scientists of various countries began to undertake a detailed study of hypothermia. An investigation of hypothermia was begun in the Soviet Union in 1939 by a professor of physiology, Pavel Mikhaylovich Starkov, and other scientists. The majority of the experiments conducted by P. M. Starkov were on cats and dogs. Professor Starkov and his assistants at first used a "cold-producing blanket" to produce hypothermia. This "blanket" consisted of two layers of rubberized cloth. It was wrapped around the animal and cold water was then passed between the two layers of cloth.

Carrying on his work in Krasnodar, Prof P. M. Starkov has been successful lately in producing hypothermia by using a so-called electrocorporal method of chilling blood. This method consists of passing the blood of the animal through a special refrigerator connected with an artery and a vein. The onset of hypothermia occurs rapidly and easily.

Interesting results were obtained in experiments in which respiration and circulation were observed during supercooling. It was observed that clinical death in animals as a result of supercooling is due to paralysis of the respiratory center in the medulla oblongata. It was also observed that the heart continues to function from 5 to 45 minutes after respiration has ceased. Subsequent observations showed that clinical death which occurs during deep hypothermia is reversible. It consists of warming the bulbar centers (passage through the animal organism of a solution, kept at a temperature of 37 degrees), thereby creating the possibility of restoring respiration.

During the early stages of warming, it is expedient to use a ""warm" blanket, dry air baths, and solar heat. It was discovered that the use of excessive heat after hypothermia may cause dry gangrene in superficial tissues.

Professor Starkov and his assistants studied the effects of chilling on energy metabolism for a long time and in detail. They found that at first this metabolism increases and then becomes 3-4.5 times lower than it was originally, before chilling was applied. If the body temperature of an animal is reduced to 20 degrees, its organism overcomes hypothermia within 10-12 hours if the external temperature is also 20 degrees. These experiments were conducted on rabbits. In subsequent experiments on cats, it was found that the restoration of temperature and all the functions of the body takes place more rapidly; within 6-8 hours. It can be concluded that the centers of thermoregulation do not lose their functional properties. It can be deduced also that an organism chilled to 20 degrees must be warmed rapidly at a temperature not higher than 32 or 33 degrees. Any warming beyond that limit may cause undesirable changes in the spinal cord centers.

But what of the limits to which an organism can be chilled? If the temperature of the body is reduced to 20 degrees, blood circulation can be cut off from the heart for about ten minutes, a situation which is very tempting for a surgeon.

Results of experiments showed that such chilling of an organism is dangerous and may cause the rapid onset of serious complications. The Pavlovian methodology of conditioned reflexes and the use of electroencephalography have helped to establish that higher nervous activity is

not restored completely whan an organism is chilled to 23 to 20 degrees. Conditioned reflexes in dogs, for example, disappear and are restored with difficulty when the body temperature falls to between 30 and 27 degrees.

The labilityy of the nervous system has its limits. During hypothermy these limits are very narrow. Anesthesia increases considerably the limits of lability of the nervous system. After pure hypothermia the conditioned reflexes seem to appear again on the 4th-9th day; during hypothermia with anesthesia, they appear on the 2d-4th day.

Having applied hypothermia and anesthesia in a dog, Professor Starkov and his assistants cut the circulation off from the heart for 15 minutes. The "dry" heart was operated on and behavior of the dog was noted after life was restored in the animal. Almost 3 weeks passed after the operation was performed before the dog's conditioned reflexes were restored. Subsequent experiments confirmed that the functions of the central nervous system are restored slowly and gradually.

Clinical physicians know that dangerous complications, such as ventricular fibrillation, arise at times during hypothermia and the subsequent cutting off of the flow of blood to the heart (during "dry" heart operations). Associates of the Institute of Surgery imeni A. V. Vishnevskiy and of the Institute of Thoracic Surgery of the Academy of Medical Sciences USSR, with which Prof P. M. Starkov maintains close contact, advised him to search for ways to prevent such complications. In trying to solve this problem, Professor Starkov and his assistants asked themselves if it is possible to prevent fibrillation by acting on the cerebral cortex, the main "panel" that controls all physiological functions of the organism.

Much had been attempted before Professor Starkov and Aspirant Pokrovskiy decided to use morphine-ether anesthesia. Their initial experiments were successful: ether anesthesia with morphine, excluding action on the cortex, sharply reduced the manifestation of fibrillation. But researchers did not stop at this, because morphine-ether anesthesia does not guarantee completely that fibrillation will not arise. It was found that if oxygen is added to anesthesia, ventricular fibrillation does not arise ordinarily during the period preceding the cutting off of the blood flow to the heart. The intravenous injection of proserine, novocaine, and glucose prevent the appearance of such a complication. When blood circulation is shut off from the heart, it is necessary to reduce sharply the "depth" of anesthesia. This is best done during inhalation anesthesia.

Professor Starkov shared his conclusions with surgeons. Clinical observations confirm, in many respects, the results of physiological experiments.

A small group of physiologists, headed by Professor Starkov, is now trying to solve other questions advanced by clinicians. The main task before them is to improve methods of producing hypothermia. The danger that hypoxia of the brain may arise is reduced and the entire technique of hypothermia is simplified when the brain is chilled through its external integument. A partisan of "hypothermia through the head," Professor Starkov searches for and finds benefits derived from this method. Even though the physiological experiments are still being continued, neither the professor nor his assistants has any doubt that they will succeed.

There is one more question which has been suggested by clinicians and is being studied in the laboratory. It is known that even though circulation of the blood to the heart is "cut off," the "dry" heart continues to contract. Harmful products of metabolism accumulate in the heart muscle. Heart beats must be artificially interrupted for the duration of the operation. The heart is "turned on" after the operation is completed, and it is made to contract with its normal rhythm. Prof P. M. Starkov is studying this question now. It is the question that is connected with the main problem of his creative genius: the problem of hypothermia.

128. Excitability of Respiratory and Deglutitory Centers

"Activity of the Deglutitory and Respiratory Centers Upon Excitation of Supralaryngeal and Vagus Nerves With a Background Hyperventilation of the Lungs and Exsanguination," by G.Ya. Priyma and V. A. Minkina, Laboratory of Physiology, Pedagogical Institute; Leningrad, Fiziologicheskiy Zhurnal SSSR imeni I. M. Sechenov, Vol 46, No 3, Mar 60, pp 305-309

This article describes experiments performed on 14 dogs to determine the reflex excitability of the deglutitory and respiratory centers on excitation of the supralaryngeal and vagus nerves after hyperventilation of the lungs and exsanguination.

Temporary asphyxia, caused by hyperventilation of the lungs, had no negative effect on the activity of the deglutitory center. Severe blood losses left this center active until the experimental animal died.

It was also noted that the deglutitory and respiratory centers do not have the same susceptibility to variations in the gas composition of the blood.

Public Health, Hygiene, and Sanitation

129. Methods of Determining Dust Contamination Compared

"A Comparison of Several Methods of Determining Dust Contamination," by J. Simecek and L. Oppl, Pracov. Lek. (Pracovni Lekarstvi), No 5, 1958, pp 286-491 (from Meditsinskiy Referativnyy Zhurnal, Section 4, No 10, Oct 59, p 22)

"Data obtained by the quantitative method (after collection of samples on a membrane filter) were compared with data obtained by calculation of the number of particles in samples collected by the electroprecipitator, an impinger, and the Bausch and Lomb conimeter. Results of the research were used to evaluate the different methods of measuring dust contamination and to establish permissible amounts of dust particles in the air which correspond to the active weight norms."

130. Plenum of Red Cross Central Committee Held

"The Fourth Plenum of the Central Committee of the Red Cross" (unsigned article); Moscow, Sovetskiy Krasnyy Krest, No 1 (49), Jan/Feb 60, p 19

This news item reports the proceedings of the Fourth Plenum of the RSFSR Red Cross in Moscow. V. A. Aparysheva, chairman of the Chelyabinskaya Oblast Red Cross Committee, and K. G. Bogdanova, chairman of the Lipetskaya Oblast Red Cross Committee, read reports on the activities of Red Cross societies in industrial establishments and in rural areas of their oblasts. Nineteen people took part in the discussions that followed.

It was reported that within the past 4 years, the number of sanitation positions in industrial establishments of Chelyabinskaya Oblast has doubled, membership in the Red Cross Society has increased to 3.5 times the previous number, and the number of blood donors has increased to 13 times the previous number. "Activists" of the Magnitogorsk metallurgical combine, the Chelyabinsk tractor plant, the Ural automobile plant, and the machine building plant and coal mines of the city of Kopeysk made the greatest progress.

Red Cross workers of Lipetskaya Oblast improved economic conditions of the kolkhozes of their oblast and made progress in the planning and organization of public services in rural areas. They took an active part in planting trees and brushwood. They also assisted in excavating many reservoirs. The Red Cross Society of Lipetskaya Oblast has over 10,000 members.

The chairman of the Central Committee of the RSFSR Red Cross, V. P. Pokhvalin, discussed in detail the problems which confront the organizations of the RSFSR Red Cross.

The plenum decided that the next All-Russian Congress of the Red Cross Society should be held in May 1960, because the authority granted to its Central Committee to act for it expires in April 1960.

131. Tasks Confronting USSR Health Organizations

"The Basic Tasks of the Sanitation Service in Connection With the Decisions Adopted by the 21st Congress of the Communist Party of the Soviet Union," by I. Mazik; Tallinn, Zdravookhraneniye Sovetskoy Estonii, No 1, Jan/Feb 60, pp 3-8

The article briefly outlines the tasks which confront the health organizations of the country during the Seven-Year Plan. Mainly, they are as follows: (1) reduce the incidence of diseases responsible for a high mortality rate; (2) reduce disease incidence among workers in industrial enterprises; (3) reduce child mortality; and (4) improve the well-being and promote the physical development of the young by means of the prophylaxis of diseases which have their origin in young children; sharply reduce the incidence of infectious and parasitic diseases. The successful solution of these problems will require a study of all the factors which have a harmful effect on people's health.

The prevention of occupational intoxications and diseases occupies a special place in the work to be done by the health organizations. The enormous development of industry and agriculture increased the use of poisonous substances, the release of poisonous vapors into the air, and the incidence of occupational diseases. Steps must be taken to improve working conditions, install proper ventilation in plants, and install proper sewage systems. Workers must be trained to observe sanitary regulations. More highly trained workers in the field of the Sanitary-Epidemiological Service and more and better laboratory facilities for analytical work will be required.

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132. Water Supply in Cities of Western Turkmenistan

"On the Sanitary-Hygienic Characteristics of the Water Supply in the Industrial Cities of Western Turkmenistan," by A. D. Mirishev, Chair of General Hygiene, Turkmen State Medical Institute imeni V. I. Stalin and Ashkhabad Scientific Research Institute of Epidemiology and Hygiene; Ashkhabad, Zdravookhraneniye Turkmenistana, Vol 4, No 1 (19), Jan/Feb 60, pp 25-28

A study has been made of the water reserves in Western Turkmenistan where intensive drilling for oil is now being conducted. The investigations revealed that the drinking water supply available for the cities of Krasnovodsk, Nebit-Daga, and Cheleken is inadequate to supply the needs of the populations of these cities: only 25-75 liters of drinking water per man in 24 hours is available as against the daily need of 90-120 liters of water per man; during the summer, the water supply is considerably smaller. Furthermore, the water which is available is bacterially polluted and is unsuitable for use because of improper facilities and handling. The construction of an extensive and sanitary water system is strongly urged.

Radiology

133. Mechanisms of Radiation Injury and Protection of Human Organism

"Ionizing Radiations and the Human Organism," (Research on Means of Protection From Radiation Injury), by Prof B. N. Tarusov; Moscow, Atomnaya Energiya, No 3, Mar 60, pp 33-38

Progressive scientists throughout the world have intensified their efforts to create effective means of protecting the human organism from ionizing radiations. There has been extensive growth in the field of chemical protection or prophylaxis by the use of certain chemical substances which, when administered prior to irradiation, alleviate radiation injury.

According to the well-known Belgian scientist, Z. M. Bacq, and other scientists, the mechanism of this type of prophylaxis can be explained on the basis of the theory of the indirect effect of radiation. Other scientists (B. N. Tarusov and others) consider that the radiochemical reactions which arise in the organic substances of cells and tissues and which have a protective effect play an important role in radiation injury. This article considers the fundamental aspects of these studies and includes the following specific topics: the mechanism of radiation injury, chain reactions after radiation action, chemical protection, the role of oxygen, direct and indirect effects, the protective effect of antioxidants, and physiological protection.

134. Serum Proteins Altered by Ionizing Radiations

"Indexes of the Changeability of Serum Proteins Under the Effect of Ionizing Radiations," by I. K. Gul'mirzayeva, Chair of Biochemistry, Tashkent State Medical Institute; Tashkent, Meditsinskiy Zhurnal Uzbekistana, No 3, Mar 60, pp 30-35

The author briefly summarizes the effects of large doses of ionizing radiations on protein molecules.

The purpose of the research discussed was to develop tests to determine the degree of variability of serum proteins under the effect of ionizing radiations administered in five doses of 5,000; 10,000, 100,000; one million; and 2 million r from Co^{60}. Tests were conducted on serum whole proteins, and on globulin and albumin fractions. Ammonium, sodium, and cadmium sulfate and trichloroacetic acid solutions causing protein precipitation were used. Turbidity was determined by means of a galvanometer for normal horse serum, and for antidiphtheria serum before and after irradiation.

The author's conclusions are as follows:

1. The thermophotoelectrometric method of testing developed by the author is effective in studying the changeability of serum proteins under the effect of various doses of gamma irradiation.

2. The use of ammonium, sodium, and cadmium sulfate and trichloroacetic acid solutions in determining the concentrations makes it possible to detect changes in whole serum proteins and various fractions after their irradiation.

3. By combining a 10-percent solution of sodium sulfate with a 0.17-percent solution of trichloroacetic acid, the precipitating effect is significantly increased, and denaturating changes resulting from smaller doses of ionizing radiation are revealed.

135. Effect of Fe-59 on Serum Albumin

"The Effect of the Introduced Radioisotope of Iron on Serum Albumin," by Ye. A. Zabozlayeva, Tr. Stalinabadsk. Med. Inta, (Works of the Stalinabad Medical Institute), No 27, 1957, pp 33-40; (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 6, 25 Mar 60, Abstract No 7394, by V. Baranova)

"The rate of peptolysis of dog serum albumin before and after the administration of radioisotope Fe-59, which emits gamma rays and accumulate in the liver was studied. It was established that after the administration

of the radioisotope to dogs, the breakdown of serum albumin is accelerated. Three months after the cessation of isotope administration, changes in the rate of peptolysis were still evident. The plasma protein electrophoregram is changed after Fe-59 administration, i.e., the beta-globulin fraction is increased. The readings of the thymolveronal test with blood serum of irradiated dogs were higher than control figures, which probably is connected not only with an increase in the quantity of beta globulins, but also with qualitative changes in the plasma proteins."

136. Myocardial Infarct During Acute Radiation Sickness

"The Course of Experimental Myocardial Infarct During Acute Radiation Sickness in Rabbits," by N. B. Ginzburg, Chair of Normal Physiology, Military Medical Order of Lenin Academy imeni S. M, Kirova, and Khar'kov Military Hospital; Kiev, Vrachebnoye Delo, No 12, Dec 59, pp 1263-1265

This report presents the results of experiments on 50 full-grown chinchilla rabbits subjected to X irradiation and suffering from experimental myocardial infarct. The authors present the following conclusions:

1. The course of myocardial infarct in animals suffering from radiation sickness most often is more severe than in unirradiated animals. Electrocardiographic and morphological changes indicate a greater extension of necrobiotic processes when myocardial infarct is combined with radiation sickness, which individual cases leads to the development of cardiac aneurism and a higher degree of dystrophic changes in the myocardium.

2. During the development of myocardial infarct against a background of radiation sickness, a fall in the blood prothrombin index is noted. Therefore, the significance of anticoagulants administered to patients suffering from coronary deficiency and penetrating radiation effects should be kept in mind.

3. Morphological changes in myocardial vessels indicate that after the ligature of the anterior descending branch of the coronary artery, a more marked stasis, together with hemorrhages, takes place in the cardiac muscles of irradiated animals.

137. Skin Sensitivity to External Medicinal Agents During Acute Radiation Sickness

"Skin Sensitivity of White Rabbits Suffering From Acute Radiation Sickness to External Medicinal Agents," by V. I. Samtsov, Chair of Cutaneous and Venereal Diseases, Military Medical Order of Lenin Academy imeni S. M. Kirov; Moscow, Vestnik Dermatologii i Venerologii, No 3, Mar 60, pp 3-6

Fifty-four rabbits were subjected to a single, whole-body X-irradiation by 750 r in an effort to explain the changes in skin reactivity to external irritants in animals suffering from acute radiation sickness of moderate severity.

The author presents the following conclusions:

1. Penetrating radiation injuring the vascular system induces increased cutaneous sensitivity to ichthyol, naphthalan, pitch, sulfur, cignolin (anthralin), adhesive plaster, gasoline, and to a lesser degree, to iodine, cleol (mastisol), and collodion.

2. The degree of the inflammatory reaction which is caused by the above-mentioned preparations depends on the severity of the radiation sickness.

3. The external use of the medicinal agents which have a side effect (pitch and cignolin) aggravate the course of radiation sickness,

4. Vaseline, 10% mercurial ointment, 10% salicylic ointment, 5% synthomycin ointment, 2% aqueous solution of methylene blue and gentian violet, 70% alcohol, 2% salycylic alcohol, ether, and Castellani stain exert no irritating effect on the skin of animals suffering from acute radiation sickness of a moderate degree.

138. Effect of Ionizing Radiation Tested in Experimental Syphilis

"The Effect of Ionizing Radiation on the Course of Experimental Syphilis in Rabbits," by A. L. Popovich, Materialy Nauchn. Sessii, Posvyashch. 50-letiyu BSSR (Data of the Scientific Session Commemorating the 40th Anniversary of the Belorussian SSR), Minsk, 1959, pp 143-145; (from Referativnyy Zhurnal--Khimiya. Biologicheskaya Khimiya, No 6, 25 Mar 60, Abstract no 8178, by M. Piotrovskiy)

"The onset of primary syphiloma is inhibited in rabbits with inoculated syphilis at the height of radiation sickness (13 days after irradiation by a 500 r dose)."

139. Iodine-Binding Capacity of Gamma-Irradiated Albumin

"The Capacity of Gamma-Irradiated Serum Albumin to Bind Iodine," by G. A. Korol'chenko, Tr. Stalinabadsk. Med. In-ta (Works of Stalinabad Medical Institute), No 27, 1957, pp 55-57; (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 6, 25 Mar 60, Abstract No 7393, by V. Baranova)

"It was found that gamma-irradiated serum albumin loses 20-30% of its capacity to bind free iodine, which, in the author's opinion, is a result of its oxidation."

140. Need for Specialization in Use of Modern Methods of Radiation Therapy

"Modern Methods of Radiation Therapy," by Prof A. Kozlova; Moscow, Meditsinskiy Rabotnik, No 34 (1886), 26 Apr 60, p 2

The author reviews various significant improvements in diagnostic and therapeutic methods of treating malignant neoplasms of various forms, sites, and stages. This is followed by a brief review and expansion of the UN recommendations of 1959 on the use of atomic energy for peaceful purposes, including the establishment of a special radiological center equipped with X rays, gamma rays, linear accelerators, betatrons, etc., for treating all forms of malignancies and for conducting all types of curietherapy.

In view of the increasing types, complications, and hazards of such equipment, the adequate preparation of the participating personnel in various therapeutic institutions is an additional necessary step toward the successful treatment of malignancy. According to the author, such therapeutic institutions should train specialists in the following disciplines: Radiotherapy physicians with 3 years of clinical experience plus 2-3 years' special training in radiotherapy; radiotechnologists who have received at least 2 years of medical training plus 2 years of special training in radiotherapy; physicist-radiologists who have completed the university plus 2-3 years' of training in radiotherapy; and physicist-technologists who are trained in dosimetry and the maintenance of the equipment.

Surgery

141. Organ Transplantation Successful

"With Two Hearts," by V. P. Demikhov, Scientific Research Laboratory for the Transplantation of Organs, First Moscow Medical Institute; Moscow, Nauka i Zhizn', No 8, Aug 59, pp 64-66

The author of this article states that the Scientific Research Laboratory for the Transplantation of Organs, First Moscow Medical Institute, has been experimenting on dogs for years to determine feasibility of replacing diseased hearts, lungs, stomachs, and kidneys with healthy ones. More than 20 variations of transplantation of the heart and lungs of dogs have been attempted. This was done without removing the dog's own heart.

Results of experiments showed that when the nerves which carry impulses from the brain to the heart are severed, the heart functions more steadily. Ventricular fibrillation was noted upon mechanical stimulation of the heart when it was connected with the brain by means of nerve tissues. When these stimulations were applied to the heart after the nerves were severed, no complications were observed. The heart showed greater resistance to the effects of poisons when it was not connected to the brain by means of nerve tissues.

Results of experiments conducted showed also that the tissue of the transplanted heart unites well with the tissues of the new organism. Symptons of biological or immunological incompatibility were not observed.

It is hoped that ultimately it will be possible to experiment on humans to observe the reaction of the human organism to such transplantations.

142. Blood Preparations as Tissue-Healing Stimulators

"The Use of Blood Preparations to Speed the Healing of Injured Tissues," by G. V. Golovin, Surgical Clinic, Leningrad Order of Red Banner of Labor, Scientific Research Institute for Blood Transfusion; Moscow, Vestnik Khirurgii imeni I. I. Grekov, Vol 84, No 3, Mar 60, pp 120-131

A comprehensive review of Soviet and non-Soviet literature on numerous means and methods of stimulating bone and soft tissue regeneration is presented. Substances described include sterilized blood serum

"F" as described by A. N. Filatov, 1942; blood-expanding solutions; homogenous salves; "V" powder, Bogomolets, 1949; leukocyte discs; "RS" powder, retroplacental blood; "KP" powder, blood and penecillin; paste with synthomycin; fibrin films; blood plasma plastics; and hemopins.

The advantage of having hundreds of methods for speeding tissue healing is that when a practicing physician is faced with the difficult decision of choosing a method, he can select the method most suitable to the general condition of his patient, the type of injury, and the form and degree of pathology.

Veterinary Medicine

143. Aerosol Vaccine Used on Fowl

"Characteristics of Strain B_1 Aerosol Vaccine Against Fowl Plague," by V. P. Golubnichiy, Ukrainian Scientific Research Institute of Experimental Veterinary Medicine; Kiev, Visnyk Sil'skohospodars'koi Nauky, No 3, Mar 60, pp 83-87

Special attention is being given to the aerogenic immunization of fowl against fowl plague by a vaccine in the form of an aerosol.

The authors studied the fundamental physical and immunobiological characteristics of an aerosol of strain B_1 fowl plague virus for the purpose of learning the effectiveness of aerogenic immunization of fowl under conditions to be found in large fowl-breeding enterprises. The results obtained from laboratory and production tests indicated that vaccine aerosols of strain B_1 produced by the O-45 pistol atomizer and the O-29 pulverizer in combination with a compressed air source are capable of providing prophylaxis against fowl plague.

The aerosols mentioned were harmless to fowl over 10 days old. Their use in production tests did not affect the growth of chicks or the productivity of laying hens.

Immunity begins 5-7 days after the vaccination of the fowl by the aerogenic method and lasts up to 6 months. Formation of immunity is accompanied by an increase in the specific antibody titer and in the concentrations of the globulin fractions.

144. Immunization Against Fowl Typhoid

"The Search for a Vaccine Against Fowl Typhoid," by M. T. Prokof'yev and I. N. Doroshko, Nauchn. Tr. Ukrainskiy N.-I. In-t Eksperim. Vet. (Scientific Works of the Ukrianian Scientific Research Institute of Experimental Veterinary Medicine), No 24, 1957 (1958), pp 141-157 (from Referativnyy Zhurnal -- Biologiya, No 23, 10 Dec 59, Abstract No 102438, by A. Ya. Shapiro)

"The authors prepared and tested 16 variants of a vaccine with different quantities of microbial cells (inactivated with crystal violet, formalin, depoted potash alum, aluminum hydroxide, etc,). All these vaccines, which established resistance against infection with Salmonella gallinarum in 50-80% of mice (when 100% of the controls died), did not confer the required immunity in turkeys. The authors suggest that the strains of Salmonella which were used to prepare the vaccines were not sufficiently immunogenic, which may be a result of their low virulence. The authors are also convinced that turkeys are extremely susceptible to experimental typhoid, and among laboratory animals, mice are also extremely susceptible; older chicks and full-grown chickens were only slightly sensitive. The authors recommend the following methods for experimental infection: for turkeys, intramuscular; for chickens, intraperitoneal; for mice, cutaneous."

Miscellaneous

145. Progress in Medical Electronics

"Today and Tomorrow in Electronics," by A. Smirnov, Physiological Laboratory of Design Bureau of Biophysical Devices (Biofizpribor), Leningrad; Moscow, Meditsinskiy Rabotnik, 8 Apr 60, p 3

This article concerns advances in the field of medical electronics which aid physicians in the objective diagnosis of difficult cases.

Electronics has not yet found wide usage in outpatient medical practice to the extent that it is a familiar sight. Prior to World War II, medical electronics as a science and as a branch of engineering was unknown.

Recently it has been recognized that electronics may be applied in medical diagnosis. There are now scientific engineering societies of medical electronics in existence in many countries, including the USSR. International electronics conferences have been held, an

International Society of Medical Electronics has been organized, and special periodicals and books are being published on the subject. Scientific research and design organizations and establishments have been set up to initiate large-scale production of medical electronic instruments and devices. Many large clinics in the USSR already have a sufficient number of electronic devices to work with.

Medical electronic equipment makes the work of physicians easier inasmuch as it supplies accurate objective data concerning the functions of various organs, systems, and the organism as a whole.

Such instruments as oxyhemometers are now being used to measure oxygen saturation of the blood. Photoelectric devices can measure within minutes, and with sufficient accuracy, the quantity of hemoglobin and its derivatives in the blood and the amount of various other pigments in the blood, bile, and urine.

Electrothermometers are superior to ordinary mercury thermometers in accuracy and measuring speed, and they can be used more conveniently. Measuring the temperature of the body within 10-20 seconds, one electrothermometer can do the work of between 25 and 50 mercury thermometers, making it possible for a nurse on a ward to measure the temperature of 6-10 patients without leaving her desk. A thermograph can draw a curve of the temperture of the body over a period of 24 hours.

Oxyhemometers and electrothermometers are very simple devices. Multichannel devices for comprehensive examination of physiological processes of the cardiovascular and the central nervous systems place the development of modern medical electronics on a high level.

An electrocardiograph with between 12 and 16 channels and a multitude of diverse attachments makes it possible to record simultaneously several electrocardiograms: arterial and venous pressure, pulse, blood pressure and oxygen saturation, heart, tonus and noises, fluctuations in hyperemia in the organs, the rate of blood flow, and other processes. The device does not offer a ready-made diagnosis, but it supplies a sufficient quantity of objective factual meterial that can be used to aid in reaching an accurate and dependable medical diagnosis. Many new discoveries in radioelectronics can be utilized in such very complex instruments.

The applications of radioelectronics are unlimited. Efficiently functioning electroencephalographs are now being used for recording biocurrents of the brain. They contain hundreds of electronic tubes and semiconductors as well as thousands of other components.

Curves obtained with the aid of the most complicated electronic medical devices, such as electroencephalograms, electromyograms, electrocardiograms, and many others, are so complicated that only exceptionally well-qualified personnel can decipher them. For this reason, further improvement in the techniques of measurement as well as the invention of new instruments must be accompanied by the development of suitable automatic devices for analysis. Analyzers and integrators of biocurrents of the brain, which operate in conjunction with the electroencephalograph, are now available.

The vigorous growth of the medical electronics industry is quite understandable. It can be said that satisfactory surgery to correct heart and lung disorders depends to a considerable degree on the efficient functioning of electronic devices. It is doubtful that any physician would undertake heart surgery on the basis of auscultation and functional trials. Decisions must be made on the basis of objective data about heart sounds obtained with the aid of a phonocardiograph.

Televison systems have been invented which permit observations of how an operation is proceeding. The picture is supplied in natural color and can be observed outside the operating room.

A special, composite electronic device which will be able to record the frequency of pulse and respiration, to determine oxygen saturation of the blood, to determine arterial pressure, to supply a photographic record of the heart's action, and to detect and record brain waves is under development. This device is expected to be operational in 1960. One person will be able to operate it.

Medical electronics has demonstrated great usefulness in measuring the temperature of the body without coming in contact with it. There is a device which automatically measures arterial blood pressure at regulated intervals and continues to do so for a period of several hours. There is another device, an oxyhemograph, which can record continuously the oxygen saturation of the blood in arteries and veins.

A so-called "radiopill" has been invented. It is a miniature radio station with microscopic semiconductors and batteries. The patient swallows the pill, and a special apparatus in it records information about pressure, acidity, and temperature in the intestines and the rate at which its contents move. The "radiopill" not only replaces the X-ray and catheterization, but also makes possible examinations of places of the body which are otherwise inaccessible.

The devices mentioned above have already been invented. They are either in use or are about to be used in various laboratories and in physiotherapeutic and other establishments.

Thousands of laboratory technicians are analyzing blood every day in the USSR. The number of these analyses approximates one million each year. One can imagine the significance of the devices which are currently under development, such as an automatic device which will be able to compute the number of blood corpuscles in the body. Apparatuses to be used in treating patients with ultrasound and with ultrahigh-frequency impulses are also under development.

The tendency now is to perfect and to simplify the existing types of electronic devices. The work presently conducted is devoted to miniaturization with better performance and accuracy. The trend is toward automatization of analysis of physiological processes. Scientists and designers are persistently searching for a way of finding instruments to visualize the internal organs with the aid of ultrasound and high-frequency electromagnetic oscillations. Some success has been achieved in this respect. A device of this type for examining tumors is in the process of development.

Some people are already dreaming of machines which can perform medical diagnosis. Although these dreams seem fantastic, no doubt a machine can combine exact diagnostic information with analysis of this information, and can do so much more rapidly than can be done by a human being. Attempts already have been made to develop an instrument which will automatically analyze the temporal and amplitudinal relationships of the electrocardiogram, and will decipher it in approximately the same manner as would a medical specialist. An apparatus to automatically control anesthesia has already been made operational.

The automatic regulation of physiological processes and the restoration of lost functions are of great practical significance. Automatic stimulation of the heart by means of biocurrents may serve as an example of this. Such devices are now in the process of development. We can look forward to the time, which is not far off, when voice, and to some extent hearing and vision, can be replaced by some sort of device. A great future is envisioned for medical electronic devices.

146. Unsatisfactory Vaccination Program

"In the Ministry of Health USSR" (unsigned article);
Moscow, Meditsinskiy Rabotnik, 5 Apr 60, p 4

At a meeting of the Collegium of the Ministry of Health USSR, considerable dissatisfaction was expressed with the manner in which plans for the widespread vaccination of the population against a number of diseases are bing implemented. Plans have been prepared for the vaccination of the people with an associated vaccine against diphtheria, pertussis, and tetanus; a live vaccine against poliomyelitis; and a vaccine

against measles and parotitis. Reports to date, however, indicate that the plans are being carried out in an unsatisfactory manner: many therapeutic establishments failed to provide space where vaccinations can be given; medical personnel are not familiar with the methods of using vaccines and sera; in some areas children who have never been vaccinated are reported as having received vaccinations; and no provisions for the storing of vaccines and sera are reported from some places. A resolution calling for the immediate correction of all these shortcomings has been adopted.

147. Price Reductions of Drugs

"What Are the Results of the Price Reduction of Drugs" (unsigned article); Moscow, Meditsinskiy Rabotnik, 5 Apr 60, p 2

M. A. Klyuyev, chief of the Main Administration of the Interrepublican Supply and Marketing of Drugs, in commenting on the recent decree ordering a reduction of prices on a number of pharmaceutical preparations said that the price reductions in effect will save the people billions of rubles. Prices of biomycin, terramycin, penicillin, synthomycin, and other antibiotics have been reduced 24-57 percent; prices of phthivazid, tubazid, and metazid--antitubercular preparations -- have been reduced by 35-50 percent; price reductions of 46-50 percent are in effect on hormone and vitamin preparations. The sharp reductions in the price of vitamins will make it possible to vitaminize such food products as bread, sugar, flour, and milk.

The drug manufacturing industry of the country is expanding, Klyuyev continued. The Kurgan and Penza Chemicopharmaceutical Plants have begun mass-scale production of biomycin and Vitamin B_{12}. A new plant in Novosibirsk will soon begin the manufacture of antibiotics. The network of the drug outlets will be supplemented by 6,500 apothecary shops and many dispensing points in the course of the years of the Seven-Year Plan.

148. Hemeopathy Denounced

"The False Wisdom of Homeopathy," letter to editorial office; Moscow, Izvestiya, 8 Apr 60, p 3

In a letter received at the editorial office of Izvestiya, Academician A. Bakulev; Active Members of the Academy of Medical Sciences USSR N. Blokhin, P. Sergiyev, V. Timakov, V. Orekhovich, V. Vasilenko, V. Parin, A. Letavet, B. Yegorov, Yu. Dombrovskaya, V. Zakusov, A. Myasnikov, A. Bilibin, and I. Filimonov; Corresponding Members of the

Academy of Medical Sciences USSR B. Ognev, I Speranskiy, N. Kurshakov, N. Shmelev, L. Larionov, and A. Minkh; and professors B. Votchal, S. Cherkinskiy, M. Mashkovskiy, S. Moiseyev, and V. Vasil'yeva denounce the recognition of homeopathy as a legitimate branch of medicine, and voice their objection to the so-called homeopathic trend of medicine in the USSR. Homeopathy, they write has been officially recognized in the USSR; homeopaths have their own clinics and dispensing shops; the addition of homeopathic facilities to municipal clinics and the supplementing of the staffs of clinics with homeopathic physicians has been proposed. Homeopathy, they continue, has no scientific basis, and its practitioners have no scientific training. It is an error on the part of the Ministry of Health USSR to permit young physicians who receive their education at the people's expense to forget all they had learned and to turn to homeopathy, particularly since the motives of many of these are not always idealistic, but are frequently dictated by mercenary considerations.

The fact that so many people turn to homeopathy and patronize its clinics the letter ascribes to the shortcomings in the assistance rendered by medicine to the people. It calls on the Ministry of Health to give this problem its serious consideration and to reject the neutral position it now takes. It is no more possible to give equal recognition to medicine and homeopathy than it is possible to give equal recognition to astronomy and astrology, the letter concludes.

149. Uses of Ultrasound in Bulgaria

"Ultrasonics in the People's Republic of Bulgaria," by L. G. Merkulov, Akusticheskiy Zhurnal, Vol 6, No 1, Jan/Mar 60, p 141

"Considerable progress has been made in recent years in the People's Republic of Bulgaria toward raising the level of the national economy. This progress has resulted in increased interest in practical applications of ultrasound technology.

"Most of the work conducted in scientific research institutes and in factories has been associated with the application of ultrasound in technical operations, investigation of the effects of ultrasound on biological objects, and hypersonic analysis.

"A special ultrasound laboratory has been established in the Scientific Research Institute of Transportation in Sofia. A number of very interesting studies are currently being conducted in this laboratory. A method has been developed to improve the quality and to accelerate the process of extracting many therapeutic substances, particularly insulin. The important problem of increasing the yield of various agricultural

crops is also being resolved in this laboratory. Results of experiments performed under laboratory conditions showed that it is possible to increase the yield of some crops by 30-40%. This is done by preliminary irradiation of seeds with ultrasound. Work has begun in this same institute on the welding of various metals by means of ultrasound and on the application of ultrasonic oscillations in electroplanting. Much research has also been done on the processing of industrial equipment, such as powerful generators, supersonic soldering bits, and other items.

"The Chair of Physics of the Medical Institute and the Institutes of Biology and Microbiology (all in Sofia) have been conducting research to determine the possibility of stimulating various biological processes and to determine the effect of powerful ultrasonic oscillations on microorganisms. An appreciable increase in the immunogenic properties of vaccines was noted after they had been subjected to treatment with ultrasound; this is of great practical interest. A new, effective method of obtaining emulsions of a number of therapeutic substances has been developed.

"Diverse technological applications of ultrasound have been initiated in light industry and in food-producing enterprises.

"Interesting investigations have been conducted by the Bulgarian Academy of Sciences to determine the effect of ultrasound on the properties of semiconductors and to observe the processes of secondary electron emission of crystals.

"Industrial application of hypersonic analysis is not yet very extensive. It is, however, being used by the Railroad Car Building Plant imeni G. Dimitrov to check the quality of car axles. This plant is located in Sofia. Hypersonic analysis has been introduced in the Metallurgical Plant imeni V. I. Lenin (in Dimitrov) and also in the Shipbuilding and Maintenance Plant imeni G. Dimitrov (in Varna)."

150. Czechoslovak National Biochemical Congress To Be Held in August

Prague, Chemicke Listy, Mar 60

"The Czechoslovak Biochemical Society of the Czechoslovak Academy of Sciences in Prague, in cooperation with the section of clinical chemistry of the Czechoslovak J. E. Purkyne Medical Association in Prague, will sponsor the Second National Biochemical Congress (with international participation) between 29 August and 3 September 1960 in Prague.

"Registration of papers to be presented and announcement of participation in the congress should be submitted by 20 March 1960. Questions should be addressed to Engr M. Cihar, Institute of Chemistry of the Czechoslovak Academy of Sciences, Prague 6, Na cvicisti 2."

VIII. METALLURGY

Physical Metallurgy

151. Precipitation of Tungsten and Molybdenum by Reduction With Hydrogen Under Pressure

"Precipitation of Tungsten and Molybdenum From Solutions of Sodium Tungstate and Molybdate by Reduction With Hydrogen Under Pressure," by A. N. Zelikman and Z. M. Lyapina, Chair of the Metallurgy of Rare Metals, Krasnoyarsk Institute of Nonferrous Metals; Ordzhonikidze, Izvestiya Vysshikh Uchebnykh Zavedeniy, Tsvetnaya Metallurgiya, No 2, 1960, pp 119-125

High extraction of tungsten (94 to 99%) from sodium tungstate solutions with tungsten concentrations ranging from 5 to 40 g/l was achieved by maintaining a pH of 2-3, hydrogen partial pressure to 20 atm, and temperature of 200°C. In contrast to molybdenum, this reaction proceeds at a high rate without the aid of seeding. Tungsten is precipitated in the form of compounds containing 73-75.2% W and 3.94-4.2% Na and molybdenum in the form of MoO_2. Content of sodium in the tungsten precipitate may be reduced from 4.2 to 3.8% by repeated processing in boiling 5% HCl. In selective precipitation of solutions containing both the tungstate and molybdate, tungsten is precipitated at a hydrogen pressure of 20 atm and temperature of 200°C. Molybdenum is subsequently precipitated by reduction with hydrogen at a pressure of 60 atm and seeding with molybdenum powder. The process is considered to be of possible interest for working waste solutions and tailings from industrial processes containing tungsten and molybdenum.

152. Fusibility Diagram of the Ti-V-Mo System Developed

"Fusibility Diagram of the Ternary System Titanium-Vanadium-Molybdenum," by I. I. Kornilov and R. S. Polyakova; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 1, Jan/Feb 60, pp 85-89

Results are given of investigations from which a fusibility diagram was developed for the Ti-V-Mo system. Alloys were prepared by powder metallurgy and arc furnace methods. Due to the smooth change in temperature curves for the beginning of melting relative to composition, it is considered possible that alloys of this ternary system crystallize as a continuous series of solid solutions. The flat minimum curve for the crystallization of alloys of the system Ti-V is reflected in the

change of the solidus surface for the ternary system T-V-Mo. Microstructural analysis of quenched alloys confirmed the unlimited solubility of these elements in one another above the temperature of polymorphic transformation of titanium. With increase of molybdenum and vanadium content, the temperature of polymorphic transformation of ternary alloys decreases. Data from the fusibility diagram may find practical application in selecting compositions for ternary alloys with a fixed initial melting temperature.

153. Solubility of Chromium, Molybdenum, and Tungsten in Aluminum

"Investigation of the Solubility of Chromium, Molybdenum and Tungsten in Aluminum," by V. N. Vigdorovich, V. M. Glazov, and N. N. Glagoleva, Chair of Physical Chemistry and the Chair of Physical Metallurgy, Krasnoyarsk Institute of Nonferrous Metals; Ordzhonikidze, Izvestiya Vysshikh Uchebnykh Zavedeniy, Tsvetnaya Metallurgiya, No 2, 1960, pp 143-146

Measurements of the microhardness of crystals of solid solutions were employed to determine the solubility of chromium, molybdenum, and tungsten in aluminum at temperatures from 400 to 660°C. The maximum solubility (% by wgt) of each element was calculated to be as follows: Cr, 0.86% at 661°C; Mo, 0.25% at 660°C; and W, 0.16% at 660°C.

154. High-Temperature Alloys of Aluminum With Ternary Intermetallic Compounds

"Effect of Ternary Intermetallic Compounds on the Heat Resistance of Deformed Aluminum Alloys," by B. K. Vul'f and M. N. Chernov, Air Force Engineering Academy and the Moscow Aviation Institute; Ordzhonikidze, Izvestiya Vysshikh Uchebnykh Zavedeniy, Tsvetnaya Metallurgiya, No 2, 1960, pp 147-152

Hot hardness tests of the ternary compounds $Cu_2Al_{20}Mn_3$ (T), Cu_3Al_6Ni (τ), $Mg_4Zn_3Al_3$ (T), $Mg_2Al_{12}Cr$ (E), $Al_9Si_3Mn_4$ (T), $Al_{60}Mn_{11}Ni_4$ (X), and Al_9FeNi (ς), showed that the hardness of $Mg_2Al_{12}Cr$ (E) dropped only 11% after 60 min at 300°C, whereas that of Cu_3Al_6Ni (τ), $Mg_4Zn_3Al_3$ (T), and Al_9FeNi (ς) dropped approximately 50%. Short and long duration strength tests of 46 experimental alloys of aluminum with the

above-indicated compounds (content of each compound up to 20, 31, 32, 17, 17, 16, and 13%, respectively) showed that the highest short duration strength was exhibited by alloys of the systems Al-Cu_3Al_6Ni (tensile strength of 22 kg/mm^2 with 17% elongation at 300°C) and Al-$Mg_4Zn_3Al_3$ (tensile strength of approximately 35 kg/mm^2 with approximately 9 to 11% elongation at 300°C). For comparison, it is noted that the short duration strength of the standard high-temperature alloys Ak 4-1 and VD 17 is approximately 16-17 kg/mm^2 with elongation of approximately 8-21% at 300°C. The highest long duration strength was exhibited by alloys of the system Al-$Mg_2Al_{12}Cr$; rupture time was greater than 250 hr at a stress of 4 kg/mm^2 at 300°C.

155. Parkerizing as Protection Against Corrosion Under Arctic Conditions

"On the Stability of Parkerized Iron Under Conditions at Sea in a Polar Climate," by V. I. Vul'fson and Ye. V. Tyutyunnikova, Uchennyye Zapiski, Leningradskoye Vysshoye Inzhenernoye Morskoye Uchilishche (Scientific Notes, Leningrad Higher Marine Engineering School), No 11, 1958, pp 159-164 (from Referativnyy Zhurnal -- Metallurgiya, Vol 7, Jul 59, Abstract No 16481)

The protective properties of parkerized sheets as a base for paint were studied under operating conditions in the Arctic. Tests were conducted with plates of No 3 steel, parkerized in a solution made up of 30 grams per liter of salts of "Mazhef" (mixture of monophosphates of manganese and iron) and 60 grams per liter of $Zn(NO_3)_2 \cdot 6H_2O$ (as a catalyst for 10 minutes at 96-98°C and painted with oil paint, primer, and enamel. Unparkerized plates were also tested. It was found that parkerized and painted iron parts had the same corrosion resistance at low fluctuating temperature as painted parts which had been primed with red lead. Iron which has been coated with phosphate film before painting is equally as corrosion resistant as that primed with red lead.

156. Coefficient of Linear Expansion for Metals at Low Temperatures

"Determining the Coefficients of Linear Expansion of Certain Metals and Alloys at Temperatures Below Zero," by I. M. Mar'yanovskiy, Trudy Leningradskogo Tekhnologicheskogo Instituta Kholodil'noy Promyshlennosti (Works of the Leningrad Technological Institute of the Refrigeration Industry), Vol 15, 1958, p 221 (from Referativnyy Zhurnal -- Metallurgiya, No 7, Jul 59, Abstract No 15997)

A special laboratory device, based on an optical indicator and a cooler, was developed for the determination of the coefficient of linear expansion at low operating temperatures. The device affords the possibility of measuring cooled specimens with an accuracy of 0.01 micron per millimeter of length. The coefficient of linear expansion is computed on the basis of the varied linear dimension of the specimens through each 10 degrees over a temperature range from plus 18 degrees to minus 190 degrees centigrade. The coefficients of linear expansion for several metals and alloys are tabulated.

157. Structure of Protective Films on Metals

"The Sorption Method of Determining the Structure of Protective Films on Metals," by V. S. Nabokov, Ye. N. Paleolog, and N. D. Tomashov, Metody Issledovaniya Struktury Vysokodispersnykh i Poristykh Tel (Methods of Studying the Structure of Highly Dispersed and Porous Bodies); Moscow, Academy of Sciences USSR, 1958, pp 137-145 (from Referativnyy Zhurnal -- Metallurgiya, No 7, Jul 59, Abstract No 16036

A description is given of a new adsorption method and of a device for determining the structure, weight, thickness, and porosity of protective films on metals. The method of studying anodic films on aluminum is described. Isopentane is used as the adsorbate. Tests were conducted at minus 72 degrees centigrade, with an accuracy of plus-minus 0.005 degrees maintained by means of a special cryostat. Anodically deposited cylindrical specimens 5 millimeters in diameter and 22 millimeters long were carefully prepared. held in the exsiccator for 24 hours, and then put into the device for recording the isotherms of adsorption. The films were removed from surface of the specimens with special solution (20 grams of CrO_3, 35 grams of H_3PO_4 per liter of H_2O). The specimens were weighed on microbalances before and after the removal of the films. Weighting accuracy was approximately 4 percent. On the basis of the obtained data, a calculation was made of the true surface and thickness of

the films, the total pore volume, and the number and distribution of the pores with respect to the effective radius. The influence of several factors on the formation of the film was studied. It was found that anodic deposition on aluminum in solutions of H_2SO_4 takes place directly in the solid phase.

158. Physical Basis for Gas Corrosion of Metals and Alloys

"Reflection of the Physical Mechanism of Reaction Diffusion in the Structural Picture of Layers of Reaction Products (Physical Bases for the Process of Gas Corrosion of Metals and Alloys)," by V. I. Arkharov, Trudy Instituta Fiziki Metallov, Ural'skiy Filial AN SSSR (Works of the Institute of the Physics of Metals, Ural Branch of the Academy of Sciences USSR), No 20, 1958, pp 229-243 (from Referativnyy Zhurnal -- Metallurgiya, No 7, Jul 59, Abstract No 16346)

A report is given of the influence of diffusion reaction observed during the chemical interaction of two media which come into direct contact with one another only in the first stage and later interact through a layer of diffusion products formed at their initial point of contact. The article surveys work done on the study of the structural mechanism of diffusion reaction, including microstructure of reaction products (scale); phase condition of scale layers (including fine structural discontinuities connected with phase divergences from the stoichiometric state); size and configuration of the crystals of the oxide phase; gradient of concentration of components, as well as of vacancies; texture and interphase orientation of components; and lattice deformations and structural indications of automatic phase hardening. The diffusion reaction is considered for the solid-gas phase system with solid nonvolatile reaction products, a particular case of which represents gas corrosion.

159. Phase Studies of the Mg-Mn-Al-Ca System

"Investigation of Alloys of the Quaternary System Magnesium-Manganese-Aluminum-Calcium," by M. Ye. Drits, M. V. Mal'tsev, L. L. Rokhlin, and O. N. Vdalova; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 1, Jan/Feb 60, pp 59-63

Isothermal profiles (for 400 and 300°C) of alloys of the system Mg-Mn-Al-Ca which lie in the tetrahedron plane corresponding to a fixed content of manganese (1.5%) and a number of polythermal profiles were constructed on the basis of microstructural analyses. It is shown that at 400 and 300°C these alloys will fall in one of ten indicated phase

regions, depending on their c position. Results of investigations are used to establish the phase composition of the industrial high-strength, corrosion resistant alloy MA9.

Production Metallurgy

160. Review of Research of the Institute of the Bearing Industry

"Scientific Research Works in the Metals Field and Heat Treatment in the Past 15 Years," by B. Ya. Bashkirov, Tekhnologiya podshipnikostroyeniya (Technology of Bearing Manufacture), No 17, 1958, pp 64-67 (from Referativnyy Zhurnal -- Metallurgiya, No 7, Jul 59, Abstract No 15791)

The following works of the institute are discussed:

(a) studies of bearing-steel alloys; improving the quality of steel through alloying; preparation of GOST and TU standards;

(b) studies of the use of stainless and high-temperature steels in bearings;

(c) studies of methods of heat treating steel bearings to guarantee minimum deformation, stability of structure, and dimensions of parts.

161. Production at Nevskiy Machine Building Plant

"Technical Progress in Metallurgical Production at the Nevskiy Machine Building Plant imeni V. I. Lenin," by S. A. Katugin, Trudy Nevskogo Mashinostroitel'nogo Zavoda (Works of the Nevskiy Machine Building Plant), No 4, 1948, pp 5-22 (from Referativnyy Zhurnal -- Metallurgiya, No 7, Jul 59, Abstract No 16154)

A report is given of the development of the Nevskiy Plant during the period 1857-1957, particularly in the production of steam, gas, and hydraulic turbines, gas compressors, fans, and other machines. The plant has mastered the casting of heavy parts made of steels 20KhML and Kh25N12T and the production of castings, forgings, and drop forgings made of steels 1Kh18N9T, Kh18N12M2T, EI268, and EI400 and high-chromium (27-30 percent) cast iron. Mold and core mixtures of sand and water glass are used for quick drying.

162. Two New High-Temperature Bearing Steels, V7Kh4F and V4Kh4MF

"Steels for Races and Bodies of Rotation of High-Temperature Bearings, Their Properties and Heat Treatment," by A. S. Sheyn, A. A. Tsareva, V. D. Fedotova, and Z. V. Pavlova, Tekhnologiya Podshipnikostroyeniya (Technology of Bearing Manufacture), No 17, 1958, pp 68-88 (from Referativnyy Zhurnal -- Metallurgiya, No 7, Jul 59, Abstract No 15793)

A study is made of the influence of geometry and dimensions, grain elongation, hardening temperature, and procedures of annealing and cold working on the structural and dimensional changes occurring during heat treatment, the stabilization of dimensions, and hot hardness and impact strength of steels EI-347, EI-161 and other high-temperature steels. A study was also made of the use of high-temperature bearing steel as a replacement for EI-347, which possesses considerable carbide heterogeneity. The steel considered for this purpose has a composition of 0.60-0.81 percent carbon, 2.99-8.01 percent chromium, 1.3-7.4 percent tungsten, 0-1.26 percent vanadium, and 0-0.49 percent molybdenum. Two new steels, V7Kh4F and V4Kh4MF, were developed for operating temperatures up to 400°C and up to 500°C, where a hardness of R_C = 50 is admissible.

The chemical compositions of the new steels are as follows:

V7Kh4F: 0.6-0.7 percent carbon, 0.4 percent (or less) manganese, 0.4-0.6 percent silicon, 4.4-5.0 percent chromium, 0.4-0.7 percent vanadium, and 0.2-0.35 percent molybdenum;

V4Kh4MF: 0.7-0.8 percent carbon, 0.4 percent (or less) manganese, 0.4-0.6 percent silicon, 4.4-5.0 percent chromium, 0.7-1.0 percent vanadium, and 0.4-0.6 percent molybdenum.

163. High-Speed Induction Annealing of Titanium Alloys VT-5 and VT-3-1

"Recrystallization Annealing of Titanium Alloys by Induction Heating," by M. M. Badzyaka and V. I. Parkhimovich; Minsk, Vestsi Akademii Navuk BSSR, Seryya Fizika-Tekhnichnykh Navuk, No 4, 1958, pp 47-54

Results are presented of investigations on recrystallization annealing of cold-worked titanium alloys VT-5 and VT-3-1 by induction heating. Optimum conditions selected are as follows: for alloy VT-5, heating to 1,050-1,100°C at a rate of 25°C/sec or to 1,100-1,150°C at 50°C/sec; for alloy VT-3-1, heating to 1,100°C at a rate of 50°C/sec. Both strength and ductility of induction annealed alloys are increased; the greatest increase of ductility (approximately 200%) was exhibited by alloy VT-3-1. Scale losses were 2.5-3 times less as compared to those in ordinary furnace annealing.

164. Research on Intricate Casting of Low-Alloyed Titanium

"Casting Properties of Low-Alloyed Titanium," by Yu. A. Nekhendzi, Doctor of Technical Sciences; L. V. Butalov and N. I. Perov, Candidates of Technical Sciences; and Engr Yu. A. Filin; Moscow, Liteynoye Proizvodstvo, No 3, Mar 60, pp 2-4

Generalized results are presented of investigations to establish the principles in the behavior of titanium and its alloys during casting. Recommendations for combating casting difficulties inherent to titanium are discussed, but also in a generalized manner. Investigations are claimed to be part of an attempt to expand the application of titanium and its alloys in intricate castings.

IX. PHYSICS

Mechanics

165. Equations of Magnetodynamics

"A Particular Solution of Equations of Magnetic Gas Dynamics," by O. A. Berezin; Leningrad, Vestnik Leningradskovo Universiteta, Seriya Matematiki, Mekhaniki i Astronomii, No 1, 1960, pp 107-110

A particular solution of equations of magnetic gas dynamics depending on one arbitrary function is given. The solution is coupled to the motion of the shock wave propagating in motionless gas in the medium with some initial density $\rho_1 (x_2)$, pressure $P_1 (x_2)$, and the strength of the magnetic field $h_1 = h_1^\circ - P_1(x_2)$. The forms of the functions $\rho_1 (x_2)$, $P_t(x_2)$ and the law of the shock wave motion are determined from the conditions of the dynamic compatability.

Nuclear Physics

166. Polarized Radiative Capture

"Circular Polarization of Gamma Quanta Accompanying Nuclear Capture of Slow Neutrons," by D. P. Grechukhin, Moscow State Pedagogical Institute; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 2, Feb 60, pp 621-630

An estimation is made of the order of magnitude of the polarization and anisotropy of the angular distribution of cascade quanta emitted by a previously polarized compound nucleus. Determination of the average of the circular polarization over the cascade permits one to establish the spin of the initial state of the compound nucleus, and by investigating the spectral distribution of the polarization and anisotropy of the angular distribution of the quanta, one can obtain information on the spin dependence of the level density of the compound nucleus.

167. Radiative Capture

"Spectra of Gamma Rays Produced in the Capture of Thermal Neutrons by Heavy Nuclei. II.," by V. M. Strutinskiy, L. V. Groshev, and M. K. Akimova; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 2, Feb 60, pp 598-611

The spectra of γ-rays accompanying the capture of thermal neutrons are calculated. The calculations are performed for dipole γ-radiation and two types of dependence of the nuclear level density on energy. The results for the level density are compared with data derived from other experiments.

168. Radiative Capture

"Spectra of Gamma Rays Produced by the Capture of Thermal Neutrons by Heavy Nuclei. I.," by L. V. Groshev, A. M. Demidov, and V. I. Pelekhov; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 2, Feb 60, pp 588-597

The experimental data on the γ-spectra from the thermal neutron ($n\gamma$) reaction are compared with the theoretical spectra calculated for two laws of variation of the level density. The effect of the energy gap in the level spectrum of even-even nuclei on the γ-ray spectrum in the 0.8-4 MeV region is discussed. The presence of an energy gap leads to large difference in the spectra of odd-odd and even-even nuclei.

169. Nucleon-Nucleon Scattering

"Nucleon-Nucleon Scattering in Two Meson Approximation at Large Orbital Moments," by A. D. Galanin, A. F. Grashin, B. L. Ioffe, and I. Ya. Pomeranchuk; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 2, Feb 60, pp 475-488

The method developed by the authors earlier (ibid, 37, 6 (1959)) is used to calculate the nucleon-nucleon scattering amplitude in two-meson approximation at large orbital moments. Concrete calculations are made for the singlet amplitude in nonrelativistic approximation at orbital moments that are not very great, $1 \ll l \ll 4\ m^2/\mu^2$ (m - nucleon mass, μ - meson mass). The results obtained indicate that F and G phases with nucleon energies $E_{lab} \lesssim 200$ MeV can be derived with good accuracy from the one-meson approximation. This conclusion may prove important for the phase analysis of nucleon scattering.

170. Hyperon Decay

"The Possibility of Determination of Form Factors in Leptonic Decay of Hyperons," by V. P. Below, B. S. Mingalev, and V. M. Shekhter, Leningrad Physicotechnical Institute, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 2, Feb 60, pp 541-552

The energy correlation and asymmetry of emission of particles produced in leptonic decay of hyperons and also the polarization of the emitted nucleons or secondary hyperons have been calculated with account of all six form factors of the decay V, A interaction. A method of comparison of the theoretical formulas with the experimental data is suggested which permits one in principle to determine the form factors. A similar calculation is presented in the appendix when all five types of decay interaction are retained and the form factors are neglected.

171. Hyperon Decay

"Interference of Form Factors in Leptonic Decay of Hyperons," by V. M. Shekhter, Leningrad Physicotechnical Institute, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 2, Feb 60, pp 534-540

It is possible to deduce the energy dependence of the coefficients before the products of various form factors in the expression for the probability of leptonic decay of hyperons and also to predict when part of these coefficients vanish by making use of invariance of the four-fermion interaction matrix element under some formal transformations, no straightforward calculations being required for this purpose.

172. Scattering of π^--Mesons

"Investigation of Elastic Scattering of π^--Mesons With Momentum 6.8 BeV/c on Protons in a Propane Bubble Chamber," by Wang Kan-chang, Wang Tso-tsiang, Ding Da-tsao, V. G. Ivanov, Yu. V. Katyshev, Ye. N. Kladnitskaya, L. A. Kulyukina, Nguyen Dinh Tu, A. V. Nikitin, S. Z. Otvinovskiy, M. I. Solov'yev, R. Sosnovskiy, and M. D. Shafranov, Joint Institute for Nuclear Research, Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 2, Feb 60, pp 426-431

The elastic scattering of 6.8 BeV/c momentum negative pions on protons was studied in propane bubble chamber. The total and differential cross sections of the elastic scattering were found based on 213 events. The total π^- p-interaction cross section was estimated to be:

$$\sigma_{el}\ (>6^\circ) = 3.75^{+0.25}_{-0.55}\ \text{mb}, \qquad \sigma_{total} = (30 \pm 3)\ \text{mb}$$

The results of the elastic scattering experiment are consistent with the optical model analysis of proton as a uniform sphere with sharp boundaries:

$$R = 1.05 \cdot 10^{-13} \text{ cm}, \quad K = 0.71 \cdot 10^{13} \text{ cm}^{-1}, \quad k_1 = 0.$$

173. Antiproton Channel

"2.8 BeV/c Momentum Antiproton Channel," by N. M. Viryasov, A. S. Vovenko, G. G. Vorobyov, A. D. Kirillov, Kim Hi In, B. A. Kulakov, A. L. Lyubimov, Yu. A. Matulenko, I. A. Savin, Ye. V. Smirnov, L. Strunov, and I. V. Chuvilo, Joint Institute for Nuclear Research; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 2, Feb 60, pp 445-448

An arrangement for separation of antiprotons possessing a momentum of 2.8 BeV/c obtained from the Joint Institute for Nuclear Research proton synchrotron is described. Data on the relative frequency of generation of antiprotons and π - mesons in Be and Cu have been obtained.

174. Meson Induced Uranium Fission

"The Mechanism of Uranium Fission Induced by Slow μ-Mesons," by G. Ye. Belovitskiy, N. T. Kashchukeyev, A. Mikhul, M. G. Petrashku, T. A. Romanova, and F. A. Tikhomirov, Joint Institute of Nuclear Research, Physics Institute imeni Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 2, Feb 60, pp 404-408

Photographic emulsions were employed to study the possibility of uranium fission produced as a result of direct transfer to the nucleus of the energy liberated in the 2p - 1 s mesic atom transition. The upper limit of the probability for fission by this mechanism is ~ 0.01. μ^- - meson; induced fission of uranium nuclei is mainly due to nuclear capture of the μ^- -meson, the probability for this being of the order of 0.07. Arguments are presented which indicate that the mesic atom 2p - 1s transition in uranium is partially a radiationless transition.

175. Positron Decay

"Positron Decay of Ir-192," by S. F. Antonova, S. S. Vasilenko, M. G. Kaganskiy, and D. L. Kaminskiy, Leningrad Physicotechnical Institute, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental-noy i Teoreticheskoy Fiziki, Vol 38, No 2, 1960, pp 379-383

Positron decay of Ir^{192} was discovered ($T^1/2$ = 74 days). Relative decay intensity amounts to $1.5 \cdot 10^{-7}$ positrons per decay. End-point energy of the β^+ spectrum E_o = (240 ± 10) keV. Total transition energy of Ir^{192} - Os^{192} equals 1950 keV. Measurements were made of the conversion electron spectrum in the energy region of more than 1 MeV. A new γ-transition was discovered with the energy E_γ = 1088 keV.

176. Analysis of Relativistic Electron Gas

"Magnetic Permeability of a Relativistic Electron Gas," by A. A. Rukhadze and V. P. Silin, Physics Institute imeni Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 2, Feb 60, pp 645-646

For the computation of the permeability of a relativistic electron gas, the quantum kinetic equations with self-consistent interaction were used. An analysis for nonrelativistic electrons, previously carried out by L. Landau (Zs. Phys., 64, 629 (1930)) showed that the diamagnetism of electrons equals one third of the spin paramagnetism. The same results have been found for relativistic electrons by way of a different computation.

177. Hyperfine Structure of Atoms

"The Hyperfine Structure of Polyelectronic Atoms," by G. M. Bukat, A. Z. Dolginov, and R. A. Zhitnikov; Moscow, Optika i Spektroskopiya," Vol 7, No 3, Mar 60, pp 285-294

Electron matrix elements forming part of the constants of hyperfine structure are computed for atoms with several equivalent electrons in the unfilled shell. The cases of LS- and jj-bonds are analyzed. The genealogy coefficients for terms of maximum multiplicity configuration f^n are given a convenient form for computation. It is shown that the application of the rule of sums permits in some cases the solution of the problem without computation of genealogic coefficients.

178. Autoionization in He and Li Atoms

"Computation of the Probability of Autoionization in the Helium and Lithium Atoms," by R. Kh. Propin; Moscow, Optika i Spektroskopiya, Vol 8, No 3, Mar 60, pp 300-302

The probabilities of autoionization in helium atom for the states $2s^2\ {}^1S$; $2s2p\ {}^{1,3}P$; $2p^2\ {}^1S$; $2p\ {}^{23}P$; $2p^2\ {}^1D$ and in the lithium atom for states $1s2s^2\ {}^2S$; $1s2s2p\ {}^2P$; $1s2p^2\ {}^2S$; $1s2p^2\ {}^2D$. were computed. The approximate wave functions and energy values were obtained for these states.

179. A Plasma Thermoelement

"Theory of a Plasma Thermoelement," by B. Ya. Moyzhes and G. Ye. Pikus, Institute of Semiconductors, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 2, No 4, Apr 60, pp 756-774

Physical processes in a plasma thermoelement are analyzed at local thermodynamic equilibrium, with a neglecting of generation and recombination in volume. It is demonstrated that in the second case, of rather practical interest, the current is determined by diffusion of carriers, and the voltage at load is basically determined by the contact difference of potentials. The volt-ampere characteristics and the emf in limiting cases are computed for the case of absence of energy exchange between the electrodes and for the case of isothermal plasma. Appendixes to the article discuss the relation of the power of the thermoelement to the work function of the cathode, the range of isothermal plasma, and the range of small temperature differences.

180. A Toroidal Discharge

"Investigation of a Toroidal Discharge in a Strong Magnetic Field," by G. G. Dolgov-Savel'yev, V. S. Mukhovatov, V. S. Strelkov, M. N. Shepelev, and N. A. Yavlinskiy; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 2, Feb 60, pp 394-403

The results of investigation of a plasma ring in a toroidal chamber with a strong magnetic field are presented. No macroscopic oscillations were observed in the plasma ring under conditions when the Shafranov-Kruskal stability condition was satisfied. Radiation emitted by the plasma in the visible, as well as ultraviolet, regions of the spectrum was studied. It is shown that in a metallic chamber with a limiting pressure of $1\text{-}2.10^{-6}$ mm Hg most of the radiated energy is caused by impurity ions.

181. Photographic Emulsion to Study Nuclear Processes

"Lead-Silver Salt Emulsion to Study Nuclear Processes," by N. R. Novikova, Radium Institute imeni Khlopin, Academy of Sciences USSR; Moscow, Zhurnal Nauchnoy i Prikladnoy Fotografii i Kinematografii, Vol 5, Issue 2, Mar 60, pp 145-146

Photographic examination of nuclear processes can be considerably improved if the photographic emulsion has added to it lead sulphate in an appreciable quantity. Electron-microscope examination has revealed that a replacement of 30% of AgBr by $PbSO_4$ produced an emulsion with fine grain structure, about 0.08 microns. These emulsions will record charged particles, such as protons up to 70 Mev, alpha particles, and fragments of nuclear fission.

Fission of a heavy nucleus by a proton of 660 Mev energy was very clearly recorded with the $PbSO_4$-fortified emulsion.

182. USSR Water-Cooled, Water-Moderated Research Reactors

"The Technique of Miracle Radiation," by V. Yemel'yanov, Corresponding Member Academy of Sciences USSR and Chief of the Main Administration for the Utilization of Nuclear Energy, Council of Ministers USSR; and Academician A. Aleksandrov; Moscow, Pravda, No 87, 27 Mar 60, p 4

Development of water-moderated, water-cooled reactors represented a significant advance in reactor construction. Reactors of this type are compact, simple to operate, and relatively cheap. In these respects, they are advantageous in comparison with the earliest research reactors, which were graphite-moderated or heavy-water moderated and employed natural uranium as fuel. At present, water-moderated, water-cooled reactors are the principal type of research reactors with a capacity in excess of 100 kw that are used in the USSR and abroad. A paper entitled "System of Water-Water Research Reactors" was presented by the candidates for a Lenin prize S. M. Feynberg, V. V. Goncharov, V. I. Merkin, T. N. Zubarev, G. A. Stolyarov, P. I. Khristenko, V. F. Kozlov, and O. I. Lyubimtsev. Reactors of the types VVR-2, VVR-S, and IRT are discussed in this paper. At the time when the first of these reactors was developed, no data on the design or physics of such reactors had been published in the world literature: the work leading to the development of these reactors was entirely original and was based solely on earlier research on the physics of water-moderated reactors that had been carried out in the USSR. The physics of reactors moderated by ordinary water are quite specific: the methods of calculation which must be used in designing them are

unlike those applied in the case of graphite-moderated reactors or reactors in which heavy water is used as a moderator. The most important problems to be solved were those pertaining to the stability of chain fission processes in water-moderated reactors and those involved in the design of the reactor core. Many physicists doubted that reactors moderated with ordinary water could be operated safely since the total volume of the moderator is in motion and subject to density fluctuations. The fear existed that density fluctuations may lead to a spontaneous, uncontrollable runaway of the reactor, as a result of which a destruction of the core or even a thermal explosion may occur.

Water-cooled, water-moderated reactors are the first type of research reactors put into continuous ("series") production in the USSR. Continuous production of these reactors as a result of the developmental work which preceded it made it possible to install such reactors at some institutes in the USSR and the people's democratic countries. At present the construction of 12 reactors of this type has been completed in the USSR, Rumania, Czechoslovakia, GDR, Poland, and Hungary. One is being erected in Bulgaria. The construction of a reactor in Egypt is being completed. A number of water-cooled, water-moderated reactors are being constructed in different cities of the USSR (Minsk, Sverdlovsk, Tomsk, and other cities). The construction of water-cooled, water-moderated reactors in China, the Democratic People's Republic of Korea, and Iraq is planned. The first reactor of this type in the Soviet Union was started by Francis Perrain.

Numerous scientific and technical investigations have been carried out on water-moderated, water-cooled reactors. Specifically, many important investigations for the nuclear energy industry have been completed. Research reactors are being used for the investigation of the behavior of individual reactor subassemblies that are subjected to the action of neutron and gamma radiation and also in work on the development of effective means of protection against these types of radiation. For instance, by using the reactors of the Institute of Nuclear Energy imeni I. V. Kurchatov, Academy of Sciences USSR, research has been conducted which made it possible to develop the effective small-dimensioned shielding installed on the ice-breaker Lenin.

By using research reactors, investigations are being conducted on the effects produced by radiation on plant seeds and the nature of the action exerted by radiation on semiconductors and liquid organic substances. Experimental work is being conducted on the radiation vulcanization of tire casings, as well as on other problems and techniques involving radiation. Many research institutes participate in this work.

The creation of perfect water-moderated, water-cooled research reactors must be regarded as a major achievement of USSR reactor building.

[SIR Note: According to Pravda, No 113, 22 April 1960, p 1, a 1960 Lenin prize for work in the field of technology was awarded to S. M. Feynberg, Chief of the Theoretical Sector of the Institute of Nuclear Energy imeni I. V. Kurchatov, Academy of Sciences USSR; to V. V. Goncharov, T. N. Zubarev, and G. A. Stolyarov, all scientific associates of this institute; P. I. Khristenko, chief engineer of a sector of the Institute of Theoretical and Experimental Physics, Academy of Sciences USSR; and V. Fedorovich and O. I. Lyubimtsev, members of this scientific research institute, for the design of experimental water-cooled, water-moderated reactors VVR-2, VVR-S, and IRT.]

183. Compact Electrostatic Accelerator

"A Compact 1.5-Mev Electrostatic Accelerator," by L. I. Pivovar, V. M. Tubayev, and M. T. Novikov; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 1, Jan 60, pp 74-81

The construction and the operation of accelerating tubes and of an electrostatic accelerator, operating under gas pressure, is described. The accelerator is located in a container 1400 mm high and 650 mm in diameter. Hydrogen ions were produced at 1.55 Mev, and the potential gradient along the accelerating tube was 2 Mv/m.

184. Testing of Betatrons

"Investigation of Electron Distribution in a Betatron Vacuum Chamber," by S. G. Denisov, D. P. Ivanov, A. P. Komar, and Yu. S. Korobochko, Physicotechnical Institute, Academy of Sciences USSR, Leningrad; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 1, Jan 60, pp 31-36

It was attempted to explain the character of space charge of electrons on the cross section of the chamber. The electron distribution occurring during electron injection into the chamber was studied with a constant field in the gap of the magnet, while the distribution of the captured electrons was studied in the operating range of the betatron in the presence of gamma radiation. All tests were carried out on the betatron of the Leningrad Polytechnic Institute with a maximum gamma radiation of 15 Mev. It was found that the electron bunch circulating in the chamber volume immediately after the injection process takes practically all the width of the chamber and half of its height. The amount of electrons with high amplitudes of radial oscillation should be considered rather great.

185. Testing of Betatrons

"Stabilization of Intensity of Gamma-Radiation of Betatrons and Synchrotrons," by G. F. Mikheyev and N. N. Chernov, Physicotechnical Institute, Academy of Sciences USSR, Leningrad; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 1, Jan 60, pp 37-40

The principles, design, and operation of the synchrotron of the FTI (Physicotechnical Institute) are described. The intensity stabilization is achieved by feedback of the intensity value to one of the synchrotron parameters. This method of stabilization was first indicated by D. W. Fry et al (Proc. of the JEE, I, 305 (1950)).

186. Plasma Behavior

"Nonlinear Phenomena in Plasma Located in a Variable Electromagnetic Field," by V. L. Ginzburg and A. V. Gurevich; Moscow, Uspekhi Fizicheskikh Nauk, Vol 70, No 2, Apr 60, pp 202-246 and No 3, Mar 60, pp 393-428

A long review in two parts is devoted to the theory of nonlinear phenomena in plasma. The dynamic equations of plasma (derived by L. V. Ginzburg in 1944 (J. of Phys., 8, 253 (1944)) or in general the field equations and the kinetic equations for plasma particles are nonlinear, and, therefore, the theory of nonlinear phenomena should be applied to a rather considerable part of plasma physics. The goal of the present work consists in explaining a rather narrow, but clear part of the problems. It concerns the problem of effect of a homogeneous electric field $E = E_0 e^{i\omega t}$ (the frequency ω may be zero, thus the field is constant) on a nonrelativistic and nondegenerate (classic) plasma. The plasma may be located in a homogeneous and constant ("external") magnetic field. Under these specified conditions, the problem of the field effect on the plasma is reduced to a variation of the velocity distribution function of plasma electrons.

The second part of the review deals with the interaction of radio waves with plasma, in particular with the terrestrial atmosphere. The wave propagation in this medium is clearly nonlinear, due to the action of the waves on the plasma in modifying the properties of the medium in which the waves propagate. The electron temperature of the ionosphere is evaluated with allowance for its variation under the action of the electric wave field emitted by radio stations of various powers. The ionospheric self-modulation, cross-modulation, and demodulation of radio waves are analyzed in approximation of geometric optics. Nevertheless, a further development of nonlinear effects during radio-wave propagation in plasma (ionosphere) is impeded by lack of reliable experimental data.

187. Czechoslovak Nuclear Researchers Liquefy Helium

"Helium Liquefied at Rez" (unsigned dispatch); Prague, Obrana Lidu, 14 Apr 60, p 1

According to a brief dispatch, appearing on the front page of the army newspaper, the Institute of Nuclear Research of the Czechoslovak Academy of Sciences, at Rez, has successfully, and for the first time, liquefied helium in specially designed equipment, manufactured in accordance with Soviet documentation.

In liquefying helium, a temperature of 4 degrees Kelvin (minus 269 degrees centigrade) was achieved.

The institute now has a cyclotron, a reactor, and a helium liquefier as part of its operational equipment.

188. Czechoslovak Work With Radioactive Isotopes Described

"In The Realm of Radioisotopes," by Eva Kis; Bratislava, Uj Szo, 23 Apr 60, p 8

This popular science article describes the use of radioactive isotopes in general and then describes a visit to the "Institute Dealing With Research In and Manufacture and Use of Radioisotopes" (Hungarian title: Radioizotopok kutatasaval, gyartasaval es felhasznalasaval foglalkozo intezet; Czech title is not given), which is located in a four-story building in Prague-Holesovice. Engineers Oldrich Stepan and Emil Plander described the work of the institute to the author of the article. The institute started operations 40 years ago as the State Radiology Institute (Czech title not given).

The article says that "there was a revolutionary change in their work when the Soviet Union began regular shipment of radioisotopes" to Czechoslovakia. "In the Czechoslovak nuclear reactor at Rez, they are preparing, for the time being, only an insignificant quantity of radioisotopes; thus our needs are supplied almost exclusively from Soviet imports," the article continues. The imports arrive in lead containers weighing 40, 400, and even 2,000 kilograms. These are stored in an armored underground chamber pending distribution. The radioactive isotopes are re-parceled in remote controlled chambers with remote controlled pipettes. Lead shielding and lead glass protect the workers. Instruments to measure ionizing radiation are placed in each room, and each worker carries a pocket radiation meter. The isotopes are repacked into lead containers and are sent to plants and hospitals. The institute keeps track of the location of all radioactive isotopes.

The article says that the institute also does some production and research work. Czechoslovakia produces more than 50 types of tagged simple and organic compounds. "We are among the foremost in the world in producing tagged elements and we export them to the Soviet Union and to the people's democratic states," the article says.

The article includes two photographs. The caption of the first is: "The so-called gloved chamber perfectly protects from the harmful effects of radioactive materials. Dr Moravek prepares anticancer medicine tagged with radioactive Carbon." The caption of the second is: "Radioactive Iodine is used primarily for treating cancer patients and for studying thyroid function. The Iodine radioisotope is parcelled out by remote controlled pipettes into special containers prepared for this purpose."

189. New Hungarian Isotope Laboratory

"Opening of Modern Isotope Laboratory at Veszprem" (unsigned article); Esti Hirlap, Budapest, 30 Apr 60, p 6

One of the most modern isotope laboratories in Hungary was opened on 30 April 1960 at the Veszprem Chemical Industry University (Veszpremi Vegyipari Egyetem), where teachers and researchers are occupied with various analytical and testing procedures. The well-equipped laboratory is provided with the most complete protective devices for safeguarding the health of its employees. Researchers who work in "hot" areas are protected by lead bricks from radiation.

Optics and Spectroscopy

190. Stokes Lines in Raman Spectra in Liquids

"Temperature Dependence of the Intensity of Stokes and Anti-Stokes Lines in the Combination Scattering of Light in Liquids," by A. I., Sokolovskaya and P. A. Bazhulin; Moscow, Optika i Spektroskopiya, Vol 8, No 3, Mar 60, pp 394-397

The temperature dependence of intensities of Stokes and anti-Stokes components and the magnitudes of their ratios in spectra of combination scattering of several liquids, $GeCH_3Br_3$, CCl_4, and C_6H_6, were studied. Temperature measurements of the intensity of lines 992 cm^{-1} in vapor-form benzene were carried out. The obtained results confirmed the suggestion on the role of intermolecular interactions in the observed anomalous temperature dependence of line intensities of combination scattering in liquids.

191. Energy Spectrum of F-Center

"The Energy Spectrum of the F-Center in Continual Theory, by Yu. Ye. Perlin; Moscow, Optika i Spektroskopiya, Vol 8, No 3, Mar 60, pp 386-393

A comparison of two classes of variational functions is carried out in the framework of the continual theory of the F-center. It is shown that a function of the first class (hydrogen-like model) provides a better result for the computation of energy of the basic state. For all excited electron states, functions of the second class (polaron model) lead to a lower energy value. Therefore, it has been established that in the theory of excited states of F-centers (and other impurity centers of ion crystals), it is necessary to make allowance for the collective phonon motion produced by excess electrons (polaron effect).

192. Determination of Oscillator Strengths

"Determination of the Absolute Values of the Oscillator Strengths From the Spectral Line Widths," by I. M. Nagibina, V. K. Prokof'yev, and G. F. Petrova; Moscow, Optika i Spektroskopiya, Vol 8, No 3, Mar 60, pp 376-381

A method for determining the absolute values of oscillator strengths by measuring the spectral line width is described. The correlation of Mg and Ca atom and ion concentration in the cloud of an arc discharge and on the electrodes are measured experimentally. The suggested method is applied to the measurement of the absolute value of the oscillator strength of the resonance line of lead (2863.33 Å), equal to 0.08.

193. Photoelectric Recording in White Light

"Photoelectric Method of Recording Interference Bands in White Light," by T. S. Kolomiytseva and I. V. Novikova; Moscow, Optika i Spektroskopiya, Vol 8, No 3, Mar 60, pp 363-370

Photoelectric methods of detecting and recording the central white band in a system of interference bands in white light are discussed. Computational results of the magnitude of photocurrents obtained during such recording are presented, as well as experimental equipment and tests based on the developed method. The principle of the possibility of automation of measurements on interferometers operating in white light is shown.

194. Illumination Effect on Molecular Absorption

"Effect of Strong Illuminations on the Absorption Capacity of Complicated Molecules," by A. P. Ivanov; Moscow, Optika i Spektroskopiya, Vol 8, No 3, Mar 60, pp 352-358

Formulas giving the absorption capacity of systems with two or three energy levels were derived. Conditions under which a negative absorption occurs were analyzed. The possibility of "translucency" of matter was shown.

195. Temperature Dependence of Spectral Bands

"Temperature Dependence of Broad Absorption Bands in the Spectra of Crystals of Various Structures Colored by Isomorphous Impurities," by V. Grum-Grzhimaylo and G. V. Klimusheva; Moscow, Optika i Spektroskopiya, Vol 8, No 3, Mar 60, pp 342-351

Absorption spectra of crystals of various structures colored by isomorphous ion impurities of variable valency were studied at a temperature range from 103 to 823° K. Comparison of experimental and computational data showed satisfactory agreement of theory and experiment.

196. Temperature Effect on Spectra

"Temperature Effect on the Electronic Spectra of Complicated Molecules," by L. G. Pikulik and M. A. Solomakho; Moscow, Optika i Spektroskopiya, Vol 8, No 3, Mar 60, pp 338-342

Absorption and fluorescence spectra of a series of phthalimides and of some dyestuffs were studied at + 20° C and at the temperature of liquid nitrogen. It was shown that upon lowering of temperature, a shift of absorption and fluorescence band maxima occurs to the frequency of purely electronic transition. The explanation of this phenomenon is given.

197. Perylene Spectra

"Emission and Absorption Spectra of Perylene in Solid Solutions at 77° K," by E. V. Shpolskiy and R. I. Personov; Moscow, Optika i Spektroskopiya, Vol 8, No 3, Mar 60, pp 328-338

Absorption and fluorescence spectra of perylene solutions in ethyl alcohol and standard paraffins (from hexane to nonane) at room temperature and at 77° K were studied. It is shown that spectra consisting, in alcohol solutions, of a series of diffusion bands reveal, in refrigerated paraffin solutions, a splitting on a series of narrow lines. Vibration analysis was carried out, and the frequencies of standard oscillations of the perylene molecule in ground and excited electron states were determined. The presence of mirror symmetry of absorption and fluorescence spectra was established. The results of experiments were discussed with allowance for particular optical properties of the perylene molecule..

198. Radiation Absorption by H Molecules

"Coefficient of the Continuous Absorption of Radiation by the Quasimolecules of Hydrogen," by S. P. Yerkovich; Moscow, Optika i Spektroskopiya, Vol 8, No 3, Mar 60, pp 307-312

The relation of the radiation absorption coefficient of hydrogen quasimolecules to temperature and atom concentration was obtained. It was shown that in a wide range of temperatures and pressures quasimolecular absorption plays an important role. Tables were computed facilitating the obtaining of K_λ for concrete conditions.

199. Anomalous Light Waves

"The Experimental Demonstration of the Existence of Anomalous Additional Light Waves in Crystals in the Exciton Absorption Region," by M. S. Brodin and S. I. Pekar, Institute of Physics, Academy of Sciences Ukrainian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 74-81

The paper considers a possible experimental procedure for demonstrating the existence in a crystal of additional waves, theoretically predicted for the exciton absorption region. Experimental data on light absorption in an anthracene crystal at 20°K reveal deviation from the Lambert-Burger law. A theoretical treatment is given of the observed nonexponential dependence of light absorption in a crystal plate on

its thickness. Also demonstrated is the existence in an anthracene crystal of two similarly polarized waves with different refractive indexes and absorption coefficients.

200. Light Dispersion

"Light Dispersion in a Medium Adjacent to a Reflecting Surface," by S. D. Gutshabash; Leningrad, Vestnik Leningradskovo Universiteta, Seriya Matematiki, Mekhaniki i Astronomii, No 1, 1960, pp 152-159

The problem of light transfer in a plane-parallel stratum limited by a reflecting surface is analyzed. The solution of the derived integral equation may be expressed by the solution of the integral equation without the reflecting surface. The probability method suggested by V. V. Sobolev (DAN, 120, No 1 (1958)) is applied to the computation. Two examples are presented: (1) the medium is illuminated by parellel rays; and (2) the sources of illumination are uniformly distributed in the medium.

Such problems are encountered in astrophysics and geophysics, for example, in studying scattering of light in a planetary atmosphere limited by the planet surface, and in physics in the study of radiation diffusion in a gas or liquid enclosed in a vessel.

201. Conference on Spectroscopy To Be Held in Leningrad

"Announcement" (unsigned), Optika i Spektroskopiya, Vol 8, No 3, Mar 60, p 432

In the first part of July 1960, the XIII All-Union Conference on Spectroscopy will be held in Leningrad.

On the agenda of the conference are reports on the following physical problems of atomic and molecular spectroscopy:

1. Theoretical and experimental determination of atomic constants.

2. Plasma spectroscopy.

3. Spectroscopy of electron states of molecules.

4. Spectroscopy of oscillatory states of molecules.

5. Crystal spectroscopy.

6. Spectroscopy of gases and condensed systems.

7. Study of intermolecular interaction by spectral methods.

8. Radiospectroscopy, including electron paramagnetic and nuclear magnetic resonance.

Declarations on reports and abstracts of reports should be sent to the Commission on Spectroscopy under the Department of Physico-mathematical Sciences of the Academy of Sciences USSR before 5 April. The address is: Moscow, K-12, proyezd Sapunova, d. 13-15, tel K 0-14-40, ext 31.

202. Energy Transfer in Luminescing Solutions

"The Energy Transfer in Luminescing Solutions. I. Solutions With Dissolved Luminescing Substance," by H. K. Bothe, Institute of Applied Radioactivity, Leipzig; Leipzig, Annalen der Physik, Vol 5, No 5/6, 1960, pp 339-352

The three mechanisms suggested in recent years for the energy transfer in luminescing solutions differ by their dependence on the aggregate state of the solutions. On the basis of the functions derived by Kallmann and Furst (Physical Review, 94, 1954, p 503) and Birks (Physical Review, 94, 1954, p 1567) for the dependence of luminescence intensity on concentration, the energy transfer in liquid solutions was compared with that in solid polystyrene solutions. For this purpose, it was necessary to generalize function (1) to make it valid for solutions whose solvent luminescence cannot be neglected (function 3). Within a wide range of concentrations, the concentration dependence determined experimentally for polystyrene solutions corresponds exactly to function (3), and, in agreement with measurements of Swank and Buck (Physical Review, 91, 1953, p 123) and Krenz (Transactions of the Faraday Society, 51, 1955, p 172), it was found that the luminescence emitted by pure polystyrene accounts for about 20 percent of the yield of energy transmission to the dissolved molecules. The types of radiation, beta or X-rays, has no appreciable effect on the energy transport in polystyrene solutions. The dependence of luminescence intensity of polystyrene solutions on concentration differs from that of the liquid solutions primarily through the fact that its parameter Q in functions (1) and (3) is greater by one order. This is best explained in the case of an energy transfer through quantum-mechanical

resonance. The available experimental results are still not sufficient to be considered unequivocal proof that the excitation energy in luminescing solutions results from quantum-mechanical resonance. For this reason, the investigations of polystyrene solutions have been enlarged to include two dissolved luminescing substances, and the results of this research will be published at a later date.

203. Theory of Concentration Depolarization of Fluorescent Solutions

"Remarks on the Theory of the Concentration Depolarization of Fluorescent Solutions," by C. Bojarski, 1st Physics Institute, Gdansk (Poland) Technological Institute; Leipzig, Annalen der Physik, Vol 5, No 5/6, 1960, pp 249-251

A simple method is given for computing the constant $\frac{\tau_0}{\chi_2}$ found in the theory of Vavilov on the influence of concentration on the fluorescence of solutions. It is further shown that the value of this constant is equal to a spherical volume with the radius R_0, where R_0 represents the critical spacing of neighboring fluorescing molecules within the theory of Foerster (Annalen der Physik, 2, 55, 1948) regarding the concentration depolarization of luminescence.

Solid State Physics

204. Testing of Germanium

"Thermal Conductivity of p- and n-Germanium With Various Concentrations of Current Carriers in the 80-440° K Region," by Ye. D. Devyatkova and I. A. Smirnov, Institute of Semiconductors, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 2, No 4, Apr 60, pp 561-565

The work is a continuation of previous experiments by the authors (ZhTF, 27, 9, 1944 (1957)). The temperature range was extended to 80-440°K, and a new method of measurements was devised. The thermal conductivity of two pairs of samples of Ge of n-type and four of p-type was measured. The results confirmed the previously found differences in thermal conductivity between the two types of Ge, but a satisfactory explanation of the phenomenon could not be found. It is assumed that the thermal resistance in the sample of n-type is due to presence of electrically neutral dissolved gases O_2, H_2 and N_2.

205. Cross Section of Hole Capture in Ge

"Capture Cross Section of Holes in Germanium by Defects Formed by Gamma Irradiation," by R. F. Konopleva, S. M. Ryvkin, and I. D. Yaroshetskiy, Leningrad Physicotechnical Institute, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 2, No 4, Apr 60, pp 566-568

Some divergence of opinions has emerged on the magnitude of cross sections of hole capture by radioactive centers of n-type Ge. Analysis of this problem showed that the cause of divergence lies in the former assumption that to one defect formed by gamma irradiation there correspond two acceptor levels in the forbidden zone. However, it has recently been found (N. A. Vitovskiy, T. B. Mashovets, and S. M. Ryvkin, FTT, 1, 1381 (1959)) that four acceptor levels correspond to one defect. Experimental results for the life period of holes depending on gamma quanta irradiation and a computation of cross sections of hole capture are presented.

206. Surface Discharge in Ge

"Anisotropy of Surface Discharge in Germanium in the Strong Field Region," by A. I. Morozov, Institute of Radio Engineering and Electronics, Academy of Sciences, Moscow; Leningrad, Fizika Tverdogo Tela, Vol 2, No 4, Apr 60, pp 620-623

Phenomena observed on a Ge surface under strong current pulses, transmitted through a point contact Ge-metallic wire, are described. The phenomena prove the anisotropy of surface discharge in the case of strong fields and high current density. It is possible to relate the observed anisotropy of discharge to anisotropy of hot electrons.

207. Yield of Photocells

"Quantum Yield of CdTe-Photocells With p-n Junction in the Ultraviolet Region of the Spectrum," by G. B. Dubrovskiy, Institute of Semiconductors, Academy of Sciences USSR; Leningrad, Fizika Tverdogo Tela, Vol 2, No 4, Apr 60, pp 569-570

Detailed measurements of spectral sensitivity of a large number of CdTe photocells have been carried out to establish the electron multiplication under action of ultraviolet light. The product of quantum yield Q by the accumulation coefficient α was plotted in graphs and showed that $Q.\alpha$ drops, with photon energy rising from 2.5 to 3.5 ev, and increases thereafter from 3.5 to 5 ev, which is to be ascribed to electron multiplication.

208. Photoconductivity of HgS

"Some Features of the Photoconductivity of Mercuric Sulphide," by N. I. Butsko, Lvov Pedagogical Institute; Leningrad, Fizika Tverdogo Tela, Vol 2, No 4, Apr 60, pp 629-633

Mercuric sulphide exists in two kinds: the black metacinnabar (βHgS) and the red kind, vermilion (αHgS). The known experimental research on HgS was carried out on natural crystals imbedded with impurities. The properties of "pure," artifically grown HgS crystals have been investigated. The generalized experimental results indicate that the compounds αHgS are related to photoresistors of the hyperbolic type, such as Se, InSe, Tl_2S, Bi_2S_3, and CdS, at low temperatures. The photoconducting cinnabar crystals are sensitive to X-rays.

209. Destruction of Superconductivity

"Destruction of Superconductivity by Current," by Ye. Troynar, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 2, Feb 60, pp 654-655

It was attempted to explain the phenomenon observed by L. W. Shubnikov and N. Ye. Alekseyevskiy (Nature, 138, 804 (1936)) of the destruction of superconductivity in a cylindrical sample by electric current due to the sudden appearance of resistance. Theoretical studies of the phenomenon by F. London (Superfluids, N. Y., 1950) and Landau (D. Shenberg, Sverkhprovodimost (Superconductivity), 1955) showed discrepancies between theoretical and experimental data. The appearance of resistance could be connected to surface tension due to phase differences between the normal and superconductivities. This explanation is valid only in the absence of overheating of the sample.

X. CYBERNETICS

210. Hungarian Research in Cybernetics Described

"Hungarian-Cybernetics Research," by Rezso Tarjan, Doctor of Technical Sciences; Budapest; Magyar Tudomany, Mar 60, pp 135-151

This article is a general review of cybernetics research in Hungary. Such research began in the early 1950s, the author writes, when it was "made very difficult by lack of understanding and by the well-known dogmatic attitude," but development really began after the article by Sobolev, Kitov, and Lyapunov in the 3 April 1955 issue of Voprosy Filosofii. In May 1956, Kalman Lissak, Istvan Bartha, Rezso Tarjan, and Bela Fogarasi debated the status of cybernetics and decided to organize research cooperation in this area. On 1 September 1956, the Presidium of the Hungarian Academy of Sciences organized the Cybernetics Research Group (Kibernetikai Kutato Csoport) of the academy. This group began functioning in April 1957. Three centers of research developed in Hungary: in Budapest, Szeged, and Pecs. The Budapest researchers concentrated on technical aspects of electronic computers, mathematical problems of cybernetics, and economics applications. The Szeged researchers concentrated on logic, and the Pecs researchers dealt with physiological problems.

Toward the end of 1959, the Cybernetics Research Group completed construction of an M-3 electronic, digital computer, built on Soviet plans and with Soviet aid. Laszlo Kalmar, chief of the department of mathematical logic and theory of mathematical machines of the Mathematics Research Institute (Matematikai Kutato Intezet) of the academy, working in Szeged, is dealing with the problems of automatic programming of the M-3. Kalmar's work has been published in the Moscow journal Problemy Kibernetiki, the article says.

Another digital computer, made of relays, was designed and built at the Budapest Technical University by Laszlo Kozma, Doctor of Technical Sciences. It is used for teaching purposes. Mathematics faculty chief Istvan Fenyo, also of the Budapest Technical University, built an analogue electronic computer which solves complex roots of sixth degree algebraic equations.

A special department in the Cybernetics Research Group headed by Istvan Aczel, is dealing with applications of the M-3 to problems of economics and of plant operations. He is being aided by Bela Kreko of the Karl Marx Economics University. In this context, the article also mentions the graph theory theorems of Denes Konig which were applied by Jeno Egervary to matrices in linear equation systems. Apparently this work, which dates from 1931, is being continued by Egervary, but the author does not say where this work is being done. The Applications Department of the Cybernetics Research Group is cooperating with the National Planning Office and the Price Office in the solution of economics input-output problems. The article briefly mentions works in this and related areas by Alfred Renyi, Andras Brody, Gyorgy Kondor, Bela Kreko, and Zoltan Bacskai.

Laszlo Kalmar is now conducting a regular programming seminar in the Szeged Science University; Ferenc Sandor, a scientific worker in the Cybernetics Research Group, has given guest lectures on cybernetics at the Lorand Eotvos Science University in Budapest; and technical questions of electronic computers will be included in courses in communications technology at the Budapest Technical University, beginning with school year 1959-1960.

Turning to the information theory itself, the article notes the 1956 work of Alfred Renyi and Janos Balatoni titled "The Concept of Entropy," which was published as a communication of the Mathematics Research Institute. The author credits it with introducing a new concept, "probability calculation entropy." Alfred Renyi is also the author of "On the Dimension and Entropy of Probability Distributions," Acta Mathematica, Vol X, 1-2, 1959. Pal Erdos is now planning to publish the work which he reported on at the Second International Information Theory Conference in Prague. The article also notes that Imre Fenyes, Doctor of Physcial Sciences, is working on physical aspects of information theory and will soon publish a paper on thermodynamics problems (the Gibbs paradox).

The article then turns to mathematical logic. The first to work on the problem of instrumenting logical problems in Hungary was Tihamer Nemes, Doctor of Technical Sciences, who prepared a logic machine in 1953 and who has since lectured on the subject in the Engineers' Further Training Institute (Mernoktovabbkepzo Intezet). The "most significant domestic experimental achievement in the area of instrumenting logical problems," the article says, is the logic machine designed by Laszlo Kalmar and built with the aid of Daniel Muszka. Built on the principle of the Ferranti-type logic machine, it contains "essential and patentable novelties." This machine was exhibited at the 1958 International Mathematics Congress in Edinburgh.

The article also mentions unpublished work of Rozsa Peter on relay switching systems and of Balint Domolki, a "young mathematician of the Cybernetics Research Group," on the event concept. The author, Rezso Tarjan, then discusses his own work on neural models which use inductive methods and which are sensitive to similarities. A network of such models would be capable of irradiation of stimulation, memory, association, and the development of conditioned reflexes. Tarjan has delivered papers on his work in 1957 in the Cybernetics Seminar of the State University in Moscow and in 1958 at the International Mathematics Congress in Edinburgh.

The article then turns to a discussion of Hungarian work on central nervous system function, work being done by the group in Pecs. Janos Szentagothai is continuing work he began in 1944 on labyrinth connections with eye muscles; the article asserts that the mathematical model of this stability control system is applicable to work with radioactive preparations. Szentagothai is also working with Alfred Renyi on developing a mathematical model of neuron functioning. A 1956 paper titled "Probability of Excitation Transference in an Interneuron Synapse Model Using Simple Convergent Connections" is cited. Szentagothai is also collaborating with Gyorgy Szekely on neuro-physiological experiments which seem to prove that receptors do not discriminate on the basis of topological principles, but rather that they transmit specific coded impulses to the brain. Gyozo [sic; Gyozo Szekely and Gyorgy Szekely are apparently the same man] Szekely has also published separately on his work in experimental embryology. Kalmar Lissak has also analyzed the significance of cybernetic methods for neuro-physiology. Working with Bela Flerke, Bela Mess, and Istvan Halasz, Lissak has recently examined neuro-endocrine regulatory mechanisms. Daniel Muszka, a member of the Mathematics Research Institute working in Szeged, built a mechanical lady beetle which has been reported on in the popular press.

The Cybernetics Research Group of the Hungarian Academy of Sciences has cooperation contracts with four research institutes of the Academy of Sciences USSR and with one industrial research institute. The Mathematics Research Institute of the Hungarian Academy of Sciences has a cooperation contract with the Institute of Automatics and Telemechanics of the Academy of Sciences USSR.

In conclusion, the author deplores the fact that there has not yet been any fruitful cooperation in Hungary between technical, mathematical, and physiological cybernetics experts, on the one hand, and researchers in the social sciences and philosophy, on the other.

211. Soviet "Cybernetic Teacher" for Foreign Languages

"Cybernetic Teacher" (unsigned news item); Budapest; Nepszabadsag, 23 Feb 60, p 6

The following information was published in the "press excerpts" section of the Hungarian party daily and was attributed to the Szovjet Tajekoztato Iroda, the Soviet Information Office.

Vladimir Taranov, chief of a laboratory in the Gorkiy Pedagogical Institute of Foreign Languages (idegen nyelvek gorkiji pedagogiai foiskolaja), has prepared a "cybernetic teacher" built on the principle of a program-control electronic computer. The machine saves the labor involved in presenting the same materials to various study groups. In addition, an "electronic-acoustical" machine surveys the answers of the students and compares them with the tasks assigned. It discovers the errors in the answers; thus the teacher has a continuous survey of where the students are in their studies. The apparatus repeats until the student has mastered the material. The designer hopes to improve the machine so that students can learn correct pronunciation with it as well.

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USCOMM-DC-62,546