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SCIENTIFIC INFORMATION
REPORT

1 OF 2

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CENTRAL INTELLIGENCE AGENCY

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SCIENTIFIC
INFORMATION REPORT



22 April 1960

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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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I. BIOLOGY

Biophysics

1. Oxidation Processes of Biologically Active Substances in Ultrasonic Waves

"Processes of Oxidation of Biologically Active Substances in an Ultrasonic Field," by I. Ye. El'piner and A. V. Sokol'skaya, Institute of Biological Physics, Academy of Sciences USSR; Moscow, Biofizika, Vol 5, No 1, Jan/Feb 60, pp 21-27

The authors studied chemical transformations of biologically active substances in the presence of various gases to determine whether ultrasonic oxidation processes occur through the action of activated oxygen or OH-radicals or both. Data obtained by the authors indicate that under the effect of ultrasound, not only does the ionization of water molecules occur, but also the ionization or activation of gases present in the cavitation area takes place. This explains the fact that ammonia is formed in the presence of N_2 and H_2 , but hydrocyanic acid and formaldehyde are formed in the presence of N_2 , CO , and H_2 . This research is significant not only because of the possibility of artificially regulating the course of chemical processes and exerting an effect on the outcome, but also because it opens new prospects for determining the effects of oxidation and other physical factors which exert a so-called indirect effect.

The data obtained and various spectrophotometric curves show the relationship between the density of various ultrasound-treated solutions and the type of gases present.

The authors present the following conclusions:

1. The rate of the oxidation reactions of amino acids, glucose, purine and pyrimidine bases, and of proteins which occur under the effect of ultrasonic waves depends on the type of the active or inert gases present.

2. Oxidation processes of biologically active substances take place in ultrasonic wave fields not only in the presence of oxygen, but also in its absence if it is replaced by argon (depending on the structure of the substance being studied). Helium is inert in this case.

3. By studying the oxidation effects of ultrasonic waves in the presence of the above-mentioned gases, it is possible to establish the significant role of oxygen or of OH-radicals in this process.

4. It is suggested that the inert gases (helium and argon) which are activated in the cavitation areas exert a different effect on the chemical activity of the OH-radicals present here -- products of water ionization.

Radiobiology

2. Effect of Ultraviolet and X-Irradiations on Nerve Fibers Compared

"The Effect of Ultraviolet Irradiation on Single Nerve Fibers,"
by R. G. Lyudkovskaya and L. P. Kayushin, Institute of Biological Physics, Academy of Sciences USSR; Moscow, Biofizika,
Vol 5, No 1, Jan/Feb 60, pp 40-45

In this research the effect of ultraviolet (UV) irradiation of various wave lengths (240-400 millimicrons) on the action potential of frog myelinated fibers and squid unmyelinated giant axons was studied and compared. The greatest effect on the electrophysiological characteristic of the fiber is in the spectral area of the 280 millimicron wave length, and this radiation is absorbed by the proteins.

The initial photochromatic reaction occurs in the proteins of the nerve fiber protoplasm. It is postulated that the products of protein photochromatic decomposition exert an effect on the permeability of the fibers which leads to a change in the value of the action potential amplitude.

Results of these experiments indicated that the combined effect of visible and UV radiation differs from the effect exerted by each factor separately.

The short waves (280 millimicrons) of UV radiation exert the greatest effect on the excitable fibers. The effectiveness of the UV light effect is diminished by using low frequency from a testing stimulation, or by permitting light flashes to fall on the nerve fiber during the intervals between excitations. Results of this research agree with those reported by Ungar (G. Ungar, et al; J. Gen. Physiol., 1957, No 40, p 465), in which it was shown that decomposition of nerve protein substances occurs following stimulation.

There is a parallelism in the change occurring in the currents of action of the nerve after nerve fiber irradiation by roentgen rays and by UV light.

3. Periodic Changes in Radiosensitivity of Ascaris During Embryogenesis

"Radiosensitivity and Embryogenesis in the Eggs of Ascaris Suum," by I. D. Vinogradova, Institute of Biological Physics, Academy of Sciences USSR; Moscow, Biofizika, Vol 5, No 1, Jan/Feb 60, pp 55-59

This research is a study of the changes in the radiosensitivity of the developing eggs of Ascaris suum from the stage of a single blastomere up to the full-grown embryo.

Results of various studies (with different radiation doses at different stages in the development of the embryo) show that the developing eggs of Ascaris suum undergo periodic changes in radiosensitivity which evidently are connected during the early stages (I, II, & III cell division) with the processes of mitoses in the irradiated cells, but at later stages they are connected with the damage of embryonic tissues and organs which are vitally important for the development of the organism as a whole.

4. Fractional X-Irradiation Effects on Plant Capacity for Growth Restoration

"The Effect of Fractional X-Irradiation on Plant Capacity for Growth Restoration," by I. M. Vasil'yev and B. G. Zhukov, Institute of Biological Physics, Academy of Sciences USSR; Moscow Biofizika, Vol 5, No 1, Jan/Feb 60, pp 46-48

Tests were run on winter wheat No 599 irradiated by 5 kr in single or fractional doses.

Plant growth 4 weeks after the irradiation indicates that the plants subjected to the most fractionated doses of irradiation (500 r in the morning and 500 r in the evening of the first 5 days of germination) were the most radioresistant, and the plants subjected to a single dose of 5 kr on the first day of germination were the least radioresistant. This phenomenon is explained as follows: plants which have been irradiated by small doses without being smothered become hardened to subsequent irradiation, and in this respect become more resistant; however, all ionizing radiation, even in "hardening" doses, exerts irreversible changes which are especially marked in the inherited traits.

II. CHEMISTRY

Electrochemistry

5. Electrolytic Deposition of Some Chromium Alloys

"On Conditions of the Electrolytic Deposition of Alloys of Chromium With Other Elements," by D. N. Usachev and A. T. Vagramyan, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 1, Jan 60, pp 231-233

Methods have been developed for the electrolytic deposition of Cr-Mn, Cr-Se, and Cr-Re alloys from solution in which these elements are present in the form of chromate, permanganate, selenate (or selenite), and perrhenate. The procedures in question are based on the formation at the cathode of a film consisting of chromate anions and partly reduced chromate anions together with permanganate, selenate (selenite), and perrhenate anions and/or products of their reduction. The metals and selenium reduced to the elemental state and deposited at the cathode are derived from these films rather than from ions present in the solution.

Fuels and Propellants

6. Free Radicals Formed as Result of Irradiation of Hydrogen Peroxide

"Electronic Paramagnetic Resonance Spectrum of Free Radicals Formed as a Result of the Irradiation of H_2O_2 With Ultraviolet Light," by S. D. Kaytmazov and A. M. Prokhorov, Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 1, Jan 60, pp 227-228

In previous work done by the authors (Zhurnal Fizicheskoy Khimii, Vol 31, 1957, p 515; cf R. Livingston, J. Ghormley, and H. Zeldes, Chemical Physics, Vol 24, 1956, p 483) the electronic paramagnetic spectra were determined of radicals obtained by freezing out products formed as a result of the action of an electric discharge on H_2O and H_2O_2 vapors. Subsequent investigation by the authors did not lead to a certain identification of these radicals, because the energy supplied was sufficient to rupture any bond in the molecules and because extensive possibilities existed for secondary reactions, particularly surface reactions. To establish what radicals are formed from H_2O_2 subjected to

an electric discharge, the electronic paramagnetic resonance of radicals resulting from the irradiation of hydrogen peroxide with ultraviolet light was investigated in the work described in this instance. The energy of the ultraviolet radiation was insufficient to break O-H bonds, so that only .OH radicals could have formed. Comparison of the resonance spectra indicated that .OH radicals also formed as a result of the action of an electric discharge on H_2O_2 . In a sample of H_2O_2 irradiated for 10 hr, a concentration of .OH radicals amounting to 5%² was obtained. Because this concentration was many times greater than that obtained by the irradiation of a sample for 2 hr, it is assumed that still greater concentrations of radicals will result under the conditions described when irradiation is carried out for periods longer than 10 hr.

7. Optimum Distribution of Droplets During Combustion of Partially Evaporated Fuels

"Optimum Distribution of Droplets During the Combustion of Partially Evaporated Fuel," by V. Ya. Basevich, Institute of Chemical Physics, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk, No 12, Dec 59, pp 2112-2115

The effect of the distribution of fuel droplets according to size on the velocity of combustion was investigated from a theoretical standpoint by R. P. Probert (cf Philosophical Magazine, Vol 37, 1946, p 94). He established that not only the degree of dispersion of the fuel (i.e., the size of droplets) but also the type of distribution of dispersed fuel with respect to droplet size has an effect on the completeness of combustion. However, Probert did not consider the effect on the velocity of combustion of partial evaporation of the fuel stream before this stream has reached the flame. This was done in the work reported in this instance. It was confirmed in the work carried out by the author that the distribution of droplets with respect to size has an effect on the completeness of combustion of a partially evaporated fuel. It was also established that high values of the distribution constant ($M \geq 4$) increase both the rate of combustion and the degree of completeness of combustion of partially evaporated fuel.

8. Method for Experimental Determination of Over-All Rates of Gas Combustion

"A Method For the Experimental Investigation of the Over-All Kinetics of Gas Combustion," by Z. S. Leont'yeva, Power Institute imeni G. M. Krzhizhanovskiy, Academy of Sciences USSR; Minsk, Inzhenerno-Fizicheskiy Zhurnal, No 2, Feb 60, pp 12-16

An attempt to investigate the over-all velocities of the combustion of hydrocarbons at temperatures up to 2000° K has been made by J. Longwell and M. Weiss (Industrial and Engineering Chemistry, Vol 47, No 8, Aug 55, pp 1634-1643). However, in the method devised by Longwell the control of the homogeneity of mixing and of the length of the zone of mixing was inadequate. The kinetic characteristics of the processes involved could be determined only in a relative manner (for purposes of orientation) by the method in question. To investigate the over-all kinetic relationships which apply to the combustion of gases at temperatures exceeding 1000° C, L. N. Khitrin at the Power Institute of the Academy of Sciences USSR proposed the following modification of Longwell's method. In this modification, the mixture is still introduced in thin streams at a high (sonic) velocity. However, as distinguished from the conditions existing in the ordinary mixing reactor, the gas consisting of combustion products and heated to a definite, very high temperature is obtained from a special auxiliary burner of the tunnel type and then introduced into the cylindrical reactor. The mixture being investigated is introduced perpendicularly to the stream of combustion products, forming a sort of network consisting of thin streams. The mixture has the necessary composition and its quantity is such that no significant rise of the temperature takes place because of the reaction of the mixture. Under the circumstances, the active concentrations of the reacting substances are small in the reaction zone. By using this arrangement, a sufficiently homogeneous temperature field, uniform concentrations, and almost isothermal conditions of conversion are achieved.

The method was checked experimentally on the example of the combustion of carbon monoxide in the temperature range of 1000-1250° C. It was established that the data obtained by this method are in agreement with data obtained by other methods, whence it follows that the effect of micromixing in the operating zone, which was disregarded in the calculations, must be negligible. It follows from this that the results of the experimental determinations correspond to the chemical kinetics of the reaction.

9. Action of Additives Which Inhibit Depolymerization of Substances That Increase Viscosity of Lubricating Oils

"Depolymerization Stability of Viscosity-Increasing Additives to Thickened Oils," by N. I. Kaverina, Ye. G. Semenidov, and N. V. Shchegolev; Moscow, Khimiya i Tekhnologiya Topliv i Masel, Vol 5, No 1, Jan 60, pp 43-47.

The characteristics were investigated of the action exerted by multifunctional additives and some chemical substances, including elemental metals, as far as inhibition of the depolymerization of thickening ingredients contained in oils subjected to the effect of high temperatures is concerned. Polyisobutylenes, vinipols, and polymethacrylates were added as thickening ingredients to the lubricating oils tested. Sulfonates, alkylphenolates, and thiophosphonated alkylphenols, alcohols, and amines were used as inhibitors of depolymerization. It was established that polyisobutylene is more stable than vinipol to thermal depolymerization. Experiments with oils containing polymethacrylate showed that many of the depolymerization inhibitors increase sharply the viscosity of the oil, bringing about formation of gels. On the basis of this result, it is recommended that the compatibility of depolymerization inhibitors added to oils thickened with polymethacrylate be established.

10. Use of Jet Engines to Remove Excavated Rock From Open-Pit Mines

"Ground Duty of a Reaction Motor," by N. Z. Podd'yakov, Chief Specialist of the Ferrous Metallurgy Division, State Planning Commission of the USSR; Moscow, Izobretatel' i Ratsionalisator, No 2, Feb 60, pp 2-3

A modern rotary excavator ejects up to 3,000 cubic meters of ground rock per hour. Transportation of this rock by truck or by a continuous conveyer belt from open-pit mines being excavated is too expensive and cumbersome. Furthermore, the capacity of excavators will increase in the future, so that more rock will have to be transported. According to author's certificate No 108502 issued to A. P. Degtyarev and S. M. Vinogradov, the excavated rock can be removed by means of jet engines. The procedure proposed by the inventors is much more efficient than the methods used hitherto. The powerful stream of combustion products and air ejected from the jet nozzle is capable of projecting even rather heavy pieces of rock to distances reaching hundreds of meters from the site of the excavation.

The stream of exhaust gases from the jet is led into a steel tube 7-8 meters long with a diameter of about 0.5 meter. The excavated rock is fed from a bunker into the same tube. The exhaust gases lift pieces of rock the dimensions of which may be as great as 200 millimeters and eject them over a distance of 200 meters. To protect the walls of the tube from damage caused by the impact of rock particles, the tube is equipped with annular baffles. These baffles produce turbulence in the gas stream, with the result that fine dust is deposited on the walls of the tube, forming a layer that is 10-15 millimeters thick. This layer protects the tube from damage. The capacity of an installation of this type reaches 4,000 cubic meters of rock per hour. The installation is relatively light, weighing only 20 tons, and costs no more than 250,000-300,000 rubles. The cost of transporting rock is reduced by a factor of 2-3 when an installation of this type is used.

It will not be necessary to manufacture new jet engines for this purpose, because aviation jet engines are discarded after they have been used for several hundred hours on planes. Although no longer suitable for use on planes, these engines are still good enough and safe enough for the application described. If jet engines are used to remove rock in connection with the excavation of open-pit mines, problems will arise because of the necessity of dissipating the combustion gases ejected by the jet engines and by reason of the deafening noise produced by these engines. There will, of course, be still other problems if the procedure in question is applied. However, these problems can be solved.

11. USSR Work on Low-Temperature Turboexpanders for Oxygen Production

"Low-Temperature Turboexpanders," by V. I. Epifanova, All-Union Scientific Research Institute of Oxygen Machine Building; Moscow, Kholodil'naya Tekhnika, Vol 36, No 6, Nov-Dec 59, p 58

The trend in oxygen machine-building toward the construction of large-capacity installations for the production of oxygen gas is indissolubly connected with the development of a reliable and simple design for low-temperature turboexpanders which operate with a high efficiency. In 1939, in work done under the direction of Academician, P. L. Kapitsa, a reaction turboexpander of the centripetal type was developed, the adiabatic efficiency of which approached 80%. At present, low-temperature reaction turboexpanders are available which have a productive capacity corresponding to 500-20,000 standard cubic meters of air per hour. The adiabatic efficiency of large-capacity equipment of this type approaches 82-83%. The paper discussed the execution of designs of turboexpanders and indicated optimum relationships and dimensions.

[SIR Note: This is an abstract of a paper presented at the Tenth International Congress of Cryogenics, held at Copenhagen 19-26 August 1959.]

12. Trends in Design and Construction of USSR Equipment for Oxygen Production

"Basic Trends in the Design and Construction of Large-Scale Installations for the Production of Gaseous Oxygen," by G. M. Baranov, All-Union Scientific Research Institute of Oxygen Machine Building; Moscow, Kholodil'naya Tekhnika, Vol 36, No 6, Nov-Dec 59, p 58

The operation of all up-to-date major installations for the production of gaseous oxygen is based on a low-pressure cycle and involves the application of turbines. As a result of extensive research conducted at the All-Union Scientific Research Institute of Oxygen Machine Building, a number of installations have been developed which produce from 3,600 to 15,000 cubic meters of oxygen gas per hour. The basic flowsheet of the installations and the solution of concrete problems pertaining to technical questions that arose in connection with the novel design and the large capacity of the installations were discussed. This refers to the design of distillation columns and long-tube condensers-evaporators, the purification of the air from water vapor and carbon dioxide so that freezing of regenerators will be prevented, and methods for warming low-pressure installations.

[SIR Note: This is an abstract of a paper presented at the Tenth International Congress of Cryogenics, held at Copenhagen 19-26 August 1959.]

13. Explosion Sensitivity of Ozone-Oxygen Solutions With Respect to Heat Impulses

"The Physical Chemistry of Concentrated Ozone. VI. Explosion Sensitivity of Ozone-Oxygen Solutions With Respect to Heat Impulses," by V. V. Yastrebov, Ye. N. Pittskhelauri, and N. I. Kobozev, Moscow State University imeni M. V. Lomonosov; Moscow, Zhurnal Fizicheskoy Khimii, Vol 33, No 6, Jun 59, pp 1209-1213

In this article the explosibility of liquid ozone-oxygen mixtures with respect to heat impulses was investigated. The ozone content varied between 15 and 90%. A sharp decrease in the explosibility of ozone on dilution with oxygen was observed.

The method used involved the combustion of wires over a wide range of concentrations of the passive diluent-oxygen.

It was observed that a mixture with an ozone concentration c (%) by weight) does not explode if the heat impulse has an energy E (cal) less than that required by the equation $E = 186 \exp(-c/6.9)$.

Industrial Chemistry

14. Polymerization of Sylan and Furan

"Polymerization of Sylan and Furan," by A. S. Sultanov and A. Abduvaliyev, Institute of Chemistry, Academy of Sciences Uzbek SSR; Tashkent, Doklady Akademii Nauk Uzbekskoy SSR, No 6, Jun 59, pp 24-27

It was established for the first time that sylan and furan can be polymerized in the presence of fused zinc chloride. This catalyst was found to be effective even at room temperature. It is concluded on the basis of the experiments described that polysylan is an excellent surface coating material. Work by Sultanov and members of his team on the conversion of furfural into sylan (by reduction at 220-250° over a copper-zinc-aluminum catalyst), into furan and tetrahydrofuran (leading to butadiene or to adipic or succinic acid), and into butanediol-1,4 (over the diacetate obtained by splitting the furan ring with acetic acid anhydride and zinc chloride) is reviewed briefly.

Inorganic Chemistry

15. Improved Method for Synthesis of Lithium Aluminum Hydride

"Concerning the Synthesis of Lithium Aluminum Hydride," by K. N. Semenenko, N. Ya. Turova, and R. N. Urazbayeva, Moscow State University; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 5, No 2, Feb 60, p 508

It was found that the reaction of LiH with $AlCl_3$ in an ethereal solution proceeds smoothly and without an induction period if a small quantity of aluminum bromide (0.5-1% of the quantity of $AlCl_3$ used) has been added to the lithium hydride.

16. Effect of Reducing and Inert Gaseous Media on Sintering of High-Melting Oxides

"The Effect of the Gaseous Medium on the Sintering and Gathering Recrystallization of Oxides at High Temperatures," by A. I. Leonov, Institute of Silicate Chemistry, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR -- Otdeleniye Khimicheskikh Nauk, No 12, Dec 59, pp 2073-2079

The effect of the oxygen pressure on the sintering of silicon dioxide and the sintering and recrystallization of the oxides of titanium, magnesium, and aluminum at high temperatures was investigated. Activation of the processes of sintering and recrystallization, which are accompanied by dissociation, becomes significant at high temperatures when the partial pressure of oxygen in the gas phase has the same magnitude as the dissociation tension of the oxides. In the production of ceramics from pure oxides which do not sinter readily (MgO , Cr_2O_3 , etc.) one can facilitate sintering by burning the ceramic in a gaseous medium which has a low partial pressure of oxygen, such as hydrogen, carbon monoxide, inert gases, or a vacuum. The relationships established have a bearing on the fact that magnesite, chromite, and chromo-magnesite refractories, although stable in an oxidizing medium, deteriorate rapidly when exposed to the action of a reducing gaseous medium. The reason is that at temperatures of 1,500-1,750° dissociative activation of the oxides takes place, with the result that their reactivity toward a reducing gas is increased.

17. Heat Resistance of Some Cermets

"An Investigation of the Properties of Protective Tips (Sheathes) for Thermocouples," by F. V. Bochkov, Design Bureau of Non-ferrous Metals (Production) Automation; Moscow, Ogneupory, No 1, Jan 60, pp 39-41

On the basis of tests which have been conducted, data are given on the thermal stability of zirconium dioxide, titanium carbide, quartz, titanium carbide containing 20% of cobalt, aluminum oxide + 77% chromium, aluminum oxide + 77% of molybdenum, and aluminum oxide + 50% of molybdenum. Information is given on the resistance of the materials tested to oxidation in air at elevated temperatures (1000-1100°). The errors occurring in temperatures measurements with thermocouples protected by sheathes consisting of aluminum oxide + 77% of aluminum, aluminum oxide + 77% of chromium, titanium carbide + 20% of cobalt, titanium carbide + 10% of nickel, titanium carbide + 10% of chromium, and molybdenum are listed. Some data on the production of the protective sheathes are given.

Isotopes

18. Comparison of Different Methods of Isotope Separation

"On the Coefficients of Utilization of Isotope Separation Methods," by A. N. Murin; Moscow, Zhurnal Fizicheskoy Khimii, Vol 34, No 1, Jan 60, pp 231-233

The coefficients of utilization of three isotope separation methods are compared on the example of the separation of N^{14}_2 from N^{15}_2 . The methods in question are thermal diffusion, the Hertz method (ordinary diffusion through a porous diaphragm), and H. C. Urey's exchange reaction method. The coefficient of utilization (c. u.) is defined as the ratio of the increase of free energy in the separation to the maximum work involved in transition from the initial to the final state in the process. The results obtained are listed in the following table:

	maximum c. u. / $(\frac{c}{c_0})$
Hertz diffusion	2.10
Chemical exchange	$1 \cdot 10^{-2}$
Thermal diffusion	$3 \cdot 10^{-6}$

Nuclear Fuels and Reactor Construction Materials

19. Method for Determination of Optimum Yield of Enriched Ore When Radiometric Enrichment of Uranium Ores Is Applied

"Determination of the Optimum Yield of Enriched Ore When Radiometric Enrichment of Uranium Ores Is Applied," by Ye. Mal'tsev; Moscow, Atomnaya Energiya, Vol 8, No 2, Feb 60, pp 121-126

This article describes a method for the determination of the optimum conditions of operation at plants applying radiometric sorting of ores under consideration of the costs of geologic prospecting and surveying S_1 , of the production of ore S_2 , of radiometric enrichment S_3 , and of hydrometallurgical conversion S_4 , and also under consideration of the yield of enriched ore γ , the content α of uranium in the ore, and coefficients of extraction corresponding to a radiometric enrichment of ore ξ and a hydrometallurgical conversion ξ' .

To determine the minimum cost S_m of uranium salts, an analytical method is applied; S_m is represented in the form of a continuous function $S_m = (S_1, S_2, S_4, \alpha, \gamma, \varepsilon, \varepsilon')$. By applying the method of selected experimental points according to the theory of approximation, it was established that $\varepsilon = f_1(\gamma)$ and $\varepsilon' = f_2(\alpha, \gamma, \varepsilon)$. Because $S_m = f(\gamma)$ is a function which exhibits an extremum, one can determine from the equation $dS_m/d\gamma = 0$, the optimum yield γ_{op} of enriched ore at a plant applying radiometric sorting of ore, i.e., the yield which corresponds to a minimum cost of uranium metal. An actual example is given of the determination of the optimum yield of enriched ore.

20. Thiocarbamate Complexes of Uranyl

"Investigation of the Process of Formation of the Trithiocarbamate Complex of Uranyl," by B. I. Peshchevitskiy, Institute of Inorganic Chemistry, Siberian Branch of the Academy of Sciences USSR; Novosibirsk, Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR, No 9, Sep 59, pp 56-62

The formation of the negatively charged trithiocarbamate complex of uranyl $UO_2(S_2CNC_4H_{10})_3$ as a result of the interaction of uranyl acetate with sodium diethyldithiocarbamate was investigated. Advantage was taken of the fact that the neutral uranyl dithiocarbamate $UO_2(S_2CNC_4H_{10})_2$, which also forms, can be extracted with ether. To establish conditions under which both the uranyl ion and the dithiocarbamate ion are stable in aqueous solution, an excess of sodium acetate was added.

21. Deformation of Uranium Under Effect of Thermal Cycling and Stretching Load

"Deformation of Uranium Under the Simultaneous Effect of Thermal Cycles and a Stretching Load," by A. A. Bochvar, G. Ya. Sergeev, and V. A. Davydov; Moscow, Atomnaya Energiya, Vol 8, No 2, Feb 60, pp 112-116

It was established that cyclic thermal treatment of uranium in the region of the γ -phase while an externally applied stretching load is acting on the uranium brings about a considerable residual deformation which is several times greater than the total deformation resulting from cyclic thermal treatment and creep in the absence of such a load.

The deformation of samples in all cases investigated showed a change of dimensions in the direction in which the external force was acting. Samples obtained by cross-sectioning sheet uranium, when subjected to cyclic thermal treatment in the temperature region corresponding to the γ -phase, are shortened in the absence of a stretching load. When a stretching load is applied, this treatment does not prevent elongation of the samples: a deformation is produced in the direction of the action of the external force which is greater than that resulting from creep.

22. Separation of Carrier-Free Pa²³³ From Thorium Nitrate Irradiated With Slow Neutrons

"Separation of Carrier-Free Pa²³³ From Thorium Nitrate Preparations Irradiated With Slow Neutrons," by V. I. Spitsyn and M. M. Golutvina; Moscow, Atomnaya Energiya, Vol 8, No 2, Feb 60, pp 117-120

This article describes a method for the separation of carrier-free Pa²³³ from thorium nitrate that has been irradiated with thermal neutrons. The Pa²³³ was separated from the thorium nitrate solution by adsorption on a Mn O₂ precipitate followed by extraction of the cupferron complex of protactinium with amyl acetate and re-extraction into a citric acid solution. Finally, the citric acid complex was decomposed by oxidation with concentrated nitric acid. As a result, a good purification from γ - and β -emitters was achieved. The radioactive isotope which had been isolated was identified by determining its half-life. The method in question is of importance for the preparation of the carrier-free radioactive isotope Pa²³³. This isotope can be used as a tracer in research on the chemistry of protactinium and also in the solution of problems pertaining to the extraction of protactinium from naturally occurring raw materials as well as separation of Pa²³³ from thorium in connection with the production of U²³³.

23. Coprecipitation of Tetravalent Plutonium With Organic Coprecipitants

"Coprecipitation of Pu (IV) With Organic Coprecipitants," by V. I. Kuznetsov and T. G. Akomiva; Moscow, Atomnaya Energiya, Vol 8, No 2, Feb 60, pp 148-150

Methods for the coprecipitation of plutonium from very dilute solutions to bring about separation of this element from other elements are described. Detailed description is given of several procedures of precipitation by the "nitrate" method (coprecipitation of tetravalent plutonium with butylrhodamine nitrate) and coprecipitation of Pu (IV)

in the form of cyclic salts (e.g., precipitation with arsenazo, stilbazo, chromotrope 2B [p-azo-nitrobenzene], etc). References are made to earlier work done by Kuzetsov and coworkers on the subject.

24. Uranium-Germanium Alloys

"Investigation of Uranium-Germanium Alloys," by V. S. Lyashenko and B. N. Bykov; Moscow, Atomnaya Energiya, Vol 8, No 2 Feb 60, pp 146-148

The properties of uranium-germanium alloys were investigated. The constitutional diagram of the system uranium-germanium was compared with those formed by uranium with other elements of group IV of the periodic system. It was established that there is a considerable similarity of the newly determined diagram with the constitutional diagrams of uranium-silicon and uranium-tin. The work described was carried out in 1955.

25. Chinese Research on Rare-Earth Elements

"Investigations Carried Out in the Chinese People's Republic in the Field of the Chemistry of Silicates," by N. A. Toropev and E. K. Keler; Moscow, Izvestiya Akademii Nauk SSSR --
CPYRGT Otdeleniye Khimicheskikh Nauk, No 11, Nov 59, pp 2061-2062

"At a number of institutes of the Chinese People's Republic an extensive program is to be carried out with the view of investigating the properties of rare and dispersed elements and of utilizing these elements in different fields of industry. Preparations are being made to produce in the near future considerable quantities of rare-earth elements. A number of spectroanalytically pure oxides has been obtained, including Er_2O_3 , La_2O_3 , CeO_2 , Y_2O_3 , Yb_2O_3 , Pr_6O_{11} , Nd_2O_3 , and some others. Work has been launched on the investigation of the nature of rare-earth minerals which crystallize in blast-furnance slags containing fluorine. It is proposed to investigate the fine structure and also the electrical and other properties of phases which crystallize from slags and contain rare-earth elements. Work has begun on the preparation and investigation of the properties of materials with very high melting points, such as the nitrides, sulfides, and borides of rare-earth elements. Research has been initiated on the effects exerted by rare-earth element oxides on the crystallization properties of glasses formed in some special systems and also the chemical stability of these glasses and their capacity to protect from ionizing radiation. At the Institute of Physics work will be conducted on the growing of single crystals of some coordination compounds that exhibit paramagnetism."

26. Hydrates of Zirconium Tetrafluoride

"The Crystal Hydrates of Zirconium Tetrafluoride," by Yu. V. Gagarinskiy and V. P. Mashirev; Novosibirsk, Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR, No 11, Nov 59, pp 50-56

By using the X-ray diffraction and pycnometric methods, it was established that there are two crystal hydrates of zirconium tetrafluoride. It was established that after the lower hydrate of zirconium fluoride has been dehydrated in vacuum by gradually raising the temperature to 250°, the phase that is formed preserves a structure similar to the structure of the initial hydrate. However, hydration of the dehydrated phase with liquid water results in the formation of the higher crystal hydrate. Measurement of the heats of hydration of zirconium fluoride hydrates dehydrated to different degrees and extrapolation to a zero heat effect of the established dependence between the heat of hydration and the water content led to the conclusion that the composition of the higher hydrate corresponds to $Zr F_4 \cdot 3 H_2O$.

Chemical analysis established that the composition of the lower hydrate corresponds to the formula $Zr F_4 \cdot H_2O$. It was found that anhydrous ZrF_4 obtained at 500° or higher temperatures does not become hydrated for several days on being exposed to liquid water or to mixture of the air. This behavior is similar to that exhibited by anhydrous ThF_4 or UF_4 .

27. Precipitation of Niobium as Niobium Phosphate From Sulfuric Acid and Hydrochloric Acid Solutions

"Niobium Phosphate," by A. K. Sharova and A. P. Shtin, Ural Affiliate of the Academy of Sciences USSR; Novosibirsk, Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR, No 9, Sep 59, pp 40-47

The conditions under which niobium can be precipitated as its phosphate from sulfuric acid and hydrochloric acid solutions have been investigated.

28. Work on Coordination Compounds in Connection With Technical Problems Arising Under Seven-Year Plan

"Tasks of Research on Complex Compounds in Connection With Chemical Problems To Be Solved Under the Seven-Year Plan," by V. I. Spitsyn, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk, No 12, Dec 59, pp 2067-2072

The production of semiconductor devices will be expanded greatly under the Seven-Year Plan. For these devices, very pure semiconductor materials are required; it will not be possible to produce these materials without using complex compounds that are already known and new complex compounds which are to be synthesized. The application of complex compounds as ferromagnetic and seignettelectric materials is increasing.

Of great importance is theoretical work on the synthesis of organic precipitants with predetermined properties for the selective separation of elements or groups of elements. Research in this field must cover the whole periodic system. The organic substances for the purpose in question should include representatives of the most important types of compounds containing the most characteristic functional groups. Particular attention must be paid to substances capable of forming inner complex compounds, as for instance Schiff bases, Mannich bases, and others. The employment of organic precipitants forming coordination compounds is of importance not only for analytical chemistry but also for applications in technology. For instance, precipitants of this type play an important role in the production of very pure semiconductor materials, e.g., germanium and silicon.

Solvent extraction must be regarded as a very promising method for applications in modern chemical technology. This pertains especially to technological processes for the production of rare and radioactive elements. The selection of solvents for extraction is rather limited at present: only tributylphosphate, diethyl ether, some ketones and higher alcohols, carbon tetrachloride, and to some extent hydrocarbons are available. The solvents for extraction are usually selected on a purely empirical basis. It would be of importance to study the complex compounds formed by all elements of the periodic systems with solvents suitable for extraction. Introduction of extraction methods into processes for the production of rare elements will be of great economic importance because of the possibilities opened thereby to conduct processes in the production branches involved on a continuous basis, to reduce sharply the quantity of reagents used, and to improve the quality of the products. It is to be expected that extraction will be used extensively for the separation and purification of rare-earth elements. Application of extraction methods in the technology of the production

of beryllium, niobium, zirconium, and other rare elements is foreseen in the near future. Extraction will also undoubtedly be applied in the production of individual radioactive elements and carrier-free radioactive isotopes.

Methods developed by Chugayev and Chernyayev's school for the refining of platinum and metals accompanying platinum by employing complex compounds will have to be modified in connection with the extraction of platinum from the new and rich deposits discovered in the eastern USSR. Coordination compounds formed by iridium and ruthenium will have to be investigated in order to develop methods for producing these metals in a state of very high purity. Interesting data have been obtained on the radiation-chemical reduction of platinum and palladium by using a stream of electrons.

Extensive work will have to be done as far as investigation of the complex compounds formed by rare elements is concerned; these have been investigated to a much lesser extent than the compounds of precious metals and elements related to the precious metals. It is necessary to conduct systematic investigations of compounds of beryllium and those formed by rare-earth elements, gallium, indium, thallium, germanium, zirconium, hafnium, niobium, tantalum, and rhenium. This refers first of all to complex compounds of the type of fluorides, ferrocyanides, and others formed in solutions, as well as compounds not containing any water or formed in the absence of water, such as the products of the interaction of tetrachlorides of zirconium and hafnium with phosphorus oxychloride. The phosphorus oxychloride addition compounds derived from these tetrachlorides were applied for the separation of zirconium-hafnium mixtures by fractional distillation. One must by every means expand research on the coordination compounds of uranium, thorium, protactinium, and other radioactive elements, paying particular attention to elements of the transuranium group. Many common elements are important from the standpoint of the investigation of their properties as complex-formers; among them one may mention boron, the compounds of which may form a basis for the production of inorganic high polymers, and aluminum, silicon, titanium, and phosphorus.

[SIR Note: Spitzyn's paper was presented on 26 May 1959 at the Eighth All-Union Conference on the Chemistry of Complex Compounds, held at Kiev.]

Organic Chemistry

29. Reaction Between Akyl Esters of Phenylphosphinous Acid and Ketene Described

"New Method of Synthesizing Esters of Phosphinic and Thiophosphinic Acids. XXXIII. Concerning the Interaction of Incomplete Esters of Phosphinous Acids With Ketene," by A. N. Pudovik, V. I. Nikitina, and G. P. Krupnov, Kazan State University; Moscow, Zhurnal Obshchey Khimii, Vol 29, No 12 Dec 59, pp 4019-4021.

The addition of ethyl and butyl esters of ethylphosphinous acid and of the methyl, ethyl, and propyl esters of phenylphosphinous acid to ketene was studied.

The reaction proceeds in two stages. The initially formed esters of acetoethylphosphinic and acetophenylphosphinic acids on further reaction with the ketene form the esters of acetoxyvinylethylphosphinic and acetoxyvinylphenylphosphinic acids, respectively.

The results obtained indicate that esters of acetophenylphosphinic acids enter into reaction with ketene considerably more slowly than esters of acetophosphinic and especially acetothiophosphinic acids.

30. Derivatives of α, β -Diphenylethylenediamine Exhibit Curare-Like Activity

"Several Derivatives of α, β -Diphenylethylenediamine," by N. K. Kochetkov and N. V. Dudykina, Institute of Pharmacology and Chemotherapy of the Academy of Medical Sciences USSR; Moscow, Zhurnal Obshchey Khimii, Vol 29, No 12, Dec 59, pp 4079-4081

Several N-chloroacyl, N-dialkylaminoacyl, and N-dialkylaminoalkyl derivatives of fatty-aromatic amines previously prepared by the authors have shown considerable physiological activity (action on the central nervous system). In their continuing search for physiologically active substances among derivatives of fatty-aromatic amines, the authors accomplished the synthesis of several formerly unknown derivatives of α, β -diphenylethylenediamine of the type:



The N,N'-bis- β -chloropropionyl, N,N'-bis- β -diethylaminopropionyl, N,N'-bis-diethylaminoethyl, and N,N'-bis-diethylaminopropyl derivatives of α , β -diphenylethylenediamine were obtained.

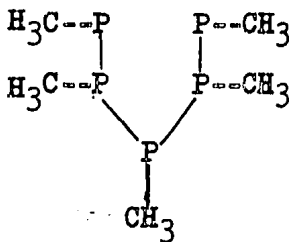
The compounds synthesized were subjected to physiological tests by M. Yu. Ladinskaya. None of them showed antispasmodic activity, but all except one exhibited marked curare-like activity. The iodomethylate of the N,N'-bis-diethylaminoethyl derivative of α , β -diphenylethylenediamine brought about relaxation of the musculature for 7-10 minutes.

11. Acid Fluorides of Alkylphosphinous Acids Synthesized

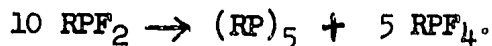
"Synthesis and Properties of Alkyldifluorophosphines," by V. N. Kulakova, Yu. M. Zinov'yev, and L. Z. Soborovskiy; Moscow, Zhurnal Obshchey Khimii, Vol 29, No 12, Dec 59, pp 3957-3959.

The authors prepared for the first time fluorine derivatives of organic phosphines (RPF_2) which can be regarded as acid fluorides of alkylphosphinous acids. These substances were obtained from the corresponding chlorine and iodine derivatives by reacting antimony trifluoride with these derivatives under mild conditions.

The RPF_2 compounds are unstable substances. On heating or long storage, they undergo an unusual rearrangement, as a result of which, as in the case of methyldifluorophosphine, substances are formed which on the basis of analytical data the authors assume to be five-membered cyclic derivative of phosphorus



Simultaneously the corresponding alkyltetrafluorophosphines are formed. The rearrangement observed can be represented by the scheme:



In addition to the unsubstituted alkyldifluorophosphines, the authors synthesized the previously unknown analogons trifluoromethyl derivatives-- CF_3PF_2 and $(CF_3)_2PF$. The starting materials used were the iodides mentioned above. The perfluorides synthesized are gaseous substances which spontaneously catch fire in air. Consequently, all the experiments were conducted in a nitrogen atmosphere.

32. Synthesis of Several Complete Esters of Halogenated Alkane- and Alkenephosphinic Acids Reported

"Complete Esters of Several Halogenated Alkane- and Alkene-phosphinic Acids," by Yu. M. Zinov'yev and L. Z. Soborovskiy; Moscow, Zhurnal Obshchey Khimii, Vol 29, No 12, Dec 59, pp 3954-3956

As a result of the oxidative chlorophosphination of haloalkanes, olefins, mono- and dihalo-olefins, the acid chlorides of mono-, di- or tri-haloalkanephosphinic acids are formed. Alkyl esters of acids of this type have hardly been studied, notwithstanding the fact that the compounds mentioned, because of the relative ease of their synthesis, can serve as insecticides and starting materials for producing esters of unsaturated phosphinic acids which can be used as monomers in the synthesis of polymers containing phosphorus and other elements.

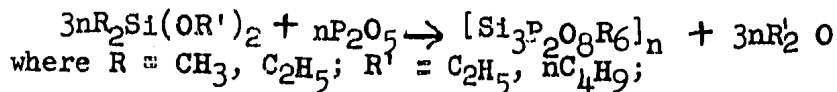
In the present work the authors prepared a number of complete esters of several halogenated alkane- and alkene-phosphinic acids (15 in all), for whose synthesis the acid chlorides were used which were formed as a result of oxidative chlorophosphination of the corresponding hydrocarbons or halo-derivatives of the latter.

The methyl and ethyl esters of chloropropanephosphinic acid were synthesized both from the acid chlorides of the latter (obtained by oxidative chlorophosphination of propylene) and from compounds which do not contain isomers and have a definitely established structure. The halogenated alkane- and alkene-phosphinic acids used in this research included the chloropropane-, fluoropropane-, chlorobutane-, chlorobromoethane-, trichloroethane-, dichloroethene-, and fluorochloroethenephosphinic acids. The physical constants of the newly obtained compounds are presented in a table.

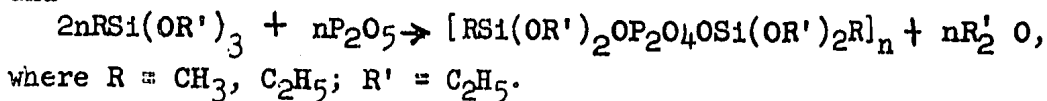
33. Reactions Between Alkylalkoxysilanes and Phosphorus Pentoxide Investigated

"Investigation of the Reactions Between Di- and Tri-functional Alkylalkoxysilanes With Phosphorus Pentoxide," by A. P. Kreshkov and D. A. Karateyev, Moscow, Chemicotechnological Institute imeni D. I. Mendeleev; Moscow, Zhurnal Obshchey Khimii, Vol 29, No 12, Dec 59, pp 4082-4085

The reactions between diemthyldiethoxy-, dimethyldi-n-butoxy-, diethyldiethoxy-, methyltriethoxy-, and ethyltriethoxysilanes and phosphorus pentoxide were investigated. They can be represented by the reaction equations:



and



These reactions are accompanied by a process of dialkoxylation which leads to the formation of phosphorosilicon organic derivatives and ethers.

A new method was developed for preparing polymers of the types: [Si₃P₂O₈R₆]_n and [Si₂P₂O₆R₂(OR')₄]_n.

Three previously unknown polymeric compounds were obtained: [Si₃P₂O₈(C₂H₅)₆]_n, [Si₂P₂O₆(CH₃)₂(OC₂H₅)₄]_n and [Si₂P₂O₆(C₂H₅)₂(OC₂H₅)₄]_n.

34. Synthesis of Derivatives Of N-Phosphoric Acids of Nitrobenzenesulfonamides Described

"Derivatives of N-Phosphoric Acids of Nitrobenzenesulfonamide,"
by A. V. Kirsanov and N. G. Feshchenko, Institute of Organic
Chemistry, Academy of Sciences Ukrainian SSR; Moscow, Zhurnal
Obshchey Khimii, Vol 29, No 12, Dec 59, pp 4085-4091

In the reaction of dimethylamine with trichlorophosphazosulfonenitrophenyls (I), all three chlorine atoms are replaced by dimethylamino groups and the hexamethyltriamidophosphazosulfonenitrophenyls (II) are formed.

When diethylamine reacts with I only two chlorine atoms are replaced by diethylamino groups and the tetraethyldiamidomonochlorophosphazosulfonenitrophenyls (III) are formed.

The ortho-isomer of II is not hydrolyzed by acids or bases and the meta- and para-isomers are hydrolyzed, considerably more slowly than a majority of the known phosphazosulfone compounds.

III are not hydrolyzed by bases in contrast to all known chlorophosphazosulfone compounds.

By the action of dimethyl- and diethylamines on di- acid dichlorides of nitrophenylsulfonamidophosphoric acids, the tetraethyldiamides of nitrophenylsulfonamidophosphoric acids are formed which are strong monobasic acids.

On the interaction of sodium methylate and sodium arylates with the acid dichlorides of nitrophenylsulfonamidophosphoric acids the sodium salts of the diesters of nitrophenylsulfonamidophosphoric acids are obtained. These sodium salts were obtained for studying the physiological properties of these compounds.

35. Effect of Isopestox Chemiluminescence of Luminol

"On the Luminescence of Luminol. Report No 9. The Catalytic Effect of Isopestox the Chemiluminescence of Luminol and the Inhibition of This Reaction," by K. Weber, Lj. Huic, and M. Mrazovic, Institute of Medical Research, Zagreb; Zagreb, Arhiv za Higijenu Rada i Toksikologiju, Vol 9, No 4, 1958, pp 345-347.

Photoelectric measurements of the intensity of the emitted light were used to study the catalytic effect of Isopestox on the chemiluminescence of luminol in the presence of hydrogen peroxide in alkaline solution. In relatively low concentrations, Isopestox increases the intensity of the luminescence of luminol considerably. A determination was made of the Michaelis constant of this reaction, which can be considered a model reaction of the enzymatic effect (peroxydase effect) of the organophosphorus compound Isopestox.

Various inorganic and organic substances have an effect on the Isopestox-accelerated chemiluminescence of luminol. The effect of foreign substances (inorganic salts, polyphenols, aromatic amines) is mostly in the form of an inhibition (extinguishing of the luminescence). There are substances, however, which considerably increase the intensity of luminescence, or which increase the intensity of luminescence in low concentration, but reduce (extinguish) it in large concentrations.

It is of special interest that Isopestox, which, as an organophosphorus compound, has the capability of inhibiting enzymatic reactions, was found to have in a concrete case, in vitro, exactly the same effect as the enzyme peroxydase and that substantially the fundamental laws of the kinetics of enzymatic reactions were found to apply to its activity. However, in a more detailed examination of the inhibition of this reaction by the addition of foreign substances, it was found that the fundamental regularities pertaining to the inhibition of enzymatic reactions are obviously not fulfilled in this case. It can be assumed that, as a consequence of the very complex mechanism of the luminol reaction, the foreign substances (effectors) can produce several different effects in the reaction mixture.

The catalytic effect of Isopestox on the luminol reaction can be used for the quantitative determination of this substance through photoelectric measurements of the intensity of luminescence.

36. Inhibition of Chemiluminescence of Luminol by Parathion and Paraoxon

"On the Luminescence of Luminol. Report No 10. The Inhibition of the Chemiluminescence of Luminol by Parathion and Paraoxon," by M. Mrazovic and K. Weber, Institute of Medical Research, Zagreb; Zagreb, Archiv za Higijenu Rada i Toksikologiju, Vol 9, No 4, 1958, pp 349-364

It was found that organophosphorus compounds not only can affect the chemiluminescence of luminol as promoters (positive catalysts), but also are capable of inhibiting the luminol reaction catalyzed by other substances (complex iron compounds and the like). This inhibitor effect, which manifests itself as an extinguishing of the luminescence of luminol, is exerted by a rather great number of organophosphorus compounds. This is readily understood when it is remembered that organophosphorus compounds are known as inhibitors of certain enzyme reactions.

In this work, quantitative photoelectric measurements were used to investigate the effect of parathion (E 605) and paraoxon (E 600) on the luminol reaction which was accelerated by the addition of a blood solution. Before the experiments were conducted, the hemoglobin in the blood solution was converted by chemical action into methemoglobin. First, the Michaelis constant of the luminol reaction in the presence of methemoglobin ($K_s \approx 7.4 \cdot 10^{-5}$) was determined and then quantitative measurements were made of the inhibitor effects. For a luminol concentration of $4 \cdot 10^{-4}$ M, the half-concentration value of the inhibitor effect for parathion was $5.0 \cdot 10^{-4}$ M; it decreases with increased luminol concentrations. The inhibition of the luminol reaction by paraoxon is much weaker and, under similar experimental conditions, yields values for the half-concentration of inhibition higher than $1 \cdot 10^{-3}$ M.

A mathematical treatment of the experimental data showed that the observed effects are to be interpreted as noncompetitive inhibition. Since such inhibitions occur very rarely, it is to be assumed that they are manifested here because the luminol reaction has a very complex mechanism. It is possible that the described inhibitor effects can be utilized for the detection and determination of the organophosphorus compounds in question.

Physical Chemistry

37. Possibilities of Application of Magnetic Resonance and Microwave Gas Spectroscopy Methods in Chemistry

"Radiospectroscopy and Its Applications in Chemistry," by L. A. Blyumenfel'd, Doctor of Chemical Sciences, and V. V. Voyevodskiy, Corresponding Member, Academy of Sciences USSR; Moscow, Vestnik Akademii Nauk SSSR, Vol 29, No 12, Dec 59, pp 16-21

Several new physical methods based on the application of electromagnetic waves in the regions of high and superhigh frequencies can be used for the investigation of molecules with electric and magnetic dipoles. When no electric or magnetic dipoles are present, irradiation can be used to bring about formation of unpaired electrons or stable isotopes having a nuclear moment can be introduced.

The method of electronic paramagnetic resonance is suitable for the detection of the presence of free radicals and the investigation of processes involving the participation of free radicals. Of particular importance for the clarification of the structure of complex radicals and paramagnetic groups is investigation of the so-called superfine structure of electronic paramagnetic resonance spectra, which reflects the interaction of the magnetic moment of the unpaired electron with the magnetic moments of nuclei contained in the radicals, groups, or complexes in question. Investigation of the superfine structure of electronic paramagnetic resonance spectra opens up interesting possibilities in connection with applications involving the substitution of definite atoms in a molecule with stable isotopes having a different nuclear moment. Electronic paramagnetic resonance spectra give very precise information on the nature of the interaction of unpaired electrons with the surrounding medium. This enables one to study intramolecular interactions, which may play a decisive role in chemical transformations taking place in the solid or liquid phase. If the solid or liquid substances which interact are not paramagnetic, small quantities of paramagnetic molecules or free radicals can be introduced into them.

Exposure of most solid substances to the action of penetrating radiation results in the formation of stable free radicals in them. Investigation by the method of electronic paramagnetic resonance of a number of irradiated polymers (e.g., teflon and polyethylene) yielded new data on the structure of these polymers.

Nuclear magnetic resonance is fundamentally similar to electronic paramagnetic resonance. However, because nuclear magnetic moments are much weaker than electronic moments, absorption takes place in the range of longer waves. The method of nuclear magnetic resonance has been applied in the investigation of phase transformations and in research on the kinetics of reactions proceeding at a rapid rate.

The method of nuclear quadruple resonance is of importance mainly in structural investigations.

Microwave gas spectroscopy is based on the investigation of absorption spectra of gases in the microwave range of frequencies. Transitions between levels of the magnetic fine structure of rotational states of paramagnetic molecules of the type of O_2 and of free radicals such as CH, OH, and NH lie within the microwave range of the spectrum. This makes it possible to detect and identify such molecules and radicals and to measure their concentration. Rotational spectra are very useful for the analysis of molecules containing isotopes. Thus, the distance between the rotational lines of $CsCl^{35}$ and $CsCl^{37}$ amounts to 100 megacycles at a precision of the measurement equal to 15 kilocycles.

Radio-wave spectroscopy enables one to solve problems in chemical research which cannot be solved by the application of any other method. Furthermore, the number of applications of radio-wave spectroscopy in chemistry will undoubtedly increase. It is apparent that the methods of radio-wave spectroscopy will be of help in the clarification of the mechanism of different reactions in which radicals participate, including reactions at low and extremely low temperatures; in the investigation of many diverse phenomena of chemical and biological catalysis; in the solution of the problem of action over distances in chemistry and biology; in the clarification of the mechanism of the most important polymerization reactions; and in the determination of the structure and characteristics of many new high-molecular compounds as well as of polymers that are of importance in biology (proteins, nucleic acids, etc).

[For additional information on physical chemistry, see Fuels and Propellants.]

Radiation Chemistry

38. Paramagnetism of Radioactive Solutions

"The Paramagnetism of Radioactive Solutions," by V. M. Vdovenko, Corresponding Member, Academy of Sciences USSR, and V. A. Shcherbakov, Radium Institute imeni V. G. Khlopin; Moscow, Doklady Akademii Nauk SSSR, Vol 127, No 1, 1 Jul 59, pp 127-130

The magnetic properties of aqueous solutions irradiated by radioactive isotopes dissolved in them or by external sources of β - and γ - radiation were investigated. The effect of irradiation on the spin-lattice relaxation time T_1 of protons of the water was determined.

T_1 is the time necessary for the formation of a thermodynamic equilibrium between the system of proton spins and the mass of the solution representing the lattice in this case. The value of T_1 depends to a very great extent on the presence of paramagnetic components in a solution. It was established that a reduction of T_1 takes place as a result of the irradiation. In the experiments described this reduction was due to the formation of radicals because of the radiolysis of water. Presence of molecules of paramagnetic substances dissolved in the water may also have contributed to the reduction of the magnitude of T_1 . Solutions containing radioactive isotopes of sodium, sulfur, strontium, zirconium, cadmium, and europium were investigated.

39. Radiation-Chemical Isomerization of Benzene

"The Radiation-Chemical Isomerization of Benzene," by I. V. Vereshchinskiy, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR--Otdel'niye Khimicheskikh Nauk, No 12, Dec 59, pp 2234-2235

It was established that fulvene, a hydrocarbon isomeric with benzene, is formed under the action of accelerated electrons on liquid benzene saturated with argon. The yield of fulvene comprised 0.76-0.85 molecules per 100 electron volts.

40. Oxidation of Technical Paraffin Wax Under Action of Gamma Radiation

"Oxidation of Technical Paraffin Wax Under the Action of Gamma Radiation," by Yu. L. Khmel'nitskiy, A. T. Slepneva, and I. I. Melekhonova, All-Union Scientific Research Institute of the Petroleum Industry; Moscow, Khimiya i Tekhnologiya Topliv i Masel, Vol 4, No 1, Jan 59, pp 25-27

It was established in experiments on the oxidation of technical paraffin wax conducted by applying at 130° gamma radiation emitted by Co^{60} at a magnitude of the dose amounting to ~ 200 roentgens per second:

(1) That the velocity of the reaction increases sharply in the initial state when radiation is applied, as compared with the velocity in the absence of irradiation.

(2) That after irradiation has been carried out for a certain length of time, the velocity of the reaction ceases to increase and becomes independent of the duration of irradiation.

Similar relationships were found to apply in earlier work carried out by the authors on the oxidation of n-hexadecane (cetane) under the action of gamma radiation.

41. Adsorptive Properties of Silica Gel

"Variation of Adsorptive Properties of Silica Gel under the Action of Gamma Rays," by S. V. Starodubtsev, Sh. A. Ablyayev, and S. Ye. Yermatov, Moscow, Doklady Akademii Nauk SSSR, Vol 129, No 1, Nov 59, pp 72-73

The adsorptive properties of silica gel were tested by measuring the adsorption of gases with thermocouples and ionization manometers. Before the test the silica gel was treated thermally. The results show that under action of gamma rays the adsorptive ability of silica gel increases noticeably and the amount of the adsorbed gas increases with the irradiation dosis up to certain limit.

Radiochemistry

42. Isolation of Radioactive Cesium With Ferrocyanides

"Separation of Radioactive Cesium by Means of Ferrocyanides of Heavy Metals," by V. V. Pushkarev, L. D. Skrylev, and V. F. Bagretsov, Ural Polytechnic Institute imeni S. M. Kirov; Leningrad, Zhurnal Prikladnoy Khimii, Vol 33, No 1, Jan 60, pp 81-85

It was shown that it is possible to separate the radioactive isotope cesium-134 from aqueous solutions by adsorption of this element on precipitates consisting of mixed ferrocyanides of heavy metals (nickel, cobalt, copper, manganese, and zinc) followed by separation of the solid phase by means of gelatine foam.

43. Method for Isolation of Cesium-134

"Concentration of Radioactive Cesium With Gelatine Foam," by V. V. Pushkarev, L. D. Skrylev, and V. F. Bagretsov; Leningrad, Radiokhimiya, Vol 1, No 6, Dec 59, pp 709-711

A new method is proposed for the concentration of radioactive cesium-134 from solutions by adsorption of this isotope on mixed ferrocyanides and ferricyanides of some heavy metals followed by separation of the complex salt precipitates by means of gelatine foam.

44. USSR Work on Application of Radioactive Tracers in Investigation of Lubricating Oils

"Present-Day Status of the Application of Radioactive Isotopes and Penetrating Radiation in Petroleum Conversion," by Yu. S. Zaslavskiy, All-Union Scientific Research Institute of the Petroleum Industry; Moscow, Khimiya i Tekhnologiya Topliv i Masel, Vol 4, No 1, Jan 59, pp 5-15

CPYRGHT

"Soviet investigators have a priority in the application of radioactive tracer methods to study the corrosive action of lubricating oils and in the development of techniques for this type of work. This has been recognized abroad (cf Lubricating Engineer, Vol 14, No 1, 1958, p 27). The USSR also leads in the development of tracer methods for the investigation of the mechanism of the action of additives to oils, a fact which also has received international recognition."

[For additional information on radiochemistry, see Nuclear Fuels and Reactor Construction Materials.]

III. ELECTRONICS

Communications

45. TV Receiver "Voronezh"

"TV Receiver 'Voronezh,'" by V. Gugin and N. Kuznetsov;
Moscow, Radio, No 2, Feb 60, pp 35-37

The TV receiver "Voronezh" is designed for reception of programs on 12 channels in the frequency range of 48.15 to 230 Mc. The set incorporates 12 vacuum tubes as follows: 4 type 6F1P, 2 type 6P14P, 2 type 6Zh1P, one type 6P15P, one type 6P13S, and 2 type 6Ts10P. Sensitivity of the receiver is 200 microvolts, and selectivity is about 20 db. Horizontal distortion of the picture does not exceed 16%, and vertical distortion is not over 10%. The power consumption of the set is about 140 w. The set is equipped with either a 35LK2B picture tube having a 210 X 280 mm screen or a 43LK3B picture tube having a 270 X 360 mm screen. The intermediate frequencies employed in this set are: for video signal -- 34.25 Mc, and for audio signal -- 27.75 Mc. The three-stage IF amplifier is built with two type 6Zh1P and one type 6F1P tubes. The single-stage video amplifier incorporates tube 6P15P, and the AVC stage is built with one type 6F1P. The over-all weight of the set is 25 kg.

46. Recent Soviet Patents in the Field of Communications

"Authorship Certificates" (unsigned article), Moscow,
Elektrosvyaz', No 2, Feb 60, p 79

Class 21a¹, 50₃, No 120851. P. A. Kotov. Device for Testing the Quality of Telegraph Channels.

Class 21a¹, 11₀₁, No 121142. A. B. Pugach, Ye. T. Darov, and Z. S. Pashchenko. Electronic Transducer for Telegraph Test Combinations.

Class 21a¹, 20₀₁. No 121143. L. A. Posnyak and V. V. Yefremov. Polarized Relay.

Class 21a¹, 32₂₁. No 121476. G. V. Braude. Method of Reducing TV Transmitting Tube Inertia When Using Photoresistors in TV Film-Reproduction.

Class 21a¹, 32₃₅, No 121477. V. V. Odnol'ko and P. V. Shmakov. Method for Obtaining Three Fundamental Color Signals With One Single-Beam TV Transmitting Tube.

Class 21a¹, 34₁₁. No 121478. K. I. Sedov. Device for Correcting Nonlinear Phase Characteristics of a TV Video Channel.

Class 21a¹, 34₃₂, No 121479. G. G. Slyusarev and Yu. P. Shchepetkin. Optical System of Multilens Camera for Three-Channel Color Image.

Class 21a¹, 35₃₀. No 121480. Ye. I. Meybaum. Method for Separating Vertical Pulses From the Composite Synchronizing Pulses.

Class 21a¹, 35₁₄. No 120856. V. A. Pruzhanovskiy. Parametric Voltage Stabilizer.

Class 21a⁴, 42. No 121153. S. I. Yevtyanov. Method for Automatic Adjustment of Oscillator Frequency.

Class 21a⁴, 72₀₄. No 121489. S. M. Khazin. Electronic Antenna Switch.

47. Assignment of Radio-Amateur Frequency Bands

"Radio-Amateur Frequency Bands and Their Assignment for Various Types of Operation" (unsigned item); Moscow, Radio, No 1, Jan 60, p 20

3,500 to 3,650 Kc for telegraph and telephone

7,000 to 7,100 Kc for telegraph and telephone

14,000 to 14,100 Kc for telegraph

14,100 to 14,300 Kc for telephone

14,300 to 14,350 Kc for single-sideband telephone

21,000 to 21,150 Kc telegraph

21,150 to 21,350 Kc for telephone

21,350 to 21,450 Kc for single-sideband telephone

28,000 to 28,200 Kc for telegraph

28,200 to 28,500 Kc for telephone

28,500 to 29,700 Kc for single-sideband telephone

144,000 to 146,000 Kc for telegraph and telephone

420,000 to 435,000 Kc for telegraph and telephone

48. Simplified Methods for Computing Radio Receiver Noises

"Calculation of Noise in Radio Receivers," by I. M. Aynbinder; Moscow, Radiotekhnika, Vol 15, No 1, Jan 60, pp 48-59.

On the basis of the reciprocity theorem and the theorem of nonreciprocity of the noise level of linear circuits on the value of output load, basic relationships are derived for an engineering computation of noises in radio receivers, including antenna-feeder devices.

The general purpose of this analysis is the determination of conditions for which the equivalent spectral density of rated noise power directed to the antenna is a minimum. This value is characterized by the total noise level of the receiver.

As a result of the analysis the author concluded that:

1. The spectral density of rated noise power represents a suitable value for determining the noise properties of simple and complex linear circuits.
2. An expedient evaluation of noise intensity may be made according to the noise level factor (which is proportional to the noise intensity of the circuit), not to the noise factor.
3. On the basis of the reciprocity theorem, a single descriptive method is obtained for the direct summation of noise intensities of linear passive networks which is equally applicable to systems with lumped parameters, as well as systems with distributed parameters.
4. Calculation of tube noise is simplified by use of the above-described methods.

49. Effect of Feeder Parameters on Operation of Receiver Systems

"On the Effect of Feeder Parameters on the Noise Factor and Sensitivity of a Receiver System," by L. M. Mashbits; Moscow, Radiotekhnika, Vol 15, No 1, Jan 60, pp 38-47

The question of the influence of feeder parameters on the noise factor and sensitivity of a receiver system is examined. Questions of optimum matching of the receiver input and a method for determining relative noise temperature of the antenna are also considered. Relationships for various values of noise factor and noise temperature are presented in a set of curves which illustrate the gain in sensitivity which may be obtained by changing from matching according to a power maximum to matching according to a noise factor minimum.

Components

50. Transistorized Amplifiers With Automatic Volume Control

"Nonlinear Distortions in a Transistorized Amplifier With Automatic Volume Control," by Ye. P. Dement'yev; Moscow, Radiotekhnika, No 11, Nov 59, pp 58-66

The article discusses in some detail the causes of nonlinear distortions for the case of amplification control by changing the emitter current and for the case of amplification control by changing the voltage at the collector. In both cases, the transistor parameters vary during the operation, which gives rise to the difficult problem of determining a function with a large number of variables. The problem is further complicated by the fact that the change in the emitter current produces a change of voltage at the collector, which in turn affects various parameters of the circuit.

Although the calculation of nonlinear distortions with automatic volume control in transistorized amplifiers is very complicated, the assumption that for small emitter current the distortions are defined solely by the nonlinear characteristics of the emitter and that for small voltages at the collector the distortions are solely defined by nonlinear characteristics of the collector will considerably simplify the problem of approximation evaluation of nonlinear distortions.

A graphic method for determination of the coefficient of nonlinear distortions is explained.

51. Solid-State Molecular Oscillators

"Radiation of Atoms," by A. Kol'tsov; Moscow, Znaniye-Sila, No 2, Feb 60, pp 22-24

N. G. Basov and A. M. Prokhorov of the Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR, have carried out extensive work in developing the solid-state molecular oscillator. They have found a simple method of bringing the passive particles into an excited state by means of "supplementary feeding" of energy. The Soviet scientists used a totally new paramagnetic crystal to generate high-frequency radio waves. These crystals are capable of absorbing from an extraneous source electromagnetic oscillations at a certain frequency. Basov and Prokhorov have developed "artificial feeding" of energy to the passive particles by irradiating them with electromagnetic oscillations. A radio wave of high stability is generated when such crystals with activated particles are placed in a special resonator. This resonator can be adjusted to various frequencies, depending on the energy levels of the crystal particles.

Thus Soviet scientists have built high-frequency oscillators of great stability, as well as highly-sensitive high-frequency amplifiers. Such amplifiers have a sensitivity from 100 to 1,000 times greater than former high-frequency amplifiers. These devices are capable of amplifying even the faintest radio signals reaching the earth from outer space. Thus the range of radio telescopes has been increased by from 10 to 30 times. Radio waves from outer space can now be received and amplified without introducing any noise from the instruments.

52. Battery Operated Fluorescent Lamps

"Fluorescent Storage-Battery Lamps With Semiconductor Inverters," by V. B. Mitnik, Mining Institute, Academy of Sciences USSR; Moscow, Svetotekhnika, No 2, Feb 60, pp 20-25

Recent study in the application of transistorized current inverters to storage-battery-operated fluorescent lamps has opened great possibilities for this new type of illumination. By utilizing sufficiently powerful transistors of high current gain, it is possible to build an inverter for power supply and starting of a 3-4 w fluorescent lamp operating at a voltage of 2.5 to 3.75 v. For a 6 to 10 w fluorescent lamp, a storage battery should generate a voltage of 5 to 7.5 v.

The life of transistors operating in such an inverter circuit with inductive-active load has not yet been fully established; however, a test conducted for a period of 4,000 hours did not indicate any deterioration of the characteristics. Such inverters built with standard transistors can be adjusted for operation at any of the following frequencies: 300,400, 8,000, and 10,000 cycles. The efficiency of inverters with P-4 transistors operating from a 5-12-v battery and at 1,000 to 3,000 cycles is in the range of 75-85%.

An experimental type of fluorescent lamp capable of producing 230 lumens for use in the mines was built with three iron-nickel storage batteries. The whole fluorescent lamp assembly weighs about 3.4 kg.

53. Low-Frequency Divider

"Divider of Low-Frequencies," by V. S. Andreyev and Ye. M. Soshnikov; Moscow, Elektrosvyaz', No 2, Feb 60, pp 32-37

An experimental low-frequency divider was assembled with the following components: a selective RC amplifier, with a double T-shape bridge incorporating a 6Zh4 tube, an electronic switch on a P-13 triode, and an auxiliary amplifier on a 6N15P triode. This low-frequency divider has stable operation for a considerable range of supply voltage; thus, for plate voltage changes from 250v to 150 v, a deviation of only 10-15% is observed.

This frequency divider can be easily adjusted for different desirable frequency division factors. The frequency of the output signal of this low-frequency divider can be adjusted to values from 10 cycles to several hundreds of cycles.

54. Nickel-Zinc Storage Battery

"Nickel-Zinc Storage Battery," by V. Flerov; Moscow, Radio, No 1, Jan 60, p 61

A new type of nickel-zinc storage battery, with high operating characteristics, that requires for its manufacture inexpensive and easily obtainable materials has been developed. The operating voltage of such a Ni-Zn battery is in the range of 1.60-1.70 v. The positive electrode consists of a highly porous sintered powdered-nickel matrix impregnated with active material, nickelous hydroxide. The nickel paste is prepared by calcining nickel carbonyl powder at high temperature. The negative electrode consists of bars pressed from a mixture of powdered zinc oxide and metallic zinc in a ratio of 7 to 3 and of 2.5% starch acting as a binding material. The electrolyte of this battery is potassium hydroxide solution and lithium hydroxide, the latter in an amount of 15 g per liter. The capacity of such a battery is 65.8 amp hr per kg. Ni-Zn storage batteries will lose up to 30% of their power in storage for one month.

55. Transistor Circuits for Digital Computers

"The Use of Semiconductor Devices for the Construction of the Basic Elements of Digital Computers," by A. N. Zimarev and Yu. I. Sharapov, Primeneniye poluprovodnikov v elektrotekhn. (The Application of Semiconductors in Electrical Engineering); Leningrad, 1958, pp 45-46 (from Referativnyy Zhurnal--Mashinostroyeniye, No 1, 10 Jan 60, Abstract No 1627)

Circuit diagrams are given for a pulse shaper and a dynamic trigger based on point-contact transistors and for a static trigger, a rectifier, and a pulse amplifier based on junction transistors. The choice of the parameters of the elements of these designs is also discussed.

56. Electronic Reading Machines

"Fundamentals of Reading Machine Construction," by. A. A. Kharkevich; Moscow, Radiotekhnika, No 2, Feb 60, pp 3-9

The article describes briefly certain general principles relating to the construction of electronic character-scanning machines. The author states that compiling of an orderly classification for electronic reading machines is somewhat premature at the present stage of development, but should be attempted when many of the unsolved problems are clarified.

Although a few practical character-scanning electronic machines are in existence, the necessity for further development of certain principles of the scanning procedure is evident. The solution of some of these problems will simplify the technique of scanning, which at present is still rather cumbersome.

The author believes that complete or partial abandonment of arithmetical technique in electronic computers will help in building more simplified electronic character-scanning machines.

57. Irkutsk Computer Center

"Computer Center at Irkutsk" (unsigned article); Moscow, Promyshlenno-Ekonomicheskaya Gazeta, 20 Nov 59.

CPYRGHT

"The development of science and technology and the building of high-capacity power plants and specialized industry in the eastern regions of our nation have created a need for fast computation of complex mathematical problems.

"A large computer center, the first one on the huge territory of Siberia and the Far East, was organized at the Irkutsk State University to fulfill these needs. The solution of a variety of problems of a scientific and industrial nature will be effected here with the help of modern computers.

"The university has already received a new electronic computer, 'Ural', and in the near future will receive more computers and equipment.

"A cadre of mathematicians, electrical engineers, and radiophysicists, needed to service the complex computers, has been trained within the university."

58. Contactless Coders and Decoders

"Contactless Coders and Decoders for Multifrequency Telemetering Systems," by F. A. Katkov, Kiev Polytechnic Institute; Minsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Energetika, No 12, Dec 59, pp 62-65

At the Chair of Automation and Telemetry of the Kiev Polytechnic Institute, simple and reliable contactless coders and decoders were developed suitable for application to multifrequency telemetering systems. The contactless coders comprise the following units: nonself-resetting control keys, frequency-signal generator, capacitors, germanium diodes, limiting resistors, and amplifiers.

At the instant the contacts of the control keys open, the capacitors begin to charge through resistors and diodes. At the instant the telemetering operation begins, the contacts of the control keys close and the capacitors discharge through the input circuits of corresponding generators, which in turn are triggered and feed the multifrequency pulse into the communication channel. Although the amplitude of the frequency-pulse gradually decreases with the discharge of the capacitors, this does not affect to any appreciable degree the performance of the receiving frequency-relays. The two-frequency combination decoder consists of magnetic amplifiers, a relay, frequency discriminators, rectifiers, and diodes. This type of decoder can be used for any number of frequencies in a multifrequency signal, as well as for group selection.

The Chair of Automation and Telemetry has been using these coders and decoders in building multifrequency narrow-band telemetering systems.

Instruments and Equipment

59. Infrared Spectro-Pyrometer

"Experimental Infrared Spectro-Pyrometer," by V. Ye. Finkel'shteyn and N. G. Starunov; Moscow, Izmeritel'naya Tekhnika, No 1, Jan 60, pp 28-30

The infrared spectro-pyrometer IKP-57 designed at the Khar'kov Institute of Measures and Measuring Instruments (KhGIMIP) is intended for precise measurement of temperature under laboratory conditions. The device consists of two detached units: one unit contains the optical system of the instrument, and the other unit contains the electronic components.

The IKP-57 spectro-pyrometer was calibrated for the following four values of wave length: 1,014, 1,250, 1,692, and 2,250 microns as emitted during the solidification of pure zinc, aluminum, and silver. The accuracy of wave length determination is about ± 0.0025 micron. The rms error of temperature determination for the range from 420°C to 960°C varied from 0.4°C to 1.2°C . It was observed that the error in temperature measurement increased with decrease of wave length, especially in the range of lower temperatures.

60. Precision of Electrical Instruments Improved

"Graphico-Analytical Investigation of Optical Systems in Electrical Instruments," by S. M. Deshovoy and B. L. Poshekhonov, Leningrad Order of Labor Red Banner Military-Mechanical Institute; Leningrad, Izvestiya Vysshikh Uchebnykh Zavedeniy, Priborostroyeniye, No 2, 1959, pp 119-126

The Chair of Descriptive Geometry and Drawing at the Leningrad Military-Mechanical Institute, in cooperation with Leningrad Plant "Vibrator," has worked out an improved optical system for various electrical instruments which will increase the precision of readings. The problem was solved by means of a graphico-analytical method with the aid of descriptive geometry and derivation of formulas for precise computation.

The theoretical computations and their being checked at Laboratory No 2 of the "Vibrator" Plant have confirmed that all the problems have been solved satisfactorily. This calculation method for optical-mirror systems for electrical instruments has been approved by the plant and will be incorporated in newly developed instruments.

61. Synchronization Apparatus for Photographing High-Speed Processes

"Some Methods of Synchronization During High-Speed Photography," by S. R. Zhukovskiy; Moscow, Zhurnal Nauchnoy i Prikladnoy Fotografii i Kinematografii, Vol 5, No 1, Jan 60, pp 48-53

The author describes three special cases of high-speed photography with the FP-22 camera which require additional synchronization devices in order to coordinate the camera with the processes being photographed. The tests were conducted at the Moscow State University.

The first case, related to the study of destruction processes in rocks and similar materials, involves synchronization of the camera with the striking moment of a plunger against, in this case, a glass block. The method of synchronization was developed jointly with the All-Union Scientific Research Institute of Drilling Technology.

The second case, developed with the Institute of Metallurgy imeni A. A. Baykov of the Academy of Sciences USSR, involves the use of a special apparatus for studying the deformation of particles of molten metal at the moment they strike the surface of a part in the process of metallization. Photographs were taken at a frequency of 25,000 frames/second.

The third case concerns apparatus used in high-speed photographing of the process of cavitation erosion of solid bodies in an ultrasonic field. The synchronization apparatus used in the experiment, conducted with the cooperation of the ultrasonics laboratory of the Acoustics Institute of the Academy of Sciences USSR, uses two telephone-type relays, a resistor, capacitor, and gas stabilizer and corresponding power supplies.

Diagrams of apparatus and explanations are given for each of the cases studied.

62. Current Corona in Hydrogen

"Some Results of Investigation of a Heavy-Current Corona in Hydrogen," by V. A. Burmakin, V. G. Gubanov, and P. N. Chistyakov; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 2, Feb 60, pp 199-205

A steady corona in hydrogen was studied in a coaxial cylindrical system of electrodes. The instability of the corona voltage U_c during a 50 hours test at a current of $I_1 = 80$ microamp per one cm of electrode length was less than one % of 4 kv voltage, and at $I_1 = 200$ microamp less than 0.2 %. The effect of the corona voltage surge U_c on the form of volt-ampere characteristics was established, and an explanation of "negative" characteristics of the steady corona was furnished. The conditions for finding strong limiting currents $I_p = 1$ ma/cm and higher of the corona were established; the accuracy of reproduction of such currents lies within limits ± 10 % of the mean value. In the transition region between the corona and the glowing discharge, the hysteresis characteristic of discharge was revealed.

63. Hungarian Electronics Laboratory Tests Parts in China

"Tropics and Polar Regions in the Parts Laboratory of the Signal Technology Industry Research Institute," by Erzsebet Kun; Budapest, Magyar Nemzet, 2 Feb 60, p 5

This feature article is based on interviews with Candidate Frigyes Komuves, chief of the Signal Technology Industry Research Institute (Hiradastechnikai Ipari Kutato Intezet), and with Candidate Janos Katona, chief of the parts laboratory of that institute. The testing of parts in "climate chambers" is described. The laboratory attempted to import ants and tropical fungi for these tests, but found that they could not be acclimatized due to the unfavorable effect of Hungarian bacterial flora. Hungarian electronics parts are now sent to Canton for ant and fungi tests. Work on subminiaturization is also discussed. The "pride of the laboratory" is a material produced for condensers: a plastic strip 3 thousandths of a millimeter thick, covered with a silver metallic layer 5 ten-thousandths of a millimeter thick.

64. Contrast in Electron Microscope

"Investigations on Filter Lenses," by E. Hahn, Electron Microscopy Laboratory, Carl Zeiss, Jena; Berlin, Experimentelle Technik der Physik, Vol 7, No 6, 1959, pp 258-268

A report is given of an electrostatic velocity filter with a blocking voltage of only 10 volts at a beam potential of 40 kilovolts. The connection between achromatically conjugated object and pupillary position is discussed, as is the possibility of further reduction of the blocking voltage. The varying effect of contrast screen and filter is illustrated by a series of photographs of an ultrathin section.

Materials

65. Silicon Photocells Found To Be More Sensitive to X Rays Than Germanium Photocells

"The Sensitivity of Silicon Photocells to X Rays," by Ye. M. Lobanov, V. I. Zvyagin, and A. Shalpykov, Physico-Technical Institute of the Academy of Sciences Uzbek SSR and Institute of Nuclear Physics, Academy of Sciences Uzbek SSR; Tashkent, Doklady Akademii Nauk Uzbekskoy SSR, No 6, Jun 59, pp 11-12

Hitherto photocells equipped with germanium photodiodes were regarded as the most sensitive to X rays. It was established in work described in this instance that silicon photocells are more sensitive to X rays than germanium photocells. Silicon single crystals of the p-type into which phosphorus had been diffused from the surrounding gas atmosphere at 1200° were used.

66. Separation of Germanium by Means of Ion-Exchange Resins

"Separation of Germanium From Dilute Solutions by the Method of Ion Exchange," by A. K. Sharova, I. G. Chufarova, M. V. Vittikh, and F. T. Shostak, Ural Affiliate of the Academy of Sciences USSR; Novosibirsk, Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR, No 8, Aug 59, pp 36-41

By investigating the adsorption of germanium on four different ion-exchange resins, it was established that strongly basic anion-exchangers are suitable for the concentration of germanium. It was found that the highest adsorption of germanium takes place at $pH = 5-9$ and that conditions under which the germanium is present in the form of pentagermanic acid are most favorable for the separation of this element by the ion-exchange method.

67. Power Efficiency of Thermoelectric Cooling

"Concerning the Power Efficiency of Thermoelectric Cooling," by V. S. Martynovskiy and V. A. Naer, Odessa Technological Institute of the Food and Refrigerator Industry; Moscow, Kholodil'naya Tekhnika, Vol 36, No 6, Nov/Dec 59, p 59

The authors propose a more precise method for the calculation of installations for thermoelectric cooling. By using this method, the power efficiency of the system in question can be compared with that of installations of other types. Experiments carried out with a semiconductor electrothermal installation of the evaporator type indicated that, as compared with equipment in which direct electric heating is applied, one can reduce the expenditure of electric power in semiconductor evaporator equipment by a factor of 4-5. For the semiconductor materials which were used for these experiments, the most advantageous production capacity corresponds to no more than several tens of calories per hour at temperature differences not exceeding 30-40°. For electrothermal installations of the heat pump type, higher production capacities are of advantage. However, at temperature differences exceeding 40-50°, application of the electrothermal effect is not justified from the practical standpoint.

[SIR Note: This is an abstract of a paper presented at the Tenth International Congress of Cryogenics held at Copenhagen on 19-26 August 1959.]

68. Thermoelectric Cooling

"Thermoelectric Cooling," by Academician A. N. Ioffe, Institute of Semiconductors, Academy of Sciences USSR; Moscow, Kholodil'naya Tekhnika, Vol 36, No 6, Nov/Dec 59, p 59

The thermoelements available at present use 1.5-2 watts of electric power for the removal of every watt of thermal energy at 0° when the temperature difference between the hot and the cold ends of the thermoelement approaches 40°. When this difference is 30°, only 1-1.2 watts are required. The cost of the battery is proportional to the efficiency and may comprise 30-50 rubles per 100 watt. Of great importance are the conditions under which the heat is removed from the hot end of the battery. From an over-all standpoint, one may conclude that application of thermoelectric cooling is practical at present only when applied at small installations; application of this type of cooling at large installations is too expensive. As thermoelements are improved, the boundary between the areas of practical application of thermoelectric and compressor installations will be displaced towards thermoelectric installations.

[SIR Note: This is an abstract of a paper presented at the Tenth International Congress of Cryogenics held at Copenhagen on 19-26 August 1959]

[For additional information on materials, see also under Chemistry, Nuclear Fuels and Reactor Construction Materials.]

Wave Propagation

69. Frequency Multiplication With Reflex Klystron

"Frequency Multiplication at a High Multiplication Factor With a Reflex Klystron," by Ye. N. Bazarov, M. Ye. Zhabotinskiy, and Ye. I. Sverchkov; Moscow, Radiotekhnika, No 2, Feb 60, pp 75-79

It was shown that a high ratio of frequency multiplication can be obtained with a reflex klystron when the input voltage is fed into the gap between reflector and resonator (the bunching space) because, under these conditions, a very effective interaction with the electron beam takes place. This method is well adaptable to almost any type of reflex klystrons, and the frequency multiplication factor can be as high as 30.

In practice, the input signal is fed to the reflex klystron through a coaxial cable or resonator. It was shown that in multiplying the frequency of a meter wave with the aid of a single reflex klystron, 3-cm oscillations of sufficient power were obtained. Power in the range of several tens of milliwatts can be obtained for parallel operation of several reflex klystrons which are terminated with a regenerative (amplifying) klystron. The band-width at which a multiplier operates depends on cathode current, voltage at the reflector, and the frequency multiplication factor. Power of the order of 500 to 1,000 microwatts was obtained from a single reflex-klystron multiplier when operating with a multiplication factor of 30.

The values obtained with the derived formulas for a reflex-klystron frequency multiplier were in good agreement with actual measurements.

70. Investigation of Retarding-Field Oscillators

"Investigation of Triggering Mechanism in Retarding-Field Relaxation Oscillators," by V. V. Grigorin-Ryabov; Moscow, Radiotekhnika, No 2, Feb 60, pp 58-66

Wide application of retarding-field relaxation oscillators in computer technology and in systems of automatic control requires a clear and precise understanding of the triggering mechanism in such devices.

A new method for triggering mechanism investigation in retarding-field relaxation oscillators, which utilizes the amplitude characteristics of nonlinear four-pole networks, is described. It is shown that there exist several zones within which the amplitude of triggering voltage can be selected for proper operation. The value for the lowest permissible steepness of the leading edge of the triggering voltage and the optimum value for internal impedance of the generator of this voltage are derived. The effect of a blocking capacitor on the triggering mechanism in a relaxation oscillator is clarified.

The proposed method for investigation of the triggering mechanism in a retarding-field relaxation oscillator permits formulating unified theory applicable to most types of relaxation oscillators now in use. This method also permits disclosure of the relaxation processes during triggering in greater detail and the accomplishment of engineering calculations with higher precision.

71. Wave-Guide Testing for Irregularities

"Device for Wave-Guide Investigation of Irregularities," by
A. S. Vladimirov; Moscow, Elektrosvyaz', No 2, Feb 60, pp 3-13

The precise measurement of reflection from irregularities in a wave guide is highly desirable in the design of multichannel relay communications lines, in which the power to the antenna is fed through a long wave guide (150 m). In a 600-channel radio-relay system with an antenna-feed wave guide of 120 m, the reflection from each wave-guide joint should not exceed 0.2%.

The State Scientific-Research Institute of the Ministry of Communications USSR has developed a special UIN-1 device. The range-detection principle is utilized here for investigation of wave guides. The UHF energy in form of short pulses is fed into the examined wave guide, and the combination direct and reflected pulses are observed on the screen of the cathode-ray tube. The irregularity measurement in the wave guide is performed by comparison of the magnitude of reflected and direct pulses by adjusting the attenuation so that the direct pulse amplitude becomes equal to the reflected pulse amplitude as observed prior to attenuation. The UIN-1 device has the following characteristics: carrier frequency of probing pulse is 3,550 Mc, resolving power for measurement of distance between the irregularities is 1.5 m, accuracy of distance measurement is ± 20 cm, minimum detectable ratio of reflected pulse amplitude to the direct pulse amplitude is $10^{-4}\%$, and accuracy of reflection measurement is ± 2 db. The duration of UHF test pulses was of the order of 10 millimicrosec.

The device was also used in investigation of a large number of coaxial cables for various institutes of the Committee for Radioelectronics and Cable Industry. The device was used in measurement of attenuation in wave guides of very great length; however, the accuracy of such measurements was rather low, of the order of $\pm 2-3$ db.

72. Determination of Parameters for Multichannel Line Repeaters

"Determination of Principal Parameters for Transistorized Multichannel Repeaters on Cable Trunk Lines," by A. I. Borisov; Moscow, Elektrosvyaz', No 2, Feb 60, pp 45-53

The evaluation of analytical dependencies between basic parameters of multichannel line repeaters and the parameters of a trunk line permits direct calculation of such principal repeater parameters as maximum

and minimum permissible transmission level of line repeaters and the magnitude of nonlinear attenuation. Examination of the determined dependencies has proved the feasibility of building multichannel trunk communication lines which satisfy the norms with regard to permissible noise and incorporating line repeaters of various parameters, depending on the selected length of the repeater link.

It was found that the lowest requirements as to nonlinear attenuation of the line repeater occur when amplification is equal to one nepier and that the lowest requirements as to the transmission level occur when amplification is equal to 0.5 nepier. Thus the established fact permits a considerable reduction in the requirements set for the principal parameters of multichannel line repeaters when the attenuation of the repeater section is reduced to 1-2 nepiers; this in turn permits the construction of transistorized multichannel repeaters to be simplified.

An example of multichannel line-repeater parameters calculation is presented for a 300-channel coaxial cable telephone line.

73. Quasicircular Electric Wave

Distribution of a Quasicircular Electric Wave in a Cross-Shaped Wave Guide," by V. M. Sedykh and A. F. Zorkin, Kharkov State University imeni Gor'kiy; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 2, Feb 60, pp 159-164

The study of wave guides with a cross-shaped section at Kharkov University showed that such wave guides are intermediary with respect to their parameters between rectangular and circular wave guides. The possibility of propagation of a quasicircular electric wave in such wave guides, with low losses in a wide frequency range and without a "satellite" wave, is demonstrated. Formulas are derived for the determination of the critical frequency and the attenuation constant of such a wave.

Miscellaneous

74. New Publications in Radio Engineering

"Radio Engineering Literature in 1960 -- Gosenergoizdat," by A. Smirnov, director of Gosenergoizdat; Moscow, Radio, No 2, Feb 60, p 63

Publication plans of the Gosenergoizdat Publishing House for 1960 include a series of handbooks on radio engineering, among which are a translation of the two-volume Radiotekhnicheskiy spravochnik (Radio Engineering Handbook), published in 1956 in the Federal Republic of Germany, and Spravochnik radioinzhenera (Radio Engineer's Handbook), a translation of the American handbook on applied radio engineering.

Gosenergoizdat will publish, in addition to a number of Soviet books on problems of television and television engineering, Spravochnik po televizionnoy tekhnike (Handbook on Television Engineering), translated from English.

Publication of Slovarya radiolyubitelya (Radio Amateur's Dictionary) by S. E. Khaykin was completed in 1959. The second edition of this dictionary has been considerably revised and appended with new terms, with translations of words into English, German, and French.

IV. ENGINEERING

75. On the Circling of an Object on the Earth's Surface

"On the Circulation of an Object on the Earth's Surface," by V. N. Kalinovich, Institute of Mathematics, Academy of Sciences Ukrainian SSR; Kiev, Dopovidi Akademii Nauk Ukrains'koy RSR, No 8, 1959, pp 837-841

Formulas are derived for the change in the northern and eastern components of the linear velocity of an object moving along a circle on the Earth's surface. It is shown that the formulas $V \cos \omega t$ and $V \sin \omega t$, which are ordinarily applied to describe this form of motion, are inaccurate, being the first approximation of the formulas derived in the article. It is further demonstrated that with large radii of circulation, the application of the usually applied formulas may lead to considerable errors in the determination of the northern and eastern components of the linear velocity of the object. The motion taking place according to the formulas $V \cos \omega t$ and $V \sin \omega t$ is not circulation, but motion along some closed curve inscribed in a spherical zone.

76. Analysis of Stresses in Thin-Walled Circular Cylindrical Shell

"Calculating a Uniform Circular Cylindrical Thin-Walled Shell," by Yu. G. Odinkov, Tr. Kazansk. aviats. in-ta (Works of the Kazan Aviation Institute), 43, 1958, pp 55-59 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 21, 10 Nov 59, Abstract No 88919)

A solution is given for the problem of determining the stresses in a thin-walled cylinder consisting of a thin shell reinforced by stringers and ribs and subjected to an arbitrary loading system. The supporting arrangement is also arbitrary. Expressions are derived for the coefficients of the differential equations of deformation established by the author (Trudy KAI, [Works of the Kazan Aviation Institute], No 18, 1946); the method of determining this deformation and, on the basis of it, the stresses in the elements of the cylinder are demonstrated.

77. Computing Optimal Stage Parameters in Turbine Design

"A Method of Computing Steam and Gas Turbines," by G. A. Zal'f and V. V. Zvyagintsev, Tr. Nevsk. mashinostroit. z-da 1957 (1957 Works of the Neva Machine Building Plant), No 1, 1958, pp 92-123 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 1, 10 Jan 60, Abstract No 2014)

A description is given of a method of computing the inlet-to-outlet section of steam and gas turbines. The method, which was devised, and is now used, by the Neva Machine Building Plant imeni Lenin, is based on the results of research conducted in the self-modeling region ($Re > 10^5$, $M < 1.1$) of a multistage experimental turbine. The individual stages had an output nozzle angle of 13.5 degrees and output blade angles of 22-25 degrees. With an average diameter of one meter and a nozzle height of 12-100 millimeters, the per stage efficiency amounted to 71-89 percent, with optimal u/c_0 . Added packing increased the efficiency to 75-90 percent. The optimal lower overlap for the tested stages was 1 - 1.5 millimeters; the optimal upper overlap was 2.5-3.0 millimeters, disregarding the height of the nozzle. A procedure is described for making the choice of optimal stage parameters on the basis of technical-economic considerations with respect to both economy and stability of construction. For partial stages, the optimal dimensions are chosen so that expulsion and ventilation losses are taken into account (empirical formulas given for them). Stages with long blades twisted in accordance with the rule, $r_{\theta}^2 = \text{constant}$, were calculated by means of velocity triangles, with the well-known relationship of V. V. Uvarov taken into account. The losses and the efficiency were determined on the basis of the experimental data. Of the tested two-crown stages, the two best stages (with nozzle heights of 15 and 18 millimeters, various arches of feed line, and average diameter of one meter) were accepted by the plant.

78. Stability of Ships on Basis of Hydrodynamic Theory of Rolling and Pitching

"The Application of the Hydrodynamic Theory of Rolling and Pitching to the Calculation of the General Stability of Ships," by Yu. V. Remez, Tr. Nikolayevskogo korablestroit. in-ta (Works of the Nikolayev Ship Building Institute), No 9, 1958, pp 3-13 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 23, 10 Dec 59, Abstract No 98240)

A linear method, based on the hydrodynamic theory of rolling and pitching, is considered for determining the additional shearing forces and bending moments for an arbitrary course of a ship on a regular sinusoidal swell. The use of this method affords the possibility of

accounting for dynamic factors, of avoiding the solution of systems of algebraic equations, and of closing, without difficulty, the curves of the shearing forces and bending moments at the bow and stern of a ship. In accordance with hydrodynamic theory, expressions are obtained for the components of the shearing force and bending moment caused by damping, by the inertia of the liquid, and by the disturbing force of the waves, whereby the coefficient of damping and the additional mass are determined by means of an approximate formula. A system of differential equations of pitching (longitudinal) is derived on the basis of these disturbances. A partial solution of the system is found in complex form, which facilitates a certain simplification of the solution. Simplified formulas are derived for the shearing force, the bending moment, and the characteristic of rolling and pitching, assuming all to be symmetrical with respect to the midship point.

79. Soviet Textbook on Positive Pressure Pumps for Jet Engines

Agregaty Vozdushno-Reaktivnykh Dvigatelye. Zhidkostnyye Ob'yemnyye Nasosy (Jet Engine Accessories. Liquid Positive-Pressure Pumps), by M. V. Razdolin, Moscow, State Publishing House for the Defense Industry, 1959, 186 pp

The book deals with the efficiency and uniformity of delivery of liquid pumps, their characteristics, design, manufacturing methods, materials, and operating conditions. A method is described for selecting the basic parameters and testing their operational reliability; the technical requirements of the basic parts are given, as well as examples of complete designs. The book is intended for students, but may be of interest also to specialists engaged in engine design and construction.

The foreword reads as follows: "This is the first textbook in the course, 'Ram-Jet Engine Accessories,' given by the author at the Moscow Order of Lenin Aviation Institute imeni Sergo Ordzhonikidze. The material in the book is based on data taken from the literature, industrial-technical data, and personal research done by the author.

CPYRGHT

"The development of aviation engine designs has been enhanced by the improvements in their accessories. As applied to aviation engines, the term accessory usually refers to a portion of the engine which constitutes a complete subassembly and which serves and regulates the engine. Among the accessories of an engine belong the pumps, various elements of the hydraulic systems, the starting device, regulators, servomechanisms, propeller hubs, and several other devices.

"Problems dealing with the design and planning of aviation engine accessories are elucidated both in the general courses on engines and power plants and in special works devoted to special problems of assembly design.

"At the present time, the need is obvious for a special textbook on the design and planning of jet-engine accessories. This book, which represents the first attempt to publish such an aid, is devoted to liquid positive-pressure pumps.

"Associates of the design office and industrial establishments have considerably aided the author in the selection of the material.

"Considerable help was given in the publication of this textbook by Prof G. S. Skubachevskiy, V. I. Polikovskiy, and Docent K. A. Kryukov; Candidate of Technical Sciences A. N. Dobrynin and engineers V. S. Pogorov and Ye. M. Yudin have contributed valuable criticism.

"To the above persons and to associates of the chair who assisted in the preparation of the manuscript for publication, the author extends sincere thanks.

"Observations and suggestions of possible improvements of the textbook will be gratefully received by the author."

The type of pump discussed is defined as a "volume" (positive-pressure) pump, which includes gear pumps, rotary pumps, piston pumps, and plunger pumps; this type is also referred to as a "displacement pump." This category thus embraces all types of fluid pumps except centrifugal pumps.

80. Influence of Surface Roughness on Compressor Cascade Drag

"The Influence of Surface Roughness of the Blades on the Drag of a Compressor Cascade," by B. N. Chizhov, Tr. Ufinsk. aviats. in-ta (Works of the Ufa Aviation Institute), 1957 (1958), No 4, pp 105-117 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 23, 10 Dec 59, Abstract No 99238)

Experimental data are given on the dependence of the power loss factor on surface quality of the blades.

81. Angle of Attack Fluctuation at Vane Wheel

"Fluctuations of the Angle of Attack on a Moving Cascade by A. N. Rakhmanovich, Tr. Ufinsk. aviats. in-ta (Works of the Ufa Aviation Institute), No 4, 1958, pp 3-20 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 23, 10 Dec 1959, Abstract No 99237)

The fluctuations of the angle of attack on the blades of an operating (turbine) wheel, caused by the heterogeneity of the field of the velocity vector beyond the immobile cascade and a design of the stage of an axial vane-type machine, are given.

82. Simplified Method of Determining Parameters of Gas-Turbine Installation

"On One Method of Determining the Optimal Parameters of a Gas Turbine Installation," by V. I. Fulanin, Tr. Leningr. politekhn. in-ta, (Works of the Leningrad Polytechnic Institute), No 193, 1958, pp 119-133 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 22, 25 Nov 59, Abstract No 94489)

A method is devised for solving the problem of the determination of the optimal parameters of a compound gas-turbine installation by computing the maximum efficiency of the installation as a function of certain variables. The solution amounts to a determination of coefficients in the case of differential independent variables, i.e., to a determination of partial derivatives of the efficiency for each of the independent variables. In this method, the number of equations is equal to the number of unknown parameters; in this respect, it is easier than the Lagrange method. It can also be further simplified. The equations for a two-shaft gas turbine installation with two turbines, two combustion chambers, and two compressors are used as an example.

83. Low-Loss Electric Power Line

"Losses and Efficiency of an Electric Power Transmission Line Tuned to Half-Wave Length," F. A. Zykin, Chelyabinsk Polytechnic Institute; Minsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Energetika, No 12, Dec 59, pp 11-14

An electric transmission line tuned to a half-wave length is characterized by the state of complete compensation, i.e., such a line will not consume nor generate any reactive power. In such a line, the voltage vector and the current vector, at the beginning and at the end of

the line, are shifted 180° with respect to each other, and the values of current and voltage will be greater at the beginning of the line. It was shown by theoretical calculations and experimental investigation that the maximum efficiency for such a line is independent of the line voltage. It was also shown that the half-wave transmission line characteristics can be considerably improved by proper voltage regulation, i.e., when operating under reduced load, the line voltage should be reduced to such values so as to correspond to normal equivalent operating conditions.

84. Expansion of Synchronous Motor Usage

"Expanding the Field of Application of Synchronous Motors in Industry," by I. S. Syromyatnikov; Moscow, Vestnik Elektropromyshlennosti, No 1, Jan 60, pp 70-71

On 9 June 1959 at the State Scientific and Technical Committee of the Council of Ministers USSR, a conference took place on the subject of expanding the field of application of synchronous motors in industry. It was suggested that the newly designed motors be excited with the aid of solid-state rectifiers and that magnetic clutches be incorporated in these motors which will permit easy starting while the load is off. It was noted that the production of synchronous motors was unsatisfactory from the standpoint of both volume and types and that many of the synchronous motors now manufactured are technically obsolete, while the newly developed series does not satisfy fully the requirements in regard to speed, voltage, and rated power.

The conference pointed out the necessity for working out a unified series of synchronous motors based on standard scale of rated capacity and speed. An abnormal condition with respect to the scarcity of technical literature on the subject was noted, and it was suggested that the Central Institute of Scientific-Technical Information on the Electrical Industry should initiate mass publication of literature on the subject of construction and performance of synchronous motors.

85. Yugoslav Fair of Technology in Belgrade Announced

"Exhibit of Nuclear Energy Will Appear as Part of 1960 Fair of Technology in Belgrade" (unsigned article); Zagreb, Borba 5 Mar 60, p 5

The Fourth International Fair of Technology, to be held 23 August-2 September 1960 in Belgrade, will be limited to products of the machine, electrical, and metallurgical industries. All of Hall 3 will be devoted

to exhibits of nuclear energy. The general section of the exhibit will show the organization of the Federal Commission for Nuclear Energy and its activity. Models of the three institutes of nuclear energy will be shown. The methods of exploring for and exploiting uranium ore and the areas in which it is found will be clearly presented. Another group of exhibits will show the electronic equipment used by the institutes.

A model of a 2.5-meter-high reactor in cross-section will be the central attraction of this exhibit. The technological channels, circulation of water, the control system in operation, and the control panel will be clearly shown. The model will include an apparatus with the aid of which the visitor can obtain artificial radioactive isotopes. The production and application of isotopes obtained by the new reactor at Vinca will be explained in a special section of the exhibit. A model of nuclear-powered equipment for producing electricity will also be displayed. Numerous exhibits will present the achievements in biological applications of nuclear energy.

86. Supplementary Plasmas on an Anode

"Anode Region in a Gas Discharge at Low Pressure. III. The Appearance of Supplementary Plasmas on the Anode," by B. N. Klyarfeld and N. A. Neretina, All-Union Electrical Engineering Institute, Moscow; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 2, Feb 60, pp 186-198

Spots appearing on the anode during low-pressure discharge in mercury vapor, inert gases, and hydrogen were investigated. By introducing a probe into the spot on the anode side, it was possible to study the properties of the spot. The distribution of spots on the anode in a regular pattern was explained as the result of inverse action of each spot on the surrounding discharge region.

V. MATHEMATICS

87. Inelastic Scattering in an Unrelativistic Approximation

"Dispersion Relationships for Inelastic Scattering in Nonrelativistic Approximation," by D. Ya. Petrina; Kiev, Ukrainskiy Matematicheskiy Zhurnal, Vol 11, No 3, Jul/Aug/Sep 59, pp 267-274

Inelastic scattering is considered in nonrelativistic approximation. Fredholm's method for a system of integral equations is applied to solve this problem. The author proves that under certain conditions imposed on the potential, the amplitudes of scattering typical for elastic and inelastic scattering permit an analytical continuation in a complex E-plane.

Dispersion relations are derived.

88. Particular Integro-differential Equation Solved

"Concerning One Problem for a Functional Equation," by R. I. Alikhanova, Institute of Physics and Mathematics Academy of Sciences Azerbaydzhan SSR; Baku, Doklady Akademii Nauk Azerbaydzhanskoy SSR, Vol 15, No 5, May 59, pp 371-374

In the work, the solution of the integro-differential equation

$$\frac{\partial u}{\partial t} \sum_{\Sigma m_s} \varphi^{(m_1, \dots, m_n)} \left[\int_0^1 \int_0^1 u^2 dx_1 \dots dx_n \right] \\ \frac{\partial^{m_1+m_2+\dots+m_n} u}{\partial x_1^{m_1} \dots \partial x_n^{m_n}} \quad (1)$$

is investigated under the conditions

$$u|_{t=0} = F_1(x_1, x_2, \dots, x_n) \quad (2)$$

$$u|_L = 0. \quad (3)$$

$\varphi^{(m_1, m_2, \dots, m_n)}(z)$ is a continuous function for all $z > 0$. The function $F_1(x_1, x_2, \dots, x_n)$ is expanded into a sine series. The solution of problem (1), (2), (3) is sought in the form of the series.

$$u(t, x_1, \dots, x_n) = \sum_{\sum K_s=1} A_{K_1, K_2, \dots, K_n}(t) \sin K_1 x_1, \dots, \sin K_n x_n. \quad (4)$$

The problems (1), (2), (3) reduces to the solution of the infinite system of ordinary differential equations

$$A_{K_1, K_2, \dots, K_n}(0) = a_{K_1, \dots, K_n} \quad (5)$$

with the initial conditions

$$A'_{K_1, K_2, \dots, K_n}(t) + \sum_{\sum m_s \leq 2p} \varphi^{(m_1, m_2, \dots, m_n)} \left[\left(\frac{\pi}{2}\right)^r \sum_{\sum i_s=1} A_{i_1, \dots, i_n}^2(t) \right] \chi_{(K_1)^{m_1} (K_2)^{m_2} \dots \dots (K_n)^{m_n}} A_{K_1, K_2, \dots, K_n}(t) = 0 \quad (6)$$

The problem (5), (6) is solved by the method of reduction.

In the work, the existence of a solution for the problem (5), (6), as well as a solution for the problem (1), (2), (3), is proved.

Several auxiliary lemmas are also proved.

89. Method for Finding the Characteristic Indexes of a System of Two Linear Homogeneous Differential Equations

"The Search for Characteristic Indexes of a System of Two Linear Homogeneous Differential Equations Having Periodic Coefficients Containing a Small Parameter," by P. B. Golokvoschus; Minsk, Doklady Akademii Nauk BSSR, Vol 3, No 9, Sep 59, pp 361-367

The system

$$\frac{dX}{dt} = X[\bar{U}_1 \varphi_1(t) + \mu \bar{U}_2 \varphi_2(t)] = X P(t), \quad (1)$$

given in matrix form, is considered where the differential substitutions

\bar{U}_k ($k=1,2$) are any real matrices of the second order; $\varphi_k(t)$ ($k=1,2$) are continuous periodic functions of period $\omega = 1$, satisfying the condition

$$\int_0^1 \varphi_k(t) dt = 0 \quad (k=1, 2); \quad (2)$$

X is an integral matrix, and μ is a small real parameter. A knowledge of the characteristic indexes of system (1) is necessary to investigate the behavior of its solutions. A method is given in the present work for determining these indexes on the basis of the characteristic matrix of a reduced system.

90. Region of Stability for a Hill Equation Defined and Found Exactly

"Boundedness Test and the Exact Evaluation of the Multipliers of Solutions to the Equations of Hill," by T. M. Karaseva, Kharkov Automobile Road Institute, Ministry of Higher Education UkSSR; Moscow, Doklady Akademii Nauk SSSR, Vol 127, No 6, Aug 59, pp 1161-1163

Q_α denotes the set of all real periodic functions $q(x)$ ($q(x+T) = q(x)$), the squares of which are integrable on the interval $(0, T)$ and satisfy the conditions

$$\begin{aligned} 1) \quad T \int_0^T q^2(x) dx &= \alpha, \\ 2) \quad \int_0^T q(x) dx &= 0. \end{aligned} \quad (1)$$

The set of all generalized functions $p(x)$ of the form $p(x) = q'(x) + \gamma$ ($\gamma \geq 0, q \in Q_\alpha$) is denoted by $P_{\alpha\gamma}$. It is noted that

$$\gamma = \frac{1}{T} \int_0^T p(x) dx.$$

The differential equation

$$y'' + p(x)y = 0 \quad (p(x) \in P_{\alpha\gamma}, \quad -\infty < x < \infty) \quad (2)$$

is then considered. If for all $(p(x) \in P_{\alpha\gamma})$ the solutions of equation (2) are bounded then it will be said that the point (γ, α) belongs to the region of stability.

M. G. Kreyn (Prikl. matem. i mekh., Vol 19, 1955, p 641) proved that all points (γ, α) , for which

$$\alpha < 2 - \frac{1}{2\pi} \pi^4 \gamma^2, \quad \gamma \geq 0, \quad (3)$$

belong to the region of stability. He also proved that the region of stability contains the segment

$$\gamma = 0, \quad 0 < \alpha < \frac{\pi^2}{4}. \quad (4)$$

The criterion (3), obviously, is not exact, since for $\gamma = 0$ condition (3) must be greater than condition (4).

Exact boundaries of the region of stability are found in the present work.

91. Subtheories of the Solutions of Differential Equations

"The Local Properties of the Solutions for Differential Equations in Partial Derivatives Having Constant Coefficients," by G. Ye. Shilov; Moscow, Uspekhi Matematicheskikh Nauk, Vol 14, No5(89), Sep/Oct 59, pp 3-44

The three classical equations of mathematical physics are: the Laplace equation

$$u_{xx} + u_{yy} = 0, \quad (1)$$

the equation of heat conductivity

$$u_y - u_{xx} = 0, \quad (2)$$

and the wave equation

$$u_{xx} - u_{yy} = 0, \quad (3)$$

which differ significantly, in particular, according to the local properties of their solutions. Any solution $u(x, y)$ of the equation (1) in a particular region G of the xy plane has derivatives of all orders in that region and in the neighborhood of each of its points can be expanded into a power series of x and y ; that is, it is an analytical function of x and y . Any solution of equation (2) in a region G has derivatives of all orders; however, generally speaking, it is not an analytic function. Finally, among the solutions of the equation (3) there are functions not possessing derivatives of all orders, for example, derivatives of the forms $f(x+y)$, where $f(\xi)$ is any twice (but not more) differentiable function

Consider a differential equation with the constant coefficients

$$P\left(i \frac{\partial}{\partial x_1}, \dots, i \frac{\partial}{\partial x_n}\right) u(x_1, \dots, x_n) = 0, \quad (4)$$

where P is a polynomial of degree m of its arguments. This equation may possess a property analogous to the property of the equation of Laplace, namely, that all solutions of equation (4) are locally analytic according to each of the real variables x_1, \dots, x_n . In this case, one will call the equation (4) an elliptic equation. If equation (4) possesses a property analogous to the property of the equation for heat conductivity, namely, that all solutions of (4) are locally infinitely differentiable, we will call equation (4) analogous to that of Semir Schwartz (Fac. sci. Paris, 1954/55), a hypoelliptic equation. Like the wave equation, equation (4) may be neither elliptic nor hypoelliptic. The problem arises as to which of the indicated types equation (4) belongs.

The answer to that problem (brought up by L. Schwartz) was given by L. Hoermander ("On the Theory of General Partial Differential Operators," Acta Math, No 94, 1955, pp 161-248). The author presents the results of Hoermander and the results of others which pertain to his and which somewhat simplify the proofs, minimizing the technique of Hilbert spaces constructed according to differential operators. In the author's opinion, these do not lie at the essence of the problem. The present work, not claiming completeness, has as its goal only to indicate existing subtheories remaining within the particular bounds.

92. Singular Integral Equations Solved Without Employing Theory of Automorphic Functions

"On One Class of Singular Integral Equations, Effectively Solved," by R. S. Isakhanov, Academy of Sciences Georgian SSR, Tbilisi Mathematics Institute imeni A. M. Razmadze; Tbilisi, Soobshcheniya Akademii Nauk Gruzinskoy SSR, Vol 23, No 3, Sep 59, pp 257-264

Let L_0 be a simple, closed, smooth contour in the complex plane $z = x + iy$. The singular integral equation

$$a(t_0) \varphi(t_0) + \frac{b(t_0)}{\pi i} \sum_{p=0}^{n-1} \int_{L_0} \frac{\varphi(t) dt}{t - w_p(t_0)} + \sum_{q=1}^m A_q(t_0) \int_{L_0} B_q(t) \varphi(t) \times dt = f(t_0) \quad (1)$$

is considered where $a(t_0)$, $b(t_0)$, $A_q(t_0)$, $B_q(t_0)$ ($q=1, 2, \dots, m$), $f(t_0)$

are given functions of class H , $\varphi(t)$ is the function sought which satisfies the condition H , and $w_0(t_0) = t_0, w_1(t_0), \dots, w_{n-1}(t_0)$ are linear fractional functions forming the group.

In the joint work of F. D. Gakhov and L. I. Chibrikova ("Concerning Several Types of Singular Integral Equations, Solvable in close form," Matem. sb., Vol 35, No 3, 1954), the problem of an effective solution for the equation

$$a(t_0) \varphi(t_0) + \frac{b(t_0)}{\pi i} \sum_{p=0}^{n-1} \int_{L_0} \left[\frac{1}{t - w_p(t_0)} - \frac{1}{t - w_p(\infty)} \right] \varphi(t) dt = f(t_0), \quad (1')$$

is considered, which is a partial case of the equation (1). The authors give an effective solution for the equation (1') with the application of the theory of automorphic functions. It is proved in the present work that an equation of the form (1) (and also several more general equations) can be solved effectively using a completely simple method, without application of the theory of automorphic functions.

93. Asymptotic Estimates of the Functions of Logic Algebra

"Asymptotic Estimates of the Complexity of the Formulas Which Form the Functions of Logic Algebra," by O. B. Lupanov, Mathematics Institute imeni V. A. Steklov, Academy of Sciences USSR; Doklady Akademii Nauk SSSR, Vol 128, No 3, Sep 59, pp 464-466

Asymptotic expressions are derived by employing formulas over a finite basis for a function of minimum complexity and sufficient for formation of any function of logic algebra having n arguments. The obtained results may be generalized over infinite bases satisfying certain conditions, as well as for the case of functions of a k -valued logic.

94. Integral Multiformality of a System of Nonlinear Differential Equations

On a Periodic Integral Multiformality of a Nonlinear System of Differential Equations With a Small Parameter Containing Derivatives," by K. V. Zadiraka; Kiev, Ukrainskiy Matematicheskiy Zhurnal, Vol 11, No 3, Jul/Aug/Sep 59, pp 243-250

If f and F are sufficiently smooth periodic vectors of dimensions n and m , respectively, and the real parts of the eigenvalues of the matrix F'_z are negative, the system

$$\frac{dx}{dt} = f(t, x, z), \quad \mu \frac{dz}{dt} = F(t, x, z)$$

has a single integral multiformity $z(t, x, \mu) = \varphi(t, x) + \psi(t, x, \mu)$, where $\varphi(t, x)$ is a root of the system $F(t, x, z) = 0$, while $\psi(t, x, \mu) \rightarrow 0$ as $\mu \rightarrow 0$ permitting limited and uniformly continuous derivatives with respect to x and the parameter μ .

95. Approximation of Differentiable Functions by Linear Positive Operators

"The Asymptotic Value of the Approximation of Differentiable Functions by Linear Positive Operators," by R. G. Mamedov, Institute of Physics and Mathematics, Academy of Sciences Azerbaydzhan SSR; Moscow, Doklady Akademii Nauk SSSR, Vol 128, No 3, Sep 59, pp 471-474

Let $L_n(f; x)$ be a sequence of linear operators defined for each function $f(x)$ of a given class. We set

$$\Delta_n(f; x) = L_n(f; x) - f(x) = L_n[f(t); x] - f(x).$$

Investigation of the order of magnitude of the quantity $\Delta_n(f; x)$ for a definite class of linear positive operators is one of the important problems of the constructive theory of functions. This problem has been investigated similarly for certain particular linear positive operators. Asymptotic equalities for the approximation of functions were obtained by Ye. V. Voronovskaya (DAN (A), 79(1932)), I. P. Natanson (Konstruktivnaya teoriya funktsiy [Constructive Theory of Functions], Moscow-Leningrad, 1949; DAN, Vol 113, No 2, 1957), P. P. Korovkin (DAN, Vol 114, No 6, 1957; Usp. matem. nauk, Vol 13, No 6(84), 1958), and others.

Several general theorems concerning the asymptotic value of the approximation of functions by linear positive operators are established in the present work.

96. Quadrature Formula of Cotes

"Concerning the Signs of Coefficients in the Quadrature Formula of Cotes," by V. I. Krylov; Minsk, Doklady Akademii Nauk BSSR, Vol 3, No 11, Nov 59, pp 435-439

Equations of the form

$$\int_0^1 p(x) f(x) dx = \sum_{k=0}^n A_k f\left(\frac{k}{n}\right),$$

exact for any polynomial f of degree not higher than n , are called the formulas of Cotes. Here $p(x)$ may be any summable function not equivalent to zero.

For the case of the constant weighting function $p(x) = 1$, it is known that for $n \gg 10$ there will always be negative coefficients among the coefficients A_k ($k=0, \dots, n$) (see S. N. Bernshteyn, "Concerning the formulas of Cotes and Tchebycheff," Sobr. soch., Vol 2, No 67, Academy of Sciences USSR, 1954. The assumption that for any function $p(x)$ there exists a number $N = N(p)$ such that for any $n \gg N$ the coefficients A_k ($k=0, 1, \dots, n$) will not have the same sign is very probable.

The case of a constant weight $p(x)$ apparently is the only one in which there will be limited knowledge concerning the bound of $N(p)$. For cases different from a constant, estimates of $N(p)$ have not been found, to the knowledge of the author.

In the present work, an estimate obtained by the author for the weighting function

$$p(x) = x^\beta (1-x)^\alpha \text{ is considered.}$$

It is not assumed that the coefficients A_k are different from zero during the description of the Cotes formula (1). For judgment concerning the number of coefficients not equal to zero, it will be sufficient in the future to test the correctness of the following assertion pertaining to any interpolation by mechanical quadratures:

$$\int_a^b p(x) f(x) dx = \sum_{k=0}^n A_k f(x_k).$$

97. Theorems Representing Further Generalization of Korovs' Theorem

"Concerning the Asymptotic Behavior of Sequences of Orthogonal Polynomials," by T. Frey; Moscow, Matematicheskiy Sbornik Vol 49 (91), No 2, Oct 59, pp 33-180

Many results are known, with the help of which one can characterize the asymptotic behavior of a sequence of polynomials, orthogonal with respect to a nonnegative weighting function. The majority of these have a broader character; but there also exist local results, that is, results which restrict the weighting functions to only definite intervals or only to one point (see, for example, G. Szegoe, Orthogonal Polynomials, New York, 1939; Ya. L. Geronimus, "Concerning Several Asymptotic Relations in the Theory of Orthogonal Polynomials," DAN SSSR, Vol 96, No 6, 1954, pp 1097-1099; Ya L. Geronimus, "Concerning Asymptotic Properties of Orthogonal Polynomials," Publ. inst. math. Ac. Serbe des sci., Vol 9, 1957,

pp 19-32). The latter theorems also contain strong broader structural conditions pertaining to the entire interval of orthogonality. However, with respect to the problems concerning asymptotic behavior, there are no theorems known which are analogous to the "comparison" theorem of J. Korovs (Rozpravy Ceske Ak., Vol 2, No 48, 1938, p 12) or to its generalization (L. Fejer, "Concerning the Trigonometric Polynomial," Journ. reine und angew. math., Vol 146, 1915, p 53), and for that reason we are generally not able to localize the broader results.

In the present work, several such theorems are indicated which may be considered as a further generalization of Korovs's theorem.

98. Entropy of a Sequence of Mutually Independent Random Variables Estimated

"Concerning a Statistical Estimate for the Entropy of a Sequence of Independent Random Variables," by G. P. Basharin; Moscow, Teoriya Veroyatnostey i Yeye Primeneniya, Vol 4, No 3, Jul/Aug/Sep 59, pp 361-364

The mean and variance are computed for a statistical estimate for the entropy of a sequence of mutually independent random variables having a similar distribution. The estimate is shown to be biased, consistent, and asymptotically normal.

99. Chinese Work on Harmonic Functions in Classical Domains

"Theory of Harmonic Functions in Classical Domains," by Hue Lo-keng (華 羅 庚) and Lu Ch'i-keng (陸 啟 鏗), Institute of Mathematics, Academia Sinica; Peiping, K'o-hsueh T'ung-pao (Scientia), No 19, 26 Oct 59, p 649

This item announces the recent publication of a document which reports in four chapters the results of 2 years' research which culminated in the authors' establishing the theory of harmonic functions in classical domains.

According to the item, Chapter One introduces the notion of slit spaces and finds their limit values. Chapters Two and Three treat the hyperbolic spaces of matrices and a Lie-sphere. In these chapters, the respective boundary value problems are also solved. Chapter Four discusses applications for the new theory in other branches of mathematics.

[SIR Note: An English version of this work is published in the October issue of Scientia Sinica.]

100. State of Operations Research in China

"We Should Vigorously Develop Operations Research," by Sun K'o-ting (孙克定) and Chu Yung-ching (朱永津), Institute of Mathematics, Academia Sinica and Li Hsiu-mu (李修睦), Department of Mathematics, South China Normal College; Peiping, K'o-hsueh T'ung-pao (Scientia), No 2, 26 Jan 60, pp 53-54

In this article, the authors briefly discuss some important theories in operations research, namely, programming theory, queueing theory, game theory, etc., giving examples of their applications. The military application of game theory is stressed. The following information concerning progress in other countries and in China is given.

Since World War II, many people in capitalist countries, particularly the US and Britain, have pursued studies in operations research. In these countries the armed forces, major industries, and some higher schools have established research organs which specialized in this new science. There are professional societies and journals solely concerned with operations research. In Japan, too, an operations research society was recently organized.

Mathematicians in the USSR, Poland, and Hungary have made some achievement in various branches of operations research. Recently a group of Soviet mathematicians were organized to investigate every aspect of the science.

Operations research in China is still in its initial stage of development. Much work needs to be done. For example, in nonlinear programming, Chinese scientists are still immature both in theoretical research and computational methods. Newly established theorems have expanded the heretofore limited theory and application of linear programming. The theory of dynamic programming has just been formed. The problem of postal routes and other problems concerned with linear programming remain unsolved. Chinese research on game theory has brought good results for the type of games which involves two players, but in game theory involving three or more players, many problems remain unsolved. Progress is being made by the Chinese on queueing theory.

VI. MEDICINE

Aviation Medicine

101. Problems of Interplanetary Flight

"Advance Into Interplanetary Space," by Ye. Arkad'yev and S. Vladimirov; Moscow, Yunyy Tekhnik, No 1, Jan 60, pp 37-40

The authors of this article point out that the founder of astronautics, space biology, and space medicine, Konstantin Eduardovich Tsiolkovskiy, predicted the launching of vehicles into outer space as early as 1926. They then cite the launching of two earth satellites 31 years later.

The instruments installed in the second satellite sent much information to earth about the magnitude of solar radiation and ionization, gas composition, temperature, and other parameters of the satellite's immediate environment, and also transmitted data on the main physiological functions of the dog Layka. Scientific data obtained as a result of this experiment showed that a highly developed animal organism tolerates the conditions encountered in interplanetary flight satisfactorily.

The successful launching of artificial earth satellites, of Lunik, and of an automatic interplanetary station have created possibilities for solving many technical problems of interplanetary travel. Scientists are familiar with the unusual factors involved in man's flight beyond the limits of the earth's atmosphere which may unfavorably affect his organism. These unfavorable factors will be different at various stages of the flight. This premise leads scientists to conclude that manned space vehicles must be designed around a man and his requirements and must carry everything needed for man's existence.

When a rocket takes off, its engines create intense noises and vibrations, and its occupant is subjected to acceleration several times the force of gravity on earth which multiplies his weight by the same factor. After the rocket escapes into space and the rocket engines shut off, the occupant will be completely weightless. He will then travel through a vacuum; an intensive stream of solar and cosmic radiation will fall on the cosmic vehicle. But the rocket cabin can protect its human occupant from this danger. Proper air pressure and sufficient oxygen content and normal temperature and humidity must be maintained inside the hermetic cabin. Conditions which approximate the conditions on earth must be maintained. But even under such conditions, astronauts will experience the oppressive effect of a long period of confinement, a feeling of isolation, and complete detachment from accustomed terrestrial conditions and people with whom contact can be made for days or weeks by radio only.

Soviet scientists are presently investigating the effects of various factors on the organisms of astronauts. These investigations have been conducted on dogs, rabbits, white rats, and mice. Emergency rescue devices are also being tested.

The problem of a long period of weightlessness has not been solved yet. Results of various experiments have shown that animals and humans can tolerate brief periods of weightlessness: no disturbance in the vital functions of their organisms has been noted. It is expected that soon scientists will find a solution to this and other still unsolved problems in space biology and medicine.

Bacteriology

102. Rapid Detection of Brucellosis Antigen

"An Accelerated Method of Detecting Brucellosis Antigen in Environmental Objects," by A. S. Ziyabkin, Byul. Nauchno-Tekhn. Inform. Leningr. N.-I. Vet. In-ta (Bulletin of Scientific-Technical Information, Leningrad Scientific Research Veterinary Institute), No 5, 1958, pp 7-8 (from Referativnyy Zhurnal -- Biologiya, No 23, 10 Dec 59, Abstract No 100464, CPYRGHT by Ye. S. Morozova)

"The best results in obtaining a precipitating serum were achieved by immunization with antigens which were prepared by treating Br (Brucella) with 0.2 N HCl or CCl_3COOH . These sera precipitated polysaccharides of Br in a dilution of 1:800-1:2,000, and antigens prepared by the Boivin method, in titers of 1:125-1:250,000. Acetic acid hydrolysis was used to prepare extracts from environmental objects which had been artificially infected with Br. The presence of brucellosis antigen was successfully detected by this method in one ml of water containing 250,000 Br, in washings from hay (50 million Br) and in soil (20 million Br). The reaction was specific."

103. Detection of Toxigenic Strains of Cl. perfringens

"A Medium for Observing Toxigenic Strains of Types A, B, C, D, and F Cl. perfringens," by B. D. Bychenko, Institute of Epidemiology and Microbiology imeni N. F. Gamaleya; Moscow, Laboratornoye Delo, Vol 6, No 1, Jan/Feb 60, pp 40-43

This article reports the development of an improved, highly specific method of isolating Cl. perfringens based on the principle of culturing suspicious microorganisms between two indicator layers of agar. Ferric

sulfite, blood, and yolk agar were used as indicator films. The preparation of the medium is described. Material used for seedings consisted of pure and contaminated cultures of *Cl. perfringens*, exudates, and emulsions of tissue from wounds and organs of animals which have died of gas gangrene, and emulsions from kidneys, feces, and food products. This method was employed in the absence of a vacuum apparatus under field conditions for the isolation of *Cl. perfringens* from sheep organs by the addition of a layer of glucose agar.

The use of ferric sulfite-blood agar makes it possible to isolate any types of *Cl. perfringens*, whereas other media cannot be used for certain strains of type F. The method was used to detect the presence of toxigenic *Cl. perfringens* in 120 samples of soil from South Kazakhstan, where infectious enterotoxemia of sheep had been observed during the spring and autumn. After preliminary one-day incubation on casein medium No 3 TsIEM (Central Institute of Epidemiology and Microbiology), the cultures were seeded on ferric sulfite-blood agar. *Cl. perfringens* was isolated from 75% of the soil samples. Results of the activation of the filtrates with trypsin and the neutralization reaction with specific *Cl. perfringens* types A, B, C, D, and F antitoxic sera showed that the majority of the cultures studied belonged to type A and nontoxigenic variants. Three strains from the filtrates of fresh cultures activated with trypsin were found to be highly toxigenic; before activation, these filtrates were nontoxigenic or weakly toxigenic. The results of the neutralization reaction showed that all three strains were *Cl. perfringens* type D.

The author concludes that these data can serve as indirect verification of the source of infectious enterotoxemia of sheep in Southern Kazakhstan.

104. Effect of Fermentative Poisons on Bacillus coli

"Effect of Certain Fermentative Poisons, Antimetabolites, and Antibiotics on Bacillus coli Strains Sensitive and Adapted to Colimycin," by Yu. S. Sazykin, Laboratory of Experimental Investigation of Therapeutic Properties of New Antibiotics, Institute of Search of New Antibiotics, Academy of Medical Sciences USSR; Moscow, Antibiotiki, Vol 4, No 6, Nov/Dec 59, pp 84-87

A report on the results of investigations conducted to determine the effect of a number of substances which are inhibitors of respiration processes on Bacillus coli strains sensitive and adapted to colimycin is presented. NaCN, NaF, NaN₃, Na₃AsO₃, dinitrophenol, thiourea, urethan, malonic acid, and gramicidin C were used as inhibitors of respiration. The results of the investigation were as follows:

1. No change in the sensitivity of Bacillus coli, which were adapted to colimycin, to NaCN, NaF, Na₂AsO₃, thiourea, dinitrophenol, was noted. A somewhat increased sensitivity to gramicidin C was observed.

2. The mechanism of the effect of sodium azide on respiration of the sensitive and adapted to colimycin Bacillus coli is different for each of the strains.

3. The respiration of Bacillus coli adapted to colimycin is not affected by malonic acid; this indicates changes in the terminal stages of the respiration process in the adapted bacilli.

Contagious Diseases

105. Book on Little-Known Infections Reviewed

Klinika i Epidemiologiya Nekotorykh Maloizvestnykh Infektsiy
(The Clinical Picture and Epidemiology of Certain Little-Known Infections), by K. Gapochko, N. S. Garin, and V. A. Lebedinskiy, reviewed by I. A. Chalisov; Moscow, Arkhiv Patologii, Vol 21, No 12, Dec 59, pp 74-75

The reviewer of this 1957 book on diseases encountered infrequently or not at all in the USSR states that a knowledge of these infections is necessary in view of present conditions and means of transportation.

The book contains information on psittacosis, yellow fever, the epidemic encephalitides, lymphocytic choriomeningitis, Colorado tick fever, the hemorrhagic fevers, certain rickettsioses, and melioidosis. Each nosological form is treated in a separate chapter in which the etiology, epidemiology, pathogenesis, pathological anatomy, clinical picture, laboratory diagnosis, therapy, and prophylaxis are given. The reviewer considers the discussions of differential and laboratory diagnosis extremely important in connection with organizing prophylactic and antiepidemic measures. He regrets that the authors have omitted a number of pertinent Soviet survey articles (for example, articles on psittacosis by Ye. D. Bunina, P. P. Dvishkov, and A. Rubakin, etc.). The paucity of illustrations is also pointed out. After criticizing each chapter separately, the reviewer concludes by urging additional printing of this book of undisputed interest and use.

106. Tick-Borne Recurrent Typhus Described

"Tick-Borne Recurrent Typhus," by I. D. Netrebko, Kiev Institute of Epidemiology and Microbiology; Kiev, Vrachebnoye Delo, No 1, Jan 60, pp 69-72

To assist the difficult diagnosis of tick-borne recurrent typhus, the author discusses this disease from the standpoints of etiology, clinical picture, differential diagnosis, therapy, epidemiology, and control measures. He notes that it is frequently diagnosed as malaria, leptospirosis, or typhoid-paratyphoid.

Epidemiology

107. Bacterial Aeroplankton Content of Upper Atmosphere

"Bacterial Aeroplankton of the Upper Layers of the Atmosphere During the Winter," by S. D. Klyuzko, Ya. G. Kishko, and Yu. I. Bershchanskiy, L'vov Institute of Epidemiology, Microbiology, and Hygiene and L'vov Meteorological Station; Kiev, Vrachebnoye Delo, No 1, Jan 60, pp 75-76

This brief article discusses investigations initiated in 1957 for the announced purpose of studying the microflora of the upper atmosphere and determining the nature of the air mass during the winter. The authors point out that the study of the transportation of microorganisms over great distances is of hygienic and general biological value.

Air samples were collected at heights of 100 - 6,000 meters and more by specially equipped "LI-2" aircraft according to the method proposed by Ya. G. Kishko (Laboratornoye Delo, No 5, 1959). Twelve flights were made in March 1958. The methodological data were evaluated after analysis of processed meteorographic records and data collected by observers, and the nature of the air mass, after analysis of aerological and synoptic charts from aviation meteorological stations. The content and species composition of microorganisms, hemolytic cocci, and anaerobic and thermophilic microorganisms were also studied. Bacterial counts at various heights are given.

The observations also demonstrated the effect of meteorological conditions on the resistance of bacterial aeroplankton. It is noted that at a height of 2,000 meters, the number of microorganisms in the air increased with an increase in relative humidity to 90%; however, the reverse occurred at heights of 4,000-6,000 meters.

The period of investigation over L'vov was characterized by the predominance of arctic air masses, which do not contain large numbers of microflora at the heights chosen for sampling; this picture changed when this air was replaced by the air of continental temperate latitudes. The microorganism count then increased to 3-6 times the previous level at high altitudes (100-6,000 meters). The number of bacteria at these heights was also found to depend on the distance from the city. The results of sample collection at different times of the day are presented. In discussing various species isolated, the authors note that a large number of sporogenous species and several fungi were seen.

108. Brucellosis Caused by Tick Bites

"Infection of Guinea Pigs With Brucellosis By Tick Bites," by Yu F. Nesterova and I. N. Venkova, Byul. Nauchno-Tekhn. Inform. Ukr. N.-I. In-t Eksperim. Veterinarii (Bulletin of Scientific-Technical Information of the Ukrainian Scientific Research Institute of Experimental Veterinary Medicine), No 4-5, 1958, pp 41-42 (from Referativnyy Zhurnal -- Biologiya, No 23, 10 Dec 59, Abstract No 100474)

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"Hyalomma plumbeum, Dermacentor marginatus, and Boophilus bursa ticks have been established as carriers of Brucella in the Crimea. Experiments were performed on larvae obtained from the eggs of H. plumbeum ticks removed from brucellar cattle. The larvae were placed on two healthy guinea pigs. The agglutination reaction was performed after 20-25 days with serum from the pigs and was positive in both cases. Cultures of Brucella melitensis were isolated from the organs of the pigs in bacteriological investigations."

Forensic Medicine

109. Detection of Thiophos in Biological Material

"Detection in and Isolation From Biological Material of Thiophos in Forensic Chemical Investigations," by S. B. Novikov, Moscow City Bureau of Forensic Medicine Expert Investigation; Moscow, Sudebno-Meditsinskaya Ekspertiza, Vol III, No 1, Jan/Mar 60, pp 45-47

A description of a method for the detection of thiophos in biological material and its isolation from these materials for Forensic Chemical Investigation is presented. The method is based on the distillation of parts of the biological materials with subsequent hydrolysis with alkalies by heating. Thiophos is an organophosphorus compound, diethyl-nitrophenylthiophosphate, widely used in agriculture as an insecticide. It is highly

toxic and enters the organism by being absorbed through the skin or through the respiratory organs. The symptoms of thiophos intoxication are salivation, vomiting, abdominal pains, headaches, hypotonia, and cardiovascular insufficiency. Death is caused by paralysis of the respiratory organs.

110. Diagnostics of Acrichine Intoxication

"On the Problem of the Diagnostics of Acrichine Intoxication in a Corpse," by A. D. Starchevskaya and M. M. Khaut, Kiev Oblast Bureau of Forensic Medicine Expert Investigation; Moscow, Sudebno-Meditsinskaya Ekspertiza, Vol III, No 1, Jan/Mar 60, pp 55-57

Description of the forensic medical examination of the body of a person who died after the mistaken ingestion of a large dose of acrichine is described. The forensic medical examination disclosed a marked yellow coloration of the skin, mucous membrane, and internal organs, particularly in the liver, urinary bladder, and esophagus. Histological examinations revealed that acrichine sharply increased the permeability of the vascular walls, the arterioles and capillaries in particular. Ultraviolet analysis disclosed considerable changes in the internal organs. Further investigations established that the acrichine was concentrated most of all in the liver, lungs, and urinary bladder; somewhat less in the kidneys and heart; least of all in the stomach wall and the brain. Similar examinations conducted on the body of a person who died from a trauma revealed changes which were considerably different from those caused by acrichines intoxication. The above methods are recommended for the diagnosis of intoxication by acrichine.

111. Determination of Duration of Posttraumatic Life

"Determination of the Duration of Posttraumatic Life by Means of Calculating the Quantity of Leukocytes in the Capillary Network of the Internal Organs," by D.M. Logoyda, Laboratory of Infectious Pathology, Division of Pathological Anatomy of Institute of Experimental Medicine, Academy of Medical Sciences USSR, and Chair of Pathological Anatomy of Lvov Medical Institute; Moscow, Sudebno-Meditsinskaya Ekspertiza, Vol 2, No 4, Oct/Dec 59, pp 5-13

The problem of the duration of life after fatal wounds have been inflicted frequently confronts forensic medical experts and cannot always be solved by autopsy or through histological investigations of the tissues. Investigations conducted by Margolin, Gul'kevich, Kuklin, and others established that the leukocyte content in the internal organs of persons who met with violent death is characterized by a number of changes which cannot be ascribed to agonal disturbances of the circulation or changes in the body after death. They found that in cases of sudden death, the

number of leukocytes founds in sections of different organs and tissues is unequal, although characteristic for each organ. Following severe injuries, if death occurs within 30 minutes to an hour, the number of granular leukocytes in the capillary network of the internal organs sharply rises. An exception is the spleen where the number of leukocytes is noticeably decreased. The distribution of leukocytes in the organs of a body which met with violent death may serve as a useful index in determining the duration of posttraumatic life in some cases under medical investigations, the author concludes.

112. Carbon Monoxide Intoxication

"On the Histological Modifications in the Cerebrum of Dogs Revived After Carbon Monoxide Intoxication," by N.P. Romanova, Laboratory of Experimental Physiology for Revivification of the Organism; Moscow, Sudebno-Meditsinskaya Ekspertiza, Vol 2, No 4, Oct/Dec 59, pp 13-19

The article reports on the results of experiments conducted on dogs to determine the changes in the brain resulting from carbon monoxide intoxication. Intoxication was induced in the animals by the inhalation of air containing carbon monoxide in concentrations of 0.17 - 0.25 percent. With the onset of clinical death (cessation of breathing and a drop in arterial pressure) the revivification method developed by V. A. Negovskiy and coworkers was used. Of the 32 dogs used in the experiments, nine died within 1-13 days. The rest were killed 15 days to 7 months after the beginning of the experiments for the purposes of histological investigations. The experiments established that diffused and local changes took place in the brains of the dogs following acute intoxication with CO; diffused modifications were of a hypoxia character and the dynamics of their development depended on the time that elapsed; local modifications were for the most part in the white matter of the brain; and the application of medically induced sleep and a complete change of blood by transfusion had no effect on the histopathological changes which followed the intoxication.

Hematology

113. Application of Low Temperatures for Preservation of Blood for Long Periods

"Application of Low Temperatures for the Prolonged Preservation of Blood," by F. R. Vinograd-Finkel', F. G. Ginzburg, and L. I. Fedorova, Central Order of Lenin Institute of Hematology and Blood Transfusion, and E. I. Kauhcheshvili, Moscow Technological Institute of Meat and Dairy Industry; Moscow, Kholodil'naya -- Tekhnika, Vol 36, No 6, Nov/Dec 59, p 62

An abstract of a paper presented at the tenth International Congress of Cryogenics held in Copenhagen, 19-26 August 1959 reports that two methods have been tested to preserve blood at temperatures below 0° C: (a) preservation of blood in the liquid (refrigerated) state, a procedure which is easier to use from the practical standpoint; (b) preservation of blood in the solid (frozen) state, with the aim of suppressing to the fullest possible extent enzyme activity and prolonging the period over which the blood can be preserved.

The authors developed a preservative solution which protects erythrocytes from the harmful effects of low temperatures. This solution contains substances which are suitable for intravenous injection. Application of this solution makes it possible to use for transfusion all the blood components without any losses, which could not be accomplished when blood was preserved with glycerine according to the method described in the literature. By using the solution in question, one can preserve blood in a liquid, nonfrozen state for long periods of time at temperatures from minus 8° to minus 10°. When blood is preserved in this manner, the erythrocytes remain unaffected and suitable for transfusion for periods up to 100 days.

Immunology and Therapy

114. Effect of Chlortetracycline on Experimental Plague

"The Therapeutic Action of Chlortetracycline in Experimental Plague Produced by Streptomycin-Resistant and Streptomycin-Sensitive Forms of the Plague Pathogen," by E. N. Makarovskaya, I. S. Tinker, and Ye. N. Aleshina, Rostov-na-Donu State Scientific Research Antiplague Institute; Moscow, Antibiotiki, Vol 4, No 6, Nov/Dec 59, pp 81-83

In testing the therapeutic action of chlortetracycline on experimental plague, the authors used the following strains of B. pestis to infect white mice: (1) strain 177, resistant to 50,000 units of streptomycin,

which reduced its virulence to a one hundredth of the initial strain; (2) strain 773, which was resistant to 100,000 units of streptomycin and which maintained its initial virulence. The Dcl of strain 177 was 1,000 microbial bodies, and of strain 773, one microbial body. Chlortetracycline was introduced intramuscularly (0.25-2.0 mg) or perorally (2.5-20 mg) once a day for one week. The therapy was initiated one to two days after infection. Seedings for evaluation of the therapeutic effectiveness were taken from the infection site, from the regional lymph nodes, and from the liver, spleen, lungs, and blood.

Results of the experiments are shown by four charts and are discussed in the text. The following conclusions are presented:

"1. Chlortetracycline had a pronounced therapeutic effect on experimental plague produced in white mice by streptomycin-resistant and streptomycin-sensitive forms of B. pestis.

"2. Chlortetracycline introduced both intramuscularly and perorally had therapeutic activity in experimental plague. The use of the intramuscular method of introduction permitted us to decrease the therapeutic dose of the preparation considerably."

115. Phytoncides

"News About Phytoncides," by F. Protopopov; Moscow, Meditinskiy Rabotnik, No 82 (1830), 13 Oct 59, p 2

Biologists, hygienists, and specialists in the food industry and in agriculture are displaying considerable interest in phytoncides. Many higher plants have been found to contain substances which are highly antimicrobial and antifungoid. A group of research workers at the Institute of Microbiology of the Academy of Sciences Ukrainian SSR isolated the antibiotic Imanin from St John's wort. Imanin has been found to be effective mainly against gram-positive bacteria and is used in the therapy of severe purulent inflammatory processes of the skin and subcutaneous tissue. It is also highly useful in the therapy of severe burns. Cansatyn, an antibiotic effective against specific fistulas, was isolated from hemp by research workers of the Kiev Institute of Microbiology. Gordetsyn, another antibiotic, was obtained from swollen barley seed by the workers of the Leningrad Technological Institute of the Refrigeration Industry. It has a wide spectrum of antibacterial action.

Garlic continues to hold the attention of the medical profession. In powder form it is used in the therapy of purulent wounds, abscesses, and fistulas. It has been found beneficial also in the therapy of influenza when used in the form of 10-percent tincture in a physiological salt solution and introduced into the nasal cavities.

Antimicrobial substances effective against phytopathogenic bacteria and a number of pathogenic fungi have been isolated from sage. Eleven substances effective against staphylococci and coli, dysentery, and tubercular microbacteria have been found in red and white cabbage. A number of plants have been found to contain substances effective against brucella. The most active of these substances have been found in the leaves and stems of the nasturtium. The possibility of treating burns with extracts from cranberry leaves has been proved. Additional information on the therapeutic properties of propolis has been obtained. It is successfully used in the therapy of infected wounds, burns, and certain skin diseases affecting animals. Milk to which 5 percent propolis is added has a stimulating effect on the growth of animals.

In conclusion, the author stresses the advisability of further research on the problem of phytoncides.

116. Therapy of Hemiballism

"Therapy of Hemiballism With Aminazine," by F. M. Lisitsa and V. P. Silis, Republican Clinical Hospital imeni P. Stradynya, Riga; Moscow, Zhurnal Nevropatologii i Psikhiiatrii imeni S. S. Korsakov, Vol IX, No 1, Jan 60, pp 37-39

Aminazine (in doses of one milliliter of a 2.5-percent solution administered twice in 24 hours) was used in the therapy of hemiballism. The results were positive: the main symptoms of the disease rapidly disappeared, and there was a relaxation of the entire complex of hyperkinesia. The effect of aminazine is ascribed to its action on the pallidum. The possibility of its effect on the frontal formations and the substantia nigra which are linked with the pallidum system is not excluded.

117. Immunology in Bulgaria and USSR

"Immunization Against Infantile Paralysis," by Dr T. Krustev; Sofia, Rebotnichesko Delo, 21 Feb 60, p 2

Citing the magnitude of the world-wide problem of infantile paralysis and crediting Dr. Salk for the preparation of the first practical vaccine, the author discusses the extent of poliomyelitis immunization in Bulgaria and in the USSR as follows.

"Immunization with the Salk vaccine was carried out for the first time in Bulgaria in the fall of 1957. Throughout subsequent years, more than 750,000 children ranging in age from 6 months to 14 years were immunized by the end of 1959.

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"However, observations and research conducted both abroad and in Bulgaria show that this vaccine provides protection only against paralytic forms of the disease but not against infection from the poliomyelitis virus. This is why it is incapable of effecting a sharp decline in the incidence of the disease.

"Medical science, still faced with the task of finding a more effective immunizing agent, found experiments being continued in various countries. Sabin and Koprowski were the first to develop an oral vaccine, which has far greater advantages than the Salk vaccine. It is administered easily and evokes no fear on the part of children since it is not injected. However, its most valuable asset is its ability to confer much more complete immunity than is attained with the Salk vaccine. The body develops immunity against the virus directly in the digestive tract and throat, thereby assuring lifetime immunity.

"The harmlessness of the oral vaccine was demonstrated in numerous laboratory and epidemiological studies completed by qualified doctors in many countries. The vaccine prepared in the Soviet Union was utilized extensively. To date, more than 18 million persons ranging in age from 2 months to 45 years have been immunized. The vaccine proved completely safe, created no reactions, and provided more effective protection against infection. All immunized children acquired immunity against infantile paralysis.

"The nationwide polio immunization of all children from 2 months to 14 years old will begin in a few days. The second immunization will be completed in March 1960 and the third will be done in April. All children, regardless of whether they have received Salk vaccine inoculations previously, are subject to the new immunization program. The vaccine will be administered to school children at their respective schools; smaller children attending children's institutions will be treated in their respective establishments. For other children, immunization stations have been organized in polyclinics and at other locations which will be announced subsequently."

118. Yugoslav Researchers Develop Influenza Vaccine

"Yugoslav Vaccine Against Influenza Developed," by Aleksandar Misic; Belgrade, Politika, 2 Mar 60, p 7

A group of experts in the Microbiological Institute of the Military Medical Academy, with the aid of the Commission for Medical Scientific Research, have developed the first Yugoslav vaccine against the two most frequent types of influenza, Asiatic, which is caused by influenza virus A₂, and type B influenza. The vaccine is not polyvalent, that is, it does not protect against both types of influenza simultaneously. It is given in the form of a hypodermic injection.

The vaccine prepared by the Microbiological Institute is not new in principle. A similar method was used by American scientist Dr Salk in 1947. To produce 3 million doses of the vaccine, about 7 million fresh eggs would be needed.

Pharmacology and Toxicology

119. Effect of Ganglioblocking Substances on Adenosine Triphosphatase

"Effect of Ganglioblocking Substances on the Activity of Adenosine Triphosphatase of the Upper Cervical Ganglion," by N. B. Vysotskaya, Laboratory of Special Pharmacology, Institute of Pharmacology and Chemotherapy, Academy of Medical Sciences USSR; Moscow, Farmakologiya i Toksikologiya, Vol 22, No 6, Nov/Dec 59, pp 516-519

Cats under urethan anesthesia were used in experiments which were conducted to determine the effect of ganglioblocking substances--nicotine, tetraethyl ammonium, pachicarpine, pentamine, and hexone--on the activity of adenosine triphosphatase in the upper cervical ganglion. The experiments established that nicotineline acting substances increase the activity of the enzyme and that blocking transmission with hexone has little effect on the activity of adenosine triphosphatase in the ganglion.

120. Effect of Ganglioblocking Substances on Arecoline Toxicity

"Effect of Ganglioblocking Substances on the Toxicity of Arecoline and Some Other Cholinomimetics," by I. M. Sharapov, Division of Pharmacology, All-Union Scientific Research Chemico-pharmaceutical Institute imeni S. Ordzhonikidze; Moscow, Farmakologiya i Toksikologiya, Vol 22, No 6, Nov/Dec 59, pp 512-516

The effect of the ganglioblocking substances (pachycarpine, pentalin, nemophine, dioquine, dicolline, dimelline, ansolysen, hexone, mecamin, and pempidine) on hyperkinesia induced in white mice by arecoline was studied. The experiments established that the preliminary administration of the ganglioblocking substances strongly intensified the toxic activity of arecoline. Changes in the toxicity of the arecoline paralleled changes in the activity of the ganglioblocking substances. It is assumed that the deposition of arecoline and other cholinomimetics in the organism is prevented by the ganglioblocking substances with the result that the arecoline is concentrated in the fluid media of the organism.

121. Effect of Pantothenic Acid on Acetylcholine

"Effect of Pantothenic Acid on the Sensitivity of Rats' Intestines to Acetylcholine," by Istvan Szorady, Margit Vicsay, and Fereng Obal; Budapest, Kiserletes Orvostudomány (Hungary), Vol 2, No 1, 1960, pp 75-79

Physiological concentrations of pantothenic acid (10^{-2} -- 10^{-12}) increase the sensitivity of rats' intestines to acetylcholine; concentrations higher than the physiological decrease the sensitivity of rats'

intestines to acetylcholine; concentrations of the acid lower than the physiological have no effect on the sensitivity of the rats' intestines to acetylcholine. These observations provide new data on the mechanism of the rising activity of intestinal peristalsis induced by pantothenic acid.

122. Preparation 1478

"On the Pharmacology of the Iodomethylate of the Dimethylaminoethyl Ester of 5-Ethoxymethylfuran-2-Carboxylic Acid," by M.D. Mashkovskiy and V. M. Avakyan, Division of Pharmacology of the All-Union Scientific Research Chemicopharmaceutical Institute imeni S. Ordzhonikidze and Institute of Fine Organic Chemistry, Academy of Sciences Armenian SSR; Moscow, Farmakologiya i Toksikologiya, Vol 22, No 6, Nov/Dec 59, pp 506-512

Cats and rabbits were used in experiments conducted to determine the effect of the iodomethylate of the dimethylaminoethyl ester of 5-ethoxymethylfuran-2-carboxylic acid (preparation 1478) on the organism, and particularly its effect on the cholinoreactive systems, because of the similarity of its chemical structure with that of acetylcholine. The experiments established that preparation 1478, despite its similarity to acetylcholine, does not possess its muscarinelike activity, and at the same time has a more selective and stronger effect on neuromuscular conductivity than acetylcholine. It was found also that the curarelike action of preparation 1478 is due to its ability to induce strong depolarization in the area of the neuromuscular synapses. In small doses it produced relaxation of the skeletal muscles without depressing circulation and respiration. Further study of the preparation is recommended.

123. Effect of Cholinolytics When Used in Therapy of Nervous Diseases

"General Principles of the Application of Drugs With a Cholinolytic Action in Neuropathology," by N.N. Anosov (Leningrad); Moscow, Zhurnal Nevrapatologii i Psikhatrii, Vol 60, No 1, Jan 60, pp 29-36

A report on the results of the investigations in which the therapeutic effect of cholinolytics when used in the therapy of different diseases of the nervous system is presented. Three types of cholinolytic drugs were studied: drugs with a muscarinelike action (atropine, scopolamine, and diphazine, a new phenothiazine derivative); drugs with a nicotinelike action (gangleron and arpenal); and drugs with a

muscarinelike and nicotinelike action (tropacine, pentaphen, and merpanit). The effect of the cholinolytic drugs was studied in 213 patients. Optimally effective doses were administered in all cases. All drugs have been found to reduce, to a greater or lesser degree, or to remove spasms, hyperkinesias, and muscular tonus of pyramidal as well as extrapyramidal character. The anticholinesterase substances intensified hyperkinesias.

In comparing the data obtained in the investigations with the data perviously obtained by M. Ya. Mikhelson, it may be concluded that cholinolytics with a central action which belong to the tertiary ammonium compounds should be used in hyperkinesias, spasms, and in cases of increased muscular tonus. Quaternary ammonium compounds with a nicotinelike action should be given to patients suffering from disturbances of the automatic nervous system. Quaternary ammonium compounds with a muscarinelike action should be administered when it is necessary to affect the peripheral synapse of the parasympathetic nervous system.

124. Significance of the Position of Nitrogen Atom in Relation to Cholinesterase

"On the Significance of the Position of the Quaternary Nitrogen Atom in the Molecule of Some Substances on Their Ability to React With True and Pseudocholinesterases," by N. K. Fruyentov, Laboratory of Pharmacology and Biochemistry of Biologically Active Substances, Institute of Evolutionary Physiology imeni I. M. Sechenov, Academy of Sciences USSR, Leningrad; Moscow, Byulleten' Eksperimental'noy Biologii i Meditsiny, Vol 18, No 12, Dec 59, pp 55-61

Investigations established that the intensity of the interaction of cholinesterases with their substrata and inhibitors depends not so much on the appearance of the positive charge in the molecule of the substance involved as on the position of the atom carrying the charge in relation to the atom which forms the ester bond in the molecule. In a number of compounds which were studied, complex esters of some of the organic acids and alkylamino alcohols, the appearance of the charge intensified the interaction of cholinesterases with these substances only when the ester atom of the oxygen was at a distance from the positively charged nitrogen atom equal to that in the molecule of acetylcholine. An increase in this distance not only did not intensify the reactive ability of the substance, but on the contrary, weakened it.

125. Prevention of Spasmodic Attacks

"New Data on the Possibility of the Prevention of Spasmodic Attacks by the Intravenous Administration of Solutions Which Affect Carbohydrate Metabolism and Hemodynamics and Modify Synaptic Transmission," by I. I. Fedorov, V. P. Bezuglov, and M. A. Gorin, Fiziol. Mekhanizmy Kompensatorn. Reaktsiy i Vosstanivt. Protssesov (Physiological Mechanisms of Compensatory Reactions and Restoration Processes), 1958, 60-66 (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 2, 25 Jan 60, Abstract No 2629)

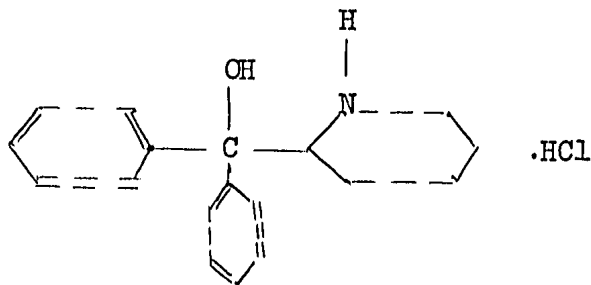
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"In experiments on rabbits it was found that the intravenous administration of 10 milliliters of a 10-percent solution of sodium lactate prevented the development of spasms induced by pyramidon (2.1 milliliters of a one-percent solution per kilogram of body weight) or corazol (one milliliter of a one-percent solution per kilogram of body weight). It is the authors' opinion that the basis for the antispasmodic action of sodium lactate are the modification of metabolism in the central nervous system (elimination of the acidotic change), changes in cerebral circulation and nerve reception sensitivity."

126. Piridrol, New Stimulant

"Piridrol," by T. G. Soldatova; Moscow, Farmakologiya i Toksikologiya, Vol 23, No 1, Jan/Feb 60, p 89

Piridrol, the hydrochloride of alpha-/2-piperidyl/-benzhydrol, was synthesized at the Laboratory of Mixed Organic Compounds of the All-Union Scientific Research Chemicopharmaceutical Institute imeni S. Ordzhonikidze. Its structural formula is as follows:



Piridrol is a white crystalline powder with a melting point of 286-288 degrees. It is readily soluble in water. Experimental investigations established that piridrol is an active stimulant, affecting mainly the central nervous system. It increases motor activity, reduces and in many cases prevents the affect of anesthetic and somnifacient drugs, and prevents asthenia. It is used in psychiatric clinics and

clinics for nervous diseases to stimulate the central nervous system in neurotic and schizophrenic patients. Doses of one milligram two or three times a day are indicated in most cases. When no side effects are apparent, doses of 2.5 milligrams three times a day may be administered.

127. Biochemistry of Toxic Proteins

"Biochemical Properties of Some Toxic Proteins," by N. Muic, School of Public Health "Andrija Stampar," Medical Faculty; Zagreb, Arhiv Za Higijenu Rada i Toksikoloju, Vol 10, 1959, pp 1-30

A report on research work done to determine the biochemical properties of some of the toxic proteins found in the venom of *Vipera ammodytes* and the venom of the spider *Latrodectus tredecimuttatus* Rossi is presented. The biochemical methods used to determine these properties is described.

128. Intoxications Caused by Poisonous Fungi

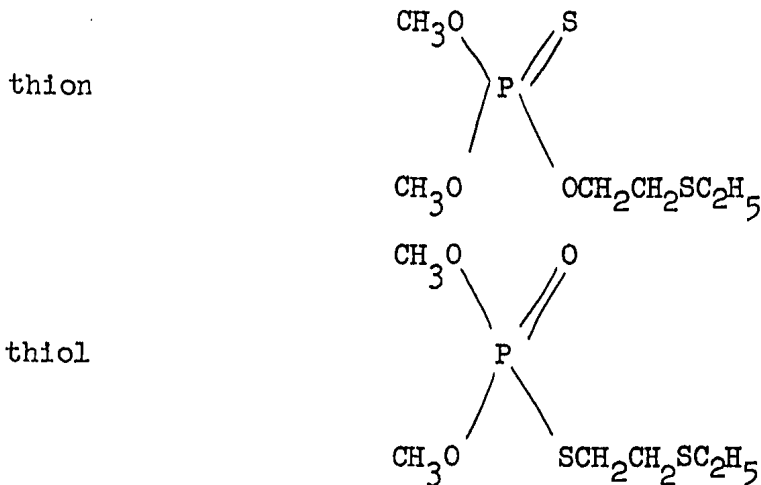
"Food Intoxications by Products -- Poisonous Fungi (Micro-toxicoses)," by Ye. N. Ivanova; Moscow, Meditinskaya Sestra, Vol 19, Nov 2, Feb 60, pp 31-33

Three types of diseases caused by poisonous fungi are now known. These are: ergotism, a disease caused by eating products prepared from flour containing ergot; "drunken" bread intoxication, caused by eating products prepared from grains infected with the fungus *Fusarium graminearum*; and alimentary-toxic aleukia, a disease caused by the fungus *Fusarium sporotrichiella*, which affects first of all the hemopoietic organs. Four distinct stages characterize the intoxications. The first stage is marked by the development of a sense of burning in the thorax, profuse perspiration, nausea, and vomiting. The second stage is characterized by the development of leukopenia and marked changes in the blood composition. In the third stage a rash appears on the chest, extremities, and face. Considerable changes in the blood mark this stage. Temperature is high, and arterial pressure is low. This stage is marked by high lethality. The fourth stage of the disease is that of recovery. The duration of this stage depends on the severity of the case.

129. Toxicology of Methylsystox

"Experimental Data on the Toxicology of Methylsystox," by N. K. Statsek, Toxicological Laboratory of the Kiev Institute of Labor Hygiene and Occupational Diseases; Moscow, Farmakologiya i Toksikologiya, Vol 22, No 6, Nov/Dec 59, pp 559-565

Methylsystox is a new organophosphorus compound of interplant action synthesized at the Scientific Research Institute of Fertilizers and Insectofungicides imeni Ya. V. Samoylov by N. N. Mel'nikov and Ya. A. Mendel'baum. Methylsystox is highly effective against suctorial insects and pests which infest fruit trees, cotton plants, and various other agricultural plants. It is a light yellow fluid with an unpleasant odor, and is composed of two isomers of dimethyl beta-ethylmercaptoethyl thiophosphate:



The thiol isomer is the main carrier of the insecticidal properties. The toxic properties of methylsystox were studied in experiments carried out on mice, rats, cats, and rabbits.

The investigations established that methylcistox is generally toxic whether it is absorbed through the broken skin or introduced into the organism through the respiratory or gastrointestinal tracts; when inhaled its liquid phase aerosols are more toxic than its vapor phase aerosols; it affects mainly the central and automatic nervous system, an indication that it stimulates the cholinesterase systems of the organism; although presumably not a cumulative poison, it can cause chronic intoxication; and it produces morphological changes in the blood. Methylcistox is a compound close in toxicity to metaphos and M-81, but is considerably less toxic than mercaptophos.

In handling the compound, the skin, eyes, and respiratory organs must be protected. Measures must be taken to prevent the entry of the poison into the organism.

130. Toxicity of Dipin

"On the Pharmacology of Dipin," by A. I. Polezhayeva and A. A. Grushina, Division of Pharmacology and Laboratory of Chemotherapy of Experimental Tumors, Division of Chemotherapy of the All-Union Scientific Research Chemicopharmaceutical Institute imeni S. Ordzhonikidze; Moscow, Farmakologiya i Toksikologiya, Vol 22, Nov/Dec 59, pp 533-538

White mice, rats, and rabbits were used in experiments conducted to determine the toxicity of dipin, an antitumor preparation. Dipin is the tetra-(ethyleneimide)-piperazine of N, N'-diphosphoric acid, and was synthesized by A. A. Kropacheva and coworkers at the Laboratory of Anticancerous Compounds of the All-Union Scientific Research Chemicopharmaceutical Institute imeni S. Ordzhonikidze. The experiments established that: (1) Dipin administered to white mice and rats in doses of 125-150 milligrams per kilogram of body weight killed all the animals; toxic symptoms appeared in the animals from doses of 50-75 milligrams per kilogram of body weight; rabbits were found to be far more sensitive to dipin than the other animals: death in the rabbits occurred from doses of 25-50 milligrams per kilogram of body weight. (2) Considerably smaller doses of dipin killed the mice and rats when the preparation was administered for a second time (1-5 milligrams per kilogram of body weight). (3) Intravenous and subcutaneous injections of dipin produced in all animals hypoplastic and aplastic processes in all elements of hemopoiesis, and pathological changes in the hemopoietic organs. (4) Toxic doses of dipin produced degenerative-necrobiotic changes in the liver, myocardium, and kidneys of the animals. The intensity of the pathomorphological changes in the experimental animals depended on the dose of dipin administered, and on individual and specie sensitivity to the preparation.

131. Effect of Cobalamine and Aminazine on Dehydrogenase Activity

"Effect of Cobalamine on the Dehydrogenase Activity of the Tissues of Normal Rabbits and of Rabbits in a State of Hypothermia," by Ye. V. Lakhno and R. V. Chagovets, Institute of Biochemistry of Academy of Sciences Ukrainian SSR; Kiev, Ukrainskiy Biokhimichnyy Zhurnal, Vol 31, No 5, 1959, pp 691-699

The effect of cobalamine and aminazine and of their combined action on the dehydrogenase activity of lactic and isocitric acids in the tissues of rabbits was studied. Cobalamine administered to the animals in doses of 15 micrograms per kilogram of body weight increased dehydrogenase activity in the cerebral cortex and in the skeletal muscles and depressed the enzyme activity in the muscles of the heart, liver, and kidneys.

Aminazine strongly inhibited the activity of the dehydrogenase in the skeletal muscles, cerebral cortex, kidneys, and suprarenals, but had a stimulating effect on the cardiac muscles. Used together, cobalamine and aminazine depressed the dehydrogenase activity in skeletal muscles and somewhat stimulated the activity of the enzyme of lactic and isocitric acids in the heart and liver.

132. Uranium Excreted With Urine

"Determination of Uranium Content in Urine," by Endre Upor, Endre Deemko, and Laszlo Fekete; Budapest, Kiserletes Orvostudomany, Vol 12, No 1, 1960, pp 91-94

When absorbed by the organism, uranium is excreted with the urine. A simple method of determining the presence of uranium in the urine has been devised which makes it unnecessary to resort to the normally lengthy processes of analysis. The investigated urine is boiled with oxalic acid. The solution is then cooled, and the uranium is separated from the solution by dibutyl sulfate dissolved in carbon tetrachloride. The solvent is then heated in platinum dishes and the dibutyl sulfate is driven off by the heat. The residue is dried with hydrochloric acid, then mixed with sodium fluoride and sodium carbonate and pressed into small globules. The fluorescence of the globules is compared with that of standard fluorescence under ultraviolet light.

133. Benzidine Absorption

"Chemical Assay of the Harmful Effects of Benzidine in Industry. III. Assay of Benzidine Absorption Under Production Conditions," by D. Ader, J. Piotrowski, and Z. Zaremba, Med. Pracy, 1958, No 3, pp 207-217, (from Medit-sinskiy Referativnyy Zhurnal, Section 4, No 11, Nov 59, p 20)

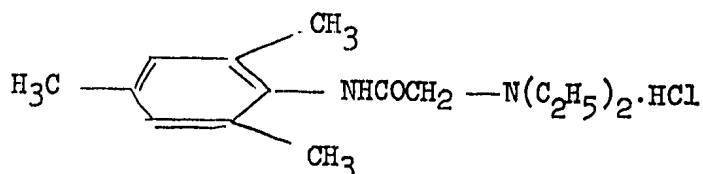
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"Benzidine concentration in the air of industrial premises averages 0.2 milligram per cubic meter, according to the authors. The benzidine content in the wash from workers' hands was about 2.7 milligrams; the benzidine content on the workers' clothes was about 15 milligrams per square decimeter. The quantity of diamines found in the workers' urine was 276 micrograms per liter. The authors think that 80 percent of the benzidine is absorbed through the skin."

134. Mesocaine, New Anesthetic

"Mesocaine," by T. G. Soldatova; Moscow, Farmakologiya i Toksikologiya, Vol 23, No 1, Jan/Feb 60, p 90

Mesocaine, diethylaminoacetyl-2,4,6-trimethyl aniline hydrochloride, was synthesized at the Division of Chemistry, Institute of Pharmacology and Chemotherapy, Academy of Medical Sciences USSR. It has the following structural formula:



Mesocaine is a white crystalline powder with a melting point of 36-137 degrees. It is readily soluble in water and hot alcohol; it is insoluble in ether. It is stable in solution and can be sterilized by boiling. Experiments established that mesocaine is a rapidly acting anesthetic superior to xylocaine and novocaine. It produces a deep and long-lasting anesthesia. It is only slightly toxic, but there are no contraindications to its use.

135. New Antiseptic

"New Antiseptic," by S. Uss, Narodnoye Kh-vo Sov. Latvii (National Economy of Soviet Latvia), 1958, No 3/4, pp 35-36 (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 24, 25 Dec 59, Abstract No 32744)

"The properties of ammonium fluorosilicate produced from the waste products in the manufacture of superphosphate are described. The solubility of ammonium fluorosilicate at temperatures of 10, 25, and 70 degrees is respectively 14.0, 18.75, and 32.25 percent. In its toxicity, it is close to sodium fluoride and sodium fluorosilicate."

136. Sulfonyl-Butyl-Urea Derivatives

"On the Synthesis of Sulfonyl-Butyl-Urea Derivatives," by V. A. Zasosov, T. N. Akif'yeva, and T. A. Veselitskaya, All-Union Scientific Research Chemicopharmaceutical Institute imeni S. Ordzhonikidze; Moscow, Meditsinskaya Promyshlennost' SSSR, Vol 14, No 1, Jan 60, pp 7-12

The article describes the synthesis of a number of sulfonyl-butyl-urea derivatives which in recent years have attracted considerable attention as preparations which can be used in the therapy of sugar diabetics. Their advantage over other preparations is that they can be taken internally in tablet form. Of these preparations, N¹-sulfonyl-N²-n-butylurea and N¹-(4-methyl benzosulfonyl)-N²-n-butylurea have already been tested and recommended for manufacture.

137. Effect of Galascorbine on Injured Muscles

"Effect of Galascorbine on the Content of Glycogen, Adenosine Triphosphate, Creatine Phosphate, and Inorganic Phosphorus, and on the Activity of Phosphorilase in Injured Muscles," by V. A. Tsiomik, Chair of Biochemistry, Kiev Medical Institute; Kiev, Ukrainskiy Biokhimichnyy Zhurnal, Vol 31, No 5, 1959, pp 709-716

A report on the effect of galascorbine, a preparation composed of crystalline ascorbic acid and tannins, when applied to injured muscles is presented. Experiments which were conducted on 54 rabbits have shown that injury to muscular tissue reduced the content of glycogen, adenosine triphosphate, and creatine phosphate and decreased the activity of phosphorilase in the muscles. Simultaneously, an increase in the content of inorganic phosphorus in the muscular tissue occurred. The injured tissue was gradually restored to normal. An injection of galascorbine accelerated the recovery, while the application of ascorbic acid and tannins separately had no noticeable effect on the injured muscles.

138. Antibiotic Formation

"Investigation of the Formation of Antibiotics by Actinomycetes," by Marian Mordarski, Postepy Hig i Med. Doswiadcz, 1958, Vol 12, No 6, pp 641-644 (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 3, 10 Feb 60, Abstract No 3234, by V. Nikol'skiy)

"Some 10,000 strains of actinomycetes obtained from the soils of Lower Silesia were investigated. About 80 percent of the strains were found to be antagonistic to one or a number of species of bacteria.

About 100 strains were suitable for deriving antibiotics from them. Two such antibiotics are described. One was obtained from strain 229/2702 in crystalline form and is identical to actinomycin in its amino acid content, adsorption spectrum, and its Rf. The other antibiotic was obtained from strain No 3/17 in the form of a chromatographic and electrophoretic homogenous preparation which, in a concentration of 0.3-0.1 gamma per milliliter, inhibits the growth of gram-positive and acid-resistant bacteria and pathogenic fungi; it is thermolabile in solutions (inactivated when heated to a temperature of 60 degrees at pH8) and is resistant to cold for many months when in a lyophil state."

139. Cholera Vibriones

"Amino Acid Composition of Cholera Vibriones," by L. M. Pustavalova, Chair of Biochemistry, Rostov-na-Donu Medical Institute; Kiev, Ukrainskiy Biokhmichnyy Zhurnal, Vol 31, No 5, 1959, pp 684-690

With the aid of monomeric chromatography, 20 already well-known amino acids have been detected in cholera vibrio. In addition, three as yet unidentified amino acids have been discovered: two of them occupy a position above that of isoleucine on the ascending monomeric chromatogram, and the third, a position between valine and phenylalanine. A nucleoprotein-polysaccharide fraction was also isolated from the cholera vibrio. A protein isolated from this fraction was found to contain the following amino acids: diaminopimelic acid, cysteine, lysine, histidine, arginine, asparagic acid, serine, glycol, oxyproline, glutamic acid, treonine, alanine, proline, tyrosine, tryptophan, methionine, valine, phenylalanine, leucine, and isoleucine.

140. Antitumor Compound, Meta-Sarcolyusin, Synthesized

"Isomers of Sarcolysin and Their Derivatives. I. Synthesis of m-Di-(2-chloroethyl)-amino-dl-phenylalanine," by M. N. Vasil'yeva, Ye. N. Shkodinskaya, and A. Ya. Berlin, Leningrad Technological Institute imeni Lensovet; Moscow, Zhurnal Obshchey Khimii, Vol 29, No 12, Dec 59, pp 4094-4096

The purpose of the present research, according to the authors, was to synthesize the ortho- and meta- isomers of sarcolysin (hydrochloride of p-di-(2-chloroethyl)-aminophenylalanine) and their derivatives with the aim of comparing these substances with sarcolysin itself in respect to antitumor activity.

Only the synthesis of "meta-sarcocollin" is described in this article. Starting with m-nitrotoluene and converting this to m-nitrobenzylbromide, the m-nitrobenzylacetyl-amino-a malonic ester, the m-aminobenzylacetyl-amino-malonic ester, the m-di-(2-hydroxyethyl)-aminobenzylacetylaminomalonic ester, the m-di-(2-chloroethyl)-aminobenzylacetylaminomalonic ester and finally, the hydrochloride of m-di-(2-chloroethyl)-amino-dl-phenylalanine (meta-sarcocollin) were synthesized.

Preliminary tests showed that meta-sarcocollin possesses considerable antitumor activity in relation to sarcoma 45.

141. Chinese Study Chemical Prevention of Ventricular Fibrillation Following Use of Adrenalin on Subjects Exposed to Benzene Vapors

"Further Studies on the Pharmacology of Ventricular Fibrillation," by Shen Chi-ch'un (沈 崇 春) [also known as T. C. R. Shen] and Li Shih-yuan (李 士 媛); Peiping, K'io-hsueh T'ung-pao (Scientia), No 2, 26 Jan 60, pp 55-56

This article reports the use of 21 dogs in experiments which apparently were conducted to test the effectiveness of novocain, vitamin B₁, and Promazine, respectively, in preventing the occurrence of fatal ventricular fibrillation caused by the administration of adrenalin after exposure to benzene fumes. Whether noradrenalin administered under the same conditions would produce the same effect as does adrenalin was also investigated.

The reported results are summarized as follows:

1. The administration of noradrenalin produced ventricular fibrillation and death in eight experimental dogs which had previously inhaled benzene fumes for 4-5 minutes. In this respect, noradrenalin was found to have the same effect as adrenalin. The minimal effective [lethal] dose of either was 0.005 milligram per kilogram of body weight.
2. Repeated experiments demonstrated that novocain (10 milligrams/kilogram) was effective in preventing ventricular fibrillation caused by the use of noradrenalin on subjects under the influence of benzene fumes.
3. The mode of novocain and adrenalin administration was found to be a factor in the effective use of the anesthetic for protection against ventricular fibrillation of the benzene-adrenalin type under study. It was found that the simultaneous injection of appropriate amounts of novocain and adrenalin, each via one of the external jugular veins, was effective, whereas various other modes of administration failed to prevent fibrillation and death.

4. In five experiments conducted to investigate the protective effects of Promazine, it was found that large doses of Promazine (5-20 milligrams/kilogram) and adrenalin (0.02 milligram/kilogram) administered simultaneously and intravenously prevented fibrillation and death. But 0.02 milligram/kilogram of Promazine protected only one of two dogs.

5. Vitamin B₁ in doses ranging from 20 to 100 milligrams/kilogram failed to protect experimental dogs against the benzene-adrenalin type of ventricular fibrillation and death.

The authors recount the facts which led them to consider thiamine as a possible protective agent against the benzene-adrenalin type of ventricular fibrillation. They had read recent medical reports on the role of Prostigmine in preventing ventricular fibrillation during hypothermia. Prostigmine, as well as ethyl carbamate, was known to them to be a cholinesterase inhibitor. In their own research they had found and reported (1941-1948, 1957) the anticholinesterase property of vitamin B₁. The difference between vitamin B₁ and Prostigmine or ethyl carbamate with respect to the prevention of ventricular fibrillation now awaits further investigation, they say.

142. Soviets Manufacture Thiophosphamide Cancer Medicine

"New Soviet Medicine" (unsigned article); Budapest, Magyar Nemzet, 24 Feb 60, p 6

The Soviet pharmaceutical industry has begun the manufacture of thiophosphamide for treating cancer. It has been especially successful in treating cancer of the mammary glands and female organs, where it is used as supplementary treatment.

Physiology

143. Chinese Study Effect of Gamma-aminobutyric Acid on Conditioned Reflexes

"Effect of Gamma-aminobutyric Acid Applied to Cerebral Cortex and Lateral Chamber on the Conditioned Reflex Activity of the Rabbit," by Mei Chen-t'ung (梅 鎮 彤) and Chao Shang-chi (趙 尚 吉), Institute of Physiology, Academia Sinica; Peiping, K'o-hsueh T'ung-pao (Scientia), No 2, 26 Jan 60, p 55

This item reports experiments undertaken to observe the effect of gamma aminobutyric acid, as applied to the cortex and lateral chambers of the cerebrum, on the conditioned reflexes of five rabbits. It was

found that the drug produced contralateral inhibition of certain conditioned reflexes when applied to the cortex. However, when applied to the lateral chambers, no modification of conditioned or unconditioned reflexes was apparent.

144. Chinese Build Automatically Controlled Conditioned Reflex Instrument

"An Automatically Controlled Conditioned Reflex Instrument," reported by Institute of Materia Medica, Academia Sinica; Peiping, K'o-hsueh T'ung-pao (Scientia), No 21, 11 Nov 59

This item reports that an automatically controlled conditioned reflex apparatus has been built by scientists in the Institute of Materia Medica, Academia Sinica. The instrument is to be used in the study of the effects of drugs used in psychotherapy on the higher nervous activities of humans and animals. It has a data-recording unit and will run automatically for 4 1/2 hours. It can perform studies on five different types of conditioned reflexes and can be set to change from one type to another.

Public Health, Hygiene, and Sanitation

145. Plans for Public Health in 1960

"Public Health During 1960," by S. V. Kurashov, Minister of Health USSR; Moscow, Sovetskoye Zdravookhraneniye, No 1, 1960, pp 3-8

The author of this article states that the plan for the development of the national economy of the USSR, the state budget for 1960, the budgetary requirements of the USSR and union republics, and the term of office of deputies of the Supreme Soviet USSR were approved at the recent session of the Supreme Soviet. N. S. Khrushchev spoke at this session on the subject "The International Situation and the Foreign Policy of the Soviet Union." After the speech, the Supreme Soviet voted unanimously to urge parliaments of all countries to consider seriously the question of general disarmament.

The year 1959 was remarkable, the author continues, not only because industrial growth and output of consumer goods was greater that year than during any previous year since the end of the war, but also because N. S. Khrushchev's visit to the US created a favorable climate for the alleviation of international tension. The year 1959 will go down in history as the beginning of a new era in the conquest of space.

An increase in production in ferrous and nonferrous metals, coal, petroleum, electric energy, the most important types of chemicals, machines, building material, and consumer goods was noted toward the end of 1959. Labor productivity has increased and manufacturing costs have decreased. The demand for various products has been on the upswing.

Improvement in living conditions in the USSR is demonstrated by the fact that the birth rate has increased and infant mortality has decreased.

The Seven-Year Plan contains provisions for transition to a 7-hour workday. This is significant as far as the health of the population is concerned. This transition to a 7-hour day will not be accompanied by a reduction in salary; several groups of workers will receive a salary increase.

An estimated 1,620,000 hospital beds were available in the USSR by the end of 1959. Construction of therapeutic and preventive establishments and industrial medical establishments was not satisfactory during the first 9 months of 1959, however.

About 25,000 physicians were graduated in 1959. There will be 380,000 physicians practicing in the USSR by the end of the year. This figure does not include dentists. More than 68,000 subprofessional medical workers and pharmacists were graduated in 1959.

The 1960 plan calls for the construction of approximately 2.4 million apartments. It is expected that 10 million people will move into new homes during 1960. In addition members of kolkhozes will build approximately one million dwellings. This will break all records of housing construction during any one year since the end of the war.

Expenditures on public health during 1960 will be 47 billion rubles; this is 7% higher than the amount spent during 1959. The number of hospital beds available is expected to reach 1,709,000 by the end of 1960, for an increase of 89,000 (or 5.5%) over the previous year. In other words, there will be 79.3 beds available per 10,000 people by the end of 1960, in comparison with 76.3 beds per 10,000 people in 1959.

During 1960, medical universities will admit 24,900 students, including 2,300 persons who work during the day and attend classes in the evening. A total of 25,000 physicians will be graduated in 1960 throughout the USSR.

The plan for 1960 emphasizes outpatient clinics because they embrace the greatest number of people. The Ministry of Health USSR will call a special conference in 1960 to discuss outpatient medical service to the population.

The author of this article thinks that an effort must be made to protect the health of children. This can be done by eradicating certain children's diseases, such as diphtheria, whooping cough, and measles. Whooping cough and measles can be prevented by resorting to gamma globulin and combined vaccines. At present, medical establishments can meet the demand for poliomyelitis and brucellosis vaccines. Sufficient means are available to carry on active work in the "dehelminthization" of the population.

In 1960, the therapeutic establishments will be better supplied with antibiotics, sulfanilamide preparations, and a number of new preparations manufactured by the medical industry.

A number of new institutes will be established during 1960. Two of these institutes are the Institute of Pediatrics, Academy of Medical Sciences USSR, and the Institute of Experimental Endocrinology. Construction will start soon on a building to house the Institute of Experimental Oncology and another building to house the Institute of Experimental Radiobiology.

The Academy of Medical Sciences USSR unifies and directs the activity of the country's scientists. Its effort is directed toward solving the problems of prevention and eradication of such communicable diseases as influenza and malignant neoplasms. It controls production of medicines and directs studies intended to improve experimental and clinical research.

146. Possibilities of Extending Life Expectancy

"A Human Being Must Live a Long Time," by I. Lukomskiy;
Moscow, Krasnaya Zvezda, 26 Nov 59, No 278 (10965), p 4

Following a reference to Gulliver's Travels, which reflected the desire of all people to live a long life without the infirmities associated with old age, the author discusses varied changes that take place in the aging human organism. It is not always easy to decide which of these changes are connected with the aging process and which accompany senility. A long-held viewpoint expressed by the aphorism "our age depends on the age of our arteries" has been largely refuted by recent scientific studies, particularly those conducted by N. N. Anichkov, which showed that although arteriosclerosis develops more often at a later age, it is not directly connected with senility.

Claims that symptoms of senility are manifested as result of diminution in the size of a tissue or an organ or as a result of a decrease in the activity of the endocrine glands have not been substantiated. It has been demonstrated that the aging process of an

organism does not depend on local changes but on general changes. Atrophic changes in the pituitary, thyroid, and other glands are not the cause of senility; they are individual symptoms of this general process. General physicochemical changes in an organism play a much greater role in the process of aging.

One of the most substantial changes that takes place in an aging organism is dryness of tissues. Czech scientist Ruzhichka explained this by saying that tissue and cells lose their capacity to bind water as an organism grows older. It has been firmly established that noticeable changes take place in the metabolism of gases, tissue respiration, and in oxygen absorption as an organism grows older. Some qualitative changes in tissue proteins also occur.

Oxygen starvation leads to reduction in oxidation of cellular substances which produce energy for the organism. Incompletely oxidized products of metabolism become transformed into inert, insoluble substances which accumulate in an organism and contribute to its reverse development, i.e., aging.

It is clear, therefore, that symptoms of senility might be deferred. It is clear also that the successful solution of this problem requires control of various processes that takes place within the cells of an organism. Results of Soviet and foreign experiments on animals have shown that the time of manifestation of aging symptoms and diseases accompanying aging can be postponed. The well-known Rumanian scientist, Parkhon, discovered through experiments on animals that senile symptoms disappeared after the animals received thyroxin, pineal body extract, sex hormones, antireticular serum, and other preparations. These experiments, together with experiments conducted earlier, led Parkhon to conclude that the reverse development of senile changes can be achieved in humans also. But retardation of the aging process in humans is invariably more difficult than is possible even in highly developed animals.

The very complicated human organism is subjected to the varied effects of its immediate environment, including the social environment, which acts directly on its neuropsychic sphere. Inasmuch as the mental and physical conditions of a human being are invariably connected, the mental experiences affect the physical health of an individual and consequently influence the period of his active life.

The human organism is not a mechanical aggregate of cells and tissues. Its features are unity and completeness. Attempts to achieve "rejuvenation" by limited action on one organ or a system of an organism have produced, at best, only a temporary effect. Positive results can be attained with methods that act on the organism as a whole, such as administration of the serum developed by Academician A. A. Bogomolets and the method of novocain therapy developed by Academician Parkhon. A number of preparations used

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in the treatment of diseases which are not caused by old age, but which shorten human life and are encountered most often in the aged, have also been suggested.

It should be mentioned, however, that there can be no single preparation to control senility and diseases accompanying it; no preparation can be looked on as an all-purpose preparation. Treatment must be individual and comprehensive and each case must be considered separately.

However, some attempts at self-treatment deserve consideration. If such a treatment exists, it should be made accessible to everyone. In connection with this, the data collected by scientific expeditions which studied longevity among inhabitants of Daghestan, Abkhazia, and certain areas in the Ukraine, are quite instructive. The average age of 200 people studied in Daghestan was 114.5 years. Eight of these were city dwellers; the rest lived in mountainous areas and were occupied with animal husbandry and with work in the fields. Such people eat simple food, mostly dairy products and vegetables. One of the investigators, R. Sh. Alikishiyev, reported that strict observance of a number of hygienic rules, rest, and a number of traditions passed on from generation to generation are important conditions which help to prolong life. These traditions consist of exercise, rational distribution of work, and interest in work.

Severe climatic conditions in Daghestan have helped mold a physically strong people, devoid of laziness and other human weaknesses which shorten life. Investigators observed that almost all old people in Daghestan were good-natured and cheerful; the majority were never sick and seemed to be in good health when members of the expedition examined them. Many of them were still able-bodied and continued to work.

Studies have shown that the most important factors in longevity are not climatic conditions in the place of residence, but adherence to a proper regimen of work and rest, and the type and amount of food eaten.

All kinds of excesses can cause illnesses that shorten life. For example, the development of sclerosis accelerates the accumulation within the organism of substances rich in cholesterol. It is recommended, therefore, that older people avoid fats, fish, and eat less butter. Alcoholic beverages shorten life. Alcohol influences metabolism and is harmful to the functions of important organs. This applies to people of any age.

Physical exercise, recreation, and sports affect longevity. Exercise is beneficial to people of any age, although different exercises must be prescribed for different age groups. Systematic physical exercises and sports early in life contribute to a long life. Although the work regimen must be changed as a person grows older, nothing contributes more to the aging process than the transition from an active life to mental and physical indolence.

Observations during the past 10 years of a large group of people who are prominent in art, science, and literature and who have reached old age but have continued to work regularly, revealed that they not only retained their mental and physical vigor, but manifested great creative prowess. It was also discovered that complete cessation of customary activity in old age after many years of strenuous and productive labor can lead to a decline in strength and the rapid onset of senility.

At present, scientists doing research in biology, medicine, and other related sciences have gathered sufficient information to assist in solving the problem of longevity and healthy old age. But achievements in prolonging life also depend on the development of such new branches of science as gerontology and geriatrics. The Institute of Geriatrics of the Rumanian People's Republic has been conducting research in this field for many years. The institute is headed by Academician Parkhon and his daughter, Professor Aslan. An Institute of Gerontology has been established in Kiev. Scientific societies of gerontologists have been established in a number of USSR cities. The success of these scientific societies, the author states, depends not only on the close cooperation of representatives of various branches of knowledge, but also on the exceptionally favorable environment created by the socialist system for shaping the destiny of every individual.

This article concludes with the statement that the socialist way of life has created conditions for prolonging life, has brought about confidence in tomorrow, has promoted efficiency at all levels, has sponsored attempts to accomplish a protective regimen for people who have reached the twilight of their lives, and has revealed for Soviet scientists favorable prospects for a successful fight for longevity and preservation of the physical and mental vigor of human beings even in old age.

147. Health Propaganda Unit Established

"University of Health," by R. Pavlov; Moscow, Meditinskiy Rabotnik, No 13, (1865), 12 Feb 60, p 2

The author of this article states that the agitation point of the Minsk Medical Institute has always paid a great deal of attention to the propagation of knowledge in the field of natural sciences. A propaganda unit has been formed by professors and docents of the VUZ (higher educational institution) to supply lecturers. The propaganda post has arranged lectures on the following subjects to various groups: cancerous diseases and measures to prevent them, rheumatism and protection against it, influenza, the importance of vitamins in nutrition, and other subjects.

The propagation of medical knowledge has not kept up with the growing demand, however. Toward the end of 1959, the Leninskiy Rayon Party Committee of Minsk decided to establish a health university at the Medical Institute. It was opened and instruction was begun in January 1960 of Academician Leonov, Doctor of Medical Sciences, who is the oldest professor at the Medical Institute, told his listeners about the aims and endeavors of the health university and wished them success in their studies. I. B. Kardash, Deputy Minister of Health Belorussian SSR, read a lecture on the subject of "Prevention as the Basis of Soviet Medicine." This lecture was followed by two films: "Pay Attention to Your Health" and "Thaumaturgist From Byurilev."

Radiology

148. Effects of Anesthesia and Antishock Measures on Course of Acute Radiation Sickness

"The Effect of Anesthesia and Antishock Measures on Acute Radiation Sickness," by A. N. Syzganov, B. S. Babashev, and Yu. M. Bryakin; Alma-Ata, Vestnik Akademii Nauk Kazanskoy SSR, No 12, Dec 59, pp 57-65

Two series of tests were conducted on dogs suffering from acute radiation sickness and subjected to the effects of various methods of anesthesia and antishock measures.

In general, when anesthesia (intratracheal oxygen-ether, intravenous ether, nitrous oxide inhalation, and local anesthesia according to the method of A. V. Vishnevskiy) was applied during the peak of acute radiation sickness it aggravated the course of the disease, but it was less deleterious when applied during the initial period.

Results of using the various antishock measures (peptone solution, fresh whole blood, Asvatyan fluid, and Polosukhin fluid which consists of 25 g NaCl; 1.5 g CaCl₂; 0.5 g sodium hyposulfite, and distilled water to make up to 500 ml) indicated that all the antishock substances used in acute radiation sickness preserved the arteriopressor effect to some extent. In all cases, the antishock fluid was most effective when used during the initial period of acute radiation sickness, and least effective when used during the peak of acute radiation sickness. Blood transfusion in combination with the infusion of Polosukhin fluid had the best therapeutic effect.

149. Blood Coagulation System as Index of Early Radiation Damage

"The Condition of the Blood Coagulation Systems of X-Ray Room Personnel," by V. I. Shevchenko and Ye. Ya. Sukhovéyeva; Chair of Propaedeutics of Internal Diseases, Altay Medical Institute; Moscow, Sovetskaya Meditsina, No 1, Jan 60, pp 100-103

The authors observed 55 X-ray personnel to determine the factors in the blood coagulation system, and the blood morphological composition most clearly reactive to ionizing radiation. The following conclusions are presented:

1. A number of disturbances connected with the blood coagulation system are noted in X-ray personnel subjected to systematic X irradiation. These disturbances are especially marked in people who for long periods have been within the sphere of the effect of penetrating radiation.

2. Decreased blood recalcification time, decreased tolerance to heparin, and shortened prothrombin time are most marked. A decrease in the activity of proaccelerine and proconvertine is less regularly noted.

3. These data indicate that the blood coagulation system is sensitive to penetrating radiation, and its study can be used as one of the methods of detecting early and latent radiation damages.

150. Use of Circular and Lateral Arterial Sutures in Acute Radiation Sickness

"Arterial Sutures in Acute Radiation Sickness" (Experimental Research), by A. M. Demetskiy, Chair of Operative Surgery and Topographic Anatomy, Vitebsk Medical Institute; Minsk, Zdravookhraneniye Belorussii, No 1, Jan 60, pp 23-25

Tests were conducted on dogs subjected to a single general X irradiation by 350-400 r doses to determine the feasibility of using manual circular and lateral arterial sutures during the four periods of acute radiation sickness.

The author presents the following results:

1. It was possible to use manual circular and lateral arterial sutures in cases of acute radiation sickness of a moderate degree, under experimental conditions.

2. The outcome of the use of vascular sutures depended on the period of acute radiation sickness during which the operation was performed. Best results were obtained when the sutures were applied during the initial and recovery periods. The use of circular and lateral vascular sutures during the peak of the disease was accompanied, in more than half the cases, by various complications (thrombogenesis, suppuration, and the separation of the suture).

3. After the use of manual circular arterial sutures, scar formation was completed within 30-40 days.

151. Characteristic Neurological Changes in Radiation-Treated Cancer Patients

"Certain Changes in the Neurological Condition of Cancer Patients Under Radiation Therapy," by L. I. Abaskuliyeva, Chair of Pathophysiology of Azerbaydzhan State Institute for Advanced Training of Physicians; Baku, Azerbaydzhanskiy Meditsinskiy Zhurnal, No 1, Jan 60, pp 61-65

The author describes his observations of 30 cancer patients under radioactive cobalt therapy and presents the following conclusions:

1. The effect of ionizing radiation in therapeutic doses leads to certain changes in the neurological condition of cancer patients.
2. Under the effect of radiation therapy, phasic changes in tendon and skin reflexes, dermographism and latent period, the periodic appearance of pathological Babinskiy and Bechterew's reflexes, and the frequent distortion of visceral reflexes can be observed.
3. The above-mentioned changes depend, to a great extent, on the original condition of these indexes before therapy, the severity of the basic disease, the effectiveness of the treatment, and the general reaction of the organism to radiation treatment.

152. Effect of Radiation Sickness on Natural Resistance of Rats to Tuberculosis

"The Effect of Radiation Sickness on the Natural Resistance of White Rats to Tuberculosis Under Experimental Conditions," by A. M. Zubets, Microbiological Department of Tuberculosis Institute, Academy of Medical Sciences USSR; Moscow, Problemy Tuberkuleza, No 1, Jan/Feb 60, pp 103-111

Ionizing radiation in doses which cause radiation sickness significantly changes the immunological reactivity of an organism so that its susceptibility to the majority of infectious diseases is increased. Keeping in mind the fact that rats have a high natural resistance to tuberculosis, the author examined the effect of acute radiation sickness on tuberculosis in mature white rats.

The experimental animals were subjected to a single general dose amounting to 560-800 r, or fractional general doses amounting to 1,420 and 2,951 r. The irradiation was conducted or started on the day of intravenous or subcutaneous infection by Mycobacterium tuberculosis (strain "Akademiya" 28) of medium virulence.

The author presents the following conclusions:

1. The natural resistance of white rats to tuberculosis during radiation sickness is disturbed to different degrees depending on the method of infection.
2. Under the effect of radiation sickness, a marked decrease in the resistance is noted after intravenous infection, which is evidenced by the more aggravated course of the infection. During this process, as a rule, the infection retained its chronic course and progressed in essentially the same areas where it was started, just as it did in the control animals.
3. Judging by the macroscopic picture and by seedability, the aggravation of the disease after a single irradiation by 560-800 r did not coincide with the development of radiation sickness, but was apparent at later stages in the course of the sickness.
4. Following subcutaneous infection, regardless of radiation sickness, the rats remained highly resistant to tuberculosis, i.e., no generalization or progression of the process occurred.

153. Alpha-Dosimetry for Boundary Regions of Heterogenous Media

"The Problem of Alpha-Dosimetry of Boundary Regions of Heterogenous Media," by G. A. Volkov and G. R. Rik; Moscow, Biofizika, Vol 5, No 1, Jan/Feb 60, pp 60-68

In studying the effects of alpha radiations on a living organism subjected to radiation therapy, which involves a number of problems of applied physics, it is necessary to determine accurately the magnitude of the radiation dose received by various parts of an organism, the area involved and the particular organ. It is especially difficult to calculate the radiation dose absorbed at the boundary areas of two media with different capacities for slowing alpha radiation of a given energy, different energies of alpha particles, and different concentrations of alpha-emitting radioactive isotopes.

This article explains the methods of calculating the doses and derives the formulas for determining the doses received by plane, spherical, and cylindrical surfaces of heterogenous media per unit time per volume, and at definite distances. Detailed mathematical treatments for these calculations are employed and elaborated.

154. Pocket Size Gamma Dosimeters Described

"Pocket Model Gamma-Indicating Dosimeters," by M. I. Amiragova, V. Ye. Busygin, and Yu. M. Shtukkenberg; Issled. v Obl. Dozimetrii Ioniziruyushchikh Izlucheni (Research in the Field of Dosimetry of Ionizing Radiations), 1957, pp 102-111 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 24, 25 Dec 59, Abstract No 102538, by D. M. A.)

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"A portable apparatus the size of a fountain pen, which consists of a combination of an ionization chamber with an electric motor, is described. Before measuring the dose, the collecting electrode of the chamber is charged to a certain potential. Its potential is decreased under the effect of gamma radiation, which causes deflection of the moving unit of the electrometer. Gamma dosimeters are produced for three ranges: 0-0.2, 0-5, and 0-50 roentgens. They can measure doses of gamma radiation with energies greater than 0.15 Mev (when r is less than 2 r/min), over a broad temperature range and at 100% humidity, with $\pm 15\%$ accuracy."

155. Popular Information on Radiation Detection and Measurement

"Methods of Radiation Detection and Measurement," by M. I. Amiragova, V. Ye. Busygin, and Yu. M. Shtukkenberg, Issled. v Obl. Dozimetrii Ioniziruyushchikh Izlucheni (Research in the Field of Dosimetry of Ionizing Radiations), 1957, pp 102-111 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 24, 25 Dec 59, Abstract No 102540, by D. I. A.)

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"Brief information on the processes of the interaction of nuclear particles and quanta with a substance and the various methods of recording ionization radiations are described in a popular style. The construction of the ionization chamber, G-M counters, scintillation transducers, etc. are described. The principle of the operation of mass-spectrometry is briefly described."

156. Chinese Study Effects of X Rays on Rhesus Monkeys

"The Effect of X Rays on Male Germ Cells of Macaca mulatta, I. The Sensitivity of Spermatogonia," by Wang Hao (王浩) and Tseng Chung-hsing (曾中興), Institute of Biophysics, Academia Sinica; Ch'en Hsiu-lan (陳秀蘭), Institute of Zoology, Academia Sinica, and others; Peiping, Science Record, Vol 4, No 1, Jan 60, pp 33-40

This paper, published in English, presents details of animal experiments conducted to study the effect of whole-body X irradiation on the germ cells of Rhesus monkeys. The authors state that detailed studies on monkeys are expected to elucidate the mechanism of action of irradiation on the germ cells of human beings.

Nine monkeys were subjected to whole-body X irradiation in doses of 50 r, 100 r, and 200 r. At definite intervals after irradiation, beginning with the 10th day, testicles were removed from the animals and serial sections prepared in the usual way. Statistical data, based on 200 microscopic fields enlarged 400 times, are presented to show the morphological changes at different stages of spermatogenesis. Degeneration was observed on the tenth post irradiation day. Sperm cells were seriously destroyed as the radiation dose increased. No sign of recovery was observed during the whole experimental period, which lasted 50 days.

In discussing the experimental results, the authors allude to previous experience in irradiating mice, with 400 r and 500 r for studies on germ cells.

"Effects of a Single [Whole-Body] X Irradiation on the Peripheral Blood of Rhesus Monkey (Macaca mulatta)," by Ma Hsiu-Ch'uan (馬秀權), Institute of Biophysics, Academia Sinica, and Wang An-ch'i (汪安琦), Institute of Zoology, Academia Sinica; Peiping; Science Record, Vol 4, No 1, Jan 60, pp 41-53

Fourteen Rhesus monkeys (Macaca mulatta), 11 male and 3 female, age 6-19, were used in this study of the effects of single X irradiation on the blood picture. Each animal received a total dose of 200-600 roentgens, which, according to Haigh, would be within the LD₅₀-LD₃₀ range. Because of the limitation of the X-ray field, some of the monkeys received whole-body irradiation by separate exposure of the upper and lower halves of the body, while others received whole-body irradiation by a single exposure which did not include small parts of their heads and feet. Results of postirradiation examination of the blood picture and the authors' conclusions follow:

1. Whole-body irradiation administered by exposing first one and then the other half of the body caused more severe injury than did whole-body irradiation administered at one time.
2. The primary cause of death for animals which died 1-2 weeks after irradiation was found to be bone marrow aplasia. From 2 to 3 days before death, their erythrocyte and leucocyte counts and hemoglobin concentrations were lower than those of the survivors which had received the same doses of irradiation. The nonfilamented neutrophil and degenerated leucocyte counts were also higher than those of the survivors, which showed no significant change in this respect. The changes observed may be regarded as prognostic signs for radiation sickness.
3. Leucocytes, neutrophils, and monocytes had increased markedly 6 hours after irradiation. The lower dose group had higher counts than the higher dose group. This difference may be due to an earlier peak of elevation occurring in the higher dose group.
4. The degree of the reduction of leucocytes, eosinophils, lymphocytes, and monocytes after irradiation and the time of the beginning and completion of their recovery was definitely related to the dose of radiation received. In the higher dose group, the reduction was greater and the beginning and completion of recovery was later. Neutrophils with toxic granules, binucleated lymphocytes, and degenerated lymphocytes were found more frequently in the higher dose group.
5. Immediately after irradiation, neutrophils increased to 2-6 times their preirradiation level, and most of them showed signs of pre-necrosis. Concurrently, nonfilamented neutrophils rose from their pre-irradiation level of from 2-4 percent to 5-40 percent, causing a shift to the left in the blood picture. Thereafter, neutrophils fell rapidly, and during the first 3 days of reduction, cells with nuclei of 6-10 lobes increased markedly to 2-6 times their preirradiation level. Many of them were giant-size. Hence, a shift to the right in the blood picture was observed a few days following irradiation.
6. Immediately after irradiation, eosinophils disappeared almost entirely, returned to normal in 2 days, and disappeared again in a few weeks. The situation was then followed by eosinophilia.
7. Small lymphocytes were more radiosensitive than the medium-size and large ones. The lymphocytes which disappeared after irradiation and returned during recovery were mostly small. One to 4 days after irradiation, degenerated lymphocytes constituted about 0.5-5.0 percent of all lymphocytes, which was 2-20 percent above their normal level.

"Effect of a Single Session of Half-Body X Irradiation on the Peripheral Blood of the Rhesus Monkey (*Macaca mulatta*), by Ma Hsiu-ch'uan (馬秀權), Institute of Biophysics, Academia Sinica; Peiping, Science Record, Vol 4, No 2, Feb 60, pp 111-119

This paper, published in English, presents the details of experiments conducted to study the effects of low dosages (50r-200r) of half-body X irradiation on the blood picture of 13 Rhesus monkeys. In his summary of results obtained, the author states that the response of the blood elements to a lower dose (50-200 roentgens) of half-body X irradiation agreed broadly with the pattern of response to a higher dose (200-600 roentgens) of whole-body irradiation, which was described in the preceding paper.

The present paper was received for publication in November 1959. It may be concluded from the author's statement, quoted below, that other studies on the effects of radiation on monkeys were pursued in the Institute of Biophysics, Academia Sinica: "Almost 13 blood picture determinations were made for each animal except those which had to be killed to meet the needs of cooperative experiments." A table giving experimental data shows that nine of the 13 monkeys were "killed to meet the needs of cooperative experiments."

Surgery

157. Intravenous Anesthesia

"Potentiated Anesthesia With Neuroplegic Preparations (Pentothal-Curare). New Method of Prolonged Intravenous Anesthesia," by C. Cosma, Chirurgia, 1951, No 1, pp 85-90 (from Meditzinskiy Referativnyy Zhurnal, Section 2, No 12, Dec 59, p 19)

The author describes his own method of intravenous anesthesia with the use of pentothal-sodium. The action of the preparation is prolonged by potentiating the drug with an intravenous injection of a lytic mixture and the administration of curare. This method makes it possible for the patient to better tolerate surgical trauma and simplifies the necessary equipment used. The method was used without complications in 30 cases."

158. Prophylaxis of Operative Shock

"On the Prophylaxis of Operative Shock by the Administration of Dibazole per os" (Experimental Study), by Ye. G. Vodokhlebova, Laboratory of Experimental Pathology, Leningrad Institute of Blood Transfusion; Moscow-Leningrad, Vol 83, No 11, Nov 59, pp 98-104

In experiments conducted on rabbits to determine the effectiveness of dibazole [the hydrochloride of 2-benzyl-benzimidazole, by Prof M. D. Mashkovskiy, Lekarstvennyye Sredstva, Medgiz, Moscow, 1957, pp 212-213] when used in the prophylaxis of operative shock, it was established that if it is administered per os in conjunction with vitamins, novocain anesthesia of the mesentery, and the paranephral areas, and blood transfusion, it considerably increased the resistance of the animals to the development of visceral shock. Blood transfusion alone has little effect in preventing visceral shock.

159. Exocardiac Circulation

"Experimental Application of Exocardiac Circulation With the Help of a Bubble Oxygenator," by B. Bednarik and M. Vasulin, Rozhledy chir. (Czechoslovakia), 1959, No 3, pp 201-209, (from Meditzinskiy Referativnyy Zhurnal, Section CPYRGIF, No 12, Dec 59, p 59)

"The results of the experimental application of exocardiac blood circulation with the help of an apparatus which replaces cardiac and pulmonary action are reported. The equipment and the bubble oxygenator used in laboratory experiments which were conducted at the Second Surgical Clinic of Brno are described. Surgery was performed on 58 dogs. Exocardiac blood circulation was used for periods lasting from 8 to 67 minutes with an average blood flow of 40-50 milliliters per kilogram of body weight a minute. During the period of exocardiac circulation, arterial pressure decreased, and venous pressure slightly increased; the number of erythrocytes, leukocytes, and thrombocytes decreased. The temperature fell 1-2 degrees. The average hemolysis expressed by the quantity of hemoglobin plasma was 42 percent. Oxygen saturation in the arterial blood with the help of the apparatus reached 95-100 percent, and in the venous blood, 40 percent."

160. Mechanism of Thermoreception Restoration After Severe Burns

"Morphological and Functional Regeneration of the Nervous Apparatus of Human Skin After Burns," by K. K. Sergeev, Aktyubinsk State Medical Institute and Chair of Histology; Moscow, Vestnik Dermatologii i Venerologii, No 2, Feb 60, pp 30-34

The author describes the case histories of six patients treated for severe burns in whom he observed the cutaneous nerve regeneration process for 21 months.

The author presents the following conclusions:

1. Histological and functional regeneration of nerve endings of the skin occurs after burns, even after severe burns.
2. The younger the victim, the greater the histological regeneration. Regeneration was observed in Meissner's and Pacinian corpuscles, in the free nerve endings of the dermis, and in the intraepithelial nerve endings of the epidermis.
3. Thermal sensations were restored in all the patients except the one afflicted by roentgen burns, who lost cold sensation. Pain sensation was weaker than normal in almost all the patients.
4. In the majority of patients in whom thermal sensations were restored, no encapsulated nerve endings were detected, which confirms the author's opinion that thermoreception is a function of the histologically simple nerve endings in the epidermis and connective tissue.

Virology

161. Hydrogen Peroxide Affects Activity of Tick-Borne Encephalitis Virus

"The Action of Hydrogen Peroxide on the Virus of Tick-Borne Encephalitis," by V. A. Anan'yev, Institute of Virology imeni D. I. Ivanovskiy; Moscow, Voprosy Virusologii, Vol 4, No 6, Nov/Dec 59, pp 684-686

The action of hydrogen peroxide was tested on the Ix10 strain of tick-borne encephalitis virus; virus-containing suspensions of brains of white mice in dilutions of 1:50-1:100 were exposed to various concentrations of hydrogen peroxide and then administered subcutaneously to white mice, which were observed for 3 weeks. In view of the inactivating effect

observed, it was decided to enhance the oxidation process by using horseradish as a source of peroxidase. Three tables show the effects of different concentrations of hydrogen peroxide and the combined effects of hydrogen peroxide and horseradish extract. The following conclusions are presented:

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"1. Hydrogen peroxide in a 2-3% concentration had a virucidal capability with respect to the tick-borne encephalitis virus.

"2. Inactivation of the virus by hydrogen peroxide was significantly reinforced in the presence of peroxidase (horseradish extract).

"3. Freshly prepared horseradish extract had a virucidal effect on the tick-borne encephalitis virus."

162. Virus Toxicity Discussed

"The Toxic Properties of Viruses," by B. F. Semenov and V. I. Gavrilov; Moscow, Voprosy Virusologii, Vol 5, No 1, Jan/Feb 60, pp 5-13

In introducing this extensive discussion, the authors state that the concept of "toxic properties" has been adopted in modern virology to signify the capability of viruses to cause rapidly arising pathological organ and tissue changes which are not connected with the dispersal of the infectious agent. The terms "cytopathic" and "neuropathic" properties are similar but not identical to "toxic" properties.

The article is subdivided under the following headings: "Methods of Demonstrating the Toxic Properties of Viruses; Differentiation of Affections Caused by the Toxic Action of Viruses and Changes Connected With Their Replication; Data on Mechanisms of the Toxic Action of Viruses; Immunity to the Toxic Action of Viruses; and Toxic Properties of Viruses and Problems of the Pathology of Virus Infections. The authors conclude the following:

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"The data presented attest to the fact that the pathogenicity of many viruses is connected not only with their capacity to replicate in sensitive tissues and cells, but also with the presence of toxic properties. Hence the necessity arises for intensive study of the role of the toxic factor in the pathogenesis and clinical picture of virus diseases. Such research will permit the development of more modern methods of diagnosing and treating virus diseases."

Soviet and foreign sources on the viruses of lymphogranuloma, pneumonia, meningopneumonia, influenza, Newcastle's disease, Western equine encephalomyelitis, parotitis, smallpox, ornithosis-psittacosis, poliomyelitis, and the adenoviruses are referenced.

Miscellaneous

163. Problems of Otorhinolaryngology

"Basic Problems of Soviet Scientific Otorhinolaryngology" (On the Working Plan of Scientific Research Work for 1960, According to the Academy of Medical Sciences USSR), by I. A. Lopotko, V. F. Undrits, B. S. Preobrazhenskiy, K. L. Khilov, A. G. Likhachev, I. Ya. Sendul'skiy, T. M. Milsh-teyn, G. I. Grinberg, and S. Z. Romm; Moscow, Vestnik Otorinolaringologii, Vol XXI, No 5, Sep/Oct 59, pp 3-15

The Committee of Otorhinolaryngology of the Academy of Medical Sciences USSR outlined the plan for investigations in the field of otorhinolaryngology to be carried out in 1960. The plan calls for research on the following groups of diseases: angina and chronic tonsillitis, chronic suppurative otitis and its complications, physiology and pathology of the acoustic and voice analyzer, control of occupational diseases and mechanical traumas connected with otorhinolaryngology, and oncology in otorhinolaryngology. Concrete problems in each of the groups are pointed out.

164. Review of Book on Theoretical Medicine

Nekotoryye Filosofskiye Vprosy Teoreticheskoy Meditsiny (Some Philosophical Questions of Theoretical Medicine), edited by D. A. Biryukov, reviewed by L. Sheputo; Moscow, Meditsinskiy Rabotnik, No 15 (1867), 19 Feb 60, p 4

The reviewer of this book states that it contains articles which concern the interrelationship between physical and mental ailments, between biochemistry and microbiology, the application of philosophical categories to specific problems of pathology, and the formation of the materialistic world outlook of I. P. Pavlov. The book, edited by D. A. Biryukov, was published in Leningrad by the Institute of Experimental Medicine.

The first article in the book, by V. F. Serzhantov, is entitled "The Principal Aspects of the Problem of Matter and Consciousness and Their Bond With Physiology."

The article by I. V. Danilov entitled "Approaches to the Study of Physiological Mechanisms of Consciousness," should evoke a favorable reaction. I. V. Danilov points out the methodological inconsistency of some scientists abroad in their attempt to solve the problem of the relationship between matter and consciousness. The article contains factual material which reveals existing differences of opinion among scientists who are trying to develop methods of investigating physiological mechanisms of consciousness.

"Cybernetics and Some Questions Concerning Physiology of the Nervous System" is the title of the article contributed by D. N. Menitskiy. He showed in this article what the study of the physiology of the nervous system contributed to the emergence and development of cybernetics. He discusses the significance of the physiological processes of mental phenomena and the role that Russian and Soviet scientists played in developing this idea.

According to this reviewer, some medical scientists in capitalist countries reject the principle of nosology and diagnosis in medicine. The article of P. N. Veselkin, "The Question of Dialectic Materialistic Understanding of Causality in Etiology," is critical of the representatives of the antidiagnostic idea in medical science.

S. A. Neyfakh wrote the article dealing with "The Problem of Proteins in Biology and Medicine." S. A. Neyfakh takes exception to the tendency found in medical literature to transfer the principal substratum of a disease from systemic infections and from the pathology of organs and tissues to molecules of proteins. The foundation for this concept was laid by Poligin, who advanced the idea of "diseases of molecules". The reviewer disagrees with S. A. Neyfakh. It is known that during the last century I. M. Sechenov expressed the opinion that in the future medicine would become molecular. The father of Russian materialistic physiology advanced the hypothesis that disease in a human being consists, first of all, of disturbance in the molecular structure of living matter. Extensive branching of exact natural sciences into physiology, biology, and medicine is creating conditions for theoretical generalization and substantiation of the atomic-nuclear theory in medicine. Modern biophysics and biochemistry offer the possibility of penetrating into the essence of the molecular structure of cells, tissues, and systems of the organism. The molecular state of the development of medicine will, no doubt, be exceptionally favorable for both theoretical and practical medicine, for solving many problems of early diagnosis, and for the successful prevention and treatment of various diseases.

The initiative taken by the Institute of Experimental Medicine in publishing this collection of articles on some philosophical questions of theoretical medicine is to be commended in the reviewer's opinion. The reviewer feels that it is desirable that more such works be published in the future.

165. New Medical Research Institutes in Czechoslovakia

"New Medical Research Institutes" (unsigned article); Prague, Hospodarske Noviny, No 7, 12 Feb 60, p 2

According to a government decision, during the Third Five-Year Plan several new research institutes are to be established in Czechoslovakia, including the Research Institutes for Pediatrics. The existing laboratory, operating as a part of the Pediatrics Faculty in Prague, will take on more research work, particularly after the establishment of the Pediatrics Faculty in Prague-Motol. The Research Institute for Neurology and Psychiatry will be established while the existing research laboratory, operating as part of the neurological clinics in Prague and Bratislava, will be expanded both in equipment and personnel.

The Research Institute for Experimental Therapy will be established in Prague; this type of institute is essential in view of the development of Czechoslovakia's pharmaceutical industry. In Prague-Krc, the Central Isotope Center will be established, as will a new model laboratory for the design of unique instruments for the medical profession. The Biochemistry Laboratory of the Oncological Institute in Brno will become a branch of the Research Institute for Oncology in Bratislava. The Third Five-Year Plan provides for the establishment of a Gerontological Work Center which will serve as the nucleus for the development of the independent Research Institute for Gerontology. The activity of the Research Institute for Medical Organization, which deals with major economic problems of medical care, will be expanded.

Generally, the physiological and pathological aspects of medical research will be strengthened. Physiological laboratories are to be established at all medical research institutes.

VII. METALLURGY

166. Influence of Cold Working On Heat Resistant Steels and Alloys

"The Influence of Cold Working on the Structure and Quality of High-Temperature Steels and Alloys," by M. L. Bernshteyn, Trudy Sektsii Metallovedeniya i Termicheskoy Obrabotki Metallov. Tsentral'naya Pravleniye Nauchno-Tekhnicheskogo O-va Mashinostroitel'noy Promyshlennosti (Works of the Section on Physical Metallurgy and the Heat Treatment of Metals, Central Board of the Scientific-Technical Society of the Machine Building Industry), No 1, 1958, pp 230-265 (from Referativnyye Zhurnal--Mashinostroyeniye, No 23, 10 Dec 59, Abstract No 97020)

Theoretical notions regarding the hardening effect of cold working were tested experimentally on specimens of EI395 steel consisting of 0.11 percent carbon, 17 percent chromium, 24 percent nickel, 6.64 percent molybdenum, and 0.12 percent nitrogen; on specimens of nickel alloys containing 0.075 percent carbon, 20.5 percent chromium, 0.04 percent cesium, 2.6 percent titanium, and 0.56 percent aluminum; and on specimens of alloy KhN60 (15 percent chromium, 62.5 percent nickel, 21.2 percent iron and 0.19 percent carbon). The specimens of steel EI395 were cold worked by stretching to 20 percent elongation and then age hardened at 600-900 degrees by soaking for 1-100 hours. A second group of specimens was age hardened directly after quenching. The nickel alloy (EI437) specimens were cold worked by rolling and drawing, with a reduction of area of 5.50 and 75 percent. Cold deformation took place following the quenching at various rates of cooling; then followed an age hardening at 500-800 degrees by soaking for 5-5,000 minutes. Specimens of alloy KhN60 were rolled and drawn with a 50 percent reduction. The cold worked specimens were subjected to various types of mechanical tests. The specific electrical resistance and the hot hardness were measured in vacuum. It was found that the important factors which determine the heat resistance of steel are the distribution and the size of the particles of the hardening phase. The distribution of the phases formed during the age-hardening affects the impact ductility and the plastic characteristic of the steel; the size of the particles determines the characteristics of hardness and strength in short-duration tests. The size and distribution of particles of the hardening phase affect the characteristics of endurance and fatigue strength.

167. Tribenzylamine Corrosion Inhibitor for Iron and Zinc

"Combined Protection of Iron and Zinc in Acid Media," by A. T. Petrenko and L. I. Antropov, Sbornik Komiteta po Korrozii i Zashchity Metallov Vsesoyuznykh Sovetov Nauchno-tekhnicheskikh Obshchestv (Collection of Articles of the Committee on Corrosion and the Protection of Metals of All-Union Councils of Scientific-Technical Societies), No 2, 1957, pp 82-93 (from Referativnyy Zhurnal--Mashinostroyeniye, No 23, 10 Dec 59, Abstract No 97175)

Experimental proof is given of a new combination method of protecting iron and zinc from acid corrosion. Prepared specimens of iron and zinc were exposed to the effect of 1-normal solutions of sulphuric and hydrochloric acid. During a cathode polarization in the presence of adsorption inhibitors, the rate of corrosion of iron decreased to such a degree that, even with relatively low currents (5-15 times less than without the addition of inhibitors), the weight losses of the specimens did not increase during the testing period. The best protection of the zinc was provided in the presence of tribenzylamine at a current of 3.2×10^{-2} amperes per square centimeter (8.4×10^{-2} amperes per square centimeter without the addition of tribenzylamine). Thus, in parts containing both iron and zinc, complete protection against corrosion can be provided for both metals by the addition of one inhibitor, tribenzylamine, and the application of an external current. If current is absent, the decomposition of the zinc is retarded, and a complete protection of the iron is afforded by the increased effectiveness of the inhibitor resulting from the current of the two galvanic elements zinc and iron. Thus, in the combined protection of the iron and the zinc, the most effective inhibitors are those which add surface active cations to solutions, which may have a connection with increasing the rate at which they are adsorbed during a shift of potential in the negative direction and away from the zero point of the metal.

168. Leningrad Research On Forging of EI612 Steel

"Research On the Production of Forgings of EI612 High-Temperature Steel," by V. P. Chikidovskiy, Novoye v Kuznechno-Shtampovichnykh Tsekhakh Leningrada (New Developments at Leningrad Forging and Pressing Shops), Leningrad, 1958, pp 29-43 (from Referativnyy Zhurnal--Mashinostroyeniye, No 24, 25 Dec 59, Abstract No 101361)

On the basis of research conducted at the Leningrad Metals Plant on the forging, stamping, and rolling of EI612 steel, the following conclusions were drawn: a careful ultrasonic check of the original billets is necessary; important working parts should have a grain size of 3-4; the

billets should be heat treated in an electric furnace with a Silit resistor; the temperature range for drop forgings should be 950-1200°C, for open-die forgings 1000-1200°C; the deformation in the final operation should be equal to or more than 15 percent; and in order to avoid flaws inside the forgings, in the case of open-die forgings, it is necessary to use sunken hammers or dies.

169. Research On Electrosark Hardening Methods

"The Structure, Hardness, and Depth of a Layer Hardened by the Electrosark Method," by G. P. Ivanov, Elektrotermicheskaya Obrabotka i Elektroiskrovoye Uprochneniye Detaley. TsNIIITMASH, Kniga 89 (Electrothermal and Electrosark Treatment of Parts. Central Scientific Research Institute of Technology and Machine Building, Book 89), Moscow, 1958, pp 188-203 (from Referativnyy Zhurnal--Mashinostroyeniye, No 24, 25 Dec 59, Abstract No 101924)

Unlike low-power electric spark installations which produce a high quality hardened layer only 0.05 - 0.2 millimeter thick, the IAS-3 apparatus (15,000 watts capacity; 250 amperes, 60 volts) provides a very deep hardened layer (0.8, 1.4, and 2.5 millimeters thick on Steel-45 at a frequency of 50 cycles, a power of 1,000, 3,600, 9,000 watts and hardening times of 0.2, 0.04, and 0.03 seconds per square millimeter). The surface cleanliness is impaired with increased wattage, and improved with increased frequency (although the depth of the hardened layer is somewhat reduced as the frequency is increased). With a ferrochromium electrode, 6,400 watts of power, a 50-cycle frequency, and a general depth of hardened layer of 1.37 millimeters, the surface was poor; when a 100-cycle frequency was used, however, the surface was satisfactory with a hardened layer 1.37 millimeters thick. When a Steel-45 electrode was used, the depth of hardened layer was greater than when the ferrochromium electrode was used; with quenching in a jet of water, the layer depth was only one fourth that produced with quenching in air. A description is given of the influence of various operational procedures on the hardness and microstructure of the white and the diffused layers. To improve the surface cleanliness and to increase productivity, methods were devised for a mechanization of the electrosark hardening process.

170. Technological Data for Investment-Mold Pattern Production

"An Investigation of the Properties of the Alloys Used for Making Investment-Mold Patterns," by V. A. Ozerov, Nauchnyye Trudy Stalingradskogo Mekhanicheskogo Institut (Scientific Works of the Stalingrad Mechanical Institute), 1956 (1957), 3, pp 67-80 (from Referativnyy Zhurnal--Mashinostroyeniye, No 24, 25 Dec 59, Abstract No 102898)

In Soviet industrial practice, various low-melting alloys, usually based on paraffin, stearin, ceresin, polystyrene, and gum rosin, are used for the preparation of investment-mold patterns. Studies were made to determine the strength, shrinkage, and expansion under heat of pattern alloys and a method was devised for conducting a series of tests at the same time. The results obtained afford the possibility of estimating the technological properties of various pattern alloys and of determining the influence of the method of preparation on the quality of the patterns. On the basis of the obtained data, a choice can be made of the proper alloy, the method of preparing, the pattern, and the method of preparing the mold.

171. Computing Creep in Operating Turbine Blades

"Computing Creep in Operating Turbine Blades," by N. N. Malinin, Raschetny na Prochnost' (Computing Strength), No 3, Moscow (Mashgiz), 1958, pp 252-286 (from Referativnyy Zhurnal--Mashinostroyeniye, No 1, 10 Jan 60, Abstract No 2086)

A method is described for computing creep in operating turbine blades of variable cross section, with bending taken into account.

A uniform temperature field with blade height and unchanged primary blade dimensions are assumed. Stress is constant with respect to time, and the stress condition is uniaxial. It is also assumed that the neutral line lies outside the cross section, i.e., the bending stress is lower than the tensile stress. Two procedures are proposed, depending on the ratio of these two stresses; in the first, when this ratio (and, consequently, the ratio of the plastic deformation resulting from bending to the deformation resulting from tensile stress) is small, only two terms of the power series are retained in the solution of the problem of steady creep. Here, stress is determined as in the case of elastic limit. Axial variations are computed by a numerical method on the basis of integral equations. For the calculation of blade creep in the case where three terms of the series expansion are retained, first the positions of the center of gravity and of the main moments of inertia and uniaxial and biaxial moments of a third-order

surface are determined in relation to the main central axis for various blade cross sections. The calculation of a real blade is done in detail. In his conclusions, the author considers certain properties of uniaxial and biaxial moments of a third-order surface and gives examples for calculating them. That method of calculation is recommended which accounts for the bending of the blade during creep.

172. New Alloy Recommended as Laboratory Replacement of Corundum

"A New Heat-Resistant Alloy," by V. A. Malevanny, Tyazhelaya Promyshlennost' Podmoskov'ya (Moskovskiy Oblastnoy Sovnarkhoz) (Heavy Industry of the Moscow Area. Moscow Oblast Council of National Economy), No 12, 1958, p 29 (from Referativnyy Zhurnal--Mashinostroyeniye, No 1, 10 Jan 60, Abstract No 1335)

A Kh26N20Yu2-type alloy (C \leq 0.06 percent; Si $<$ 1.5 percent; Mn 0.3-0.4 percent; Cr 25-27 percent; Ni 19-21 percent; Al 1.8-2.2 percent; Fe remainder), produced in an induction furnace at a melting temperature of about 1,500°C, is heat-resistant at 1,200°C, has a high corrosion resistance, but, because of the scarcity of its components, is recommended for use in laboratories and experimental production as a substitute for corundum parts.

173. Forging of Turbine Disks in Three Operations

"Reducing the Expenditure of Metal and the Costs of Production of Large Forgings by the Sectional Pressing Method," by A. V. Altykis, Trudy 1-y Ekonomicheskoy Konferentsii TsNIITMASH 1957 (Works of the First Economic Conference of the Central Scientific Research Institute of Technology and Machine Building 1957), Moscow, 1958, pp 82-85 (from Referativnyy Zhurnal--Mashinostroyeniye, No 1, 10 Jan 60, Abstract No 1175)

A new technology is described for the preparation of blanks for disks of steam turbines and blowers. The ingots are forged into the original cylindrical blanks, which are then pressed on a three-section press. A preliminary blank is first prepared and then pressed in three operations (internal, central, and outer sections). In sectional pressing, an economy of force results from the distribution of area of the blank by sections, and from the reduction of the pressure per unit area during the pressing of individual sections, since that part of the force of the press is reduced which is expended to overcome friction. An economy of 46 percent is realized in the transition from open forging to the sectional-pressing method.

174. Working of High-Strength Two-Phase Titanium Alloy 48-T6

"The Plastic and Thermal Working of Certain Two-Phase Alloys of Titanium," by Yu. D. Khesin and S. M. Shul'kin, Sbornik: Metallovedeniye (Collection of Articles: Physical Metallurgy), 2d edition, Leningrad, Sudpromgiz, 1958, pp 251-265 (from Referativnyye Zhurnal--Mashinostroyeniye, No 23, 10 Dec 59, Abstract No 97013)

Optimal procedures were worked out for the mechanical and thermal working of the high-strength two-phase titanium alloy 48-T6, which is alloyed by means of beta-stabilizers (Mn, Fe, Cr, Mo, V). The total amount of alloying elements is 6-7 percent. To prevent beta brittleness, hot plastic deformation was performed in the alpha-plus-beta region with reductions in area not over 30 percent, and with heat treatment at temperatures in the alpha-plus-beta range (760-780°C). Maximum strength in the alloy is attained at the ratio of alpha:beta = 1:4 in the phase structure. After quenching (760°) and 25 hours of age hardening at 550 and 420 degrees, the alloy 48-T6 has the following mechanical properties:

$\sigma_b = 104$ and 163 kg/mm² [tensile strength]

$\sigma_b = 101$ and 155 kg/mm² [tensile strength]

$\delta = 24$ and 5.7 percent [elongation]

$\psi = 52$ and 11.5 percent. [reduction of area]

A practical test of the technology of rolling tubing of alloy 48-T6 has shown that completion of rolling at a temperature above 780°C (in view of the limited strength of the equipment) led to a reduction of the plastic characteristics of the alloy.

175. Creep of Fe-Cr-Ni-Alloys With Added Titanium, Niobium, and Tungsten

"Investigation of the Creep of Iron-Chromium-Nickel Austenitic Alloys With Additions of Titanium, Niobium, and Tungsten," by M. G. Gaydukov and V. A. Pavlov, Trudy Instituta Fiziki Metallov, Ural'skiy Filial Akademii Nauk SSSR (Works of the Institute of "the" Physics of Metals of the Ural' Branch of the Academy of Sciences USSR), No 19, 1958, pp 140-148 (from Referativnyy Zhurnal--Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 5137)

The alloy Kh20N20, alloyed with titanium, niobium and tungsten, was studied at 700°C on machines of the type TsKTI-2. The tests were conducted at various stresses and for a period of 250 hours. In alloys containing titanium, the greatest heat-resistance was obtained with a titanium content of 0.27 percent. In an alloy containing 1.09 percent titanium, a negative creep was observed, which was associated with a phase transformation accompanied by a decrease of volume. The extent of the phase transformation depends on the intensity of the active stresses. The optimum niobium content in the alloy is 0.2 percent. An addition of 0.2 percent titanium plus 0.12 percent niobium increases the heat-resistance of the alloy in comparison with the unalloyed Kh20N20. Increasing the content of niobium to 0.33 and 0.8 percent in an alloy with 0.2 percent titanium leads to a further increase of heat-resistance. Alloying 0.20 and 0.50 percent tungsten increases the heat resistance of an alloy at low stresses. When 1.15 and 2.95 percent tungsten were alloyed, the heat resistance of the alloy increased considerably. All alloys with additions of niobium and tungsten had higher heat resistance than those with tungsten alone.

176. Chemical Stability of Titanium

"Investigation of the Chemical Stability of Titanium," by I. Z. Kozlovich and N. D. Artem'yeva, Trudy Leningradskogo Tekhnologicheskogo Instituta im. Lensoveta (Works of the Leningrad Technological Institute imeni Lensovet), No 50, 1959, pp 260-273 (from Referativnyy Zhurnal--Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 5152)

A report is given of the results of tests of the chemical stability of metallic titanium in atmosphere, tap water, and water from the Gulf of Finland, solutions of salts of calcium chloride, ammonium chloride and barium chloride in pure form and with additions of ammonium thiocyanate, in sulfuric, hydrochloric, nitric and phosphoric acids and aqua regia, in potassium hydroxide, and in sodium hydroxide. A study

was also made of the influence of the mobility (activity?) of the medium on corrosion stability, the dependence of the rate of corrosion on time, and the influence of cold working or pressure. A parallel study was also made of steels 1Kh18N9T, 3Kh13, 40Kh and St3. Tests of titanium in certain media were also made at the Neva and Koksogazov plants. As a result of the work, it was established that titanium has a high corrosion stability in the atmosphere, tap water and water from the Gulf of Finland, Neva cold and hot water, and in nitric acid and in aqua regia. Titanium is stable in chlorides of low and medium concentration at normal temperature, in low and medium-concentration alkalis, in concentrated phosphoric acid, vapors, and solutions of ammonium hydroxide. The resistance to the effect of sulfuric and hydrochloric acid depends on the concentration and the temperature. Titanium is absolutely unstable in sulfuric acid and a solution of nitrosyl sulfuric acid in sulfuric acid, and in the gases of the Neva plant. The activity of the corrosive medium shows no appreciable effect on the rate of corrosion of titanium.

177. Temperature Ranges for Machining Heated Steels

"Cutting Hot Metal," by Ye. A. Veretennikov, Sbornik Nauchnykh Trudov Kuybyshevskogo Industrial'nogo Instituta Mekhaniki (Collection of Scientific Works of the Kuybyshev Industrial Institute of Mechanics), No 7, 1958, pp 55-70 (from Referativnyy Zhurnal--Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 5595)

Experiments are described which were aimed at explaining certain physical-mechanical phenomena occurring during the removal of chip from heated metal. The cutting involved planing on a horizontal milling machine, the bracket arm of which holds an attachment with a fixed cutter. Specimens were heated with a low-voltage high-wattage current. The power supply was specially designed. The temperature was measured with an iron-constantan thermocouple. The cutting pressure was determined by means of a spring dynamometer. The specimens used were blanks of 60S2 low-carbon spring steel and ShKh15 ball-bearing steel. The cutting was done with hard-alloy cutters at a speed of 0.8 meter per minute and feed of 0.3 millimeter. The temperature of the work varied within the limits 20-800 degrees. The results of the tests showed:

1. With a change of the temperature condition of the metal, there is a change of its strength characteristics, which in turn influences the process of chip separation.

2. The cutting pressure is not always found to be directly dependent on the temperature in the machined layer of metal, which is particularly characteristic for carbon steels.

3. When semifinished articles are cut after a preliminary heating, the optimal temperature range must be established for each individual case. Such an optimal temperature range would be 300-400 degrees for low-carbon steels, 400-600 degrees for steel 60S2, and 300-500 degrees for steel ShKh15. The data obtained may be applied to the theory of the cutting of metals.

178. Conference on Cermet Cutting Tools

"Results of a Scientific-Technical Conference on Cermet Cutting Tools," by S. B. Futoryan, Konstruktsii Rezhushchikh Instrumentov i Tekhnologiya Ikh Izgotovleniya (The Design of Cutting Tools and the Technology of Their Manufacture), No 1, Moscow, 1958, pp 101-125 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 5599)

A report is given of the work of the Scientific-Technical Conference on Cermet Cutting Tools, held by the Moscow Oblast Association of the Machine Building Industry in June 1956. The reports and demonstrations revealed work both in the improvement of the manufacturing technology of Cermet cutting tools, and in the area of their use. The conference passed resolutions on the improvement of the physicommechanical properties of existing cermet, on the establishment of conditions for their use, and on the founding of a Scientific Research Institute of Metalloceramics and a shop for the production of cermets.

179. Laboratory Testing of Atmospheric Corrosion of Metals

"A Laboratory Installation for the Study of Atmospheric Corrosion of Metals," by I. L. Rozenfel'd and T. I. Lukonina, Metody Issledovaniya Ingibitorov Korrozii Metallov (Vses. sov. nauchno-tekhn. o-v, No 7) (Methods of Studying Inhibitors of Corrosion in Metals (All-Union Council of Scientific-Technical Societies, No 7)), Moscow, 1958, pp 30-40 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 6120)

The Institute of Physical Chemistry, Academy of Sciences USSR, devised a method of studying the atmospheric corrosion of metals at various relative air humidities and various atmospheric contents of corrosive gases. To obtain the required relative humidity, the air is first purified in a proper absorber, passed through a saturated solution of NaCl (relative humidity 76 percent), NaNO_2 (66 percent) or other salts of known vapor tension. To obtain a 98-percent relative humidity, it is passed through distilled water heated 2-3 degrees above room temperature, then the test specimens are inserted, and the measured quantity of aggressive gas is introduced. This method afforded the first possibility of studying the processes which occur at the cathode in thin layers of electrolytes, and of showing that the increased corrosion of metals in the presence of sulfur dioxide is connected with a cathodic depolarization caused by a direct reactivation of it at the cathode.

180. Effect of Ionizing Radiation on the Corrosion of Metals Under Atmospheric Conditions

"The Effect of Ionizing Radiation on the Corrosion of Metals Under Atmospheric Conditions," by A. V. Byalobzheskiy, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Zhurnal Fizicheskoy Khimii, Vol 33, No 6, Jun 59, pp 1262-1262

The authors report that they have experimentally demonstrated that fast electrons, X rays and gamma rays at intensities corresponding to energy absorption of not less than 10^{14} eV/liter second in air and not more than 10^{19} eV/cm³ second in the sample led to a multiple increase in the corrosion rate of iron, copper, zinc, and aluminum in a moist atmosphere.

This is the result of the appearance in the atmosphere of radiochemical reaction products such as long-lived O₃, H₂O₂, N₂O₅ and especially short-lived HO₂, OH, NO₃, etc. Being active cathodic depolarizers, these products intensify the work of the corrosion microcouple. The usually inert nitrogen under radiation in the presence of oxygen and moisture becomes an active corrosion agent, facilitating the formation of nitric acid.

181. Alloying Ceramics With Metals

"Alloying Ceramics With Metals," by V. A. Presnov, Trudy Sibirskogo Fiziko-Tekhnicheskogo Instituta pri Tomskom Universite (Works of the Siberian Physicotechnological Institute, Tomsk University), No 36, 1958, pp 133-143 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 6140)

A study is made of methods used in the alloying of metal with ceramics using glazed materials, metallic oxides (Cu₂O, for example), pressed powdered metal with damp (unsintered) ceramic mass, based on the use of titanium hydride or an active metal (zirconium, titanium, etc) and by means of the metallization of ceramics with powdered high-melting metals (molybdenum, for example). The discussion includes the physicochemical nature of the stable bonding of a metal with a ceramic, the hypothesis in this region, and the results of an experimental investigation of the mechanism of formation of a stable bond between a ceramic and a metal at junctions produced by the method of metallization of ceramic with high-melting metals and other methods.

182. Solubility of Tungsten Carbide in Cobalt and Nickel

"Concerning the Solubility of Tungsten Carbide in Cobalt and Nickel," by I. N. Chaporova and Ye. A. Shchetilina; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 5, Sep/Oct 59, pp 91-96

Investigations of alloys containing structurally free carbon showed that the maximum solubility of tungsten carbide in cobalt in the solid state did not exceed 10% WC by weight. Higher values of solubility (12% WC by weight) related to alloys with less carbon than the compound WC. Basic reasons for the large divergence of results of specific investigators in the determination of the solubility of WC in cobalt are the variations of carbon content of the alloys. In contrast to cobalt, the solubility of tungsten and carbon in nickel is not proportional to the content of these elements in the compound WC. Free carbon is precipitated out upon saturation of nickel with tungsten carbide. Maximum solubility of WC in nickel (in the presence of structurally free carbon) is approximately 15% WC by weight. Microhardness of solid solutions on a cobalt base ranges up to 820 kg/mm² as compared to 340 kg/mm² for those on a nickel base.

183. New Semicontinuous Pipe Casting Method

"New Pipe Casting Method," by A. Chemortan; Moscow, Pravda, 20 Mar 60, p 2

Cast iron may be extracted as pipe from a crystallizer at a rate of 1.5 to 2 meters per minute in lengths up to 10 meters on an experimental machine developed by Engr A. Myasoyedov at the Sinarskiy Pipe Plant. Process is semicontinuous in that both the extraction operation and feed of molten cast iron to the crystallizer are halted while a finished length of pipe is being removed. Construction of an experimental production shop employing this method which would begin operation by late 1960 or early 1961 is planned.

184. Plastic-Bonded Powdered Metal Tubing for High-Temperature Coatings

"New Materials for Depositing Coatings by the Flame Spray Method," by A. L. Kozlovskiy, Candidate of Technical Sciences; Moscow, Trudy Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Avtogennoy Obrabotki Metallov, Kislorodnaya Reзка i Svarka (Works of the All-Union Scientific Research Institute of Welding and Cutting of Metals, Oxygen Cutting and Welding), No 5, 1959, pp 260-262

Production of fine solid tubing made of a mixture of powdered metals (NiCrB, NiCr and SiB, CrSi and others, 80 to 85% by weight), polyethylene and polyisobutylene (mixture ratio of the latter two varied according to strength or flexibility requirements) is described. Flame spray coatings obtained with this tubing have finer grain structure and are more dense than those obtained by usual methods employing metal powders or wire. It is claimed that investigations are being conducted on coating molybdenum with silicon and chromium by the tubing technique and also that coatings of high-melting materials such as tantalum have been deposited successfully. No coating specifications or data are given.

185. Structure and Properties of Niobium-Tin Alloys

"The Structure and Properties of Niobium-Tin Alloys," by M. I. Agafonova, V. V. Baron and Ye. M. Savitskiy, Institute of Metallurgy of the Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 5, Sep-Oct 59, pp 138-141

Constitutional diagrams of Nb-Sn alloys are constructed based on results of microstructural, thermal, and X-ray analyses. It is shown that the compound Nb₃Sn forms in this binary system at 2,000±25°C

through a peritectic reaction. Alloys containing 60% or more Sn by weight separate into layers in the liquid state. Temperature of the monotectic reaction is 730±5°C. A considerable region of solubility was noted on the niobium side of the diagram. The compound Nb₃Sn

(29.87% Sn by weight) has a β-W structure and Vickers hardness of 900 kg/mm². Transition of this compound into the superconductive state occurs at approximately 18.05°K. Increased hardness and oxidation resistance are exhibited by alloys consisting of solid solutions of tin in niobium as compared to pure niobium.

186. High-Temperature Creep Studies

"Effect of Creep at Elevated Temperatures on the Internal Friction and Coefficient of Elasticity of Metals," by I. A. Odin, Corresponding Member of the Academy of Sciences USSR, M. G. Lozinskiy, Doctor of Technical Sciences and Engr L. K. Gordiyenko, Institute of Machine Building of the Academy of Sciences USSR and Institute of Metallurgy of the Academy of Sciences USSR; Moscow, Metallovedeniye i Termicheskaya Obrabotka Metallov, No 12, Dec 59, pp 24-31

The following regularities were established from investigations of internal friction of commercially pure iron and a nickel-chromium complex alloy (69.67% Ni, 14.8% Cr) at various stages of creep: (1) at the steady creep stage the level of internal friction (the peak of internal friction in the case of iron specimens) decreases continuously; (2) at uniform creep conditions the value of internal creep remains unchanged; and (3) at an accelerated creep stage the level of internal creep increases. Changes in the coefficient of elasticity and internal creep of the nickel-chromium alloy at the first and third stages of creep occur in opposite directions. Change of physical properties in the process of creep is determined by the state of the dislocation structure of the metal, principally by the change in density surrounding dislocations prior to slippage. It is shown that microstructural conditions have a considerable effect on the above indicated regularities.

187. Deformation Characteristics of Titanium Alloy VT-5

"Concerning the Nonuniformity of Deformation of Titanium Alloy VT-5," by M. N. Bodyako, Yu. M. Loyko and V. I. Parkhimovich; Minsk, Doklady Akademii Nauk BSSR, No 1, Jan 60, pp 28-31

Data presented from investigations of the distribution of deformation in cold and hot upset specimens of titanium alloy VT-5 show that the character of the distribution of deformation in this alloy is analogous to that in other metals and alloys and differs only quantitatively. Change of temperature in the interval from 900 to 1,100°C shows no substantial effect on the distribution and magnitude of local deformations.

188. Effect of Aluminum on the Coefficient of Elasticity of Titanium Alloys at Elevated Temperatures

"Effect of Aluminum on the Coefficient of Normal Elasticity of Titanium Alloys at Elevated Temperatures," by V. S. Mikheyev and S. G. Fedotov, Institute of Metallurgy of the Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Metallurgiya i Toplivo, No 5, Sep/Oct 59, pp 141-142

Whereas small soluble additions of chromium, iron, silicon and boron to pure titanium result in a higher coefficient of elasticity at both room and elevated temperatures, a considerable increase of this characteristic is noted with the subsequent addition of aluminum. The higher the content of aluminum in the alloy, the higher the coefficient of elasticity, for example, for pure titanium, fundamental alloys without aluminum and the alloys T-3, T-4, T-6 and T-8, the values are 10,980, 11,390, 12,100, 12,500, 12,900 and 13,250 kg/mm², respectively, at room temperature. It was also noted that with heating, the rate of decrease of this coefficient becomes noticeably less with increase of aluminum in the titanium alloy; for example, upon heating to 800°C this coefficient for pure titanium drops from 10,980 to 4,770 kg/mm², i.e., by more than a factor of 2, whereas it drops by only a factor of 1.5 for the alloy T-8 which contains 7.5% Al.

189. Applications of High-Melting Carbides, Borides, and Nitrides

"Crucibles of High-Melting Carbides, Borides, and Nitrides," by G. V. Samsonov and G. A. Yasinskaya, Institute of Powder Metallurgy, Cermets, and Special Alloys, Academy of Sciences Ukrainian SSR, and T'ai Shou-wei, Institute of Metals, Academy of Sciences, People's Republic of China; Moscow, Ogneupory, No 1, Jan 60, pp 35-38

The characteristics of titanium carbide, titanium nitride, titanium boride, an alloy consisting of titanium boride to which 5% of molybdenum has been added, and chromium boride are described from the standpoint of their use as materials for metallurgical crucibles. In tests the results of which are reported, particular attention was paid to the behavior of the materials towards nonferrous metals.

190. Characteristics of the Cyclone Method of Smelting

"Similarities of and Differences Between the Cyclone and Suspended Particles Methods of Smelting," by I. P. Basina and A. V. Tonkonogiy; Alma-Ata, Vestnik Akademii Nauk Kazakhskoy SSR, Vol 15, No 12, Dec 59, pp 89-93

The methods of suspended particles and cyclone smelting resemble each other in that the efficiency of the conversion process is increased in both by utilization of the greatly enhanced surface of finely dispersed particles and by the possibility of blowing with air that has been enriched with oxygen. An advantage of the cyclone method as compared with the suspended particles method is the additional increase in efficiency due to the "cyclone effect," which brings about development of high relative velocities of the gas with respect to the solid material being converted. In this lies the most essential difference between the cyclone method and the suspended particles method of smelting. Furthermore, the cyclone method is distinguished by a greater flexibility (it can be applied for both oxidative and reductive smelting) and a considerably lower carry-over of solids with the outgoing gases.

It is possible to carry out reduction processes by the cyclone method with a weakly reductive or even oxidative atmosphere in the chamber. This is of particular importance in cases when reduction processes must be conducted at high temperatures. When reduction of suspended particles is carried out, a strongly reducing atmosphere must be established around the suspended particles, which necessarily leads to a lowering of the over-all temperature level. When the cyclone method is applied, a solid reducing agent is added to the charge. Under the effect of the centrifugal force, the reducing agent is projected to the wall, where a local reduction zone is established. In view of the fact that the reduction takes place principally at the wall, a weakly reductive or even oxidative atmosphere can be maintained in the chamber, so that the temperature level can be raised.

Because of the specific characteristics of the cyclone process (the fact that melting takes place at the wall of the cyclone chamber), the requirements with regard to the size distribution of the suspended particles and the content of moisture in the charge are not as rigid as in the case of smelting by the suspended particles method. This simplifies the operation of the drying and filtration department and reduces the losses of metal in this stage.

When the pyrometallurgical process to be carried out takes place in the kinetic region (i.e., the temperature is the critical factor), the cyclone and suspended particles methods are mutually competitive in most respects, but the suspended particles method should be applied

preferably because of the lower amount of power required for blowing. On the other hand, in the case of processes taking place in the diffusion region (when velocity is the critical factor), the cyclone method is of greater advantage, because the efficiency of the process can be brought to a much higher level.

The advantages of the cyclone method with respect to reduction of carry-over are illustrated by the fact that 5.0-7% are carried over in the smelting of copper concentrates by the suspended particles method at Outokumpu (Finland), whereas no more than 2.5% are carried over in cyclone smelting done at BCMK [Balkhash Mining and Metallurgical Combine?]

191. Chinese Research on High Temperature Steels

"Recent Advances in High-Temperature Steels," by Li Yu-k'o (李有柯), Institute of Metals, Academia Sinica; Peiping, K'o-hsueh T'ung-pao (Scientia), No 1, 1960, pp 15-22

In this article the author discusses important developments in high-temperature steels, citing 66 current references of Soviet, American, British, German, Japanese, and Chinese origins. The material is organized under five subheadings: pearlitic steels, martensitic steels, ferritic steels, austenitic steels, and epilogue and prospects. Information on Chinese research, past, present and future, is presented in passages as follows:

CPYRGHT

"N10 (3Cr-Mo-W-V) steel is one of the better types of high temperature steels. Its development and application as reported by E. Houdremont (1956) was a major achievement. Its properties have been investigated by Soviet and American Scientists. We modified the composition of N10 steel, added appropriate amounts of Ti and B, and thereby developed two steel types (H124 and H127) which have even better properties than N10 steels. Figure 3 shows the creep curves of H124 and H127 steels as compared with that of N10 steel. The curves were plotted with the help of Kornilov's centrifugal creep tester." (12) [Numbers in parentheses refer to source list appended to this item.]

"With respect to the Fe-W-Si system of ferritic steels, researches on the strength of [inter-]atomic bonds of elemental components, resistance to the effects of heat, and resistance to oxidation were conducted at Kirin University (吉林大學) [formerly Northeast People's University]. The results of research indicate a promising future for this alloy system. The university is currently investigating new steel types." (53)

CPYRGHT

"One of the recent advances in the Cr-Ni system of austenitic steels is the development of multiphase steels.... They have greater resistance to the effects of heat, but are subject to phase changes while in use. The kinetics of such phase changes and their influence on the mechanical properties of steel have been investigated exhaustively." (54, 55, 56)

"As a result of the demand for large quantities of nickel for high-temperature alloys, the nickel supply became critical. The situation, which was general, stimulated research on new nickel-free systems suitable for high-temperature steels.... The Cr-Mn-N system is a new alloy system which has better properties than the Cr-Ni system. In recent years some original work (61, 62) has been done along this line, and we, too, conducted systematic research on this alloy system with the hope of developing new types of high-temperature steel (63). There have been (a) studies pertaining to the choice of composition -- the incorporation of Mo, W, V, B, and rare earth elements into the Cr-Mn-N system; (b) studies on the high-temperature strength of Cr-Mn-N steels as compared with that of Cr-Ni steels;.... and (c) studies on age-embrittlement..."

"The few studies conducted in the past on the Fe-Al-Mn system of austenitic steels merely consisted in the plotting of a few isothermal diagrams and were reported by W. Koster, et al, in 1933-34 and by D. T. Schwartz in 1959. We are currently investigating the various properties of this alloy system. Its application will effect economy not only on nickel, but also on chromium.

"Epilogue and Prospects. The trend in the development in high-temperature steels is to place the greatest emphasis on low alloy steels and high alloy steels. The operating temperatures of such steels are being raised steadily. The operating temperature of pearlitic steels is going to exceed 600 degrees centigrade and austenitic steels are going to take the place of some nickel-base alloys. The application of martensitic steels will be limited considerably because of inherent defects, but the investigation of new systems such as Fe-Al and Fe-W-Si may open new roads and bring major advances.

"At present, China is still somewhat deficient in nickel, but abundant in molybdenum, tungsten, and vanadium. Therefore, stress should be laid upon research on low alloy steels. However, it is very difficult to raise the operating temperature of low alloy steel to above 600 degrees centigrade. To accommodate industry in its trend toward the use of high temperature and high pressure conditions, research on austenitic steels which contain no nickel, and even no chromium, should be given first priority.

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"With respect to the development of high-temperature steels, [China] has been accumulating experience and is now going slowly in this stage. Theoretical instruction lags way behind actual needs. Quarternary and higher alloy systems were long ago developed as high-temperature steels. Nevertheless, many important tertiary phase diagrams are regarded today as things not understood. Collected data on the effects of alloying elements on the temperature resistance of steels are disorganized and even contradictory. All these problems call for research and solution. The establishment and perfection of alloy theory will contribute much toward new progress in high-temperature steels.

"The use of boron and rare earth elements is something new, but only fragmentary investigations have been conducted. Systematic research in this area of concern would broaden the application of these elements, which occur abundantly in China.

"Our country is making daily progress in socialist construction. The need for high-temperature steels will continue to grow. Under the cooperative effort of workers concerned, China's work on high-temperature steels will inevitably prove successful!"

SOURCES

- (12) Institute of Metals, Academia Sinica. "Studies on Pearlitic High Temperature Steels." (Awaiting publication.)
- (53) Department of Metal Physics, Kirin University. "A New Trend in the Study of High-Temperature Alloys -- the Fe-W-Si Alloy System," Wu-li Hsueh-pao (Acta Physica Sinica), Vol 15, No 2, Feb 59, pp 98-111.
- (54) Chuang Yu-chih (莊育智) and Liu Chia-lo (劉嘉樂). Chin-shu Hsueh-pao (Acta Metallurgica Sinica), Vol 1, 1956, p 337.
- (56) Chuang Yu-chih (莊育智) and Liu Chia-lo (劉嘉樂). Chin-shu Hsueh-pao, Vol 2, 1957, p 87
- (62) Hsiao Chi-mei (肖紀美). Chin-shu Hsueh-pao, Vol 3, 1958, p 138.
- (63) Institute of Metals, Academia Sinica. "Studies on Cr-Mn-N High-Temperature steels." (Awaiting Publication.)

VIII. PHYSICS

Acoustics

192. Hydrodynamics of Submerged Acoustics

"The Motion of Air Bubbles in a Liquid Upon Action of Bjerknes Forces in Acoustic Fields," by V. F. Kazantsev, Acoustics Institute, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 129, No 1, Nov 59, pp 64-67

By integrating the equations of bubble motion in an ideal liquid under the action of Bjerknes central forces (C. A. Bjerknes, Hydrodynamische Fernkraefte (Hydrodynamic Forces) Leipzig, 1915) the relation of distance between bubbles to time and other parameters was derived for non-monochromatic radiation.

Cryogenics

193. A USSR Design of a Vortex Refrigeration Installation

"A Vortex Refrigeration Installation," by A. P. Merkulov, Kuybyshev Aviation Institute; Moscow, Kholodil'naya Tekhnika, Vol 36, No 6, Nov/Dec 59, p 59

The principal way of improving the economic aspects of the operation of a vortex refrigerator installation is utilization of the velocity impact of the cold stream to increase the degree of expansion in the vortex refrigerator, complete utilization of the cooling effect [regeneration of the cold], utilization of the energy of the hot stream to increase the degree of expansion in the vortex refrigerator, and shortening of the length of the vortex zone. All these measures were applied by the author of the paper in his work on the development of a vortex refrigerator. Tests that have been conducted established that the cooling effect in the refrigerator chamber designed under consideration of all of these aspects exceeded the cooling effect obtained in an ordinary vortex refrigerator of the same size by almost 50%. Because of their simplicity of design, reliability, and portability or transportability, the vortex refrigeration chambers are being applied for the intermittent generation of low temperatures in industrial production and at laboratories.

[SIR Note: This is an abstract of a paper presented at the 10th International Congress of Cryogenics held at Copenhagen on 19-26 August 1959.]

Nuclear Physics

194. Betatron Injection

"The Problem of Electron Injection Into the Betatron," by V. P. Yashchukov; Moscow, Atomnaya Energiya, Vol 8, No 2, Feb 60, pp 150-151

A quantitative theory of electron capture into a betatron orbit is developed. The synchrotron of the Leningrad Physicotechnical Institute with betatron injection was used at 100 Mev energy for studying the optimal conditions of the injection pulse shape effect on the intensity of gamma rays. It was found by means of an oscillogram of the current at the instant of capture that the optimal amount of particles circling in the chamber in one turn is 10--25 % of the theoretical charge limit.

195. Strong Focusing

"Strong Focusing in a Linear Accelerator," by P. M. Zeydlits, L. I. Bolotin, Ye. I. Revutskiy, V. A. Suprunenko; Moscow, Atomnaya Energiya, Vol 8, No 2, Feb 60, pp 127-133

The problem of application of strong focusing to a linear proton accelerator is analyzed and a detailed numerical analysis of proton motion in the system is carried out. A computation of the design of quadrupole lenses is presented and experimental results of strong focusing in a linear proton accelerator to 5.5 Mev are described.

196. Proton Flight

"The Time Factor of Flight for a Linear Proton Accelerator," by V. S. Kladnitskiy, Laboratory of High Energies, Joint Institute for Nuclear Research; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 2, Feb 60, pp 178-185

An electrolytic tank was first used for determining the flight factor of the linear proton accelerator in the Physicotechnical Institute of the Academy of Sciences of the Ukrainian SSR in 1948. By measuring the potential distribution in the gap the time factor was obtained for a system with grids essentially differing in construction from those in Berkeley.

The character of voltage distribution of the electric field along the axis of the accelerating system of the linear proton accelerator was studied by means of an electrolytic tank for a symmetric gap and for a gap with a grid of the klystron type. These measurements were used for determining the relation of the time factor of flight T to the length of the period of the accelerating system L_n and the obtained results were compared with known computed formulas. It is shown that the taking into account of the field penetration behind the grid plane is essential for the determination of T , particularly for small L_n . For a better efficiency of the accelerating system it is desirable to secure the ratio of period duration of the system to the aperture of drift tubes $L_n/d' \geq 4$.

197. Critical Parameters of Fissile Bodies

"A Method of Evaluating Critical Parameters of Fissile Bodies of Arbitrary Shape," by V. G. Zagrafov; Moscow, Atomnaya Energiya, Vol 8, No 1, Jan 60, pp 23-29

An approximate method of determining the critical parameters of a body of arbitrary shape or of a group of bodies of fissile substances is presented. Contrary to the variational method the suggested computation is simple and advantageous from the safety viewpoint in treating fissile materials, the error being small; and it is therefore suitable for engineering calculations. The method may be applied to systems on fast neutrons, in which the one-velocity approximation is applicable.

198. Fission Neutrons From U-235

"On the Number of Neutrons From Separate Fission Fragments From U-235," by V. F. Apalin, Yu. P. Dobrotin, V. P. Zakharov, I. Ye. Kutikov, and L. A. Mikaelyan; Moscow, Atomnaya Energiya, Vol 8, Jan 60, pp 15-22

By means of a large detector filled with a liquid organic scintillator containing cadmium, the number of neutrons emitted by separate fragments induced by thermal neutrons in U-235 is measured. The relation of the neutron number emitted by fragment pairs to their masses is measured by means of 4π -geometry. The excitation energy used for neutron evaporation is determined on the basis of Weizsacher's semi-empirical formula. A sharp asymmetry in the energy distribution between heavy and light fragments was revealed. The obtained data disagrees with the statistical theory of Fong.

199. Observation of Hydrogen Discharge

"Mass Spectrometric and Spectroscopic Study of an Ion Source by Hydrogen Discharge," by A. I. Nastykha, A. R. Striganov, I. I. Afanas'yev, L. N. Mikhaylov, and M. N. Oganov; Moscow, Atomnaya Energiya, Vol 8, No 1, Jan 60, pp 44-46

Preliminary tests on the 1.5 meter cyclotron of the Academy of Sciences USSR showed that from an area of 20 x 2 mm, an ion current of the order of 60 ma, containing 95 % protons or 80 % molecular H may be obtained as reported by the authors (Pribery i Tekhnika Eksperimenta, No 6, 25 (1959)). By using optical spectroscopic methods it was possible to observe not only the H^+/H_2^+ ratio in the ion source, but also the variation of the relative content of neutral particles H and H_2 in the discharge plasma. The optical observations were carried out with a triple prism Zeiss spectrograph of 840 mm focal length.

200. Fission of Th-229

"Cross-Section of Monochromatic Neutron Induced Fission of Th-229 in an Energy Range of 0.02 to 0.8 ev," by Yu. Ya. Konakhovich and M. I. Pevzner, Moscow, Atomnaya Energiya, Vol 8, No 1, Jan 60, pp 47-48

The sample was $6 \cdot 10^{-5}$ gr of Th-229, obtained by chemical separation from U-233 where it appeared as an alpha-decay product. A crystalline neutron spectrometer, described by the author (Pribery i Tekhnika Eksperimenta, No 3, 26 (1959)), was set into a reactor beam for studying the Th-229 fission cross section at 0.025 to 0.80 ev. The results of measurements are presented in graphs.

201. Stability of Plasma Bunches

"Stability of Plasma Bunches in a Waveguide," by M. L. Levin; Moscow, Atomnaya Energiya, Vol 8, No 2, Feb 60, pp 134-135

The stability of plasma bunches in an accelerating field is studied for the realization of a radiative acceleration method. The problem of deformation of an ideally conducting plasma bunch in a quasistationary homogeneous magnetic field is analyzed.

202. Model for Plasma Equations

"Automodel Solutions of Plasma Equations," by B. N. Kozlov; Moscow, Atomnaya Energiya, Vol 8, No 2, Feb 60, pp 135-137

The equations of stationary plasma density distribution do not have an analytic solution. Automodels for the solution of a cylindrical plasma pinch are suggested. A case in which the field is concentrated in a thin surface layer of plasma, the thickness of the surface electromagnetic layer being considerably less than the pinch radius, is analyzed.

203. Nonconservation of Parity

"Tests of Conservation of Parity in Strong Interaction at High Energies," by V. G. Solov'yev, Joint Institute for Nuclear Research; Moscow, Doklady Akademii Nauk SSSR, Vol 129, No 1, Nov 59, pp 68-71

Processes are analyzed with N particles ($N \gg 3$) in final states. Asymmetries in the distribution of formed particles were studied to demonstrate the nonconservation of parity in strong interaction. There was investigation as to in what reactions and between what particles the appearance of asymmetries is most likely. The asymmetry in a hyperon decay was studied particularly to find the nonconservation of parity in strong interactions.

204. Molecular Rotational Equations

"A New Method for the Calculation of Statistical Weights of Rotational Equations of Polyatomic Molecules," by Ye. D. Trifanov, Leningrad State University; Moscow, Doklady Akademii Nauk SSSR, Vol 129, No 1, Nov 59 pp 74-76

The method presented is a further development of E. Wilson's (J. Chem Phys., 3, 276 (1935)) and I. N. Godnev's (ZhFKh, 19, 637 (1945); 20, 897 (1946)) methods. The peculiarity of the new method consists in the use of an irreducible representation not of a nonpoint molecular group, but of a group of transposition. The possibility of introducing a new idea of molecular spin modifications is noted. The symmetry of the spin function is determined by one irreducible representation of a point group.

205. Hydrogen Desorption

"Study of Hydrogen and Deuterium Desorption From Palladium by Means of a Pulse Mass Spectroscope," by Yu. I. Belyakov and N. I. Ionov, Physicotechnical Institute, Academy of Sciences USSR, Leningrad; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 2, Feb 60, pp 216-222

A pulse mass spectroscope was used to check the possibility of positive and negative hydrogen ions during hydrogen penetration under pressure of 0 to 120 mm Hg through a palladium membrane heated from 80 to 750°C. At a mass spectroscope response to 10^{-12} a/cm² under experimental conditions, neither positive nor negative H ions were revealed. On the heated palladium membrane upon interaction with hydrogen during desorption H atoms did not form in an amount over 1% of molecular H. During diffusion through the membrane of an equimolecular mixture of H₂ and D₂, on the output side, besides the expected substances, HD molecules also were observed in amounts corresponding to the formation of separated atoms of H and D in accordance with the random laws.

206. Surface Ionization of Atoms

"The Influence of Electrical Field on the Temperature Threshold of Appearance of Positive Ions by Surface Ionization of Atoms," by E. Ya. Zandberg, Physicotechnical Institute, Academy of Sciences USSR, Leningrad; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 2, Feb 60, pp 206-215

The shift of near-threshold temperature curves of the surface ionization of potassium atoms and CsCl molecules on tungsten during superposition of electric fields of 7 M volts/cm was studied. It was found that equal coefficients of surface ionization in near-threshold temperature regions and in electric fields of various voltage E are matched by temperatures which decrease with rising E at the surface proportionally to \sqrt{E} . This ratio indicated the decrease of heat of escape of ions from the surface according to Schottky rule. The correctness of Schottky rule is checked for distances of ions from the surface not exceeding 7 Å. The possibility of determining the heat of escape of ions from the surface according to the shift of temperature thresholds of ionization for these elements whose ionization potential is less than the minimum local work function of nonhomogeneous surface. The heat of escape of ions for potassium from tungsten was determined. An evaluation of possible values of critical distance of adatom recharge at surface ionization is carried out.

207. Oscillations of Volume Charge

"The Mechanism of Volume Charge Oscillations in Quasicompen-
sated Ion Beams," by M. V. Nezlin; Moscow, Zhurnal Tekhniche-
skoy Fiziki, Vol 30, No 2, Feb 60, pp 168-177

The state of compensation of volume charge of an intensive ion beam passing through rarefied gas in a strong magnetic field was studied. The author established the oscillation mechanism affecting a strong de-
compensation of the volume charge of the beam, at which the electric fields in the beam reach several tens of volts per centimeter.

208. Vertical Beam Focusing

"Vertical Focusing of an Electron Beam by Means of Cylindri-
cal Magnetic Lenses in an Axially Symmetric Magnetic Field
Increasing Radially," by V. M. Kelman, B. P. Peregud, K. A.
Dolmatova, and I. D. Lusanin, Physicotechnical Institute,
Academy of Sciences USSR, Leningrad; Moscow, Zhurnal Tekhni-
cheskoy Fiziki, Vol 30, No 2, Feb 60, pp 153-158

The authors showed previously Zhurnal Tekhnicheskoy Fiziki, 28, 1056
(1958)) that cylindrical magnetic lenses may cause vertical focusing of
electrons moving in a magnetic field on trajectories approaching circular
or helical paths. Experimental study of the motion of electrons in such
a magnetic field is described, the defocusing action of the field being
compensated by the cylindrical magnetic lenses.

209. Symmetric Magnetic Fields

"Optic Properties of Axially Symmetric Magnetic Fields With a
Central Source of Charged Particles," by S. A. Kuchay; Moscow,
Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 2, Feb 60, pp 142-152

It is demonstrated that axially symmetric fields with a central source
may be used for isotopic separation of wide angle and high beams.

210. Paraboloid Magnetic Lens

"Investigation of Paraboloid Magnetic Lens Focusing Properties," by P. I. Strelnikov and A. I. Fedorenko, Physicotechnical Institute, Academy of Sciences Ukrainian SSR, Kharkov; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 2, Feb 60, pp 138-141

The possibility of compensation of the diverging effect of a space charge on an electron beam by a paraboloid magnetic field is studied experimentally. It is established that by means of a paraboloid magnetic lens it is possible to focus electron beams up to 1 mm in cross section, reaching current densities to 0.8 amp/mm^2 . It is shown that a beam entering the lens may not only be converging, but also be parallel or diverging.

211. Magnetic Mirrors

"Achromatic Magnetic Mirrors," by V. M. Kelman, S. Ya. Yavor and T. Ya. Fishkova, Physicotechnical Institute, Academy of Sciences USSR, Leningrad; Moscow, Zhurnal Tekhnicheskoy Fiziki, Vol 30, No 2, Feb 60, pp 129-137

The properties of achromatic magnetic mirrors are analyzed. The mirrors have two-dimensional fields with a plane of antisymmetry at incident angles of 45° , 40.7° , 30° , and 27.6° . The plane and spatial trajectories of charged particles affected by these mirrors are computed.

212. Scattering of Spinless Relativistic Particles

"Dispersion Relationships for the Scattering of Spinless Relativistic Particles by an External Scalar Field," by V. I. Mal'chenko; Kiev, Urainskiy Matematicheskii Zhurnal, Vol 11, No 3, Jul/Sep 59, pp 256-266

Fredholm's method is applied for solving an integral equation for the scattering of Klein-Gordon particles by a scalar spherically symmetrical potential. The matrix of scattering is constructed, and it is shown that for a broad class of potentials, when considered as a function of the energy and momentum of transfer, it is analytical in the complex energy plane for a real momentum of transfer. The dispersion relationships are obtained in a standard way from Cauchy's theorem.

213. Optimal Thermodynamic Cycle of a Reactor

"The Effect of Reactor Temperature Characteristics on the Choice of an Optimal Thermodynamic Cycle for an Atomic Power Station," by D. D. Kalafati; Moscow, Atomnaya Energiya, Vol 8, No 1, Jan 60, pp 5-14

Possible temperature variations are analyzed in nuclear energy equipment in relation to the thermal power of the reactor with consideration of the limiting temperatures: for the shield and for the center of heat emitting elements. The variations of the possible thermal and electric power ratings of the equipment in relation to the parameters of the thermodynamics cycle are deduced. The conceptions of limiting thermal power of the reactor and of the energy efficiency of the steam generator are introduced. The conditions under which the derived formulas may be applied for the tentative computation of optimal parameters of the thermodynamic cycle are presented. The analysis shows the possibilities of improved parameters and efficiency of atomic power stations with respect to shielding materials and the type of nuclear fuel.

214. Thermal Stresses in Reactors

"Thermal Stresses in Reactor Structures," by A. Ya. Kramerov, Ya. B. Fridman and S. A. Ivanov; Moscow, Atomnaya Energiya, Vol 8, No 2, Feb 60, pp 101-111

The conditions at which thermal stresses appear in reactors are described and their magnitude and danger degree evaluated. The effect of the shape of heat exchangers on the temperature drop and the magnitude of thermal stresses are analyzed. Suggestions are given for decreasing the harmful effects of thermal stresses. The methods of elasticity theory applied have essential limitations. In many cases when evaluating the magnitude and degree of danger in thermal stresses, when adding the mechanical stresses, and when seeking measures to decrease these stresses, allowance has to be made for the effects of viscosity, creep, initial destruction and for microscopic processes.

215. Czech Reactor Research

"Investigation of Heat Exchange in a Homogeneous Boiling Atomic Reactor," by J. Malak and J. Shmid, Institute for Nuclear Research, Czechoslovak Academy of Sciences, Prague; Minsk, Inzhenerno-Fizicheskiy Zhurnal, No 9, Sep 59, pp 12-23

The process of heat exchange during volume boiling, important in homogeneous boiling atomic reactor design, is examined. The study was made using experimental equipment simulating part of the active zone of a

homogeneous reactor with natural circulation. Water was heated electrically in the active space of the experimental apparatus and experimental data developed for the case when the specific heat capacity is expressed as $q_s = q(1 - \phi)$, where q is the heat capacity of a cubic meter of water and ϕ is volume stream content.

Conclusions useful for further investigation of volume boiling are drawn. Additional information must be accumulated on steam velocity in a stream heating mixture, coefficient of heat exchange from water to steam and on the specific surface of separation of phases.

216. Ion and Electron Accelerator at Lodz University

Warsaw, Zolnierz Wolnosci, 9 Mar 60

The unsigned caption of a photograph showing a technician assembling an accelerator states that the ion and electron accelerator will be put into operation in 1960 at the Lodz University. The institution will train specialists in nuclear physics. All of the installations for the new research center have been designed by a 10-person group of scientific workers under the direction of Docent Dr Aleksander ZAWADZKI; Prof Dr Ludwik NATANSON also participated. Assembly of the electrostatic generator is now in progress.

217. Chinese Atomic Energy Journal Changes Staff, Policy

"Announcement," unsigned article; Peiping, Yuan-tzu-neng (Atomic Energy), Vol 5, No 1, Jan 60, back cover

It is announced in this item that, beginning January 1960, the Nuclear Science Commission (原子核科學委員會) of the Academia Sinica will assume the editorship of the journal Yuan-tzu-neng (Atomic Energy), and supervise the translation and compilation of articles for its publication. The editorship of the journal was formerly held by a component of the Chinese Physical Society. The announcement also states that Yuan-tzu-neng will be published as the Chinese edition of the Soviet periodical Atomnaya Energiya.

[Note: In 1958 the journal announced that it would begin to publish reports of Chinese research in 1959. That promise was not fulfilled. The Nuclear Science Commission mentioned in the above item is probably the same body mentioned in other Chinese sources as the Atomic Nucleus Commission (原子核委員會) of the Academia Sinica. The January, February, and March 1960 issues of the Chinese monthly Wu-li Hsueh-pao (Acta Physica Sinica) carry reports of Chinese work in nuclear physics and related fields.]

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