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REPORT

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CENTRAL INTELLIGENCE AGENCY

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# SCIENTIFIC INFORMATION REPORT



6 May 1960

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PLEASE NOTE

This report presents unevaluated information extracted from recently received publications of the USSR, Indonesia, and Eastern Europe. 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

Radiobiology

1. Reparative Effect of Visible Light on Irradiated Tissue

"The Reparative Effect of Light After the Irradiation of Tissue Cells by Short-Wave Ultraviolet Rays," by V. L. Levin, Laboratory of Cellular Adaptation, Institute of Cytology, Academy of Sciences USSR; Moscow, Tsitologiya, Vol 1, No 6, Nov/Dec 59, pp 699-706

The purpose of this research was to discover a means of increasing the resistance of tissue cells to the effect of ultraviolet rays by exposing the irradiated cells to visible light. The methodology is explained in detail and various pertinent data are presented. The author presents the following conclusions:

- (1) Ultraviolet rays cause injury, which increases with time, to the ciliated epithelium of the gilled pearl oyster (*Unio crassus*).
- (2) It is possible to increase significantly the resistance of ciliated epithelial cells to the injurious effect of ultraviolet light following moderate doses of irradiation (600 microvolts per minute per  $\text{cm}^2$ ), by subjecting them to the effect of visible light for the first 3 days after the irradiation.
- (3) The partial reparation or the delay (caused by the light effect) in the onset of radiation, is compatible with a previously described photoreactivation phenomenon.
- (4) Experiments on maintaining the irradiated epithelium at various temperatures indicated that the development of injury in the cells of irradiated epithelium both in the dark and in the light proceeds significantly faster when the epithelium is kept at 15 degrees rather than at 5 degrees.

2. Localized Effects of Ultraviolet Rays on Living Cells by Micropuncture Method

"The Study of Localized Effects of Ultraviolet Rays on the Living Cell by the Micropuncture Method," by S. S. Chakhotin, Institute of Cytology, Academy of Sciences USSR; Moscow, Tsitologiya, Vol 1, No 6, Nov/Dec 59, pp 614-626

The author reviews microdissection methods and cites many Soviet and non-Soviet authors who have contributed to their development.

This article presents photographs and sketches of microphotosurgery, and describes a micropuncture apparatus which operates by means of a monochromatic beam of ultraviolet (UV) rays with a 280 millimicron wavelength, with the diameter of the beam reduced to one micron. An essential condition for success in the use of this method is the utilization of a "microclinic" for keeping alive the cells which have undergone surgery.

The following examples of microexperimentation are presented: (1) inducing parthenogenesis in the eggs of echinoidea by the local surface micropuncture method; (2) teratologic surgery on individual blastomeres and on their nuclei during the course of their development; (3) local coagulation of proteins present in the cytoplasm of the amoeba at the site of irradiation by UV-micropuncture; (4) shedding of cilia at the site of radiation micropuncture on the surface of Infusoria; (5) protrusion of the surface and local distortion followed by the leakage of a certain amount of the cytoplasm; (6) irradiation of the stigma of euglena, which "blinds" it; (7) development of a conditioned reaction in the paramecium, which makes it avoid the site of the UV-micropuncture in the medium; (8) local change of the permeability of the chinoidea eggs at the site of the micropuncture and the appearance of alkaline ions at the same site; (9) study of the role of the nucleus during cell respiration by the combined use of a capillary micromanometer and UV-micropuncture; (10) prevention of vacuole contraction in the paramecium, which causes a destructive swelling of the cell body and which disappears after the cilia in the cytostome cease to pulsate as a result of irradiation by UV-micropuncture; and (11) measurement by means of a photoelement of the difference in UV-microbeam absorption after the local irradiation of a point in the nucleus and in the cytoplasm.

The microphotooperations described above are possible because of the specific effect of UV-rays on different cell structures and biochemical processes within the cell. This effect is manifested by the denaturation of the protein colloids, which causes differences in the sorption of UV-rays by different parts of the cell, and subsequently leads to the photochemical decomposition of the substances in these parts. In a number of cases to differentiate the effects of micropuncture on the nucleus and on the cytoplasm, it is necessary to stabilize the colloids

of the surface layer of the cell by the addition of calcium ions to the medium. Local change of permeability makes it possible to perform selective poisoning of individual cells in the embryo by means of various substances.

The mechanism of the local effect of UV-micropuncture on permeability can be explained by the sorption hypothesis which assumes cell coacervation, although it is possible that a thicker layer which conforms to the established laws of membrane theory may surround the cell.

3. "Radiation Sickness" in Plants

"'Radiation Sickness' in Plants," by I. M. Vasil'yev, Institute of Biological Physics, Academy of Sciences USSR; Moscow, Zhurnal Obshchey Biologii, Vol 21, No 1, Jan/Feb 60, pp 12-19

The effect of ionizing radiations (3,000-100,000 r) on potato tubers and winter wheat variety No 599 was studied from the standpoint of growth suppression as a syndrome of "radiation sickness," the accumulation of products of photosynthesis and of mineral substances, the external manifestations of "radiation sickness," the restoration of growth capacity, and the period of "radiation sickness."

The author presents the following conclusions:

(1) "Radiation Sickness" in plants is based on a disturbed correlation between growth and other physiological processes. Growth is the most radiosensitive process, and under the effect of ionizing radiation it is the first to be disturbed when other processes, including photosynthesis, remain practically unchanged. As a result, products of photosynthesis and mineral substances accumulate in the irradiated plants, and finally lead to its death.

(2) Growth of irradiated plants can be restored, to a certain extent, by freeing the cells from excess products of photosynthesis and mineral substances, and then by exposing the plants to the effect of light.

4. Vitamin Content of Solutions, Vegetables, and Grain Products  
Subjected to Gamma-Irradiation

"The Effect of Gamma-Radiations on the Content of Vitamins C and B<sub>1</sub> in Solutions, Vegetables, and Grain Products," by N. N. Krylova, Novyye, Fiz. Metody Obrabotki Pishch. Produktov (New Physical Methods of Treating Food Products), GosINTII (State Scientific Research Technical Institute), No 2, 1958, pp 57-62 (from Referativnyy Zhurnal--Khimiya, Biologicheskaya Khimiya, No 1, 10 Jan 60, Abstract No 583, by V. Barun)

CPYRGHT

"The ascorbic acid content of potatoes after gamma-irradiation by a dose of 125,580 r (46 hours of irradiation) rose to 116% of the initial value; after gamma-irradiation by 178,548 r (65 hours of irradiation) the ascorbic acid content amounted to 120% of the initial value; and after irradiation by 205,385 r (75 hours of irradiation) the ascorbic acid content dropped to 102.4% of the initial value. In other products (pearl barley, finely ground wheat, buckwheat, millet groat, and wheat flour) irradiated by 178,548 r doses, the author noted a predominance of processes of vitamin accumulation; but after higher doses and prolonged irradiation (205,385 r) decomposition processes began to predominate. The author is of the opinion that the increase in vitamin activity is due to the intensification of cellular oxidation-reduction processes which contribute to the biosynthesis of the vitamins. After a 45-day storage, there is a sharp drop in the vitamin content, as compared with the controls. Evidently, this decreased stability of the vitamins results from the reaction of the vitamins with the products of water ionization."

II. CHEMISTRY

Fuels and Propellants

5. Ozone Determination

"New Methods for the Determination of Very Small Amounts of Ozone," by E. A. Peregud and E. M. Stepanenko, State Scientific Research Institute of Labor Hygiene and Occupational Diseases, Leningrad; Moscow, Zhurnal Analiticheskoy Khimii, Vol 15, No 1, Jan/Feb 60, pp 96-98

Highly sensitive quantitative methods for the determination of ozone are presented, based on the extinction of the luminescence of luminol and fluoreseine.

A line-coloristic method for determining ozone is developed, based on the change of the color of silica gel saturated with a fuscine solution.

It is established that the determination of ozone is possible in the presence of considerable amounts of nitrogen oxides.

Of a number of indicators proposed, the most sensitive to ozone -- and very inert to nitrogen oxides -- is an indicator on a luminol basis.

The authors begin the article by stating that an ever-increasing interest in determination of small quantities of ozone is related to problems of investigating the upper layers of the atmosphere, to the use of ozone as a highly active oxidizer, and to checking the atmosphere of industrial installations in connection with ozone's high toxicity.

High-Molecular Compounds

6. Polymerization at Low Temperatures With K-Carbon Black Catalyst

"Polymerization of a Potassium-Carbon Black Catalyst," by V. A. Kargin, V. A. Kabanov, and T. K. Metel'skaya, Chemistry Faculty, Moscow State University; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 1, Jan 60, pp 162-165

The low temperature polymerization of a number of monomers in toluene over a K-carbon black catalyst has been investigated. The catalyst has been found to bring about the polymerization of vinyl monomers with

strongly electronegative groups (methylmethacrylate, methacrylate, acrylonitrile) at low temperatures (up to  $-85^{\circ}\text{C}$ ). It has been suggested that polymerization in these systems takes place according to an ion-radical mechanism.

In the presence of such a catalyst rapid polymerization of styrene at  $20^{\circ}$  also takes place. An anionic mechanism has been proposed for this process.

7. Polysiloxane and Phenylsiloxane Chains in Polymer Molecules

"Comparison of the Properties of Polymers With Polysiloxane and Phenylsiloxane Chains in the Molecules," by K. A. Andrianov, V. E. Nikitenkov, and N. N. Sokolov, All-Union Electrical Engineering Institute imeni Lenin; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 1, Jan 60, pp 158-161

Polyorganosiloxanes have been synthesized, in the primary chain of which 50% of the oxygen has been replaced by phenylene radicals. Among such polymers a low molecular phenylsiloxane with 8 Si atoms and 6 OH groups has been obtained.

Polyorganophenylsiloxanes have been shown to possess a higher thermal stability and a lower thermal elasticity than the corresponding polyorganosiloxanes.

8. Polymers With Si-O-Ti Groups

"Polytitanomethylsiloxanes and Polytitanoethylsiloxanes," by K. A. Andrianov, and E. Z. Asnovich, Institute of Organoelemental Compounds, Academy of Sciences USSR, All-Union Electrical Engineering Institute imeni Lenin; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 1, Jan 60, pp 136-140

New polytitanoorganosiloxanes with methyl and ethyl groups at the silicon atom have been obtained by means of a double decomposition reaction. The elementary composition and the infrared absorption spectra of the polymers have been determined.

Polytitanomethylsiloxane and polytitanoethylsiloxane have been found to be readily soluble in organic solvents and not to melt at  $500^{\circ}$  and higher. Based on the elementary composition, infrared absorption data, and the properties of the new polytitanoorganosiloxanes, a linear-cyclic structure of the polymer molecules has been proposed.

9. Adhesion of High Polymers to High Molecular Substrates

"Adhesion of High Polymers. V. Adhesion of Synthetic Rubbers to Various High Molecular Substrates," by S. S. Voyutskiy, and V. L. Vakula, Moscow Institute of Fine Chemical Technology imeni Lomonosov; Moscow; Vysokomolekulyarnyye Soyedineniya, Vol 2, No 1, Jan 60, pp 51-60

The adhesion of a number of synthetic rubbers to various high molecular substrates has been determined by means of a specially developed method based on the separation of the elastomers brought into contact.

The effect of the chemical composition and structure of the rubber-like adhesives and high molecular substrates (size, shape and polarity of the macromolecules, phase state of the polymer) on the adhesion has been shown. The temperature influence on the latter has also been investigated and it has been found that a rise in temperature mostly leads to increased adhesion. The relative part played by the individual factors determining diffusion may change significantly.

The results of the investigation have been interpreted in terms of the diffusion theory of adhesion being developed by the authors.

10. Ultrasonic Quantitative Analysis of Polymers

"Application of the Ultrasonic Method in the Quantitative Determination of the Components of Polyethylene-Polypropylene Mixtures and of Ethylene-Propylene Copolymers," by S. P. Kabin and O. G. Usyarov, Leningrad Polytechnic Institute imeni Kalinin; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 1, Jan 60, pp 46-50

In the paper the results are presented of a study of the mechanical losses occurring at 2 Mc longitudinal ultrasonic vibrations in polyethylene-polypropylene mixtures and ethylene-propylene copolymers with various concentrations of the components. For polyethylene-polypropylene mixtures within the temperature range of -60 to 80° C two regions of mechanical relaxation losses, characteristic of each of the components, are observed at -60 and -45° C. The magnitude of the losses is proportional to the concentration of the respective component. For the copolymer, relaxation losses take place in a single region at about 7° C. The losses in this region are proportional to the propylene concentration with the limits ranging from 0 to 40%. From the nature of the temperature



dependence of the mechanical losses one may judge whether the material is a mixture or polymer. From the magnitude of the losses in this region one may quantitatively estimate the composition of the copolymerization products.

[For additional information on high-molecular compounds, see Radiation Chemistry.]

### Inorganic Chemistry

#### 11. Trends in USSR Work in Inorganic Chemistry

"Some Tasks of Inorganic Chemistry in the Seven-Year Period 1959-1965," by A. V. Nikolayev, Institute of Inorganic Chemistry, Siberian Branch of the Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR -- Otdeleniye Khimicheskikh Nauk, No 11, Nov 59, pp 1875-1881

The contribution of chemists in the field bordering on nuclear physics is very significant; one must remember that the discovery of the fission of uranium was made by radiochemists. The classical method of employing carriers is still of primary importance at present; for instance, in the analysis of mixtures of splinter elements, the separation of newly synthesized nuclei from irradiated targets, etc. Promethium was separated from solutions of splinter elements by using chromatography.

Major progress has been made in the preparation of ultrapure substances for applications in nuclear technology, thermonuclear reactions, and as semiconductors and also in connection with the thorough purification from radioactive impurities of elements synthesized at industrial nuclear installations. For instance, plutonium is separated from a large amount of uranium and small quantities of 20 splinter elements. The finished product, which is used as nuclear fuel, retains quantities of splinter elements so small that their determination can be made only because the total radioactivity is higher than that which would correspond to pure plutonium.

At present, nonradioactive (stable) isotopes of a number of elements are available. Both the thermodynamic and the kinetic isotope effects are being investigated. It has become possible to investigate and compare isotopically pure compounds. Preservation of isotopic purity is already of importance in some technological processes. Expansion of the range of available isotopes and production of these isotopes in a state of higher concentration together with the expansion of the production of

more sensitive mass-spectroscopy equipment makes it possible to apply tracer methods on a more extensive scale, particularly as far as light elements are concerned, and obtain better results in work involving the application of tracers.

Increased complexity of the structure of nuclei results in the radioactivity exhibited by heavy elements; radioactive isotopes of light elements originate when the relationship between neutrons and protons deviates from the equilibrium. Synthesis, isolation, and investigation of radioactive isotopes of all elements of the periodic system is not only a task of nuclear physics and radiochemistry, but also of inorganic chemistry as such. This merging of radiochemistry with inorganic chemistry is characteristic for the present-day status of both disciplines. Nuclear chemistry, which is concerned with the radiochemical investigation of nuclear transformations, also employs the whole armamentarium of inorganic chemistry.

The majority of chemists now, as heretofore, will be interested principally in processes involving the electron shells of atoms. This refers particularly to the theory of valency and of the chemical bond. More attention should be paid to research in the field of quantum chemistry. Interesting results are to be expected from the investigation of chemical bonds formed by transitional (4f and 5f) elements and also from further development of the theory of the crystal field.

As far as structural determinations are concerned, the X-ray diffraction method is comparable to chemical methods with respect to speed of determinations made by it, if rapid computers are used. At the Institute of Inorganic Chemistry, Siberian Branch of the Academy of Sciences USSR, a center is being created where equipment for X-ray diffraction analysis will be available and computers will be employed. It is planned to conduct work on the preparation of single crystals, particularly those of difficultly soluble substances, and also carry out extensive investigations of physical characteristics comprising optical, magnetic, and radiospectroscopic properties. The data obtained in work of this type are of importance for characterizing the type of bonding.

At the Department of Geological and Geographical Science, Academy of Sciences USSR, important work is being conducted on the structure of silicates, by using computers available at the laboratories where structural research is conducted (at the Institute of General and Inorganic Chemistry, the Institute of Metallurgy imeni A. A. Baykov, etc.) In regard to structural investigations during the period of the Seven-Year Plan, the USSR will occupy from the quantitative standpoint the place in world science which is due to it. Work on the structure of liquids and solutions must also be expanded. The importance of this type of

work is not being realized. It is necessary to expand to a considerable extent the number of neutronographic investigations that are being conducted. The publication of the special periodical Strukturnaya Khimiya (Structural Chemistry) has been launched.

Because many rare elements are being applied in the industry at present, much new work will have to be done on equilibria and the stability of compounds.

V. S. Fedorov, chairman of the State Committee on Chemistry at the Council of Ministers USSR, directed a complaint to Academician A. N. Nesmeyanov, President of the Academy of Sciences USSR, in regard to the difficulties which the chemical industry is experiencing because of the lack of information on physical and chemical properties of many compounds, particularly organic compounds. In connection with this, the question has been broached in regard to the creation of an Institute for the Measurement of Constants [Institut po Izmereniyu Konstant]. This institute would be similar to the American Bureau of Standards. There can be no doubt that the chemical community will support this suggestion and that everything will be done to organize this institute within the scope of the Seven-Year Plan.

In addition to the Institute of General and Inorganic Chemistry and a number of industrial institutes, the newly organized Institute of Inorganic Chemistry of the Siberian Branch of the Academy of Sciences USSR will also conduct work on chemical equilibria.

In the field of kinetics and reactivity of inorganic compounds, work will have to be expanded on isotope exchange and the velocities of isotope exchange, particularly as far as coordination compounds are concerned. In the field of kinetics, particular attention should be paid to the rates of redox reactions.

For many important fields of inorganic chemistry, such as the separation of lanthanides and actinides, the application of new solvents has been typical in recent years. Thus, extraction with organic solvents is being applied on an increasingly extensive scale in research and in inorganic technology. Fused salts and metals are being applied as solvents for the refining of lanthanum, the separation of plutonium from uranium and fission splinter elements, etc. The scope of the work done lately in this field is indicated by the fact that more than 500 organic solvents have been tested for their suitability in the extraction of uranium. The fundamental question in regard to the theoretical aspects of the selection of solvents (i.e., organic solvents, salts, metals, liquefied gases, etc.) for different classes of inorganic substances has arisen and assumed considerable importance. As far as organophosphorus solvents for nitrates and other metal salts are concerned, an approach from the standpoint of the acceptor-donor theory proved of

advantage. The underlying concepts were developed as a result of the investigation of the extracting capacity of solvents the structure of which was changed gradually (this refers to the sequence  $(RO)_3P = O$ ;  $(RO)_2 RP = O$ ;  $ROR_2 P = O$ ;  $R_3P = O$ ). It was established that the extracting capacity increases in this sequence from the left to the right. This finding led to the conclusion that the bond with the substance being extracted is established over the oxide oxygen rather than the ester oxygen of the extracting solvent. Infrared spectroscopy confirmed the truth of this assumption: after introduction of the salt, there is displacement of the absorption maximum only for the  $P = O$  bond. The other groups contained in the molecule contribute to extraction in the degree in which they exhibit donor properties.

In the field of descriptive inorganic chemistry, the study of polymorphism is of considerable importance. Research in this field is conducted in collaboration with crystallographers (for instance, as far as production of diamonds is concerned) or in collaboration with physicists (as far as work on the polymorphic varieties of phosphorus, helium, and other elements is concerned). In connection with this, an appreciable fraction of the total output of diamonds is now produced artificially.

To conduct the important process of the separation of nuclear fuel from fission splinters, one must know the chemical characteristics of all elements from zinc to gadolinium. The major part of the radioactivity of splinter elements is due to rare-earth elements, the chemistry of which is inadequately known. In purifying thorium and uranium before these elements are subjected to irradiation in nuclear reactors, one must again consider the rare-earth elements and also boron, cadmium, and others with a large cross section of thermal neutron capture. The chemistry of beryllium, carbon, graphite, and pure zirconium not containing any hafnium is also of importance from the standpoint of applications in nuclear technology. To summarize, a detailed knowledge of the chemistry of more than 50 elements is required from the standpoint of work in nuclear technology. A number of elements must be eliminated from nuclear materials until their content is no higher than  $1:10^6$  or even lower.

In the field of semiconductor materials, the research that is to be conducted must follow the recommendations made by Academician Ioffe. Investigation of the properties of inorganic substances and of their crystal structure can easily be extended to cover semiconductor materials. The elements and classes of compounds to be investigated from this standpoint will comprise (a) elemental substances (metals, such as gray tin, and nonmetals); some alloys, including intermetallic compounds (daltonides and berthollides); (b) nitrides, oxides, sulfides, selenides, and tellurides; (c) ionic crystals of the type of sodium chloride; (d) solutions, such as a solution of metallic sodium or potassium in liquid ammonia.

More specifically, with regard to research on semiconductors, there is a need to investigate equilibrium systems in which semiconductor properties function as a characteristic.

The second circumstance to be noted is that it is necessary to work with materials of very high purity. For this reason, methods for the purification of initial substances must be investigated very thoroughly and different methods for the purification applied, such as extraction, distillation, zone refining, the growing of single crystals, etc. It is of interest to know that an important semiconductor property, namely electrical conductivity, may serve as a criterion of purity.

Inorganic chemists will have to continue work on standard materials, such as ductile metallic titanium, inorganic foams, glass fibers, etc. However, increasing attention will have to be paid to inorganic polymers. Highly polymerized phosphonitrilic chloride  $(\text{PNCl}_2)_n$  may serve as a substitute for rubber. Of interest are also compounds of the borazole  $(\text{B}_3\text{N}_3\text{H}_6)$  and alazole  $(\text{Al}_3\text{N}_3\text{H}_6)$  type.

As far as rare elements are concerned, these are being applied in many different ways at present. The application often determines the level of technological advancement. Among rare elements it is necessary to investigate the chemistry of technetium, rhenium, rubidium, cesium, francium, gallium, indium, and thallium and also some others (for instance, scandium). Applications must be found for some rare elements (rubidium, strontium, and arsenic, to give a few examples) raw materials for the production of which are available in large quantities.

To implement the current Seven-Year Plan as far as work in inorganic chemistry is concerned, a number of existing institutes must be expanded and new institutes created. This applies to the Institute of Inorganic Chemistry of the Siberian Branch of the Academy of Sciences USSR, the Institute of Rare Elements, and the Institute for the Measurement of Constants. Furthermore, a network of hot laboratories must be developed, X-ray structural determinations must be carried out with the aid of rapidly acting computers, and new and modern equipment must be installed at the institutes. Academician Chernyayev is of the opinion that every element must form the subject of investigation by a separate institute, the work of which is devoted solely to research on this element. There is an inexhaustible number of investigations to be conducted on problems pertaining to every element and the results will never be useless unless the work has been of low quality. For instance, work conducted in the USSR in the 1920s on the temperature dependence of the solubilities, specific weights, and other characteristics in systems formed by water with zinc chloride, zinc bromide, and zinc iodide was of no practical importance until quite recently. At present the results obtained in this work form the basis for the designing and production of cheap transparent protective windows filled with liquid that are to be used at radio-chemical laboratories.

In regard to work to be conducted in connection with developments in nuclear technology, the chemistry of elements capable of serving as nuclear fuels must first of all be subjected to thorough investigation. This refers to the actinides and also to hydrogen, lithium, and other elements capable of participating in thermonuclear reactions. American investigators exaggerate when they state that the chemistry of plutonium is better known than that of sodium; there is almost a total absence of information on aqueous and nonaqueous equilibrium systems, the solubility of difficultly soluble compounds, temperatures of transitions, vapor pressures, etc. as far as compounds of this element are concerned. The situation is still worse with respect to thermochemical and thermodynamic data. If we consider the chemistry of protactinium, which is of importance in connection with the production of uranium-232, we find that more remains to be found in this field.

12. System CsF-Be F<sub>2</sub>

"X-Ray Diffraction Investigation of the System Cesium Fluoride-Beryllium Fluoride," by O. N. Breusov and Yu. P. Simanov; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 11, Nov 59, pp 2582-2590

In an investigation of this system by the thermal analysis method conducted by the authors on an earlier occasion, the formation of four compounds, namely Cs<sub>3</sub> Be F<sub>5</sub>, Cs<sub>2</sub> Be F<sub>4</sub>, Cs Be F<sub>3</sub>, and Cs Be<sub>2</sub> F<sub>5</sub>, was established. Their polymorphic transformations were investigated. The results of the present investigation confirm that the four compounds mentioned above are formed. The temperature of the polymorphous transformation of Cs<sub>3</sub> Be F<sub>5</sub> was found to lie above the stability range of silicate-free glass.

13. Ternary Systems Consisting of Fluorides of Lithium, Barium, Sodium, and Potassium

"Fusibility Diagrams of Ternary Systems Consisting of the Fluorides of Lithium, Barium, Sodium, and Potassium," by V. T. Berezhnaya and G. A. Bukhalova, Rostov-na-Donu Engineering and Construction Institute; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 11, Nov 59, pp 2600-2605

The ternary systems lithium fluoride-potassium fluoride-barium fluoride and lithium fluoride-sodium fluoride-barium fluoride were investigated. Ternary systems consisting of the fluorides of alkali metals and alkaline earth metals are acquiring increasing importance in connection with the extensive applications of salts of this type in the welding and melting of light metals and as fluxes in the electrometallurgical production of metals.

14. New Equipment for Nickel Plating With Nickel Tetracarbonyl

"Nickel Plating by Thermal Decomposition of Nickel Tetracarbonyl Vapor," by A. M. Verblovski and A. L. Rotinyan; Leningrad, Zhurnal Prikladnoy Khimii, Vol 33, No 1, Jan 60, pp 102-110

As a result of an investigation of nickel plating by the thermal decomposition of nickel tetracarbonyl vapor on heated surfaces, a new design of equipment for this process has been developed and the optimum conditions of plating have been worked out which ensure the decomposition of high-quality nickel coatings that for all practical purposes are free of pores. It was established that adhesion of the coating to the support is achieved only after the nickel-plated article has been subjected to thermal treatment. The principal characteristics of nickel coatings obtained by plating with nickel tetracarbonyl from the gas phase have been studied. It was established that these coatings exhibit superior anticorrosion properties.

Laboratory Instruments

15. Logarithmic Photometer

"Logarithmic Photometer for the Range of 0.7-0.2 Micron," by V. I. Dianov-Klovov, Institute of Organochemical Compounds, Academy of Sciences USSR; Moscow, Pribery i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 91-94

A photometric attachment to a monochromator is described for measuring the logarithm of the ratio of intensities of two light fluxes by means of a "logarithming" diode operating as load of the photomultiplier. The operating scale range extends to a ratio of photocurrents of  $10^4 : 1$ . The recording of spectrograms is carried out by an EPP-09 potentiometer.

Nuclear Fuels and Reactor Construction Materials16. Compounds Formed by Uranyl With Ethylenediaminetetraacetic Acid

"Investigation by the Solubility Method of the System  $UO_2(NO_3)_2$  -- Ethylenediaminetetraacetic Acid-Water," by A. Ye. Klygin, I. D. Smirnova, and N. A. Nikol'skaya; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 11, Nov 59, pp 2623-2629

The method of the investigation of solubilities at different values of the pH has been scrutinized from the standpoint of its suitability for the determination of dissociation constants of complex compounds and of the composition of these compounds. Calculations that have been carried out and results of experiments that have been conducted indicate that the method in question can be used to determine the composition of ions of complex compounds and the dissociation constants of such compounds. The solubility product of the ethylenediaminetetraacetate of uranyl ( $UO_2 H_2 R$ ) has been determined and found to be equal to  $(2.3 \pm 0.2) \cdot 10^{-6}$  at  $25^\circ$ . It was established that under the experimental condition in question the complex ion  $UO_2 HR^-$  is formed. At  $25^\circ$  this ion has a constant of dissociation amounting to  $(7.4 \pm 0.4) \cdot 10^{-5}$ . No other complexes are formed. It is indicated how the results obtained can be used in analytical chemistry. Specifically, it has been established that gallium, yttrium, gadolinium, lutecium, iron, scandium, indium, and thorium can be determined by titration with ethylenediaminetetraacetic acid with a precision of up to 0.1% in the presence of uranyl ions.

17. Solid Phase in System  $UO_4 \cdot 4 H_2O - MOH-H_2O_2 - H_2O$ 

"Investigation of the Solid Phase in the System  $UO_4 \cdot 4 H_2O - MOH-H_2O_2 - H_2O$ ," by A. M. Gurevich and L. P. Polozhenskaya; Leningrad, Radiokhimiya, Vol 1, No 5, Oct 59, pp 573-580

As a result of an investigation of the solid phase in the system  $UO_4 \cdot 4 H_2O - MOH-H_2O_2 - H_2O$  ( $M = Na, K$ ), the following compounds were identified:  $Na_2 UO_6 \cdot x H_2O$ ;  $K_2 UO_6 \cdot x H_2O$ ;  $Na_6 U_2 O_{13} \cdot 13 H_2O$ ;  $K_4 UO_8 \cdot H_2O$ ;  $K_8 U_4 O_{22} \cdot 15 H_2O$ ;  $K_6 U_2 O_{13} \cdot 10 H_2O$ ;  $K_8 U_4 O_{24} \cdot 4 H_2O$ ;  $K_4 U O_8 \cdot 4 H_2 O_2 \cdot x H_2O$ . Of the compounds listed above, the salts  $Na_6 UO_{13} \cdot 12 H_2O$ ;  $K_8 U_4 O_{22} \cdot 15 H_2O$ ; and  $K_8 U_4 O_{24} \cdot 4 H_2O$  have not been described in the literature hitherto. It was established that there is



a lower limit of concentrations of uranium and caustic below which formation of the salts  $K_6 U_2 O_{13} \cdot 10 H_2O$ ;  $K_8 U_4 O_{22} \cdot 15 H_2O$ ; and  $K_8 U_4 O_{24} \cdot 4 H_2O$  does not take place. It was also established that the compounds  $M_6 U_2 O_{13} \cdot x H_2O$ ;  $M_8 U_4 O_{22} \cdot x H_2O$ ; and  $M_8 U_4 O_{24} \cdot x H_2O$  are products of the decomposition of the anion  $UO_8^{4-}$ . A probable mechanism of the formation of the solid phase is proposed that includes a stage in which soluble complexes are formed. Formulas are given which describe the complex composition of the compounds that were investigated.

18. Distribution of Cesium, Calcium, Strontium, and Lanthanum Between Aqueous Solution and Methylbutylketone in Presence of Uranium

"Distribution of Cesium, Calcium, Strontium, and Lanthanum Between an Aqueous Solution and Methylbutylketone in the Presence of Uranium," by V. M. Vdovenko, A. A. Lipovskiy, and M. G. Kuzina; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 11, Nov 59, pp 2502-2504

The distribution of Cs, Ca, Sr, and La between aqueous solutions containing nitric acid and methylbutylketones as affected by the concentration of uranyl nitrate was investigated. It was established that the coefficient of distribution of these elements becomes greater as the concentration of uranyl nitrate in the initial aqueous solution increases. This may be due to the extraction of the elements in question in the form of salts having the composition  $MUO_2(NO_3)_3$ .

19. Extraction of Thorium With Tributyl Phosphate

"The Effect of Sulfate Ions on the Coefficient of Distribution of Microquantities of Thorium During the Extraction With Tributyl Phosphate (TBP)," by Ye. P. Mayorova and F. F. Fomin; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 11, Nov 59, pp 2511-2514

It is shown that the values of the association constants of the ions  $\text{Th}(\text{NO}_3)_4^{4-j}$ ,  $\text{Th}(\text{SO}_4)_k^{4-2k}$ , and  $\text{Th}(\text{NO}_3)_j(\text{SO}_4)_k^{4-j-2k}$  and the constants of the reaction whereby the compound  $\text{Th}(\text{NO}_3)_4 \cdot 2 \text{TBP}$  is formed, which have been established in experiments with tracer quantities, make it possible to calculate the distribution coefficients for weighable quantities of thorium at the same ionic strength.

20. Potassium-Thorium and Ammonium-Thorium Fluorides

"Interactions in the Systems  $(\text{Th}(\text{NO}_3)_4 - \text{KF}(\text{NH}_4\text{F}) - \text{H}_2\text{O})$ ," by I. V. Tananayev and Lu Chao-ta; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 12, Dec 59, pp 2796-2802.

The systems  $\text{Th}(\text{NO}_3)_4 - \text{KF}(\text{NH}_4\text{F}) - \text{H}_2\text{O}$  were investigated by determining solubilities, the electrical conductivity, the pH, and the apparent volume of precipitate and also by subjecting individual phases to X-ray diffraction analysis. It was found that in both systems, in addition to basic and normal fluorides, complex salts of the type  $\text{MeTh}_2\text{F}_9$  and  $\text{Me}_2\text{ThF}_6$  are formed at ratios of  $\text{MeF}:\text{Th}(\text{NO}_3)_4$  higher than 4.5. The X-ray diffraction diagrams of the salts isolated were taken by the Debye method. The formation of thorium fluoride complexes was found to proceed according to the scheme  $\text{Th}^{4+} \rightarrow \text{ThF}^{3+} (\text{ThF}_2^{2+}) \rightarrow \text{Th}_{4-x}(\text{OH})_x \rightarrow \text{MeTh}_2\text{F}_9 \rightarrow \text{Me}_2\text{ThF}_6$ .

21. Phenylarsonic Acid as Reagent for Separation of Neptunium From Plutonium

"Application of Phenylarsonic Acid for the Separation of Neptunium from Plutonium," by I. Ye. Starik, A. P. Ratner (deceased), M. A. Pasvik (deceased), and F. L. Ginzburg; Leningrad, Radiokhimiya, Vol 1, No 5, Oct 59, pp 545-547

A method has been developed for the quantitative separation of neptunium from plutonium based on the coprecipitation of neptunium with zirconium phenylarsonate under conditions involving reduction of the plutonium to the trivalent state.

(This investigation was carried out in 1952.)

22. Some Properties of Ethylenediaminetetraacetic Acid and Its Interactions With Uranium and Plutonium

"Solubilities of Ethylenediaminetetraacetic Acid in Ammonia and Hydrochloric Acid and the Interactions of This Acid With Uranium (IV) and Plutonium (IV)," by A. Ye. Klygin, I. D. Smirnova, and N. A. Nikol'skaya; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 12, Dec 59, pp 2766-2771

The solubilities of ethylenediaminetetraacetic acid ( $H_4R$ ) in the region of  $pH = 0.8-3.0$  were determined. It was established that on dissolution of  $H_4R$  in hydrochloric acid the ion  $H_6R^{2+}$  is formed, the dissociation constant of which at  $25^\circ$  can be expressed as follows:

$$K_0 = \frac{[H^+]^2 [H_4R]}{[H_6R^{2+}]} = 1.24 \times 10^{-2}$$

The constants of the acidic dissociation of  $H_4R$  were determined. At  $25^\circ$  these were found to be  $K_1 = 6.13 \times 10^{-3}$  and  $K_2 = 1.71 \times 10^{-3}$ . It was established that the preparation of  $H_4R$  from its sodium salt should be carried out in solutions having a  $pH = 1.6$ , because the solubility of  $H_4R$  goes through a minimum at this point. It amounts to  $3.05 \times 10^{-4}$  mols per liter at the minimum. The constant of the formation of a complex compound of the nonhydrolyzed plutonium (IV) ion [Pu (IV) which has not been transferred into the colloidal state] was determined more precisely. This constant was found to be equal to  $1.38 \times 10^{26}$ . The constant of the formation of a complex compound of uranium (IV) with  $H_4R$  was determined. Its value was found to be  $4.2 \times 10^{25}$ . It was established that the stability of ethylenediaminetetraacetate complex compounds increases in the sequence  $Th^{4+} - U^{4+} - Pu^{4+}$ .

23. Extraction of Plutonium Perchlorate With tri-n-Butylphosphate

"Extraction of Plutonium (IV) Perchlorate With tri-n-Butylphosphate," by A. S. Solovkin, A. I. Ivantsov, and E. V. Renard; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 12, Dec 59, pp 2826-2827

It was established that Pu (IV) is extracted to a considerable extent by tributylphosphate with the formation in the organic phase of neutral complexes containing the perchlorate ion. This result, and also results obtained earlier in experiments on the extraction of the perchlorates of uranyl and zirconium, indicate that actinides exhibit a stronger degree of association with the perchlorate ion than has been assumed earlier.

24. Carbonates of Tetravalent Plutonium

"Simple and Complex Carbonates of Plutonium (IV)," by A. D. Gel'man and L. M. Zaytsev; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 12, Dec 59, pp 2688-2696

The following three coordination compounds were isolated in the solid state from green-colored carbonate solutions of Pu (IV) and analyzed:

Ammonium plutoniumtetracarbonate  $-(\text{NH}_4)_4 [\text{Pu}(\text{CO}_3)_4] \cdot \text{H}_2\text{O}$

Ammonium plutoniumpentacarbonate  $-(\text{NH}_4)_6 [\text{Pu}(\text{CO}_3)_5] \cdot n\text{H}_2\text{O}$

Ammonium plutoniumhexacarbonate  $-(\text{NH}_4)_8 [\text{Pu}(\text{CO}_3)_6] \cdot n\text{H}_2\text{O}$

The molecular conductance in aqueous solutions and the apparent molecular weight were determined for the plutonium tetracarbonate salt. The results obtained confirm that the compound in question is the coordination type and that the formula proposed for it is correct. The processes of the decomposition of complex carbonates of plutonium under different conditions were investigated. The oxycarbonate of tetravalent plutonium,  $\text{Pu OCO}_3 \cdot 2\text{H}_2\text{O}$ , was isolated and investigated. It was established that under conditions which favor hydrolysis products poorer in  $\text{CO}_3^{2-}$  form instead of the plutonium oxycarbonate. Products of the latter type which were isolated have the formulas  $\text{Pu O}_2 \cdot \text{Pu OCO}_3$  and  $2.5 \text{ Pu O}_2 \cdot \text{Pu OCO}_3 \cdot n \text{H}_2\text{O}$ .

25. Chromatographic Separation of Rare-Earth Elements by Means of Tributyl Phosphate

"Chromatographic Separation of Rare-Earth Elements by Means of Tributylphosphate," by L. I. Martynenko, G. K. Yeregin, and A. I. Kamenev, Chair of Inorganic Chemistry, Chemical Faculty of Moscow State University; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 11, Nov 59, pp 2639

It was established that it is possible to separate rare-earth elements of the cerium subgroup by the method of distribution chromatography using silica-gel and tributylphosphate. A sharp separation of the rare-earth elements was obtained and the concentration of these elements in the eluate was high.

26. Association Constant of  $YF^{2+}$  Ion

"Association Constant of the  $YF^{2+}$  Ion," by G. B. Seyfer; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 12, Dec 59, pp 2832-2834

The association constant of the complex  $YF^{2+}$  ion was determined experimentally. It was found that by plotting the association constants of the ions  $ScF^{2+}$ ,  $YF^{2+}$ ,  $LaF^{2+}$ ,  $CeF^{2+}$ , and  $GdF^{2+}$  against ionic radii a smooth curve is obtained.

27. Complex Compounds of Rare-Earth Elements With Trihydroxyglutaric Acid

"Complex Compounds of Trihydroxyglutaric Acid With Cerium, Neodymium, and Samarium," by N. K. Davidenko; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 11, Nov 59, pp 2469-2475

In work done earlier by the author, the interaction of trihydroxyglutaric acid with lanthanum was investigated. In the present instance, the systems cerium chloride (or neodymium or samarium chloride) - trihydroxyglutaric acid were investigated in aqueous solutions by the methods of potentiometric titration, measurement of the pH, and determination of the transfer of ions during electrolysis. It was established that depending on the pH, cationic, electrically neutral, and anionic complex compounds are formed in mixtures of the reacting components having a molar ratio of 1:1. The compounds  $Ce_2(C_5H_6O_7)_3$ ,  $Nd_2(C_5H_6O_7)_3$ ,  $CeC_5H_7O_8$ ,  $NdC_5H_7O_8$ ,  $NdC_5H_7O_8$ , and  $NaNdC_5H_6O_8$  were isolated. Some of the properties of these compounds were determined. Their structure was established. The dissociation constants of cationic complexes of the type  $LnC_5H_6O_7^+$  were determined in the cases of lanthanum, cerium, neodymium, and samarium. These constants are practically the same in all four cases and have a numerical value of  $1 \pm 0.6 \times 10^{-4}$ .

28. Electrolytic Separation of Europium

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

The chemical processes were investigated which take place in aqueous solutions when europium acetate is subjected to electrolysis in the presence of potassium citrate and europium is isolated in the form of its amalgam. The effect of the initial acidity of the electrolyte on the

yield of europium was investigated. Furthermore the effects of the quantity of potassium citrate and of the initial concentration of europium and of the temperature on the yield of europium were determined. The results obtained were compared with those pertaining to ytterbium and samarium. As compared with ytterbium and samarium, europium can be separated electrolytically with relative facility. A high yield of this metal is obtained without great difficulty.

29. Interaction of Nitric Acid With Tributyl Phosphate (TBP)

"Interaction of Nitric Acid With Tributyl Phosphate (TBP)," by Z. A. Sheka and Ye. Ye. Kriss; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 11, Nov 59, pp 2505-2540

By applying methods of physicochemical analysis and determining the dielectric permeability, it was established that the compounds  $\text{HNO}_3 \cdot \text{TBP}$  and  $3 \text{HNO}_3 \cdot \text{TBP}$  are formed in the system  $\text{HNO}_3 - \text{TBP}$  when TBP dissolved in carbon tetrachloride is used. On the basis of the distribution of nitric acid between the aqueous and nonaqueous phase, the constants of the reactions by which these compounds are formed were determined. A comparison of the experimental curve of distribution plotted against the concentration of nitric acid with theoretical curves for the two compounds mentioned above indicated that the first complex compound is predominantly present at concentrations of nitric acid below 4 mols per liter of water, while the second complex compound is predominantly present at concentrations of nitric acid between this point and 9 mols per liter of water. At concentrations still higher than this, there is in addition to the nonchemical solution of nitric acid in the nonaqueous phase formation of complexes of the type  $n\text{HNO}_3 \cdot \text{TBP}$  ( $n > 3$ ).

TBP is used as a solvent in industrial procedures for the separation of rare elements, lanthanides, and actinides by extraction.

30. Extraction of Metals With Acidic Alkyl Phosphates

"The Problem of the Extraction of Metals With Acidic Alkyl Phosphates," by A. S. Chernyak and M. L. Navtanovich, Irkutsk State Scientific Research Institute of Rare Metals; Leningrad, Zhurnal Prikladnoy Khimii, Vol 33, No 1, Jan 60, pp 85-89

To investigate the composition of products resulting from reactions between alcohols and phosphoric acid anhydride, separation of acidic from neutral esters followed by the titration of alkylphosphoric acids and

quantitative determination of phosphorus in the products being investigated was applied. It was established that only acidic alkyl phosphates are formed in this reaction, and that the quantity of monoesters increases and the quantity of diesters decreases when the molar ratio of alcohol to anhydride increases from 2 to 6. Under the conditions which are typical for the synthesis of alkyl phosphate extracting agents (i.e., synthesis by the interaction of 2 mols of alcohol with 1 mol of phosphorus pentoxide), disubstituted esters (dialkyl-phosphates) form predominantly (to the extent of 87.7-90.5%). It was established experimentally that the extraction of metals with acidic alkyl phosphates proceeds by an ionic mechanism. On the basis of the results obtained, one may assume that acidic alkyl phosphates can be used for the extraction of metals both from strongly acidic and weakly acidic solutions.

31. Thermodynamics of Compounds Formed by Chlorides of Tantalum, Niobium, Titanium, Zirconium, Hafnium, and Aluminum With Chlorides of Alkali Metals

"Thermodynamics of Compounds Formed by Chlorides of Tantalum, Niobium, Titanium, Zirconium, Hafnium, and Aluminum With Chlorides of Alkali Metals," by I. S. Morozov and D. Ya. Toptygin, Institute of General and Inorganic Chemistry imeni N. S. Kurnakov, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR -- Otdeleniye Khimicheskikh Nauk, No 11, Nov 59, pp 1920-1927

The thermal stability of compounds formed by the chlorides of tantalum, niobium, titanium, zirconium, hafnium, and aluminum with chlorides of alkali metals was investigated.  $\Delta H$ ,  $\Delta S$ , and  $\Delta F$  of the reactions of decompositions of the compounds in question were calculated. It is stated that the double chlorides mentioned are being investigated, because electrolysis of double chlorides and fluorides of the metals enumerated is an advantageous method for the production of these metals.

32. Zirconium and Hafnium Tungstates

"The Tungstates of Zirconium and Hafnium," by Academician V. I. Spitsyn, L. N. Komissarova, and V. A. Vladimirova, Moscow State University; Moscow, Doklady Akademii Nauk SSSR, Vol 127, No 1, 1 Jul 59, pp 120-123

Anhydrous zirconium and hafnium tungstates and hydrated tungstates of zirconyl and hafnyl were synthesized. Their chemical and physical properties are described.

33. Tashkent Conference on Nuclear Energy

"The Tashkent Conference on Peaceful Uses of Nuclear Energy,"  
by A. Kiev and E. Parilis; Moscow, Atomnaya Energiya, Vol 8,  
No 2, Feb 60, pp 167-168

A Conference on Peaceful Uses of Nuclear Energy was held at Tashkent, 28 September-3 October 1959. The conference was organized by the Academy of Sciences Uzbek SSR and the State Scientific Technical Committee at the Council of Ministers Uzbek SSR. The beginning of the conference corresponded to the starting of the nuclear reactor of the Institute of Nuclear Physics, Academy of Sciences Uzbek SSR. This reactor was put into operation on 10 September 1959.

About 1,000 persons participated in the conference. Among them were 400 persons from localities outside the Uzbek SSR. The conference had the scope of a major all-union meeting.

At the first plenary session of the conference U. A. Arifov, director of the Institute of Nuclear Physics of the Academy of Sciences Uzbek SSR, gave a report on the progress of work conducted at this institute. P. S. Savitskiy and V. I. Sinitsyn, representatives of the Main Administration on Peaceful Uses of Atomic Energy, Council of Ministers USSR, presented a report dealing with prospects of the peaceful utilization of nuclear energy in the USSR.

At the same session S. V. Starodubtsev, Vice-President of the Academy of Sciences Uzbek SSR, gave an extensive review report dealing with research on the changes of properties of matter exposed to the action of intense nuclear radiation fields. This report summarized research on the physics of radiation effects conducted at laboratories of the Academy of Sciences Uzbek SSR.

At meetings of the Section of Nuclear and Radiation Physics, 50 papers were presented. The papers on nuclear physics dealt principally with nuclear reactions and the dispersion of neutrons as a result of interaction with neutrons. Several reports were concerned with reactions taking place under the effect of alpha particles and deuterons and also with results of the investigation of fission splinters.

A number of reports dealt with results of investigations on the photodisintegration of nuclei. Results were reported that were obtained in investigations of excited splinters and in the study of spectra of conversion electrons.



The majority of reports on radiation physics dealt with the modification of optical, electric, magnetic, elasticity, and adsorption properties of crystals under the action of gamma radiation.

In this section, the radiolysis of hydrocarbons under the action of gamma radiation was discussed. At a special meeting of the section, methods of investigation, specifically physical methods of investigation employing radioactive isotopes, were considered. At this particular meeting, information was given on mass-spectrometric methods, nuclear magnetic resonance methods, and the application of radioactive isotopes in nuclear and molecular physics as well as electronics.

At meetings of the Section of Radioactive Isotopes and Applications of Nuclear Radiation in Chemistry, 44 reports and 5 communications were presented. The reports dealt with diverse problems of radiochemistry and radiation chemistry, the application of radioactive isotopes in chemistry, and the chemical analysis of radioactive isotopes. Radiation-chemical methods for the preparation of various pure substances were discussed. Furthermore, reports were given on the investigation of the kinetics of chemical reactions by methods involving the application of isotopes, the effects of nuclear radiation on chemical compounds, and the application of spectral analysis in connection with the production of radioactive compounds. Furthermore, problems of gamma-spectroscopy and of the synthesis of compounds containing two different species of tracer atoms, as well as many other problems, were discussed.

The transactions of the conference will be published in the form of a book in 1960.

34. Production and Application of Nonradioactive Isotopes

"Production and Application of Stable Isotopes in the USSR," by S. P. Potapov; Moscow, Atomnaya Energiya, Vol 8, No 2, Feb 60, pp 160-164

The production and application of nonradioactive isotopes in the USSR are discussed in detail. No information is given on the production of hydrogen and uranium isotopes. It is stated that the electromagnetic method is principally applied in the USSR for the concentration and separation of nonradioactive isotopes produced in quantities from a few milligrams to several kilograms. In cases when larger quantities of isotopes are required, more efficient methods such as distillation, chemical exchange, low temperature distillation, diffusion of vapor, etc. are applied. Installations have been built for the separation of the isotopes of boron, carbon, nitrogen, oxygen, and

some other elements by the methods mentioned. At present there is a trend toward the development of full-scale industrial processes for the production of isotopes. The most common application of nonradioactive isotopes is as tracers. In the field of the construction of electronic and physical equipment, the specific nuclear characteristics of nonradioactive isotopes are taken advantage of in designing radiation detectors. Furthermore, these isotopes are used in nuclear technology (e.g., B<sup>10</sup>).

It is stated that 222 different nonradioactive isotopes were produced and supplied in the USSR in 1958, as compared with 55 isotopes in 1955. The quantity of isotopes supplied to research institutes for scientific investigations amounted to 25,000 grams in 1958, as compared with 2,500 grams in 1955.

Nonradioactive isotopes supplied in quantities larger than one gram, isotopes used as radiation targets, and radioactive isotopes produced from nonradioactive isotopes are listed in three tables which accompany the article. The degree of enrichment and (in two tables) the method of production are indicated for every isotope listed.

### 35. Uranium Separation

"Separation of Uranium From Accompanying Metals by Ion Exchange Chromatography," by D. I. Ryabchikov, P. N. Paley, and Z. K. Mikhaylova, Institute of Geochemistry and Analytical Chemistry imeni Vernadskiy, Academy of Sciences USSR; Moscow, Zhurnal Analiticheskoy Khimii, Vol. 15, No 1, Jan/Feb 60, pp 88-95

Uranium can be separated from accompanying elements by ion exchange chromatography using different ability of uranium and other elements to form compounds with complexone III.

Separation is possible in two cases:

In acid mediums, where uranium is present as a positive ion, the majority of accompanying elements form an anion complex with complexone III and are not sorbed with cationite.

In almost neutral mediums uranium is present as an unstable anion complex and can be sorbed with carboxylic resin after the decomposition of this complex.

Depending on the nature and quantity of accompanying elements, two modifications of the analysis were used.

Separation of uranium from solutions at pH 1.7-1.9 on KY-2 cationite in sodium form can be applied to materials rich in uranium.

Separation of uranium from solutions at pH 5-8 on amberlit IRC-50 cationite in sodium form can be applied to rich uranium ores and to poor ores and uranium solutions as well.

### 36. Uranium Determination

"Determination of Uranium by Amperometric Titration," by V. F. Yeskevich and L. A. Komarova; Moscow, Zhurnal Analiticheskoy Khimii, Vol 15, No 1, Jan/Feb 60, pp 84-87

A method is suggested for the amperometric titration of uranium (up to 1 ug/l) with ammonium vanadate solution. The accuracy of the method is 2-3%. The titration is carried out without applying the external potential vs the bismuth reference electrode. The sample is prepared by the hydrosulphite-phosphate or chromium-phosphate method.

### 37. Zirconium Determination

"Complexometric Determination of Zirconium," by V. F. Lukyanov and Ye. M. Knyazeva; Moscow, Zhurnal Analiticheskoy Khimii, Vol 15, No 1, Jan/Feb 60, pp 69-72

A sample of material to be analyzed (ores, concentrates, cakes, alloys, etc.) is decomposed by a suitable method, zirconium is precipitated with  $\text{NH}_4\text{OH}$  or  $\text{NaOH}$ , and the precipitate is dissolved in 2N HCl and boiled with excess of complexone III; the solution is brought to pH 2.3-2.4 and the excess of complexone is titrated with  $\text{Th}(\text{NO}_3)_4$  with the use of uranon (arsenazo) as an indicator. The experimental error does not exceed 0.6% relative.

The method was applied to the determination of zirconium in ores, cakes, and concentrates, containing 2 to 40% of zirconium, with satisfactory results.

38. Scandium Determination

"Quantitative Determination of Scandium With the Use of Mandelic Acid," by I. P. Alimarin and Shen Han-Si, Moscow State University; Moscow, Zhurnal Analiticheskoy Khimii, Vol 15, No 1, Jan/Feb 60, pp 31-35

A new method for the quantitative determination of scandium with the use of mandelic acid and a method for separating scandium from rare earths and thorium are developed. The precipitate composition corresponds to the formula  $H_3 [Sc (C_8 H_6 O_3)_3] \cdot n H_2O$ . This compound, as was shown by the thermogravigram, decomposes at  $280^\circ$ . Scandium mandelate dissolves in ammonia with the formation of  $(NH_4)_3 [Sc (C_8 H_6 O_3)_3]$ .

"Quantitative Determination of Scandium by Spectrographic Analysis," by V. M. Alekseeva and A. K. Rusanov, All-Union Institute of Mineral Raw Materials; Moscow, Zhurnal Analiticheskoy Khimii, Vol 15, No 1, Jan/Feb 60, pp 27-30

The use of an ac is stabilized with strontium carbonate as an excitation source enables the direct determination of scandium in the range 0.001% to 0.1% in silicate ores of variable composition. The mean error of a single determination is  $\pm 10\%$ .

39. Determination of Aluminum in Uranium

"Spectrographic Determination of Aluminum in Uranium," by Ye. A. Vernyy and V. N. Yegorov; Moscow, Zhurnal Analiticheskoy Khimii, Vol 15, No 1, Jan/Feb 60, pp 24-26

A spectrographic method for determining small amounts of aluminum in uranium is based on the phenomenon of fractional distillation with a carrier. Some experiments have been carried out with the aim of studying the effect of barium and carbon powder on the intensity of aluminum lines. The influence of third elements on the results of the aluminum determination has been studied.

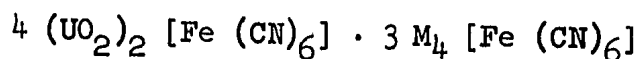
40. Formation of Mixed Uranyl and Alkali Element Ferrocyanides

"Potentiometric Study on the Formation of Mixed Uranyl and Alkali Element Ferrocyanides," by V. D. Ponomarev and I. V. Tananayev, Moscow Engineering Physics Institute; Moscow, Zhurnal Analiticheskoy Khimii, Vol 15, No 1, Jan/Feb 60, pp 10-15

It is established that the position of the equivalent point corresponding to the bend of the oxidation-reduction potential curves in systems of the type  $UO_2^{2+} - M_4 [Fe(CN)_6] - H_2O$  ( $M = Li, Na, K, Rb, Cs$ ) depends on the nature of the alkaline element present in the solution. When lithium ferrocyanide is present, a normal uranyl cyanide  $(UO_2)_2[Fe(CN)_6]$  is formed.

Mixed ferrocyanides  $Na_2 (UO_2)_5 [Fe(CN)_6]_3$ ,  $2 (UO_2)_2 [Fe(CN)_6] \cdot K_4 [Fe(CN)_6]$ ;  $3 (UO_2)_2 [Fe(CN)_6] \cdot 2 Rb_4 [Fe(CN)_6]$ ;  $3 (UO_2)_2 [Fe(CN)_6] \cdot 2 Cs_4 [Fe(CN)_6]$  are formed in the presence of other alkali elements.

In the presence of an excess of alkali element ions, the equivalent point shifts to the formation of compounds containing large quantities of alkali elements; whereas in the presence of very large concentrations of the solutions of alkali element chlorides, a mixed uranyl ferrocyanide is formed;



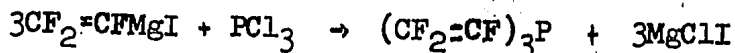
The mixed uranyl ferrocyanides are suggested to be considered as polynuclear molecules of the polymer type.

Organic Chemistry

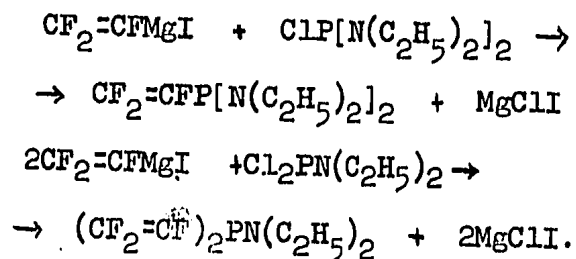
41. "Synthesis of Perfluorovinylhalophosphines

"Perfluorovinylhalophosphines," by I. L. Knunyants, R. N. Sterlin, R. D. Yatsenko, and L. N. Pinkina; Moscow, Khimicheskaya Nauka i Promyshlennost', Vol IV, No 6, 1959, pp 810-811

Until recently, the only known fluorinated phosphines were trifluoromethyl derivatives. In an earlier work the authors demonstrated that perfluorovinylmagnesium iodide reacts with silicon tetrachloride forming tetra-(trifluorovinyl)-silane. Application of this reaction to phosphorus trichloride led to the formation of tri-(fluorovinyl)-phosphine:



Primary and secondary perfluorovinyl derivatives could not be obtained by this reaction. However, they were obtained by the action of perfluorovinylmagnesium iodide on the acid chloride of the tetraethylamide and the acid dichloride of the diethylamide of phosphorous acid:



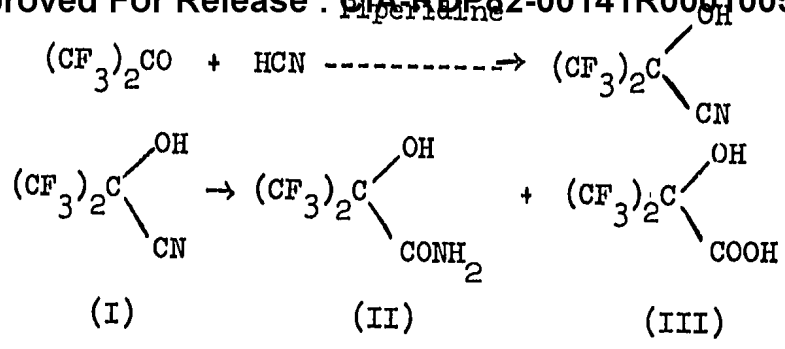
Cleavage of amides of the type  $\text{R}'\text{P}(\text{NR}_2)_2$  with dry  $\text{HCl}$  leads to the formation of primary and secondary chloro-phosphines; in this manner  $\text{C}_2\text{H}_5\text{PCl}_2$ ,  $\text{CF}_2=\text{CFPCl}_2$  and  $(\text{C}_2\text{F}_2=\text{CF})_2\text{PCl}$  were obtained. By substituting the chlorine with fluorine in the two latter compounds  $\text{CF}_2=\text{CFPF}_2$  and  $(\text{CF}_2=\text{CF})_2\text{PF}$  were obtained.

#### 42. Synthesis of Fluorinated Ketones

"Fluorinated Ketones. Bis-(trifluoromethyl)-glycolic Acid," by I. L. Knunyants, Ye. M. Rokhlin, N. P. Gambaryan, Yu. A. Cheburkov, and Ch'en Ch'ing-Yun, Institute of Organoelemental Compounds, Academy of Sciences USSR; Khimicheskaya Nauka i Promyshlennost', Vol IV, No 6, 1959, pp 802-804

This report describes the preparation of bis-(trifluoromethyl)-glycolic acid, the first representative of completely fluorinated  $\alpha$ -hydroxyacids. Several stages are involved in this preparation.

The nitrile of bis-(trifluoromethyl)-glycolic acid is obtained by reacting hexafluoroacetone with hydrocyanic acid in the presence of piperidine, which acts as a catalyst. The nitrile is hydrolyzed with concentrated sulfuric acid by mild heating, forming the amide of bis-(trifluoromethyl)-glycolic acid (II). Under more severe conditions of hydrolysis, the free bis-(trifluoromethyl)-glycolic acid (III) is formed. These reactions can be formulated as follows:



The physical properties of the synthesized compounds are listed in one table.

Radiation Chemistry

43. Radiation Intensity Influence on Kinetic Process Rate

"Kinetic Processes in Irradiated Substances," by M. A. Mokul'skiy; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 1, Jan 60, pp 119-129

A theoretical treatment has been presented of the previously proposed mechanism for the acceleration of kinetic processes by irradiation. It is believed that the anomalously large number of "hot" atoms in the irradiated substance is the probable cause of the acceleration. The possible concentration of the "hot" atoms has been estimated. The effect of temperature, of stress, and of radiation intensity on the rate of kinetic processes has been studied using the example of mechanical stress relaxation. Formulas have been derived for the change in the time spectrum of relaxation, in the dynamic modulus, and in other properties of a body subjected to the action of a radiation field.

44. Mechanical Properties of Irradiated Polymers

"Investigation Into the Mechanical Properties of Polymers Undergoing Irradiation. I. The Strength and Ultimate Forced Elasticity of Solid Polymers in the Process of Irradiation in a Nuclear Reactor," by M. A. Mokul'skiy, Yu. S. Lazurkin, M. B. Fiveyskiy, and V. I. Kozin; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 1, Jan 60, pp 103-109

This study is devoted to an investigation into the mechanical properties of materials being irradiated in a nuclear reactor. The apparatus for the measurement of the strength, yield value, and the creep of the

materials is described. The strength of polymethylmethacrylate and the ultimate forced elasticity of polyvinyl chloride have been determined. A reversible decrease in the values of these quantities under irradiation has been revealed.

"Investigation Into the Mechanical Properties of Polymers Undergoing Irradiation. II. Creep of Solid Polymers and Rubbers in the Process of Irradiation in a Nuclear Reactor," by M. A. Mokul'skiy, Yu. S. Lazurkin, and M. B. Fiveyskiy; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 1, Jan 60, pp 110-118

The paper presents the results of experiments on the creep of various polymers during irradiation. In the case of strength and ultimate forced elasticity measurements a reversible change in the mechanical properties has been revealed. The rate of creep increases sharply in the process of irradiation and falls after its termination. A great number of various formations -- electrons, ions, excited molecules, free radicals, etc. -- occur in the process of irradiation.

45. Radiation Polymerization of Isoprene

"Radiation Polymerization of Isoprene. I," by V. S. Ivanov, M. A. Sokolova, S. V. Aver'yanov, V. F. Yevdokimov, and I. S. Gurlyand, Leningrad State University; Moscow, Vysokomolekulyarnyye Soyedineniya, Vol 2, No 1, Jan 60, pp 35-37

Radiation polymerization of isoprene by  $\gamma$ -rays from a  $\text{Co}^{60}$  source leads to the formation of polymers in yields proportional to the dosage. The yield has been observed to increase with decrease in radiation intensity.

The order of magnitude of the mean molecular weights is independent of the dosage within the limits of experimental error. The weights increase as the irradiation intensity decreases.

The addition of a sensitizer (5 mol. %  $\text{CCl}_4$ ) considerably raises (approximately doubles) the polymer yield without changing the mean molecular weight.



It is highly noteworthy that the ratio of the microstructural elements of polyisoprene (1.2; 3.4; 1.4 units) is practically independent of the irradiation dosage, radiation intensity, presence of sensitizer ( $\text{CCl}_4$ ), and irradiation temperature within the limits of 40 to 20°.

Radiochemistry

46. Application of New Continuously Produced Equipment for Radiometric Control of Boundaries Between Petroleum Products in Pipelines

"Application of Series-Produced Scintillation Equipment in the Radiometric Control of Boundaries Between Petroleum Products in Pipelines," by L. N. Posik; Moscow, Atomnaya Energiya, Vol 7, No 6; Dec 59, pp 553-554

B. Z. Votlokhin and others recommended the application of a radiometric method for the determination of boundaries between petroleum products in pipelines (cf. Atomnaya Energiya, Vol 4, No 5, 1958, p 475).  $\text{Sb}^{124}$  is used as a tracer in the procedure described. This radioactive isotope is contained in a triphenylstilbine solution. Since the publication of Votlokhin's paper, scintillation counter equipment of the RSU type, which is series-produced and with which superior results can be obtained, has become available for application in connection with the procedure recommended in that paper. This equipment is described.

47. Separation of Radioactive Isotopes of Tin, Antimony, and Tellurium by Means of Anion-Exchange Resins

"Separation of Tin, Antimony, and Tellurium by Means of Anion-Exchange Resins," by V. N. Rybakov and I. I. Stronski, Laboratory of Nuclear Problems at Dubna, Joint Institute of Nuclear Research, and Laboratory of Nuclear Physics at Krakow, Institute of Nuclear Research, Polish Academy of Sciences; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 11, Nov 59, pp 2449-2451

In connection with the investigation of light isotopes of tellurium and antimony formed from iodine under the action of high-energy protons, it was of interest to develop a method for the separation of these elements by means of ion-exchange resins. In procedures which had been applied for this purpose the strongly basic anion exchange resin Dowex-1

was used. The elements were adsorbed from hydrochloric acid solutions in the form of the anions  $(\text{Sn Cl}_6)^{2-}$ ,  $(\text{Sb Cl}_6)^{-}$ ,  $(\text{Sb Cl}_6)^{2-}$ , and  $(\text{Te Cl}_6)^{2-}$ . In the experiments conducted in this instance, small quantities of antimony and tellurium were separated by using the anion-exchange resins EDE-10 P and ASD-2. Tin, antimony, and tellurium were separated using the anion-exchange resin ASD-2. These ion-exchange resins are produced in the USSR. It was established that the strongly basic anion-exchange resin ASD-2 can be used to advantage instead of Dowex-1 X-8 for the separation of tin and tellurium from each other.

48. Thulium-170 Sources of Gamma Radiation

"Tu<sup>170</sup> Gamma Radiation Sources," by Ye. K.; Moscow, Atomnaya Energiya, Vol 8, No 2, Feb 60, pp 177-178

The characteristics of Tu<sup>170</sup> and the advantages of applying it as a source of gamma radiation are discussed. It is pointed out that because of the relatively soft radiation emitted by it, as compared with Co<sup>60</sup>, Cs<sup>137</sup>, and Ir<sup>192</sup>, thulium-170 is better suited as a source of radiation in the defectoscopy of light metals and alloys and also of relatively thin parts and products consisting of steel and other heavy metals. The characteristics of Tu<sup>170</sup> radiation sources produced in the USSR are listed in a table. It is stated that at present large quantities of different types of thulium-170 sources are being produced in the USSR.

49. Focusing Ion Exchange Separation of Isotopes

"Separation of Some Fission Isotopes by the Focusing Ion-Exchange Method," by V. P. Shvedov, Ten Ten, and A. V. Stepanov, Leningrad Technological Institute imeni Lensovet; Moscow, Zhurnal Analiticheskoy Khimii, Vol 15, No 1, Jan/Feb 60, pp 16-19

Separation of mixtures Sr<sup>90</sup> - Y<sup>90</sup>, Sr<sup>90</sup> Y<sup>90</sup> - Ce<sup>144</sup>, Ce<sup>144</sup> - La<sup>140</sup> without carriers, as well as the mixture Ce - Pr by the focusing ion exchange method, has been studied. It has been established that the mixtures Sr<sup>90</sup> - Y<sup>90</sup>, Sr<sup>90</sup> - Y<sup>90</sup> - Ce<sup>144</sup>, and Ce<sup>144</sup> - La<sup>140</sup> can be separated in 5 min with the use of citric acid or complexone III; the separation of the Ce - Pr mixture at concentrations up to 0.5 mg/ml is not complete.

III. ELECTRONICS

Communications

50. Evaluation of Equipment Reliability

"Estimation of Mean Time for Reliable Operation of Equipment,"  
by M. A. Sinitza; Moscow, Radiotekhnika, No 3, Mar 60, pp 58-66

The mean operating time between two successive failures of radio-electronic equipment serves as a convenient criterion for evaluation of its reliability. This operating period, however, changes considerably with the time-in-use of the equipment, especially in aircraft practice.

The exponential law of probability was used in estimating the mean time between two successive failures in the case of extended exploitation of the equipment. The author states that a great number of (Soviet ?) radio-engineering components for general use have a life of about 1,000 hours and that only such components as magnetrons, klystrons, and certain superhigh-frequency electronic vacuum devices have a service life considerably exceeding this figure; however, the number of the latter type of devices is not great.

An evaluation of the derived approximation formulas is given, and it is shown that such approximations lead to inaccuracies of only a few percent.

51. TV Receiver "Druzhba"

"TV Receiver 'Druzhba'" (unsigned article); Moscow, Promyshlenno-Ekonomicheskaya Gazeta, No 34, 20 Mar 60

The new TV receiver "Druzhba" was designed by the workers of the radio-engineering industry of Leningrad. The set incorporates a wide-angle picture tube in which the electron beam is deflected by an angle of  $110^{\circ}$ . The use of a wide-angle kinescope, elliptical loudspeakers, miniature tubes, solid-state diodes, vertical chassis with printed circuits, and miniaturized subassemblies and parts has made it possible to hold the over-all dimensions of this 360 X 270-mm-screen TV set within reasonable limits. The set has high sensitivity and is equipped with a number of automatic controls which assure high brightness, contrast, and resolution of the image. The set will be provided with a remote-control device.

The "Druzhba" receiver will appear on the market toward the end of 1960.

52. Equations for Selecting Parameters of an AVC System

"The Influence of an Amplitude-Modulated Signal on a Two-Loop System of Automatic Volume Control," by V. V. Shirokov; Moscow, Radiotekhnika i Elektronika, Vol V, No 2, Feb 60, pp 218-223

An integral equation is derived which describes the processes in an AVC (automatic volume control) system under steady-state conditions. This equation is used to obtain a solution for the spectrum of the signal envelope at the output of a receiver device with two-loop AVC, using a method of successive approximations. A detailed analysis is made of the passage of a signal with a sinusoidal envelope through a receiver with AVC. The equations which are obtained make it possible to select the parameters of an AVC system, proceeding from minimum distortions of the sinusoidal signal envelope since it contains the received information or proceeding from the necessity for obtaining the best possible signal demodulation in those channels of the receiver not having amplitude modulation.

53. Soviet Video Tape Recorder

"Apparatus for Magnetic Recording of Images," by R. M. Kasherinov, V. V. Rakovskiy, and V. G. Komar; Moscow, Tekhnika Kino i Televideniya, No 2, Feb 60, p 57

A laboratory model of a set of equipment for the recording of moving images on magnetic tape has been developed and manufactured by the Leningrad plant "Kinap," in conjunction with the All-Union Scientific Research Cinemaphotography Institute and the All-Union Scientific Research Institute of Television, with the participation of a number of organizations (Central Design Bureau of the Ministry of Culture USSR, Scientific Research Institute of Ferrous Metals, Cinema Film Factory No 3, and others).

The recording is made by a disc with four special heads across a 70-mm-wide magnetic tape moving at a speed of 380 mm/second.

The principle of recording with a rotating disc with commutating heads and using wide film by a method of dividing it into transverse bands was proposed by the Soviet inventor K. L. Isupov (Authors Certificate No 34173, filed on 14 May 1932).

Use of 70-mm-wide magnetic tape makes it possible to substantially increase the amount of recorded information compared to the 50.8-mm-wide tape used abroad at the present time.

To secure the most rapid design and manufacture of the laboratory sample of the set of equipment, a method of parallel work arrangement was conducted in which the scientific research and experimental design work, as well as manufacture of the model, were carried out at the same time that the separate structurally independent elements of the set were being produced.

In design of the equipment, particular attention was paid to the problem of the manufacturing technology in that it was considered that this equipment would be series produced. In this connection, already in the experimental model a large number of units of technological equipment was designed and manufactured, and a large amount of experimental technological work was carried out.

In the design process, a number of original circuits and construction solutions assuring the required operational quality of the set and the possibility of rapid introduction of it into production were found.

The laboratory model of the equipment was tested with specially designed and produced magnetic tape and showed satisfactory results. Recording of the image can be made by picking up the video signal from the air or from an optical pick-up.

At the present time, further work is being carried out in widening the recorded frequency band, perfecting the design for series manufacture, and improving the electronic part of the set.

The work was carried out under the direction and participation of M. G. Shul'man, Ye. Ya. Akinin, V. F. Vorob'yev, P. G. Tager, G. V. Mering, T. A. Khinchuk, and others.

#### Components

#### 54. Stability of Transistorized Amplifiers to Temperature Changes

"Thermal Stability Equation for Voltage Amplifiers Built With Different Types of Transistors," by Yu. R. Nosov and B. I. Khananov; Moscow, Radiotekhnika, No 3, Mar 60, pp 38-44

The stability of transistorized voltage amplifiers to temperature changes can be determined by establishing the dependence of the voltage amplification factor on the transistor parameters and the dependence of the amplification factor on temperature. The thermal stability equation is derived for the general case and can be applied to different, standard types of germanium and silicon transistors. The derived equations show

that amplification-factor stability can be attained by an appropriate increase in the emitter current with temperature rise. These formulas relate temperature increments, and consequent changes in the transistor characteristics, to circuit parameters which would ensure thermal stability of voltage amplifiers.

The types P13, P14, P15, P13A, P8, P9, P10, P11, P401, P402, and P403 germanium transistors and the type P101 silicon transistor were studied with the aid of the derived formulas. This study led to the interesting conclusion that silicon-transistor thermal stabilization can be attained at constant emitter current. This fact should lead to the construction of a temperature-stabilized transistorized dc-current amplifier.

55. Hall-Effect Transducer

"Voltage Multiplication With Hall-Effect Transducer," by V. V. Kobzev; Moscow, Elektrosvyaz', No 3, Mar 60, pp 9-16

The Hall effect manifests itself in such a manner that under the action of a magnetic field perpendicular to the direction of current flow through a narrow semiconductor bar with high current-carrying mobility, an emf perpendicular to the direction of current flow and the field appears at the side edges of the bar. This emf is proportional to the product of current flowing through the bar and the magnetic field intensity perpendicular to the bar surface. Such a phenomenon leads to the expectation that, by utilizing the Hall effect, it is possible to obtain linear amplification of voltage.

Various types of germanium and InSb Hall-effect transistors were examined for voltage multiplication. A series of experiments carried out in this field confirmed the theoretical conclusion that it is possible in practice to utilize Hall-effect transducers for linear multiplication of two voltages. For a germanium Hall-effect transducer incorporating a steel core having a gap of 0.6 mm and induced field of 1,000 oersteds, it is possible to produce an open-circuit voltage of about 30-50 millivolts. The best results are obtained by feeding a low-frequency signal to the magnetizing circuit and a signal of higher frequency to the input circuit of the transducer.

Even at the present stage of development, Hall-effect transducers may be used in the construction of a great number of electric circuits; thus, further improvement of this type of components should be given due consideration.

56. Thermoresistors With Indirect Heating

"Thermoresistors With Indirect Heating," by P. M. Makandov, Primeneniye Poluprovodnikov v Priborostr. (The Use of Semiconductors in Instrument Building), Moscow, Mashgiz, 1958, pp 65-77 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 6746)

Indirectly heated heaters with semiconductor resistances, consisting of two electrically different circuits (semiconductor and resistor), are discussed. The semiconducting and resistance elements mostly are placed into an evacuated or gas-filled envelope. These heaters are characterized by various parameters, such as cold resistance (generally around 20 degrees), constant, dependence of resistance on temperature, and temperature coefficient. The characteristics of thermoresistors with indirect heating are dependence of resistance of the element on power, diffusion in the heater, and the dependence of the voltage at the semiconducting element on the current passing through it. The preparation of indirectly heated heaters from two-component mixtures of  $TiO_2$  and  $MgO$  is treated in detail and involves a study of the influence of the percentage content of  $TiO_2$  on the electrical conductivity and nominal resistance at various annealing temperatures, the dependence of the temperature coefficient on the  $TiO_2$  content, and the influence of temperature and length of annealing period on nominal resistance and conductivity. The technology of preparation of thermoresistors TKP-300, TKP-50, and TKP-20 is treated in detail, and the basic parameters of these types are tabulated. Thermoresistors with indirect heating are used in industry for automatic control, amplitude amplification in oscillators, measuring low-frequency power, low pressures, and analyzing gases.

57. Thermoelectric Cooling in Instrument Building

"Thermoelectric Cooling and Its Use in Instrument Building," by Ye. A. Kolenko, Primeneniye poluprovodnikov v priborostr. (Use of Semiconductors in Instrument Building), Moscow, Mashgiz, 1958, pp 213-230 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 6749)

A practical application of thermoelectric cooling, based on the Peltier effect, has come about only with the advent of semiconductors. Semiconductor thermocouples which ensure a temperature drop of 25-60 degrees between the hot and cold junctions are generally used for the purpose. The effectiveness of the operation of thermocouples depends on the diffusion of heat at its hot end, for which purpose radiators with either natural or artificial cooling are used. This article gives a technological procedure for the manufacture of the thermocouples and battery. Some instruments in which thermoelectric cooling is employed are described: a high-vacuum trap with thermoelectric cooling; semiconductor cooling of the stages

for a freezing microtome, which affords the possibility of lowering the temperature of the tissue placed in it to 8-10 degrees (power supply, 2 watts); microthermostat for lowering the temperature of photoresistances 50-60 degrees below that of the ambient medium; a thermostat for the components of radioelectronic installations; "artificial zero" instrument for keeping the temperature of a free thermocouple at zero; a visual microscope stage with thermoelectric heating and cooling to allow observation of objects in a temperature range of from minus 10 to plus 70 degrees; a thermoelectric instrument for calibrating thermometers in the below-zero range; a thermoelectric instrument for cooling photomultipliers; a thermoelectric ultrathermostat for maintaining the temperature of standard cells with an accuracy of plus-minus 0.001 degree; and a condensation thermoelectric hygrometer.

58. Application of Indium-Germanium Diode

"Application of a Fused Indium-Germanium Diode as a Temperature Converter," by R. Ye. Smolyanskiy; Moscow, Pribery i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 83-85

A device using industrially produced semiconducting diodes is described. The device permits measurement of temperature within the range of 20 to 60°C with an accuracy of tenths of a degree. As a temperature converter, an indium-germanium diode in a hermetic version may be used. The width of the forbidden zone of the germanium is computed in relation to the inverse current of the diode.

59. Czechoslovaks Produce Solar Battery

"Solar Battery of Czechoslovak Manufacture" (unsigned item); Prague, Obrana Lidu, 15 Mar 60, p 2

According to a brief announcement in source, the "A.S. Popov" Research Institute of Communications Technology in Prague (Vyzkumny ustav pro sdelovaci techniku) has developed the first Czechoslovak solar battery. Although giving no details, the article stresses that the Czechoslovak product meets world standards and is capable of converting solar energy into power to be used in transistorized radio receivers and other similar appliances and that larger solar batteries are used in communications equipment which is, for example, installed in automatic interplanetary stations, meteorological instruments, etc. The possibilities of utilizing solar batteries in Czechoslovakia are currently in a stage of promising development.

CPYRGHT

CPYRGHT

[For additional information on components, see Physics, Optics.]



Computers and Automation

60. Proposal for Further Increase of Computer Speed

"Superhigh-Frequency Application to Discrete Computers," by M. S. Neyman; Moscow, Radiotekhnika, No 3, Mar 60, pp 7-12

In modern electronic computers operating with dc pulses (video-pulses), the time intervals for the relaxation processes are of such duration as to limit the over-all speed of the computer. However, application of superhigh-frequency radio techniques to discrete computers, especially the introduction of superhigh-speed triggers, should raise performance to several billion elementary operations per second, i.e., many times the speed of modern computers operating with video pulses. Obtaining transfer capacity in an electronic computer similar to that obtained in television practice is, in principle, even more simple because maintenance of the desired passband is less rigid.

Application of superhigh-frequency techniques to the automation of computers promises, in addition to the increase in speed, an improvement in the flexibility of the system since both the oscillation amplitude and the frequency (or phase) change can be utilized. Superhigh-frequency technique will also facilitate the repeated, sequential use of the same discrete elements of the computer, thus reducing the total number of these elements needed.

[For information on automatic control, see Mathematics, Stability Problems.]

Instruments and Equipment

61. Effect of Limited Electron Stream on Gas Discharge Plasma

"Interaction of an Electron Stream With Plasma," by Ye. V. Bogdanov, V. Ya. Kislov, and Z. S. Chernov; Moscow, Radiotekhnika i Elektronika, Vol V, No 2, Feb 60, pp 229-238

The question of the interaction of a limited electron stream with plasma is examined. A dispersion equation is obtained, and the build-up conditions for a high-frequency signal are analyzed. An experimental study is made of a system in which the modulated electron stream interacts with a gas discharge plasma located in a longitudinal magnetic field. Plasma gains up to 40 db were obtained in a range of 30 to 3 cm.

The authors conclude that there is the possibility of obtaining the required high electron concentrations and the effective interaction of plasma with electron streams. This, in turn, should lead to the development of other effective devices for amplifying and generating short waves, based on the use of the oscillatory properties of plasma.

62. Photochronoscope for Precise Recording of Time

"Photochronoscope -- an Instrument for the Precise Recording of Moments of Time," by K. V. Pruss, Tr. Vses. n.-i in-t fiz.-tekh. i radiotekhn. izmereniy (Works of the All-Union Scientific Research Institute of Physicotechnical and Radio-Engineering Measurements), No 1, 1958, pp 60-71 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 6917)

The Central Scientific-Research Bureau of Unified Time Service has devised an instrument called the photochronoscope, which produces a numerical record of moments of time. The principle of operation of the instrument is based on the instantaneous photographing of portions of a numbered dial rotated by a synchronous motor fed by an alternating voltage with precise frequency stabilization. The moment of the photographing is determined by the flash of a neon bulb activated by a pulse arriving from the main instrument (clockwork or passage device). The maximum error is plus or minus 0.16 microsecond. Diagrams of the cinematic and electrical circuits and drawings of the photochronoscope are given.

63. Amplitude Analyzer

"Multichannel Amplitude Analyzer With a Mechanical Commutator," by N. L. Grigrov, V. Ya. Shestoperov, and V. A. Sobinyakov, Scientific Research Institute of Nuclear Physics, Moscow State University; Moscow, Pribory i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 67-69

A block diagram and a brief description of the device is given. It is applied for a simultaneous amplitude determination in many channels. The basic element of the device is a mechanical commutator. The time resolution of the circuit is 0.25 sec. The circuit consists of a few electronic tubes and is reliable in operation.

64. Sensitive Radiospectrometer

"High Response Paramagnetic Radiospectrometer on 9000 Mc Frequency," by Ya. L. Shamfarov, Institute of Radiophysics and Electronics, Academy of Sciences Ukrainian SSR; Moscow, Pribory i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 57-61

A high-response paramagnetic superheterodyne spectrometer operating on 9000 Mc is described. The spectrometer circuit applies stabilization of a signal klystron to a measuring resonator, as well as a self-tuning of the local heterodyne frequency. The system permits the observing of the signal of the paramagnetic resonance absorption in pure form (eliminates dispersion) and attenuates noises connected with the fluctuations of the signal klystron and of the measuring resonator.

Materials

65. Photoelectric Processes in Semiconductors

"Investigations of Kinetics of Photoelectric Processes in Semiconductors," V. A. Romanov, Physics Institute, Academy of Sciences Ukrainian SSR; Moscow, Pribory i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 70-74

An apparatus using sinusoidal modulation of light by Kerr cell is described. The method of measurement is based on the compensation principle and permits investigation of the kinetics of photoconductivity, volume photoelectromotive force, and photomagnetic electromotive force in semiconductors with high accuracy in a wide range of frequencies (20 cycles to 1.5 Mc). A method is devised to eliminate spotting by the Kerr cell, occurring during light modulation at frequencies of over 100 kc.

66. Study of Semiconductors

"Measurement of Specific Resistance and Hall's Constant in High Resistance Semiconductors," by Ch'iang Pi-huang, Leningrad Polytechnic Institute; Moscow, Pribory i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 81-82

The method and equipment for measuring the specific resistance and Hall's constant of semiconductor samples are described. The specific resistance of samples was found to be within the limits from  $10^2$  to  $10^9$  ohm·cm.

67. Life and Velocity of Current Carriers

"Computation of Volume Lifetime and Velocity of Surface Recombination of Current Carriers," by V. N. Dobrovolskiy and V. G. Litovchenko, Kiev State University; Moscow, Pribory i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 78-80

A nomogram is suggested for computation of volume lifetime ( $\tau$ ) and velocity of surface recombination ( $s$ ) from two values of effective lifetime corresponding to two values of the sample thickness. The conditions are derived under which it is possible to measure  $\tau$  and  $s$  by methods described by D. Navon, R. Bray, and H. Fan (Proc. IRE, 40, 1342 (1952)) for an arbitrary value of  $s$ .

68. Current Noises

"Investigation of Current Noises in Semiconductors," by D. N. Mirlin and L. S. Sochava, Institute of Semiconductors, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 75-77

Equipment for studying current noises in semiconductors in the range of 20 to 20,000 cycles, with an equivalent noise resistance of 10 ohms, is described.

69. The System Antimony-Tellurium

"Investigation of the System Antimony-Tellurium," by N. Kh. Abrikosov, L. V. Poretskaya, and I. P. Ivanova; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 11, Nov 59, pp 2525-2530

Compounds with a tetradymite structure are of interest as semiconductor materials. In a preceding work by the authors, the system Bi-Te was investigated. The work reported in this instance dealt with the investigation of the system Sb-Te. In this system, the compound  $Sb_2Te_3$  is formed, which has a tetradymite structure. The physical properties of this compound were investigated a short time ago. However, adequate data on the constitutional diagram of the system Sb-Te were not available. The data on this system have been supplemented, revised, and brought up to date.

70. Constitutional Diagram of the AlSb-GaSb System

"Constitutional Diagram of AlSb-GaSb," by A. S. Borshchevskiy, I. I. Burdiyan, E. Yu. Lubenskaya, and Ye. V. Sokolova, Physico-technical Institute, Academy of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 12, Dec 59, pp 2824-2826

It was established by chemical analysis that the composition of alloys in the system AlSb-GaSb, after zone leveling, shifts toward a greater degree of enrichment with the high-melting component, which corresponds to a constitutional diagram that is given. A more complete homogenization of the alloys was achieved by having the liquid zone move at two velocities and by using purer initial materials. A constitutional diagram of the system which corresponds more closely to conditions encountered at the state of equilibrium was constructed.

[For additional information on electronics materials, see Chemistry, High-Molecular Compounds and Inorganic Chemistry.]

Radar and Aids to Navigation

71. Interference of Radio Stations on Direction Finders

"The Errors of Automatic Radio Direction Finders With Servo-system in the Presence of Interferences From Radio Stations," by V. I. Bykov and Yu. I. Nikitenko, Tr. Leningr. basseyn. prav. Nauchno-tekhn. o-va vodn. transp. (Works of the Leningrad Basin Administration of the Scientific Technical Society of Water Transport), No 4, 1958, pp 9-12 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 6803)

In type ARP-50 automatic radio direction finders, the field intensities of radio stations operating on adjacent frequencies cause a steady deflection of the servosystem loop from the true bearing by an angle  $\Delta\theta$ . At input of the controls which rotate the servosystem loops, the sum of the voltages of the direction-finding and interfering station entering the pass band of the receiver is equal to zero. This produces a direction-finding error of  $\Delta\theta = \sin \gamma / (V_1/V_2 + \cos \gamma)$ . With a signal-to-noise ratio of 10 (20 db) and an angle of 90 degrees between the direction-finding and interfering stations, during aural reception the error in the reading of the direction finder,  $\Delta\theta = 5.73$  degrees, becomes inadmissible for marine navigation. The interfering station produces a tone which is different in frequency from the tone of the direction-finding station, thus its presence is easy to verify.

72. Radio Range Finders

"Dynamic Characteristics of Automatic Radio-Pulse Range Finders With Two Integrators," by Ye. P. Nikitin and A. G. Saybel'; Moscow, Radiotekhnika, No 3, Mar 60, pp 25-30

Radio-pulse range finders with two integrators are analyzed, and their dynamic characteristics are determined, taking into account the effect of the pulsed nature of control. The performance characteristic of a control unit with two integrators is the continuous voltage change during the whole control cycle. It was shown that an automatic range tracking system with two integrators can be described by a second-degree difference equation.

A series of formulas and graphs are given which permit the determining of the stability of the system, its behavior in the transient state, and the systematic dynamic errors. The two-integrator system possesses a "memory" which helps to maintain the automatic range tracking of the target even during short fadings of the reflected signals.

Wave Propagation

73. Generation of Sub-Millimeter Wave

"Experimental Generation of Energy in the Sub-Millimeter Range With a Magnetic Undulator," by I. A. Grishayev, V. I. Kolosov, V. I. Myakota, V. I. Beloglazov, and B. V. Yakomov, Physico-technical Institute, Academy of Sciences Ukrainian SSR; Moscow, Doklady Akademii Nauk SSSR, Vol 131, No 1, Mar 60, pp 61-63

The undulator employed in this experiment to generate a sub-millimeter wave utilized the principle of the double Doppler effect for frequency conversion. The undulator consisted of several separate electromagnets which were capable of setting up a magnetic field of 1,500 oersteds. The input current to the undulator travels through a wave guide having a cross-section of 10 X 23 mm. The electrons were accelerated in the undulator to 17 Mev. An electromagnetic wave in the range of 50 to 67 microns with an average power of  $10^{-7}$ w was generated in this experimental undulator.

The authors thank K. D. Sinel'nikov and Ya. G. Faynberg for their assistance.

74. Investigation of Resonance Phenomenon in Ferrite Wave Guides

"Resonance Ferrite Systems With a Large Gating Ratio, by A. L. Mikaelyan, A. K. Smolyarov, and M. M. Koblova; Moscow, Radiotekhnika i Elektronika, Vol V, No 2, Feb 60, pp 269-277

Some results of an experimental study of resonance phenomena in rectangular wave guides containing ferrites are presented. It is shown that the gating properties of the system may be significantly improved by the proper selection of parameters and dimensions of the ferrite layer in the wave guide. The characteristics of two gates are given. One of these, designed for operation in the 8-cm band in radio relay lines, has a gating ratio of more than 500. The second gate may be used for operation at high power levels and has a gating ratio of 170.

Results show that the displacement phenomena of resonance fields for direct and backward waves may be strengthened and used for improving the gating ratio in wave guides.

75. Methods for Determining Pulse Time Position of Signals

"On the Optimal Method for Determining Pulse Time Position," by B. M. Mityashev; Moscow, Radiotekhnika i Elektronika, Vol V, No 2, Feb 60, pp 206-213

Conditions and methods for realizing limiting accuracy and greatest limiting signal-to-noise ratio in the determination of pulse time position of signals are refined by the author. One method examined is the use of a square pulse time discriminator with optimum filtration for determining discrimination time error and limiting signal-to-noise ratio. Another method is proposed for finding pulse time position according to the position of maximum signal values.

76. Wave Excitation in Dielectric Films

"Excitation of Surface Electromagnetic Waves in Flat Dielectric Coatings," by M. D. Khaskind; Moscow, Radiotekhnika i Elektronika, Vol V, No 2, Feb 60, pp 188-197

CPYRGHT

"The author examines a conducting surface covered with a dielectric film and studies the electromagnetic field above the surface which is excited by given sources.

"In solving the problem, a simplification is made of the boundary conditions on the surface of the dielectric coating, and a method is derived for determining the total wave field which, in a simplified form, is used to separate the surface waves. A general method is applied to the analysis of excitation of surface waves by electric and magnetic dipoles and their distributions. The results obtained may be used for improving the design of flat, surface-wave antennas."

77. Effect of Ionospheric Inhomogeneities on Radio Waves

CPYRGHT "The Statistical Properties of Large Inhomogeneities in the Ionosphere," by V. D. Gusev; Moscow, Radiotekhnika i Elektronika, Vol V, No 2, Feb 60, pp 179-187

"An examination is made of the statistical and correlation properties of the phase of a wave reflected from an ionosphere containing large inhomogeneities. The analysis is made on the basis of the solution of an eikonal equation. It is shown that only under the normal law for the distribution of angles of arrival of a wave does the law of the distribution of changing speed of phase in time not depend on the distance to the ionosphere. The author studies the statistical nature of the phenomenon of focusing by large ionospheric inhomogeneities, which is strongly influential in the use of the phase method for studying these inhomogeneities."

78. Generator of a Pulse Group

"A Generator of a Pulse Group of Nanosecond Duration," by V. V. Udalov and Yu. I. Tumin, Institute of Radio Engineering and Electronics, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 62-64

A generator of pulse groups of nanosecond duration is described. The group consists of four pulses of about 20 nsec duration (at the base), each with independent amplitude control of each pulse from 0 to 30 v. The duration of the pulse group is from 60 to 140 nsec; the polarity is positive.

79. Electromagnetic Wave Reflection From Plasma

"Reflection of Electromagnetic Waves From Plasma Moving in Slow-Wave Guides," by O. G. Zagorodnov, Ya. B. Faynberg, and A. M. Yegorov; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 7-9

An experimental investigation of electromagnetic wave reflection from moving plasma has been conducted. It is shown that with the wave greatly slowed-down (1/200-1/375 c), the double Doppler effect observed in reflection increases the frequency by 11-20%. The measurements were made at 24.75 Mc. A helix was used as the damping system. It is indicated that this effect can be utilized for microradiowave amplification, frequency multiplication improvement of plasma dynamic stability, and measurements in plasma.



IV. ENGINEERING

Aerial Surveying

80. Method of Controlling and Improving Air Survey Closures

"Aerotopographic Method of Controlling Closure of Air Survey Strips in Aerogeophysical Surveys," by V. F. Davydov, Irkutsk Aerogeophysical Expedition; Moscow, Razvedka i Okhrana Nedr, No 1, Jan 60, pp 51-53

An aerotopographic method of more effectively controlling and improving closure of air survey strips has been developed by the Irkutsk Aerogeophysical Expedition since 1956. The method consists in comparing the local relief along the course on a map and the actual flight path of the airplane. The relief in the locality of the course is easily photographed with topographic base, assisted by a special grid, and according to the actual path determined on the data of continuous recording of the airplane's line of flight and its true altitude over the Earth.

It is claimed that the method not only permits checking, but also improves the accuracy of closure in aerogeophysical measurements for a locality without the need for additional flights. It can, however, be applied only for absolutely flat regions. Wide introduction of the method in aerogeophysical surveys is recommended on the basis of the results obtained in the experimental work.

Atomic Power Engineering

81. Construction of the Beloyarsk Nuclear Power Plant

"Construction of the Beloyarsk Nuclear Power Plant" (TASS dispatch); Moscow, Sovetskaya Rossiya, 14 Feb 60, p 4

Notwithstanding the low temperatures and snowstorms which prevail in the Ural Mountains at present, work on the construction of the Beloyarsk Nuclear Power Plant imeni I. V. Kurchatov is proceeding at an undiminished rate. An electric power substation supplying currents of 110 and 220 kilovolts has been put into operation. The construction of a high-voltage transmission line has been completed, so that the nuclear power station which is being built is included in the Ural power network. Up to now the construction works received electric power from the network. In the near future, when the first nuclear power plant section with a capacity of 200,000 kw has been completed, the nuclear power station will supply current to the network over the line from which it receives power at present.

The main building of the power plant where the turbogenerator units will be placed is being rapidly constructed of prefabricated reinforced concrete. The use of this type of construction made it possible to mechanize all work. Few personnel can be seen; but powerful cranes in operation. Assembly of the engine room is being completed and foundations are being prepared for the first turbogenerator units. Notwithstanding the cold weather, energetic work is being done by the constructors who are erecting the heart of the nuclear power station, namely, its reactor department. Complicated operations are being conducted in connection with the placing of the concrete which will serve as biological shield protecting the service personnel of the power station from radiation. Erection has been started of the walls of the control room where the instruments necessary for the operation of the power will be located. Not far from the station a huge water reservoir is being constructed. On the day when the power plant is started the water from this reservoir will spread over 40 square kilometers. Filling of the reservoir has already been begun.

[For additional information on atomic power engineering, see Chemistry, Nuclear Fuels and Reactor Construction Materials.]

#### Civil Engineering

##### 82. Sea Silt as a High-Grade Construction Material

"Sea Silt as a High-Grade Raw Material for Kermazit," by P. P. Stupachenko; Moscow, Stroitel'nyy Materialy, No 2, Feb 60, pp 16-17

Kermazit is a coarse porous concrete aggregate (gravel substitute) originally developed in the USSR, which is manufactured by sintering a mixture of clay and sand.

The bays of the Primorskiy Kray are rich in silt which is suitable for the production of high-grade kermazit without any further adjustment of its composition. The first experiments in sintering and swelling of silt from the Amurskiy Cove were conducted by A. A. Stolyar and G. I. Trofimuk. In 1959 detailed laboratory tests on 42 samples of silt from the Ugol'naya Cove were made at the Laboratory of Construction Materials at the Far Eastern Polytechnic Institute. The silt composition varies as follows: SiO<sub>2</sub>, 60 - 78%, Al<sub>2</sub>O<sub>3</sub>, 6.5 - 18.5%; Fe<sub>2</sub>O<sub>3</sub>, 2.2 - 5.6%; CaO, 1.4-3.6%. The best sintering temperature for greatest swelling of Kermazit was 1,250°C. The coefficient of swelling varied for different materials from 2 to 3.8.

The great coastal areas of the USSR offer favorable factors for the development of the kermazit industry utilizing ocean silt.

Heat Engineering

83. Generalization of Gretz Solution to Radiant Heat Exchange

"Generalization of the Gretz Solution for the Case of Radiant Heat Exchange," by E. A. Sidorov, Moscow; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Energetika i Avtomatika, No 6, Nov/Dec 59, pp 183-185

The calculation applies to the laminar motion of a fluid in the stabilized portions of a tube. The calculation of the radiation of a liquid or gaseous medium moving along the tube assumes that the temperature drop of the medium and the amount of heat given off by the medium change abruptly along the tube. It is shown that, if the radiation is not taken into account, this temperature drop is in accordance with one exponential law, and is in accordance with another exponential law if the radiation is taken into account. This applies, in a qualitative sense, even for turbulent flow. Only numerical power factors, however, are subject to quantitative changes.

84. Scale for the EOP-51M Pyrometer of 6,000 and 10,000 Degrees

"Increasing the Scale of the EOP-51M Pyrometer to 6,000 and 10,000 Degrees," by V. Ye. Finkel'shteyn, Ye. S. Shpigel'man, and V. V. Kandyba, Tr. Vses. n.-i in-ta metrol. (Works of the All-Union Scientific Research Institute of Metrology), No 35, (95), 1958, pp 60-69 (from Referativnyy Zhurnal-- Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 6735)

The widening of the scale was done with two absorbers made of PS-2 glass. The first was 4.71 millimeters thick and had a pyrometric attenuation of  $430.7 \times 10^{-6}$  lumen per degree and increased the scale to 6,000 degrees. An additional absorber, one millimeter thick, with a pyrometric attenuation of  $87.7 \times 10^{-6}$  lumen per degree increased the scale to 10,000 degrees. With the use of light filters made of various S3S-glasses, the variation of the pyrometric attenuation of the absorber during a change of the apparent brightness temperature with the scale widening was found to be  $0.3 \times 10^{-6}$  lumen per degree.

The pyrometric attenuation value for the first absorber was determined by sighting with a temperature lamp with a light filter made of PS-5 glass. An electric arc was used as a light source in the measurement of the second absorber. An estimate was made of the error involved

in the determination of the pyrometric attenuation. A description is given of the method of devising the high-temperature scale, the mean quadratic error of which does not exceed 50 degrees at 6,000 degrees, and 160 degrees at 10,000 degrees.

Mechanical Engineering

85. Coefficient of Evacuation of Two-Stage Piston-Type Vacuum Pump

"The Coefficient of Evacuation of a Two-Stage Piston-Type Vacuum Pump," by Ye. S. Frolov, Moscow Higher Technical School imeni Bauman; Moscow, Izvestiya Vysshikh Uchebnykh Zavedeniy—Mashinostroyeniye, No 4, 1959, pp 20-24

A method is described for determining the evacuation loss of a two-stage piston-type vacuum pump with slide valve. Experimental data were obtained for the components of the coefficient of evacuation, and equations are given for computing certain of these components.

86. Determining Efficiency of Piston-Type Compressed-Gas Engine

"Determination of the Efficiency of a Piston-Type Compressed-Gas Engine," by A. G. Golovintsov, Moscow Higher Technical School imeni Bauman; Moscow, Izvestiya Vysshikh Uchebnykh Zavedeniy—Mashinostroyeniye, No 4, 1959, pp 3-9

A new approach is described for the determination of the efficiency of a piston-type compressed-gas engine. All internal losses are considered in two categories, grouped according to their origin. The adiabatic efficiency is presented as the product of the two efficiencies.

87. Use of Direct-Flow Actuator in Compressed-Gas Engine

"On the Use of a Direct-Flow Actuator in a Compressed-Gas Engine," by V. B. Gridin, Moscow Higher Technical School imeni Bauman; Moscow, Izvestiya Vysshikh Uchebnykh Zavedeniy - Mashinostroyeniye, No 4, 1959, pp 25-37

On the basis of thermodynamic theory and experimental data, proof is given of the feasibility of employing in a compressed-gas engine a new direct-flow method of operation which makes possible a sharp increase in the number of revolutions per minute together with a radical reduction of the dimensions and weight of the machine, with guaranteed high efficiency.

88. Machining of Stainless Sheet Parts

"The Machining of Sheet-Metal Parts of Stainless Steel," by K. P. Malyshkin, Sb. statey. Ural'skiy z-d tyazh. mashinostr. im. S. Ordzhonikidze (Collection of Articles of the Ural' Heavy Machine Building Plant imeni S. Ordzhonikidze), No 7, 1958, pp 185-190 (from Referativnyy Zhurnal--Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 5533)

A report is given of the practical machining of sheet-metal parts made of stainless steel 1Kh18N9T at the Ural' plant. Methods of storing and transporting such parts are also described, and examples give rational designs for transporting equipment. The technology of mechanical processing of the sheet-metal parts is explained; it calls for a single operation on a number of parts at one time instead of the machining of individual parts, and the design of a cutting tool used for facing, edging, drilling, reaming, and countersinking.

89. Experimental Study of Combined Wheel-Blade Vibrations in Turbine Wheels

"Influence of the Transverse Vibrations of a Turbine Wheel on the Vibration of the Blades," by S. I. Bogomolov, Tr. Khar'kovsk. politekhn. in-ta (Works of the Khar'kov Polytechnic Institute), No 14, 1958, pp 23-41 (from Referativnyy Zhurnal--Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 7195)

The combined vibrations of a turbine wheel and its blades are considered in detail, and a special study is made of the influence of the transverse vibrations of the wheel on the vibrations of the blades. A mathematical analysis of the vibrations of the wheel and of the blades attached to it leads to a solution of a system of differential equations, assuming boundary conditions and wheel-to-blade-coupling conditions to be fixed. The obtained system provides homogeneous equations with arbitrary constants and, by successive elimination of them, is transformed into a frequency equation for a wheel of constant thickness with blades of constant profile, which is then solved by trial and error method. Once the frequency of the system is established on the basis of the obtained expressions, a determination is made of the forms of the free vibrations of the wheel and blades. The influence of the transverse vibrations of the turbine wheel on the vibrations of the blades was studied experimentally with the aid of a sand figure on a model of a wheel with blades. The diameter of the wheel was 855 millimeters; the blades were made of 8-millimeter rolled sheet, were 227.5 millimeters long and 30 millimeters wide. The vibrations of the model were excited with an electromagnetic

vibrator. For transverse resonant vibrations, the frequencies of which were determined by computations, sand figures were observed which permitted the determining of the number and distribution of nodal diameters of the wheel and of the wheel-to-blade junctions. On the basis of theoretical investigations of the simultaneous vibrations of the system, and on the basis of model experiments, the following conclusions were drawn:

When the number of nodal diameters increases asymmetrically, the frequencies of the vibrations of the system approximate the axial frequencies of the individual blades. When the frequency of the vibrations was increased, and increase of the number of nodal diameters of the wheel was observed, which repeated itself following the emergence of one, and then two, etc., nodes on the blade. The degree of excitation of the vibrations of different forms depends on the length of the blade; for comparatively long blades, the oscillations are more readily excited in accordance with higher forms. The blades located precisely between the nodal diameters of the wheel perform axial bending vibrations; the blades coinciding with the nodal diameters of the wheel undergo torsional vibrations; all remaining blades exhibit complex bending-torsional vibrations.

Photographs show sand figures obtained by pouring sand over models of bladed wheels.

90. Computing the Bending of Turbine Wheels

"Calculation of the Bending of Turbine Wheels," by V. A. Strunkin, Tr. Kazansk. aviats. in-ta (Works of the Kazan Aviation Institute), No 40, 1958, pp 53-62 (from Referativnyy Zhurnal--Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 7194)

A method is described for calculating the axially symmetrical bending of turbine wheels under the effect of an externally applied load and with radially discontinuous temperature conditions. The influence of elongation on bending is not taken into account; the radial fluctuation of temperature is assumed to be linear. A differential equation of bending is given for sheets of constant thickness and is solved specifically for external loads and for nonuniform radial heating of the wheel. The wheel configuration is divided into the required number of sections of constant thickness, and the values of the bending moments and of deformation are determined for each section.

91. Vibration Damping in Turbine Rotors

"On the Problem of Increasing the Accuracy of the Dynamic Balancing of the Rotors of High-Speed Turbomachines on Antifriction Bearings," by A. A. Chistyakov, Tr. Mosk. aviats. tekhnol. in-ta (Works of the Moscow Aviation Technology Institute), No 32, 1957, pp 169-204 (from Referativnyy Zhurnal--Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 6132)

Since rotors of modern high-speed turbines are subject to considerable vibration, a detailed investigation was made of the additional distortion of dynamic equilibrium caused by the lack of precision in the manufacture of and contact deformations in rotor journals and antifriction bearings. The resultant supplementary vibrations of the center of gravity of the rotor are aperiodic, and their amplitude varies as a lemniscate. A study of the fitting of antifriction bearings of rotors is reported, and recommendations are made for such operations.

Mineral Prospecting

92. New Method of Geophysical Prospecting

"New Method of Geophysical Prospecting"; Baku, Izvestiya Vysshikh Uchebnykh Zavedeniy, Neft' i Gaz, No 2, 1960, p 58

A new method of geophysical prospecting has been developed in the Lvov Institute of the Geology of Mineral Resources, Academy of Sciences Ukrainian SSR. The method is based on the use of the natural pulsations of the Earth's electromagnetic field. Its advantage lies in the elimination of the need of a cumbersome power supply. This greatly reduces the cost of prospecting operations in comparison with existing methods requiring the creation of an artificial electromagnetic field.

93. A New Neutron Pulse Device for Petroleum Prospecting

"General Meeting of the Siberian Branch, Academy of Sciences USSR," by A. K. Chernenko; Novosibirsk, Izvestiya Sibirskogo Otdeleniye Akademii Nauk SSSR, No 11, Nov 59, pp 107-108

At the regular general meeting of the Siberian Branch, Academy of Sciences USSR, held on 23-24 September 1959, V. G. Yerozolimskiy, Chief of Sector at the Institute of Nuclear Physics, Siberian Branch of the Academy of Sciences USSR, presented a report entitled "A Well [logging] Neutron Pulse Generator to be Used in Prospecting for Petroleum and Gas." The

device described by Yerozolimskiy has been subjected to industrial scale tests at the Bashkir Petroleum Fields. It has been developed by the Institute of Nuclear Physics in collaboration with the Institute of Geology and Prospecting of Mineral Fuels, Academy of Sciences USSR. Use of this device can reduce considerably the cost of determining the available quantity of petroleum and gas in deposits and solve problems arising in connection with petroleum prospecting which hitherto could be solved only with great difficulty.

Miscellaneous

94. Conference and Exposition on Engineering and Administrative Work Mechanization

"Mechanization of Engineering-Technical and Administrative Work," by B. Veyze; Moscow, Nauchno-Tekhnicheskiye Obshchestva SSSR, No 1, Jan 60, pp 14, 15

CPYRGHT

The article contains the following passages:

"At the initiative of the All-Union Council of Scientific and Technical Societies, and with support from the State Scientific and Technical Committee USSR, it was decided to conduct in Moscow during May 1960 an All-Union Conference on mechanization of engineering-technical and administrative-supervisory work, and to organize an exposition of modern engineering control equipment.

"The State Committee on Automation and Machine Building, the Central Statistical Administration, a number of ministries, administrations, Sovnarkhozes and other organizations will participate in organizing the conference and exposition.

"In addition to the initiating organizations, representatives from Gosplan USSR and RSFSR, Academy of Sciences USSR, and the Exposition of USSR National Economy Achievements will also be represented in the organizational committee of the conference.

"The Organizational committee has selected an exposition Commission under the chairmanship of the Deputy Director of the Exposition of USSR National Economy Achievements, V. E. Novakovskiy, to conduct the work of actual organization of the exposition."



## V. MATHEMATICS

Differential Equations95. Uniform Approximation for the Solutions of a System of Differential Equations

"On the Structure of a Uniform Approximation for Solutions of Systems of Differential Equations Having a Small Parameter in Largest Derivative," by A. B. Vasil'yeva; Moscow, Matematicheskii Sbornik, Vol 50 (92), No 1, Jan 60, pp 43-58

Systems of differential equations having the form

$$\begin{aligned} \mu \frac{dz}{dt} &= F(z, x, t), \\ \frac{dx}{dt} &= f(z, x, t), \end{aligned} \quad (1)$$

where  $\mu > 0$  is a small parameter, have been repeatedly considered from various points of view. The present work is devoted to obtaining an asymptotic formula in terms of  $\mu$  for the solution of the problem of system (1) with initial conditions having a uniform character with respect to  $t$  over a certain finite interval of definition  $[0, T]$ . This paper is an application of the methods of the work by the author appearing in Matem. sb., Vol 48(90), 1959, pp 311-334. However, the author states, the formulation of the results in the present work represent independent interest, and the material is presented in such a manner that it is not necessary to refer to the above mentioned work unless the reader wishes to devote himself to the details of the proof.

96. Linear Differential Operator Investigated

"Solution by the Method of Fourier of Nonself-Conjugate Mixed Problems for Hyperbolic Systems on a Plane, Part 2," by V. F. Zhdanovich; Moscow, Matematicheskii Sbornik, Vol 48(90), No 4, Aug 59, pp 447-498

The linear differential operator

$$L y(x) = A(x) y'(x) + B(x) y(x) \quad (1)$$

having its region of definition  $\Theta_0$ , consisting of the vector function

$y(x) \in C^{(1)}(0, l)$  satisfying the boundary value condition

$$hy = MA(0)y'(0) + [MB(0) + N]y(0) + PA(l)y'(l) + [PB(l) + Q]y(l) = 0 \text{ is investigated.} \quad (2)$$

The writer denotes by  $L_0 y(x)$  an operator, in contrast to (1), defined for all functions  $y(x) \in C^{(1)}(0, l)$ . It is assumed that the matrices  $A(x)$ ,  $B(x)$ ,  $M$ ,  $N$ ,  $P$  and  $Q$  satisfy all the requirements placed on them in the first part of the current work (see V. F. Zhdanovich, Matem. sb. Vol 47(89), 1959, pp 307-354). Imposing several auxiliary conditions on the matrices  $M$ ,  $N$ ,  $P$  and  $Q$ , the nonsatisfaction of which has the character of degeneration, the author investigates the resolvent of the operator  $L_0$  and the convergence of the expansion of the initial function  $f(x)$  from the condition (3), part 1, according to eigen and adjoint functions of that operator in two cases, when  $f(x) \in \Theta_0$  and when  $f(x) \in D_2(0, l)$ .

#### 97. Differential Equations in Banach Spaces

"Concerning Differential Equations in Banach Spaces," by M. Z. Solomyak, Leningrad Shipbuilding Institute; Kazan', Izvestiya Vysshikh Uchebnykh Zavedeniy, Matematika, No 1(14), Jan/Feb 60, pp 198-209

The equation

$$\frac{du}{dt} + Au = f(t), \quad (1)$$

having the initial conditions

$$u \Big|_{t=0} = u_0, \quad (2)$$

is investigated in the present work where  $u = u(t)$  and  $f(t)$  are elements of a complex Banach space  $\mathfrak{X}$  depending on the numerical parameter  $t \in [0, t]$ ;  $A$  is a closed unrestricted operator acting from  $\mathfrak{X}$  to  $\mathfrak{X}$ , with a dense region of definition  $D(A)$ . Equations containing a weaker operator  $B$ , which may depend on  $t$ , instead of  $A$  are also considered. The problem (1)-(2) in the Hilbert space has been studied by a series of authors and extremely complete results have been obtained for it (where dependence of  $A$  on  $t$  is permitted). However, the methods applied there are not applicable on arbitrary Banach spaces.

For investigation of the problem (1)-(2) in Banach spaces it is natural to employ the theory of subgroups (see E. Hille, R. S. Phillips, "Functional Analysis and Semigroups" Amer. Math. Soc. Coll., Publ. 31, 1957).

If the operator  $A$  is generating for a certain semigroup  $T(\xi)$  of linear restricted operators, then the formal solution of problem (1)-(2) may be described in the form

$$u(t) = T(t) u_0 + \int_0^t T(t-\tau) f(\tau) d\tau. \quad (3)$$

Nevertheless, it is still necessary to investigate for which restrictions on  $u_0$  and  $f(t)$  the constructed function is real, and in what sense it is a solution for the presented problem.

The character of these restrictions depends on those properties which the subgroup generated by the operator  $A$  possesses. In the work of R. S. Phillips, "Perturbation Theory for Semigroups of Linear Operators" (Trans. Amer. Math. Soc. Vol 74, 1953, pp 199-221), as well as in the work of M. A. Krasnosel'skiy, S. G. Kreyn, and P. Ye. Sobolevskiy, "Concerning Differential Equations With Unrestricted Operators in Banach spaces," (DAN SSSR Vol 111, No 1, 1956, pp 19-22), it was assumed that the semigroup  $T(\xi)$  is uniformly continuous for  $\xi > 0$ . This restriction on  $f(t)$  and  $u_0$  proves to be extremely rigid.

Problem (1)-(2) is investigated in the present work under the hypothesis that the semigroup  $T(\xi)$  is analytic in a certain sector of the complex plane, containing the positive real semiaxis. This gives the possibility to extend to Banach spaces several results analogous to those obtained by M. A. Krasnosel'skiy, S. G. Krein, and P. Ye. Sobolevskiy in their work "Concerning Differential Equations With Unrestricted Operators in a Hilbert Space," (DAN SSSR Vol 112, No 6, 1957, pp 990-993) for equations with self-conjugate positive definite operators in a Hilbert space. In comparison with the work of Hille the conditions on  $f(t)$  and  $u_0$  are significantly weakened. However, the author did not succeed in giving these conditions in as complete form as in the case for a Hilbert space.

An analogous semigroup  $T(\xi)$  for the case when  $A$  is an elliptical operator with homogeneous boundary conditions of the first type considered in the  $L_p$  ( $p \geq 1$ ) spaces was established in the work by M. Z. Solomyak, "Analogy of Semigroups Generated by an Elliptic Operator in  $L_p$  Spaces" (DAN SSSR, Vol 127, No 1, pp 37-39). In the present work investigation of the problem (1)-(2) was limited to an abstract form.

Numerical Analysis98. Integral Function Approximated

"Concerning Integral Equations of the First Kind," by M. M. Lavrent'yev; Moscow, Doklady Akademii Nauk SSSR, Vol 127, No 1, Jul 59, pp 31-33

The equation

$$A \varphi = f \quad (1)$$

is considered where A is a complete continuous operator. As is known, the problem concerning definition of a function  $\varphi$  in terms of a given function f is not correct in the classical sense, since variations as small as desired of the function f can be made to correspond to variations as large as desired of  $\varphi$ . However during consideration of the Cauchy problem for elliptical equations, (see M. M. Lavrent'yev, Izv. AN SSSR, Ser. Matem., Vol 20, No 6, 1956), the problem becomes correct if we restrict the class of considered functions. The classes having correctness will depend on the operator A.

In the present work a method is proposed for the effective solution of (1), where the classes of correctness and estimation, characterizing the correctness of the solution, are assumed known. An effective method of solution is understood to be an algorithm which yields the possibility of calculating the values of the function with a certain guaranteed degree of accuracy in terms of the approximate values of the function f (see M. M. Lavrent'yev, Izv. AN SSSR, ser. Matem., Vol 20, No 6, 1956).

The case is considered when the class having correctness is in the form of a sphere in the Hilbert space, after the application to the space of a complete continuous operator.

Probability99. Wandering With Return to Initial Point

"On One Problem of Random Wandering," by E. I. Vilkas, Institute of Physics and Mathematics, Academy of Sciences Lithuanian SSR; Vilnyus, Trudy Akademii Nauk Litovskoy SSR Seriya B, Vol 2(18), Apr/Jun 59, pp 31-38

A theorem of G. Polya concerning wandering is generalized by the method of characteristic functions. Let  $X = (x_1, \dots, x_n)$  and  $X_0$  designate unit points of the n-dimensional Euclidean space;  $p(X, X_0)$  be

the probability that a particle of unit mesh from the point  $X_0$  coincides with the point  $X$ ; and  $p(X, X_0) = p(X - X_0)$ ,  $\sum_X p(X) = 1$ ,  $p(\bar{0}) = 0$ ,  $\bar{0} =$

$(0, \dots, 0)$ . For such wanderings the probability of returning to the initial point is found, and with the additional condition  $\sum_X X^2 p(x) < \infty$ ,

where  $X^2 = x_1^2 + \dots + x_n^2$ , the necessary and sufficient conditions were found that this probability be equal to one.

### Stability Problems

#### 100. Stability of Relay Systems Pertaining to Automatic Control

"On the Problem Concerning Stability of Relay Systems for Automatic Control," by Yu. I. Alimov, Ural Polytechnic Institute imeni S. M. Kirov; Kazan', Izvestiya Vysshikh Uchebnykh Zavedeniy, Matematika, No 1, Jan/Feb 60, pp 3-10

Behavior of a wide class of relay systems for automatic control with absence of exterior perturbations is described (see Ya. Z. Tsypkin, Teoriya releynykh sistem avtomaticheskogo regulirovaniya (Theory of Relay Systems for Automatic Control], GITTL, Moscow, 1955) with sufficient accuracy by the equation

$$a_0 \frac{d^n x}{dt^n} + \dots + a_{n-1} \frac{dx}{dt} + a_n x + k_p f(\sigma, \dot{\sigma}) = 0 \quad (1)$$

having constant coefficients  $a_0, \dots, a_n, k_p$  where it is possible to consider that  $a_0 > 0, k_p > 0$ .

It is convenient to pass from equation (1) to the system of differential equations

$$\begin{aligned} \dot{x}_1 &= x_2, \\ &\dots \dots \dots \\ \dot{x}_{n-1} &= x_n, \\ \dot{x}_n &= - \sum_{j=1}^n \frac{a_{n-j+1}}{a_0} x_j - \frac{k_p}{a_0} f(\sigma, \dot{\sigma}), \end{aligned}$$

where

$\sigma = \sigma(x_1, \dots, x_n)$  are single-valued continuous functions,  $\sigma(0, \dots, 0) = 0$ ,

$$f(\sigma, \dot{\sigma}) = \begin{cases} 0.5[\text{sign}(\sigma - \chi_0) + \text{sign}(\sigma + \lambda\chi_0)] & \text{for } \dot{\sigma} > 0, \\ 0.5[\text{sign}(\sigma + \chi_0) + \text{sign}(\sigma - \lambda\chi_0)] & \text{for } \dot{\sigma} < 0, \end{cases} \quad (2)$$

$$(\chi_0 \geq 0, \quad -1 \leq \lambda \leq 1),$$

$$\text{sign } \sigma = \begin{cases} 1 & \text{for } \sigma > 0, \\ 0 & \text{for } \sigma = 0, \\ -1 & \text{for } \sigma < 0. \end{cases}$$

It is possible to conduct a theoretical investigation of the dynamic properties of a relay system in a series of cases permitting the following assumptions:

a. The characteristic  $f(\sigma, \dot{\sigma})$  of a relay member has the simplest form

$$f(\sigma, \dot{\sigma}) = f(\sigma) = \text{sign } \sigma, \quad (3)$$

and the point  $0(0, \dots, 0)$  is an equilibrium solution of system (A).

b. The limiting system of the work of Ya. Z. Tsypkin mentioned above, p 127, satisfies the existence and uniqueness conditions of the solution on the surface of change-over S.

c. The function  $\sigma = \sigma(x_1, \dots, x_n)$  has continuous partial derivatives of the first order with respect to any of the arguments.

Assuming the correctness of the limitations a, b, as well as another condition formulated in the work within the entire phase space L of the variables  $x_1, \dots, x_n$ , a solution  $M(t, t_0, P)$  for the system (A) of differential equations having piece-wise continuous straight portions passing through the point  $P(x_1, \dots, x_n)$  for  $t = t_0$  is determined.

101. Trajectories of Difference Equations Investigated Qualitatively

"Qualitative Investigation of the Trajectories of Difference Equations in the Neighborhood of a Fixed Point," by A. M. Panov, Sverdlovsk State Pedagogical Institute; Kazan', Izvestiya Vysshikh Uchebnykh Zavedeniy, Matematika, No 1(14), Jan/Feb 60, pp 166-174

Solution of a stability problem by a system of intermittent control plays an important role in contemporary technology. Investigation of the stability of solutions of finite-difference equations is one of the fundamental mathematical apparatus employed for calculation of a system of intermittent control. An interesting and little-considered problem is the qualitative investigation of systems describing nonlinear difference equations.

In the present work the system of difference equations

$$y_{n+1} = A_m y_n^m + A_{m-1} y_n^{m-1} x_n + \dots + A_0 x_n^m + \eta_1(x_n y_n),$$

$$x_{n+1} = B_2 y_n^2 + B_{2-1} y_n^{2-1} x_n + \dots + B_0 x_n^2 + \eta_2(x_n y_n),$$

is considered where the functions  $\eta_1(xy)$  and  $\eta_2(xy)$  satisfy the condition

$$\eta_i(xy) = o(r^m, r^2), \quad \eta_i(0, 0) = 0, \quad r = \sqrt{x^2 + y^2}, \quad m \geq 2,$$

$2 \geq 2$ . The case for  $m = 1$ ,  $2 = 1$  was considered by the author in his work "Behavior of the trajectories of a System of Finite-Difference Equations in the Neighborhood of a Singular Point" (Uch. zap. Ural'sk. gosun-ta, No 19, 1956, pp 88-99).

VI. MEDICINE

Epidemiology

102. Study of Brucellosis suis

"The Epidemiology of Brucellosis of the suis Type," by D. I. Drankin, B. A. Zamotin, and V. S. Korzheva, Kemerovksaya Oblast Sanitary Epidemiological Station and Stalinskiy Institute for Advanced Training of Physicians; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 31, No 2 Feb 60, pp 95-100

The authors attempted to determine the pathogenicity of Br. suis strains distributed throughout the USSR. Two pig farms on which the workers kept cattle and small livestock for their individual use were investigated epidemiologically in 1957. According to the records kept by these farms, brucellar cattle had not been detected for the past 9 years; sheep and goats had not been examined. All small livestock were therefore investigated by the allergic test and the agglutination and complement fixation reactions; no positive reactions were obtained. Only the swine on the farms were found to be infected (with Br. suis), which indicated that the prolonged presence of brucellosis among swine had not caused the migration of Br. suis to other species of agricultural animals.

Of 420 persons examined in the two foci, 19 percent had positive brucellosis reactions. The number of positively reacting persons was found to depend on the extent of their contact with brucellar swine, on their age, and on the length of time they had been in the foci. The Br. suis strain circulating in these farms was slightly pathogenic for humans. Three tables are given to show of the observations.

Hematology

103. Soviet Mucovite Preparation for Treating Addison-Biermer's Disease

"Experience in Using a Mucovite Preparation for Treating Addison-Biermer's Disease," by A. M. Akhundova and O. Kh. Ter-Mktrycheva, Azerbaydzhan Scientific Research Institute of Hematology and Blood Transfusion; Moscow, Problemy Gematologii i Perelivaniya Krovi, Vol 5, No 2, Feb 60, pp 55-56

The laboratory of Vitamins of the Institute of Biochemistry, Academy of Sciences USSR, in conjunction with the Institute of the Meat Industry, has produced a new preparation called mucovite. Mucovite is



isolated from the pyloric mucosa of swine stomachs and consists of mucoprotein plus vitamin B<sub>12</sub>. The preparation is manufactured in the form of tablets each weighing about 0.5 g and containing about 200 micrograms of vitamin B<sub>12</sub> and 0.2 gm of the protein preparation.

A total of 30-50 tablets are prescribed for a 15-23-day treatment of Addison-Biermer's disease. Mucovite treatment effects remission, restores peripheral blood composition, and leads to recovery with regard to normoblastic hematopoiesis. The preparation is well tolerated by patients, does not cause side reactions, and can be recommended for treating patients suffering from Addison-Biermer's anemia.

104. Ultrasonic Vibration Effects on Blood

"The Effect of Ultrasonic Vibrations on the Blood," by M. I. Gurevich and M. F. Sirotina; Kiev, Fiziologichnyy Zhurnal, Vol 5, No 1, Jan/Feb 60, pp 73-78

The authors of this article describe experiments performed on rats and rabbits to determine the effect of ultrasonic vibrations on the blood in vitro and to find out what changes take place in the morphological composition of the peripheral blood after the abdominal area of animals has been subjected to the action of ultrasonic vibrations.

Results of the experiments showed that ultrasonic vibrations of a definite intensity have a destructive effect on the formed elements of the blood when sodium citrate is used to stabilize the blood. The destructive action of ultrasonic vibrations increases when the intensity of the sound increases.

No substantial changes were detected in the peripheral blood one hour after the abdominal area of rats and rabbits had been subjected to ultrasonic vibrations of various intensities. A decrease in the number of leucocytes was noted in a number of cases on the second day, and on the sixth day, the number of leucocytes increased in many instances. By the 12th day the number of leucocytes had returned to original level.

Immunology and Therapy

105. Duration of Immunity After Combined Vaccination for Plague, Tularemia, and Brucellosis

"The Problem of the Duration of Immunity to Plague, Tularemia, and Brucellosis in Guinea Pigs Inoculated by the Cutaneous Method With a Mixture of the Three Corresponding Vaccines," by V. G. Pilipenko, M. A. Miroshnichenko, A. M. Polyakova, and T. A. Shchekina, Scientific Research Antiplague Institute of the Caucasus and Transcaucasus; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 31, No 2, Feb 60, pp 23-29

This report, presented at the Expanded Conference of the Armenian Antiplague Station on the Problem of the Prophylaxis of Especially Dangerous Infections, 8-10 October 1958, concerns the authors' efforts to eliminate the undesirable local reaction produced by the subcutaneous administration of combined plague, tularemia, and brucellosis vaccine, or by plague vaccine alone, and also to determine the duration of the immunity conferred.

The cutaneous method of administering combined vaccines was found to be less reactogenic and generally more effective than either the subcutaneous or intracutaneous methods. A study of the effectiveness of the cutaneous method and of the duration of the immunity conferred by a mixture of the three aforementioned vaccines was undertaken by the authors from August 1957 to April 1958. Live dry plague and tularemia vaccines and live brucellosis vaccine from Br. abortus BA and M strains were used to immunize guinea pigs. Physiological solution (containing 10 billion Brucella per ml) was used instead of distilled water to dilute the dry plague and tularemia vaccines. The methodology of cutaneous inoculation of guinea pigs is described.

Indexes of immunological reconstruction were tested by the allergic test with tularin and brucellin and by the agglutination reaction with corresponding antigens. The intensity of immunity to plague was determined by challenging the experimental animals with 200 Dcl dose of B. pestis, 2 and 6 months after inoculation. Immunity to tularemia was tested by challenge with 10,000 Dcl of B. tularensis after 2 months and 5,000 Dcl after 6 months, and immunity to brucellosis, with ten microbial cells of Br. melitensis. Results are shown in tables and discussed. The following conclusions are offered on the basis of these results:

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"1. Local reactions in guinea pigs inoculated cutaneously with a mixture of plague, tularemia, and brucellosis vaccine were considerably more benign and terminated more quickly than in animals inoculated subcutaneously with the same vaccine mixture. The general condition of the animals was not disturbed in any case.

"2. On testing of immunity 2 months after cutaneous inoculation with associated vaccine, an overwhelming number of animals were found to be resistant to massive infecting doses of brucellosis pathogen. There was no essential difference in the number of animals immune to plague and tularemia among those which were inoculated with associated and monovaccines; the number of animals immune to brucellosis was greater among guinea pigs inoculated with associated vaccine.

"3. Toward the end of 6 months, the number of animals among those inoculated with associated vaccine which had lost immunity to massive doses of plague and tularemia pathogens was almost twice the number of animals among those inoculated with the monovaccine which had lost immunity. This was not noted with respect to immunity to brucellosis.

"4. The question of whether the discrepancy noted between the number of animals inoculated cutaneously with the combined vaccine and with monovaccine is regular or accidental needs further investigation.

"5. The discrepancy noted in immunological effectiveness a long time after inoculation with an associated preparation and with monovaccine does not minimize the advantages of and prospects for the cutaneous method of inoculation with a mixture of the three vaccines."

106. Chlortetracycline Therapy of Experimental Plague

"Therapeutic Effect of Chlortetracycline in Experimental Plague Caused by Forms of the Plague Pathogen Resistant and Sensitive to Streptomycin," by L. N. Makarovskaya, I. S. Tanker, and Ye. N. Aleshina, Rostov-na-Donu State Scientific Research Antiplague Institute; Moscow, Antibiotiki, Vol IV, No 6, Nov/Dec 59, pp 80-84

To determine the therapeutic effectiveness of chlortetracycline when used in the therapy of experimental plague, white mice were infected with variants of the strain *Pasteurella pestis* sensitive and resistant to streptomycin. Chlortetracycline was administered to the animals intramuscularly in doses of 0.25, 0.5, 1, and 2 milligrams, and per os in doses of 2.5, 5, 10, and 20 milligrams. Therapy was begun 24-48 hours after the infection. The experiments established that chlortetracycline is therapeutically effective against experimental plague

induced by forms of the plague microbe either resistant or sensitive to streptomycin, and that somewhat larger doses of the antibiotic are required when it is administered per os, than when it is given intramuscularly.

107. Industrial Environment Affects Immunobiological Reactivity

"The Role of Factors of the Industrial Environment in the Immunobiological Reactivity of the Organism," by V. K. Navrotskiy, Khar'kov Institute for Advanced Training of Physicians; Moscow, Vestnik Akademii Meditsinskikh Nauk SSSR, Vol 15, No 3, Mar 60, pp 57-69

The author reports his studies of the effect of factors with small parameters which are present in an industrial environment and which act within permissible limits on the human organism for long periods. He states that although the results may be used in part to evaluate the effect of these factors on immunogenesis, he was primarily concerned with obtaining data on the action of low-intensity industrial irritants on the general reactivity of the organism. The research of Soviet authors who have reported the results of studies of these effects on antibody formation and on the course of the infection process is cited. Navrotskiy pursued the following two lines of investigation, the first of which is discussed in this article: (1) a study of immunological reactions under the effect of factors found in an industrial environment; and (2) a study of the course of certain diseases (viral influenza and pulmonary tuberculosis) under the effects of the same factors.

Two conditions served as the basis for the immunobiological reactivity studies: (1) the generally known fact that the nature of the genesis and course of pathological processes depends on the reactivity of the organism; and (2) the opinion that the industrial physical and chemical factors to which humans are usually subjected over a long period are one of the strongest external irritants capable of altering the reactivity of the organism.

Immunobiological reactivity was determined according to the agglutination reaction after the immunization of rabbits with typhoid vaccine; the complementary activity of the blood was selected as an index of the status of natural immunity. In addition, the protein fractions of the blood, the acetylcholine content, cholinesterase activity, and blood and organ morphology were studied.

Three groups of experimental rabbits were used: the first, the control group, received only vaccine; the second was exposed to the preliminary action of the factor being investigated and was then immunized; the

third was subjected to the action of the factor and to immunization simultaneously. No significant differences between the last two groups were observed. Five tables show the agglutination titers determined for these groups. The physical effects tested were chilling, heating, and ultraviolet irradiation from a BUV-15 lamp; the chemical agents were benzene, aniline, nitrobenzene, lead (acetate), tetraethyl lead, carbon tetrachloride, dichlorethane, sulfur dioxide, carbon monoxide, and aviation gasoline.

Complement titers are shown in tables 6 and 7, and tables 8 and 9 [not reproduced here] show acetylcholine accumulation and a simultaneous increase in cholinesterase activity after the action of industrial poisons. The following conclusions are given:

CPYRGHT

"1. A number of physical and chemical factors which were studied in parameters encountered in industry cause the abrupt suppression of immunobiological reactivity in animals. Ultraviolet radiation increases immunobiological reactivity considerably. The significance of the data obtained becomes evident when mass inoculations are performed.

"2. The agglutination titer after immunization is a sensitive index of early changes in the organism under the effect of factors found in an industrial environment.

"3. The agglutination titer after immunization as a sensitive integral index can be used together with other indexes to establish the preliminary threshold permissible concentrations of chemical substances in the air of industrial establishments."

108. Tablet Form Polio Vaccine To Be Used

"In a Few Words" (unsigned article); Sofia, Rabotnichesko Delo, 20 Mar 60, p 5

During 1960, the Soviet Union will immunize 80 million persons against infantile paralysis with a vaccine given in the form of ordinary tablets.

109. Czechoslovakia Beginning Mass Polio Vaccinations

"Against Poliomyelitis," CTK dispatch; Prague, Obrana Lidu, 22 Mar 60, p 1

According to a very brief announcement, all children in Czechoslovakia from the age of 2 months through the 8th grade of all schools will receive their first doses of oral polio vaccine, in syrup form, beginning 28 March. Second doses will be administered beginning 2 May.

Oncology

110. Content of 3,4-Benzpyrene in Smoked Fish

"Content of 3,4-Benzpyrene in Fish Smoked by Different Methods," by N. D. Gorelova, P. P. Dikun, V. A. Solinek, and A. V. Yemshanova, Laboratory of Experimental Oncology, Institute of Oncology, Academy of Medical Sciences USSR, and Technological Laboratory of Institute for Mechanization of the Fishery Industry; Moscow-Leningrad; Voprosy Onkologii, Vol 6, No 1, 1960, pp 33-37

A report on the results of the investigations conducted to determine the comparative content of 3,4-benzpyrene in smoked fish prepared by different methods of smoking is presented. The investigations established that fish smoked by the usual cold or hot methods of smoking contained 3,4-benzpyrene in the order of one gamma per kilogram of fish; fish prepared by the electric smoking method, that is, smoked in chambers with the aid of a high-potential electric field, contained considerably more 3,4-benzpyrene than fish smoked by the usual method; only traces of 3,4-benzpyrene were found in fish treated with liquid smoke; fish prepared by the application of liquid smoke and then by regular smoke for a period of 12-14 hours contained a considerably smaller quantity of the chemical than fish prepared by the usual methods of smoking; and 3,4-benzpyrene rapidly penetrates the surface of the fish to the inner layers, with the result that after 40 days of storage about half of all the chemical may be found in the fleshy parts of the fish.

111. Chemotherapy in Oncology

"Principles of Chemotherapy in Oncology," by Prof L. Larionov, Corresponding Member of Academy of Medical Sciences USSR; Moscow, Meditsinskiy Rabotnik, No 8 (1960), 26 Jan 60, p 2

Although chemotherapy is a comparatively new branch of the oncological sciences, considerable progress has been made in its development. Two principles guide the oncologists in their search for chemotherapeutic agents: the first principle is that of the selective action of drugs, that is, the discovery of drugs which will act on tumorous tissue without affecting normal tissue. To some degree this principle has already been realized with the synthesis of such drugs as embichin, novembichin, dopan, leukeran, mercaptopurine, thiophosphamide, and sarcolysin. However, considerable more research is necessary, for most of these preparations have a depressing effect on the hemopoietic organs.

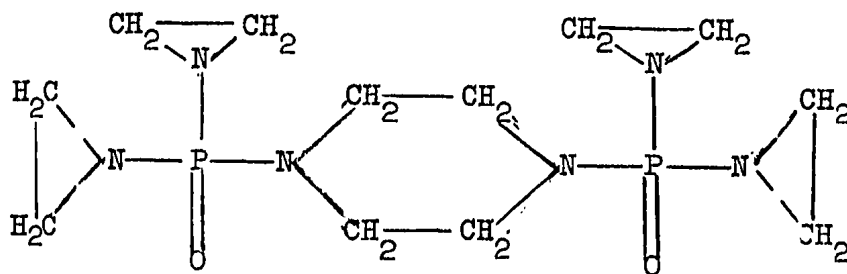
The second principle is that of the differential effect of the drugs on the tumors, that is the principle of the reaction of different tumors to different drugs. Thus, some sarcomas are sensitive to sarcolysin, while others are not. Therefore, there is an urgent need for the development of drugs which will affect different types of tumors. Recently the Institute of Experimental Pathology and Therapy of Cancer of the Academy of Medical Sciences USSR, in cooperation with the Institute of Elementoorganic Compounds of the Academy of Sciences USSR, began work on the development of antitumor drugs with a wide spectrum of action.

The practical application of chemotherapy in oncology is based on two principles: the first is that of chemotherapeutic radicalism which seeks the complete destruction of cancerous tissue to the last cell without the help of other therapeutic measures; the second is one in which chemotherapy is combined with other methods of therapy. There are only a few forms of cancer which will respond to chemotherapy alone. In most cases chemotherapy must be used in conjunction with radiation and surgery. When used in conjunction with surgery, chemotherapy may be either pre-operationally or postoperationally applied.

#### 112. Dipin Therapy of Tumors

"On the Therapeutic Properties of Dipin in Tumorous Diseases of the Hemopoietic System," by A. N. Komissarov and N. Ye. Komissarova, Main Military Hospital imeni Academician N. N. Burdenko; Moscow-Leningrad, Voprosy Onkologii, Vol 6, No 1, 1960, pp 79-86

Dipin, a new antitumor compound, was synthesized at the All-Union Scientific Research Chemicopharmaceutical Institute imeni A. A. Kropacheva. Chemically, it is the tetra-ethylene imidepiperazine-N of N-diphosphoric acid, and has the following structural formula:



Dipin is a white crystalline powder, readily soluble in water. Its melting point is 186 degrees C. Observations conducted on patients who were treated with dipin established that dipin in doses of 10 milligrams

in 2<sup>4</sup> hours, and not exceeding 200 milligrams in the course of therapy, has definite cytostatic properties without expressed toxic effects; and that it is one of the more effective preparations in the therapy of chronic lympholeukosis, as well as systemic diseases of the lymphatic apparatus.

In the course of the dipin therapy, examinations of the peripheral blood must be conducted at least two or three times a day to prevent sharp blood modifications. Contraindications to the use of dipin are thrombocytopenia, leukopenia, anemia, and individual sensitivity to the drug.

#### Pharmacology and Toxicology

##### 113. Antispasmodic Action of Hexamidine

"Effect of Hexamidine on Modifications in the Potentials of the Cortical and Subcortical Cerebral Formations in Electric Shock Fits in Rabbits," by A. A. Tyurina, Chair of Pharmacology, Second Moscow Medical Institute imeni N. I. Pirogov, and Chair of Pharmacology, Kursk Medical Institute; Moscow, Farmakologiya i Toksikologiya, Vol 23, No 1, Jan/Feb 60, pp 3-12

In experiments in which rabbits were used to determine the effectiveness of hexamidine [4,6-dioxo-5-ethyl-5-phenyl-tetrahydropyridimine, Lek-arstvennyye Sredstva, by Prof M. D. Mashkovskiy, Medgiz, Moscow, 1957, pp 73-74/ as an antispasmodic in fits induced by an electric current and its effect on the bioelectric activity of the cortical and subcortical formations of the brain, it was established: (1) in doses of 100-330 milligrams per kilogram of body weight, hexamidine intensified the inhibitory processes of the cortical and subcortical cerebral formations; (2) electric shock fits induced by an electric current of threshold value were arrested by the drug; and (3) the bioelectrical activity of the cerebrum was restored to normal 3-4 hours after the administration of hexamidine.

##### 114. Standards for Cholinesterase Activity Recommended

"Standards for Erythrocyte and Plasma Cholinesterase Activity in the Population of Silesia," by M. Krause and A. Lewicka, Physiological Institute, Silesian Academy of Medicine, Zabrze-Rokitnica; Warsaw, PolSKI Tygodnik Lekarski, No 6, 8 Feb 60, pp 206-207

The authors determined plasma- and erythrocyte-cholinesterase activity on whole blood samples by the gasometric method described by Augustinsson in 1955. The subjects were 50 male and 50 female inhabitants



of Silesia. The plasma-cholinesterase activity for men ( $76.1 \pm 16.5$ ) and women ( $65.0 \pm 11.9$ ) in Silesia did not differ from the values found in Sweden by Augustinsson. However, the erythrocyte-cholinesterase activity was significantly lower for the population of Silesia. The values were as follows:  $29.9 \pm 5.1$  for men and  $23.6 \pm 6.1$  for women. Because of these differences it was recommended that the standards of cholinesterase activity be determined wherever the activity of that enzyme is used for estimating degree of intoxication due to organophosphorus compounds.

115. Effect of Pentamethonium on Neuroadrenergic System

"Investigation of the Pharmacodynamic Effect of Pentamethonium (Penthonium) on the Neuroadrenergic System," by Sylvia Simionescu-Carapancea, Gh. Suhagiu, and Rodica Muller-Bartel; Bucharest, Studii si Cercetari de Fiziologie, Vol 4, No 4, 1959, pp 519-527

CPYRGHT

"The nonspecific pharmacodynamic effect of pentamethonium on the secretion of chromaffin tissue of the adrenal medulla was studied in dogs anesthetized with chloralose, with the help of the adrenalin secretion method (D. Danielopolu) in combination with other methods.

"The pharmacodynamic nonspecific effect of the preparation is due to the fact that it intensifies the secretory activity of chromaffin tissue under the influence of naturally stimulating factors (acetylcholine, and the K ion in particular) administered intraortally at the adrenal medulla level. This favorable effect is accomplished by either nervous (hypothalamus--adrenalin secretion center) or humoral means.

"The intensification of the sympathicomimetic effect (hypertensive) of adrenalin and noradrenalin administered intravenously after the administration of pentamethonium is not the result of the direct action of the latter on the sympathicomimetic reactivity of the blood vessels, but is the result of the effect of pentamethonium on the chromaffin cell of the adrenal medulla. When the suprarenals are clamped on both sides, the favorable effect of pentamethonium on the sympathicomimetic action of adrenalin and noradrenalin is removed. The results obtained by the authors refute the theory that pentamethonium, a preparation which belongs to the neuroplegic group of drugs, has a blocking effect; the sympathicomimetic origin of the adrenal medulla is considered. The specific effect common to all neuroplegic drugs."

116. Effect of 1,3-Aminopropanol Derivatives on Organism

"On the Pharmacology of 1,3-Aminopropanol Derivatives," by S. N. Golikov, A. T. Selivanova, and V. Ye. Shelokhanova, Laboratory of Toxicology at Sanitation-Chemical Institute, Academy of Medical Sciences USSR; Moscow, Farmakologiya i Toksikologiya, Vol 23, No 1, Jan/Feb 60, pp 8-12

The following six derivatives of 1,3-aminopropanol were tested for their effectiveness when used in the therapy of hyperkinesia of central origin: (I) 1,1-diphenyl-3-diethylaminopropanol-1; (II) 1,1-diphenyl-3-dimethylaminopropanol-1; (III) 1-phenyl, 1-cyclohexyl, 3-dimethylaminopropanol-1; (IV) 1,1-diphenyl-3 (N-piperidyl) propanol-1; (V) 1-phenyl, 1(alpha-thienyl)-3-(N-piperidyl)-propanol-1; (VI) 1-phenyl-1 cyclohexyl, 3-(N-piperidyl) propanol-1. Cats, dogs, white mice, and rats were used in the experiments. It was established that of the six compounds under investigation, compound (V) --1-phenyl,1(alpha-thienyl)-3-(N-piperidyl)-propanol-1--having a strong central and cholinolytic action, has greater prospects of being used in the therapy of hyperkinesia. It produces very few side reactions.

117. Effect of Benzene and Acetone Vapors on Organism

"On the Problem of the Combined Action of Benzene and Acetone Vapors on the Organism," by N. A. Zhilova, Chair of General Hygiene of the First Moscow Order of Lenin Medical Institute imeni I. M. Sechenov; Moscow, Gigiyena i Sanitariya, Vol 24, No 12, Dec 59, pp 18-23

Studies were conducted to determine the combined effect of the vapors of benzene and acetone, substances widely used in the manufacture of paints, on the organism. The studies established that the combined action of the vapors of the two substances in concentrations exceeding those of the allowable limits produce an effect which is different from that produced by the vapors of each of the substances separately, and requires further investigation. It was further established that acetone in a concentration of 0.5 milligram per liter, when in combination with benzene, reduces the period of chronaxy; acetone alone in concentrations of 2 milligrams per liter and particularly in a concentration of 0.2 milligram per liter has no noticeable effect on phagocytic activity; when in combination with benzene it somewhat retards the decline in phagocytic activity induced by the action of benzene vapors alone; benzene and acetone in various concentrations irritate the hemopoietic organs; the irritation is considerably more expressed than when the organism is exposed to the effect of the prolonged action of the two substances separately. Further study and revision of the allowable concentrations of the vapors of each of the substances separately and in combination is urged.

118. Ethylene Oxide Intoxication

"Concerning the Clinical Picture of Ethylene Oxide Intoxication," by E. M. Bongard and V. F. Shlyapin (Gorkiy), Institute of Labor Hygiene and Occupational Diseases; Moscow, Gigiyena Truda i Professional'nyye Zabolevaniya, Vol 4, No 2, Feb 60, pp 9-13

Investigations conducted to determine the toxic effects of ethylene oxide, a preparation used in the organic synthesis industry and for the control of agricultural pests, on the organism established the following: (1) acute, subacute, and chronic intoxications may be caused by high concentrations of ethylene oxide in areas where the chemical is produced; (2) neuropsychotic disturbances of a diffused character are the result of all forms of intoxication by ethylene oxide; (3) typical symptoms of acute and subacute intoxication are disturbed consciousness, inhibited reactions, bradyphrenia, and disturbed coordinations; and (4) an expressed pathological condition of the liver is another characteristic of ethylene oxide intoxication.

119. Toxicity of Monoethanolamine

"Monoethanolamine," by L. A. Timofeyevskaya; Moscow, Gigiyena Truda i Professional'nyye Zabolevaniya, Vol 4, No 2, Feb 60, p 61

Monoethanolamine,  $\text{NH}_2\text{CH}_2\text{CH}_2\text{OH}$ , is a liquid with strong hydroxyl properties; it is readily soluble in water, alcohols, fats, and organic solvents. It is used as a gas absorbent, mainly for the retardation of metal corrosion. Technical monoethanolamine consisting of 75 percent of monoethanolamine, 5.6 percent of di- and triethanolamine, and water was studied. When administered into the stomach of white rats in dilution of 1:5 with water its absolute lethal dose was 500 milligrams per kilogram of body weight; its average lethal dose was 350 milligrams per kilogram of body weight; and its minimal lethal dose was found to be 250 milligrams per kilogram of body weight. Its maximal tolerated dose was found to be 200 milligrams per kilogram of body weight. A single 2-hour inhalation of monoethanolamine in concentration of 0.06 milligram per liter lowered the threshold of its stimulation effect. The compound has definite irritating properties. Monoethanolamine can be absorbed through the unbroken skin. The allowable concentration of vapors of the compound in working premises has been established at 0.001 milligram per liter.

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120. Toxicity of Anisole Derivatives

"Comparative Evaluation of the Toxicity of Anisole Derivatives," by G. N. Zayeva, Institute of Labor Hygiene and Occupational Diseases, Academy of Medical Sciences USSR; Moscow, Gigiyena Truda i Professional'nyye Zabolevaniya, Vol 4, No 2, Feb 60, pp 30-36

White mice were used in experiments conducted to determine the comparative toxicity of the anisole derivatives p-methoxyanisole, p-nitroanisole, p-aminoanisole, o-nitro-p-methoxyanisole, and o-amino-p-methoxyanisole, products used mainly in the production of azo dyes used in dyeing cotton fibers. The experiments established that the amino derivatives of anisole, o-amino-p-methoxyanisole, and p-aminoanisole produced deep anesthesia in the animals and caused the formation of methemoglobin and considerable vascular disturbances; the nitro derivatives of anisole has a stimulating effect on the animals without the formation of methemoglobin, and produced marked modifications of the cardiac functions and dystrophic changes in the cells of different divisions of the central nervous system; and p-methoxyanisole produced anesthesia with the simultaneous development of convulsive twitching and degenerative changes in the liver and kidneys. The following amino derivatives of anisole were found to be the more toxic of the given group of substances: o-amino-p-methoxyanisole and p-aminoanisole; somewhat less toxic were o-nitro-p-methoxy anisole and p-nitroanisole; p-Methoxyanisole was found to be the least toxic of the products. A definite relationship between chemical structure of the substances and the degree of their toxicity has been established.

121. Toxicity of Bis-trichloramylsulfide

"Bis-trichloramylsulfide," by S. N. Kremneva; Moscow, Gigiyena Truda i Professional'nyye Zabolevaniya, Vol 4, No 2, Feb 60  
p 60

Bis-trichloramylsulfide (hexachloride) is one of the intermediate products in the production of enant, a synthetic fiber. Hexachloride,  $S[(CH_2)_4 CCl_3]_2$ , is crystalline in form and has a melting point between 30 to 40 degrees; it has an unpleasant odor and is insoluble in water, but is readily soluble in ether and acetone. It is only slightly toxic: concentrations of 0.1-0.2 milligrams per liter of hexachloride vapors did not produce any symptoms of intoxication in white rats and mice. The allowable concentration of the hexachloride vapors is in the order of hundreds parts of a milligram per liter.

122. Al'bofungin, Antifungal and Antibacterial Antibiotic

"Isolation and Primary Chemical Purification of the Antibiotic Al'bofungin," by S. S. Khokhlov and G. S. Rosenfel'd, All-Union Scientific Research Institute of Antibiotics and Institute of Organic Chemistry imeni N. D. Zelinskiy, Academy of Sciences USSR; Moscow, Antibiotiki, Vol 4, No 6, Nov/Dec 59, pp 10-13

The article describes the method of isolating and purifying al'bofungin, a new antibiotic obtained from actinomycete 604-36 which belongs to the Actinomyces albus group. Al'bofungin has been found to possess a wide spectrum of antifungal and anti-bacterial action. In concentration of 0.1 gamma per milliliter it suppresses Candida albicans in vitro; in concentration of 0.06 gamma per milliliter it is active against Saccharomyces cerevisiae; it is active against the pathogenic fungi Trychophyton crateriforme in concentration of 1.7 gamma per milliliter, Microsporon lanosum in concentration of 5.0 gamma per milliliter, and Epidermophyton rubrum in concentration of 0.3 gamma per milliliter. In concentration of 0.005 gamma per milliliter it is effective against Staphylococcus aureus. Al'bofungin is ineffective against gram-positive bacteria. It is readily soluble in a number of organic solvents, poorly soluble in alcohol, and insoluble in water and petroleum ether. Al'bofungin is not identical with any of the 165 antifungal antibiotics already described in literature.

123. 6270, New Antibiotic of Antitumor Action

"Experimental Study of the Antitumor Properties of 6270, a New Antibiotic," by O. K. Rossolimo, M. S. Stanislavskaya, and G. N. Lepeshkina, Laboratory for the Experimental Study of the Therapeutic Properties of New Antibiotics, Institute for Search for New Antibiotics, Academy of Medical Sciences USSR; Moscow, Antibiotiki, Vol 4, No 6, Nov/Dec 59, pp 54-59

Mice were used in the experiments conducted to determine the effectiveness of 6270, a new antibiotic, when used in the therapy of lymphosarcoma, Ehrlich's carcinoma, and Crocker's sarcoma. The 6270 was isolated from the culture fluid of Actinomyces flavochromogenes. It is slightly soluble in water, but dissolves more readily in alcohol. Alcoholic solutions of the antibiotics, containing 1,000 gamma of the substance in a liter of alcohol were, therefore, used in the experiments. The results of the experiments established that: 6270 has an inhibiting effect on the growth of mouse lymphosarcoma (strain L10<sub>1</sub>), Ehrlich's carcinoma, and Crocker's sarcoma in vivo; its inhibiting effect was more expressed if the administration of the antibiotic was begun 24 hours after the tumors were

transplanted; when administered to the animals in maximally tolerated doses, 6270 depressed the growth of lymphosarcoma by 68-88 percent, Crocker's sarcoma by 70-86 percent, and Ehrlich's carcinoma by 50 percent; and the depressing effect of 6270 on tumors in the active stage growth is somewhat less pronounced than in the beginning of the growth. In large doses, 6270 produced atrophic symptoms in the spleen.

124. Reweryn, New Antibiotic

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"Reweryn," by L. Ciesielski and Z. Dowgiallo, Polski God. Lek. (Poland), 1959, 34, 1590-1592 (from Meditsinskiy Referativnyy Zhurnal, Section 4, Vol 4, No 2, Feb 60, pp 22-23)

"Reweryn, a new antibiotic of the tetracycline group, is administered by intravenous infusion in a small volume of solvent. The authors administered reweryn to 23 patients suffering from diffused purulent peritonitis, intraperitoneal abscesses, and acute intestinal obstruction. The preparation was administered once in 24 hours in a dose of 250 milligrams. It is emphasized that reweryn is an effective antibiotic in the therapy of severe cases of infections of the gastrointestinal tract. Bibliography -- nine titles."

125. Pharmacology of Angesin

"On the Pharmacology of Angesin -- a Crystalline Substance Obtained from *Angelica silvestris*," by Ya. I. Khadzhay and V. Ye. Sokolova, Laboratory of Pharmacology, Khar'kov Scientific Research Chemicopharmaceutical Institute; Moscow, Farmakologiya i Toksikologiya, Vol 23, No 1, Jan/Feb 60, pp 37-42

Experiments which were carried out on isolated hearts of cats and rabbits to determine the pharmacological properties of angesin, a crystalline substance obtained from the seeds of *Angelica silvestris*, established that angesin when administered in dilutions of 1:5,000,000 and 1:500,000 acts as a spasmolytic; it has an expressed coronary dilating action of a myotropic character; it can eliminate spasms of the coronary vessels induced by pituitrine and barium chloride; and in doses of 2-5 milligrams administered intravenously to the experimental animals it reduced blood pressure and depressed the hypertensive reflex from the glomulus caroticum. Angesin does not possess any adrenolytic, cholinolytic, or antihistamine properties.

126. Czechoslovaks Use Wheat Bran Liquor for Penicillin Fermentation

"New Raw Material for Production of Antibiotics" (unsigned article); Prague, Hospodarske Noviny, 28 Feb 60, p 4

A brief news item mentions that the Biologic Institute of the Slovak Academy of Sciences has finally found a substitute for corn liquor, used in the fermentation of penicillin. The institute searched for a domestic substance which would yield larger quantities of the end product and finally came up with liquor of wheat bran and liquor of tobacco seeds. According to the article, Slovakia alone produces some 2,400 tons of tobacco seeds per year and which have thus far barely been used in any form of production. The article states that the use of these seeds will henceforth obviate the necessity to import corn liquor for the fermentation of antibiotics.

Physiology

127. Vestibular Irritation Alters Skin Temperature

"Skin Temperature Changes During Vestibular Irritations," by B. A. Nakhapetov; Moscow, Vestnik Otorinolaringologii, Vol 22, No 1, Jan/Feb 60, pp 25-28

According to this article, the results of investigations of vestibulo-autonomic reactivity have revealed that adequate irritation of the vestibular apparatus leads to regular changes of skin temperature in various portions of the body. These results indicate that it is possible to utilize skin thermometry as a supplementary, objective method of determining vestibulo-autonomic instability.

Experiments were conducted on a group of young men whose skin temperature was measured by means of N. N. Mishchuk's type AK-5 apparatus. Vestibular irritations were produced by rotating each individual in a Barany chair.

128. Vibration Affects Voice

"The Role of Vibration Sensation in Regulation of Vocal Function in Humans," by V. P. Morozov; Leningrad, Vestnik Leningradskogo Universiteta, No 3, Seriya Biologii, No 1, 1960, pp 174-178

The author of this article states that the results of investigations which he conducted with the aid of a voice recording apparatus showed that when voice response accuracy decreases because the acoustic feedback is



disturbed by noise, it is restored to a great extent by the action of vibration feedback. Since in the course of normal conversation or singing the function of the human voice-forming apparatus is accompanied by sharp vibrating irritations (of natural origin), the vibrating sensation is very important in the regulation of vocal activity.

Public Health, Hygiene, and Sanitation

129. Effect of Quartz Dust and Radon on Organism

"Combined Action of Quartz Dust and Radon in an Experiment,"  
by V. S. Kushneva; Moscow, Gigiyena Truda i Professional'nyye Zabolevaniya, Vol IV, No 1, Jan 60, pp 22-28

The combined effect of quartz dust and radon on the organism as compared with the effect of each of the substances separately was tested in white rats with the following results:

1. Periodic exposure of the animals to the combined action of dust quartz and radon increased animal mortality and caused a decrease in weight and growth which was more pronounced than that when the animals were affected by each of the substances separately.
2. A severe and diffused silicotic-type pathological process developed in the lungs, producing severe affections of the bronchi and an expressed desquamative reaction; plethora, occasional hemorrhages, and degenerative, inflammatory, and sclerotic manifestations developed in the parynchematous organs.
3. The quartz dust particles present in the lungs retain the products of radon decomposition in the pulmonary tissue thereby increasing the danger of the development of radiation sickness.

130. Labor Hygiene in Chemical Industry

"Urgent Problems of Labor Hygiene in the Chemical Industry,"  
by A. S. Arkhipov (Moscow), Institute of Labor Hygiene and Occupational Diseases, Academy of Medical Sciences USSR; Moscow, Gigiyena Truda i Professional'nyye Zabolevaniya, Vol IV, No 1, Jan 60, pp 4-9

The article points to the successes which have already been attained in the effort to remove such harmful elements as chlorine gases, tetra-ethyl lead vapors, and concentrations of other poisonous substances from

the atmosphere of chemical industry plants. Considerable work, however, must still be done. In many plants, poisonous vapors, gases and aerosols are being released into the air, among them such substances as sulfuric acid vapors, sulfurous and sulfuric anhydrides, and vapors of fluorine compounds. To control the release of poisonous substances into the air of plants it is necessary to utilize waste products in the production cycle; to intercept and render harmless the toxic vapors, gases and aerosols; and to install proper ventilation facilities. Steps should be taken also to reduce the dust content in the air.

131. Doctors Honored

"Decree of the Presidium of the Supreme Soviet RSFSR Concerning the Awarding of the Honorary Title of Honored Physician of the RSFSR to Medical Workers of Therapeutic Institutions of Ryazanskaya Oblast" (unsigned article); Moscow, Meditzinskiy Rabotnik, No 26 (1878), 29 Mar 60, p 1

This article states that a decree of the Supreme Soviet RSFSR, signed by N. Organov, chairman of the Presidium of the Supreme Soviet RSFSR, and S. Orlov, the secretary, bestows the title of Honorary Physician RSFSR on the following for services in the field of public health:

Anna Mikhaylovna Vasina, physician of the Ryazanskaya Oblast Hospital imeni Semashko.

Sergey Ivanovich Vesnovskiy, physician of the Sasovskiy Rayon Hospital.

Mariya Yevgeniyevna Dmitriyevskaya, chief physician of the Pronskiy Rayon Hospital.

Mariya Ivanovna Dronova, chief physician of the Skopinsk City Hospital.

Ol'ga Aleksandrovna Kal'skaya, chief of Children's Consultation No 1 of the city of Ryazan'.

Yelena Vasil'yevna Litvina, physician, deputy director of the Department of Public Health of the executive committee of the Ryazanskaya Oblast Soviet.

Anastasiya Petrovna Makshinova, chief of a department of the Oblast Clinical Hospital imeni Semashko.

Antonina Alekseyevna Malakhova, chief of a department of the Shatskiy Rayon Hospital.

Nina Nikolayevna Pavlova, chief physician of Ryazan' City Hospital No 1.

Galina Markovna Paykina, chief physician of the Skopinskiy Rayon Hospital.

Nikolay Ivanovich Popov, chief physician of Ryazan' City Hospital No 4.

Vera Aleksandrovna Rubaylova, chief of a department of the Ryazhskiy Rayon Hospital.

Galina Leonidovna Suslova, physician of Maternity Home No 1 of the city of Ryazan'.

Nina Vasil'yevna Tronova, chief of a department of the Sarayevskiy Rayon Hospital.

Jaida Arifovna Urmanova, physician of Yermishinskiy Rayon Hospital.

Yuliya Vyacheslavovna Yabloneva, physician of [Ryazanskaya] Oblast Hospital No 2.

132. Hungarian Public Health Service Offers Course on Aerosols

"Aerosol" (unsigned news item); Budapest, Magyar Nemzet, 16 Mar 60, p 6

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"A basic course on aerosols (air contamination) has been initiated by the Aerosol Work Committee (Aerosol munkabizottsag) of the Power Management Scientific Association (Energiagazdalkodasi Tudomanyos Egyesulet) with the cooperation of the Budapest Public Health and Epidemic Station (Kozegeszsegugyi es Jarvanyugyi Allomas). The course will probably be continued at an advanced level in mid-May."

Radiology

133. Cholinesterase Activity Altered During Acute Radiation Sickness

"Change of Cholinesterase Activity During Acute Radiation Sickness," by A. S. Mozzhukhin and D. L. Pevzner; Moscow, Eyulleten' Eksperimental'noy Biologii i Meditsiny, Vol 48, No 9, Sep 59, pp 34-37

This research is a study of cholinesterase enzyme activity in various animal tissues after irradiation.

Results indicate that whole-body gamma irradiation of mice with 700-1,000 r decreases cholinesterase activity in the brain, liver, and intestine during the first and the third weeks after irradiation. This coincides with the period of initial radiation sickness and the peak of radiation sickness. This decrease in cholinesterase activity is especially pronounced just before the death of the animals.

Whole-body gamma irradiation with 700-1,000 r doses intensified the sensitivity of frogs, but not of mice, to strychnine.

134. Radiation-Induced Changes in Functional Condition of Bone Marrow of Monkeys

"Peripheral Blood Picture of Monkeys During Acute Radiation Sickness," by A. S. Petrova and M. I. Novikova; Moscow, Byulleten' Eksperimental'noy Biologii i Meditsiny, Vol 48, No 9, Sep 59, pp 26-29

Tests were conducted at the Sukhumi Medico-Biological Station on the peripheral blood of 18 monkeys suffering from acute radiation sickness induced by a single X irradiation by 600 r doses.

Essential results of these studies reveal hypersegmentation of the neutrophil nuclei, which was especially marked by the third day after irradiation. In certain cases there were as many as 17-18 segments per nucleus. Toxic granularity and dissociation during the maturation of the protoplasm and the nucleus were especially pronounced. Additional deviations included pyknosis of the thrombocytes, formation of deformed microforms, pale, ungranulated thrombocytes, and degenerative forms -- all of which verify a change in the functional condition of bone marrow and a disturbance of the process of blood cell development and maturation.

135. Radiation Effects on Hereditary Apparatus

"Problems of Hereditary and Nonhereditary Disturbances of Ontogenesis Caused by Radiation Effects," by Prof P. G. Svetlov, Laboratory of Embryology, Institute of Experimental Medicine, Academy of Medical Sciences USSR; Moscow, Vestnik Akademii Meditsinskikh Nauk SSSR, No 11, Nov 59, pp 29-37

In this article the author discusses the genetic effects of radiation with special emphasis on the irreversibility of radiomutations, the lack of a threshold dose, and the ratio of the frequency of mutations to the dose of the effect.

The author presents the following conclusions:

1. The study of hereditary changes (mutations) resulting from the effect of ionizing radiation on an organism must constitute one of the major tasks of medical radiobiology.

2. Since the minimum X-ray dose injurious to the embryo was shown to be below 30 r, it is urgently necessary to re-examine the danger of prescribing penetrating radiation for pregnant women.

3. Although radiomutations differ sharply according to a number of indexes from hereditary changes in ontogenesis, the problems of hereditary and nonhereditary radioaberrations which appear during ontogenesis are inseparable in view of the general mechanism of their appearance in the phenotype.

4. To understand these mechanisms, it is necessary to conduct a more complete study of the changes occurring in the physiological characteristics of embryogenesis in the light of the theory of the critical period of development.

5. The external conditions of development can intensify and suppress the effect of hereditary factors. This forms the basis for assuming that it is possible in principle to prevent the appearance of radiation damage to the hereditary apparatus in a given individual.

136. Goiterogenic Effect of Uranium Nitrate

"The Problem of the Biological Role of Uranium in Mammals,"  
by D. P. Kladiyenko, Chair of Histology, Chernovitskiy  
Medical Institute; Moscow, Byulleten' Eksperimental'noy  
Biologii i Meditsiny, No 11, Nov 59, pp 73-76

A number of tests were conducted on rats and rabbits to study the relationship of uranium nitrate to the function of the thyroid gland.

On the basis of the results of these tests, the author concludes that the absorption of  $I^{131}$  by the thyroid gland under the effect of uranium nitrate is changed greatly. Uranyl administered subcutaneously, even in very insignificant amounts, produces great changes both in the function and in the structure of the thyroid gland, and acts like certain powerful thyroid gland inhibitors.

137. Dangers of Radiation Sickness Reviewed, Hopes for Its Cure Revived

"When They Said 'No' About Radiation Sickness" (unsigned  
article); Moscow, Tekhnika Molodezhi, No 9, Sep 59,  
pp 32-34

This article compares the effects of radiation to those of an "invisible flame" but states that they are much more horrible because of its prolonged course and because radiation sequelae appear even in the remote progeny of the irradiated victims.

The treatment of the six Yugoslav scientists who were the victims of a nuclear reactor accident is reviewed and certain passages from their diary are quoted. The seriousness of radiation sickness is explained as essentially due to the fact that radiation damages the bone marrow capacity for blood regeneration, and the body reserves of red blood corpuscles are depleted in 4 months, whereas the white corpuscles are depleted in about 9 days at which time death results.

Great significance is attributed to the experiments involving bone marrow transplantation from healthy rats into irradiated mice, and from healthy mice into irradiated rats, i.e., successful bone marrow transplantation not only between different individuals, but also between different species. This fact is significant in that although radiation exerts a lethal effect on an organism, it provides a miraculous method of treating its victims. Furthermore, the experiments conducted at the Scientific Research Laboratory of the Louvain Cancer Institute, Belgium, indicate that rats irradiated during intrauterine life are less sensitive to radiation than normal, unirradiated rats of the same age. If this is confirmed, and there is much research on this subject, it seems that a possibility for obtaining "something like a preventive inoculation against radiation" has been discovered.

This article describes a case which occurred in April 1959 in Alma-Ata; a 10th grader, Valeriy Opalko, was afflicted suddenly by leukemia and received bone marrow transplantations from five volunteers of his class. V. M. Pilat performed the successful operations, and the life of the youth was saved.

Several photographs of people and tissues subjected to radiation effects and one photograph of remote control weighing of radioactive materials are included.

138. Effective Method of Treating Acute Radiation Sickness

"The Use of Bone Marrow in the Complex Method of Treating Radiation Sickness," by Prof I. R. Petrov and I. V. Il'in-skaya, Laboratory of Experimental Pathology, Leningrad Institute of Blood Transfusion; Moscow, Patologicheskaya Fiziologiya i Eksperimental'naya Terapiya, Vol 3, No 5, Sep/Oct 59, pp 65-70

The purpose of the research described was to develop a complex method of treating acute radiation sickness.

Tests were conducted on dogs subjected to X irradiation by 450 r. This produced acute radiation sickness with 86 % mortality.

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The complex method of treatment consisted of transfusions of blood, plasma, leukocytes, and thrombocytes, and the administration of vitamins, antibiotics, dimedrol, reduced iron, a well-balanced diet, and good care. The mortality rate of dogs subjected to 450 r doses and treated by this complex method was reduced to 42.1 %.

Augmenting the above-described method of treating radiation sickness by the addition of bone marrow obtained from healthy individuals and injected into irradiated victims decreased the mortality rate to 11.7 %.

139. Radiation Sensitive Individual Badges Described

"On the Use of Photographic Films for Individual Dosimetry of Beta-Particle Fluxes," by N. S. Nikitin; Moscow, Vestnik Rentgenologii i Radiologii, No 4, Jul/Aug 59, pp 59-65

The author discusses the possibility of using a photographic film for individual beta-dosimetry.

Mathematical formulas and various graphs show the number of beta-particles per  $\text{cm}^2$ , from thick applicators, necessary to obtain a designated darkening (where  $S = 0.7$ ) of "Agfa Duro," and Roentgen X" films; a badge for conducting individual photographic control of beta particle flux and gamma-radiation is described; and a method for measuring the doses of beta-radiations by IFKB (Individual Photographic Control of Beta-Radiations) is derived.

Results of research in this respect indicate the possibility of the practical application of a photofilm as a beta- and gamma-dosimeter for an extensive range of energy from beta and gamma radiations provided the spectrum of beta radiations is known and the beta radiations are not accompanied by appreciable quantities of gamma radiations with energies below 200 Kev.

140. Protection During Work With Radioactive Capsules

"Protection From Irradiation During Work With Radioactive Capsules," by A. Ya. Berlovskiy, Laboratory of Physics, Khar'kov Institute of Medical Radiology; Moscow, Vestnik Rentgenologii i Radiologii, No 1, Jan/Feb 60, pp 51-54

The use of radioactive capsules of radium and cobalt for therapy requires numerous preparatory procedures which to some extent expose personnel to irradiation. The more laborious the process, the more difficult the protection and the more dangerous the preparation of vaginal and uterine applicators for treating gynecological patients. Preparing the



applicators after their use, which includes washing, rinsing, boiling, assortment, sterilization, placement of capsules in containers, etc., also is hazardous.

With these facts in mind, the gynecological department of the Khar'kov Institute of Medical Radiology, under the direction of S. I. Pavlenko, has designed new equipment and has developed a new method which guarantees a decrease in the daily dose (from a range of 0.1-0.2 r to a range of 0.02-0.03 r) received by a nurse attending eight gynecological patients.

Photographs of the equipment and detailed explanations of the method accompany the article.

141. Adaptation of Organism to Radiant Energy

"On the Adaptation of an Organism to the Prolonged Effect of Radiant Energy," by T. V. Kalyada, Institute of Labor Hygiene and Occupational Diseases; Moscow, Gigiyena Truda i Professional'noye Zabolevaniya, No 6, Nov/Dec 59, pp 16-21

The purpose of this research was to study the dynamics of the prolonged, repeated effect of infrared rays with a wave length of  $\lambda_{\max} = 2.2$ , and an intensity of one  $\text{cal}\cdot\text{cm}^2$  per min. Observations were conducted on three subjects.

The author presents the following conclusions.

1. The process of the development of adaptation (during a 70-day period) to the effect of infrared radiation with an intensity of one  $\text{cal}\cdot\text{cm}^2$  per minute is triphasic: The first phase is the period of initial adjustment, which is characterized by a sharp rise in the temperature of the skin, prolonged recovery time, increased arterial pressure, and shortened chronaxy. The second phase is characterized by the stress on the thermoregulating adaptation reactions, which is expressed by the acute inhibition of sweat gland activity and decreased arterial pressure. The third phase is the establishment of comparative adaptation during which the reactions of an organism become more weakly expressed.
2. After a 3-month period, the change in the physiological reactions to the effect of irradiation retains its initial direction which indicates the relative stability of the process of adaptation.
3. The initial training of an organism to adapt to the prolonged effect of a weak irritant (infrared radiation with the intensity of one  $\text{cal}\cdot\text{cm}^2$  per min), increases its resistance to the effect of stronger irritants (2  $\text{cal}\cdot\text{cm}^2$  per min).

142. Hungarian Radiotherapy Suffers From Lack of Equipment

"Healing Rays," by Rozsa Feher; Budapest, Magyar Nemzet,  
17 Mar 60 p 5

This article is based on an interview with Dr Vilmos Varteresz, Candidate of Medical Sciences and director of the Central Radiobiology Research Institute (Kozponti Sugarbiologiai Kutato Intezet), and it describes the use of radiation in therapy in general terms. Dr Varteresz notes that Hungarian medical science is backward in this field because of a lack of equipment.

Surgery

143. Therapy of Traumatic Shock

"Potentiated Anesthesia and Hypothermia in the Therapy of Traumatic Shock," by I. Sh. Blyumin and I. T. Vilenskiy (Kuybyshev); Moscow, Eksperimental'naya Khirurgiya, Vol 4, No 6, Nov/Dec 59, pp 46-48

The effectiveness of drug potentiated ether-oxygen anesthesia in combination with hypothermia when used in the therapy of traumatic shock artificially induced in dogs was studied. Anesthesia was potentiated by the use of neuroplegic, spasmolytic, and antihistamine preparations. Hypothermia was induced by the transfusion of cold blood (the temperature of the blood was 5-6 degrees) without the help of external cooling. The experiments established that potentiated anesthesia in combination with hypothermia is highly effective in the therapy of traumatic shock and that potentiated anesthesia in combination with the transfusion of noncooled blood is also effective in the therapy of traumatic shock. Hypothermia can also be attained by the transfusion of aminopeptide. There is, however, danger of complications which may develop from the use of the latter.

144. Fibrin Cuffs for Blood Vessel Repair

"Fibrin Cuffs for Connecting Vessels Without Stitching," by T. Bednarzhik, O. Shterba, L. Geygal and P. Firt, Institute of Hematology and Blood Transfusion, and Institute of Clinical and Experimental Surgery, Prague; Moscow, Problemy Gematologii i Perelivaniya Krovi, Vol 5, No 2, Feb 60, pp 38-42

The authors studied the effect of various chemical substances on fibrin to improve the mechanical properties of this blood preparation for use in certain cases of restorative surgery such as connecting blood vessels without stitching.

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The methodology of treating and molding the fibrin material into the appropriate shape and thickness for cuffs is explained in detail. The procedure consists essentially of folding back one end of the blood vessel over the fibrin cuff, then pushing this end of the vessel with the fibrin preparation enclosed into the end to be attached and ligating the two ends without stitching.

Results of experiments on animals and clinical observations indicate that the new fibrin cuff method has no unfavorable effects and that the fibrin cuffs are resolved within 7 months.

145. Method of Knee Joint Draining

"Closed Method of Knee Joint Draining," by J. Sik. Orvost  
Het. (Hungary), 1959, 33, 1201 (from Meditzinskiy Refer-  
ativnyy Zhurnal, Vol 4, Section 4, No 2, Feb 60, p 85)

CPYRGHT

"A new method for the closed draining of the knee joint, a modified method of fenestration, has been proposed. A longitudinal skin incision 3-4 centimeters long is made along either the outer or inner edge of the patella; the joint capsule is also opened in the longitudinal direction, and through the opening a pincette is passed over the patella and under the tendon of the straight hip muscle into the suprapatellar sac, the upper wall of which is pierced by the ends of the pincette. This permits the fluid to drain from the knee joint into the intermuscular space with its profuse network of lymphatic vessels. The described method may be supplemented by the application of the fenestration method or by the introduction of hyaluronidase. On the day following the operation, the patients may begin limited postarthrotomic exercise; from the fourth day they are permitted to actively bend the knee joint; on the sixth day they are permitted to rise. The closed draining of the knee joint is recommended only if the usual conservative methods of therapy fail. Contraindications to the closed method of draining are purulent and tubercular processes and tumors of the knee joint."

Virology146. Third Report on Adaptation of Standard A Foot-and-Mouth Disease Virus to Mouse Brain

"The Problem of the Adaptation of the Foot-and-Mouth Disease Standard A Virus to the Central Nervous System of the Mouse. Report No III. Dependence on the Degree of Adaptation and the Behavior in the Central Nervous System of Small Laboratory Animals," by A. Veckenstedt and K. Fischer, Friedrich Loeffler Institute, Riems; Leipzig, Archiv fuer Experimentelle Veterinaermedizin, Vol 14, No 1, 1960, pp 160-183

From earlier reports on the adaptation of the standard A virus of foot-and-mouth disease to the central nervous system of the mouse, it is known that the virus can be multiplied in the brain of this species and that the virus changes in the course of continuous intracerebral passages into a strain which is neurotropic for the mouse, while gradually losing its original tropistic properties.

In the present investigations it could be shown that the properties of neuroinfectivity and neuropathogenicity, which are characteristic for the neurotropic standard A strain I (series I: linear phase), appear regularly, both after intracerebral and extraneural inoculation in young guinea pigs, golden hamsters, and rats. This means that the neurotropy of the standard A virus which emerges in the course of the mouse brain passages does not represent a host-specific property variation. Accordingly, the changes in properties of the standard virus are not to be considered "host-controlled variations" (Hoskins, Virus Growth and Variation, Cambridge, University Press, 1959, page 122), according to which the variant remains stable only within the host which causes the change and is thus host-specific.

In the manner and severity of the development of the disease in the selected representatives of the four rodent species there are distinct differences, which lead to the conclusion of varying sensitivity.

The following table gives incubation time and mortality rate following intracerebral or extraneural infection of four different types of rodents with the Neurotropic Standard A Virus I (averages).

<u>Type of Rodent</u>	<u>Incubation Time (hr)</u>	<u>Mortality (%)</u>
Mouse	8-10	100
Golden Hamster	18-25	100
Rat	28-72	90
Guinea Pig	72-96	60
	- 90 -	

In contrast to the case of the guinea pig, the infection with the neurotropic standard A virus I is characterized in the mouse, golden hamster, and rat by a rapid and severe disease process. The evidence of the sensitivity of the rat to the neurotropic strain conflicts with the data given by Nagel (Zbl. Bakt. Abt. I Orig., 159, 1952, p 40) who reported that this animal is highly sensitive to the foot-and-mouth disease virus in the first 24 hours of life, but that it later develops complete resistance.

A comparison of the histological findings also reveals differences. The characteristic inflammatory changes observed in the brain are comparable in the three animal species investigated and are in agreement with the findings reported by Koetsche (Arch. exp. Veterinaermed., Vol 12, 1958, p 524) for the mouse. In the case of the guinea pig, however, they are limited to small segments of the large pyramidal cell layer of the cornu Ammonis, whereas in the rat, golden hamster, and the mouse, extensive areas of the cerebral cortex and the cornu Ammonis are affected. On the other hand, the histopathological lesions of the spinal cord are comparable in type and localization in the case of the guinea pig, rat, and hamster.

A surprising exception in the case of the guinea pig and golden hamster (but not in the rat) is the foot-and-mouth disease-specific tissue processes in the tongue epithelium and in the skeletal musculature. In these cases, therefore, for the standard A strain I, which is neurotropic for the mouse, the epitheliotropic and myotropic properties characteristic of the standard A strain suddenly appear in addition to the neurotropic properties, infectivity and pathogenicity. Heretofore, such a phenomenon has never been observed in the "linear phase" in the case of mouse-brain passages.

On the basis of the experimental arrangement selected, there can be no question of any possibility of contamination of the passage material with the standard A virus. In this case, a readaptation, possibly in the sense of a remutation of a neurotropic virus particle in the standard A virus, would be more probable. The available experimental data, however, is insufficient for an interpretation of the genetic mechanism of this process.

A comparison of two passage series shows both agreements and differences in the behavior of the two investigated strains following intracerebral inoculation in young guinea pigs. The standard A strain, which did not adjust to the replication conditions in the central nervous system, can, like the neurotropic standard A strain I, be multiplied in the guinea pig brain and cultured in continued passages. This means that both strains, following intracerebral inoculation in the guinea pig, reveal the neurotropic characteristic, infectivity. This result is not surprising in light of the fact that, following intracerebral application, a multiplication of the standard A virus takes place even in the mouse brain. The literature gives only contradictory reports of observations. Hobmaier (Dtsch. med. Wschr.,

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1, 1921, p 616), Galea (Compt. rend. Soc. biol., 109, 1932, p 19), van Waveren (Zbl. Bakt. Abt. I Ref., 118 1935, p 110), Jansen (Tschr. diengenesk., 61, 1934, p 567), and Toussieng (Mskr. Dyrlaeg., 47, 1935/36, p 305) all report that the intracerebral infection of guinea pigs with the foot-and-mouth disease virus leads to generalization, i.e., to the formation of aphthae. Attempts by Jansen and van Waveren to culture the virus in continuous guinea pig brain passages, however, produced negative results. As early as 24 hours after infection, the pathogen could no longer be identified from the brain. Nagel (Dtsch. tieraerztl. Wschr., 39, 1937, p 624) also was unable to reproduce the foot-and-mouth disease virus in the brain of the guinea pig, even though he used about 500 animals of various ages for his tests. Brain passages always were disrupted after two or three transfers, regardless of the type of virus used. The only positive indication comes from Toussieng, who reports that it was possible to culture one guinea pig strain of the foot-and-mouth disease virus through ten passages on the brain tissue of guinea pig fetuses.

With respect to their pathogenicity, the neurotropic standard A strain I and the standard A strain are quite different. Whereas the occurrence of meningoencephalitic symptoms, frequently accompanied by paralysis of the extremities, is characteristic for infection with the neurotropic virus, pronounced myositic symptoms characterize the clinical picture of the guinea pig infected with the standard A virus.

Histological examination of the brain, tongue, epithelium, and skeletal musculature of the experimental animals represents a suitable method of determining the neurotropic, epitheliotropic, and myotropic characteristic, pathogenicity, which often cannot be recognized clinically. A tabulation of comparative results of histopathological examinations made during the guinea pig brain passages with the neurotropic standard A strain I and with the standard A strain shows the difference in the pathological characteristics of the two strains. For the neurotropic strain, the occurrence of neuropathogenicity and the lack of epitheliotropic and myotropic properties is typical. For the standard strain, however, the manifestation of the epitheliotropic and myotropic pathogenicity is characteristic even after intracerebral inoculation. The relationships are not as clearly defined with regard to the recognition of neurotropic pathogenicity.

Up to the very end of the experimental series, after 15 guinea pig brain passages, no encephalitic symptoms occurred; in the histological investigation of the brains of the passaged animals, however, capillary hyperemia and a swelling of the vascular endothelia, as well as incipient vascular infiltrates, occurred regularly. If these changes are not to be considered specific for foot-and-mouth disease, they might be looked on as the first indications of a slow development of neuropathogenicity. The available experimental data is not sufficient, however, for an unequivocal decision in this matter. Appropriate research is now in progress for the solution of this problem, which is so very important for a determination of the genetic processes in the development of the neurotropic properties of the foot-and-mouth disease virus.

147. Cytopathogenicity of Foot-and-Mouth Disease Virus in Monolayer Tissue Cultures

"The Cytopathogenicity of the Virus of Foot-and-Mouth Disease in Monolayer Tissue Cultures of Calf Kidneys," by H. Bindrich and E. Kuwert, Friedrich Loeffler Institute, Riems; Leipzig, Archiv fuer Experimentelle Veterinaermedizin, Vol 14, No 1, 1960, pp 142-150

A report of the behavior of the foot-and-mouth disease virus in monolayer tissue cultures of calf kidneys is given. Tests were run on 12 O strains, 21 A strains, and 2 C strains which previously had been passed on the cow tongue only. In contrast to the results of Dinter (Archiv fuer Virusforschung, No 8, 1958, pp 42-50), who, with 19 strains isolated directly from cattle, was able to establish cytopathogenic properties for the calf kidney tissue culture in every case, here no changes at all were found in the cell cultures of seven strains also isolated from cattle. In 19 cases, a cytopathogenic effect which appeared within 15-48 hours post infectionem was proved, the intensity depending on the particular strain. No qualitative difference could be established between types and variants. It was apparent, however, that type A strains in most cases exhibited a more pronounced cytopathogenic capability than the other two types.

The tissue changes produced by the virus were predominantly a rounding and swelling of individual or several cells. Such damaged cells underwent lysis and detached themselves from the glass wall, with the result that the cell patches, particularly in the case of highly cytopathogenic strains, had a "moth-eaten" look. The cytopathogenic effect could be extinguished by inactivation of the virus and could be made specific by the neutralization test. In several cases, the virus specificity of the cell changes could also be confirmed by the intracutaneous transmission of the culture medium of damaged cultures to the cow tongue, followed by serological examination of the inoculated apthae.

No explanation can be given for the lack of all cytopathogenic properties in the case of several virus strains. The presence of strain-specific virus in the liquid culture could be proved in every case. In the case of the "Koos" strain, which at first produced no damage to the cell culture, an increase of cytopathogenic properties for the monolayer tissue culture of calf kidney occurred in the first 50 passages following passage through the tissue culture according to Frenkel. A similar report is given by H. G. Petermann (Zbl. Bakt. Abt. I Orig., No 175, 1959, p 63), who was able to accelerate the adaptation of the foot-and-mouth disease virus to the tissue culture by the Frenkel method, by passages through monolayer pig kidney tissue culture.



On the basis of the investigations performed on monolayer calf kidney tissue culture, it does not seem possible to evaluate the cytopathogenic effect of the foot-and-mouth disease virus for this type of cell directly for type determination in the case of suspected aphthae material, since the cytopathogenic effect is absent in many strains.

Miscellaneous

148. Scientific Coordinating Council Formed

"Planning of Scientific Investigations in the Field of Medicine" (unsigned article); Moscow, Sovetskoye Zdravookhraneniye, Vol 19, No 2, 1960, pp 98-100

According to this article, continued progress in medical scientific research and improvement in the organization of health service to the population is impossible without proper current and long-range planning, coordination of effort, and supervision over the execution of various projects.

Since the Scientific Medical Council of the Ministry of Health USSR was abolished, planning of scientific medical research has been taken over by the presidium of the Academy of Medical Sciences USSR. The Academy of Medical Sciences USSR therefore has the authority to supervise the work of scientific medical establishments and medical vuzes (higher educational institutions) and is responsible for protecting the health of the population.

The Ministry of Health USSR and the Academy of Medical Sciences USSR decided to improve the level of scientific research, to reduce the time it takes to put medical discoveries into practice, to keep medical establishments and medical schools informed about plans and medical discoveries, and to eliminate parallelism and irrational expenditure of funds.

The Minister of Health USSR issued order No 368, dated 30 July 1959, confirming the transfer of responsibility for the coordination and planning of scientific medical research and supervision over the fulfillment of the most important research projects to the Scientific Coordinating Council, organized within the framework of the presidium of the Academy of Medical Sciences USSR. The Scientific Coordinating Council has the authority to approve the principal long-range plans for the development of medical science in the USSR, to coordinate the main scientific medical research projects, to scrutinize the most important medical and organizational questions, to apportion research projects among scientific establishments and schools of higher education in various republics, and to see that results of scientific medical research are put into practice.

The Scientific Coordinating Council consists of chairmen of scientific councils of all union republics, chairmen of all problem commissions, and other prominent scientists and organizers of the health service. The president of the Academy of Medical Sciences USSR, Academician A. N. Bakulev, is also the chairman of the Scientific Coordinating Council. The Scientific research planning committee of the presidium of the Academy of Medical Sciences USSR acts as a permanent unit of the Scientific Coordinating Council which meets as the need arises; it must meet at least once or twice a year. All plans formulated by the presidium of the Academy of Medical Sciences USSR jointly with the Scientific Coordinating Council must be based on currently available data in the natural sciences and on the needs of the entire public health service and the national economy.

The collegium of the Ministry of Health USSR and the presidium of the Academy of Medical Sciences USSR have decided that it is expedient to have biennial thematic plans drawn up to cover the most important medical problems. The formulation of annual plans will be abandoned. Supervision over scientific medical research will be based on an evaluation of published articles, spot inspections of scientific medical research establishments and vuzes, discussions at conferences, symposiums, and congresses, the ability to make use of new instruments and equipment, and the effective application of results of scientific medical research. The scientific councils of the union republics and the problem commissions are required to file annual reports with the presidium of the Academy of Medical Sciences USSR and the Scientific Coordinating Council informing them about progress in the most important medical research projects and the action which has been taken to put new discoveries into practice. The deadline for filing such reports is 1 July. On the basis of these reports, the presidium of the Academy of Medical Sciences USSR and the Scientific Coordinating Council, USSR, send to the Minister of Health USSR an outline of progress made in the most important areas of medical research and recommend methods to be used in making new discoveries operational.

The need for the Scientific Coordinating Council, its composition and its duties, were first discussed at the conference of Ministers of Health in Moscow. It was agreed at that time to delegate responsibility to some organized body which could mobilize all material and human resources to carry out some of the most important tasks. It was also decided at that time to give this authority to the Scientific Coordinating Council and the presidium of the Academy of Medical Sciences USSR.

The Scientific Coordinating Council of the presidium of the Academy of Medical Sciences USSR and its permanently functioning branch, the Scientific Planning Commission, were thus responsible for putting scientific medical research planning in the country in proper order. It must be remembered, however, that proper planning and successful fulfillment of a plan depend on the combined efforts of personnel of various health agencies, the Academy of Medical Sciences USSR, party and public organizations, and on the agencies of the Soviet government.

149. New Medical Equipment

"Medical Technology in the Seven-Year Plan" (unsigned article); Zdorov'ye, Vol 59, No 11, Nov 59, pp 16-17

This article briefly describes and illustrates six apparatuses designed to assist the observation of precise physical-chemical changes in human organs and tissues; it is noted that this equipment is still in the experimental stage.

Descriptions of the following devices are given. An ultrasound apparatus for the diagnosis of various tumors in deep cavities of the body; a tele-electrocardiograph designed at the All-Union Scientific Research Institute of Medical Instruments and Equipment; a ballistocardiograph; an ultramicrophone for listening to heart sounds, produced by the Laboratory of Rentgenophonodiagnosis of the Institute of Therapy, Academy of Medical Sciences USSR, in conjunction with the Acoustic Institute, Academy of Sciences USSR; a portable electrogastrograph for diagnosing various diseases of the digestive tract; and a luminescence microscope, the ML-1, designed by industrial workers in cooperation with the Leningrad Optical Institute.

150. Progress of Medical Science

"Achievements and Problems of Medical Science" (unsigned article); Moscow, Izvestiya, 2 Feb 60, p 3

This report concerns the 5-day 14th Session of the General Meeting of the Academy of Medical Sciences USSR which was held in Moscow. The following read reports at this session: Prof A. F. Bilibin, Prof G. F. Gauze, Prof Z. V. Yermol'yeva, Prof Kh. Kh. Planel'yes, Prof P. N. Kashkin, Prof A. P. Avtsyn, Prof N. A. Shinelev, and Prof L. F. Iarionov. All reports read concerned antibiotics and chemotherapy. This was followed by discussions in which 18 scientists took part. A resolution was passed which called the attention of all scientists to the need for a further search for more effective and less toxic antibiotics and synthetic chemotherapeutic preparations.

Academician V. V. Parin, secretary of the Academy of Medical Sciences USSR, read the presidium's account of the activities of the academy during the 1957-1959 period. This was followed by a discussion in which 49 scientists participated. The statement, read by Academician V. V. Parin, called the attention of everyone present to the decree of the Central Committee CPSU and the Council of Ministers USSR entitled "Measures for the Further Improvement of Medical Service and Health Protection to the Population." This decree defined the principal trends in the development of medical science in the USSR. It was noted that Soviet medical science has accumulated considerable experience in eradicating some diseases and in

sharply reducing the incidence of a number of communicable diseases, but stressed that efforts in this direction should not be relaxed. It was noted that the necessary conditions for the further reduction and complete eradication of such communicable diseases as diphtheria, tularemia, poliomyelitis, and others now exist in the USSR. It was stated that medical scientists have been called to concentrate, in the next few years, on a search for methods and preparations for the treatment and prevention of influenza, angina, measles, and cardiovascular diseases, to inquire into the nature of cancer and methods of controlling it; to develop measures to further reduce child mortality; to seek methods of reducing illnesses among workers employed in newer industries; to solve the most important problems in theoretical medicine (physiology, biochemistry, cytology, virology, and immunology); and to discover new and effective remedies and devices to improve the utilization of modern achievements in biology, chemistry, nuclear physics, and electronics.

Those present at the session approved the academy's work during the reported period and passed an appropriate resolution.

The general assembly of the Academy of Medical Sciences USSR filled 23 vacancies for active membership and 15 vacancies for corresponding membership in the academy. New members of the presidium were also selected. The general assembly praised the work of Academician A. N. Bakulev, who has headed the Academy of Medical Sciences for the past 6 years. Academician A. N. Bakulev's request to be relieved from his duties as president of the Academy of Medical Sciences USSR was granted.

Prof N. N. Blokhin was elected as the new president of the Academy of Medical Sciences USSR. He has been an active member of the Academy of Medical Sciences USSR and is a Doctor of Medical Sciences and a surgeon-oncologist. For the past 8 years, he has headed the Scientific Research Institute of Experimental and Clinical Oncology of the Academy of Medical Sciences USSR, in which capacity he has been successful in developing a comprehensive method of treating tumorous diseases (surgical, radiation, and chemotherapeutic). N. N. Blikhin is also serving as vice-president of the International Union for Cancer Control.

V. D. Timakov, active member of the Academy of Medical Sciences USSR, Professor and Doctor of Medical Sciences, was elected the first vice-president of the Academy. V. N. Orekhovich, active member of the Academy of Medical Sciences USSR, Professor and Doctor of Biological Sciences was elected vice-president of the academy. V. M. Zhdanov active member of the Academy of Medical Sciences USSR, Professor and Doctor of Medical Sciences, was elected academician-secretary of the Academy. V. M. Zhdanov is a virologist. The following people were elected as academician-secretaries of various divisions of the academy: V. Kh. Vasilenko, N. A. Krayevskiy, and G. V. Vygodchikov active members of the Academy of Medical Sciences

USSR. V. V. Parin and G. P. Rudnev, active members of the Academy of Medical Sciences USSR, were elected to membership in the presidium of the Academy of Medical Sciences USSR.

Those present at the 14th session drafted a letter to the Central Committee CPSU and the Council of Ministers USSR thanking them for their constant interest in the health of the Soviet population and in continued progress in the field of medicine.

151-152. USSR Exports of Drugs

"Export of Health," by A. Romanova, director of Export and Import Office of Drugs; Moscow, Sovetskiy Soyuz, No 3 (121), 1960, p 50

With the upsurge in the production of medicinal preparations in the USSR, a threefold increase in the past 7 years, large quantities of pharmaceuticals are now being exported to other countries. Among the drugs which are being exported are such well-known preparations as aspirin, phenacetin, pyramidon, streptocide, salicylic acid, norsulfasol, ephedrine, sodium benzoate, santonin, and bismuth nitrate. Other drugs which are being exported are galanthamin, an alkaloid obtained from snowdrops and effective in the therapy of paralyses caused by poliomyelitis; Shostakowskiy's Balsam used in cases of gastric and duodenal ulcers; sarcocollin, novoembichin, and dopan used in the chemotherapy of different types of cancer; and the Margulis-Shubladze vaccine which is recommended for use in multiple sclerosis patients. About 2,500 tons of pharmaceuticals will be exported from the USSR during 1960. Most of the exported drugs will carry the label "Made in the USSR."

## VII. METALLURGY

Physical Metallurgy153. Thermal Reduction of Titanium Tetrachloride With Sodium

"On Certain Phenomena of the Thermal Sodium Reduction of Titanium Tetrachloride," by V. A. Shubin and V. A. Pazukhin, Sbornik Nauchnykh Trudov Moskovskogo Instituta Tsvetnykh Metallov i Zolota (Collection of Scientific Works of the Moscow Institute of Nonferrous Metals and Gold), No 31, 1958, pp 162-173 (from Referativnyy Zhurnal--Metallurgiya, No 7, Jul 59, Abstract No 14848)

Calculations were made of the change of free energy in relation to temperature for the reaction during reduction of titanium tetrachloride and of possible intermediate reactions. Titanium chloride was reduced in the laboratory at 200-700 degrees, and a study was made of the reaction velocity. The dependencies of the ratios of titanium of various valencies on temperature are given, as well as the dependencies of the ratios of titanium to its total low chlorides on temperature and time. An equation is given for the dependence of a constant reaction rate on temperature, and the activation energy is computed. It is pointed out that the reduction of a chloride of titanium is of a surface character and goes through stages of lower chlorides. The amount of reduced titanium in the produced lower chlorides increases with increased temperature. The reduction reaction is characterized by three stages: the diffuse, kinetic, and transitional.

154. Oxidation Resistance of Alloys of Borides of Titanium and Niobium

"Investigation of the Oxidation Resistance of Alloys of Borides of Titanium and Niobium," by V. S. Neshpor and G. V. Samsonov; Sbornik Nauchnykh Trudov Nauchno-Tekhnicheskogo Obshchestva Tsvetnoy Metallurgii, Moskovskogo Instituta Tsvetnykh Metallov i Zolota (A Collection of Scientific Works of the Scientific-Technical Society of Nonferrous Metallurgy of the Moscow Institute of Nonferrous Metals and Gold), No 29, 1958, pp 349-355 (from Referativnyy Zhurnal -- Metallurgiya, No 6, Jun 59, abstract No 12521)

Results are given of investigations of oxidation of  $TiB_2-NbB_2$  alloys at 450 to 1,000°C. Specimens were prepared by hot pressing followed by high-temperature sintering. Calculations were made of the thicknesses of the protective oxide films based on the assumption of the formation of the compounds  $Ti(B_4O_7)_2$  and  $Nb_2(B_4O_7)_5$  in the films. Thinnest films and

therefore the highest oxidation resistance were obtained when the amounts of the two compounds in the film were equal (by molecular weight). The temperature dependence of the increase in weight of specimens followed an exponential form indicating a diffusion characteristic in the oxidation of specimens. At approximately 6500C a change in the rate of oxidation was observed. The kinetic curves for increases of weight had a parabolic character. Constants for the speed of oxidation were determined.

155. Volume Transformations of Steel During Annealing

"Some Peculiarities of Volume Transformations of Steel During Annealing," by L. V. Rozhdestvenskaya, Trudy Kuybyshevskogo Aviatcionnogo Instituta (Works of the Kuybyshev Aviation Institute), No 7, 1958, pp 183-193 (from Referativnyy Zhurnal - Metallurgiya, No 7, Jul 59, Abstract No 15579)

The extent and the temperature condition of the first, second, and third transformations were examined and more precisely defined for steels with varying contents of carbon and alloying elements during annealing. Steel 30, steel 45, U-7, U-9, U-13, 15Kh, 12KhN3, 18KhNVA, 40Kh, Kh09, and ShKh-15 steels were studied. A new, more precise universal electro-magnetic Starobinsk dilatometer was used. The instrument automatically records the temperature-time curve and the elongation-time curve. The processing of these curves affords the possibility of obtaining dilatometric curves of annealing for continuous heating. The fact that the main influence on the magnitude of the dilatometric effects of the first and third transformations is shown by the carbon content, was confirmed. The effect of the third transformation is revealed at concentrations greater than 0.4 percent carbon. U-9 and Kh09 steels showed the greatest dilatometric effect of the first and third transformation. The temperature at the completion of the first transformation is 175-180 degrees; the temperature at the completion of the second transformation is 278-285 degrees, and the temperature of the third transformation increases with increased carbon content, from 320 degrees for 0.45 percent carbon to 400 degrees for 1.38 percent carbon.

The alloying elements, particularly chromium and molybdenum, inhibit the second and third transformations or shift them in the direction of higher temperature.

Production Metallurgy

156. Extraction of Vanadium From Pig Iron in the Converter

"Extraction of Vanadium From Pig Iron During Its Conversion in Converters," by A. N. Lekontsev, Promyshlenno-Ekonomicheskii Byulleten', Sovnarkhoz Permskogo Ekonomicheskogo Administrativnogo Rayona (Industrial-Economic Bulletin, Council of National Economy of the Perm' Economic Administrative Region), No 6, 1958, pp 11-13 (from Referativnyy Zhurnal--Metallurgiya, No 6, Jun 59, Abstract No 12128)

The Chusovskoye Metallurgical Plant converts vanadium-bearing pig irons as follows: The pig iron contains 0.4-0.5 percent silicon, up to 0.30 percent magnesium, 0.55-0.65 percent chromium, at least 0.5 percent vanadium, and a chromium/vanadium ratio of 1.15-1.20. It is previously heated in the mixer to 1,250-1,289 degrees. To keep the temperature at a specified level, one or two scoops of iron ore are put into the converter before the first ladle of cast iron is poured. After the first ladle is blown through for a period of 2-3 minutes, an additional scoop of iron ore is added. An additional blowing through lasts for 3-4 minutes. The vanadium extraction process is considered complete when the vanadium content is equal to or less than 0.04 percent and the chromium content is equal to or less than 0.1 percent. The temperature of the semifinished product (1,350 degrees) is not sufficient to compensate the heat loss resulting from the discharging and transporting of the semifinished product. For this reason, 45-percent Fe-Si is added to the converter and blown through for 1-2 minutes. The semifinished product is poured into the ladle, and the vanadium-bearing slag is held back by hand rakes, then poured into the slag pot and put in storage for analysis. The pig iron expenditure is 1.1 ton per ton of semifinished product; the amount of slag obtained is 7.3 percent of the pig iron by weight; and the amount of ore used is about 50 kilograms per ton of pig iron. The disadvantages involved in the use of this method of converting vanadium-bearing pig irons are also discussed.

157. Effective Method of Melting High-Temperature Steel LA-1

"Melting of High-Temperature Austenitic Steel," by S. A. Iodkovskiy, Uluchsheniye Kachestva Stal'nykh Otlivok (Improving the Quality of Steel Castings), Moscow, Mashgiz, 1958, pp 61-74 (from Referativnyy Zhurnal--Metallurgiya, No 6, Jun 59, Abstract No 12152)

Investigations have shown that the most effective method of melting steel, LA-1 is by the method of alloying in conjunction with refining under a semi-acid slag. This method affords the possibility of increasing the temperature of the molten metal very rapidly, of obtaining a steel with low oxygen content, and of reducing the melting time and expenditure of electric power and ferro-alloys. The ductility of the steel is increased by the method.



158. Melting of EI 316 Steel for High-Temperature Furnace Equipment

"A New Technology of Melting High-Temperature Steel," by V. G. Dolzhenko, Byulleten' Tekhnicheskoy-Ekonomicheskoy Informatsii, Sovnarkhoz Rostovskogo Ekonomicheskogo Administrativnogo Rayona (Bulletin of Technical-Economic Information, Council of National Economy of the Rostov Economic Administrative Region), No 9, 1958, pp 13-14 (from Referativnyy Zhurnal--Metallurgiya, No 6, Jun 59, Abstract No 12151)

At the Rostsel'mash (Rostov Agricultural Machine Building) Plant, the boxes for annealing malleable cast-iron parts, the packing boxes for carburizing, and certain other furnace equipment items are made of high-temperature steel, EI 316 (22-26 percent chromium and 11-23 percent nickel), which is melted in a 5-ton acid electric furnace. The charge consists of steel scrap and high-temperature steel refuse. The slag is made up of molding loam and sand diluted with lime. The bath boil lasts 15-20 minutes. The Fe-Cr is added in four batches. After the metal has been heated to the tapping temperature, 45 percent Fe-Si, Fe-Mn, and Al are added at the rate of one kilogram per ton. The temperature of the metal in the runner is 1,720-1,725 degrees.

159. Production of Magnesium Casting Alloys Containing Zirconium

"Production of Magnesium Casting Alloys Containing Zirconium," by V. V. Krymov, Ye. M. Nikol'skaya, V. V. Tikhonova, and V. K. Fedorova; Moscow, Liteynoye Proizvodstvo, No 1, Jan 60, pp 23-25

Results are given of experiments to develop an optimum method for introducing zirconium into magnesium casting alloys which would ensure a zirconium content of not less than 0.6% in the alloy. Charges consisting of 100% fresh metals require 7.5% of the master alloy (30 to 50% Zr); those of 60 to 80% scrap plus 20 to 40% fresh metals, 7.5% by weight of the fresh metal portion and 2% by weight of the scrap portion and those of 100% scrap, 2% of the master alloy. Master alloy portions are added at the last stage of the melting process.

160. Metallurgy of Light Metals in Eastern Siberia

"The Development of the Metallurgy of Light Metals in Eastern Siberia and the Problems of Scientists," by V. A. Krotov, Trudy Vostochno-Sibirskogo Filiala Akademii Nauk SSSR (Works of The East Siberian Affiliate of the Academy of Sciences USSR), No 13, 1958, pp 5-7 (from Referativnyy Zhurnal--Metallurgiya, No 7, Jul 59, Abstract No 14671)

The regions of Western and Eastern Siberia, Kazakhstan, and the Far East contain more than 75 percent of the fuel and hydroelectric power resources of the USSR which are most accessible to exploitation. Plans are being made for the construction of large-scale aluminum and titanium-magnesium plants. At a conference on the problem, "Establishing the Metallurgy of Light Metals in Eastern Siberian On the Basis of Local Ores," 32 reports were presented, dealing with the five basic areas: general problems, sillimanite ores, nepheline syenites, bauxites, and manganese raw materials.

Welding

161. Distribution of Chromium in Arc Welding of Stainless Steel

"Investigation of the Distribution of Chromium During Arc Welding of Stainless Steel," by B. I. Bruk; Moscow, Metallurgiya i Metalovedeniye, Sbornik (Production and Physical Metallurgy, a Collection of Articles), Academy of Sciences USSR, 1958, pp 398-406 (from Referativnyy Zhurnal -- Metallurgiya, No 6, Jun 59, Abstract No 12608).

Radioactive isotope methods using  $Cr^{51}$  were employed in determining the transition of Cr into the joint from the parent and weld metals as well as the electrode coating. An 18-8 type stainless steel and TsL-11Kh electrodes with cores made of 1Kh18N9B steel and coatings containing approximately 17% metallic chromium were employed in the tests. Welding conditions were as follows: voltage, 25 v; welding speed, 10 cm/min; welding current, 100, 120, 160 and 200 amperes. It was shown that approximately half of the Cr contained in the joint enters from the electrode core, a third from the parent metal and the remainder from the electrode coating. Of all of the Cr remaining in the slag phase, one fourth is from the coating and the remainder from the electrode core and parent metal. Analysis of the coefficient of distribution of Cr between the slag and parent metal showed that no equilibrium could be attained between the slag and parent metal during welding and that the transfer of Cr into the slag does not occur at the end of the electrode but in the bath proper.

162. Welding of Cast Austenitic Steel LA-3

"The Welding of Cast Austenitic Steel LA-3," by V. N. Zemzin, G. L. Petrov, I. D. Smirnova, A. S. Soldatova, A. A. Kakstov, and Kh. I. Kopelevich, Trudy Nevskogo Mashinostroitel'nogo Zavoda, (Works of the Neva Machine Building Plant), No 4, 1958, pp 104-118 (from Referativnyy Zhurnal--Metallurgiya, No 7, Jul 59, Abstract No 15069)

Austenitic chromium-nickel steel, LA-3, is used for superhigh parameter steam fittings. Electrodes were designed and the technology established for the welding of casting flaws in castings and the welding of valve bodies to pipelines of rolled chromium-nickel steel. The heat resistant properties of welded joints should be the same as for cast steel parts, i.e., at a temperature of 580-600 degrees and 100,000 hours of operation, the tensile strength should be equal to or greater than 14 kilograms per square millimeter, and equal to or greater than 6 kilograms per square millimeter with an elongation of  $1 \times 10^{-5}$  percent per hour, and an impact strength equal to or greater than 4 kilogram-meters per square centimeter. A peculiarity of the welding of LA-3 steel is the development of hot cracks in the metal joints. The development of hot cracks is promoted by the presence of sulfur, silicon, niobium, and even phosphorus, which produce a eutectic. The presence of a second phase, in the given case  $\delta$  - ferrite, reduces the probability of the formation of hot cracks in the metal joint and produces a finer structure. With the dilution of the metal of the joint by the base metal taken into account, the ferrite content in the fused metal is assumed to be 5-7 percent. With increased ferrite content, its distribution by continuous "little chains" leads to the formation of the  $\delta$ -phase and an embrittlement of the metal with age. The metal joints were alloyed with carbon, chromium, nickel, manganese, molybdenum and vanadium by means of plating. The ferrite content was controlled by a variation of the chromium content. The requirement regarding the chemical composition of the metal deposited was established (KTI-5 electrodes) as follows: 0.08-0.15 percent carbon, 0.40 percent silicon, 2.8-4.0 percent manganese, 1.8-2.7 percent molybdenum, 0.35-0.50 percent vanadium, not over 0.03 percent sulfur, not over 0.04 percent phosphorus; for chromium and nickel, four variants were indicated within the ranges, 9.6-13.5 percent nickel and 17.7-21.3 percent chromium. The wire leads of the electrodes were made of EI-400 or Kh18N11M steel. The mechanical properties of the deposited metal were satisfied after aging at 800 degrees for 10 hours. In the period 1952-1956, the plant used 21 tons of KTI-5 electrodes in correcting the casting flaws of castings of LA-3 steel weighing 50-800 kilograms, and 12 tons of electrodes of Kh22N12 steel.

163. Roller Welding of Thin Stainless Steel Sheet

"Investigation of the Process of Roller Welding of Thin Stainless 1Kh18N9T Sheet," by V. V. Gonskiy and L. T. Babkin; Kiev, Avtomaticheskaya Svarka, No 1, Jan 60, pp 38-45

Results are given of investigations of the process of roller welding of stainless steel which were conducted for the purpose of establishing a reliable parameter for controlling weld quality directly during welding. It was shown that the control of thermal expansion of the metal while observing technological welding requirements is the prime factor in obtaining high-quality joints.

[For additional information on metallurgy, see Chemistry, Inorganic Chemistry.]

## VIII. PHYSICS

Atomic and Molecular Physics164. Interaction in Polyatomic Molecules

"Effect of Interaction With Environment on Fermi Resonance in Polyatomic Molecules," by V. L. Strizhevskiy; Moscow, Optika i Spektroskopiya, Vol 8, No 2, Feb 60, pp 165-170

The problem of the effect of interaction of polyatomic molecules with the environment on Fermi resonance is theoretically analyzed for cases of pure matter and a weak solution. It is shown that interaction with the environment would always lead to a partial leveling of intensities of the resonating components. If the molecule containing the resonating levels appears to have no polarity, this leveling will be much stronger in pure matter than in solution for many types of solvents. This conclusion is confirmed by experimental data.

165. Metal Model of Molecule

"New Type of Metal Model of the Molecule," by L. A. Borovinskiy; Moscow, Optika i Spektroskopiya, Vol 8, No 2, Feb 60, pp 191-198

A molecule model is suggested with chains of associated bonds. The molecule core consisting of nuclei and  $\sigma$  electrons is modeled by an immobile charge equally distributed along a rectilinear section having a length coinciding with the length of the chain of associated bonds. The motion of  $\pi$ -electrons in the field of this core model is analyzed. An approximative separation of the variables of the lateral and the longitudinal motions of  $\pi$ -electrons is carried out. In zero approximation, the longitudinal part of the potential function may be replaced by the potential function of the harmonic oscillator, and the corresponding energy levels are determined as energy levels of the harmonic oscillator. In a more accurate representation of the potential function, the problem is solved by means of the semiclassical method of quantum mechanics. The results of computations of the wave lengths of absorption bands are in good agreement with experimental data.

166. Coordinates in Molecular Oscillations

"Theory of Application of Dependent Coordinates to the Problem of Oscillations in a Molecule," by I. V. Rigina and I. N. Godnev; Moscow, Optika i Spektroskopiya, Vol 8, No 2, Feb 60, pp 171-175

It is shown that the analysis of the problem of molecular oscillations by means of Lagrange equations with nonexcluded constraints leads to equations more general than the equations by R. Gold, J. M. Dawling, and A. G. Meister (J. Molec. spectr., 2, 9, (1958)). These equations facilitate the determination of the type of matrices used in the solution of the specified problem in dependent coordinates.

167. Infrared Molecular Spectra

"Theory of Intensities of Infrared Molecular Spectra, VI.  $\text{BF}_3$ ,  $\text{NF}_3$ ,  $\text{SiF}_4$ , and  $\text{SF}_6$ " by L. M. Sverdlov; Moscow, Optika i Spektroskopiya, Vol 8, No 2, Feb 60, pp 183-190

The electro-optical parameters of molecules  $\text{BF}_3$ ,  $\text{NF}_3$ ,  $\text{SiF}_4$ , and  $\text{SF}_6$  were computed in first approximation on a basis using absolute integral intensities of the infrared bands of the specified molecules. The law of increasing dipole moment of the bond X - F in the case of increasing difference of electronegativities of the X and F atoms was established.

168. Excitation Function of  $\text{N}_2^+$

"Photoelectric Determination of Excitation Functions of the Negative Band System of  $\text{N}_2^+$ ," by S. M. Kishko; Moscow, Optika i Spektroskopiya, Vol 8, No 2, Feb 60, pp 160-164

Excitation functions of bands ( $0 \rightarrow 0$ ) and ( $0 \rightarrow 1$ ) of the negative system  $\text{N}_2^+$  and the effects of monokineticity of the electron beam and the nitrogen pressure on their behavior are studied. On the excitation functions of the studied bands, five maxima were revealed, lying at various energies of the exciting electrons.

Experimental Equipment and Techniques

169. High-Speed Camera

"The Camera RKS-1 for High-Speed Motion Pictures," by S. M. Provornov and O. F. Grebennikov, Leningrad Institute of Motion-Picture Engineers; Moscow, Pribery i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 104-107

The high-speed raster motion-picture camera RKS-1 is described. It is intended for research motion pictures with a frequency over  $10^8$  frames/sec. Results of some of the motion pictures are presented.

170. Hydrogen Pump

"Hydrogen Pump In," by Ye. T. Kucherenko and O. K. Nazarenko, Kiev State University; Moscow, Pribery i Tekhnika Eksperimenta, No 6, Nov/Dec 59; pp 124-125

The construction of a metallic variant of a pump-in of high efficiency, providing stable input of pure hydrogen in a vacuum system, is described. The purity of the pumped-in hydrogen is, according to a mass spectrometer, over 96%.

171. Czechoslovaks to Experiment With Extremely Low Temperatures

"Cosmic Frost in the Laboratory" (unsigned article); Prague, Obrana Lidu, 12 Mar 60, p 1.

According to an unsigned article, reported as compiled following a discussion with J. Pages of the Physics Institute of the Czechoslovak Academy of Sciences, the academy is currently engaged in building a hydrogen-liquefying plant in the Physics Institute in Prague. Although not completely ready as yet, the laboratory will receive special equipment in the spring of 1960 which will permit the simulation of temperatures like those encountered in outer space.

The article mentions that both the Physics Institute of the Academy of Sciences and the Institute of Nuclear Research will be conducting low-temperature experiments almost exclusively with equipment produced by the "Marshal Rybalka" Plant in Decin. The article is accompanied by a photograph purported to be that of an experiment in which a magnet is suspended by the force of its own magnetic fields in the center of a lead dish, which is kept at the "superconducting" state by being subjected to extremely low temperatures in a vacuum.

Nuclear Physics

172. Cosmic Ray Mesons

"Polarization of Cosmic Ray  $\mu^+$  -Mesons in the High Energy Region," by N. M. Kocharyan, Z. A. Kirakosyan, E. G. Sharoyan, and A. P. Pikalov, Physics Institute, Academy of Sciences Armenian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 18-21

Measurements were made of the polarization of cosmic ray  $\mu$ -mesons with energies close to 2 BeV. The obtained value of  $P = 0.23 \pm 0.12$  indicates that in the higher atmosphere  $\mu$ -mesons predominately originate in  $\pi$ -meson decay. As follows from our data, the number of  $\mu$ -mesons produced due to  $K_{\mu 2}$  decay cannot exceed 15% of the total number of  $\mu$ -mesons.

173. Radiative Capture in Cosmic Showers

"Effect of the Density of the Medium on Radiative Capture in Electron Photon Showers at Energies of  $10^{11}$  to  $10^{13}$  eV in Nuclear Emulsions," by A. A. Varfolomeyev, R. I. Gerasimova, I. I. Gurevich, L. A. Makar'ina, A. S. Romantseva, and S. A. Chuyeva; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 33-45

Examination was made of 15 electron-photon showers with energies from  $10^{11}$  to  $10^{13}$  eV recorded in emulsion stacks. Energies of primary quanta causing showers were determined by measuring the energy spectrum of cascade electrons at a depth of  $2.5 \pm 3$  rad, units and by the screening effect on the first pairs. The energy spectrum was measured of pairs, produced at a depth of 1.5 rad. units. The results obtained agree with the calculations made taking into account the influence of multiple scattering and medium polarization on high energy electron bremsstrahlung.

174. Extensive Air Showers

"Ultrahigh Energy Extensive Air Showers," by A. T. Abrosimov, G. A. Bazilevskaya, V. I. Solov'yeva, and G. B. Khristiansen, Institute of Nuclear Physics, Moscow State University, Physics Institute imeni Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 100-107

Extensive air showers with the number of particles from  $5 \cdot 10^6$  to  $10^8$  were investigated. The paper presents data on absolute shower intensity, value spectrum exponent, space distribution of the electron-photon component,



and  $\mu$ -mesons of these showers. Data on the electron-photon component indicate that either in the lower atmosphere there is no balance between the electron-photon and nuclear components in ultrahigh energy showers or electron space distribution is determined, not only by Coulomb scattering, but also by particle angular divergence in nuclear cascade elementary events.

175. Fast Particles Interaction

"The Measurement of Angles in Nuclear Fast Particle Interaction," by V. M. Chudakov, Central Asian State University; Moscow, Pribery i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 37-38

A new measuring method for angular distribution of shower particles in nuclear interactions observed in photoemulsions is described. The method is based on determination of coordinates of intersection points of particle tracks with a sphere whose center coincides with the summit of the shower.

176. Measurement of Ion Beam Width

"Measurement of the Ion Beam Width Near the Cyclotron Source," by N. D. Fedorov and Yu. A. Kholmovskiy; Moscow, Pribery i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 27-29

The results of measurement of the ion beam width in the cyclotron at the first input into the dee (after first acceleration) are given for the 1.5-meter cyclotron of the Institute of Atomic Energy, Academy of Sciences USSR. The results of measurements concur satisfactorily with the computation carried out under the assumptions: the electric field between the source and the dee is uniform; the range of starting phases used is from  $-10$  to  $+30^\circ$ ; and the initial velocities of the ions are zero. Therefore, in the case of a slit ion source, the distortions of the electric field by the ion plasma pinch may be practically neglected, and ordinary equations may be used for the computation in the central region of the cyclotron.

177. Measurements of Electron Bunches

"Measurement of the Phase Width of Electron Bunches Accelerated in a Linear Accelerator," by I. A. Grishayev, V. I. Kolosov, B. V. Yakimov, V. I. Myakota, and A. I. Zhdanov, Physicotechnical Institute, Academy of Sciences Ukrainian SSR; Moscow, Pribery i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 30-32

A method of measurement of phase width of bunches of nonmonoenergetic electrons, accelerated in a linear accelerator up to an energy of 2.2 Mev, is described. The accuracy of measurement is 30% at a phase width of the bunch of  $17^\circ$ .

178. Special Beta-Spectrometer

"A General Duty Beta Spectrometer With Double Focusing at an Angle  $\pi\sqrt{2}$ ," by P. S. Samoylov; Moscow, Pribory i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 33-37

A beta spectrometer is described in which the configuration of the magnetic field may be varied without alteration of the poles of the magnet. The device realizes double focusing at an angle of  $\pi\sqrt{2}$  of the widely diverging electron beams and selects empirically the optimal field for the specific conditions of the experiment. The configuration of the field is maintained within the range of potentials necessary for investigations of electrons with energies of 2 Kev to 6 Mev.

179. Measurement of Magnetic Field Distortion

"Measurement of Magnetic Field Distortions in Accelerators With Sharp Focusing," by Yu. M. Goryachev, S. V. Skachkov, and T. G. Smolyankina; Moscow, Pribory i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 13-17

A device permitting a fast determination of the radial distribution of the magnetic field in accelerators with sharp focusing is described. The error of measurement of relative distortion at the instant of injection is about  $10^{-3}$  and decreases toward the end of the operating cycle to  $5 \cdot 10^{-4}$ . As an example of the application of the device, an experimental test of correcting coils creating surface currents at the poles is described.

180. Measurement of Photon Intensity

"Precision of Absolute Measurements of Photon Beam Intensity From the Synchrotron Target by Ionization Chambers," by T. N. Usova, Physics Institute, Academy of Sciences USSR; Moscow, Pribory i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 17-19

It is shown that in measuring the photon beam intensity at high energy by ionization chambers, it is necessary to take into account the presence of long-path  $\delta$ -electrons carrying with them a part of the energy lost by the secondary electrons in the operating volume of the chamber. Formulas making allowance for this effect were derived. Computations carried out for the bremsstrahlung of the physics Institute synchrotron with a maximum energy of 260 Mev showed that the allowance for the presence of long-path  $\delta$ -electrons changes the value of the absolute sensitivity of the thick-walled graphite chamber ( $T = 4.5$  cm) by 2% and increases the absolute value of the intensity measured by the thin-walled chamber, by the method of pair difference, by 12%.

181. Injector for the Betatron

"A Cold Cathode in a Betatron Injector," by G. D. Kuleshov and A. I. Pavlovskiy; Moscow, Pribery i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 119-120

There is an attempt to use, as emitter of the injector of an ironless betatron, a cold cathode with a heating device (Ch. M. Slack and L. F. Ehrke, J. Appl. Phys. 12, No 2, 165 (1941)), as used in some pulsed X-ray tubes. At a duration of the pulse voltage of 0.2 mc sec and at an amplitude of 10-25 kv, currents of several amperes are easily injected.

182. Self-Tuning of Cyclotron Resonance

"Self-Tuning of Reactive Parameters of the Resonance System of the Cyclotron," by A. V. Antonov, Yu. V. Korshunov, Ye. A. Meleshko, and V. S. Panasyuk; Moscow, Pribery Tekhnika i Eksperimenta, No 6, Nov/Dec 59, pp 20-24

A stabilizer of amplitude difference of the high frequency potentials of the dees is described, as well as the scheme of self-tuning of the resonance system of the cyclotron to the oscillating frequency. The trimming capacitors of the accelerating chamber of the cyclotron are used as governing elements. The self-tuning system is tested on operating equipment.

183. Ion Source for a Cyclotron

"A Slit Ion Source for a Cyclotron," by I. I. Afanas'yev, L. F. Kondrashev, L. N. Mikhaylov, and A. I. Nast'yukha; Moscow, Pribery i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 25-27

This type of ion source contributes to the stabilization of cyclotron operation. It is applied for obtaining  $H^+$ ,  $H_2^+$  and  $D^+$  ions.

184. Measurement of Nuclear Moments

"Equipment for Measurement of Nuclear Moments by the Method of Magnetic Resonance in Molecular Beams," by A. G. Kucheryayev, Yu. K. Szhenov, Sh. M. Gogichayshvili, I. N. Leont'yeva, and L. V. Vasil'yev," Moscow, Pribery i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 48-57

Equipment differing from that presently known is described. A method is presented for the design of a refocusing system, securing a specified reponse to change in orientation. The latter's dependence on the width of the collimator slit is experimentally confirmed. A method for detecting atomic beams of alkali-earth elements is devised.

185. Trigger Feeding of Counters

"Trigger Feeding of a Pair of Geiger-Mueller Counters,"  
by L. Mitrani and B. Betev, Physics Institute of the  
Bulgarian Academy of Sciences, "Moscow, Priboiy i Tekhnika  
Ekspserimenta, No 6, Nov/Dec 59, pp 64-66

A new method of coupling two counters is suggested which permits their more extensive use at higher intensities. The method is based on the use of a relaxation relay with two stable states. The emitted pulses have higher amplitude and are easier to record.

186. Corona Counters

"Characteristics of Corona Counters of Slow Neutrons,"  
by A. I. Dokuchayev; Moscow, Priboiy i Tekhnika Ekspserimenta,  
No 6, Nov/Dec 59, pp 41-45

The properties of slow-neutron counters operating on corona discharge and having a solid boron coating (type SNM) are investigated. The amplitude of "neutron" pulses reached 300-400 mv and depended but slightly on voltage. The resolving time did not exceed 1-2 microsec. The absolute efficiency of the counter for thermal neutrons was  $\sim 2 \cdot 10^{-3}$  at an input discrimination threshold of 50 mv. The counters are usable in gamma fields of  $10^2$  to  $10^3$  roentgen/hour at temperatures of +120 to 150°C.

187. Photon Counter

"Photon Counter With Grid Control," by S. M. Perelman, V. I. Malinin, and I. M. Shyutse; Moscow, Priboiy i Tekhnika Ekspserimenta, No 6, Nov/Dec 59, pp 95-97

A gas discharge photon counter is described with a regulated red boundary. It is intended for spectroscopic investigations in the ultraviolet range.

188. Detector of Gamma

"Detector of Gamma-Radiation Based on a Scintillating Plastic,"  
by N. K. Pereyaslova, Institute of Applied Geophysics, Academy  
of Sciences USSR; Moscow, Priboiy i Tekhnika Ekspserimenta,  
No 6, Nov/Dec 59, pp 45-47

The method of coincidences was investigated for lowering of the noise background pulses and for increasing the response of a gamma-radiation detector based on a scintillating plastic, with application of a coincidence circuit.

189. Strange Particles

"The Existence of Particles With Masses of  $2m_e \leq \mu \leq 25m_e$ ,"  
by A. N. Gorbunov, V. M. Spiridonov, and P. A. Cherenkov,  
Physics Institute imeni Lebedev, Academy of Sciences USSR;  
Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki,  
Vol 38, No 1, Jan 60, pp 69-72

Experiments were made with a Wilson chamber in a magnetic field for the purpose of detecting the possible generation of particles of mass  $2m_e$  to  $25m_e$  in a lead target placed in the 265 MeV bremsstrahlung beam of the Physics Institute synchrotron. It is shown that if particles of mass from  $2m_e$  to  $25m_e$ , spin  $\frac{1}{2}$  and life time over  $10^{-9}$  sec exist, the cross section of their production in electromagnetic interactions is more than two orders smaller than the values expected.

190. Element 102

"Experiments on Production of Element 102," by G. N. Flerov, S. N. Polikanov, A. S. Karamyan, A. S. Pasyuk, D. M. Parfanovich, N. I. Tarantin, V. A. Karnaukhov, V. A. Druin, V. V. Volkov, A. M. Semchinova, Yu. Ts. Oganeysyan, V. I. Khalizev, G. I. Khlebnikov, B. F. Myasoyedov, and K. A. Gavrilov; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 82-94

Results of new experiments on production of 102nd element and investigation of its nuclear properties are described.  $\text{Pu}^{241}$  and  $\text{Pu}^{239}$  targets were irradiated by  $\text{O}^{16}$  accelerated ions; nuclear photoemulsion was used to record radioactive decay of 102nd element atoms.  $\alpha$ -decay of the obtained isotope of the 102nd element (most probably  $102^{253}$ ) was observed with a half life between 2 and 40 sec and  $\alpha$ -particle energy of  $8,9 \pm 0.4$  MeV. Careful analysis of possible background sources indicated that the background level is much lower than the effect observed.

191. Measurement of Gas Speed

"Measurement of Gas Flow Rate by Tracing the Flow with Ions," by P. Ye. Suetin, G. T. Shchegolev, and R. A. D'yachenko, Ural Polytechnic Institute; Moscow, Pribory i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 111-114

A simple design for an ion source, an ion collector, a sensitive system for revealing the ion cloud in a gas flow, and the laboratory means of measuring the speed of gas motion with an accuracy of 2% are described. A method of flow ionization by alpha particles is used.

192. Alpha Decay

"Excitation of Vibrational Levels and Coulomb Excitation in  $\alpha$ -Decay," by V. M. Strutinskiy; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 122-133

The relative probability of excitation of vibrational levels in the  $\alpha$ -decay of even-even nuclei is calculated. An expression for the intensity of excitation of the daughter nucleus by  $\alpha$ -particles of the main (allowed) group is derived in the quasi-classical perturbation theory approximation. The results obtained are applied to an analysis of the experimental data on the fine structure of  $\alpha$ -decay.

193. ( $\gamma$ ,p) Reaction on Au-197

"( $\gamma$ ,p)-Reaction on Au-197," by Ye. D. Makhnovskiy, Leningrad Physicotechnical Institute, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 95-99

Energy and angular distributions of photons diffused by gold irradiated by bremsstrahlung at  $E_{\max} = 22.5$  Mev were obtained. The results are compared with calculations on the basis of the statistical theory and direct photoelectric theories.

194. Polarization of Bremsstrahlung

"Circular Polarization of Internal Bremsstrahlung Accompanying K-Capture in Fe-55," by V. P. Parfenova, Institute of Nuclear Physics, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 56-59

The circular polarization of the internal bremsstrahlung accompanying K-capture in Fe<sup>55</sup> was measured by scattering in magnetized iron. The techniques of the measurements were based on the azimuthal dependence of the Compton scattering cross section of gamma quanta on polarized electrons. Within the limits of error, 100 percent polarization of the bremsstrahlung quanta was obtained independent of the radiation energy.

195. Collisions of He, B and F With Gas Molecules

"Capture and Loss of Electron in Collisions of Fast Helium, Boron, and Fluorine Atoms With Gas Molecules," by Ya. M. Fogel, V. A. Ankudinov, and D. V. Pilipenko; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 26-32

Results are demonstrated of the measurements of the cross sections  $\sigma_{0-1}$  and  $\sigma_{01}$  of electron capture and loss by fast He, B, and F atoms with 10-60 keV energies in collisions with inert gas atoms. It is shown that the shape of  $\sigma_{0-1}(\gamma)$  curves and the position of their maxima can be explained in terms of the Massey adiabatic hypothesis. In the case of He atoms, the shape of the curve is affected by admixture of metastable He atoms in the primary beam. The adiabatic hypothesis cannot be applied to electron loss by fast atoms.

196. Meson-Nucleon Scattering

"Meson-Nucleon Scattering at Large Orbital Moments," by A. D. Galanin; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 243-247

$\pi$  n scattering phases at large orbital moments are described in terms of the  $\pi$   $\pi$  -interaction constant. If the obtained results can be extended to the case of  $l = 2$  with the assumption that at low energies the  $\pi$   $\pi$ -scattering amplitude is not resonant, disagreement with experimental data is observed.

197. Pion Exchange

"Peripheral Nucleon Interactions at Energies of 9 Bev," by I. M. Dremin and D. S. Chernavskiy, Physics Institute imeni Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 229-232

The paper considers the peripheral interaction of two nucleons (9 Bev energy) involving the exchange of one pion. The cross section of such processes is estimated. It has been found also that during such peripheral interactions, excited nucleons are in a state with an iso-spin of  $3/2$ .

198. Pair Correlation

"Green's Function of Odd Nuclei," by Yu. T. Grin, S. I. Drozdov, and D. F. Zaretskiy, Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 222-228

The techniques of the many body theory are applied to a study of pair correlation in finite systems with an odd number of particles. The Green's function has been found and the perturbation theory developed.

199. Stripping Reactions

"Collective Properties of Si-30, Si-31, and Ne-23, and Reduced Widths in Stripping Reactions," by V. G. Sukharevskiy, Institute of Nuclear Physics, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 219-221

In the framework of the strong coupling unified model, investigation has been made of Si<sup>30</sup>, Si<sup>31</sup>, and Ne<sup>23</sup> collective properties by analyzing experimentally obtained reduced neutron widths in (d, p)-stripping reactions.



The analysis indicates that  $\text{Si}^{31}$  is apparently oblate with the Nilsson deformation parameter  $\delta < 0$ . However, the analysis does not make it possible to ascertain the shape of  $\text{Ne}^{23}$  deformation although it does confirm that this nucleus is strongly distorted. The result obtained for  $\text{Si}^{30}$  does not agree with theoretical calculations, and this fact makes it doubtful whether a strong coupling scheme can be applied to this nucleus.

200. Scattering of Gammas

"Nucleon Scattering of Gamma Quanta Near the Meson Production Threshold," by L. I. Lapidus and Chou Kuang-chao, Joint Institute for Nuclear Research; Moscow, Zhurnal Eksperimental'noy Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 201-211

Elastic scattering of  $\gamma$  rays near the single meson production threshold is examined with the aid of dispersion relations. It is shown that if meson production in the s-state is taken into account, perceptible non-monotonies result in the energy dependence of the scattering amplitudes, cross sections, and other observable quantities near the reaction threshold. The scattering amplitudes and differential and total cross sections of elastic scattering of nonpolarized and polarized  $\gamma$ -quanta on protons, as well as the polarization of recoil protons above the production threshold, have been calculated under certain assumptions concerning the analysis of photoproduction in a  $\gamma$ - quantum energy range of up to 220 Mev.

201. Model of Scalar Mesons

"Green's Function in the Model of Scalar Charged Mesons With a Fixed Source," by B. M. Barbashov and G. V. Yefimov, Joint Institute for Nuclear Research; Moscow Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 198-200

A new method of calculating the Green's function, differing from the perturbation theory method, is given, as illustrated for the case of a static nucleon interacting with charged scalar mesons.

202. Two Center Model

"Two Center Model and Hydrodynamic Theory of Multiple Particles Production," by A. A. Yemel'yanov and L. L. Rozental, Physics Institute imeni Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 194-197

It is pointed out that in cases of fluctuations of the initial volume or final temperature values, the hydrodynamic theory of collisions of high-energy particles may result in kinematics similar (but not identical) to that predicted by the two-center model.

203. Polarization of Gammas

"Polarization of Gamma-Quanta by the Internal Compton Effect," by F. Yanukh, Institute of Nuclear Physics, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 180-183

Circular polarization of  $\gamma$ -quanta induced by the internal Compton effect is considered. Angular correlation between the direction of an outgoing  $\beta$ -electron and that of the circularly polarized  $\gamma$ -quantum is presented both for magnetic and electric type transitions.

204. Electromagnetic Transitions

"Probabilities of Electromagnetic Transitions and Static Moments of Odd-Odd Atomic Nuclei," by A. Varshalovich, Leningrad Physicotechnical Institute, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 172-179

Formulas are given relating the probabilities of gamma transitions with the static moments of odd-odd and neighboring odd spherical nuclei, assuming multiplet level structure. A rule of relative intensities has been established for transitions to multiplet levels, analogous to that for transitions to rotation band levels in deformed nuclei. This rule facilitates determination of the spins and state configurations of odd-odd nuclei. Examples are discussed. The correctness of the assumptions made is confirmed by satisfactory agreement between the experimental and theoretical values of the magnetic dipole moments for a large group of odd-odd nuclei.

205. Fermion Spin

"The Behavior of the Fermion Spin at Elastic Scattering," by A. A. Sokolov and M. M. Kolesnikova, Moscow State University; Moscow, Zhurnal Eksperimental'noy Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 165-171

Behavior of the fermion spin during elastic scattering is investigated in its dependence upon the type of the interaction. In the ultrarelativistic case (or in case of the zero rest mass particles), it is shown that the angle between the spin pseudovector and the momentum remains unchanged for the V- and A-interactions, while for S, P, and T-interactions, this angle is changed by  $180^\circ$ .

206. Paramagnetic Absorption Line

"Second Moment of Paramagnetic Absorption Line With Allowance for Fine and Hyperfine Structure," by U. Kh. Kopvillem, Kazan State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 151-156

Formulas for the calculation of the reduced second moment of the paramagnetic resonance line and low frequency paramagnetic absorption were derived, taking into account the intracrystalline electric field. A formula is given for the calculation of the fine structure constants of nuclear and electron paramagnetic absorption, with the use of the experimental value of the absorption curve second moments. The dependence is examined of the spin-spin paramagnetic relaxation time on the interaction of the electronic magnetic moments with the internal electric field and nuclear magnetic moments. As an example, the time order of magnitude of the spin-spin relaxation time in diamagnetic crystals with  $Mn^{2+}$  ion admixtures is evaluated.

207. Reflection in Space and Time

"Spatial and Time Reflections in the Relativistic Theory," by Yu. M. Shirokov, Institute of Nuclear Physics, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 140-150

A complete classification has been obtained for the representations of the inhomogeneous Lorentz group, including reflection in space and time reflections of the Wigner type. A detailed study has been made of the values of the squares of various reflection operations for particles of halfinteger spin. The general results are compared with the results obtained by imposing additional requirements on theory, particularly the

requirement of locality of the field operators. It has been shown that besides mass, spin, and parity, elementary particles possess one more purely geometrical characteristic which may be called the symmetry type. The question of the symmetry types of real particles is discussed.

208. Wave Functions of Zero Mass Particles

"Integral Transformations of the I. S. Shapiro Type for Zero Mass Particles," by L. G. Zaslavskiy and Chou Kuang-chou, Joint Institute for Nuclear Research; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 122-139

An expansion is presented for a representation according to which the wave function of a zero mass and arbitrary spin particle transforms into irreducible representations of the proper Lorentz group.

209. Evaluation of Coulomb Scattering

"A New Method for Evaluating the Parameter of Multiple Coulomb Scattering," by Z. Al'per and E. Fridlender, Physics Institute and Institute of Atomic Physics of the Rumanian People's Republic; Moscow, Pribery i Tekhnika Eksperimenta, No 6, Nov/Dec 59, pp 39-40

A new method is devised, simplifying the automatization of measurements. Simultaneously, it noticeably decreases the influence of some uncertainties introduced by the procedure of truncating.

210. Gas Heating in Plasma

"Certain Peculiarities of Electron Gas Joule Heating in Plasma," by A. V. Gurevich, Physics Institute imeni Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 116-121

Electron gas heating in plasma in a constant electric field is considered, taking into account nonelastic electron collisions. It is shown that electron temperature can be stable only in weak electric fields with  $E < E_k$ ; at  $E \geq E_k$ , this state is unstable. Dependence of  $E_k$  on plasma ionization was studied. A comparison is made with experimental results. Two modes of heating observed in these experiments are interpreted. Good quantitative agreement with their results is obtained.

211. Steady State Processes in Plasma

"The Nonlinear Theory of Steady State Processes in Electron Plasma," by F. M. Nekrasov, Kharkov State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 233-238

Nonlinear problems of oscillation modes of electron plasma and interaction of plasma beams are considered on the basis of the kinetic equation without taking into account the collision integral. Relations between the wave length and frequency and the oscillation amplitude are obtained. The maximum field in which periodic processes in plasma are possible is determined. Conditions for large amplitude wave propagation have been found applicable to plasma at rest and plasma of moving beams.

212. Structure of Shock Waves

"The Effect of Anisotropy of Conductivity in a Magnetic Field on the Structure of the Shock Wave in Magnetic Gas Dynamics," by S. A. Kaplan, Lvov State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 38, No 1, Jan 60, pp 252-253

Rather simple equations are derived for a quantitative evaluation of the width of the shock wave front in a plasma and for studying qualitative peculiarities produced by anisotropy of conductivity in the magnetic field. It has been found that the anisotropy of conductivity leads to a strong increase of the width of the front of inclined gasomagnetic shock waves that the width of this front is proportional to the square of the magnetic field strength.

213. Detonation of China's Atom Bomb Predicted in New Delhi

"Will the PRC Explode Its Atom Bomb on 28 March? A Fairy Tale, Says Yemel'yanov" (unsigned article); Djakarta, Merdeka, 10 Mar 60

Published in an Indonesian daily newspaper with the dateline "New Delhi, 8 March," the article gives information on China's atomic research program as follows:

"The People's Republic of China will explode an atom bomb on 28 March according to Dr Raghuvira, a Congress Party member of the Indian Parliament, who spoke in Parliament on 7 March. Dr Raghuvira, without mentioning the source of his information, said that China's atom bomb would be

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exploded 'near' Urumchi in the Uighur autonomous region of Sinkiang, in the westernmost part of China. He said that the date 28 March had been chosen to make it possible for Prime Minister Chou En-lai to 'negotiate on a basis of strength' when he visits India to confer with Prime Minister Nehru on the problem of the India-People's Republic of China border....

"An AFP report from Paris said that the statement of the member of the Indian Parliament came as a surprise to the world of science. According to AFP correspondent Bernard Kirschner, the opinion of interested groups in Paris was that if Raghuvira's report is true, it would mean either that China's atomic research program had been speeded up a great deal or that China was receiving increased assistance from the Soviet Union.

"Reports from Hong Kong in February 1960 regarding the progress of the Chinese government's atomic program stated that China's first atom bomb would not be completed before 1961 at the earliest.

Assistance from the Soviet Union has played the definitive role in China's atomic program. China's first step toward development as a nation with atomic weapons came with the construction of a 60,000-kilowatt Soviet reactor. This followed the signing of a scientific agreement between the two nations in December 1955. Work began on a heavy water reactor in Urumchi in 1958. Nuclear research centers have been established in Chungking and in the East China Sea [area]. Meanwhile, exploitation of radioactive deposits is being rapidly carried out in Sinkiang and on Hainan Island.

"The research work of scholars in 12 Chinese universities is coordinated in a central organization which is headed by Ch'ien San-Chi'ang, a physicist and former pupil of Frederic Joliot-Curie. Other prominent scholars known to participate in this program are Wang Te-chao, who studied atomic physics in France for 20 years, and Dr Chang Wen-yu, who engaged in research in the US and England for 13 years.

"Prof Vassily S. Yemel'yanov, chief of the Soviet Union's Main Administration for the Utilization of Atomic Energy, said in New Delhi on 8 March that the predicted detonation of China's first atom bomb on 28 March in the Sinkiang Autonomous Region was a fairy tale. Yemel'yanov, who is now visiting New Delhi to discuss the possibilities of cooperation between the Soviet Union and India in the field of nuclear research, made this statement in the Soviet embassy after newspapermen asked him to comment on Dr Raghuvira's statement concerning the explosion of an atom bomb by China. Asked if he thought China had the capability to build an atom bomb, Yemel'yanov said 'Only God knows. I am not a prophet, only a scientist.'

"Dr Raghuvira also said in Parliament that according to a report from sources in Chinese Turkestan and Tibet, who have proved to be reliable in the past several years, China will explode its first atom bomb on 28 March 1960 in Kha Yuan Teu, which lies in the Gobi desert 120 [sic] miles south-east of Urumchi, Sinkiang Autonomous Region. ...Dr Raghuvira also said that he had received a report that, in preparation for the detonation of the atom bomb, China had conducted tests with the assistance of Soviet technicians and heavy water equipment...."

Optics and Spectroscopy

214. Spectral Sensitivity of Radiant-Flux Sensing Device Used in Photography

"Determining the Optimal Form of the Spectral Sensitivity Curve of a Radiant-Flux Sensing Device," by A. Ye. Bel'tishchev, Moscow; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Energetika i Avtomatika, No 6, Nov/Dec 59, pp 185-190

The spectral sensitivity curve required for the reduction of background interference can be obtained in practice by the connection of two photocells in opposition, one cell having a spectral sensitivity curve  $\phi_1 \lambda$  and the other,  $\phi_2 \lambda$ . If background radiation is absent, the spectral sensitivity curve of the sensing device coincides with the spectral density curve of the radiant flux of the detected object ( $\phi \lambda = \phi_1 \lambda$ ). In this case, the reaction of the sensing device to the radiation of the detected object would be greatest. If the sensitive element used is a photocell for which the spectral sensitivity curve  $K \lambda$  is given, then the spectral sensitivity  $\phi_1 \lambda$  and  $\phi_2 \lambda$ , given here by two equations, affords the possibility of obtaining the spectral transmission curve of the light filter, which is determined here in dimensionless units by the equation

$$\tau_{i \lambda} = \frac{\phi_{i \lambda} / K \lambda}{(\phi_{i \lambda} / K \lambda)_{\max}},$$

where  $(\phi_{i \lambda} / K \lambda)_{\max}$  is the maximum value of the ratio  $\phi_{i \lambda} / K \lambda$  for the interval wave lengths.

The results obtained were confirmed in practice by a reduction of the interference effect of the background by means of compensated radiant-flux sensing devices and filters.

215. Concentric Mirror-Lens Objective With Two Symmetries

"Concentric Mirror-Lens Objective With Two Symmetries," by L. V. Romanova, Sb. statey . Leningr, in-t tochnoy mexhan. i optiki (Collection of Articles of the Leningrad Institute of Precision Mechanics and Optics), No 27, 1958, pp 61-65 (from Referativnyy Zhurnal -- Mashinostroyeniye, No 2, 25 Jan 60, Abstract No 7031)

The calculation is presented for a mirror-lens concentric objective which operates up to infinity and consists of a concentric meniscus and two mirrors, one concave and one convex. Analytical expressions are given for the angles of incidence, refraction, and reflection.

216. Brightness of Electroluminescence

"Electroluminescence Brightness Waves Under Simultaneous Action of Direct and Alternating Voltage," by G. S. Kozina, V. N. Favorin, and I. D. Anisimova; Moscow, Optika; Spektroskopiya, Vol 8, No 2, Feb 60, pp 218-223

The distortions of brightness waves of electroluminescence of the yellow luminophore ZnS-Cu, Mn are described for a varying ratio of direct and alternating components of voltage applied to the layer (for alternating voltage of square and sinusoidal shape), as well as the relation of these distortions to the conductivity of the layer. The nonadditivity of the effect of direct and alternating voltages is established. The absence of similar brightness wave variations for a green electroluminophore under the same circumstances is noted. The described phenomena are explained from the viewpoint of the combination of electroluminescence effects of the luminophore ZnS-Cu, Mn in direct and alternating fields.

217. Raman Spectra at Low Pressure

"Photoelectric Investigation of Combination Scattering Spectra in Gases at Low Pressure," by P. A. Bazhulin and Yu. A. Lazarev; Moscow, Optika i Spektroskopiya, Vol 8, No 2, Feb 60, pp 206-213

A photoelectric method was applied to the investigation of contours and widths of lines of rotational and rotational-vibrational spectra of gases  $H_2$ ,  $O_2$ ,  $N_2$ , and  $CH_4$  in a pressure range of 1-10 atm. From the magnitude of line broadening of the rotational spectra of combination scattering, the optical cross sections of  $H_2$ ,  $O_2$ ,  $N_2$ , and  $CO_2$  gases were computed.



218. Polarization of Luminescence

"Luminescence Polarization in a Harmonic Oscillator," by V.P. Gribkovskiy and B. I. Stepanov; Moscow, Optika i Spektroskopiya, Vol 8, No 2, Feb 60, pp 176-182

A quantum mechanical computation of the polarization of luminescence of a particle system with two levels of energy and an association of harmonic oscillators is carried out. The value of luminescence polarization of harmonic oscillators equals  $1/2$ , does not depend on the temperature and intensity of the exciting light, and coincides perfectly with results of classical computations of the polarization of a dipole association.

"Luminescence Polarization of a System of Particles With Three Energy Levels as a Function of the Exciting Light Intensity," by B. I. Stepanov and V. P. Gribkovskiy; Moscow, Optika i Spektroskopiya, Vol 8, No 2, Feb 60, pp 224-231

The relations of polarization of luminescence, the absorption coefficient, dichroism, and intensity of  $\alpha$ - phosphorescence to the intensity of the incident radiation are computed. It is demonstrated that all of these relations are nonlinear and depend on the accumulation of particles on the metastable level.

219. Contour of Hydrogen Line

"Contour of Hydrogen Line  $H_{\beta}$  in Argon Behind a Shock Wave," by V. N. Alyamovskiy and V. F. Kitayeva; Moscow, Optika i Spektroskopiya, Vol 8, No 2, Feb 60, pp 152-156

The study belongs to a series carried out in the Physics Institute of the Academy of Sciences USSR on spectroscopic investigations of the state of a gas behind a shock wave. By studying the  $H_{\beta}$  line in argon behind the shock wave, it has been found that a noticeable part of the contour is satisfactorily described by the statistical theory of Holtmark. The concentration of charged particles in argon behind the shock wave is determined from the experimental contour and half-width of  $H_{\beta}$  line. The values found agree with the theoretical ones obtained under the assumption of ideal gas and thermal equilibrium.

IX. MISCELLANEOUS

220. China-Russia Educational Exchange

"Together -- For One Goal," by S. Tikhvinskiy; Moscow, Sovremenny Vostok, Feb 60, p 18

More than 700 Soviet specialists have given lectures, aided in establishing 337 chairs and over 550 laboratories, and trained a large group of teachers in the higher educational institutions of China. The government of the People's Republic of China has sent 6,561 persons to study in the Soviet Union. The Soviet Union began sending its students to study in China's higher educational institutions in 1957. Soviet doctors are studying the 1,000-year-old experience of Chinese national medicine. Chinese scientists are taking active part in the work of the Joint Institute for Nuclear Research in Dubna.

221. Sino-Soviet Scientific Exchange

"Sino-Soviet Scientific Exchange" (unsigned article); Moscow, Problemy Vostokovedeniya, No 1, 1960, pp 94-98

In 1958-1962, Soviet-Chinese collaboration is planned for 122 important scientific technical problems.

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