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CENTRAL INTELLIGENCE AGENCY

SCIENTIFIC INFORMATION REPORT

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PLEASE NOTE

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

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I. BIOLOGY

1. Concentration of Radioactive Isotopes in Bodies of Fresh-Water Mollusks

"The Concentration of the Radioactive Isotopes of Phosphorus and Strontium by Various Species of Fresh-Water Mollusks," by Z. S. Povelyagina, and M. M. Telitchenko; Moscow, Byulleten' Moskovskogo Obshchestva Ispytateley Pripody, Otdel Biologicheskiy, Vol 64, No 2, Mar/Apr 59, pp 79-83

The rapid development of atomic industry poses the complex problem of finding methods of purifying water, soil, and air from radioactive waste products. Since it is known that water organisms, especially mollusks, possess the capacity of accumulating radioactive isotopes of chemical elements in their bodies in significantly larger quantities than their surrounding environment, this research was undertaken as a study of the accumulation and distribution of Sr^{90+89} and P^{32} in mollusks. The fresh-water mollusks Unio pictorum, Anodonta Sygnea, Dreissena polymorpha, and Planorbis corneus were investigated.

In conclusion, the author states that the magnitude of radioisotope accumulation by the mollusks depends on the species specificity of the mollusks, on the organotropicity of the isotopes, on the concentration of the isotopes, and the length of time the animals are kept in the solution. The isotopes of strontium are well retained by the shell, but are excreted from the body of the mollusks when the latter are transferred from the radioactive solutions into water.

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II. CHEMISTRY

Electrochemistry

2. The Behavior of Mercury During the Electrolysis of Amalgams to Recover Trace Elements

"Behavior of Mercury During the Electrolysis of Amalgams," by A. A. Shokol and L. F. Kozin, Institute of General and Inorganic Chemistry, Academy of Sciences Ukrainian SSR; Kiev, Ukrainskiy Khimicheskiy Zhurnal, Vol 25, No 3, May-June 59, pp 374-381

Amalgams are used for the extraction of metals from ores and industrial wastes, and also for the refining of such metals as zinc and indium. Amalgam methods are also applied in the production of sodium, titanium, and some other metals. The behavior of mercury during the electrolysis of amalgams has not been investigated sufficiently as yet. The mercury may dissolve in the aqueous electrolyte and in the presence of oxygen be oxidized to ions which contaminate the deposit at the cathode.

By using the radioactive tracer Hg^{203}, it was established that the tendency of the mercury to dissolve in the aqueous electrolyte depends on the amount of oxygen dissolved in the electrolyte and the temperature. When a reducing agent is used, the dissolution of mercury in the electrolyte depends only on the action of the electrolyte on the metallic mercury. The velocity of cementation of mercury by a 10% amalgam of indium and the volatilization of mercury from the electrolytic cell at the temperatures of 20°, 40° and 60° were studied. The dependence of the mercury content in the cathodic deposits of thallium and indium on the concentration of mercury in the electrolyte and on the temperature was investigated. It was established that the oxygen of the air has an effect on the content of mercury in the cathodic deposits.

When the amalgams are electrolyzed in the presence of oxygen of the air dissolved in the electrolyte at 20°, cathodic deposits of indium with a mercury content amounting to $(1.6 - 1.9).10^{-3}\%$ and cathodic deposits of thallium with a mercury content of $(0.7 - 0.9).10^{-3}\%$ are obtained. When the oxygen contained in the electrolyte is brought into reaction with a reducing agent, the content of mercury in the cathodic deposits drops to $(1.2 - 2).10^{-5}\%$.

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3. Expansion of the Production of Oxygen in the USSR

"Expansion of the Production of Oxygen and the Problem of Lowering its Cost," by A. V. Leskov, Candidate of Economic Sciences; Moscow, Kislorod, Vol 12, No 3, Jun 59, pp 1-6

Oxygen for large ferrous metallurgy plants should be produced only at high-capacity oxygen installations attached to these plants or regional oxygen plants equipped with installations of the BR-1 and BR-2 types producing 12,500 and 35,000 cubic meters of oxygen per hour respectively. Production units equipped with these installations are capable of producing oxygen at a considerably lower cost (no more than 3-4 kopecs per cubic meter or lower than that if the cost of electric power is 3 kopecs per kilowatt-hour). The construction of high-capacity oxygen installations, particularly those of the BR-1 type, ought to be expanded considerably. A still more important task is development in the shortest possible time and introduction into operation of BR-2 installations as well as completion of the planning and designing of installations producing 50,000 - 100,000 cubic meters of oxygen per hour per unit installation. A complete oxygen plant would consist of three installations of the latter type.

Argon and krypton should be produced at oxygen-producing plants, although this will not necessarily lead to a considerable reduction in the cost of oxygen. Krypton is used for filling incandescent lamps and other evacuated electrical appliances. Argon is used in argon arc-welding and in evacuated electrical appliances. It is also used as an inactive medium in many metallurgical processes (particularly in the titanium and magnesium industries).

At some oxygen units attached to metallurgical plants, production of nitrogen of high purity and application of this nitrogen at nitrogen-fertilizer plants in the vicinity will make it possible to lower the cost of oxygen to 2.0 - 2.5 kopecs per cubic meter. Oxygen as cheap as this can be used to advantage in any processes of ferrous metallurgy. Additional lowering of the cost of oxygen at high-capacity oxygen-producing unit can be achieved through lowering of the relative use of power by improving conduction and increasing the efficiency of compressors; by lowering the capital costs in connection with the construction of oxygen-producing units; and by increasing the degree of automation and expanding the production of spare parts, so that less personnel for operation and maintenance will be required.

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4. New Data on Explosions of Mixtures of Hydrocarbons in Liquid Oxygen

"New Data on the Explosion of Mixtures of Hydrocarbons in Liquid Oxygen," by Engineers G. A. Gittsevich, Z. B. Basyrov, and V. G. Sagaydak; Moscow, Kislorod, Vol 12, No 3, June 59, pp 12-16

Experiments carried out in an autoclave confirmed that on heating of cylinder oil under pressure in air, a process of thermal cracking takes place. As a result of this cracking, low-boiling liquid and gaseous hydrocarbons are formed, and also coke. The sensitivity toward explosion in the presence of liquid oxygen of all products resulting from cracking produced in this manner proved to be considerably higher than that of an explosive such as nitroglycerin. Data of experiments carried out on the sensitivity to explosions of mixtures of liquid oxygen with hydrocarbons indicated that acetylene cannot be regarded as the only substance which causes explosions in air separation (liquid air distillation) equipment. Formation of a considerable quantity of cracking gases as a result of the compression of the air by piston compressors and presence of these gases in liquid air distillation equipment explain the explosions of equipment in cases when neither acetylene nor lubricating oil was found to be present. These cracking gases, determination of which in the liquid content of the still and of the condenser was not made, apparently were responsible for the explosions in question.

By purifying the air from oil and other hydrocarbons including products of the cracking of oil, safe operation of liquid air distillation equipment can be achieved.

Industrial Chemistry

5. Expansion of the Production of Furfural in the USSR

"Valuable Products from Wastes," by A. Khlyzov, chief specialist, Gosplan RSFSR; Moscow, Master Lesa, No 5, May 59, p 9

An important trend in the development of the chemistry of products derived from wood is expansion of the production of furfural. This is an irreplaceable material for the manufacture of entirely new types of products, including synthetic fibers, plastics, and synthetic resins. Furfural is also needed for the production of lubricants and the treatment of some types of ferroconcrete. Furfural eliminates the porosity of ferroconcrete and thus makes it waterproof. Various types of structures for the storage of fuels can be built from this type of ferroconcrete; in this manner, a huge quantity of metal will be saved.

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In the near future, furfural will be applied extensively in many branches of industry, such as nonferrous metallurgy, the building of machine tools, the aviation industry, and the automotive industry. Some types of plastics derived from furfural are as strong as any metal. One of the plants producing furfural will be put into operation in the Mariyskaya ASSR as early as 1960. The production of this plant will amount to 5,000 tons per year. This is 2 1/2 times more than the production of all furfural enterprises of the USSR at present.

Toward the end of the current Seven-Year Plan, the production of furfural in the USSR will be increased to 40,000 tons. This compares with a production of only 2,000 tons at present.

6. A Method of Improving the Yield of Furfural

"Without Building New Plants, the Production Furfural Can Be Increased by Introducing Novel Technological Methods" by S. Belen'kiy, Candidate of Technical Sciences; Moscow, Lesnaya Promyshlennost', No 67 (1207), 4 Jun 59, p 3

The problem of increasing the content of pentosans in raw material subjected to hydrolysis occupied workers in this field for some time. It was established that the husks of cotton seed consist of three layers: the outer, to which cotton fibers are attached; the middle, which contains more than 80% of the pentosans; and the inner, which is adjacent to the seeds. The problem, therefore, consisted of the separation of the middle layer rich in polysaccharides from the outer and inner layers. The problem was solved in work done at the Fergana Oil and Fat Combine. The cotton husks are treated by passing them through cam mills of a simple design. As a result of the separation of fiber residues and partly of the upper and lower layers of the cotton husks in the cam mills, 35% by weight of the initial material can be shifted off. Analysis showed that the fraction which has been sifted off consists of polysaccharides to the extent of almost 50% and has a loose weight which is 3 1/2 times higher than that of untreated cotton husks. A preliminary treatment of cotton husks in this manner makes it possible to charge into the hydrolysis equipment 10 tons of pentosans rather than 2 tons.

If all cotton husks which accumulate at oil and fat combines will be subjected to treatment in cam mills and the raw material obtained by the process described converted into furfural and protein yeast at hydrolysis plants, it will be possible, without introducing into operation additional capacities, to produce in Central Asia a quantity of furfural corresponding to 50% of the present US production.

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Inorganic Chemistry

7. Compounds of Trivalent Copper

"Some Compounds of Trivalent Copper," by A. Yu. Prokopchik and P. K. Norkus, Institute of Chemistry and Chemical Technology, Academy of Sciences Lithuanian SSR: Moscow, Zhurnal Neorganicheskoy Khimii, Vol 4, No 6, Jun 59, pp 1,359-1,361

By reacting the hypochlorites of barium and calcium with cupric hydroxide, barium cuprate $Ba(CuO_2)_2$ and calcium cuprate $Ca(CuO_2)_2$ were prepared. These compounds contain trivalent copper. Preparation of strontium cuprate and of the hydroxide of trivalent copper did not succeed. The fact that copper may assume a valency of three was established in work published in 1937 by L. Malaprade. (Compt.rend., Vol 204, 1937, p 979)

Insecticides, Herbicides

8. New Herbicides Tested

"New Herbicides for the Control of Weeds in Corn Fields," by Candidate of Agricultural Sciences I. A. Makodzeba and V. S. Podoprigora, All-Union Scientific Research Institute of Corn; Moscow, Doklady Vsesoyuznoy Ordena Lenina Akademii Sel'skokhozyaystvennykh Nauk imeni V. I. Lenina, No 4, 59, pp 19-23

Over the past several years a number of compounds have been tested by the authors to find an effective herbicide for controlling weeds in corn fields.

The compounds were synthesized in the laboratory of the Chair of Technology of Organic Synthesis of the Dnepropetrovsk Chemicotechnological Institute (Prof S. I. Burmistrov).

Several of the preparations exhibiting high herbicidal activity are "E-1" -- acid phthalate of 2,4-dichlorophenoxyethanol; "E-12" -- acid phthalate of 2,4,5-trichlorophenoxyethanol; "DE-1" -- 2,4,2,4,-tetrachlorodiphenoxyethane; "T-1" -- 2,4,5-trichlorobenzoic acid; and "T-2" -- 2,3,6,-trichlorobenzoic acid.

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All the tested preparations exhibited greater toxicity toward dicotyledonous weeds than toward monocotoledonous weeds.

After preparations "E-1," "E-12," "DE-1," "T-1," and "T-2" were spread into the soil, they preserved their toxicity to weeds for several months. This is of very important practical value, since weed seeds are killed by the preparations during the entire vegetation period.

Injurious actions by the preparations were not observed.

9. Insecticidal Aerosols Produced by Burning Thermal Mixtures

"Comparative Evaluation of the Insecticidal Properties of Methoxychlorine and Chlorophos Aerosols," by G. G. Tsintsadze, Ye. V. Shnayder, and V. I. Vashkov, Central Scientific Research Disinfection Institute; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, No 6, Jun 59, pp 52-57

The insecticidal activity of methoxychlorine ($C_{16}H_{15}O_2Cl_3$) and chlorophos (O,O-dimethyl-2,2,2-trichloro-1-oxyethlphosphonate) aerosols were studied in comparison with DDT and hexachlorocyclohexane preparations. Field and laboratory experiments were performed on the domestic flies.

The insecticidal activity of aerosols of these preparations was found to be different. A concentration of 0.1 g/m^3 of chlorophos produced 100% destruction of flies in 37 minutes; the same concentration of DDT required 40-60 minutes; a concentration of 0.2 g/m^3 of hexachlorocyclohexane required 40 minutes and 0.5 g/m^3 of methoxychlorine produced 100% destruction after 2 hours.

Chlorophos aerosols obtained by burning various thermal mixtures (aerosol paper, tablets and smoke-boxes) produced a nearly identical insecticidal effect.

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10. The Effect of Moisture on the Action of Insecticides in Plant Cells

"The Role of the Moisture Factor in the Action of Insecticides (Hexachlorocyclohexane and Preparation M-74) on Plant Cells," by L. M. Lupova, All-Union Scientific Research Institute of Plant Protection; Moscow, Doklady Vsesoyznoy Ordena Lenina Akademii Sel'skokhozyaystvennykh Nauk imeni V. I. Lenina, No 4, 59, pp 41-43

Hitherto, little attention has been paid to the study of the effect of organic insecticides on the important physicochemical properties of protoplasm which appears to be the chief medium for all the various biochemical processes.

The results of experiments conducted by the author in 1956 indicated that organochlorine and organophosphorus insecticides exhibit a great effect on the colloidal-chemical properties of protoplasm.

Optimal water-cycle conditions which cause only a small change in the colloidal-chemical properties of protoplasm favor the development of positive activity by small doses of insecticide in the plant cell and in the organism as a whole. Under these conditions, the phytocidal action of large doses of insecticide decreases.

A water-shortage condition which causes a sharp decrease in the plasma viscosity and a strong increase of osmotic pressure in the plant sap favors the phytocidal action of an insecticide. This relationship develops very suddenly as a result of the action of an insecticide used in large quantities. This condition leads to a decrease in yield.

11. Review of the Development of Mosquito Repellents

"The Status of the Study of Mosquito Repellents," by V. A. Nabokov and P. S. Batayev, Institute of Malaria, Medical Parasitology and Helminthology of the Ministry of Public Health USSR; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, No 6, Jun 59, pp 44-48

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In the summation of their review, the authors report that "the study of repellents has demonstrated the complexity of this problem in itself, but the absence of data on the physiology of the process of repelling Arthropoda renders it even more difficult. A unified technique in the study of repellents is of importance in assessing their value. It is only a comprehensive study of the relation existing between the chemical structure of repellents and their effect that makes it possible to discover new

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effective repellents and not just a search for them by means of empirically testing numerous chemical substances. An important gap in the study of repellents is the absence of data on the epidemiological effect of their employment. There are only a few observations characterizing the effect of repellents (principally dimethylphthalate) on the increase of labor productivity of persons performing different kinds of work.

"Strict differentiation in the choice of repellents, conforming to actual conditions, is imperative for the rational development of the problem of repellents."

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Nuclear Chemistry

12. The Discovery of Element 102 and the Synthesis of new Transuranium Elements in General

"The Synthesis of Heavy Transuranium Elements" (unsigned article); Moscow, Priroda, Vol 48, No 8, Aug 59, pp 83-84

The history of the discovery of transuranium elements was connected with the development of micromethods for the isolation and identification of the substances obtained. At a seminar held at the Institute of Physical Problems imeni S. I. Vavilov, Prof V. I. Gol'danskiy told briefly about the synthesis of einsteinium and fermium.

On 9 June 1957, a communication was published to the effect that the element 102, named nobelium (No^{253}), had been isolated at Stockholm. Notwithstanding the fact that No^{253} was henceforth listed in the tables of elements, work done by G. Seaborg and his collaborators at Berkeley, US, and G. N. Flerov and members of his team in the USSR proved that there is no such element. Results obtained in research done by USSR and US scientists indicated the presence of the isotope 102^{254} with a half-life of approximately 3 seconds. However, one cannot regard element 102 as definitely discovered at this stage; consequently, no name can be given to the element in question for the time being.

It is commonly considered that the highest possible order number of a chemical element is 137. If the charge of the nucleus is higher than 137, the electron in the first quantum orbit must have a velocity higher than that of light. In other words, when the charge of the nucleus is increased above 135, a K-capture is inevitable, with the result that the charge of the nucleus diminishes. However, this conclusion applies only to a point nucleus. By extrapolation from transuranium atoms which have already been investigated, Wheeler arrived at the conclusion that elements

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with an order number up to 147 and a mass up to 500 can be obtained. This is a purely speculative assumption which does not take into consideration the sharp change in the course of the curve expressing the half-life in the region of nuclei with a number of nucleons amounting to 152.

Academician L. V. Landau emphasized that Wheeler's hypothesis lacks valid theoretical grounds.

To synthesize heavy transuranium elements, two ways are open: (1) successive capture of Cf^{253} of a number of neutrons followed by β-decay and (2) bombardment with multiply charged ions (C,N,O, and others) It is obvious that the second way will be followed in attempts to synthesize elements with $Z > 103$. It is difficult to apply this method, however, because one cannot bring out of a cyclotron with facility powerful rays consisting of such ions. For this reason, high-energy linear accelerators for multiply charged ions are being built at present in some laboratories throughout the world.

No matter by what method new chemical elements are synthesized, the difficulties connected with the chemical separation and identification of the very few atoms of the new element must be overcome.

Nuclear Fuels and Reactor Construction Materials

13. Relationships Pertaining to the Mineralogy of Uranium

"Specific Characteristics of Uranium Mineralogy" by V. I. Gerasimovskiy; Moscow, Atomnaya Energiya, Vol 7, No 1, Jul 59, pp 47-56

This article points out the following characteristic peculiarities of the mineralogy of uranium: (1) all known uranium minerals and minerals containing uranium also contain oxygen; (2) uranium is invariably contained in minerals in the tetravalent or hexavalent state; (3) most of the uranium present in the earth's crust is found in uranium-containing minerals rather than uranium minerals (uranium enters into uranium-containing minerals by isomorphus substitutions of other elements such as thorium, zirconium, rare earth elements, etc); (4) uranium minerals and uranium-containing minerals arise as a result of a number of different processes of mineral formation; and (5) radioactivity is the most typical characteristic of uranium minerals.

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14. Uranium and Thorium in the Bottom Deposits of the Antarctic

"The Forms in Which Uranium and Thorium Occur in the Bottom Deposits of the Antarctic" by R. Ye. Starik, Yu. V. Kuznetsov, and V. K. Legin; Leningrad, Radiokhimiya, Vol 1, No 3, May-Jun 59, pp 321-324

An investigation of the distribution of uranium and thorium in different fractions of deposits of the Antarctic Shelf (Station Nos 192 and 157) indicated that in the deposits investigated, the principal part of uranium and thorium is contained in fragments of continental rocks. It was also established that in deep water marine deposits (Station Nos 206 and 211) the principal part of uranium is derived from sea water.

15. Method for the Determination of Thorium

"A New Rapid Method for the Determination of Thorium in the Presence of Zirconium, Iron, Lanthanum, Uranium, and Other Elements," by R. Pribil and K. Burger, Research Institute of the Czechoslovak Academy of Sciences in Prague and Institute of Inorganic and Analytical Chemistry, Lorand Etvos University of Science at Budapest; Budapest, Magyar Kemiai Folyoirat, Vol 65, No 5, May 59, pp 204-206

A new specific method for the determination of thorium was developed which can be applied in a simple manner in the presence of large quantities of zirconium, iron, lanthanum, uranium, manganese, and magnesium and small quantities of cobalt and nickel.

The method is based on the fact that the compound formed by thorium with Complexon III [ethylenediaminetetraacetic acid] is decomposed by sodium sulfate at a pH lower than 1.0 and that the complexon that has been set free can be titrated with a bismuth nitrate solution, using xylenol orange as an indicator.

To a solution which contains in addition to thorium the cations mentioned above, an excess of Complexon III solution is added. The excess of complexon is then titrated at pH = 2-3.5 with bismuth nitrate, using xylenol orange as an indicator. After this, one gram of sodium sulfate is added to the solution. After acidification with about 1-1.5 milliliters of a 2N solution of nitric acid, the quantity of Complexon III which corresponds to the thorium can be titrated with bismuth nitrate.

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16. Complexes of Pentavalent and Trivalent Plutonium With Ethylenediaminetetraacetic Acid

"Composition and Dissociation Constants of Complexes of Pu (V) and Pu (III) With Ethylenediaminetetraacetic Acid," by A. D. Gel'man, A. I. Moskvin, and P. I. Artyukhin; Moscow, Atomnaya Energiya, Vol 7, No 2, Aug 59, pp 162-163

By using the method of ion exchange the formation of complexes by pentavalent and tetravalent plutonium with ethylenediaminetetraacetic acid was investigated. Comparison of the dissociation constants of the ethylenediaminetetraacetic acid complexes formed by trivalent transuranium elements shows that as the order number of the elements increases, the stability of complexes of the MY^- type increases with the decrease of the ionic radius of the cation. Data on the stability of ethylenediaminetetraacetic acid- plutonium complex ions make it possible to compare the relative tendency of trivalent plutonium, tetravalent plutonium, pentavalent plutonium, and hexavalent plutonium to form complexes. It is known that the tendency toward the formation of complexes increases as the nominal charge of the ion increases and the ionic radius becomes smaller. This tendency also depends on the structure of the cation. Comparison of the dissociation constants of the ethylenediaminetetraacetic acid complexes shows that the tendency of plutonium ions to form complexes decreases in the following order,

$$Pu^{4+} > Pu^{3+} > PuO_2^{2+} > PuO_2^{+}$$

i.e., in a sequence which corresponds to the reduction of the ionic potential.

17. The Thermal Expansion of α - Plutonium

"The Thermal Expansion of α - Plutonium," by N. T. Chebotarev and A. V. Beznosikova; Moscow, Atomnaya Energiya, Vol 7, No 1, Jul 59, pp 68-69

The thermal expansion of α - plutonium along the directions of the lattice parameters a, b, and c in the temperature range from minus 196° to plus 100° C was determined. The values obtained were found to be in satisfactory agreement with data published previously in the US literature.

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18. A Comparative Evaluation of Industrial Methods for the Production of Heavy Water

"Industrial Production of Heavy Water," by M. P. Malkov; Moscow, Atomnaya Energiya, Vol 7, No 2, Aug 59, pp 101-109

The available methods for the production of heavy water on an industrial scale are discussed. The processes by means of which heavy water can be produced at the lowest cost are described and evaluated from the standpoint of technical advantages and relative cost. The conclusion is drawn that the distillation of liquid hydrogen and the hydrogen sulfide method are of the greatest advantage.

It is pointed out that production of deuterium by the distillation of liquid hydrogen has been applied for some time in the USSR on an industrial scale (cf paper No 2323 presented at the Second International Conference on Peaceful Uses of Atomic Energy, Geneva, 1958, by M. P. Malkov, A. G. Zel'dovich, A. B. Fradkov, and I. B. Danilov). The following comment is made:

> "Prolonged application of this production method [i.e. production of deuterium by the distillation of liquid hydrogen] completely confirmed the correctness of all project indices. There were no complications in connection with the application of the process. Thus, in the USSR the transition was made for the first time from the temperature range in the vicinity of 80° K, which is used extensively for liquid air separation, to the temperature range in the neighborhood of 20° K, which is used for the separation of hydrogen isotopes."

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19. Reports on Nuclear Materials and Metals Presented at the 1959 Annual Scientific Conference Held at the Moscow Engineering-Physics Institute

"Scientific Conference of the Moscow Engineering-Physics Institute," by G. A. Tyagunov; Moscow, Atomnaya Energiya, Vol 7, No 2, Aug 59, pp 176-177

The annual scientific conference conducted at the Moscow Engineering-Physics Institute was held on 17 April-15 May 1959. One hundred forty-eight reports were presented at two plenary sessions and sectional meetings of 18 sections. At meetings of the Section on Metallurgy and Metal Science, a considerable number of reports dealt with problems pertaining to the production of pure metals and alloys and the investigation of the properties of these metals and alloys. Furthermore, some papers discussed the application of autoradiography for the investigation of the properties of metals. Some of the reports presented at meetings of the Section of Metallurgy and Metal Science are listed below:

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"Investigation of the Iodide Method for Refining Niobium and the Properties of the Metal Produced in this Manner," by G. A. Leont'yev and A. I. Yevstyukhin; "Investigation by Autoradiography Methods of the Microdistribution of Elements (Carbon, Tungsten, Iron, etc.) in Zirconium and its Alloys," by P. L. Gruzin and G. G. Ryabova; "Determination By the Radioactive Tracer Method of the Heats of Sublimation of Zirconium and Nickel," by G. B. Fedorov; and "Determination of the Coefficients of Diffusion of Chromium, Nickel, and Iron in Chromium-Nickel Steels," by G. B. Fedorov and A. N. Semenikhin.

The information presented at the conference will be published in collections of articles issued by the Moscow Engineering-Physical Institute.

20. Dispersion With a Stream of Air in Plate Column Liquid-Liquid Extractors

"Mechanism of the Dispersion of Liquids in Plate Extractors and a Method of Increasing the Degree of Dispersion," by N. P. Galkin, V. A. Tikhomirov, N. Ye. Goryaynov, and V. D. Fedorov; Moscow, Atomnaya Energiya, Vol 7, No 2, Aug 59, pp 159-160

It was established that extraction in plate columns is much more efficient when a stream of air is blown from the bottom of the column at the level where the light phase is introduced. The stream of air increases the degree of dispersion of the liquid phases. The investigation described was carried out on the system water -nitric acid-uranyl nitrate-tributyl phosphate in kerosene.

21. Improvement of the Efficiency of Chromatographic Methods of Separation by the Application of Complex-Forming Agents

"Adsorption Methods for the Separation of Barium from Radium, Aluminum from Gallium, and Zirconium from Hafnium," by B. N. Laskorin, V. S. Ul'yanov, R. A. Sviridova, A. M. Arzhatkin, and A. I. Yuzhin, Moscow, Atomnaya Energiya, Vol 7, No 2, Aug 59 pp 110-116

Chromatographic methods for the separation of elements which are very close to each other in their properties have now been developed. However, the industrial application of the methods in question had to be held up in some cases because of the low efficiency of separation. The efficiency of chromatographic methods of separation can be increased considerably by using appropriate complex-forming agents, which reduce the active concentration of the ions being separated. In the first approximation, this is

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equivalent to a reduction of the quantity of the elements being separated. By increasing the difference between the equilibrium constants of the formation of complex compounds of the elements being separated, higher separation coefficients can be achieved. As a result of the investigation of chromatographic separations with the application of different complex-forming agents, the optimum conditions of the separation of barium from radium, zirconium from hafnium, and aluminum from gallium were found. The efficiency of the methods developed with reference to the macroelement comprises 15-60 kilograms per hour per square meter of the cross-section of the column.

22. A New Type of Counter Filled With Boron Trifluoride

"News Items -- USSR" (unsigned items); Moscow, Atomnaya Energiya, Vol 7, No 1, Jul 59, p 88

A very efficient boron counter has been developed. The counter is filled with BF_3 at a pressure of 700 millimeters of mercury. The BF_3 is enriched with B^{10} to the extent of 88%. The cathode of the counter is a tube of stainless steel 400 millimeters long with a diameter of 25 millimeters. The inner surface of this tube is polished. The anode consists of a tungsten wire with a diameter of 50 microns. The front end of the counter is executed in the form of a flat window made of boron-free glass. This glass has a thickness not exceeding one millimeter. The back end is a cover flange with an opening for a glass insulator which is provided with a protective ring and an arrangement for stretching the filament. For a parallel bundle of thermal neutrons, the effectiveness of the counter is close to 100%.

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Organic Chemistry

23. New Method of Obtaining Pyrophosphates

"Mixed Anhydrides of Carboxylic Acids and Acid Esters of Phosphoric and Methylphosphinic Acids," by K. A. Petrov and A. A. Neymysheva; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 6, Jun 59, pp 1,822-1,826

The present research is concerned with the synthesis and study of the properties of previously undescribed dialkylacylphosphates. Six of these compounds were obtained and characterized. They were produced by the action of the silver salts of carboxylic acids on the acid chlorides of esters of phosphoric and alkylphosphinic acids in an inert medium at 35-40° C.

Unlike dialkylacylthionophosphates, dialkylacylphosphates are thermally unstable compounds. Upon being distilled in a vacuum, they are quantitatively decomposed with the formation of the esters of pyrophosphoric acid and the anhydride of carboxylic acid according to the equation

$$2\,(RO)_2P\overset{O}{\underset{OCOCH_3}{<}} \xrightarrow{t^\circ} (RO)_2P(O)\text{-}O\text{-}P(O)(OR)_2 + (CH_3CO)_2O.$$

The authors noted that the formation of the pyrophosphates on thermal decomposition of acylphosphates was observed only in cases where the acylphosphates did not contain alkylamide groups.

24. Previously Undescribed Esters of Alkylcyanophosphinic Acids Obtained

"Esters of Alkylcyanophosphinic Acids," by K. A. Petrov, L. G. Gatsenko and A. A. Neymysheva; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 6, Jun 59, pp 1,827-1,831

The action of alkyl halides on dialkylcyanophosphites was studied in the present work. The authors supposed that the reaction would take place in accordance with the "Arbuzov Rearrangement" as a result of which the esters of alkylcyanophosphinic acids would be obtained.

$$(RO)_2PCN + R'I \rightarrow \left[(RO)_2P(CN)(R')I\right] \rightarrow \begin{matrix} R' \\ RO \end{matrix}\!\!>\!P(=O)\!<\!CN + RI.$$

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The experimental evidence confirmed this supposition. This method of obtaining esters of alkylcyanophosphinic acids, according to the authors, is a general and suitable one for obtaining any esters of alkylcyanophosphinic acids.

The initial dialkylcaynophosphites were obtained by substituting the chlorine in the dialkylchlorophosphites with the CN-group with the aid of silver cyanide in a solution of dry ether with heat.

25. New Synthesis of Triallylphosphate

"Synthesis of Traillylphosphate," by Ye. V. Kuznetov and R. K. Valetdinov, Kazan Chemicotechnological Institute imeni S. M. Kirov; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 6, Jun 59, pp 2,017-2,018

A new method for synthesizing triallylphosphate has been proposed which consists of passing dry oxygen through triallylphosphite at 70-80°C. The advantages of this method are greater simplicity of synthesis which eliminates the necessity of cooling the reaction at very low temperatures; and the removal of the danger of explosion during distillation.

26. Characterization of the Frequency of the P=S Group

"Vibration Spectra of Organophosphorus Compounds. The Problem of the Characterization of the Frequency of the P=S Group," by Ye. M. Popov, T. A. Mastryukova, N. P. Rodionova and M. I. Kabachnik, Institute of Organo-elemental Compounds of the Academy of Sciences USSR; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 6, Jun 59, pp 1,998-2,006

The examination of the vibration spectra of phosphorus and organophosphorus compounds leads to the conclusion that vibration exists in molecules, containing the P=O group, and this group, mainly, participates in this vibration. Small differences in the frequencies of a given vibration in the spectra of compounds with different substitutents on the phosphorus atom permit its calculation sufficiently to characterize it by frequency. This vibration without exception clearly appears in the combined dispersion spectra and the infrared spectra in the region, 1,200-1,300 cm^{-1}, and serves as a reliable characteristic of the P=O group. Similarly, the spectral characteristics of the P=S group is of very great interest for structural and analytical purposes in the chemistry of phosphorus compounds.

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To locate the so-called frequency characteristics of the P=S group, the authors obtained the infrared and combined dispersion spectra of organic thionophosphorus compounds parallelly with the corresponding thiolophosphorus and phosphorus compounds.

They found that in the investigated compounds the bands, associated with the P=S group are found in the 750-580 cm^{-1} region. The frequency of normal molecular vibration in which the P=S group takes part is sufficiently confirmed by the constitutive effect whereby each type of substitute changes the frequency by a determined amount. The frequencies which pertain to the P=S group maintain constant values only with the same proximate environment at the central phosphorus atom.

Bonds and angles which do not have a common atom with the P=S group take little part in a given vibration and practically do not influence the frequency. The authors hope to achieve conclusive results in this relationship after calculating normal molecular vibrations, the quantitative determination of the characteristic of a given vibration according to frequency and form and a numerical analysis of the dependence of the frequency on the energy and kinematic parameters of the molecule on the basis of the theory of characteristic frequencies.

27. Research on Organophosphorus Compounds: Formation of Anilidoesters of Alpha-hydroxyalkylphosphinic Acids

"The Reactions of Aldehydes and Ketones with Amides of Phosphorous Acids," By V. S. Abramov and I. A. Il'ina, Kazan Chemico-technological Institute imeni S. M. Kirov; Moscow, Doklady Akademii Nauk SSSR, Vol 125, No 5, 59, pp 1,027-1,029

The experimental evidence established that aldehydes and ketones react quite readily with dialkylamido-(anilido)-phosphites.

Diphenylanilidophosphite, pyrocatechinanilidophosphite, and other compounds react quite vigorously with acetaldehyde, propionaldehyde, and benzaldehyde, with the evolution of a considerable amount of heat.

Seven new anilidoesters of alpha-alkoxyalkylphosphinic acids were synthesized and characterized. The physical properties are presented in a table.

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28. Oxidative Chlorophosphination of Nitriles

"Synthesis of Organophosphorus Compounds From Hydrocarbons and Their Derivatives. XI. Oxidative Chlorophosphination of Nitriles," by R. I. Bystrova, Yu. M. Zinov'yev and L. Z. Soborovskiy; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 6, Jun 59, pp 2,088-2,092

Oxidative chlorophosphination of nitriles can proceed in two directions. Nitriles of acids, having four or more C-atoms in the molecule form acid chlorides of cyanoalkanephosphinic acids $C_nH_{2n}(CN)P(O)Cl_2$, i.e. compounds which contain the C-P bond. The first members of a series of nitriles (acetonitrile, propionitrile) and also benzonitrile on interaction with PCl_3 and O_2 form compounds which contain the P-N bond, i.e., derivatives of acid chlorides of imido-N-phosphoric acids, corresponding to the formula $RCCl{=}NP(O)Cl_2$.

The acid chlorides of cyanopropane- and cyanobutanephosphinic acids were synthesized in the investigation.

Two acid chlorides of imido-N-phosphoric acid with the probable structure $C_2H_5CCl{=}NP(O)Cl_2$ and $C_6H_5CCl{=}NP(O)Cl_2$ were obtained.

The authors were not able to separate in the pure state the acid chloride of imido-N-phosphoric acid, which was formed from acetonitrile.

29. Synthesis of Thiosemicarbazide Derivatives of Iminodiacetic Acid

"Thiosemicarbazide Derivatives of Iminodiacetic Acid," by I. Ya. Postovskiy and V. L. Nirenburg, Chair of Organic Chemistry of the Ural Polytechnic Institute im. S. M. Kirov; Moscow, Nauchnyye Doklady Vysshey Shkoly-Khimiya i Khimicheskaya Tekhnologiya, No 2, 59, pp 330-332

Derivatives of iminodiacetic acid have acquired great value as complex-forming compounds. Several of them, the so-called "complexsions," have been used not only in analytical chemistry but even in medicine as detoxicating substances.

In this experiment the authors have added a second group, thiourea, to the iminodiacetic acid base to ensure the formation of salts or complexes with metals. Thiourea was selected because it and several of its derivatives produce a characteristic reaction with salts of various metals and therefore, are used in analytical chemistry. Further, several thiourea derivatives have exhibited antibacterial and antifungal activity.

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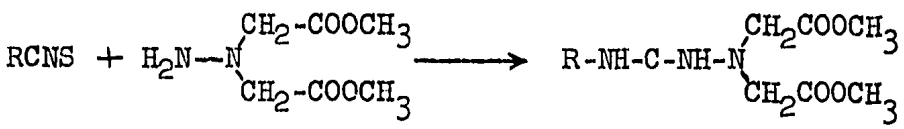
The schematic equation for the synthesis of the N^4-substituted-N^1-thiosemicarbazideiminodiacetic acids is given as follows:



where R = C_6H_5, n-ClC_6H_4, n-$CH_3OC_6H_4$ and 1-$C_{10}H_7$.

The N^4-substituted thiosemicarbazide-N^1-diacetic acids form soluble complexes with bivalent cobalt ions in the pH range from 2.4 to 12. According to the authors, these compounds are of practical interest both for analytical chemistry and for biological tests.

Physical Chemistry

30. Third Ukrainian SSR Conference on Physical Chemistry

"The Third Ukrainian SSR Conference on Physical Chemistry," by V. A. Lunenok-Burmakina, Institute of Physical Chemistry imeni L. V. Pisarzhevskiy, Academy of Sciences, Ukrainian SSR; Moscow, Zhurnal Fizicheskoy Khimii, Vol 33, No 7, Jul 59, pp 1,671-1,673

The Third Ukrainian SSR Conference on Physical Chemistry was held in Kiev at the Institute of Physical Chemistry imeni L. V. Pisarzhevskiy on 22-25 December 1958. Two hundred physical chemists from 49 scientific institutions located in 13 cities participated in the conference. Sixty-eight reports on different problems of physical chemistry that are of essential importance at present were given. In opening the conference, A. I. Brodskiy outlined the problems which physical chemistry must solve and pointed out that modern methods of investigation are not being applied to a sufficient extent in the Ukrainian SSR. This includes infrared and microwave spectroscopy, X-ray diffraction and electron diffraction structural analysis, and isotope methods. Insufficient work is also being done on problems of quantum chemistry.

At one of the plenary sessions, D. F. Kalinovich, I. N. Frantsevich, I. I. Kovenskiy, and M. F. Smolina (Kiev) reported on the acceptor-donor interaction between atoms in solid metal solutions. N A. Izmaylov (Khar'kov) proposed a general equation for the constant of ion-exchange equilibrium, which clarifies some properties of ion-exchange resins and the influence which solvents exert on ion exchange. A report by A. I. Brodskiy

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(Kiev) gave a classification of methods involving the application of isotopes for the investigation of the mechanism of chemical reactions, mentioning methods based on the use of tracer atoms, isotopic exchange, isotopic dilution, and determination of the kinetic isotopic effect.

At meetings of the Section of the Mechanism of Chemical Processes and the Structure of Molecules, V. P. Morozov, G. I. Rybakova, N. K. Morozova, V. N. Khlebnikova, and D. S. Koval'chuk (Dnepropetrovsk) reported on an investigation of pyramidal hydrides and deuterides. In the work described, vibrational frequencies, force constants, and thermodynamic functions were calculated for compounds of this type. M. O. Tereshevich, O. K. Skarre, and T. S. Shelekhova (Dnepropetrovsk) reported on the effect which the nature of the cation has on the mobility of oxygen atoms in nitrates. N. I. Grishko and Ye. N. Gur'yanova (Dnepropetrovsk, Moscow) reported on the isotopic exchange of sulfur in salts and esters of organic thiosulfonic acids.

In the Section of the Theory of Solutions, A. Z. Golik, A. F. Skryshevskiy, P. F. Choplan, and V. Ye. Baranovskiy (Kiev) reported on the results of an investigation of the structure of polyethylsiloxanes and also of their viscosity, density, compressibility, and surface tension.

A report by G. V. Samsonov (Kiev) given at a meeting of the Section of Phase Equilibria and Physicochemical Analysis dealt with the results of an investigation of the physicochemical properties of compounds formed by transitional metals of the IV, V, and VI groups of the periodic system with nonmetals. These properties correspond to the nature of the electron transitions which take place when the metal-like compounds of the type indicated are formed.

Problems of the theory of electrolytes were discussed in eleven reports. Ye. Ya. Gorenbeyn (Kiev) found that as the polarizability of ions increases within the limits of the same group of the periodic system, the degree of orderliness of the electrolytes also increases, with the result that the viscosity of the solution becomes greater. I. O. Galinker, I. M. Rodnyanskiy, and N. A. Belova investigated the heat capacity and the electrical conductivity of electrolytes at high temperatures.

In the Section of Electrochemical Processes, A. I. Brodskiy, I. F. Franchuk, V. A. Lunenok-Burmakina, A. S. Fomenko, T. A. Abramova, and I. L. Gankina (Kiev) reported on an investigation by isotope methods of the mechanism of a number of reactions which form the basis of industrial processes for the production of hydrogen peroxide and of inorganic peracids. V. V. Stender and V. G. Selivanov (Dnepetrotrovsk) presented a paper on the thermal analysis of fluoroborate melts and the mechanism of their electrolysis.

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The mechanism of adsorption and ion-exchange processes was discussed in a report by N. A. Izmaylov and S. Kh. Mushinskaya (Khar'kov), who investigated the effect of the temperature and of molecularly adsorbed additives on the exchange of organic ions by ion-exchange resins and a paper by L. S. Ivanova and D. N Strazhesko (Kiev), who investigated the mechanism of the adsorption of electrolytes on activated carbon.

At meetings of the Section of Kinetics and Catalysis, M. Ya. Rubanik (Kiev) reported on an investigation of the catalytic oxidation of ethylene to ethylene oxide and Ya. B. Gorokhovatskiy and M. Y. Rubanik (Kiev) on the results of an investigation of the electronic interaction of oxygen and ethylene with silver. V. V. Shalya (Kiev) and T. P. Korniyenko (Kiev) presented proofs of the operation of a heterogenous-homogenous mechanism in the oxidation of methane and of butane-propane mixtures. M. A. Piontkovskaya and I. Ye. Neymark (Kiev) reported results demonstrating that titanium dioxide is equivalent to silicon dioxide with respect to its catalytic activity. I. G. Ryss and S. L. Idel's (Dnepopetrovsk) reported results obtained in the investigation of the kinetics of the hydrolysis of dimethylaminetrifluoroboron, trimethylaminetrifluoroboron, and anilinetrifluoroboron. A report on the introduction of a catalytic method for the purification from acetylene and lubricating oil vapors of the air used at oxygen production installations was presented by G. Ya. Turovskiy and V. A. Royter (Kiev).

In regard to work on problems of chemical structure, reaction kinetics and reactivity, the scientific basis for the selection of catalysts, and the synthesis of inorganic adsorbents and ion exchangers, it was brought out that it is possible to expand research in these fields by engaging the assistance of nonacademy institutions of the Ukrainian SSR, particularly chairs of higher educational institutions.

The conference noted that the volume of work done on the Ukraine on these most important problems does not correspond to the requirements of present-day science and practical needs.

As far as work in the field of the theory of chemical structure, reaction kinetics, and reactivity is concerned, one must expand research on intermediate stages of chemical reactions, on the structure of molecules, and on quantum chemistry. In doing this, one must apply more extensively the newest physical and physicochemical methods (those of spectral analysis, electronic and nuclear paramagnetic resonance, etc.).

In the field of work on the scientific basis for the selection of catalysts, it has been regarded as advisable to organize special courses on kinetics and catalysis at universities and chemico-technological higher educational institutions. The publication of textbooks (manuals) on reaction

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kinetics and catalysis and of a series of monographs on industrial catalysts has also been recommended by the conference. Furthermore, improvement of the coordination of work on catalysis was deemed advisable. One must create in the Ukraine a research center for work on the chemical conversion of petroleum products at which adequate emphasis will be placed on problems of catalytic cracking and catalytic processes involved in the conversion of cracking products into reactive intermediate products for heavy organic synthesis.

In the field of work on the scientific basis for the synthesis of inorganic adsorbents, particular attention should be paid to the effect of chemical modification of the surface of adsorbents on their adsorption capacity, the development of methods for the production of adsorbents with pores of molecular dimensions, the development of specific adsorbents for the fine separation of complex mixtures, and the development of adsorbents for the thorough drying of gases.

31. A Hydrogen Condensation Pump

"A Hydrogen Condensation Pump With A Self-Contained Liquefier," by Ye. S. Borovik, B. G. Lazarev, and I. F. Mikhaylov; Moscow, Atomnaya Energiya, Vol 7, No 2, Aug 59, pp 117-121

A hydrogen condensation pump with a capacity of 3.7×10^4 liters per second is described. The pump produces a vacuum of 10^{-9} - 10^{-8} millimeters of mercury. The vacuum is produced as a result of the elimination of molecules by condensation on a surface cooled with liquid hydrogen. So that gases which do not condense (helium, neon, and hydrogen) may be removed, a diffusion pump of the M-2500 12 type is attached to the condensation pump. The total use of power (including the power required for the production of liquid nitrogen used in the hydrogen liquefier) amounts to 17 kilowatts, which is considerably lower than the power used by oil diffusion pumps of the same capacity.

Radiation Chemistry

32. Distribution of Ions in a Liquid Subjected to Irradiation

"The Spatial Distribution of Ions in a Liquid," by V. I. Ivanov; Moscow, Atomnaya Energiya, Vol 7, No 1, Jul 59, pp 73-74

The distribution of ions formed in a liquid as a result of the action of β- or γ - radiation is considered. It is concluded that after irradiation for a sufficient length of time a part of the ions will be distributed

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uniformly through the total volume of the liquid, while another part will be concentrated in cells of a spherical or cylindrical shape. The cells may also have a shape intermediate between the spherical and the cylindrical. Expressions are derived for the background concentration of ions and their concentration in cells of a cylindrical and spherical shape.

33. Application of the O^{18} (α, n) Ne^{21} Reaction for the Determination of the Concentration of α-Active Substances in Aqueous Solutions

"Application of the O^{18} (α, n) Ne^{21} Reaction for the Determination of the Concentration of α-Active Substances in Aqueous Solutions," by V. V. Ivanova, A. I. Nazarov, Ye. V. Polunskaya, A. G. Khabakhpashev, and E. M. Tsenter; Moscow, Atomnaya Energiya, Vol 7, No 2, Aug 59, pp 166-168

The content of α-active substances in aqueous solutions can be determined by measuring the yield of neutrons formed by the reaction O^{18} (α, n) Ne^{21}. Notwithstanding the low concentration of O^{18} in ordinary water, this water can be used for determining the content of α-active substance by the reaction mentioned above because of the high cross-section for the reaction in question exhibited by the O^{18} isotope. The possibility of applying the reaction for practical measurements was tested on solutions of polonium. The yield of neutrons emitted from the solution was measured by a scintillation counter for rapid neutrons. The scintillator used was prepared from paraffin wax and zinc sulfide. It was established that the method proposed makes it possible to determine the content of α-active substances in solutions at a distance, without opening the vessel in which the solution is placed. Concentrations beginning with one to 2 millicuries per meter can be measured. Impurities contained in the solution (such as uranium or plutonium, which emit neutrons) do not affect to a significant degree the results of the determinations. Use of lead screening makes it possible to conduct measurements at a concentration of γ-active substances in the solution amounting to approximately 150 gram equivalents per liter.

34. Sensitization of a Radiation-Chemical Reaction by the Recharging of Ions

"Sensitization of a Radiation-Chemical Reaction by the Recharging of Ions," by M. T. Dmitriyev and S. Ya. Pshezhetskiy, Physicochemical Institute imeni L. Ya. Karpov; Moscow, Doklady Akademii Nauk SSSR, Vol 127, No 2, 11 Jul 59, pp 369-372

The radiation-chemical oxidation of nitrogen with oxygen takes place as a result of the formation of N_2^+ ions. Its velocity is proportional to the effective concentration of these ions. It was established in the experiments described that the concentration of N_2^+ ions and consequently

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also the velocity of the reaction can be increased by adding helium, neon, or argon. The ionization potentials of atoms of these noble gases are higher than that of the nitrogen molecule. Consequently, recharging of ions takes place in a mixture of nitrogen with noble gases that is being irradiated; the ions of noble gases transfer their charge to nitrogen molecules. Although the velocity of the radiation-chemical oxidation of nitrogen is increased by the addition of noble gases, the energy yield of the reaction drops. The reduction of the yield is due essentially to recombination of ions; this problem has been discussed in two articles by the authors of the present communication (cf. Zhurnal Fizicheskiy Khimii, Vol. 32, 1958, p 2418; Vol 33, 1959, p 463)

35. USSR Work on the Treatment of Wood With Penetrating Radiation

"News Items - USSR" (unsigned item); Moscow, Atomnaya Ehergiya, Vol 7, No 1, Jul 59, p 88

Investigations on the effects exerted by penetrating radiation on wood, materials derived from wood, glues, and binders are being conducted at the Central Scientific Research Institute of Mechanical Working of Wood. The action of penetrating radiation brings about various changes in the properties of wood. This includes changes in color, mechanical strength, the capacity to absorb moisture, etc. On the basis of results obtained in the work in question, one can produce materials derived from wood which have characteristics superior to those of natural wood.

36. The Electrical Resistance of Boiling Nitrogen Being Irradiated in a Nuclear Reactor

"Measurement of the Electrical Resistance of Boiling Nitrogen Being Irradiated in a Reactor," by Yu. K. Gus'kov and A. V. Zvonarev; Moscow, Atomnaya Energiya, Vol 7, No 2, Aug 59, p 165

Changes in the electrical resistance of liquid nitrogen during irradiation in a nuclear reactor were measured. To investigate changes produced in solids by radiation, one must conduct experiments on irradiation of the solid substances in question within an extensive temperature range, beginning with very low temperatures. Low temperatures are maintained by cooling the samples of solid substances with liquid gases. Liquid nitrogen is the most convenient cooling agent for this purpose. Furthermore, nitrogen has a low activation cross-section, which facilitates work with it. To measure the electrical properties of substances irradiated in liquid nitrogen, one must know the electrical resistance of the nitrogen under the conditions in question.

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37. Disproportionation of Tetravalent Americium

"Disproportionation of Am (IV)" by A. A. Zaytsev, V. N. Kosyakov, A. G. Rykov, Yu. P. Sobolev, and G. N. Yakovlev; Moscow, Atomnaya Energiya, Vol 7, No 1, Jul 59, pp 69-71

Several anhydrous compounds of Am (IV) are known. These compounds are quite stable. However, the presence of Am (IV) in aqueous solutions has not yet been established. The reason that is the high redox potential of the pair Am (III) - Am (IV), because of this high redox potential, tetravalent americium is reduced to trivalent americium by water. The ratio of Am (IV) to Am (III) observed after disproportionation of Am (V) can be explained by the occurence of one or both of the following reactions parallel to the disproportionation of pentavalent americium:

$$2\ Am^{4+} + 2\ H_2O = Am^{3+} + Am\ O_2^+ + 4\ H^+ ;$$

$$Am^{4+} + Am\ O_2^+ = Am^{3+} + Am\ O_2^{2+}$$

Experimental results which indicate that both of these reactions take place are presented in the paper.

38. Formation of Radioactive Aerosols in the Synchrocyclotron Building of the Joint Institute for Nuclear Research

"Radioactivity of Aerosols in the Synchrocyclotron Building of the Joint Institute for Nuclear Research," by V. P. Afanas'yev; Moscow, Atomnaya Energiya, Vol 7, No 1, Jul 59, pp 74-75

It was established that radioactive aerosols are formed in the Synchrocyclotron Building of the Joint Institute for Nuclear Research. It is concluded on the basis of the results described that the radioactivity of the aerosols is caused by the presence of Na^{24}. The concentration of Na^{24} that is reached corresponds to 0.001 of the maximum permissible concentration of this isotope.

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39. Hungarians Review 10 Years of Chemical Industry Research

"Concerning a Decade of Work at the Heavy Chemical Industry Research Institute," by Gyorgy Koranyi, of the subject institute; Budapest; Magyar Kemikusok Lapja, May 59; Vol XIV, No 5; pp 181-186

The Heavy Chemical Industry Research Institute ((Nehezvegyipari Kutato Intezet, NEVIKI) was established in Veszprem in 1949 on the basis of a government decree with the mission of performing the research necessary for the technical development of the inorganic and coal-processing chemical industry. Construction of a central laboratory building began immediately and in 1952 the researchers in Veszprem moved into one of Europe's most modernly equipped research establishments. During the past 10 years, the regime has aided the development of research with the investment of about 50 million forints so that today NEVIKI has a whole series of laboratories and experimental plants in addition to its central building. During its first 10 years, NEVIKI initiated and completed about 180 research projects of varying importance. In contrast to the several million forints spent on the experiments on coking Borsod brown coals, there were jobs which required only a few engineer-days. In general, it can be stated that as a result of the industrial utilization of researches completed by the Institute the economy has saved 5.5-6.0 million forints per year; if we take into consideration the economic results to be expected from researches currently being realized, the yearly average comes to 13-15 million forints. In the past 10 years, NEVIKI has published about 150 research reports and about 50 other publications.

1. Inorganic Chemistry Industry Researches

We participated in the development of several detailed problems during the designing of the Borsod Chemical Combine -- small-scale and full-scale experiments on coke gasification with oxygen-enriched air and selection of reagents for extracting carbon monoxide. We developed a procedure for utilizing the nitrogen oxide content of the gases resulting from oxidation of ammonia, using mechanical absorption equipment.

In developing new synthetic fertilizer manufacturing processes, we must give first place to nitric acid phosphate digestion. We worked out in detail the technology for the manufacturing of dicalcium phosphate, and then, in the interest of the economic advantages to be expected, the manufacturing process for mixed NP artificial fertilizer. While working out these technologies we focused much attention on the extraction of valuable by-products from "Kolafoszfat" -- fluorine and the oxides of rare earth metals. Plant growth experiments proved the effectiveness of dicalcium phosphate; with the same phosphous pentoxide content, dicalcium phosphate

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produced a 25-30 percent increase over the superphosphate. The process is being put into practice in as much as a double-synthetic fertilizer plant with a 30,000-ton per year capacity is being built at the Borsod Chemical Combine site. The laboratory experiments were finished in 1952 but the first experimental plant will begin operation only in 1962 or 1963.

Our researches, aimed at increasing domestic fluorine production, were completed with good results. The effectiveness of extracting fluorine released during the manufacture of superphosphate could be significantly increased by certain improvements in present procedures. We could recover 80 percent of the fluorine content of "Kola" apatite with nitric acid phosphate digestion. We developed a process, new to the world at large, for producing aluminum fluoride; and we solved the production problems of synthetic cryolite. We developed two processes, according to the initial raw material, for this purpose; of these, the processing of sodium silicofluoride into cryolite is the more significant from the economic viewpoint. Our aluminum fluoride process will be used in the superphosphate factory being built in Szolnok; our cryolite manufacturing process will be used only in designing the mixed synthetic fertilizer factory.

We focused less attention on the problems of sulfuric acid and superphosphate manufacture; our most significant achievement in this area was the development of fluidization pyrite calcination -- practical use of this has been delayed despite the economic results to be expected. We set up equipment for the qualitative examination of sulfuric acid factory catalysts and the industrial tests of the catalysts proved our examination results to be useful.

Among the synthetic fertilizers which are the cheapest and simplest to manufacture, we developed, on a semiplant scale, a domestic "Rhenania" type artificial phosphate fertilizer and its effectiveness is not much less than the superphosphate.

In the area of artificial potassium fertilizers, we opposed, on the basis of economic considerations, the digestion of the Kanyahegy trachyte which contains 10 percent K_2O, and we recommended direct use of fine potassium trachyte grist as a synthetic fertilizer.

To supplement the phosphate needs in animal fodders, we recommended the utilization of our process for the manufacture of dicalcium phosphate in a plant large enough to satisfy the needs of animal husbandry.

We developed a process for the production of MgO from domestic dolomite, suitable for the manufacture of magnesite. According to our process, we digest the dolomite with carbonic acid in a water suspension

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at a pressure of about 20 atmospheres. If the process were realized, not only would there be direct import savings but also our refractory materials factories would be getting magnesite of uniform good quality as compared to the present substandard quality of supplies.

In recent years, we have done work on developing the technology for inorganic dry pigments and on developing processes for new products. Thus, by using domestic titanium ore concentrate we succeeded in producing experimental quantities of rutile-type titanium dioxide pigments and we greatly improved the manufacturing technology for chrome oxide green.

NEVIKI has worked on operational and automation problems for only a few years. We developed the necessary equipment for the spray drying of pulpy materials; we surveyed several factories from the viewpoint of metering techniques and automation; and we designed several simple instruments for the automatic recording and regulation of a few industrial processes. Naturally, problems in this area will increase in the future.

2. Coal-Processing Chemical Industry Researches

Initially, the Institute had inherited some research projects concerned with the processing of peat and we began with some of the simpler problems connected with the processing of tar. As the coking of brown coal moved into the foreground, the institute joined in this work; and in 1953, in connection with the supplying of coal to the Sztalinvaros Coking Works, we began to work on the coking of black coal. We studied various methods of gas desulfurization relatively early and we began to deal with a cadastral survey of black and brown coals rather late. Our work was strongly influenced in many cases by outside factors; e.g., the coking experiments on Borsod brown coals with the equipment available in Pecs had to be done on the basis of viewpoints determined in advance primarily by others.

We can summarize the more important results of our work on coal chemistry as follows.

We worked out a process for handling, distilling, and coking various domestic peats, for the manufacture of activated carbon from peat, and for the extraction of humic acids. We developed a process for recovering the monosubstitutedphenol content of gas liquors through distillation; we established the possibilities for using monosubstitutedphenols and disubstitutedphenols extracted by the phenosolvane [sic] process; and we developed a process for the preliminary purification of gas liquors and for anihilation of disubstitutedphenols remaining in the gas liquor. We introduced a phenol recovery process at the Obuda Gas and Coke Works. We

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implemented several technological modifications at the phenol factory of the Dorog Coal Processing Chemical Industry Enterprise. We established the data necessary for the distillation of domestic brown coal tars in pipe furnaces.

We did systematic work in recovering and refining several important constituents of domestic black coal tars. We developed technological procedures for the more effective recovery of naphthalene, anthracene, pyridine bases, coumarone resin, and carbazole, and for their refinement to various degrees of purity. We succeeded in producing fluorescent anthracene of exceptional purity usable for scintillation purposes.

We developed our diphenolate gas desulfurization process and solved several problems in the area of activated carbon gas desulfurization, gas purifying mass regeneration, and sulfur recovery; we carefully examined the domestic possibilities for the most important desulfurization processes and made recommendations for the desulfurization of the various industrial gases. We participated in developing the coking technology for the Borsod brown coal and we developed further the original two-phase technology in several respects. We participated in the selection, through experimentation, of a technology suitable for the low temperature distillation of domestic brown coals.

We developed our own special and highly effective type of furnace for coking brown coal. We tested the coking characteristics of the more important domestic brown coals in our experimental plant. In cooperation with the Mining Research Institute we developed a method for preparing a cadastral survey of domestic coals and we participated in development of coal classification tests. The chemical industry cadastral survey of the Trans-Danubian brown coal deposits is nearing completion as is the classification of our Mecsek black coal deposits. The cadastral survey includes, among other things, an examination of germanium and gallium contents of coals. The presently operating germanium oxide plant uses a technology developed by us.

We developed a manufacturing process for carbon zeolite using sulfonation of Varpalota lignite, and we introduced this process in the Budapest Sulfuric Acid Factory.

3. Researches Directed at Developing Silicate Chemistry Industries

The Silicate Department worked at the institute only from 1952 to 1956. We developed processes suitable for the production of several new optical and technical glasses. While studying the problem of producing fused basalt, we developed a process for the production of a crystalline synthetic stone out of waste materials which approximates the composition of basalt and which surpasses its technological qualities.

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On the basis of X-ray structural analysis and crystal chemistry considerations, we developed a process for the manufacture of silica brick from domestic sand and sandstones and for the manufacture of a stabilized dolomite brick. With a geological, mineralogical, and structural examination of Pilis coal ash found by the Coal Processing Department, we succeeded in identifying the rocks accompanying the coal deposits and introduced use of these refractory materials.

4. Research Done in the Area of Protection Against Corrosion

Our Corrosion Deparment was formed on 1 August 1950, when the corrosion research laboratory of Szeged Science University was transferred [to us]. In its first years, the department worked on several minor but urgent problems, especially on an examination of the corrosion resistance properties of aluminum and certain steels. Even in this first period, intensive work was done on problems of cold and hot phosphate coating. In 1951, we began research work on the introduction of cathode protection and on inhibitors effective under various circumstances. Beginning in 1952, the department has been increasingly concerned with introducing corrosion protection methods into industry and giving advice in the various areas. We are doing systematic research in the following most important areas: protection of metal surfaces by metal and lacquer sheathing; corrosion defense of power plant equipment; use of cathode protection in the most varied areas; corrosion protection of agricultural machines and tools; and special chemistry industry corrosion problems.

We have done especially fundamental and profound examinations in the area of contact corrosion of aluminum. We have worked on the development of bauxite-base paints. We participated in designing and introducing cathode protection in petroleum pipelines. We determined the necessary interdependencies for designing cathode protection of tanks and reservoirs and we participated in the designing of such equipment.

We did research on the causes of boiler corrosion, on the prevention of intercrystalline corrosion of power plant and locomotive boilers, and on the development of inhibitors for use in acid treatment of power-plant condensers. We achieved results in classifying lead types for chemical industry purposes and we developed lead alloys. We worked on the classifications of acid-resistant steels, intercrystalline corrosion of acid-resistant steels, and problems of corrosion in acid-resistant welds. We also worked on corrosion problems appearing during processing of the Nagylengyel oil.

In 1954, we organized corrosion exposure stations in ten rural areas meteorologically most characteristic. There are 3,600 sample sheets in each station. We worked out a 10-year observation plan.

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In 1958, we opened our Budapest corrosion counseling office which can do minor laboratory work.

5. Other Researches

We worked, from the beginning, on organic silicon compounds, primarily with problems of producing various monomers. In 1952, we gave this work to the Synthetics Industry Research Institute.

We have been using a quartz spectrograph for spectral emission analysis and we have cooperated with the spectrography laboratory of the Hungarian Petroleum and Natural Gas Experimental Institute in the field of absorption spectral analysis. We have examined the germanium content of coal ash, impurities in synthetic magnesium oxide, etc.

Our polarographic laboratory has aided greatly in doing series examinations.

We based our silicate chemistry research primarily on X-ray and differential thermal analyses.

In 1956, we built our completely modern radio chemistry laboratory in Veszprem. We worked with radioactive isotopes received from the Soviet Union and we achieved valuable results in explaining the mechanism of ion exchange reactions.

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III. ELECTRONICS

Automation and Computers

40. Automatic Control and Computer Engineering Conference To Be Held in Moscow

"Announcement," (unsigned article); Moscow, Promyshlenno-Ekonomicheskaya Gazeta, 30 Aug 59

The Central Board of the Scientific Technical Society of the Instrument Building Industry announces that a Scientific Technical Conference on Automatic Control and Computer Engineering will be held in Moscow from 6 to 10 October, 1959.

All inquiries and communications should be sent to the following address: Moscow, G-19, Volkhonka, 5; Telephone, B-3-32 46.

Communications

41. Information-Carrying Properties of Laguerre Functions

"Experimental Investigation of Laguerre Function Separation Methods" by A. G. Leont'yev; Moscow, Radiotekhnika, No 8, Aug 59, pp 22-25

The article describes a communication system which utilizes the Laguerre function as information carrier. Since the Laguerre function is orthonormal, it is adaptable to separation, the condition required for transmission of information.

The separation of Laguerre functions can be accomplished by two methods: by utilizing directly the property of orthogonality, or by applying a Duhamel integral which connects the results of action of the linear system (filter) with the action proper through the filter response. A communication system model was built in which both methods of separation could be tested. The system was composed of the following units: a forming circuit for obtaining first five Laguerre functions, a blocking oscillator generating singular pulses, an adder unit which would add any two Laguerre functions, commutation block from which Laguerre functions were taken off for transmission to the adding unit, and multiplying and integrating units. The error in separation with this method did not exceed 1/20 in the extreme case.

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This experiment, conducted for the first time in this field, has proven in principle the possibility of practical separation of Laguerre functions. Further experimentation is needed to refine the process of separation.

42. Newly Assigned Amateur Frequency Bands

"New Amateur Frequency Bands," (unsigned article); Moscow, Radio, No 7, Jul 59, p 16

The article contains the following passage:

"The...changes will become effective 1 August 1959. The operation of amateur radio stations on 1,470-1,520 and 5,650-5,850 Mc bands will be discontinued on the same date. Thus, the radio amateur will retain only the following ultrashort wave ranges: 28.0-29.7, 144-146, and 420-435 Mc. The transmitter power should not exceed 5 w for the frequency ranges of 144-146 and 420-435 Mc."

43. Multichannel Communication System "Vesna"

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"Multichannel System 'Vesna'," by G. Agrikolyanskiy; Moscow, Radio, No 7, Jul 59, pp 6-7

The radio-relay equipment P-600 "Vesna" was designed at the State Scientific Research Institute of the Ministry of Communications in cooperation with a number of other scientific institutions. The automated radio-relay equipment P-600 "Vesna" can operate five two-way wide-band trunk channels over a distance of several thousand kilometers. Each trunk is capable of handling 600 telephone conversations simultaneously, or one black-and-white TV channel.

Such a radio-relay system, when designed for a distance of 2,500 km, will have nine different points at which the telephone channels can be separated out or new ones introduced.

At present it is expected that the P-600 system will be able to serve the needs of the country for intercity communication for a considerable time to come. The radio-relay system P-600 operates in the ultrashort wave range and has an operating band of 500 Mc, which is divided into 16 radio channels. The P-600 system utilizes parabolic reflectors which are connected to high-frequency equipment by wave guides. The intermediate frequency used in the system is 70 Mc.

To improve the reliability of the system, an automatically controlled redundancy is incorporated. The P-600 system is designed to draw its power from a 50-cycle, 220-v supply line.

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44. Reduced Dimensions for Pulse Transformer

"Method of Demagnetizing Pulse Transformer Cores," by R. Kh. Bal'yan, V. I. Laletin and I. V. Trofimov; Moscow, Radiotekhnika, No 8, Aug 59, pp 40-42

The dimensions of pulse transformers can be substantially reduced by applying core demagnetization. The author suggests a new method for core demagnetization of pulse transformers, in which the source of demagnetizing current -- a rectifier -- is connected in series with the secondary winding in such a manner that the demagnetizing and operating current flow in the same direction. For normal operation of the circuit, the core should be fully demagnetized at the beginning of the operating cycle. The magnetizing current can be disconnected during the intervals between the pulses, but in such cases it is important that it recover its stable value before the start of an operating pulse.

One of the advantages of this method is that the operating and demagnetizing circuits are common and that all of the coils of the secondary winding are used to demagnetize, thus reducing the current to minimum.

The validity of the described method was fully confirmed by a series of actual tests with pulses of 50 millisecond duration. The over-all dimensions of a pulse transformer can be reduced almost to a tenth by applying core demagnetization.

45. Surface Problems with Transistors at East German Manufacturing Plant

"Surface Problems In Junction Semiconductors," by H. H. Plagemann, Kleinmachnow; Berlin, Nachrichtentechnik, No 7, Jul 59, pp 292-295

Experimental findings show that alloyed diodes with similar dimensions and arrangement, such as the collector-base junction of a pnp-transistor produced by alloying a lead-antimony bead into p-germanium, react only very slightly to moisture in a nitrogen atmosphere, and practically not at all in oxygen. The formation of a short-circuit channel by adsorbed water in the narrow zone of recrystallization is not possible in such a case, since the zone consists of p-germanium. On the other hand, in thoroughly dried diodes of this type, during the changeover from dry nitrogen to dry oxygen, a current increase has been observed, which is traced back to the formation of a p-channel in the recrystallization zone as a result of the oxygen adsorption.

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At the VEB Werk fuer Bauelemente der Nachrichtentechnik, "Carl von Ossietzky," in Berlin-Teltow, a sealed assembly line (air-conditioned chambers with "rubber-glove" access by assembly workers from outside) has been erected for the sealing operation on alloyed germanium pnp-type transistors. After etching, the transistor does not come into contact with the outside air, and is expelled only after being encapsulated. At present, dry air is being used as the protective gas, since the effect of small amounts of residual water can be compensated by the oxygen of the air, or by a pure oxygen atmosphere. This has been demonstrated clearly by measurements of the emitter-collector current.

When a component is sufficiently dried, however, the oxygen presumably produces a disadvantageous effect by forming a p-channel in the base area. The lowest emitter-collector current values are then measured in a dry nitrogen atmosphere. An encapsulment in nitrogen should also prevent oxidation process extending over a long period of time.

Other surface problems are being encountered in semiconductor manufacture. There is very little information available on the influence of the etching and the rinsing which follows. Little is known also about the effect of slight impurities in the etching chemicals. The entire field is still in a state of flux, and essential improvements in the surface quality and stability of germanium components are to be expected in the coming years.

Materials

46. The Effect of Radiation on Ferrites

"The Effect of Radiation on the Magnetic Properties of Ferrites," by N. M. Omel'yanovskaya; Moscow, Atomnaya Energiya, Vol 7, No 1, Jul 59, pp 66-68

The effect of nuclear radiation on the magnetic properties of ferrites was investigated to establish to what extent the functioning of ferrites used as memory cells in equipment exposed to radiation is impaired by the effects of radiation. ZK-210 ferrites having the shape of toroids were tested in a vertical experimental channel of a nuclear electric power station. The ferrites were irradiated with neutrons and γ-rays. On the basis of the results obtained, it is concluded that when ferrites are used as memory cells in equipment operating in neutron and γ-ray fluxes greater than 9×10^{11} - 5×10^{12} neutrons per square centimeter per second, one must provide automatic modification of the matrix current or cool the ferrites to the temperature required to offset the effects of irradiation.

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Patents

47. Recent Soviet Patents in the Field of Electronics

"Class 21. Electrical Engineering," (unsigned article); Moscow, Byulleten' Izobreteniy, No 14, 1959, pp 13-24

Class $21a^1$, 7_{05}. No 121141. by G. A. Yemel'yanov and V. I. Kirsanov. Device for Determination of Density Distribution-Probability of Complete Start-Stop Distortions.

Class $21a^1$, 11_{01}. No 121142. A. B. Pugach, Ye. T. Darov and Z. S. Pashchenko. Electronic Generator of Test Telegraph Combinations.

Class $21a^1$, 20. No 121143. L. A. Poznyak and V. V. Yefremov. Polarized Relay.

Class $21a^1$, 32_{04}. No 121146. A. S. Yukhnevich. A Method of Frequency Modulation of Video Signals at Low Modulation Index and the Device to Accomplish It.

Class $21a^2$, 18_{01}. No 121147. E. N. Ulanovskiy. Device for Obtaining Automatic Bias in Variable Voltage Amplifiers.

Class $21a^4$, 6_{01}. No 121148. D. M. Kazarnovskiy. Seignetto-Electric Device for Frequency Doubling of Three-Phase Voltage.

Class $21a^4$, 6_{01}. No 121149. D. M. Kazarnovskiy. Seignetto-Electric Converter of Three-Phase Voltage.

Class $21a^4$, 8_{04}. No 121151. by A. B. Tatarinov. Device for Forming of Statistically Distributed Pulses With Respect to Amplitude and Duration.

Class $21a^4$, 42. No 121153. by S. I. Yevtyanov. A Method for Automatic Adjustment of Oscillator Frequency.

Class $21a^4$, 71. No 121155. Ye. B. Isserlin and Z. G. Ryzhik. Device for Taking the Phase-Frequency Response of Four-Terminal Network.

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Wave Propagation

48. Band-Width of Pulses With Cosine-Square Rounded-Off Edges

"Frequency Band Required in Transmission of Pulses With Cosine-Square Rounding-Off," by M. S. Gurevich; Moscow, Elektrosvyaz', No 8, Aug 59, pp 38-42

The article analyzes symmetrical pulses, the central portion of which has a rectangular form, while the edges are rounded off according to the cosine-square law. The data obtained in this experiment is useful in making decisions as to whether pulses with rounded-off edges according to cosine-square law, or trapezoidal pulses should be used.

The author draws a conclusion that the pulses with rounded-off edges (cosine-square law) require a somewhat wider frequency band than the trapezoidal pulses; however, the pulses with cosine-square rounding-off have the advantage of a more rapid decay for outside-the-band radiation, especially when mistuning is high.

49. Multielement Omnidirectional Antenna

"Multidipole Antenna With Circular Polarization," by A. L. Drabkin; Moscow, Radiotekhnika, No 8, Aug 59, pp 3-7

Up to now, no suitable antennas with an equiamplitude field of circular polarization and of large space angle, of the order of 180°, were available.

A new type of antenna is proposed by the author, which radiates in such a manner that one section of it forms a field of circular polarity in the direction along the axis of the system, changing into a field of linear polarization in the plane perpendicular to the axis. The other section of the antenna does not radiate along the axis but forms an auxiliary field shifted 90° with respect to the field of the first part of the antenna.

Such an antenna has a circular polarization with a wide-angle radiation pattern in two perpendicular planes. The antenna is built with eight half-wave dipoles, in such a manner that four of the dipoles are located at the corners of an imaginary cube, while the other four dipoles are placed in pairs at 90° to each other and at the two faces of the cube which intersect perpendicularly the first four dipoles. The planes passing through the vertical dipoles are displaced by an angle of 45° with respect to the planes passing through the horizontal vibrators.

The radiation pattern of this antenna array has the form of a cordioid, and the field polarization is approximately circular.

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IV. ENGINEERING

50. Analogy Methods in Aerohydrodynamics

Metody Analogiy v Aerodidrodinamike (Analogy Methods in Aerohydrodynamics), State Publishing House of Physico-mathematical Literature, Moscow, 1958, 324 pp

Analogy methods used in solving problems in aerohydrodynamics are described in a book which claims to be the first to give a fairly complete coverage of the subject. The first chapter contains general information on analogy methods and a brief history of their development and application. The second chapter covers the basic equations of aerohydrodynamics to an extent necessary for understanding the material in the last three chapters, which develop analogy methods for electrohydrodynamics, magnetohydrodynamics, and gas hydraulics. Individual problems introduced as examples are flow around a single wing profile, flow through a curved grid, and motion of gas in jets. The solutions obtained by using analogy methods are compared with theoretical solutions and wind-tunnel studies.

51. Cohesion Modulus to Predict Cracking in Brittle Materials Proposed

"On Equilibrium Cracks Forming in a Brittle Fracture," by G. I. Barenblatt, Institute of Geology and Mining of Mineral Fuels, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 127, No 1, 1 Jul 59, pp 47-50

Equilibrium cracks in brittle materials, meaning cracks whose dimensions do not change under a given load, are considered. The crack is assumed to be divided into two regions: the inner region, where opposite edges of the crack are a considerable distance apart and interaction between them is negligible, and the end region, where edges of the crack are close together and act on one another with a considerable cohesive force. A new universal characteristic of a material is introduced and called the "cohesion modulus." It has dimensions of force divided by length to the 2/3 power. It is shown that the dimensions of a crack are uniquely determined by the force acting on the material and the cohesion modulus for the material.

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52. Molybdenum Disulfide -- a New High-Duty Lubricant

"Molybdenum Disulfide -- a New Grease for Light Industrial Machines," by Candidate of Technical Sciences, Docent G. A. Bobrovnikov, Engineers N. A. Belentsova and M. M. Bolilyy, Kiev Technological Institute of the Light Industry; Kiev, Izvestiya Vysshikh Uchebnykh Zavedeniy -- Tekhnologiya Legkoy Promyshlennosti, No 2, 59, pp 105-110

Tests performed with molybdenum greases obtained in East Germany have shown that MoS_2 is an effective greasing material and can be widely used to improve operating conditions and prolong the service life of light-industry machine parts and assemblies.

Purified and refined natural MoS_2 does not lose its lubricating properties in the temperature range from - 70° to + 450°C and is characterized by high chemical stability since it is not soluble in cold or boiling water and slightly soluble in all acids (except boiling concentrated nitric acid) and other chemicals (except Cl_2 and F_2).

The authors recommend the organization of production of MoS_2 from domestic raw materials and the expansion of research on its use.

53. Lack of Mechanization in Instrument Building

"Most Important is the Wider Introduction of Automation," by B. Grigor'yev, Chief Engineer, Scientific Research Institute of Aviation Technology; Moscow, Izobretatel' i Ratsionalizator, No 7, Jul 59, pp 1-2

The article contains the following passage:

"Notwithstanding the definite progress of the Soviet instrument building industry, it is still unable to provide the necessary quantity and required types of instruments and means of automation to a great number of industrial enterprises.

"What now hinders the production of instruments and where is the bottleneck?

"This question can be answered in just two words: manual assembly. Unfortunately, it is still widely used in instrument building.

"At many enterprises in this field of industry, only the simplest fixtures and inefficient means of production control are still widely used.

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"Here the automated assembly processes are only in their initial stage. Only low precision instruments, consisting of a few components, are assembled now with the aid of automated assembly devices. And in assembling even simple instruments of higher precision, such automated assembly devices are used only in a few isolated instances."

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54. New Trends in Hydroelectric Power Plant Construction

"Problems of Hydroelectric Power Plant Builders in the Light of July Resolutions of the Central Committee of the CPSU," by I. T. Novikov, Ministry for Construction of Electric Power Stations; Moscow, Gidrotekhnicheskoye Stroitel'stvo, No 7, Jul 59, pp 1-3

The article contains the following passage:

"In 1958, Comrade N. S. Khrushchev subjected the hydroelectric power-plant builders to a severe but just criticism for the high cost of construction of hydroelectric installations. This criticism awakened a great number of hydroelectric power-plant builders to the reality that a radical revision of old concepts and approaches, as well as substantial revamping of the whole business of design and building of hydraulic power structures was needed.

"With great satisfaction it can be noted that at present there are on hand new suggestions and design developments which radically change the whole approach to the principles of construction of hydraulic power plants. The main elements of innovation here will be the introduction of prefabricated-concrete structural units up to 500 tons (at Saratovskaya Hydroelectric Station), structural components from rolled reinforced concrete (Kievskaya Hydroelectric Station), and structural members from light-weight concrete (Sovetskaya Hydroelectric Station on the Neman River).

CPYRGHT

55. Five Hundred-KV Voltage Surge Arresters

"On the Requirements for Arresters Used as Protection Against Voltage Surges," by M. L. Levinshteyn and K. P. Kadomskaya, Leningrad Polytechnic Institute; Moscow, Elektrichestvo, No 8, Aug 59, pp 9-14

In conjunction with the increase of the operating voltage of the 400-kv transmission lines to 500 kv, the relative dielectric strength of the power line insulation has been substantially lowered, so that the problem of protection against voltage surges has become more acute. One of the measures against such overvoltages is the use of special arresters.

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In the case of the Votkinskaya Hydroelectric Station -- Sverdlovsk transmission line, the greatest danger from voltage surges arises in cases when the connection to the power line is done from the Votkinskaya Station, and when the number of generators connected to the bus-bars of the station is small. Practice has shown that in case of such connection to the power line, a multiple discharge occurs at the arrester, a condition for which the older models of arresters were not designed. To improve the operating conditions, a new model arrester was designed at the All-Union Electrical Engineering Institute imeni Lenin. This new arrester was studied for its operating characteristics with the aid of an analog computer at the Laboratory for High-Voltage Currents imeni Gorev of the Leningrad Polytechnic Institute. The investigation has proven that this type of arrester could operate satisfactorily for more than two successive discharges; however, the characteristics of this arrester require further improvement in the speed (up to 0.003 sec) of the gap's dielectric strength restoration.

56. Explosion Method of Rapid Shaft Sinking

"It is Possible to Sink Shafts With the Energy of Explosion," by A. Osipov; Moscow, Izobretatel' i Ratsionalizator, No 7, Jul 59, p 11

The associates of the Central Scientific Research and Planning-Design Institute for Underground and Mine Building have been working since 1957 on the development of a new speedy method of shaft sinking. In this new process liquid explosives are admitted through a special pipeline to the orifice of the drilling bit. At the exit from the orifice the liquids form an explosive mixture to which a small amount of detonator is added. The resulting explosion crushes the rock in the vicinity of the bit to a fine pulp.

The experimental data disclosed that this new explosion method is capable of sinking a 3.6-m diameter shaft at a rate of one meter in depth in 4 min, and a shaft of 8 meters in diameter at a rate of one meter in depth in 25 min. This is approximately ten times faster than with conventional methods.

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57. New Measuring Microscope Developed

"Precision Measuring Microscope for Measuring Small Dimensions," by V. Ye. Kostin; Moscow, Izmeritel'naya Tekhnika, No 5, 59, pp 18-19

A precision measuring microscope has been developed at the Bureau of Interchangeability of the Committee of Standards, Measures and Measuring Instruments. This microscope can measure small dimensions by the noncontact method. The limits of measurement are 0.01-2 mm.

Measurements are conducted by absolute and comparative procedures. The first is accomplished with the aid of a helical ocular micrometer; the second, by comparison with a terminal measure mounted between the supports.

58. Congress of Inventors and Innovators To Be Held

"On Calling the First Congress of the All-Union Society of Inventors and Innovators," (unsigned article); Moscow, Pravda, 22 Aug 59, p 4

"The Organizational Committee of the All-Union Society of Inventors and Innovators wishes to inform delegates that the first congress of the All-Union Society of Inventors and Innovators will be held on 22 September 1959 in the city of Moscow."

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59. Integro-Differential Operators

"Functions Analytical With Respect to Some Integro-Differential Operators and Their Applications," by Yu. M. Valits'kiy, Chernovitsy State University; Kiev, Doklady Akademii Nauk Ukrainskoy SSR, No 3, May/Jun 59, pp 237-240

The operator

$$\Lambda[y] = y^{(n)}(x) + \sum_{i=0}^{n-1} p_i(x) y^{(i)}(x) + \sum_{i=0}^{n-1} \int_{x_0}^{x} H_i(x,t) y^{(i)}(t)\, dt =$$

$$= L[y] + H[y], \qquad (1)$$

is considered where the functions $p_0(x), \ldots, p_{n-1}(x)$ are assumed continuous and $H_0(x,t), \ldots H_{n-1}(x,t)$ are assumed measurable and bounded for $a<x,\ t<b;\ x_0 \in (a,b)$. A number or facts which hold in the theory of ordinary analytical functions are proved for functions which can be expanded into the series $f(x)=\sum_{m=0}^{\infty} a_m \varphi_m(x,x_0)$, the coefficients of which satisfy the condition $|a_m| \leq B^m m!$ $(m=1,2, \ldots)$. The local equivalence of any two operators of the type (1) is established.

The local equivalence of the Volterra-type operator $Sf(x)=\int_{x_0}^{x} S(x,t) f(t)\, dt$, $x \in [x_0, j]$, given in the family $C[x_0,j]$ of functions continuous on $[x_0,j]$, the kernel of which satisfying the conditions

1) $S(x,x)=\left.\frac{\partial}{\partial x} S(x,t)\right|_{t=x} \equiv \ldots \equiv \left.\frac{\partial^{n-2}}{\partial x^{n-2}} S(x,t)\right|_{t=x} \equiv 0;$

$\left.\frac{\partial^{n-1}}{\partial x^{n-1}} S(x,t)\right|_{t=x} = p(x) \neq 0$; $p(x)$ bounded; and 2) existence of the bounded derivatives $\frac{\partial}{\partial t} \frac{\partial^n}{\partial x^n} \left[\frac{S(x,t)}{p(t)}\right]$, is proved with an operator of n-fold integration as an application.

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60. Sequences of Linear Aggregates Form From Solutions of Differential Equations

"On the Problem Concerning Sequences of Linear Aggregates, Formed From Solutions of Differential Equations," by A. F. Leont'yev; Moscow, Matematicheskiy Sbornik, Vol 48(90), No 2, Jun 59, pp 129-136

CPYRGHT The following is a translation of the introductory part of the above cited article:

We designate by $y_j(z,\lambda)$ $(j=1,2, \ldots ,s)$ any linearly independent solutions of the equation

$$\sum_{j=0}^{s} Q_j(z)\, y^{(s-j)}(z) = \lambda^s y, \tag{1}$$

where the $Q_j(z)$ are several analytical functions and λ is a parameter (generally speaking, complex). Let $\lambda_1, \lambda_2, \ldots, \lambda_n, \ldots$ be any sequence of values of the parameter λ. In the work by the author, "On Sequences of Linear Aggregates, formed from Solutions of Differential Equations," Izv. AN SSSR, seriya matem., Vol 22, 1958, pp 201-242, (in it instead of λ^s in the right side of (1) λ appears, which is unimportant) several properties of sequences of linear aggregates

$$P_n(z) = \sum_{k=1}^{p_n} \sum_{j=1}^{s} a_{kj}^{(n)}\, y_j(z, \lambda_k) \quad (n = 1, 2, \ldots) \tag{2}$$

($a_{kj}^{(n)}$ are constants) are indicated, compiled from the solutions $y_j(z, \lambda_k)$, which converge uniformly in the circle $|z - z_0| < r$ whereupon the radius r assumes a large definite value depending on $\{\lambda_n\}$ and the coefficients $Q_j(z)$. In particular, it is proved there that if the $Q_j(z)$ are entire functions, whereupon $Q_0(z)$ nowhere vanishes (in this case all the $y_j(z, \lambda_k)$ are entire functions), and

$$\lim_{k\to\infty} \frac{k}{\lambda_k} = 0, \tag{3}$$

then from the convergence of the sequence (2) in a particular region, it follows that the region of existence D of the limit function P(z) of this sequence is simply connected. Depending on $\{\lambda_k\}$ and $Q_j(z)$ the region D may have one or another form: It may be a half plane, a strip, the interior of an ellipse or parabola etc.

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We consider, for example, the equation

$$y'' - z^2 y = -(2n+1)\, y.$$

The function

$$h_n(z) = e^{-\frac{z^2}{2}} H_n(z) = e^{\frac{z^2}{2}} \frac{d^n}{dz^n} (e^{-z^2})$$

satisfies this equation where $H_n(z)$ is a Tchebycheff-Hermite polynomial. We take the functions $h_{n_k}(z)$ $(\lambda_k^2 = -(2n_k+1))$ as $y_1(z, \lambda_k)$. It is proved that if, in addition to condition (3), which in our case assumes the form

$$\lim_{k\to\infty} \frac{k}{\sqrt{n_k}} = 0, \tag{3'}$$

the additional condition

$$\sqrt{2n_{k+1}+1} - \sqrt{2n_k + 1} > \mu > 0, \tag{4}$$

is satisfied, then from convergence of the sequence

$$P_m(z) = \sum_{k=1}^{p_m} a_k^{(m)} h_{n_k}(z) \qquad (m=1, 2, \ldots) \tag{5}$$

in a particular region, it follows that the region of existence D of the limit function $P(z)$ is represented by a horizontal strip (without condition (4) it is only possible to assert, on the basis of the preceding that D is a simply connected region). In addition, under the indicated conditions the sequence (5) surely converges on a particular horizontal strip; This strip may be smaller than the strip D. On the entire strip D the series

$$\sum_{k=1}^{\infty} a_k h_{n_k}(z) \tag{6}$$

converges to $P(z)$, where $a_k = \lim_{m\to\infty} a_k^{(m)}$. The known theorem of E. Hille ("Contributions to the Theory of Hermitian Series," Duke Math. Journ., Vol 5, No 4, 1939, pp 875-936) concerning the fact that under conditions (3') and (4) the region of convergence of the arbitrary series (6) coincides with the region of existence of the sum of the series and represents a horizontal strip is contained in this result as a special case.

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These results indicate a strong analogy between sequences (5), in particular series (6), from one side, and sequences of Dirichlet polynomials, in particular, Dirichlet series from the other side. In fact, the following theorem holds for sequences of Dirichlet polynomials:

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If $0<\lambda_1<\lambda_2 \ldots$, the $\lim_{n\to\infty} \frac{n}{\lambda_n} = \sigma$ and the

sequence of Dirichlet polynomials

$$P_n(z)=\sum_{k=1}^{p_n} (a_k^{(n)} e^{-\lambda_k z} + b_k^{(n)} e^{\lambda_k z}) \quad (n=1, 2, \ldots) \qquad (7)$$

uniformly converges within the region G, containing a vertical, closed fragment of length $2\pi\sigma$, then this sequence uniformly converges within a certain verticle belt (the fragment indicated above is contained in this belt). The author made the note that the function $e^{\pm\lambda z}$ satisfies the equation $y'' = \lambda^2 y$. The above theorem was taken from the work of A. F. Leont'yev, "Series of Dirichlet polynomials and their generalizations," Trudy Matem. in-ta imeni V. A. Steklov, Vol 34, 1951, and the work of I. P. Kahane, "Sur quelques problemes d'unicite et de prolongement, relatifs aux fonctions approchables par des sommes d'exponentielles," Ann. Inst. Fourier, Vol 5, 1953-1954, 1955, pp 39-130.

The limit function P(z) is regular in a certain verticle belt, for in each closed segment of the boundary, verticle straight lines of length $2\pi\sigma$ if only P(z) has one singular point.

Then what was said relative to the sequence (5) corresponds to the case $\sigma = 0$.

The observed analogy between the properties of sequences (5) and (7) leads us to the thought that the aforementioned theorem may be transferred in corresponding form to the sequence (5) for $\sigma \neq 0$, and moreover, that the limiting conditions (4) may be renounced. The general method employed in the referenced work of the author does not permit (at least up to now) us to conclude concerning the correctness of this supposition.

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In the present work it is proved with the help of another method that a series of results relative to sequences of Dirichlet polynomials, in particular, the aforementioned theorem actually may be transferred to the sequence (5); in addition, it is proved that these results may be transferred to sequences of linear aggregates, formed from the solutions of the equation

$$y'' + q_1(z)\, y = \lambda_n^2 y, \tag{8}$$

where q_1 is an entire function.

61. Deduction Method for Solving Mixed Problems of Differential Equations

"Deduction Method for Solving Mixed Problems of Differential Equations and a Formula for the Expansion of an Arbitrary Vector-Function in terms of Fundamental Functions of a Boundary Value Problem With a Parameter," by M. L. Rasulov; Moscow, Matematicheskiy Sbornik, Vol 48 (90), No 3, Jul 59, pp 277-310

It is known that one of the basic methods for the solution of mixed problems for linear differential equations in finite regions is the Fourier method, employed, for the most part, during the solution of a mixed problem for which the spectral problem (the boundary value problem with parameter is selected in some suitable manner) corresponds to a self-conjugate operator and consequently possesses a complete system of orthogonal eigenfunctions (see A. I. Plesner, "Spectral Theory of Linear Operators," Uspekhi Matem. Nauk, No 9, 1941, pp 3-125). This circumstance makes it possible to seek the solution of a mixed problem in the form of a series in terms of these eigenfunctions with unknown coefficients, the calculation of which is facilitated due to the orthogonality of the eigenfunctions.

Cauchy was the first to indicate a method of solving mixed problems for linear differential equations with constant coefficients (see A. L. Cauchy, Memoire sur l'application du calcul des residus a la solution des problemes de physique mathematique, Paris, 1827, A. L. Cauchy, Oeuvres competes d'Augustin Cauchy (II), Vol 7, Paris, 1827, and A. N. Krylov, O nekotorykh differentsial'nykh uravneniyakh matematicheskoy fiziki (Concerning certain differential equations of mathematical physics), Gostekhizdat, 1950) employed, in contrast to the Fourier method, in the case when the spectral problem does not correspond to a self-conjugate operator.

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Consider the problem to find a solution of the system

$$\frac{\partial^q u}{\partial t^q} = \sum_{\substack{k \le q-1 \\ mk+j \le p}} A_{kj}(x) \frac{\partial^{k+j} u}{\partial t^k \partial x^j} + f(x,t) \tag{1.1}$$

under the boundary condition

$$\sum_{\substack{k \le q \\ j \le p-1}} \left\{ P_{kj} \frac{\partial^{k+j} u}{\partial t^k \partial x^j}\bigg|_{x=a} + Q_{kj} \frac{\partial^{k+j} u}{\partial t^k \partial x^j}\bigg|_{x=b} \right\} = 0 \tag{1.2}$$

and the initial conditions

$$\frac{\partial^k u}{\partial t^k}\bigg|_{t=0} = \Phi_k(x) \qquad (k=0, \ldots, q-1), \tag{1.3}$$

where m, q, p are arbitrary natural numbers satisfying the equality $p = m \cdot q$; $A_{kj}(x)$ is an n-dimensional quadratic matrix, the elements of which are the functions $A_{idkj}^{(x)}$; $f(x,t)$, $\Phi_k(x)$, $u_i(x,t)$ are the n-dimensional columns of functions $f_i(x,t)$, $\Phi_{ik}(x)$, $u_i(x,t)$ in consideration on [a, b]; P_{kj}, Q_{kj} are constant matrices of dimension np x n. We will assume $mk+j \le p$ for n=1 in the boundary conditions (1.2).

We will call a problem of the (1.1) - (1.3) type a problem with inseparable variables if equation (1.1) contains a mixed derivative with respect to x and t (t is the time variable) or if the boundary condition (1.2) contains the derivative with respect to t or, finally, if both conditions hold.

Thus Ya. D. Tamarkin noted in his book, O nekotorykh obshchikh zadachakh teorii obyknovennykh lineynykh differentsial'nykh uravneniy i razlozhenii proizvol'nykh funktsiy b ryady (On several general problems of the theory of ordinary linear differential equations and the expansion of arbitrary functions in series), Petrograd, 1917, that the deduction method of Cauchy had the following deficiencies:

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1. It is not clear how to immediately apply it to equations with varying coefficients.

2. A rigorous proof for convergence of the series is lacking.

3. It is possible to add the following deficiency to the remark of Tarmarkin: It is not clear how to immediately employ the Cauchy method to problems having inseparable variables (with respect to x and t), even in the case of one equation with constant coefficients.

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The method of Cauchy leads in this manner to two important problems: (a) To establish the conditions of expansion of an arbitrary vector function in terms of fundamental functions of a boundary value problem with a parameter for linear differential equations and to give a suitable formula of the expansion with the help of an integral deduction; and (b) solving the appropriate problem (a), on the basis of the formula obtained for the expansion of an arbitrary vector function to give the deduction formula representing the solution of the given mixed problem for linear differential equations.

The first substantial step in the solution of problem (a) was made by G. D. Birkhoff in his works "On the asymptotic character of the solutions of certain linear differential equations, containing a parameter" and "Boundary value and expansion problems of ordinary linear differential equations" which appeared in Transactions of the American Mathematical Society volume 9(1908) pp 219-231 and pp 373-395 respectively. In the second of these works, with the help of the results obtained in the first work, for problems of the type

$$L\left(x, \frac{d}{dx}\right) v - \lambda^p v = f(x)$$

$$\sum_{j=0}^{p-1} \left\{ \alpha_j \frac{d^j v}{dx^j} \Big|_{x=a} + \beta_j \frac{d^j v}{dx^j} \Big|_{x=b} \right\} = 0$$

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where α_j and β_j are constant matrices of dimension np x n and f(x,t) is a vector function of corresponding dimensionality, the validity of the formula for the expansion of a sufficiently smooth function.

$$f(x)=\mathcal{E}_\lambda \lambda^{p-1} \int_a^b G(x, \xi, \lambda^p) f(\xi) d\xi, \tag{1.4}$$

with $G(x, \xi, \lambda^p)$ a Green function and $\mathcal{E}_\lambda$ the complete deduction of the integrand is proved in the case of one equation (n=1). The idea of representing the function in the form (1.4) belongs to H. Poincare, "Sur les equations de la physique mathematique," Rend. Pal., Vol 8, 1894, pp 57-156.

The second substantial step in the solution of problem (a) was made by Ya. D. Tamarkin in his works, O nekotorykh obshchikh zadachakh teorii obyknovennykh lineynykh differentsial'nykh uravneniy i razlozhenii proizvol'nykh funktsiy v ryady (On some general problems of the theory of ordinary linear differential equations and expansion of arbitrary functions in series), Petrograd, 1917 and "Some general problems of the theory of ordinary linear differential equations and expansion of an arbitrary function in series of fundamental functions," Math. Zeitschr., Vol 27, 1928, pp 1-54.

It is also necessary to mention the important work of M. V. Keldysh, "Concerning eigenvalues and eigenfunctions of several classes of nonself-conjugate equations," DAN SSSR, Vol 77, No 1, 1951, pp 11-14, devoted to the spectral theory of a nonself-conjugate operator equation of the form

$$y = K_0 y + \lambda K_1 y + \ldots + \lambda^n K_n y + f, \tag{1.5}$$

under consideration in the corresponding Hilbert space, where the K_i are fully continuous operators, and y and f are elements of the space under consideration.

Mixed problems, containing derivatives with respect to time in the boundary conditions are not embedded in the system of M. V. Keldysh, since the corresponding spectral problems do not lead to the form (1.5), where the operator, applied to y, has a polynomial with respect to the parameter λ.

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Of the works pertaining to the scope of problem (1.5), the author is familiar with the work of H. Geppert, "Expansions of arbitrary functions by functional theory methods," Math. Zeitschr., Vol 20, 1924, pp 29-94, in which a certain basis for the deduction method of Cauchy is given.

Investigation by the author of problem (1.5) has shown that an expansion of type (1.4) is not applicable to obtaining a deduction representation of a mixed problem containing a derivative with respect to time of the sought-for function in the boundary conditions. As is clear from the method employed in section 4 of the present work, for this goal it is necessary to have a formula for the expansion of a vector function of the type

$$-\frac{1}{2\sqrt{-1}}\sum_{\nu}\int_{C}\lambda^{m-1}\,v^{(s)}(x,\lambda)\,d\lambda=\Phi_{s}(x)\quad(s=0,\ldots,q-1) \tag{1.6}$$

where C is a closed contour of the plane, enclosing only one pole λ_ν of the integrand function and the sum according to ν extends over all the poles of that function, where the equality (1.6) is understood in the $L_2[a, b]$ sence. In connection with this the first attempt of generalizing the results of Birkhoff and Tamarkin in the required direction was made by the author in the work "Investigation of a deduction method of solving certain mixed problems for differential equations," Matem. sb., Vol 30(72), 1952, pp 509-528. In this work; however, the author could not free himself from a series of extremely limiting and superfluous conditions (see conditions 1-5 on page 519). For example, condition 5 is not satisfied by the example in section 4 of the present work. In connection with the examples of mixed problems occurring in applications (e.g., example in section 4 of this paper), the present work has as its goal to give a deduction method of solving one-dimensional mixed problems of possibly a wider class. For this purpose a new formula (vig., theorem 3) is given in section 3 for the expansion of an arbitrary vector function in a series in terms of fundamental functions of the boundary value problem following with the parameter for a system of equations of a special form:

$$\begin{aligned}
&v^{(1)} - \lambda^{m} v^{(0)} = \Phi_{0}(x),\\
&\cdots\cdots\cdots\cdots\\
&v^{(q-1)} - \lambda^{m} v^{(0)} = \Phi_{q-2}(x),\\
&\sum_{\substack{k\le q-1\\ mk+j\le p}} A_{kj}(x)\,\frac{d^{j}v^{(k)}}{dx^{j}} - \lambda^{m} v^{(q-1)} = \Phi_{q-1}(x)
\end{aligned} \tag{1.7}$$

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under the boundary conditions

$$\sum_{\substack{k\le q-1\\ j\le p-1}} \left\{ P_{kj} \left.\frac{d^j v(k)}{dx^j}\right|_{x=a} + Q_{kj} \left.\frac{d^j v(k)}{dx^j}\right|_{x=b} \right\} +$$

$$+ \lambda^m \sum_{j=0}^{p-1} \left\{ P_{qj} \left.\frac{d^j v(q-1)}{dx^j}\right|_{x=a} + Q_{qj} \left.\frac{d^j v(q-1)}{dx^j}\right|_{x=b} \right\} = 0 \qquad (1.8)$$

The method of proof of theorem 3, differing from the method of Birkhoff and Tamarkin is embraced in the fact that investigation of the problem of expansion for the problem (1.7) and (1.8) leads to a problem of that type for a system of equations of the first order. In connection with this in section 2 a theorem is proved concerning the justification of the formula for the expansion of an arbitrary vector function in terms of fundamental functions of a boundary value problem with a parameter for a system of equations of the first order.

In section 4 on the basis of theorem 3 it is proved that a sufficiently smooth solution of the mixed problem (1.1)-(1.3) is represented by the deduction formula

$$u(x,t) = -\frac{1}{2\pi\sqrt{-1}} \sum_{\nu} \int_{C_\nu} \lambda^{m-1} e^{\lambda^m t}\, d\lambda \left\{ \int_a^b G(x,\xi,\lambda)\,(F_0(\xi,\Phi,\lambda^m) + \right.$$

$$\left. + \int_0^t e^{-\lambda^m \tau} f(\xi,\tau)\,d\tau\, d\xi + \Delta_0(x,\Phi,\lambda) \right\},$$

where $F_0(x,\Phi,\lambda^m) = \sum_{k=0}^{q-1} m(q-1-k)\,\Phi_k(x) - \sum_{\substack{1\le k\le q-1\\ mk+j\le p}} A_{kj}(x) \frac{d^j}{dx^j}(\lambda^{m(k-1)}\Phi_0(x) + \ldots$

$\ldots + {}_{k-1}(x)$ and $\Delta_0(x,\Phi,\lambda)$ has as

a solution a 0-auxiliary spectral problem, corresponding to a homogeneous system. At the end of this section an example is introduced which is encountered in underground hydromechanics and included in the system of the given method.

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In section 5 a deduction representation is given on the basis of theorem 4 for the solution of a mixed problem with divided variables for a system of equations with variable coefficients in terms of t. The result of this section indicates that the deduction method, in contrast to the method of Laplace transformations is applicable to equations with variable coefficients in terms of t. In addition, as is illustrated in the example of section 5, the induction method enables the construction of an effective solution of a mixed problem if it is possible to construct a Green Function of the corresponding spectral problem and to find its poles.

Corresponding results were obtained by the author for equations with piece-wise smooth coefficients (see M. L. Rasulov, "On one formula for the expansion of an arbitrary function," DAN SSSR, Vol 119, No 3, 1958, pp 450-453, and M. L. Rasulov, "A deduction method for solving mixed problems and several expansion formulae associated with it, "DAN SSSR, Vol 120, No 1, 1958, pp 33-36). For simplicity of exposition, equations with smooth coefficients are considered in the present work.

62. Nonnomographable Functions

"Some Examples of Nonnomographable Functions," M. A. Kreynes, I. A. Vaynshtein, and N. D. Ayzenshtat; Moscow, Matematicheskiy Sbornik, Vol 48(90), No 3, July, 1959, pp 377-395

In the present work functions nomographable on a net and functions nomographable in a rectangle are considered with the help of continuous functions and examples are constructed on non-nomographable functions. In the work sometimes the nomograms themselves are not considered, but forms dual to them; this makes the presentation easier.

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VI. MEDICINE

Aviation Medicine

63. Psychological Effects of Cosmic Flight

"Psychological Problems of Cosmic Flight," by K. K. Platonov (Moscow), Voprosy Psikhologii, No 3, May/Jun 59, pp 56-65.

Results of various surveys conducted in the USSR and in other countries and of experience accumulated by aviation psychology led the author of this article to conclude that all the difficulties that a human astronaut would encounter in outer space cannot yet be determined precisely. Psychology, the author of this article states, is contributing to effective preparation for flights into outer space, and the USSR must integrate scientific potential and technical know-how in developing space travel with other elements of balanced research. Results of various surveys and experiences have enabled the author of this article to compile the following working classification of the psychological problems involved: the effect of cosmic flight conditions on the mental state of the space traveler, the engineering psychology problems of cosmic flight, and the selection and training of astronauts. The most specific psychological problems are as follows: human activity under zero gravity conditions, the effect of danger and long periods of isolation and confinement on the emotional aspect of human activity.

References are made in the article to efforts put forth by US personnel and to studies conducted by Soviet scientists V. S. Gurfinkel', P. K. Isakov, V. B. Malkin, and V. P. Popov, who conducted experiments in an elevator of the building which houses Moscow University. They concluded that no basis exists for assuming that man cannot adjust himself sufficiently to conditions of changing gravitational pull. A. A. Shternfeld has been paying particular attention to the study of the speed with which a human astronaut can perform automatically all necessary movements. He has been stressing the need for the thorough ground training of flyers in the use of rescue equipment and in basic principles of survival.

It is suggested in this article that special attention be paid to organizing the cabin efficiently and to the special training, education, and selection of astronauts.

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64. Emotions of Parachutists Reproduced by Hypnosis

"Reproduction of the Emotional States of a Parachutist by Hypnosis," by L. P. Grimak, Voprosy Psikhologii, No 3, May/Jun 59, pp 139-142.

The author of this article states that the cardiovascular reaction and neurologic changes that take place during all stages of parachuting were studied in five parachutists. This was done by reproducing the emotional states of these parachutists after a third stage of profound hypnotic sleep was produced in them by verbal suggestion. On the basis of preliminary data obtained it was possible to form a good idea of the emotional neurovascular reaction of the organism of a parachutist from the time he leaves the airplane to the time he reaches the ground. This reaction is characterized by a rise in arterial blood pressure and by an increase in the pulse and respiration rates, the maximum level being registered during the period just prior to jumping. All indexes tend to decrease as soon as the parachutist leaves the airplane and the parachute opens. These indexes remain above the initial levels, however, after the parachutist reaches the ground. The existence of the possibility of reproducing specific emotions under hypnotic conditions was originally conceived by K. I. Platonov.

Bacteriology

65. Method of Collecting Ornithosis Virus

"The Methodology of Entrapping the Ornithosis Virus in the Droplet Phase," by V. M. Bolotovskiy, Institute of Virology imeni D. I. Ivanovskiy; Moscow, Voprosy Virusologii, Vol 4, No 4, Jul/Aug 59, pp 505-508.

An objective of the research described in this article was the testing of gelatin filters for observing the ornithosis virus in the droplet phase in the air. The author mentions shortcomings of currently employed methods and apparatuses (impingers, virus samplers, and various types of filters--membrane, cotton, and foam), which do not permit quantitative analysis of bacteria and viruses because of the difficulty of removing the organisms from the filters. This difficulty, the author submits, can be eliminated by the use of gelatin foam filters.

The technology and materials used in the experiments are described as follows:

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"Suspensions prepared from the lung tissue of white mice infected with an ornithosis virus aerosol (strains V and 'Lori') served as virus-containing material. The titer of the initial virus varied insignificantly (LD_{50} 10^{-7} to 10^{-8}). The virus aerosol was produced in an IVK-1 chamber. A glass dispersing apparatus was used to obtain a finely dispersed aerosol (Figure 1). It was established in previous experimental study of aerosol particle composition with respect to dimensions and time that 60% of the particles attained a size of not more than one micron within 8 minutes from the time of dispersal. A dose of virus equal to 10^{-4} LD_{50} was withdrawn for dispersal. The volume of the dispersed material consisted of one ml.

"Soluble sponge filters of gelatin foam were given to us by Prof S. S. Rechmenskiy. For trapping the aerosol, the filters were placed in specially prepared ebonite cartridges (Figure 2) which prevents the air pumped into the chamber from escaping into the environment. Besides, the possibility of installing two gelatin filters 3 cm from each other in the cartridge is afforded. This makes it possible to collect the virus not adsorbed by the first filter. The filters (with an area of 8 sq cm and a height of 0.5 cm) are installed in special grooves in the cartridges.

"The first aerosol sample was collected 30 minutes after the completion of dispersal. Subsequent samples were taken at 30-minute intervals. The aerosol from the chambers was passed through the cartridges with the filters at a rate of 6.5-6.7 liters per minute. Virus collection was carried out for 25 minutes. After adsorbing the aerosol, the gelatin filters were dissolved in a phosphate buffer solution with a pH of 7.17 in a flask with glass beads and a ground stopper. The flask was carefully agitated at 37° C until the filter was completely dissolved. The virus content of the solution was determined by the intracerebral infection of white mice. The specificity of the disease, after the appearance of clinical manifestations of disease in the experimental animals, was tested by microscopic examination of mouse brain smears stained by the Romanowsky method. The absence of extraneous flora (including bacterial seedings) and the presence of viral elementary bodies verified the etiology of the disease."

The results of the experiments are discussed briefly, and a table is given. The following conclusions are presented:

"1. Gelatin foam filters are suitable for trapping ornithosis virus in the droplet phase in the air and afford the possibility of carrying out a biological test for this virus.

"2. For more complete adsorption of virus in an aerosol state, samplers with double gelatin filters 3 cm from each other should be used.

"3. In the IVK-1 chamber an ornithosis virus aerosol maintains significant biological activity for at least 2 hours (on testing with gelatin filters)."

[Figures referred to by source are not reproduced in this publication.]

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66. Bacterial Penetration of Skin Studied

"Penetration of Microorganisms Through the Skin; Report II: A Study of Conditions and Routes of Penetration of Microorganisms Through Mouse Skin," by A. V. Lizgunova, Chair of Microbiology, Second Moscow Medical Institute imeni N. I. Pirogov; Moscow, Byulleten' Eksperimental'noy Biologii i Meditsiny, Vol 24, No 6, Jun 59, pp 28-32.

The research reported in this article was undertaken to explain the effects of various physiological conditions on penetration of microorganisms through the skin. In the experiments, performed on mice, the ages of the animals and nutritional and seasonal factors were taken into consideration. The author mentions that the experiments were not duplicated on other animals since it is known that the reaction of the epithelial cells does not depend on the thickness of the epidermis. The following microorganisms, pathogenic to mice, were employed: Salmonella typhi murium, Pneumococcus I, B. anthracoides, Str. haemolyticus, and B. pyocyaneum. The pathogens were cultured on liquid media. The methodology and results of the experiments are described in detail. Three photomicrographs show the extent of penetration of the pathogens into connective and other tissues, and a table summarizes the percentage results of lethal infection.

The most indicative results, obtained in mice killed immediately after the experiment, formed the basis for the following conclusions:

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"a. Groups of cocci were encountered under separate, sloughed cells of cutaneous epithelium, in the epithelial stratum, and near the hair follicles (Figure 1).

"b. Microorganisms were observed in the subcutaneous cellular tissue in groups, and granulocytes were encountered with phagocytic microorganisms (Figure 2).

"c. Cocci were distributed abundantly in the intercellular spaces of muscular tissue, in the perivascular lymphatic spaces, and in the perivascular tissue of the blood vessels (Figure 3).

"A biological reaction to the introduction of microorganisms could be seen in many histological preparations -- proliferation of the vascular endothelium and leukocytic thrombi in the small vessels. Microorganisms were not seen in the lymph node tissues during the observation period.

"The data presented make it possible to state that the functions of intact skin as a factor in protection against microorganisms were verified by histological investigations."

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Epidemiology

67. Gamasidic Ticks Experimentally Infected With Tick-Borne Encephalitis Virus

"The Methodology Experimentally Infecting Gamasidic Ticks With the Tick-Borne Encephalitis Virus," by Yu. V. Fedorov, T. A. Vershinina, and N. I. Igolkin; Moscow, Voprosy Virusologii, Vol 4, No 4, Jul/Aug 59, p 501.

"With the study of the role of gamasidic ticks in foci of tick-borne encephalitis, the virus has been isolated from these ticks repeatedly (1-2). Regrettably, the authors only approximately indicate the duration of preservation of the pathogen in the tick organism. The necessity for experimental laboratory investigation of this group of arthropods arises. However, no method of infecting gamasidic ticks with the virus in the laboratory has yet been developed.

"The experimental infection of several species of gamasidic ticks and results of a study of the duration of the preservation of the virus in their organisms are presented in this report.

"First, the species of the ticks was determined while it was alive. For this, the ticks were placed on their backs in a drop of water on a slide and covered with a cover glass. The determination was made under a microscope with direct light.

"Special chambers were used to hold the live ticks (3). The chambers were made of glass tubing with a diameter of 1.7 cm and 17-18 cm in length. A 2-cm sheet of alabaster served as the bottom of the chamber. Cotton-gauze was used to plug the chamber at the top. An oval aperture, which was covered with caprone fabric, was made at a distance of 1-2 cm from the bottom for natural aeration of the lower part. The chambers containing the ticks were placed in a vertical position on a damp cloth. The moisture, dampening the alabaster sheet, created high humidity within the chamber.

"A 10% brain suspension of the 'Sof'in' strain of the tick-borne encephalitis virus (1 g LD_{50} = 8.0) was used to infect the ticks. The suspension was diluted 50% with defibrinated blood from white mice and kept in cans at a temperature of 4° C. A capillary tube filled with the virus-containing suspension was introduced into the chamber to infect the ticks. For convenience, the capillaries were suspended on threads. The starved gamasidic ticks, 15-20 of which were distributed in each chamber, voluntarily ingested the substrate from the capillaries. The capillaries were emptied within one day. After a specified interval (2 days), five gamasidic ticks were examined for the presence of virus by the introduction of a suspension prepared from them into mouse brains.

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"We succeeded in establishing, by means of the above-described method of infection, the fact, that the virus is preserved in the organism of the Haemogamasus mandschuricus tick for 7 days; in Eulaelaps stabularis, for 18 days; in Haemolaelaps sp., for 14 days; in Haemolaelaps casalis, for 3 days; and in Haemolaelaps glasgowi, for 12 days.

"We consider the suggested method of infecting gamasidic ticks to be readily available and sufficiently effective."

Hematology

68. Protein and Gamma-Globulin Content of Blood Serum of Frequent Blood Donors Tested

"Biochemical Changes in the Blood of Donors Who Have Donated Blood for Long Periods. Report II. The Content of Total Protein and Gamma-Globulins of the Blood Serum of Donors With Respect to Sex, Age, Frequency of Blood Donation, and Time of Year," by G. M. Podrabinnik, Sb. Nauchn. Rabot i Avtoref. Khabarevskiy In-t Epidemiol. i Gigiyeny (Scientific Works and Author Abstracts of Khabarovsk Institute of Epidemiology and Hygiene), 1951-1955 (1957) No 3, pp 65-69 (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 13, 10 Jul 59, Abstract No 17345, by V. Korzhov) CPYRGHT

"The content of total protein and of globulins in the blood serum of donors is higher in women than in men. In women donors, the total content of proteins in the serum is 7.54%, while in men it is 7.49%. The gamma globulin content equals, on the average, 1.087% in women and 1.073% in men. The protein and gamma globulin content increases with age. After 1-5 blood donations, a decrease in the total protein and gamma globulin content is noted, but after numerous (15-50 times) donations, the content of proteins and of globulins is increased, exceeding the average value. This is observed in donors of both sexes. The maximum blood protein content is observed in January, and minimum in July and August. An analogous dependence on time of year was noted in the control group which had not donated blood. For report I see RZhKhim Bkh, 1956, No 20, 19472."

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69. Transitory Effect of Riboflavin on Prolonging Blood Coagulation Time

"The Effect of Riboflavin on Blood Coagulation," by S. G. Antekar', Laboratory of Pathological Physiology, Institute of Nutrition, Academy of Medical Sciences USSR; Moscow, Farmakologiya i Toksikologiya, Vol 22, No 2, Mar/Apr 59, pp 134-138.

The author studied the effect of riboflavin administration on blood coagulation time in rabbits and concluded that the intravenous and oral administration of riboflavin prolongs blood coagulation time. This effect is transitory and lasts for 3-4 hours.

70. Chinese Research on Hemopoiesis

"Concerning the Determination and Differentiation of Blood Anlage in Cynops orientalis," by Tseng Mi-pai (曾 彌 白), Institute of Experimental Biology, Academia Sinica; Peiping, Shih-yen-sheng-wu Hsueh-pao (Acta Biologicae Experimentalis Sinica), Vol 6, No 2, Dec 58, pp 111-128.

The author mentions a previous paper (Vol 5, No 2, 1956) in which he and coauthor Chuang Hsiao-hui reported observations on the pluripotency of the blood anlage in early neurula. They had found that blood anlage explanted together with dorsal structures such as the notochord and the vertebral canal eventually differentiated into only a very few mature blood cells and sometimes none at all. Their observations, corroborating those of Muchmore (1951), Fernald (1943), and others, indicated that the blood anlage in early neurula could be induced by external factors to change its direction of self-differentiation and become mesodermal structures other than blood cells. They called this characteristic "labile [embryonic] determination."

In the present paper the author reports the details of further experiments undertaken to elucidate when and how the blood anlage becomes stabilized in its determination and whether the endoderm plays any role in its differentiation, as others have theorized.

The Cynops orientalis embryos used were grown in the author's laboratory and were all neurulae. From the results of the experiments, Tseng draws the following conclusions:

The blood anlage in early neurula is labilely determined. It will differentiate into typical mature blood cells only under normal (in vivo) conditions. Under experimental conditions when the environment of the in vitro culture is neutral or without formative stimuli -- in an epithelial vesicle, for instance, blood cells resulting from self-differentiation of blood anlage remain in the early developmental stage and cannot develop into typical, mature blood cells. When subjected to various external influences, the blood

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anlage will deviate from its direction of self-differentiation and develop into different kinds of tissue. The blood anlage gradually becomes stabilized in its determination in later stages of neurula.

Endoderm plays no role in the differentiation of blood cells, and its absence will not cause degeneration of blood cells, at least not under the conditions of the author's experiments. The reason that explanted blood anlage cannot differentiate into typical, mature blood cells should be sought in disturbances of metabolism due to the absence of circulation.

Immunology and Therapy

71. Combined Enteric Vaccines

"Dry Vaccines Against Enteric Infections" (unsigned article); Moscow, Meditsinskiy Rabotnik, No 62, 4 Aug 59, p 3.

A brief newspaper item states that scientific associates at the Experimental Laboratory and Division of Vaccines of the State Scientific Control Institute of Medical Biological Preparations have developed a method of preparing dry, combined vaccines for the prophylaxis of enteric infections, including typhus, paratyphus, and dysentery.

The article continues:

"The vaccine is prepared from bacteria killed with acetone, alcohol, or heat, and dried by lyophilization. The dry vaccines are far superior to liquid preparations, they do not lose their immunogenic properties for several years, are not subject to temperature effects, and are easily transported.

"The Institute of Epidemiology and Microbiology imeni N. F. Gamaleya, Academy of Medical Sciences USSR, has developed methods of preparing the dry vaccines under industrial conditions."

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72. Chinese Treat Epidemic Meningitis

"Treatment of Epidemic Meningitis by a Chinese Traditional Medicine Method," by Chu Tao-Shu, Chung-hua Erh-k'o Tsa-chih, (Chinese Journal of Pediatrics), No 1, 1959, pp 8-10 (from Meditsinskiy Referativnyy Zhurnal, No 8, Aug 59, p 116)

"Sixty-three children with epidemic meningitis were treated by Chinese traditional medicine methods from February to June 1958. The disease proceeded with a specific clinical picture and characteristic changes in the

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cerebrospinal fluid in all the patients. Meningococcus was isolated after seeding cerebrospinal fluid from 49 patients. In the majority of the patients, the clinical symptoms disappeared in 2-6 days, and the cerebrospinal fluid returned to normal in 6-10 days. Seventy out of 73 patients (95.9%) recovered; three died."

Physiology

73. Vibration Sickness

"Vibration Sickness," by A. S. Mel'kumova, Information Bulletin of the Moscow Scientific Research Institute imeni F. F. Erisman, 1958, 16, 35-45 (from Meditsinskiy Referativnyy Zhurnal, No 5, May 59, p 23).

"The clinical course, the pathogenesis, and the mechanism of formation and prevention of vibration sickness caused by local localized vibration are discussed. The symptomatology of vibration sickness, arising as result of over-all high-frequency vibration, the course of vibration sickness, diagnosis, therapeutic-preventive measures, and problems of capacity for work and work organization are explained."

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74. Blood Picture in Vibration Sickness

"On the Problem of the Morphological and Biochemical Changes in the Blood During Vibration Sickness," by N. N. Pushkina and L. B. Yushkevich, Information Bulletin of the Moscow Scientific Research Institute imeni F. F. Erisman, 1958, 16, 47-48 (from Meditsinskiy Referativnyy Zhurnal, No 5, May 59, p 23)

"Symptoms of vibration sickness were established in 89 out of 198 workers exposed to vibration. The hemoglobin, number of erythrocytes, leukocytes, leukocytic formula, and the sugar, cholesterin, bilirubin, creatine, uric acid, protein fractions, and ascorbic acid content in the blood were ascertained. A mild form of leukocytosis was found to exist in patients suffering from vibration sickness; in pronounced stages there was a tendency toward hypoglycemia."

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75. Effect of Oxygen Under Pressure on Blood Circulation

"Utilization of Na^{24} in the Study of Blood Circulation During Respiration Under Increased Pressure," by V. S. Garfinkel', D. I. Ivanov, A. Ye. Ivanov, and V. B. Malkin, Scientific Research Institute of Aviation Medicine; Moscow, Biofizika, No 4, 1959, pp 498-503.

The authors of this article state that results of their experiments with 17 healthy men, ranging in age from 20 to 30, showed that increased oxygen pressure in the respiratory organs leads to normal changes in the dynamics of the blood flow in the tissues. The extent of these changes differs in different individuals: a relatively low oxygen pressure (10 millimeters of mercury) in the mask causes a distinct drop in intensity of the blood flow in some people; in the majority of people experimented with, however, similar changes were noted only when the pressure is much greater (20 millimeters of mercury). Special garments, which create mechanical counterpressure on the body, bring about a positive effect. This effect becomes less pronounced when the oxygen pressure in the mask is 50 millimeters of mercury and higher.

The authors of this article do not claim that the information obtained by them as a result of their experiments presents a complete picture of the changes which take place in hemodynamics during respiration under increased pressure. The picture is only fragmentary and may offer certain views which may be helpful in future studies. They do think that the study made of the "topography" of circulation is important and that the state of vascular tonus, a factor in ensuring normal circulation of the blood, is particularly important.

Blood circulation was studied by injecting radioactive sodium, Na^{24}, using the G. Kety method. This method made it possible to study not only cardiovascular insufficiency when the development of symptoms of congestion had not yet become visibly apparent, but also made it possible to evaluate the extent of the changes in hemodynamics.

76. Synthetic Method of Determining Arterial Pressure

"The Principles of Determining Arterial Pressure Standards," by Prof Ya. A. Rosin; Moscow, Klinicheskaya Meditsina, No 7, Jul 59, pp 63-66.

The author of this article states that an interest in determining the standards for arterial pressure was stimulated by the widespread incidence of hypertensive vascular disease. Such standards are usually established on the basis of separate statistical calculations for systolic and diastolic pressure. This method contradicts the physiological conception of arterial pressure and does not meet the clinical requirements.

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The author of this article advocates a synthetic method. With the aid of a simple diagram, synthetic analysis makes it possible to determine the actual distribution of any relationship which exists between systolic and diastolic pressure as elements of a single process. This method also helps to reveal the distribution of arterial pressure at separate zones.

77. Arterial Pressure Studied Under Mountain Conditions

"The Effect of Mountainous Conditions on the Arterial Pressure," by Prof M. E. Efendiyev, S. M. Bedalova, and D. K. Akhundov, Chair of Preliminary Instruction in Internal Diseases, Azerayd-zhan Medical Institute imeni N. Narimanov; Moscow, Klinicheskaya Meditsina, No 7, Jul 59, pp 59-62.

The authors of this article state that they have no conclusive evidence to indicate that residence in mountain resort areas normalizes arterial pressure. Information found in the literature and results of their experiments with people prompts them, however, to state with reasonable assurance that a mountain climate contributes to normalization of arterial pressure. In their opinion, rest in areas of high elevation should have a definite place in the treatment and prevention of hypertensive vascular diseases of the first and second stages in patients who show no symptoms of any circulatory disturbance.

78. Supersonic Perception of Bats

"Morphological Bases of Location and Supersonic Characteristics of the Bat," by V. P. Zvorykin, Brain Institute, Academy of Medical Sciences USSR; Moscow-Leningrad, Arkhiv Anatomii, Gistologii, i Embriologii, No 5, May 59, pp 19-31

The author of this article states that results of the comparative study and measurement of the auditory analysor system in humans and bats revealed unique dimensions and great complexity in the structure of the subcortical auditory analysor formations in bats as compared with those in humans.

Different parts of the auditory analysor system (with the exception of the corpus geniculatum interna) are 6-100 times larger in bats than similar formations in humans in relation to the brain stem cross section. However, it was established that these features are peculiar not to the whole auditory subcortex, but only to parts of it which are located below the corpus geniculatum interna. The corpus geniculatum interna does not possess the above-mentioned morphological features, which are characteristic of humans.

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The data obtained suggest that humans lack the ability to perceive ultrasounds because their cochlear organs are complex and the auditory cortex attains the highest degree of differentiation. The supersonic characteristics of the substratum in bats are located in the auditory subcortical region, which is the area most distant from the cortex.

Public Health, Hygiene, and Sanitation

79. Problems of Medical Science

"Urgent Problems Confronting Medical Science in the Light of Resolutions of the 21st Congress of the Communist Party of the Soviet Union," by Academician A. N. Bakulev, president of the Academy of Medical Sciences USSR; Moscow, Klinicheskaya Meditsina, No 7, Jul 59, pp 3-6.

The author of this article states that the Communist Party of the Soviet Union and the Soviet government have been allocating huge sums of money for research in medicine. Several new scientific research institutes have been organized within the framework of the Academy of Medical Sciences USSR within the past 5 years. Huge sums of money are allocated each year for equipment and capital construction. The author remarks that it is the duty of Soviet medical scientists to respond to the government's action by performing new, notable deeds in scientific medical research.

The 21st Party Congress has approved a program for building Communism: the Seven-Year Plan (1959-1965) for the development of the national economy. The responsibility that the 21st Congress placed on the Soviet public health service and Soviet medical science is of great national significance.

Any success achieved in socialist construction in the USSR would bring about improved living conditions and a higher level of cultural development to the Soviet population. This, in turn, should bring about a steady improvement in the Soviet public health service. Soviet medical scientists must advance to new lines from which they may continue their fight against many communicable diseases. The main problems with which agencies of the Soviet public health service will have to deal are as follows: eradication of a number of communicable diseases and a drastic reduction in the incidence of all parasitic diseases; a considerable reduction in the incidence of the diseases which cause the greatest number of deaths; further effort toward the preservation of the health of children; and a decrease in absenteeism from work caused by some temporary or permanent disability.

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The presidium of the Academy of Medical Sciences USSR has recently proposed a clearly defined program to be followed by medical scientists and public health service agencies during the next 7 years. The presidium noted that sufficient facilities now exist for the eradication of at least the endemic form of such diseases as malaria, dysentery, enteric fever, and typhus. Greater efforts must be made to achieve a sharp reduction in the incidence of poliomyelitis, tick-borne encephalitis, ascariasis, and tularemia. A possibility exists to reduce the incidence of such diseases as whooping cough, epidemic parotitis, tuberculosis, brucellosis, Q fever, and other infections. It is recognized that additional experimental work and an increase in facilities will be necessary.

Medical scientists must concentrate more on those diseases which cannot be easily controlled, such as tonsillitis, influenza, infectious hepatitis, measles, scarlet fever, chicken pox, and German measles. Study of the diseases of the cardiovascular system and malignant neoplasms is currently of primary importance. They are responsible not only for temporary disability, but also cause permanent disability and death.

Very little is known about the prevention and treatment of cardiovascular diseases. Further study must be conducted to determine the pathogenesis and clinical course of hypertension, rheumatic disease of the heart, atherosclerosis, coronary insufficiency, myocardial infarction, and diseases of the cerebral and peripheral vessels. Methods must be found for the quick diagnosis and proper treatment of diseases of the cardiovascular system, and to connect the clinical study of cardiology more closely with experimental work to determine the mechanisms of compensation, disturbance in blood circulation, and heart muscle metabolism. The solution of many problems connected with the pathology of the cardiovascular system is closely connected with further progress in morphology, physiology, biochemistry, general pathology, microbiology, and surgery.

Research conducted for the past 20-25 years has not led to the solution of the problem of malignant neoplasms. In addition to the need for finding new antibiotics and chemotherapeutic drugs, it is necessary to carry on more intensive research in the field of the etiology of malignant neoplasms, and to make a thorough study of the cancerogenic factors involved. The Scientific Council on Cancer was recently added to the presidium of the Academy of Medical Sciences USSR.

The vigorous growth of the chemical industry in the USSR, projected by the May plenum of the Communist Party of the Soviet Union, makes the study of industrial hygiene and occupational diseases quite stimulating. Knowledge of the toxic effects of new compounds and the utilization of mechanical processes in the chemical industry must be directed toward reducing occupational injuries to a minimum. It is necessary to define the maximum permissible limits of concentration for toxic substances in the environment and to formulate instructions and rules for the safe handling of these substances. Knowledge of the physiology of work is especially significant at present because of the increasing mechanization and automatization of industry.

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The law passed by the Supreme Soviet USSR, which deals with "strengthening the tie between school and life and further development of the system of public education in the USSR," creates a whole series of problems which must be solved by medical science.

Recognizing that the training and preservation of the health of adolescents is important, the presidium of the Academy of Medical Sciences USSR has decided recently to organize an Institute of Child Hygiene and Adolescent Hygiene within the framework of the Academy of Medical Sciences USSR.

New channels for the development of biological sciences have been opened as a result of the rapid growth of chemistry, physics, and electronics. Achievements in various scientific fields have made it possible to approach a more profound understanding of the functions of various organs and tissues. The latest achievements in electronics and radiology are helping to explain the most minute changes that develop in cells and tissues during various pathological processes.

Successful research in physiology, according to this article, must be built on the foundation of classical Pavlovian methods of study of conditioned reflex activity. Research must be continued also to determine the mechanism of the most complicated unconditioned reflexes insofar as interrelationship between the cortex and subcortex, dynamic localization of functions, etc. are concerned.

The recently held 13th Session of the General Assembly of the Academy of Medical Sciences USSR examined the principal problems that confront medical science in the light of resolutions of the 21st Congress of the CPSU. Broad exchange of ideas and discussions by directors of scientific research institutes, both active and corresponding members of the Academy of Medical Sciences USSR, and chairmen of scientific councils of ministries of health of the union republics demonstrated that Soviet scientists and scientific research establishments will easily handle well the tasks placed before them.

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80. Trichloroisocyanuric Acid, an Effective Sporocide and Bactericide

"Certain Data on the Sporocidal and Bactericidal Effects of Trichloroisocyanuric Acid," by E. P. Chenchikova and V. V. Shavyrina, Central Scientific Research Disinfection Institute; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, No 6, Jun 59, pp 82-86.

The bactericidal and sporocidal effects of trichloroisocyanuric acid were studied by means of cambric test-objects. The bactericidal effect of trichloroisocyanuric acid was more than 10 times greater than that of chloramine in the case of E. coli and 50 times greater for Staphylococcus aureus. A 0.3% solution of trichloroisocyanuric acid killed anthracoid spores in 10-15 minutes, whereas a 10% solution of chloramine did not exhibit a sporocidal effect for 6 hours.

The bactericidal action of trichloroisocyanuric acid solutions was greater than that of chloramine, calcium hypochlorite, and chlorinated lime with equal percentages of active chlorine in these solutions.

Trichloroisocyanuric acid possesses the following advantages over other chlorine-containing disinfectants: it contains a greater quantity of active chlorine, it exhibits stronger sporocidal activity, and it is more effective at equal quantities of active chlorine.

The authors urge further study of trichloroisocyanuric acid to bring it into common use.

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81. Two Upper Oxygen Limits in Reactions Which Follow Radiation Injury

"Concerning the Upper Oxygen Limit of the Reactions Which Follow Radiation Injury," by K. D. Kalantarov; Moscow, Meditsinskaya Radiologiya, Vol 4, No 6, Jun 59, p 89

The study of the effect of oxygen on the radiosensitivity of organisms and tissues is very important in explaining not only the mechanisms of radiation injury, but also is of interest to radiologists in connection with radiotherapy of various neoplasms. Recently, attempts have been made to increase the radiosensitivity of tumor tissues by methods which somehow raise the concentration of oxygen in cancerous tissues. However, this problem of increased oxygen content on radiosensitivity has not been studied in detail, especially from the quantitative viewpoint.

In a report on microorganisms published earlier by the author (K. D. Kalantarov, Biofizika, Vol 1, 1958), it was shown that the relationship of radiation injury to oxygen is quite complex. Following the irradiation of yeast cells under conditions of different oxygen pressure, an upper oxygen limit of radiation injury was observed. The existence of this phenomenon was deduced from the fact that increasing oxygen pressure raised the radiosensitivity to a definite limit, but that any further increase produced a paradoxical effect, i.e., the injury began to decrease.

In the research discussed in this article, the author conducted further studies on this topic. Yeast cells were irradiated by 200,000 r and incubated at different oxygen pressures (100, 200, 300, 400, 500, 600, and 700 mm Hg). Two maximum peaks of radiation injury were observed: one at 100 mm Hg and the other at 700 mm Hg.

The author explains the probable chain reactions and reasons for this phenomenon and recommends further study of this subject.

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82. Effect of Oxygen Pressure on Acute Radiation Sickness

"The Effect of Different Oxygen Pressures in the Inhaled Air on the Course of Acute Radiation Sickness Under Experimental Conditions," by N. M. Romanyuk (Kiev); Moscow, Meditsinskaya Radiologiya, Vol 4, No 6, Jun 59, p 88

There is no single opinion in literature concerning the effect of various oxygen pressures in the inhaled air on the course of radiation sickness under experimental conditions. There are indications, however, that in this sickness the oxidation processes in an animal organism are decreased. In view of these differences of opinion, tests were conducted on the effect of decreased and increased oxygen partial pressure in the surrounding air on the course of radiation sickness.

The experimental animals were subjected to a single X-ray dose of 1,000 r, and a group of the animals was subjected to decreased oxygen partial pressure, i.e., were placed daily for 3-4 hours in a Kalabukov-type vessel in which oxygen partial pressure was 8-10% and carbonic acid was 0.2%. The other group of experimental animals was placed daily for 4-5 hours under 40-45% oxygen partial pressure. A table summarizes the amount of oxygen in mm absorbed per hour per 100 g of animal body weight before and after irradiation under decreased and increased oxygen partial pressure.

Results indicate that oxygen consumption was decreased in all of the animals after irradiation. The amount of oxygen consumed by animals maintained at high oxygen partial pressure was slightly higher than that of the control group, and higher than that of the group maintained at low oxygen partial pressure. The average life duration was 4.52 days for the control animals, 6.1 days for the animals under high oxygen partial pressure (40-45%), and 4.2 days for the animals under low oxygen partial pressure.

83. Distribution of Promethium in Rat Organs

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"Data on the Distribution of Pm^{147}," by Yu. I. Moskalev; Moscow, Meditsinskaya Radiologiya, Vol 4, No 6, Jun 59, pp 73-75

Promethium (Pm^{147}) is one of the products of uranium fission. It is selectively deposited in the liver ($\sim$ 50%), and skeleton ($\sim$ 30%), and it is almost unabsorbed from the gastrointestinal tract ($<$ 0.05%). This research concerns the behavior of promethium in other organs, its distribution and rate of elimination.

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Tests were conducted on 20 white rats to which a suspension of rare earth metals, Pm^{147} (95%), Eu^{155} (3-5%), and Sm^{153} (1-2%), which emit soft beta-radiation, was administered intravenously. Two tables present data on the Pm^{147} content and concentration (in terms of percent of the quantity administered per weight of organ) in organs of rats at various periods after its intravenous administration, and one table summarizes the percentage of its elimination.

Results of this research show that Pm^{147} distribution is similar to that of La^{140} and Ce^{144} (Yu. I. Moskalev, 1955). All these elements are selectively deposited in the liver and skeleton and are essentially eliminated with the feces. They are almost completely retained by the skeleton. There are certain differences in the distribution of these elements. In contrast to Ce^{144} and La^{140}, 10-15% less Pm^{147} is deposited in the liver and 10% more Pm^{147} is deposited in the skeleton. This observation is in good agreement with the results reported by Durbin, Williams, Gee, Neuman, and Hamilton (1956), who state that the light lanthanides (La, Ce, Pr, and Nd), which have basic properties, are deposited chiefly in the liver (68-42%) and to a lesser degree in the skeleton (17-25%), while the heavy lanthanides (Tb, Dy, Ho, Er, Tu, Yb, and Lu), which have acidic properties, are deposited chiefly in the skeleton (55-68%) and to a lesser degree in the liver (4-16%) Pm, Sm, Eu, and Gd occupy an intermediate position."

84. Toxic Substances Formed as a Result of Ionizing Radiation in Vivo and in Vitro

"Concerning 'Toxic' Substances Which Appear in the Blood of Animals After the Action of Ionizing Radiation," by N. N. Kuznetsova, Tr. In-ta Genet A. N. SSSR (Works of the Institute of Genetics, Academy of Sciences USSR), 1958, No 24, pp 446-451; (from Referativnyy Zhurnal -- Biologiya, No 3, 10 Feb 59, Abstract No 13388, by A. D. Zh.)

"Blood samples were taken from 53 donor mice one hour after total body X-irradiation by 1,500, 2,000, and 4,000 r. This blood was citrated and administered intravenously to recipient mice in 0.2 ml quantities. No leukopenia was observed, but leukocytosis developed in all cases. Negative results were obtained also from the administration to mice of horse and mouse serum irradiated by 10,000 r in vitro. After the administration of 0.2 ml of blood from animals that were irradiated by 1,500, 2,000, and 4,000 r, the number of thrombocytes increased. The administration of the blood of nonirradiated animals caused a decrease in the number of thrombocytes. Following the subcutaneous administration

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of 0.4 ml of serum from mice irradiated by 1,000 r, the results were analogous to those obtained by the transfusion of citrated blood. The formation of 'toxic' substances as a result of the irradiation of animals and as a result of the effect of irradiation on serum in vitro is postulated."

85. Genetic Effects of Small Doses of Ionizing Radiation Reviewed

"The Genetic Effect of Small Doses of Ionizing Radiation," by N. I. Shapiro, Institute of Biological Physics, Academy of Sciences USSR; Moscow, Meditsinskaya Radiologiya, Vol 4, No 2, Feb 59, pp 67-77.

This article reviews the problem of possible genetic sequelae of the action of ionizing radiations on man; the information is taken from Soviet and non-Soviet sources. The author summarizes the subject under the following subheadings: Certain Reasons for Considering the Problems of the Genetic Effect of Radiations; Possible Genetic Sequelae From Nuclear Weapon Testing; Medical and Radiological Studies and the Genetic Effect of Radiations; Permissible Doses and the Effect of Radiation on Heredity; Somatic Mutations and Their Role in the Genetic Effect of Radiations; and the Prophylaxis and Therapy of Genetic Sequelae of Irradiation.

86. Cytogenetic Effect of Small Doses of Ionizing Radiations on Rodents and Monkeys

"Concerning the Cytogenetic Effect of Small Doses of Ionizing Radiation on Mammals," by V. Parkhit'ko; Moscow, Atomnaya Energiya, Vol 6, No 6, Jun 59, pp 690-691

The following is the summary of a talk between the author, special correspondent to Atomnaya Energiya, and Yu. Ya. Kerkis of the Institute of Cytology and Genetics, Sibirsk Department, Academy of Sciences USSR.

The effect of small doses of ionizing radiation on the heredity of higher organisms, including man, is very important. Experimental research of recent years indicates that there is no threshold for the genetic effect of radiation. Therefore, the earth's background radiation deserves special consideration.

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The radiation-genetic sensitivity of various mammals to the same dose is of special interest not only for understanding the initial mechanism of the genetic effects of radiation, but also for developing rational protective measures. With regard to mammals, the problem of the existence of a parallelism between the degree of general sensitivity of an organism to radiation and the sensitivity of the chromosome apparatus of the sex cells and of the somatic cells is especially significant. Tests conducted on guinea pigs, rabbits, mice, and rats have shown that of the total number of changes arising due to the effect of radiation, a significant portion are in the form of chromosome reconstructions, i.e., bridges and fragments are seen in the anaphase stages of mitosis.

Research conducted on the cytogenetic effect of a dose of 4 r to establish a possible minimum effective dose proves that there is a species specificity toward the effect of X rays on the sex cells of rodents: the most sensitive are guinea pigs, then rats, rabbits, and finally mice.

According to the research by G. G. Tinyakov and M. A. Arsen'yeva, chromosome reconstructions were demonstrated in the sex cells of monkeys 2 years after irradiation. In guinea pigs, the disturbances caused by doses of a few roentgens may be preserved for a significant portion of the period of sex activity. Furthermore, a comparison of the radiosensitivity of the sex cells of monkeys and mice toward 150 and 400 r doses indicates a higher radiosensitivity in the hereditary structures of the monkeys. In guinea pigs the frequency of chromosome reconstruction caused by the effect of the same dose of radiation is 50-100 times that of rabbits. All these results indicate that the cytogenetic effect of radiation depends not only on the magnitude of the dose but also on the cytological characteristics of the organism being irradiated.

Data obtained at the laboratories of this same institute are of great interest since they demonstrate the necessity for continuing to work on the detailed study of radiation sensitivity of man's structures of heredity. At present, one of the possible methods for this study is the qualitative and quantitative analysis of the sequelae of ionizing radiation effects on cell nuclei in human tissue cultures. The laboratory will also conduct its research for 1959 along these lines.

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87. Treatment of Skin Radiation Injuries With Fibrin Films

"The Problem of Using Fibrin Films in Radiation Injuries of the External Integument," by S. N. Allaverdyan, G. T. Grigoryan, Te. Kh. Sarkisyan, and S. A. Mazmanyan, Scientific Research Institute of Blood Transfusion imeni Prof R. O. Yeolyan, Ministry of Health Armenian SSR, Scientific Research Institute of Roentgenology, Radiology, and Oncology, Ministry of Health Armenian SSR, and the Republic Oncological Dispensary; Moscow, Meditsinskaya Radiologiya, Vol 4, No 2, Feb 59, pp 63-66

The use of radiation energy in therapy often causes a significant amount of injury to healthy tissue. Changes caused by the effect of radiation can be so great that they can bring about undesirable complications (dermatitis, ulcers, indurative edemas, etc.) which limit, in a number of cases, the use of radiation energy for therapeutic purposes.

In the research reported in this article, the authors attempted to discover ways of preventing the onset of complications and to treat the injuries resulting from radiation therapy.

Results of the treatment of 50 patients with fibrin films after deep X-ray therapy were favorable both in superficial and deep injuries with regard to alleviation of pain, shortening of the period of healing, prevention of secondary infections, and improvement of nutrition of the affected area. Fibrin films can be preserved for long periods, and the method of treatment is simple.

88. Postgraduate Course in Medical Radiology Recommended for Physicians

"The Problem of Training Personnel in Medical Radiology in Institutes for the Advanced Training of Physicians" (under study), by V. A. Ankudinov, Central Institute for the Advanced Training of Physicians; Moscow, Meditsinskaya Radiologiya, Vol 4, No 2, Feb 59, pp 80-85

The development of medical radiology and the extensive use of atomic energy in various fields require special preparation of medical personnel doing diagnostic and therapeutic work and require the planning of work conditions for people who come in contact with ionizing radiations.

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The following program is recommended by the Central Institute for the Advanced Training of Physicians, in Moscow:

An advanced training cycle in clinical radiology, 3 months (4 months for specialization); this includes 104 hours of lectures and 364 hours of practical experience.

An advanced training cycle on the use of radioactive isotopes in biology and medicine, 2 months (67 hours of lectures and 240 hours of practical experience).

An advanced training cycle on radiation hygiene, 3 months (164 hours of lectures and 304 hours of practical experience).

Each of these three subdivisions of medical radiology is explained separately and in detail, and various tables outline the pertinent components of the courses. The author presents the following conclusions:

1. The specialization and advanced training of physicians in medical radiology must be directed along three lines: clinical radiology, use of radioactive isotopes in biology and medicine, and radiation hygiene.

2. Regardless of the main direction of all course cycles, it is necessary to include the training of personnel in nuclear physics and dosimetry, radiology, radiation therapy, and labor protection.

3. The selection of the basic direction is determined by the specialty of the physician.

4. For the successful specialization and advanced training of physicians in medical radiology, the proper assembling of the course cycles is essential.

5. Compulsory teaching of radiology for at least 72 hours, with the specific nature of each course cycle taken into account, should be introduced into the program of specialization and advanced training of roentgenologists, therapists, and surgeons.

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Surgery

89. Surgical Application of Electronic Devices

"Cybernetics in Surgery," by A. A. Vishnevskiy, L. L. Shik, and B. I. Khodorov, Eksperimental'naya Khirurgiya, 1959, 1, 6-11 (USSR) (from Meditsinskiy Referativnyy Zhurnal, No 7, Jul 59, p 3)

"The great progress which has been made in the physicomathematical sciences and in technology will entail and bring about serious shifts in the realm of medicine. In connection with the progress made in cybernetics, it is possible to expect that technology will come to the aid of medicine in a number of processes associated with the mental activity of a physician. Surgery offers a fertile field for utilization of electronic computing and control devices. The need for such devices is determined by the extraordinary nature of surgery itself, which is often conducted under circumstances in which not hours or minutes, but seconds, determine the success or failure of operative procedures used. Individual examples are given in the article of those possibilities which become clear in the light of the progress made in cybernetics."

Veterinary Medicine

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90. New Method for Preserving Animal Semen

"Drying -- a New Method for Preserving the Semen of Animals," by Candidate of Biological Sciences N. Yushchenko; Moscow, Nauki i Peredovoy Opyt v Sel'skom Khozyaystve, No 3, Mar 59, pp 45-48

Improving the application and the search for new methods for the long-term preservation of semen of agricultural livestock is one of the real problems in the biology of breeding. Much theoretical and practical interest has been evinced in preserving semen in the dry state.

Between 1954 and 1957 in the Department of Biology of Livestock Breeding of the All-Union Scientific Research Institute of Animal Husbandry, which is under the scientific leadership of Academician V. K. Milovanov, experiments have been conducted on drying semen obtained from bulls, rams, and rabbits. The author claims to be able for the first time to keep alive a small number of dried spermatozoa after storage for a long time under vacuum, and has succeeded in preserving the ability of these spermatozoa to fertilize.

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From nine experiments involving 55 rabbits, three tests showed positive results. A total of 41 rabbits were born as a result of insemination by dried, 62-day stored spermatozoa, the longest time reported.

Miscellaneous

91. Medical Research in RSFSR During 1958

"In the Ministry of Health RSFSR" (unsigned article); Moscow, Meditsinskiy Rabotnik, 7 Jul 59

At a meeting of the members of the Ministry of Health RSFSR, Prof D. A. Zhdanov, chairman of the Scientific Medical Council of the Ministry of Health RSFSR, reported that during 1958 scientific research was conducted in 47 medical vuzes (higher educational institutions) and 73 scientific research institutes under the Ministry of Health RSFSR. Nearly 14,000 scientific associates were engaged in research in laboratories, clinics, libraries, etc. During the year, 84 doctor's and 533 candidate's dissertations were completed, and 141 monographs, 184 collections of scientific works, and 35 texts were published.

It was also pointed out at the meeting that during 1958 there was considerable curtailment of research on nutritional hygiene and the hygiene of agricultural labor. Prof A. I. Nesterov and Prof S. N. Cherkinskiy indicated in their reports that interest in the development of the problems of prophylaxis of enteric, cardiovascular, and other diseases had decreased during 1958.

92. Statistical Data on Outpatient Establishments and Dispensaries of the USSR

"Statistical Data" (unsigned article); Moscow, Sovetskoye Zdravookhraneniye, No 8, Aug 59, pp 59-64

Statistical data prepared by the Division of Medical Statistics, Ministry of Health USSR, give the number of outpatient establishments and dispensaries of the USSR in the following categories as of 1958:

Antituberculosis establishments -- total number, 5,562, of which 1,254 are dispensaries.

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Skin-venerealogical establishments (rural and urban) -- total number, 5,619, of which 615 are dispensaries.

Oncological establishments (rural and urban) -- total number, 1,498, of which 225 are dispensaries.

First-aid medical stations (rural and urban) -- total number, 1,889.

Medical-physical culture dispensaries and dispensary departments (rural and urban) -- total number, 1,160.

Public health points (independent units and those which are part of other establishments) including medical public health points -- total number, 7,262; and feldsher public health points -- total number, 15,596.

Feldsher-midwife stations and kolkhoz lying-in-homes in rural areas, including feldsher-midwife stations -- total number, 73,993; and kolkhoz lying-in-homes -- total number, 11,421.

93. 27th All-Union Congress of Surgeons To Be Convened in 1960 in Moscow

"On the Convocation of the 27th All-Union Congress of Surgeons" (unsigned article); Moscow, Meditsinskiy Rabotnik, 28 Aug 59

The Board of the All-Union Society of Surgeons has announced that the 27th All-Union Congress of Surgeons will be held in Moscow from 12 to 18 May 1960.

The program will include problems concerned with the diseases and injuries of the esophagus (excluding cancer); conservative and surgical treatment of endarteritis; pathogenesis, clinical course, and treatment of burns; and bone tumors. The congress will also take up organizational issues, elect the board of directors, etc.

Inquiries should be sent to the Organizational Committee, Moscow G-21, Teplyy per., 16.

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94. Soviet Infectious Diseases Institutes Reorganized

"Reorganization of Scientific Research Institutes" (unsigned article); Moscow, Meditsinskiy Rabotnik, 1 Sep 59

The Ministry of Health USSR has decided to reorganize a number of scientific research institutes. As of 1 January 1960 the Institute of Virology, Academy of Medical Sciences USSR, will be restricted to conducting research only on influenza and other respiratory diseases, as well as on problems of general virology.

The Institute [for the study] of Poliomyelitis [Academy of Medical Sciences USSR] will be renamed the Institute of Neuroinfections (Institut Neyroinfektsiy) and will have under its jurisdiction all laboratories concerned with the study of neuroinfections which have been under the Institute of Virology.

The Institute of Epidemiology and Microbiology, Ministry of Health RSFSR, will be reorganized into the Institute of Children's Infections (Institute Detskikh Infektsiy) and will be concerned with the study of diphtheria, whooping cough, scarlet fever, etc.

95. Lenin's Concept of Materialism and Empiriocriticism

"Philosophical Problems in Natural Science and Medicine," by M. Mirskiy (a theoretical conference devoted to the discussion of the brilliant work of V. I. Lenin entitled Materialism and Empiriocriticism); Moscow, Meditsinskiy Rabotnik, 15 May 1959, p 3

The author of this article reports that a theoretical conference arranged by the Proletarskiy Rayon Party Committee and the Chair of Philosophy of the Academy of Medical Sciences USSR was held in commemoration of the book Materialism and Empiriocriticism written by V. I. Lenin. This book was published 9 May 1909. The subject of the conference was the Marxist-Leninist Theory of Knowledge and some Philosophical Problems in Natural Science and Medicine. It aroused great interest among physicians and workers of scientific research institutes.

A. M. Pegov, the first secretary of the rayon party committee, delivered the opening address. He stressed the significance of the book Materialism and Empiriocriticism. A. M. Pegov said, "Lenin developed in his book a new concept of Marxist philosophy and thoroughly substantiated the principle of the Communist nature of philosophy; from the viewpoint of dialectical materialism Lenin drew inferences from the most important discoveries in natural sciences." A. M. Pegov

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further stated that the significance of this book in our time consists of the fact that V. I. Lenin mercilessly criticized the most influential representatives of idealistic philosophy dominant toward the end of the 19th Century and at the beginning of the 20th Century, stripped the disguise of the most important arguments of the bourgeois philosophy, and formulated the principle of scientific criticism of the reactionary philosophy of the imperialistic bourgeoisie, and philosophical revisionism.

The author of this article further states that V. I. Lenin, in exposing the agnostic essence of empiriocriticism, based the Marxist theory of knowledge on the theory of reflection. Doctor of Medical Sciences I. A. Stankevich, in his address, said that present-day knowledge of the brain offers new evidence which confirms the Lenin theory of reflection from the viewpoint of natural science. This Lenin theory is based on great scientific discoveries, including those of I. M. Sechenov and I. P. Pavlov, who established the physiological mechanism of psychic processes. The basic principles of the theory of reflection bear out the fact that psychic activity is possible only because the brain reflects the external environment; that is, the result of the effect of objective reality on the sensory organs -- the human and animal brain.

T. P. Mering stated that the agnostic formula, "we don't know and will not know," because one of the slogans of bourgeois reactionaries. In his book Lenin unmasked the reactionary nature of empiriocriticism and smashed its proponents. Physiological evidence collected to date proves the insolvency and ideological impoverishment of the proponents of agnosticism. The combined efforts of physiologists, psychologists, morphologists, and philosophers will be needed to clarify the processes through which perception, imagination, and consciousness are formed. T. P. Mering said that there is no doubt in his mind that sooner or later science will solve these problems.

Candidate of Medical Sciences A. S. Raben outlined the reactionary nature of present-day Freudianism. He said that Freudianism is one of the manifestations of reactionary bourgeois idealism which, despite its theoretical and practical insolvency, has gone beyond the limits of pure medicine: it is utilized in the West as some sort of universal philosophical doctrine counterpoised against dialectical materialism. In the US and in a number of other capitalistic countries, there exists a so-called psychological (Freudian) trend in sociology. This trend considers all social phenomena, including the class struggle, as problems of subjective psychology of the personality. Freudian sociologists, said A. S. Raben, reject the objective laws of the development of society. "The mighty weapons in the struggle against Freudianism in the realm of natural science and medicine are the Marxist and Leninist theory and the Pavlovian materialistic teachings which serve as a foundation for advanced medical science."

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No other science has made such great advances in the past 10 years as physics. Physics is acquiring an important role in biology and medicine. Further progress in these sciences is connected with the study of the physical mechanisms in a living organism. Modern physics creatively utilizes the rich Lenin legacy on the theory of knowledge. Lenin's ideas concerning the inexhaustibility of the atom and electron maintain that physics will find a way out of the crisis on the basis of dialectical materialism only. These statements are credited to Docent A. N. Krongauz.

Prof S. A. Kosilov discussed occupational activity and its role in the process of human thought and cognition. The physiology of work offers the only correct answer to the question of the mechanism of formation of the second signal system characteristics. Guided by this theory, physiologists state that work is the natural source from which the higher quality of the second signal system springs and develops. Conversion of work into conscious indispensability presents a qualitative jump into the evolution of work and mental activity.

In his writings Materialism and Empiriocriticism, Philosophical Notebook, and others, V. I. Lenin analyzed profoundly the problem of mental activity. Lenin connected this problem with the fundamental problem of philosophy: the relationship between consciousness and existence. The question of interrelationship between language and mental activity is also attracting great interest. This was discussed by Junior Scientific Worker G. M. Lyamina. The ability to form ideas, to be guided by them, and to form scientific abstractions is the most important difference between human mental activity and the highest forms of psychic activity in animals. The tongue being an instrument of thinking at the same time serves as an instrument for sharing ideas.

Prof S. M. Leytes spoke on the subject of the Lenin theory of development. The dialectic law of unity and the struggle between contrasts, and the law of negation connected with it, are of great significance in understanding a number of problems in modern endocrinology: they also serve as a guide in the contest against idealistic concepts. The so-called theory of equilibrium, which is widespread among scientists abroad, considers rest as a normal condition and rejects internal contradictions in the process of regulation and interrelationship of glands of internal secretion. This theory cannot stand criticism, because equilibrium is only an element of motion; it is relative and temporary. The dialectic idea concerning the interdependence of endocrine glands makes it possible to understand correctly and to evaluate the tangible interrelation of the glands of internal secretion.

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V. I. Lenin proved the absurdity of the application of biological laws, particularly the law of "struggle for existence," in the human society. Candidate of Medical Sciences R. A. Kalyuzhnaya, however, stressed that Marxism by no means rejects dialectic interaction between social and biological laws. Medicine studies the interaction between biological and social laws; it is impossible to separate human beings from their social environment with which they are linked organically. The problem of interaction between social and biological laws is especially important in pediatrics. A socialist society produces a significant positive influence on the growth, development, and formation of the personality of children and adolescents.

Lenin's philosophical principle of party loyalty is very important to medical scientific progress. Prof A. V. Kozlova and Scientific Worker T. P. Bolotova discussed this in their reports. They said that the fierce struggle between two irreconcilable philosophical camps lies at the base of party loyalty and that the general theory of Marxist dialectics about the irreconcilability of antagonists is beginning to take root.

Prof P. P. Bondarenko summed up the proceedings of the conference by saying that V. I. Lenin's book Materialism and Empiriocriticism, is permeated with the greatest optimism and faith in the invincibility of advanced science. Dialectical materialism affirms the omnipotence of the human mind and has the power to delve into the secrets of nature and to present a scientific, objective, and accurate picture of the universe. He said that "the immortal ideas of V. I. Lenin, embodied into the historical decisions of the 21st Congress of the Communist Party of the Soviet Union give the Soviet people a good view of the road leading to Communism."

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96. Prof V. I. Skvortsov, Soviet Pharmacologist, Dies

"Vladislav Irinarkhovich Skvortsov (1879-1959)" (unsigned article); Moscow, Vestnik Akademii Meditsinskikh Nauk SSSR, No 5, May 59, pp 93-94

Prof Vladislav Irinarkhovich Skvortsov, Active Member of the Academy of Medical Sciences USSR, Honored Worker of Science, and one of the old-time pharmacologists of the USSR, died on 30 January 1959 in his 80th year.

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Skvortsov graduated from the Military Medical Academy in 1902, and after obtaining his degree of Doctor of Medical Sciences in 1909 he held several academic positions as professor of biochemistry and pharmacology. In 1924 he became head of the Chair of Pharmacology, Second Moscow State Medical Institute imeni N. I. Pirogov; he retained this position for the rest of his life.

Skvortsov was the author of numerous important pharmacological monographs and texts. Under his supervision 11 persons received their doctoral degrees and 34 their candidate degrees.

Skvortsov was the editor of the periodical Farmakologiya i Toksikologiya from 1940 to 1948, and was awarded the Order of Lenin, the Order of Labor Red Banner, and medals.

97. Prof A. M. Grinshteyn, Soviet Neurologist, Dies

"In Memory of A. M. Grinshteyn" (unsigned article); Moscow, Meditsinskiy Rabotnik, 11 Aug 59

Aleksandr Mikhaylovich Grinshteyn, Active Member of the Academy of Medical Sciences USSR, Honored Worker of Science, and an outstanding Soviet neurologist, died in his 78th year.

Grinshteyn graduated from the Medical Faculty of the Moscow University in 1904 and began his scientific work at the Nervous Diseases Clinic of the university. After completing his dissertation he became head of the Chair of Nervous Diseases at Khar'kov and Voronezh, and finally in 1940 at the Second Moscow Medical Institute.

He was the author of over 150 scientific works, many of which are well known in foreign countries. During his academic years Grinshteyn was a member of several neurological periodicals and a member of the All-Union and Moscow Societies of Neuropathologists and Psychiatrists.

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VII. METALLURGY

98. Some Work Done at the Institute of Powder Metallurgy, Cermets, and Special Alloys of the Academy of Sciences Ukrainian SSR

"In Step with Life," by P. Likhodin; Moscow, Promyshlenno-Ekonomicheskaya Gazeta, Vol 4, No 89 (544), 31 Jul 59, p 4

The Institute of Powder Metallurgy, Cermets, and Special Alloys of the Academy of Sciences Ukrainian SSR was originally a small laboratory. It grew within a few years into one of the largest scientific research institutions of the Ukraine. The scientists active at this institute have made a major contribution to the development of powder metallurgy and to the introduction of powder metallurgy into industrial application.

The Division of Physicochemical Research of the institute is not engaged merely in theoretical research. At the laboratory of this division new carbide-chromium and carbide-titanium alloys are being developed which exhibit superior physico-chemical and mechanical characteristics. Machine parts made of materials of this type are pressure-molded at 1,200-1,400° Centigrade. The carbide-chromium materials developed at this division exhibit a high degree of hardness and great strength. They are resistant to the corrosive action of acids, solutions of alkalis, solutions of salts, petroleum, gasoline, and other agents. Carbide-chromium machine parts were found to last 40-50 hours under conditions at which annealed carbon steel deteriorated in 4 hours. The useful life of carbide-chromium pressure molds and dies for drawing steel pipes is 10 times greater than that of the corresponding parts made of carbon steel.

Parts made by powder metallurgy processes are used in automobiles, planes, machine tools, diesel locomotives, electrical machines, tractors, instruments, and laboratory equipment.

At the Technological Division of the institute which is headed by I. Fedorchenko, Corresponding Member Academy of Sciences Ukrainian SSR, work is being done on the possibilities of expanding the applications of powder metallurgy in machine building. According to N. K. Kostyrko, chief technologist of this division, a method has been developed for producing powders with spherical grains having dimensions from 30 to 250 microns. Depending on the diameter of the spherical grains, pores ranging in size from 2-3 to 50 microns result in the metal. The degree of porosity of the alloy is controlled by adjusting the arrangement of the spherical grains. Procedures of this type are very important for the production of

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filters required in building machines and in the chemical and metallurgical industries. Powder metallurgy is used extensively in the production of porous antifriction parts. Bearings and bushings produced by powder metallurgy methods are not inferior to cast parts as far as their mechanical properties are concerned. At the same time, they wear in better, have a lower coefficient of friction, and last longer. The porosity of parts of this type facilitates automatic lubrication. This applies particularly to machines which operate under water and are difficult to lubricate for this reason.

According to Kostyrko and other workers of this institute, modern machines develop very great pressures per square centimeter of the friction surface because of the high velocities of braking. The metal is heated instantaneously to 1,000-1,100° C under the circumstances. This puts tough requirements to the materials which are subjected to the friction. For operation under these conditions, dense materials have been developed which have a high coefficient of friction (0.17-0.7), are resistant to rapid heating, and do not seize during operation.

The less the clearance between the housing and the vanes of a turbine, the more efficient the operation of the turbine. However, it is very difficult to use a minimum clearance in the construction of turbines, because the vanes expand at high temperatures, so that damage to the turbine result during operation. I. Fedorchenko and A. Lyapunov, another worker at the institute, proposed that a soft alloy be used for lining the inside of turbine housings. When this is done, a very small clearance between the vanes and the housing can be maintained and expansion of the vanes still does not result in any damage. Tests conducted at Leningrad and Khar'kov plants proved that the efficiency of gas turbines can be considerably increased in this manner.

Work on the development of materials for electric contacts was also done at the institute. The temperature generated when the current is switched on or off brought about fusion of contacts made of copper or silver. With large currents, contacts of these materials could be used only once. Prof I. Frantsevich did research aimed at the replacement of these metals with materials produced by the powder metallurgy method. The purpose of his research was to develop materials which combine a high melting point with high heat conductivity and a high electrical conductivity. Materials of this type were actually developed. They consist of tungsten alloyed with copper or tungsten alloyed with silver. The alloys in question are hard, resistant to erosion, have a high tensile strength, and exhibit a high resistance to fusion. Contacts made of these alloys are used in high-capacity oil and air switches, magnetic starters, throw-over switches, and contacters. An additional advantage of the new alloys is the much lower cost in comparison with contact materials used formerly.

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Multicomponent Nickel Alloys Containing Titanium Carbide

"Investigation of Metal Compounds in Multicomponent Nickel Alloys With Varying Contents of Titanium Carbide," by R. B. Golubtsova and L. A. Mashkovich, Institute of Metallurgy, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk, No 6, Jun 59, pp 971-974

A six-component nickel solid solution containing 0-95% of titanium carbide had been investigated by Kornilov, Pryakhina, and Ozhimkova (cf Zhurnal Neoganicheskoy Khimii, Vol 3, No 3, Mar 58, pp 708-716). In the work described at present, the principal phases were studied which are formed by a system of this type. The electrolytic method of phase analysis described by R. B. Golubtsova and L. A. Mashkovich in Zhurnal Neorganicheskoy Khimii, Vol 3, No 3, Mar 58, pp 717-721, was used to investigate the composition of a six-component nickel alloy containing chromium, molybdenum, tungsten, niobium, aluminum, and titanium carbide in a quantity ranging from 0.1 to 7.5% of TiC. Electrolytic investigation of the phases showed that dissolution of an alloy containing 0.1% of Ti C did not result in the separation of a predominant phase. This finding was confirmed by data on the microstructure and the results of x-ray diffraction analysis. Investigation of alloys containing 1.0%, and 7.5% of Ti C indicated that only two phases are present: a gamma-nickel solid solution and a complex carbide phase of the composition Ti (Nb, W, Mo, Cr) C. According to the data of x-ray diffraction analysis, the carbide phase that separates has a cubic face-centered lattice which corresponds to that of titanium carbide and a cell dimension ranging from 4.33 to 4.38 kX depending on the relative content of Nb C and Ti C.

99. Some Developments in the Field of Nonferrous Metallurgy in Kazakhstan

"As Told by Kazakhstan Scientists," by A. Mirkina; Moscow, Nauka i Zhizn, Vol 26, No 8, Aug 59, p 2-8

According to V. D. Ponomarev, Corresponding Member, Academy of Sciences Kazakh SSR, the electrical smelting of lead concentrates in the presence of soda is regarded as very promising. At present quartz and iron ore are used as fluxes in smelting lead concentrates; when the soda method is applied, soda will function as a flux.

Application of the new method will make it possible to produce technically pure lead in one step. During the smelting copper, zinc, and other valuable ingredients concentrate in the melt formed by the fused matte and slag, which are later converted by hydrometallurgical methods.

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Of importance is also the cyclone method of smelting. When this method is applied, a mixture of air and small particles of material containing lead is blown into an appliance called the cyclone. The mixture moves along a spiral in the cyclone. The solid particles are projected to the wall of the cyclone while the air blows around them. Intensive oxidation takes place as a result of which the temperature is raised sharply. During the process some substances are distilled or sublimed (they are transformed into small solid particles subsequently to condensation), while others are transferred into the crude lead, matte, and slag.

The cyclone method is at present also being tested at the Balkhash Mining and Smelting Combine, where it is used for the conversion of copper concentrates.

All the new methods being applied for the conversion of materials containing nonferrous and rare metals will make it possible to recover more completely every valuable ingredient contained in them.

New branches of nonferrous metallurgy will also be developed in Kazakhstan. This applies primarily to the production of light metals.

They will be produced at nonferrous metallurgy plants located at Ust'-Kamenogorsk and also at a plant which is being built at Pavlodar. Work is being done at present on the development of an efficient method for the electrolytic production of titanium. Titanium is a new metal which is superior in many respects to aluminum and other metals. It is irreplaceable as a material for the building of aircraft, ships, and rockets.

100. Boron Trichloride in Magnesium Alloy Casting

"On the Use of Boron Chloride in Casting Magnesium Alloys," by. D. A. Kuznetsov, Candidate of Chemical Sciences and A. I. Malakhov, Candidate of Technical Sciences; Moscow, Liteynoye Proizvodstvo, No 5, May 59, p 32

Information from foreign patents on the use of a boron triflouride protective agent in sand mold casting of magnesium and its alloys is used as the basis for tests to determine if boron trichloride could produce analygous results. A cylindrical pattern 80 mm in diameter and 106 mm in length for an 820-gram casting of magnesium alloy MI-5 was formed in a 165 x 120 x 150 mm mold box with Tambov sand P01A (P 100/200) and P0063A (P 140/270) having a 4 to 6% moisture content. Plant conditions were

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approximated in melting and pouring the alloy. Boron trichloride was supplied to the mold cavity through a pouring gate until a white vapor produced in the formation of hydrochloric acid through the reaction of boron trichloride and water vapor appeared at the overflow gate. Pouring followed immediately. In separate tests, jets of boron trichloride were directed at the molten metal stream entering the pouring gate. Positive results were obtained by both methods.

The protective action of boron trichloride during casting may be explained by the following reactions:

1. Boron trichloride reacts with water vapor and surface moisture within the mold cavity --

$$2BCl_3 + 2H_2O = H_3BO_3 + HBCl_4 + 2HCl;$$

2. Oxygen not displaced by boron trichloride within the mold cavity oxidizes molten magnesium to MgO which reacts with HCl --

$$MgO + 2HCl \longrightarrow MgCl_2 + H_2O$$

3. Boron trichloride also reacts with molten magnesium --

$$3Mg + 2BCl_3 \longrightarrow 3MgCl_2 + 2B.$$

The solid solution of magnesium-boron or aluminum-boron and magnesium chloride formed on the surface of the metal prevents reaction of magnesium with oxygen, nitrogen, and water vapor.

101. Production of Fine Wire by Molten Extrusion

"A Perspective Technology -- Production of Fine Wire by a Method of Molten Extrusion," by S. Bogoslovskiy, chairman of the Temporary Commission of the State Scientific-Technical Committee USSR; Moscow, Promyshlenno-Ekonomicheskaya Gazeta, 1 Jul 59, p 2

Oshchepkov, Rybalka, Shpirnov, Troyanovskiy, and the author conducted experiments at the Institute of Metallurgy imeni Baykov, Academy of Sciences USSR, in 1956 to produce fine wire by a method involving ejection of a molten metal through a gauged orifice into a cooling stream of air or atomized water. Molten metal was poured into a crucible set in a resistance furnace housed by a steel container. The steel container was then capped

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by a hermetic lid containing a special nozzle made of heat resistant material and a valved coupling for a source of gas or air pressure. One end of the nozzle opened externally and the other just above the crucible bottom. A baffle plate with a gauged orifice was located within the nozzle. When molten metal and nozzle temperature reached a fixed point pressure was switched in and molten metal ejected from the nozzle in the form of a fountain. Ejection speeds up to 14 m/sec were obtained depending on the specific weight and temperature of the metal, pressure and orifice diameter. Cooled by air or a water spray, the molten jet (having a diameter equal to that of the nozzle baffle orifice) was transformed into a wire which fell in the form of a so-called "tangle."

Over 300 tests were conducted with aluminum and its alloys, magnesium, copper and its alloys, zinc and lead. Wires with lengths of 0.2 to 5 meters and diameters of 0.6 to 0.1 mm were produced at extrusion speeds of 5 to 14 m/sec and pressures of one to 8 atm. Highest speeds were obtained with magnesium and aluminum and the lowest with lead and copper.

Wires produced by the above method are contemplated for application in the production of filters, shells, reinforced plastics and numerous other items. Positive results were obtained by using "tangles" of fine oxidized aluminum wire for high-temperature items usually prepared with oxidized aluminum powder involving complex and hazardous techniques. Lead wires of 0.1 mm diameter were tested in storage batteries but it is considered that best results would be obtained by using 0.05 mm diameter wire also considered possible by this method.

Sufficient facilities do not exist for refinement of the process and development of wire-catching and reeling techniques. It is the opinion of the author that an industrial technology and facilities could be completed in 3 to 4 years if the experimental facilities were available. Economy of this method is obvious when considering that the production of 0.2 mm aluminum wire by present methods involves 46 individual rolling and drawing passes.

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

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VIII. PHYSICS

102. Corona Discharge Counters

"The Pattern of the Electric Field in Corona Counters," by Yu. M. Tolchenov; Moscow, Pribory i Tekhnika Eksperimenta, No 3, May-Jun 59, pp 40-43

The electric field pattern is computed for counters of strongly ionizing particles, operating in the region of a stabilized corona discharge. The results were experimentally tested by measuring the transit time of ions through the counter and by comparing these values with those obtained by computation. In all cases, good agreement between theoretical and experimental results was found.

103. Measurements of Ultraviolet Radiations

"Photon Counters for Accurate Measurements of Ultraviolet Radiation," by L. S. Shelkov, I. A. Prager, and A. G. Kostin, Physics Institute of the Academy of Sciences USSR and Moscow Electric Bulb Plant; Moscow, Pribory i Tekhnika Eksperimenta, No 3, May/Jun 59, pp 50-56

Electric and photometric characteristics of self-quenched photon counters with photocathodes of various materials are studied. The study was carried out at relatively high counting speeds ensuring a small statistical error in the measurements (~ one percent) for a limited exposure time (~ one min). The design of a photon counter with a photocathode of Cu-Be alloy provided with a shielding screen of tungsten wire was developed. This design provided a substantial increase in the stability of the sensitivity of the photocathode.

104. Gas-Discharge Counter

"Gas-Discharge Scintillation Counter," by L. S. Sorokin; Moscow, Pribory i Tekhnika Eksperimenta, No 3, May/Jun 59, pp 57-58

The possibility of applying a complex photocathode (antimony-cesium) in a self-quenched counter is shown. The effectiveness of the antimony-cesium photocathode with a slight retarding electric field at its surface in eliminating thermoelectron flow from the photocathode and the flow of

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positive ions to the photocathode is established. The possibility of recording scintillations from such crystals as NaJ (Tl) with a self-quenched gas-discharge counter is demonstrated. By using a Naj (Tl) crystal 10-mm thick, the response of the counters to gamma-quanta of Co-60 was increased by 14.5 times in comparison with usual counters of the type BC-4.

105. Solution of Equations for Shock Waves Discussed

"On the Theory of Shock Waves," by G. Ya. Galin, Moscow State University imeni M. V. Lomonosov; Moscow, Doklady Akademii Nauk SSSR, Vol 127, No 1, 1 Jul 59, pp 55-58

The existence of a continuous solution to the equations for the form and width of a shock wave, which take into account viscosity and heat conductivity, is examined for the case of a medium with arbitrary equation of state; the consequences of considering shock transitions as the limit of the continuous solutions are discussed.

106. Motion of Body Containing Liquid Studied

"On the Theory of the Elastic Oscillations of a Body Containing Liquid," by N. N. Moiseyev, Computing Center, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 127, No 1, 1 Jul 59, pp 51-54

The oscillations of an elastic body inside which there is a liquid are studied. The liquid may partially or entirely fill the body. The simplest case is considered when the elastic body is schematized as a beam with a rectilinear axis of rigidity. Infinitely small bending and twisting oscillations of the beam are assumed to produce a potential motion in the liquid. The equation of motion of the system is derived.

107. G. S. Landsberg Memorial Volume

Trudy Fizicheskogo Instituta, Vol 9 (1958)

Dissertations completed in the Optical Laboratory under Academician G. S. Landsberg and defended at the Physics Institute imeni Lebedev of the Academy of Sciences USSR are published in this issue of the Trudy,

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together with an obituary and eulogies delivered by Academicians Tamm, Landau, Kazanskiy, professors Mandelshtam and Dobrotin and corresponding member V. I. Veksler, on the occasion of Landsberg's demise on 2 February, 1957. Dissertations by Kh. Ye. Sterin, T. S. Velichkina, A. A. Shubin, I. L. Fabelinskiy and I. I. Sobel'man "defended between 1949 and 1955 and having maintained their scientific value" are presented, and are titled as follows:

"Study of Shape and Width of Lines of Combination Scattering of Light," Kh. Ye. Sterin (defended 1949)

"Molecular Scattering of Light in Viscous Liquids and in Solid Amorphous Bodies." by T. S. Velichkina (defended 1954)

"Molecular Association of Carbonic Acids and Their Infrared Spectra," by A. A. Shubin (defended 1954)

"Molecular Scattering of Light in Liquids," by I. L. Fabelinskiy (defended 1955).

Some Problems of the Theory of Spectral Lines," by I. I. Sobel'man (defended 1955).

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IX. MISCELLANEOUS

108. New Institute Established by Odesskiy Sovnarkhoz

"A New Institute for the Introduction of New Technology Established" (unsigned article); Moscow, Promyshlenno-Ekonomicheskaya Gazeta, 24 May 59

The Odesskiy Sovnarkhoz has established a Planning-Design Technological Institute (Proyektno-Konstruktorskiy Tekhnologicheskiy Institut). The institute's principal studies will concern the development and introduction of progressive technological processes and means of automation and mechanization at various establishments of the Odessa Economic Region.

109. New Armenian Scientific Research Institutes Established

"New Scientific Research Institutes" (unsigned article); Moscow, Izvestiya, 12 Aug 59

"A new scientific research center" has been established in the Academy of Sciences Armenian SSR, which consists of the Institute of Electrical Engineering (Institut Elektrotekhniki) and the Laboratory of Physical Chemistry (Laboratoriya Fizicheskoy Khimii). The Institute of Electrical Engineering will work on solving the problem of unification of the power systems of Armenia, Georgia, and Azerbaydzhan into a single Transcaucasian system. The Laboratory of Physical Chemistry, which is the 30th scientific establishment of the Academy of Sciences Armenian SSR, will work on problems of the physics of chemistry.

Other new establishments include the Problem Laboratory concerned with the study of the genetics of polymerization processes of physicochemical polymers, organized at the Yerevan State University, and the Institute of Archaeology and Ethnography (Institut Arkheologii i Etnografii).

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