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CENTRAL INTELLIGENCE AGENCY

SCIENTIFIC  
INFORMATION REPORT



29 January 1960

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PLEASE NOTE

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

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I. BIOLOGY

Organic Evolution

1. Evolution of Species

"Interrelationships Between Organisms and Their Role in Evolution," by M. M. Komshilov, Murmansk Marine Biology Institute, Kola Affiliate imeni S. M. Kirov, Academy of Sciences USSR; Moscow, Zhurnal Obshchey Biologii, Vol 20, No 5, Sep/Oct 59, pp 370-378

The author of this article states that in his book, The Origin of Species, Charles Darwin discussed the role that various physical factors play in bringing about organic alterations. Darwin concluded that interrelationships between organisms play a leading role in the evolutionary process. Investigations conducted by the Murmansk Marine Biology Institute confirm this theory. Complexes of interrelated species, not individual species, become adapted to various physical factors and the specificity of adaptation to abiotic factors is thereby determined by peculiarities of species interrelationships.

The leading role of biotic relations in the life and evolution of species is determined by the fact that the organic world emerged not in a form of a single, isolated species, but as a system of diverse, interconnected organisms living in association.

2. Controlled Selection Studied

"Controlled (Bioanthropic) Selection," by P. O. Sit'ko, Institute of Zoology, Academy of Sciences Ukrainian SSR; Moscow, Zhurnal Obshchey Biologii, Vol 20, No 5, Sep/Oct 59, pp 398-404

The author of this article presents a detailed analysis of the mechanism of controlled selection and compares it with mechanisms of natural and artificial selection; he examines the role it plays in the evolution of domestic and wild animals. The survival and evolution of organisms under controlled, or bioanthropic, selection depend on the environmental conditions created by man. The adaptation of organisms to these environmental conditions and their propagation are the result of controlled selection.

Radiobiology

3. Insects Rendered Radioactive by Direct Feeding on Radioisotope-Containing Foodstuffs

"A Method of Tagging Insects by Feeding Them Foodstuffs Containing Radioactive Isotopes," by G. D. Khudadov; Moscow, Byulleten' Moskovskogo Obshchestva Ispytateley Prirody, Novaya Seriya, Otdel Biologicheskii, Vol 64, No 3, May-Jun 59, pp 55-45

The purpose of this research was to study the feasibility of tagging insects by feeding them radioactive isotopes mixed with their food. Tests were conducted on the house fly and the brown cockroach.

A rather detailed historical survey of this subject is given by the author.

Results of this research indicated that tagging insects by feeding them foodstuffs containing radioactive isotopes is feasible for those radioisotopes which have high median energy levels for beta-spectra of the order of 0.8 Mev and higher, and a half life of at least one week.

An increase in the concentration of radioactive isotopes in the food produces a proportional increase in the radioactivity of the insects feeding on it.

By conducting such experiments for a period of 10-20 days, it is possible to tag the insects by feeding them meals containing 1-3 microcuries per ml. Longer experiments require proportionally higher concentrations of radioactive isotopes in the foodstuffs.

4. Effect of Gamma Irradiation on Silkworm

"The Effect of Gamma Irradiation by Co<sup>60</sup> on the Nutritional Characteristics of Mulberry Leaves for Silkworms," by L. F. Rozhdestvenskaya, U. A. Arifov, G. A. Kleyn, and Sh. A. Ablayev, Institute of Nuclear Physics, Academy of Sciences Uzbek SSR; Tashkent, Doklady Akademii Nauk SSSR, No 8, Aug 59, pp 11-13

The authors postulated that as a result of gamma irradiation of leaves which are to be fed to silkworms, complex protein molecules would be changed into simpler amino acids, and this chemical destruction would lead to increased silkworm feeding which, in turn, would be reflected in the silkworm's biological traits and productivity.

To test this theory, the authors conducted experiments during the summer (25 June 25 July) on hybrid silkworm caterpillars (Chinese 108 X Japanese 115) feeding on mulberry leaves irradiated by two doses of gamma rays (the first equal to 6,000 rep, and the second equal to 40,000 rep).

Results of these experiments indicate that the feeding of young caterpillars on foliage which has been irradiated by gamma-ray doses ranging from 6,000 to 40,000 rep increases their viability, the average weight of the cocoons, and the fertility of the butterflies.

This irradiation effect is more pronounced when doses are equal to 6,000 rep than when they are equal to 40,000 rep.

#### 5. Studies of Sr<sup>89</sup> in Rats

"Elimination of Radioactive Strontium From the Organism Under the Influence of Certain Complex-Forming Substances," by O. A. Khomutovskiy, Biophysical Laboratory of Institute of Physiology imeni O. O. Bogomol'yets, Academy of Sciences Ukrainian SSR; Kiev, Fiziologichnyy Zhurnal, Vol 5, No 7, Sep/Oct 59, pp 670-679

The author of this article describes experiments conducted on 233 white rats to determine the amount of Sr<sup>89</sup> accumulated in the tissues and the rate of its elimination from the organism after peroral and intra-peritoneal administration. The effect of oxalic acid, sodium rhodisonovate, and vanadium sulfate on the elimination of Sr<sup>89</sup> was also studied.

It was found that between 54% and 58% of Sr<sup>89</sup> is absorbed from the gastrointestinal tract. The maximum amount of Sr<sup>89</sup> accumulated in the soft tissues within 2 hours and in the bone tissues within 8 hours after it was taken orally. The Sr<sup>89</sup> content in the bones of the thighs was half as high and in the soft tissues one tenth as high after oral administration than it was after intravenous injection.

When oxalic acid was administered within one hour after Sr<sup>89</sup> was taken orally, the isotope content in the bones of rats was half as high as in the control group.

The preliminary data obtained indicate that sodium rhodisonovate has no effect on elimination of Sr<sup>89</sup> from the organism. Vanadium sulfate, used as a purgative, did not contribute to elimination of Sr<sup>89</sup> from the organism.



6. Soviets Use Radiation Against Phylloxera in Successful Experiments

"Use of Radioactive Isotopes Against Phylloxera" (unsigned article); Bratislava, Szabad Foldmuves, 20 Dec 59, p 2

"Shemin, a Soviet scientist, has proved in his experiments that radioactive isotopes can be successfully used against phylloxera. The roots of infected vine stocks were exposed to radiation and thereby the phylloxera were completely destroyed -- at all stages of the disease. The 20,000-30,000 roentgen units needed to destroy the phylloxera do not harm the vines."

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## II. CHEMISTRY

### Electrochemistry

#### 7. Ye. N. Yerebin's Work in the Field of Industrial Electrochemistry

"Ye. N. Yerebin (On the Occasion of His 50th Birthday)," by N. I. Kobozev and L. I. Nekrasov; Moscow, Zhurnal Fizicheskoy Khimii, Vol 33, No 10, Oct 59, pp 2387-2388

The 50th birthday of Ye. N. Yerebin, Professor at Moscow State University, Doctor of Chemical Sciences, was celebrated on 14 January 1959. Yerebin is a well-known physical chemist and a prominent investigator in the field of gas electrochemistry, i.e. a field of research which is concerned with producing chemical reactions under the action of electric discharges.

After completing the course at the Chemical Faculty of Moscow University in 1930, Ye. N. Yerebin was active at a number of production enterprises, institutes, and educational institutions.

The first independent scientific research done by Ye. N. Yerebin was carried out in 1931, when he worked at the Chenorechensk Chemical Combine. This work was on the purification of hydrogen sulfide produced by the iron-steam method. At the same time he conducted research on the thermodynamics of high-temperature gas processes. The work in question was concerned with the calculation of the free energy of the dissociation of hydrogen on the basis of molecular constants and the interpretation of the phenomenon of inversion of the ammonia equilibrium at high temperatures. The results obtained in this work made it possible to give a complete quantitative interpretation to the temperature inversion of the dissociation of ammonia.

After this, Yerebin concentrated on the investigation of two electrochemical gas reactions which are of the greatest importance both from the theoretical and practical standpoint, namely, the electrochemical oxidation of nitrogen and the cracking by means of an electric discharge of methane and gases containing methane to acetylene. The research in question, which was begun in 1932 at the Nitrogen Institute and is being continued now at the Chemical Faculty of Moscow State University, forms a substantial contribution to the development of processes of the electrochemical synthesis of nitrogen oxides and ozone, the cracking of methane and gases containing methane in an electric discharge, and the electrochemistry of gases in general. During 1932-1937, Yerebin in collaboration with N. I. Kobozev and S. S. Vasil'yev carried out work as a result of which the kinetics of reactions in electric discharges received a final formulation and practical methods were developed for the calculation of reaction constants in

electrical discharges. Calculation of yields of products in the state of equilibrium and determination of the limiting energy yields also formed a part of this investigation, in which kinetic schemes were formulated for the electrochemical oxidation of nitrogen, the electrochemical cracking of methane, the electrochemical synthesis of ozone, and a number of other processes.

One of Yeremin's outstanding achievements is the discovery of the specific action of a high-frequency discharge on the example of the electrochemical oxidation of nitrogen. In the work involved, it was established that displacement of the electrochemical equilibrium takes place in a high-frequency discharge. In connection with this, there is a change in the kinetics of the oxidation of nitrogen and also a change in the spectroscopic characteristics of the discharge. The results of the research in question formed the basis for Yeremin's candidate's dissertation, which he defended in 1937.

At the same time, Yeremin together with Kobozev and Vasil'yev formulated a theory of energy catalysis in electric discharges. This theory regards the specific chemical action of an electric discharge as a consequence of the high electron temperature which is developed and which results in an intense excitation of vibrational levels of molecules. The excited state is a result of collisions of the second type. This theory was expanded to cover the most important processes. Its validity was confirmed by spectroscopic investigation of discharges and the application of energy catalysts.

Development of relevant theoretical concepts and analysis of experimental data which were obtained led Yeremin, Kobozev, and Vasil'yev to the introduction into gas electrochemistry of a new parameter, namely that of the specific energy  $U/v$ , which expresses the ratio of the intensity of the discharge to the velocity of gas flow. This parameter is analogous to the reaction time in ordinary chemical kinetics. By using this ratio and employing data pertaining to processes taking place at low intensities, one can predict the course of a process at high intensities. The parameter  $U/v$  can be applied to any electrochemical reaction taking place in the gas phase.

During World War II, the electrochemical cracking of natural methane to acetylene was carried out at a large pilot plant installation under Yeremin's direction. High yields of acetylene and favorable energy indices were obtained. In 1949, Yeremin designed a new reactor for the electrochemical cracking of methane to acetylene. In 1950, he developed a method for the electrochemical synthesis of concentrated nitric acid from air and water and a method for recovering dilute nitrogen oxide gases. The work in question was carried out in collaboration with N. I. Kobozev and others.

During the same period, Yeremin obtained an experimental proof of the fact that the spectrum of the afterglow following the discharge in the reaction of nitrogen oxidation is due to a reaction of nitrogen oxide with oxygen atoms. In this manner it was established that atomic oxygen forms in the electrical discharge and is present in rather high concentrations.

Beginning with 1948-1949, Yeremin participated in work on the electrochemical synthesis of hydrogen peroxide and ozone. This work was carried out at the Laboratory of Catalysis and Gas Electrochemistry, Chemical Faculty of Moscow State University. In the course of the research in question, which was conducted by Yeremin in collaboration with Kobozev and L. I. Nekrasov, a method was discovered for the synthesis of hydrogen superoxide  $H_2 O_4$  by bombarding liquid ozone with atomic hydrogen.

Yeremin's activity after completion by him of the course at Moscow State University was at the chemical faculty of this university. He defended his candidate's dissertation at the Chemical Faculty in 1937 and his doctor's dissertation in 1951. Beginning with 1952, Yeremin has been professor at the Chair of Physical Chemistry. Since that time, he has conducted general and special courses and has been in charge of work done by candidates for diplomas and aspirants.

An outstanding characteristic of Yeremin's scientific work is its close correlation with practical developments in the field of chemical production. While perfecting under laboratory conditions the technology of the electric cracking of hydrocarbon gases, Yeremin maintains close contact with the constructors of the first USSR electric cracking plant.

#### Fuels and Propellants

##### 8. The Thermochemistry of Hydrogen Peroxide

"The Thermochemistry of the Dissociation of Hydrogen Peroxide," by K. B. Yatsimirskiy, Chair of Analytical Chemistry, Ivanovo, Chemicotechnological Institute; Ivanovo, Izvestiya Vysshikh Uchebnykh Zavedeniy - Khimiya i Khimicheskaya Tekhnologiya, Vol 2, No 4, Aug 59, pp 480-484.

The heats of formation of ions and radicals formed when hydrogen peroxide dissociates in different ways have been calculated. The ions and radicals in question comprise  $H^+$ ,  $O_2H^-$ ,  $H$ ,  $O_2H$ ,  $H^+$ ,  $O_2H^+$ ,  $HO^+$ ,  $OH^-$ , and  $OH$ . The electron affinity of a number of particles, the proton affinity of neutral particles and of anions, and the heats of hydration of ions and radicals formed by hydrogen and oxygen were determined. From the data obtained, the heat effects ( $\Delta H_{298}$ ) of dissociation reactions

of hydrogen peroxide and of some ions and radicals ( $\text{HO}_2^-$ ,  $\text{HO}_2^+$ ,  $\text{HO}_2$ ,  $\text{HO}$ ,  $\text{HO}^+$ , and  $\text{H}$ ) in the gaseous phase and in aqueous solutions were calculated. The lattice energies of the compounds  $\text{MO}_2$  and  $\text{M}_2\text{O}_2$  (where  $\text{M} = \text{Na}, \text{K}, \text{Rb}, \text{Cs}$ ) and the heats of formation of the ions  $\text{O}_2^-$  and  $\text{O}_2^{2-}$  in the gaseous state from them are listed.

9. A Conductometric Oxygen Indicator With a Light Signal

"A Conductometric Light-Signal Indicator of Oxygen in Gases,"  
by E. Ye. Konovalov, V. V. Matyukhin, V. P. Yemel'yanov, and  
A. G. Karabash; Moscow, Zavodskaya Laboratoriya, Vol 25, No  
10, Oct 59, pp 1260-1262

The conductometric light-signal indicator of oxygen described in this article is to be used for continuous control of the operation of equipment absorbing oxygen from chemically inactive gases; it indicates the moment when the absorbent has been spent and thus prevents the flow of contaminated gas into the system. The sensitive device of the appliance in question is charged with granulated silica gel coated with copper. The electric resistance of the copper increases after the copper has been oxidized by the oxygen contained in the gas; this change in resistance activates the signal indicator circuit. The appliance can be used to indicate the presence of oxygen in nitrogen, argon, helium, and other chemically inactive gases directly in the gas circuit at pressures up to 30 atmospheres. In one design of the appliance, the resistance of the copper in the sensitive device is offset by that of a nichrome spiral, which serves as a shunt and forms a part of the secondary signal indicator circuit. In a simplified design, the secondary circuit and shunting device are absent: there is only one circuit, i. e., the primary circuit which includes the sensitive device. When the resistance of the copper in the sensitive device becomes too great, current in the circuit ceases to flow and an electric signal lamp which is connected in series with the sensitive device goes out.

Both designs of the appliance can be used to indicate the presence of hydrogen rather than oxygen; in this case, silica gel coated with oxidized copper is used. An analogous arrangement can be used for checking chemically inactive gases for the presence of hydrocarbons (for instance, oil vapors). Just like hydrogen, hydrocarbons reduce the oxidized copper on the silica gel, except that the reduction takes place at a somewhat higher temperature (about  $500^\circ$ ). After reduction of the copper, the resistance of the sensitive device drops.

[For additional information on fuels and propellants see Electrochemistry and Industrial Chemistry]

Herbicides

10. Presprouting Application of Herbicides Recommended

"On the Question of the Presprouting Introduction of Herbicides," by Doctor of Biological Sciences Yu. V. Rakitin and A. D. Potapova, Institute of Plant Physiology imeni K. A. Timiryazev, Academy of Sciences USSR; Moscow, Doklady Akademii Sel'skokhozyaystvennykh Nauk imeni V. I. Lenin, No 7, 1959, pp 29-33

The authors recommend the further study and practical usage of the presprouting application of herbicides. They found that the presprouting treatment of soil with herbicides sharply suppresses weed sprouts and offers the possibility to better control the remaining weedy vegetation among cultivated crops.

In the experiments conducted by the authors the following herbicides gave the best results when applied in the doses indicated: isopropyl ester of phenylcarbamic acid - 5 kg/ha and isopropyl ester of 3-chlorophenylcarbamic acid - 1.5-2.5 kg/ha for destroying smartweed, chickweed and quack grass in sunflower sowings; 2,4-D(sodium salt) in a dose of 0.5 kg/ha; butyl ester of 2,4-D in a dose of 0.2 kg/ha for destroying broad-leaved weeds (smartweed, chickweed, winter cress and others) in wheat sowings and in a dose of 0.2 kg/ha for destroying smartweed, chickweed and other broad-leaved annual weeds in corn sowings; a mixture of 2,4-D in a dose of 1 kg/ha and isopropyl ester of phenylcarbamic acid in a dose of 10 kg/ha for the complete cleaning of fields to prepare them for subsequent sowings.

Industrial Chemistry

11. Titanium As a Material For Chemical Industry Equipment

"On the Fabrication of Chemical Equipment From Titanium,"  
by Engineer A. V. Nosov; Moscow, Khimicheskoye Mashinostroyeniye, No 5, Oct 59, pp 35-39.

The uses and prospects of the application of titanium, titanium alloys, and titanium-clad metals as materials for corrosion-proof and relatively heat-resistant chemical equipment are reviewed in considerable detail, mainly on the basis of non-USSR publications. It is pointed out that chemical equipment fabricated of titanium has been produced hitherto only by non-USSR enterprises, chiefly in the USA and FRG. The characteristics of VT1 (pure technical titanium), VT3 (Ti-Cr-Al), VT3-1 (Ti-Mo-Cr-Al), VT4 (Ti-Mn-Al), OT4 (Ti-Mn-Al), VT5 (Ti-Al), VT6 (Ti-Al-V), and VT8 (Ti-Mo-Al) are given. It is stated that the production of VT1 and of the alloys enumerated above (which are produced starting with VT1 and consist principally of titanium) has now been mastered. VT1 and OT4 are regarded as best-suited for the construction of chemical equipment. The dimensions of some titanium sheets and some cold-drawn seamless VT1 and VT5 tubes which can be supplied are given.

12. Investigations of the Corrosion Resistance of Metals For Chemical Equipment Including Titanium and Its Alloys

"Some Metals As Materials For Chemical Machine Building,"  
by G. L. Shvarts, Candidate of Technical Sciences; Moscow, Khimicheskoye Mashinostroyeniye, No 5, Oct 59, pp 39-42.

During the past 5 years, the Scientific Research Institute of Chemical Machine Building carried out thorough investigations to determine the technological characteristics and corrosion resistance of the new steels Kh18N28M3D, Kh23N23M3D3, Kh23N28M3D3T, and Kh23N27M2T; Ni-Si-Cu alloy; aluminum of the AV2 grade; VT1 titanium; and some other materials under different conditions encountered when the metals in question are used as material for chemical equipment. The steel institutes, the Central Scientific Research Institute of Ferrous Metals, the Scientific Research Institute of Fertilizers and Insectofungicides, the State Nickel Design and Planning Institute, the Institute of Physical Chemistry of the Academy of Sciences USSR, and other organizations participated in the

work in question. The results obtained are described. Particularly severe conditions with regard to corrosion are encountered in equipment for the processing of crude tungsten and molybdenum concentrates (sulfides and oxides of these metals which are wet or suspended in water and contain  $\text{Na}_2\text{S}$ ,  $\text{H}_2\text{S}$ ,  $\text{CaF}_2$ ,  $\text{HF}$ , and  $\text{HCl}$ ). In tests on the corrosion resistance of materials to be used for equipment applied in the filtration of a molybdenum trisulfide pulp at 80-90°, EI435 alloy (Ni-Cr), "antichlor" alloy (Fe-Si-Mo), EI461 alloy (a Ni-Mo alloy of the Hastelloy B type), the titanium alloy CT-4, and Kh23N28M3D3T steel were found to be unsatisfactory. On the other hand, VT1 titanium and tantalum stood up well. VT1 is recommended as a constructional material for single roller driers to be used in the drying of tungsten trioxide and molybdenum trisulfide concentrates.

13. A New Method for Conversion of Hydrocarbons and the Production of Hydrogen From Them

"A New Method for the Conversion of Hydrocarbons With the Purpose of Production of Gases Suitable for Organic Synthesis," by I. M. Artyukhov, All-Union Scientific Research Institute of Petrochemical Processes (VNILNEFTEKHIM); Ivanovo, Izvestiya Vysshikh Uchebnykh Zavedeniy - Khimiya i Khimicheskaya Tekhnologiya, Vol 2, No 5, Oct 59, pp 784-789

A new method has been developed for the conversion of hydrocarbons which is based on the application of iron as an oxygen transmitter. By using this method, one may produce simultaneously technically pure hydrogen, synthesis gas, and a mixture of nitrogen with carbon dioxide. A pilot plant employing this process was operated in which the iron catalyst is circulated continuously in a closed cycle through 3 reactors located one above the other. The catalyst is heated in the first (top) reactor by burning coke. In the second (middle) reactor pyrolysis of hydrocarbons takes place and also reduction of the iron oxides which are contained in the catalyst. In the third (bottom) reactor the catalyst reacts with water vapor, as a result of which there is oxidation of the iron and formation of hydrogen. The raw materials used are hydrocarbons, water, and air. The products are technical hydrogen (or gas of the hydrogen cycle) produced in the bottom reactor, synthesis gas (or gas of the raw materials cycle) produced in the middle reactor, and a mixture of carbon dioxide and nitrogen produced in the top reactor. Instead of ordinary synthesis gas, one may produce gas with a high content of olefins that is suitable for oxo-syntheses.

It has been established that the quantities of raw material and water vapor required and also the cost of the gases produced are considerably lower in the new process than in industrial processes applied hitherto.



The simplicity of the flow sheet, of the design of the equipment, and of the method of handling the catalyst makes it possible to apply the process in question in many branches of industry including that concerned with the synthesis of chemical products. The process can be carried out with a mobile or immobile catalyst. In the latter case, various types of equipment that are already available can be used, for instance gas generators, converters, etc.

The process has been originally described by the author in four articles published in 1956-1958. The most recent of these articles appeared in Gazovaya Promyshlennost', No 5, 1958, p 36.

14. Work on Acetylene Production at the Central Scientific Research Laboratory of Electrical Treatment of Materials

"Electrical Working of Metals," by A. Novikov; Moscow, Promyshlenno--Ekonomicheskaya Gazeta, 23 Dec 59, p 3

Research on the electric spark working of metals is conducted at the Central Scientific Research Laboratory of Electrical Treatment of Materials, Academy of Sciences USSR, under the direction of Prof B. Lazarenko, Doctor of Technical Sciences. The electric spark method is of particular importance in the working (e. g. cutting) of very hard alloys. At the same laboratory, research in chemistry is being done. An experimental installation has been constructed there for the production of acetylene from liquid petroleum products by subjecting these products to the action of an electric discharge. This method will undoubtedly be applied extensively on an industrial scale in the near future. It will replace the method being applied at present, which is complicated and expensive.

15. The Second All-Union Conference on the Chemistry and Practical Applications of Organosilicon Compounds

"Conference on the Chemistry and Practical Applications of Organosilicon Compounds," by S. N. Borisov, Candidate of Chemical Sciences; Moscow, Khimicheskaya Nauka 1 Promyshlennost', Vol 4, No 3, May 59, pp 402-403

"Recognition of the valuable technical properties of organosilicon polymers (polyorganosiloxanes) led to a rapid development of the chemistry of organosilicon compounds and differentiation of this field as an independent branch of chemical science and technology. Theoretical and applied research in the field of organosilicon compounds was greatly

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expanded in the USSR. The Second All-Union Conference on the Chemistry and Practical Applications of Organosilicon Compounds, which was held in 1958 at Leningrad and was organized by the Department of Chemical Sciences and the Institute of Silicate Chemistry of the Academy of Sciences USSR, the All-Union Chemical Society imeni D. L. Mendeleev, the State Committee on Chemistry of the Council of Ministers USSR, and the Leningrad Council of National Economy (Sovnarkhoz), was attended by approximately 700 persons active in the fields of science and industry and in different subdivisions of the national economy. Scientists from the people's democracies participated in the conference.

"Advance publication of the papers presented at the conference enabled the authors of papers to report in greater detail new data obtained in their investigations and made it possible for the audience to participate in lively discussions, which, however, were limited with regard to the time allotted to them. This arrangement tended to make the conference more interesting and profitable as far as the results obtained were concerned.

"The conference was subdivided into four sections, i.e. those of monomeric organosilicon compounds, organosilicon polymers, analysis and physicochemical methods of investigation, and practical applications. One of the shortcomings of the conference was the absence of reports on problems pertaining to the technology of the production of organosilicon materials and consequently also the absence of a corresponding section. In accordance with the organization of the conference, the collection of papers that has been published (in its published form this collection has a total volume of about 40 standard printed sheets) consists of four issues containing papers on four different subjects. A separate fifth issue is concerned with a project for the nomenclature of organosilicon compounds that was proposed by the conference and submitted for thorough consideration to the chemical community. A sixth issue of transactions of the conference is in preparation. This issue will contain an account of the discussions that took place at the conference. More than 100 reports were presented at the conference.

"In a report presented at the first plenary session, K. A. Andrianov, Corresponding Member Academy of Sciences USSR, outlined the principal lines of research in the field of organosilicon polymers that should be followed by Soviet scientists. V. Bazant (Prague) reviewed unpublished work that had been done at the Chemical Institute of the Czechoslovak Academy of Sciences. Particular interest was evinced in a rapid chromatographic procedure for the separation of multi-component mixtures of chloroorganosilanes which had been developed by Czech chemists.

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"A number of reports presented in the Section on Monomers dealt with problems of the direct synthesis of chloroorganosilanes. This is the principal process for the production of organosilicon materials that is available at present. Extensive information on the direct synthesis of methyl-, ethyl-, and phenyl-chlorosilanes was contained in reports by S. A. Golubtsev and his coworkers. An animated discussion was held on the subject of an electrochemical theory of direct synthesis that had been proposed by S. S. Olenin. This theory has not yet been adequately substantiated by Olenin from the experimental standpoint. P. Rosciszewski (Warsaw) presented data obtained in the investigation of the activity of different catalysts in the direct synthesis of methylchlorosilanes. T. N. Nikishin and D. A. Kochkin (Institute of Organic Chemistry, Academy of Sciences USSR) reported on the results of investigations dealing with the behavior of halides of elements of the IVth group and polyhalohydrocarbons in direct synthesis reactions. A report by I. Cermak (Czechoslovakia) on the investigation of copper-silicon alloys by the x-ray diffraction method belongs to the same general category of papers. Participants at the conference noted the necessity of expanding considerably work in the field of direct synthesis, particularly as far as the development of controllable processes proceeding in the desired direction is concerned and also as regards the theory of direct synthesis.

"Lately the attention of USSR and non-USSR investigators has turned toward the investigation of compounds which contain the very reactive Si-H bond. V. A. Ponomarenko (Institute of Organic Chemistry, Academy of Sciences USSR) and L. I. Kartasheva (Petroleum Institute, Academy of Sciences USSR) reported on behalf of a large group of investigators results obtained in work on different reactions of the addition of hydro-silanes to unsaturated compounds. A lively discussion followed a report by R. Kh. Freydlina, Corresponding Member Academy of Sciences USSR, on the telomerization of hydrosilanes with olefins. This report dealt principally with the results of an investigation of the mechanism of this reaction and the selection of efficient catalysts for it. N. A. Tishina, G. N. Mal'nova, and M. Ye. Dolgaya (Moscow), who represented a large team of investigators, discussed prospects of the development of methods for the synthesis of monomers that will be of value from the practical standpoint and can be produced by applying reactions of the thermal and catalytic arylation of silicochloroform and alkylchlorosilanes.

"A number of reports by A. D. Petrov and coworkers was concerned with the reactivity of carbofunctional organosilicon compounds which contain polar substituents and multiple bonds in different positions with relation to the silicon atom.

"M. G. Voronkov and coworkers (Institute of Silicate Chemistry, Academy of Sciences USSR) established that there is a considerable reactivity of the Si-O bond in organosiloxanes as far as reactions with alcohols,

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alkoxysilanes, and halosilanes are concerned. On the other hand, the easy splitting of the siloxane bond by compounds of titanium, aluminum, boron, phosphorus, and vanadium, and also the reactions of the latter compounds with organosilanol made it possible to develop new methods for the synthesis of metalorganosilicon compounds. This was demonstrated in communications made by N. F. Orlov, B. N. Dolgov, and M. G. Voronkov.

"Yu. K. Yur'yev supplemented his widely known research on catalytic interconversions of 5-membered saturated heterocycles by an elegant method for the transformation of furanidine [tetrahydrofuran] into tetramethylene-silane and of the latter compound into thiophane [thiolane] Yu. K. Yur'yev in work done together with Z. V. Belyakova and G. B. Belyakov investigated the extensive possibilities of the application of tetraacyloxysilanes in organic synthesis.

"A great number of reports discussed in the Section of Organosilicon Polymers were presented by K. A. Andrianov's coworkers. Reports by N. N. Sokolov, L. V. Gornets and T. Z. Lizgunova, Ye. M. Oparina, G. S. Tubianskaya, and A. S. Yermilov on the results of investigations of the thermal stability of polyorganosiloxane liquids and films were of considerable interest. A. A. Zhdanov and K. A. Andrianov presented a report on a new type of polymers, i.e., polyorganosiloxanes and polyorganosiloxano-metaloxanes, which exhibit characteristics that are of value from the technical standpoint and present considerable theoretical interest because they are polymers which occupy an intermediate position between polyorganosiloxanes and silicates.

"A group of investigators at the All-Union Institute of Synthetic Rubber reported at the conference the results of their extensive research on the polydimethylsiloxane rubber SKT, organosilicon rubbers which contain in the side chain in addition to methyl groups also phenyl-, vinyl; and chloromethyl radicals, and finished rubber produced on the basis of these materials. Considerable interest was elicited by a report of L. N. Kozlovskaya, A. I. Glukhova, K. A. Andrianov, and K. F. Kaluzhenina concerning a thermally stable rubber-like material prepared by combining polydimethylsiloxane with polymers containing fluorine. M. Kucera (Brno) reported results of a thorough investigation of the alkali polycondensation of octamethylcyclotetrasiloxane. A report by N. B. Baranovskaya and coworkers on the cold vulcanization of siloxane rubber was subjected to lively discussion.

"A report by A. P. Kreshkov presented in the Section of Analysis and Physicochemical Methods of Investigation dealt with results obtained by applying different methods of analysis to organosilicon compounds and organosilicon materials; tasks which remain to be carried out in this field were also discussed. A report of the general review type presented

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by S. V. Syavtsillo gave information on work carried out by the author and a large team of investigators concerning methods for the control of the production of organosilicon materials. Unfortunately, this was the only report given at the conference which dealt with the chemical analysis of organosilicon compounds. This indicates that insufficient attention is being paid by investigators to the important problems involved in this type of work.

"Reports on the application of spectroscopic methods of analysis in the investigation of the properties of organosilicon compounds were represented to a much greater extent. Data obtained in spectroscopic investigations were used by the authors of papers both for the study of nature of bonds and for the investigation of the structure of organosilicon compounds (Yu. P. Yegorov, Ya. I. Ryskin, and others). Spectroscopic procedures were also used for the quantitative determination of alkylchlorosilanes and of different radicals in organosiloxanes (K. K. Popkov, V. Bazant and coworkers, V. S. Fikhtengol'ts).

"A number of reports discussed interrelationships between the physical characteristics of organosilicon compounds and the structure of these compounds.

"The greatest interest was elicited and the greatest amount of discussion followed reports in the Section of Practical Applications, which testifies to the attention paid at present to organosilicon compounds by workers in different fields of the national economy.

"Eight papers discussed methods for the water-proofing and making resistant to the effects of water of different organic and inorganic materials including glass, textiles, leather, paper, construction materials, and thermal insulation materials. Electrical insulation and thermal insulation coatings based on organosilicon resins were discussed in six reports presented by coworkers of K. A. Andrianov and B. N. Dølgov. M. Ya. Borodin, V. I. Pakhomov, and B. A. Kiselev, acting on behalf of a large team of workers, reported on work dealing with the use of organosilicon compounds in the production of foam plastics, heat-resistant plastics, and glass-reinforced textolites.

"At the concluding plenary session of the conference, D. P. Novikov presented a report on the status of and plans for the development of the production of organosilicon compounds and organosilicon materials in the USSR.

"In a resolution passed by the conference, achievements that had been made were pointed out and the principal lines to be followed in research in this field, in the production of materials of this type, and in the application of organosilicon compounds were outlined. Furthermore, ways were indicated for eliminating shortcomings in this important field of chemical science and technology.

"The participants at the conference recommended that conferences on the subject be held regularly. It was decided to hold the next regular conference on the chemistry, technology, and applications of organosilicon compounds in Moscow at the end of 1960."

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16. Polyester and Polyamide Resins Containing Phosphorus

"Polyester and Polyamide Resins Containing Phosphorus," by K. A. Petrov and V. A. Parshina; Moscow, Khimicheskaya Nauka i Promyshlennost', Vol 4, No 5, Oct 59, pp 686-687.

Two polyesters and one polyamide derived from bis-(p-carboxyphenyl)-methylphosphine oxide were prepared. It was found that these polycondensation products can be drawn into fibers. The method for the preparation of bis-(p-carboxyphenyl)-methylphosphine oxide was improved. Derivatives of this substance were synthesized, but they are not described in the literature. The purpose of the investigation was synthesis of resins that are capable of forming mechanically strong fibers.

17. The Synthesis of New Monomers Derived From Acetylene and Diacetylene

"The Synthesis of New Monomers Derived from Acetylene and Diacetylene," by M. F. Shostakovskiy, A. V. Bogdanova, and I. A. Chekulayeva, Institute of Organic Chemistry, Academy of Sciences USSR; Ivanovo; Izvestiya Vysshikh Uchebnykh Zavedeniy-Khimiya i Khimicheskaya Tekhnologiya, Vol 2, No 5, Oct 59, pp 769-775

Methods have been developed for the synthesis of ethynylvinyl ethers, including derivatives containing nitrogen, and thioethers of the general formula  $CH = C - CH = CH - OR (SR)$ ; 1, 4-dithioalkyl (aryl) butadienes - 1,3 of the general formula  $RS - CH = CH - CH = CH - SR'$ ; and 1-alkoxy-4-thioalkyl (aryl) butadienes - 1,3 of the general formula  $ROCH = CH - CH = CH - SR'$ .

The syntheses were carried out starting with diacetylene, alcohols, aminoalcohols, and thiols. Some properties of the compounds prepared were investigated. It was found that these compounds exhibit a high reactivity and are capable of undergoing diene syntheses and partial hydrogenation. On the basis of partial hydrogenation of ethynylvinyl ethers, a new method for the synthesis of 1-alkoxybutadienes-1,3 is proposed. The conditions have been established under which vinyl ethers of ethanol amines of different structures can be synthesized. The properties of the products obtained were investigated.

18. The Synthesis and Polymerization of Vinyl Sulfides

"Synthesis and Polymerization of Vinyl Sulfides," by M. F. Shostakovskiy, Ye. N. Prilezhayeva, and V. M. Karavayeva, Institute of Organic Chemistry, Academy of Sciences USSR: Ivanovo, Izvestiya Vysshikh Uchebnykh Zavedeniy - Khimiya i Khimicheskaya Tekhnologiya, No 5, Oct 59, pp 761-767

A general method has been developed for the synthesis of vinyl sulfides with different types of structure. A method is proposed for the analysis of compounds with vinyl sulfide groupings. By using this method, one can check the purity of the compounds obtained, determine them in mixtures with other substances, and also titrate quantitatively the end groups of polymers. A general method is described for the selective oxidation of the sulfur of vinyl alkyl sulfides with the formation of vinyl sulfoxides (oxidation with  $H_2O_2$ ) or sulfones (oxidation with  $H_2O_2 + SeO_2$ ). It has been established that vinyl sulfides are distinguished by a low tendency towards ionic polymerization, which is explained by the binding of the catalyst under formation of complexes involving the sulfur atoms. The conditions under which ionic polymerization takes place have been established. It was found that vinyl sulfides exhibit a high activity in free-radical polymerization and co-polymerization reactions. Polymers and copolymers formed in reactions of this type have been prepared. Their properties are being investigated. The relationships which have been established are explained from the standpoint of the influence exerted on each other by the C = C bond and the sulfur atom in the vinyl sulfide molecule. It is stated that on the basis of the reactions discovered, possibilities are opened up for the synthesis of different polymers and copolymers containing SR groups and also for modifying the properties of these polymers by the chemical transformation of functional groups contained in them.

19. Research on the Chemical Utilization of Polysaccharides at a New Uzbek SSR Institute

"Opening of an Institute of Polymer Chemistry" (unsigned item); Moscow, Gidroliznaya i Lesokhimicheskaya Promyshlennost', Vol 12, No 7, Jul 59, p 31

An Institute of Polymer Chemistry has been created at the Academy of Sciences Uzbek SSR. Major aims with which the work of the newly organized institute will be concerned are production and investigation of polysaccharides. In cooperation with sovmarkhozes, the institute has planned

extensive research on the hydrolysis of cellulose and on the expedient utilization of by-products of cotton-growing, of reeds, and of other wild-growing plants which are suitable as raw material for chemical conversion. With this end in view, a Hydrolysis Laboratory has been organized. Research on the hydrolysis of cotton seed linters with hydrofluoric acid, which was begun at the Moscow Branch of the All-Union Scientific Research Institute of the Hydrolysis and Sulfite Alcohol Industry, will be continued at the Hydrolysis Laboratory of the new institute.

Catalytic conversion of polysaccharides derived from plant raw materials which cannot be used as food will contribute to the most rapid solution of important problems involved in the development of the chemical industry. In this context, work on the chemistry of carbohydrates will be conducted at the institute. With this end in view it is planned to open still another special laboratory. The intention exists of developing new methods for the synthesis of polymers and also of finding catalysts for the production of initial substances to be used in syntheses based on locally available raw material. Among these initial materials, one may mention furfural and polyhydric alcohols. Prof Kh. Yu. Usmanov will be director of the Institute of Polymer Chemistry. Yu. L. Pogosov and V. S. Minina will work at the Hydrolysis Laboratory.

20. Preparation of Graft Copolymers of Cellulose by Irradiation With Co-60

"Preparation of Graft Copolymers of Cellulose by Irradiation With Co-60," by Kh. Yu. Usmanov, V. I. Aykhodzhayev, and Yu. O. Azizov; Moscow, Vysokomolekulyarnyye Soyedineniya. Vol 1, No 10, Oct 59, p 1570

The grafting of acrylonitrile to cellulose by irradiation of the mixture with  $\gamma$ - rays of a Co-60 source has been studied. A total dose of  $1 \times 10^6$  roentgens was applied. The mixture was irradiated in different liquids (water, methyl alcohol, and benzene). Pure acrylonitrile in the absence of a solvent was also applied. The amount of acrylonitrile grafted to the cellulose increased with increased concentrations of acrylonitrile in the solution. Grafting took place only when the acrylonitrile had been preliminarily dissolved in a liquid that produces swelling of the cellulose. In the case of pure acrylonitrile without a solvent, only an insignificant amount of acrylonitrile was grafted to the cellulose (8% by weight with reference to the cellulose), although a considerable quantity of homopolymers had formed. When benzene was used as a solvent, no grafting at all took place because benzene does not wet cellulose and does not promote penetration of the acrylonitrile into the intermolecular space of the cellulose. A polar solvent which wets cellulose readily must be applied.



21. New Polyfuran and Polysylvan Polymers

"New Polymers" (unsigned item); Moscow, Vestnik Akademii Nauk SSSR, Vol 29, No 11, Nov 59, p 73

Under the direction of A. Sultanov, Candidate of Chemical Sciences, a group of specialists at the Institute of Chemistry of the Academy of Sciences Uzbek SSR developed a method for the production of new polymers, i.e. polyfurans and polysylvans, by the polymerization of furan and sylvan derived from cotton hull furfural. Polyfurans and polysylvans are good film formers; they can be used for the production of thermally stable adhesives and electric cable coatings that are resistant to the action of bacteria. They can also be used as solvents for polymers. Production of polysylvans is being organized at the Fergana Hydrolysis Plant.

22. A Catalytic Process For the Production of Nitric Acid In the Gas Phase

"Investigation of the Catalytic Synthesis of Nitric Acid In the Gas Phase," by I. P. Kirillov and M. M. Karavayev, Chair of the Technology of Inorganic Substances, Ivanovo Chemico-Technological Institute; Ivanovo, Izvestiya Vysshikh Uchebnykh Zavedeniy - Khimiya i Khimicheskaya Tekhnologiya, Vol 2, No 4, Aug 59, pp 553-557.

Catalysts were found which accelerate the process of the formation of nitric acid in the gas phase from  $\text{NO}_2 + \text{H}_2\text{O} + \text{O}_2$  (formation of nitric acid from  $\text{NO}_2$  is the slowest step in the synthesis of nitric acid). On the basis of the results obtained, the best of these catalysts is aluminum oxide. The chief obstacle to the selection of catalysts consisting of metal oxides is chemical interaction of these oxides with the gases, so that a change in the gas composition of the catalyst takes place (i.e., salts are formed). The catalysts that were found also accelerate the oxidation of nitrogen oxide (NO) in the presence of water vapor. Nitric acid with a concentration of up to 80% was obtained by condensation after catalytic gas-phase oxidation. The unconverted gas can be recirculated.

In the work described, 33 potential catalysts were investigated. Besides aluminum oxide, titanium oxide is regarded as promising for this application.

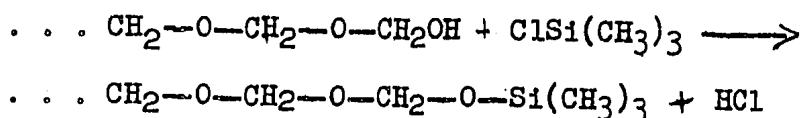
23. Chinese Research on Synthesis of High-Molecular Polyoxymethylene

"Synthesis of Polyoxymethylene," by Hu Ya-tung (胡亞東), Ko Tseng-p'ei (葛增偉), Lo Chia-wei (樂加偉), Institute of Chemistry, Academia Sinica; Peiping, Kao-fen-tzu T'ung-hsun (Macromolecular Report), Vol 3, No 2, Apr 59, pp 79-80

The authors state that the search for a method to polymerize formaldehyde to yield a polymer having relatively high molecular weight and thermal stability is of great significance, but that there is a paucity of literature on the subject. They describe a method by which they obtained a polyoxymethylene resin with good characteristics. Reportedly, it can be pressure-molded into plastic articles, fabricated into thin film, and wet-spun in carboic acid solution. It is very strong and elastic, and does not dissolve in ordinary organic solvents.

According to the article, the conditions presented for a good polymerization reaction were worked out by the authors after much experimentation. The method involved initial purification of formaldehyde to a very high degree. The monomer was polymerized in toluene as a solvent in the presence of tributylamine as a catalyst. Other solvents and catalysts were tested in earlier experiments.

It was found that the polymer obtained by the method described has a tendency to deteriorate. The authors believe that the deterioration (decomposition) begins at the end hydroxyl radical, . . .  $\text{CH}_2\text{-O-CH}_2\text{-O-CH}_2\text{OH}$ . They also believe that the hydroxyl radical may be protected and the polymer thereby stabilized by the action of an acid to form an ester, and they are currently experimenting with trimethylchlorosilane in an attempt to effect the following reaction:



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Concerning the thermal stability of their product the authors state:

"The thermolytic decomposition of polyoxymethylene is a one-stage process represented by the equation

$$-\frac{dw}{dt} = Kw$$

where K is a constant representing decomposition velocity at 222 degrees Centigrade. K is also the index of thermal stability. For the polymer we obtained by the method described above, the thermal stability K approximates 2."

Nuclear Fuels and Reactor Construction Materials

24. A Method for the Photometric Determination of Thorium in Zircons

"Photometric Determination of Thorium in Zircons with the New Reagent Arsenazo III," by V. F. Luk'yanov, S. B. Savvin, and I. V. Nikol'skaya; Moscow, Zavodskaya Laboratoriya, Vol 25, No 10, Oct 59, pp 1155-1157

The determination of thorium contained in zircon entails a number of difficulties. The reagents used for the colorimetric determination of thorium, i.e. thoron and arsenazo; are not sufficiently specific. Their employment requires a fairly complete separation of thorium from the elements accompanying it. Particularly great difficulties arise in the presence of zirconium, because the reagents mentioned have a greater tendency to react with these elements than with thorium. Procedures for the separation of thorium from zirconium by the fluoride or oxalic acid precipitation method, by extraction of thorium with mesityl oxide, or by a chromatographic method are time-consuming and do not assure complete separation. In the analysis of zircon, even carrying out the separation twice does not always lead to the desired result.

A rapid method for the determination of thorium in zircons has been developed which eliminates the preliminary separation of thorium from other elements including zirconium. This method is based on the colorimetric determination of thorium after the addition of the new reagent arsenazo III in the presence of oxalic acid. The light absorption of this reagent and of the colored complex formed by with thorium have been determined; the results obtained are plotted in the form of curves. Arsenazo III is 1,8-dihydroxynaphthalene, 3,6-disulfonic acid - 2, 7-bis (azo-1) benzene - 2 - arsonic acid. It has been originally synthesized by S. B. Savvin (cf. Doklady Akademii Nauk SSSR, Vol 127, No 6, 1959).

25. The Dependence of Thermal Characteristics of Graphitized Carbon on Its Structure

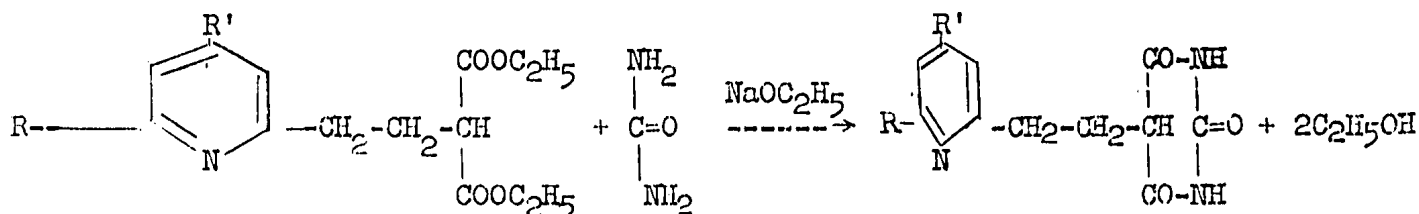
"The Relation of Thermal Characteristics to the Atomic and Molecular Structure of Carbon in Homogeneous Graphitization," by V. I. Kasatochkin, V. K. Zamoluyev, and A. T. Kavernov; Moscow, Atomnaya Energiya, Vol 7, No 3, Sep 59, pp 272-275

Results are described which were obtained by the investigation of the specific heat capacity, temperature, and conductivity and also by X-ray diffraction studies of the degree of graphitization. The investigation was carried out on petroleum coke graphitized under isothermal conditions at different temperatures and by treating the material for different lengths of time. The results of the investigation are useful for establishing conditions under which carbonized materials with predetermined thermal characteristics can be obtained.

Organic Chemistry26. New Pyridylethyl Derivatives of Barbituric Acid Synthesized

"Alkyl and Alkenyl Pyridines. V. New Pyridylethyl Derivatives of Barbituric Acid," by K. Godlewska-Zwierzak, J. Michalski and K. Studniarski, Department of Organic Chemistry, Polytechnic Institute, Lodz; Warsaw, Roczniki Chemii, Vol 33, Nos 4-5, 1959, pp 1215-1217

The authors studied the reactions of some  $\beta$ -(2-pyridylethyl)-malonic acid diethyl esters with urea in the presence of sodium ethoxide. Several 5-monosubstituted barbituric acids were obtained. The physical properties and analysis of these compounds and their picrolonates are given in the text. The over-all reaction can be represented by the equation:



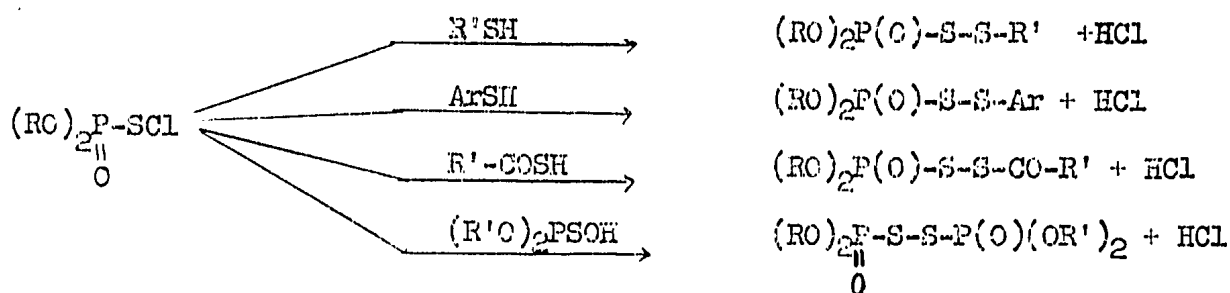
R = CH<sub>3</sub>, H

R' = CH<sub>3</sub>, H

27. Outline of Reactions of Dialkoxoxyphosphoranesulfonyl Chlorides With Organic Thiols

"Reactions of Dialkoxoxyphosphoranesulfonyl Chlorides with Organic Thiols, "by J. Michalski, B. Forecka, T. Kapecka and H. Strzelecka, Department of Organic Chemistry, Polytechnic Institute, Lodz, and the Institute of Organic Synthesis, of the Polish Academy of Sciences, Lodz; Warsaw, Roczniki Chemii Vol 33, Nos 4-5, 1959, pp 1255-1257

Thioalcohols, thiophenols, thiocarboxylic and dialkylthiophosphoric acids react with dialkoxoxyphosphoranesulfonyl chlorides with the formation of the corresponding unsymmetric disulfides:



R' = Alkyl group

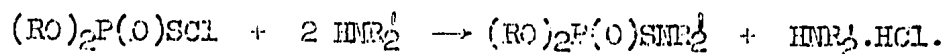
Ar = Aryl group.

Dialkoxoxyphosphoranesulfonyl chlorides exhibit a considerable chemical reactivity resembling that of simple sulfenic halides on the one hand and that of pseudohalogeno-halogens on the other. The replacement of the alkyl or aryl group in the sulfonyl chlorides R-SCL with a dialkoxoxyphosphinyl radical has but little effect on the properties of the --SCL functional group.

28. Reactions of Dialkoxoxyphosphoranesulfonyl Chlorides with Amines Described

"Reaction of Dialkoxoxyphosphoranesulfonyl Chlorides with Amines, "by J. Michalski, A. Markowska and H. Strzelecka, Department of Organic Chemistry, Polytechnic Institute, Lodz; Warsaw, Roczniki Chemii, vol. 33, Nos 4-5, 1959, pp 1251-1253

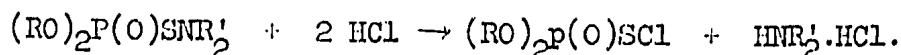
Dialkoxoxyphosphoranesulfonylamides (I) are formed by the reaction of dialkoxoxyphosphoranesulfonyl chlorides (II) with secondary aliphatic amines:



They represent a new type of organic derivative of the hypothetical oxophosphoranesulfenic acid,  $\text{H}_2\text{P}(\text{O})\text{SOH}$ .

(I) are thermolabile and decompose slowly, even at room temperature, into sulfur and the corresponding phosphoramidates  $(RO)_2P(O)NR'_2$ . In a reaction between primary aliphatic or aromatic amines and (II), the only products isolated were N-alkyl or N-aryl dialkylphosphoramidates and sulfur. The authors conclude that the intermediate sulfenylamides are not stable enough to be isolated.

N,N-dialkyldialkoxoxyphosphoranesulfenylamides are converted into the original sulfenyl chlorides by the action of hydrogen chloride:



### Physical Chemistry

#### 29. Active Carbons Tested

"On the Adsorption Properties of Hydrocarbon Adsorbents. Report 4. Investigation of the Adsorption Properties of Activated Carbons With Well-Developed Intermediate Porosity," by M. M. Dubinin and Ye. G. Zhukovskaya, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR - Otdeleniye Khimicheskikh Nauk, No 10, Oct 59, pp 1705-1715.

The absorption properties of five samples of activated carbons having a well-developed intermediate porosity were studied in detail by investigating the absorption of benzene vapor at 20° C and nitrogen vapor at minus 195° C. The purpose of the investigation was study of the capillary condensation of the different vapors in intermediate pores. This was done under consideration of the fact that penetration of the large benzene molecules into micropores is hindered.

The types of activated carbons used are described as absorbents of the mixed structural type

Methods of calculating micropore structural characteristics of active carbons were developed.

Miscellaneous

30. Ninth Mendeleev Congress To Be Held in 1962 or 1963

"Chronicle," (unsigned article), Moscow Izvestiya Akademii Nauk SSSR - Otdeleniye Khimicheskikh Nauk, No 10, Oct 59, pp 1869-70

At its meeting held in 30 June 1959, the Bureau of the Department of Chemical Sciences of the Academy of Sciences USSR acknowledged the need for holding a Mendeleev Congress once every 3 or 4 years. On this basis, the next, or Ninth Congress would be scheduled for 1962 or 1963.

31. Chemical Institute Relocated

"An Institute Changes Its Address," (unsigned article); Moscow, Izvestiya, No 284 (13211), 1 Dec 59, p 1

According to this brief newspaper item, the Central Scientific Research Institute of Forest Products Chemistry (Tsentral'nyy Nauchno-Issledovatel'skiy Lesokhimicheskiy Institut), Gosplan RSFSR, previously located in Knimki, a Moscow suburb, has been moved to Gor'kovskaya Oblast, where about one third of the forest product industrial establishments of the RSFSR are located, and where more favorable working conditions exist.

32. Soviet-Hungarian Cooperation in Heavy Chemical Industry Research

"Cooperation Agreement of Soviet and Hungarian Heavy Chemical Industry Researchers Extended", (unsigned article); Budapest, Nepszabadsag, 8 Dec 59, p 3

The article notes the return to Hungary from the Soviet Union of Dr Gyorgy Koranyi, Director of the Heavy Chemical Industry Research Institute at Veszprem, and the extension, through 1960, of the cooperation agreement which calls for selection of mutual themes and exchange of information between Soviet and Hungarian researchers serving the heavy chemical industry. As a result of this cooperation, Hungarian researchers have turned to Soviet methods in preparing colloidal sulfur products and using industrial catalysts, while Soviet researchers introduced Hungarian analytical methods in several of their experiments. The 1960 cooperation will include monthly exchanges of information on insecticide experiments.

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III. EARTH SCIENCES

33. Molybdenite Discovered in Cupriferous Sands Northeast of Baykal'

"Molybdenite in the Ores of the Udokan Cupriferous Sands," by R. N. Volodin, Moscow Geological Prospecting Institute imeni S. Ordzhonikidze; Moscow, Izvestiya Vysshikh Uchebnykh Zavedeniy, Geologiya i Razvedka, No 11, Nov 58, pp 49-50

This article reports the first finding of molybdenite in the cupriferous sands of the Udokan  $[57^{\circ}\text{N}-119^{\circ}\text{E}]$  deposit northeast of Lake Baykal'. A spectral analysis of a lump ore sample was made by A. Ya. Bursuk at the All-Union Institute of Mineral Raw Materials. The amount of molybdenite in the sample was 0.004 percent.

34. Electroprofiling Anomalies at Boundary of Two Media

"Electroprofiling Above a Sphere Located Near the Boundary of Two Media," by B. K. Matveyev and N. G. Shkabarnya, Perm (Molotov) State University; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 10, Oct 59, pp 1492-1499

In various methods of electroprofiling, the heterogeneity of embedded media exerts a substantial influence on the curves of apparent resistance. An approximate determination of this influence is possible through a comparison of field diagrams with computed theoretical curves. The article gives the solutions of formulas for the apparent resistance in the case of an electroprofiling above a sphere located near the contact of two media, and provides theoretical diagrams of the apparent resistances, for which concrete cases are calculated. A characteristic feature of these diagrams is the presence of several extrema distributed along the curve showing the change of the apparent resistance during an electroprofiling through the contact of the two media.

The form, character of the diagram, and the value of the anomaly above the sphere depend on the relative specific resistances of the material of the sphere and of the two media, as well as on the form and size of the apparatus and its location in relation to the contact area. More distinct anomalies of the apparent resistance are obtained above a conducting sphere than over a nonconducting sphere. The largest anomaly



values are observed in the case where the electroprofiling is done with an asymmetrical three-electrode apparatus, which shifts out of the medium with higher resistance, in which the sphere is located, into the medium with lower resistance (assuming that the measuring electrodes are located in front).

The conclusions drawn and the calculations may also be used for an appraisal of the influence of surface heterogeneities in the mapping of contacts and for the appraisal of the influence of caverns, hollows, and other enclosed forms in the electrical core sampling of oil wells.

#### IV. ELECTRONICS

##### Acoustics and Audio Frequencies

##### 35. Sonic Wave Propagation in Sea Water

"Some Phenomena by Sound Propagation in Sea," by A. L. Sosedova, Acoustics Institute, Academy of Sciences USSR; Moscow, Akusticheskiy Zhurnal, No 4, 1959, pp 445-449

The purpose of this experiment was to investigate the intensity of the sonic field in sea water at various distances up to 10 km from the acoustic radiator. The test, conducted in 1954, utilized a high-directivity acoustic radiator and a hydrophone; the latter was successively lowered to three different depth levels. The pulses of about 150 millisecc duration were intercepted by the hydrophone and recorded on a tape with logarithmic scale. The transmitted pulses had a frequency of 15 kc. The acoustic radiator was permanently fixed on a steep slope of the ocean bottom for each series of tests; the hydrophone was lowered into water from a ship moving away from the acoustic radiator. The temperature and salinity of the water was taken at all points of measurement. Several dozen readings were taken for each position of the ship and for each depth level. The readings of sound intensity were raised to the second power and the values in decibels were plotted on a graph as a function of distance for each level. About 20 positions of the ship were selected for measurements at a distance of about 10 km from the acoustic radiator.

The experiment has demonstrated the emergence of a secondary acoustic wave at the sea surface, as well as intense focusing of the acoustic wave at relatively short distances. The observed peculiarities in the behavior of the acoustic wave in sea water were in agreement with theoretical calculations.

Components

36. Servomechanism of Simple Design

"Servomechanism With Photoelectric Transducer," by B. S. Nana-zlashvili, B. M. Plyushch, V. O. Sarkisyan, and B. A. Kulikov, Azerbaydzhan Institute of Petroleum and Chemistry imeni M. Azizbekov; Minsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Energetika, No 10, Oct 59, pp 34-39

At the Chair of Electric Drives, Electric Machinery and Electrical Equipment for Industrial Plants of the Azerbaydzhan Institute of Petroleum and Chemistry a simple servomechanism of great practical interest was designed.

An important component of this servo system is a specially designed photoelectric transducer consisting of a hydrostatic manometer and photoelectric bridge. The U-shaped manometer, filled with mercury in its lower part and water above, is placed between the source of light and the two photocells. The transducer is designed for pressure regulation up to 3.5 atm gauge. The accuracy with which the system maintains predetermined pressure varies from 0.5 to 4 mm Hg, depending on the value of predetermined pressure; the relative error does not exceed 0.16%. Sensitivity of the system, i.e., the minimum pressure differential at which the servomotor begins to rotate slowly, is about 1.5 mmHg.

Tests conducted with this servomechanism have shown its high accuracy and sensitivity for a wide range of pressure regulation, as well as its satisfactory behavior in the case of transients.

Computers

37. Hungarian Analogue Computer

"New Electronic Computer of Gamma Works to be Tested Today" (unsigned news item); Budapest, Nepszabadsag, 19 Dec 59, p 7

After more than a year of experimentation, the designers of the Gamma Optical Works have completed the prototype of an electronic analogue computer which can solve simultaneous equations with eight unknowns. The computer is made entirely of Hungarian materials; the mathematical operations are performed by 140 electronic tubes and by 18 amplifying units, each having six stages or "degrees" /. The computer is also equipped with "control chambers" which immediately check the accuracy of the calculations. The computer can solve in 10 seconds problems which would otherwise take several days.

38. Hungarians Claim Chinese Use Machine to Translate Russian

"Language Knowing Machine" (unsigned news item); Budapest, Nepszabadsag, 10 Dec 59, p 8

"Chinese electric industry experts and linguists have designed an electronic machine with which they are doing successful experiments in translating Russian-language texts."

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Instruments and Equipment

39. Differential Amplitude Analyzer

"One-Channel Differential Amplitude Analyzer," by A. A. Khaydarov, M. N. Romanov, and A. P. Novikov, Institute of Nuclear Physics, Academy of Sciences Uzbek SSR, Tashkent, Izvestiya Akademii Nauk Uzbekskoy SSR, Seriya Fiziko-Matematicheskikh Nauk, No 5, Sep/Oct 59, pp 64-70

The article describes a scintillation gamma spectrometer developed at the Institute of Nuclear Physics, Academy of Sciences Uzbek SSR. The performance of this spectrometer was checked with gamma radiation from radioactive isotopes Cr<sup>51</sup>, Cs<sup>137</sup>, Co<sup>60</sup>, and Zn<sup>65</sup>. This scintillation gamma spectrometer permits determining the energy level of the gamma-line admixture, the relative intensities of gamma lines in the spectrum, and estimating the half-life of the admixture.

The operation of this one-channel differential amplitude analyzer is based on examination of the distribution of pulses according to amplitude with the aid of two discriminators having an anticoincidence-selection circuit. The analyzer incorporates the following main components: source of gamma radiation, crystal-scintillator, photoelectron multiplier, high-voltage amplifier, amplifier with a limiter, analyzer with anticoincidence-selector circuit, scaling circuit with electromechanical counter, and power supply unit. The measurements were taken with a Tl activated NaI crystal 19 mm in diameter and 13.4 mm thick.

A 256-channel amplitude analyzer capable of registering pulses on a potential-scope and a multichannel analyzer with "gray" wedge are now in the process of construction at the institute's laboratory.

40. Pulse Generator

"Generator of a Finite Pulse Train," by V. V. Okorokov; Moscow, Pribery i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 68-75

A generator of a finite train of pulses with quartz stabilization of interval between the train pulse, equal to 1 microsec is described. The use of 8 Mc synchronizing pulses produces a 0.12-microsec temporary jitter in the generated 1-microsec train. The presence of a phenomenon in the circuit somewhat analogous of self-phasing in accelerators lowers the requirements for all variations of parameters of the circuit, characterizing its normal operation. The conditions of maximal damping of transient processes which cannot be avoided in a circuit during generation of the first pulses of the train due to the different position of the starting signal in relation to synchronizing pulses are discussed. The generator may be used to form a time scale in amplitude and time analyzers, as well as in a circuit for phasing of signals in relation to reference pulses of high frequency (4 to 20 Mc).

41. Voltage Amplifier

"Multistage Voltage Amplifier With a Traveling Wave," by G. A. Vasil'yev, Physics Institute, Academy of Sciences USSR; Moscow, Pribery i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 75-80

A high-frequency multistage voltage amplifier using the wave characteristics of the artificial line with variable parameters is described. The number of stages may be over  $10^3$  of what facilitates the use of semiconductor diodes for obtaining voltages of hundreds of kv. The theory of the circuit is given and results of studying a low-voltage model are described.

42. Resonance Measuring at Low Temperatures

"Resonators for Observation of Electronic Paramagnetic Resonance at Low Temperatures," by S. D. Kaytmazov and A. M. Prokhorov, Physics Institute, Academy of Sciences USSR; Moscow, Pribery i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 107-110

The construction of resonators adjusted for observation of electronic paramagnetic resonance at low temperature in the centimeter ( $\lambda = 2.5$  and  $\lambda = 3.2$  cm) and decimeter wave range is described. The construction permits placing the sample into a cooled resonator. The resonator of the centimeter range may be retuned. The dimensions of the resonators are adjusted to operation in a standard dewar vessel of one-liter capacity.

43. High-Voltage Source

"Stabilized Source of High Voltage for 80 kv," by V. V. Polivanov, A. V. Iz'yurov, and N. I. Pyatakoy; Moscow, Priory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 85-88

A stabilized source of direct high voltage of 80 kv is described. During variation of the load current from 0 to 2.5 ma at simultaneous variation of the input voltage from 270 to 190 volts, the high voltage varies less than 1%. The stabilized voltage may be established in steps of 5 kv within the range of 60 to 80 kv; a continuous regulation of voltage from 0 to 60 kv is possible with the switched-off stabilizer. The stabilizer of high voltage is switched on automatically when voltage reaches 60 kv.

44. Electronic Modeling Device

"Calculation of Current-Limiting Low-Voltage Fuses With the Aid of Electronic Modeling Devices," by V. V. Kleymentov and A. G. Nikitenko; Novochoerkassk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Elektromekhanika, No 11, Nov 59, pp 123-129

Calculation of electric fuse constants can be readily made with the aid of an electronic modeling device by solving the differential equations for thermal dissipation. A modeling device to conduct such calculations consists of the following components: adder, inverter, integrator, and multiplier. Determination of current at which the fuse melts and the time delay of fusion is reduced to solution of two differential equations. The values thus calculated showed good agreement with the experimental figures. When the circuit and fuse parameters are changed, only the coefficients of the computer equations have to be adjusted, thus permitting calculations to proceed under the new setup without much delay.

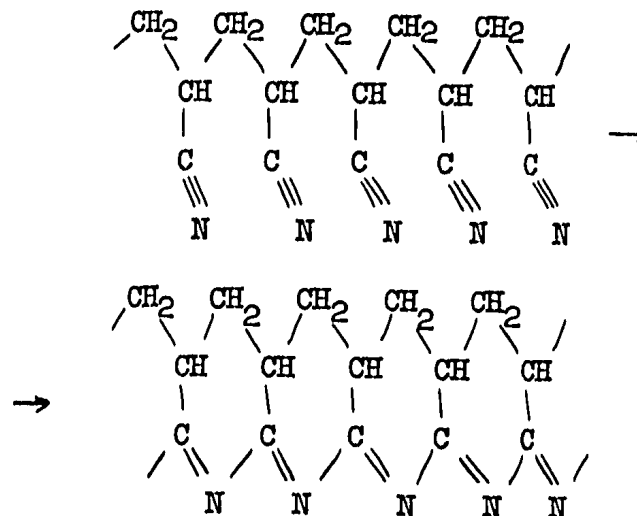
Materials45. Polyacrylonitrile Semiconductors

"On the Possibility of Producing Polymeric Materials With Semiconductor Properties From Polyacrylonitrile," by Academician A. V. Topchiyev, M. A. Geyderikh, B. E. Davydov, Academician V. A. Kargin, V. A. Krantsel', I. N. Kustanovich, and L. S. Polak; Moscow, Doklady Akademii Nauk SSSR, Vol 128, No 2 11 Sep 59, pp 312-315

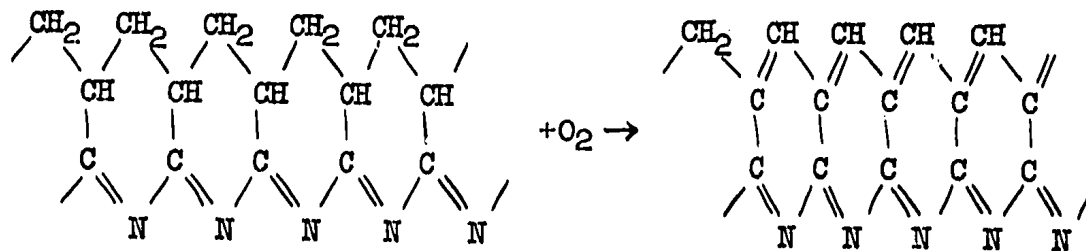
The difficulty of preparing organic materials with electronic conductivity is due to the fact that because of the specific characteristics of ordinary organic compounds, the permitted energy zones in them, if they originate at all, are narrow, and the forbidden zones are very wide. The width of forbidden zones for substances of this type is so great that at temperatures lower than the decomposition point of the substances, there is no excitation of electrons. The semiconductor characteristics of organic substances described in the literature are usually due to the presence of condensed aromatic rings and of nitrogen atoms (cf A. R. Ioffe, Fizika Poluprovodnikov [The Physics of Semiconductors], Academy of Sciences USSR, 1957). Of considerable interest from this standpoint would be polymers with multiple bonds, specifically conjugated double bonds, and also polymers containing in the chain atoms which have at external levels electrons that do not participate in chemical bonds. This applies, for instance, to nitrogen atoms. In polymers of this type, current carriers may originate with facility. When the structure of the polymer exhibits sufficient regularity, the dispersion of electrons in them must be rather small. The required degree of regularity can be estimated approximately from the length of the free path of electrons in the semiconductor, the length of C-C bonds, the length of the monomer link, and the wave length of the electron. It was established that in the case of a fiber stretched to the maximum extent, in which the polymer molecules are oriented in the direction of the current, it is sufficient, in order that there be no dispersion by reason of irregularities of the structure, to have polymer molecules consisting of 35 monomer links per chain and having no branches which consist of more than 12 carbon atoms. Polymers with this degree of regularity can at present be synthesized without difficulty.

From this point of view, it is of considerable interest to investigate the products of the thermal transformation of polyacrylonitrile, which hitherto have been investigated only from the standpoint of their considerable thermal stability.

It is assumed that as a result of thermal treatment, polyacrylonitrile undergoes the following transformations:



(after this, by oxidative dehydrogenation):



The presence of conjugated double bonds and also of regularly arranged nitrogen atoms in which the electron pair that does not participate in the chemical bond is under the influence of both the vinyl (with reference to nitrogen atoms) and the allyl double bonds, makes it reasonable to expect that these polymers will exhibit semiconductor properties. In the work that has been carried out, the semiconductor properties of the following types of polycrylonitrile were investigated: polyacrylonitrile obtained by the polymerization of acrylonitrile with organometallic catalysts ( $\text{Li Cl}_2 \text{Hg}$ ); polyacrylonitrile obtained by low-temperature polymerization (molecular weight = 10,000); polyacrylonitrile obtained by polymerization with lithium in liquid ammonia; polycrylonitrile polymers obtained by the redox initiation method (molecular weight = 10,000); and a polymer obtained by ionic polymerization followed by irradiation with a dose of  $\gamma$  - rays corresponding to  $1.1 \times 10^{22}$  electron-volts [per  $\text{cm}^3$ ]. Samples of polyacrylonitrile in the form of powder and in the form of fibers were subjected to thermal treatment. The samples obtained were investigated by the electronic paramagnetic resonance method. In the case of some samples, the dependence of the electrical conductivity on the temperature was determined. The following facts were established: (1) the semiconductors that have been obtained exhibit electron conductivity ( $\Delta G < 0$ );

(2) the concentration of current carriers in them amounts to  $10^{18}$  -  $10^{19}$  (i.e., the degeneration is not very great); (3) the half-width of the electron paramagnetic resonance spectrum band of these semiconductors which characterizes the relaxation time is equal to 10-20 gauss. In none of the cases investigated was superfine structure detected in the electron paramagnetic resonance spectrum; there was only a relatively narrow line. This is in agreement with results obtained by R. C. Fletcher (cf Physical Reviews, Vol 95, 1954, p 844).

A curve was drawn showing the dependence of the electrical conductivity ( $\sigma$ ) on the temperature for polyacrylonitrile prepared by redox initiation and subjected to thermal treatment. The width of the forbidden zone calculated on the basis of this curve was found to be  $\Delta E = 1.7$  electron volts. This semiconductor can be used at a much higher temperature than germanium (at a temperature as high as  $300^{\circ}$ , this polymer does not yet undergo any decomposition). The width found for the forbidden zone indicates that the semiconductor properties are not produced by carbonization of the polyacrylonitrile during thermal treatment, because the forbidden zone of graphite is very narrow. Thermally treated polyacrylonitrile decomposes hydrogen peroxide: This is characteristic for semiconductor catalysts.

One may therefore conclude that the materials obtained from polyacrylonitrile exhibit typical semiconductor properties and that because of the pronounced nature of these characteristics and the high thermal stability of the semiconductors in question, they can be used at elevated temperatures.

Because polyacrylonitriles swell in concentrated salt solutions, it is possible to introduce metal ions into the polymer prior to the thermal treatment. These metal ions are capable of functioning as electron donors. Experiments on the treatment of polymers with chromium trichloride, cupric chloride, and zinc chloride were conducted. It was established that as a result of the treatment of samples of polyacrylonitrile with  $\text{Cu Cl}_2$  the electrical conductivity increases sharply and reaches (at  $300^{\circ}$ )  $10^{-2}$  ohms $^{-1}$  cms $^{-1}$ . It was also established that preliminary irradiation of polyacrylonitrile with  $\gamma$ -rays in a dose corresponding to  $1.1 \times 10^{22}$  electron-volts followed by thermal treatment leads to a sharp increase in the concentration of electrons with unpaired spins (up to  $1.5 \times 10^{19}$ ) as compared with the nonirradiated polymer. If polyacrylonitrile is obtained by radiation polymerization and then treated thermally, the concentration of current carriers is practically the same as that in samples obtained by ordinary methods of polymerization. The action of  $\gamma$ -radiation on the polymer increases the effectiveness of subsequent thermal treatment for the preparation of materials with semiconductor properties.



46. USSR and East German Papers Presented at International Conference on Physics and Chemistry of Crystal Phosphors Held at Greifswald

"International Conference on the Physics and Chemistry of Crystal Phosphors," by V. V. Antonov-Romanovskiy; Moscow, Vestnik Akademii Nauk SSSR, Vol 29, No 10, Oct 59, p 87

The International Conference on the Physics and Chemistry of Crystal Phosphors was organized by the Subcommittee on Luminescence, Department of Physical Sciences, German Academy of Sciences, at Berlin, and the Institute of Physical Chemistry, E. M. Arndt University. It was held 26-29 April 1959 at Greifswald (GDR). Scientists from the Soviet Union, Hungary, Poland, Czechoslovakia, France, and Switzerland participated in the conference.

In a large group of reports presented at the conference, some properties of borate phosphors and other phosphors were discussed (G. Witzman and coworkers, GDR). Detailed reports given by G. Orthman and his coworkers (GDR) were concerned with the physicochemical characteristics of phosphors.

Considerable interest was evinced in research on the electroluminescence of single crystals of CdS, the results of which were reported by K. V. Behr (GDR). Research on the same subject was reported by V. Ye. Oranovskiy and B. A. Khmelinin (USSR) as far as ZnS-Cu is concerned and by Z. Bodo (Hungary) as applied to ZnS. E. and M. Grillot (France) told about new work on the fluorescence of excitons in pure CdS.

A number of informative papers dealt with alkali metal halide phosphors. By using an original method of comparing electron emission with photoemission upon uniform heating of excited phosphors, the effect of Ca on the emission and luminescence of sodium chloride was investigated by A. Bogun (Czechoslovakia). Ch. B. Lushchik (USSR) presented a communication on the mechanism of the luminescence of alkali halide crystals activated with the ions  $Ga^+$ ,  $Ge^{++}$ ,  $In^+$ ,  $Sn^{++}$ ,  $Tl^+$ , and  $Pb^{++}$ . In a report by N. Balarin (GDR) a discussion was given of the theory of the centers of luminescence of crystals activated with Tl.

Work on the kinetics of phosphorescence was represented by papers given by P. Jaszczyn (Poland), who discussed the effect of infrared radiation on the luminescence of ZnS-Mn phosphors (this work makes it possible to draw conclusions in regard to a special mechanism which is operative in the excitation of Mn ions) and a paper by V. V. Antonov-Romanovskiy, who discussed the kinetics of the initial stages of the attenuation (damping) and increase of the luminescence of phosphors with traps of different types.

K. Friedrich and L. Herfors (GDR) pointed out in their report that it is possible to carry out dosimetry of ultraviolet radiation and of  $\beta$  - rays by de-exciting (stimulating emission of ) irradiated phosphors with ultrasound.

Several reports were concerned with results obtained in the investigation of properties of luminophore layers.

47. Electric Properties of Borides of Rare-Earth Metals

"The Electric Properties of Borides of Rare-Earth Metals," by G. V. Samsonov and Yu. B. Paderno, Institute of Powder Metallurgy, Cermets, and Special Alloys, Academy of Sciences Ukrainian SSR; Kiev, Doklady Akademii Nauk Ukrainiskoy SSR, No 11, Nov 59, pp 1215-1218

The authors investigated the electrical and thermoelectric properties of the borides of a number of rare-earth metals. It was established that in the region from room temperature to 700-800° the materials investigated are metallic conductors with hole conductivity. Methods were developed for obtaining pseudobinary alloys of hexaborides with a high electric resistance and low value of the work-function of electrons.

48. Improvement in Selenium Photocells

"Investigation of Certain Effects on the Characteristics of Selenium Photocells," by M. Ya. Bakirov, G. B. Abdullayev, Ya. N. Nasirov, and M. A. Talibi; Baku, Izvestiya Akademii Nauk Azerbaydzhanskoy SSR, Seriya Fiziko-Matematicheskikh i Tekhnicheskikh Nauk, No 5, Sep/Oct 59, pp 65-74

Direct conversion of radiant energy into electric energy has become quite practical owing to recent advances in the construction of semiconductor photocells. Theoretical calculations indicate that ideal material for conversion of radiant energy into electric should have the forbidden-zone width between 1.5 to 1.6 ev.

The article describes extensive research conducted to improve the efficiency of selenium photocells. By proper thermal processing electrical and thermal forming, and coating with lacquer it is possible to raise the efficiency of selenium photocells to 1.5%. The best conditions for electrical forming occur when the semiconductor is held at 60°C for 3 to 4 hours. The photocell processed in this manner will generate a current of 2.5-2.8 milliamp/cm<sup>2</sup> at 0.5 v for illumination intensity of 40,000 to 50,000 lux. Under the most favorable conditions it was possible to generate a current of 3.5 to 4.0 milliamp/cm<sup>2</sup> at 0.6 v.

Investigation of the temperature effect indicated that maximum emf is obtained at  $-50^{\circ}\text{C}$  and maximum current at  $25^{\circ}\text{C}$ . A layer of sulfur between the selenium and the upper cadmium electrode will increase the emf and the internal resistance of the photocell, but will reduce the current generated.

### Wave Propagation

#### 49. Particles Having Higher-Than-Light Velocity

"Some Peculiarities of Electromagnetic Waves Radiated by Particles Moving Faster Than Light," by V. L. Ginzburg and V. Ya. Eydman, Radiophysics Institute, Gor'kiy University; Gor'kiy, Izvestiya Vysshikh Uchetnykh Zavedeniy, Radiofizika, No 2, 1959, pp 331-343

The Cherenkov-Vavilov effect is observed when particles (electrons, protons) or "systems" (atoms, plasma bunches) move with higher-than-light velocity in a certain medium or even in the vicinity of such a medium.

The quantum concept is often very useful, even if the problem is mainly classical, as in the case of analysis of electromagnetic wave radiation caused by particles or systems moving with higher-than-light velocity in a certain medium. A similar situation arises in case of examining radiation, absorption, and amplification of a wave within the beam of particles.

The report discusses the problem of classical interpretation of radiation strength when a charge is moving within a certain medium or close to it. Principal conclusion obtained from simple quantum interpretation and quantitative classical computation is that for higher-than-light velocity, the strength of radiation, which changes the amplitude of particle oscillation, is smaller than for the case of slower velocities. In an anisotropic medium it may even change the sign, i.e., may assist swinging the oscillations. This effect is primarily attributed to the instability of a beam of particles with higher-than-light velocity.

V. ENGINEERING

50. Impulse Meter for Measuring Jet Thrust

"Device for Recording Impulses of a Pulsating Jet (Impulse Meter)," by V. M. Dorofeyev and V. Ya. Levin, Trudy Kuybyshevskogo Aviatsionnogo Instituta (Works of the Kuybyshev Aviation Institute), No 6, 1958, pp 49-55 (from Referativnyy Zhurnal -- Mekhanika, No 6, 1959, Abstract No 6605, by I. A. Lukashevich)

The design and construction of an impulse meter for recording instantaneous values of jet thrust are described. The operating principle of the instrument is based on the active method of measuring jet thrust.

A trap (plate) suspended as a cantilever from a shaft rigidly attached to a fixed coupling is oscillated under the action of pressures encountered in an unsteady flow exiting from a nozzle. The shaft to which the trap is attached is subjected to bending deformation. Two identical tensometers cemented to the shaft on parallel planes equidistant from the axis of the trap form the two branches of a Wheatstone bridge. The location of these two transducers in identical conditions while being subjected to different deformations (extension and compression) makes thermal compensation possible, i.e., eliminates the effect of temperatures of the ambient medium and shaft. The bridge is supplied by current with a frequency of 4,000 cycles from an audio oscillator. Current changes with time are taken from the bridge through a special amplifier and fed to the loop of an oscillograph where they are fixed.

The instrument makes it possible to measure the impulse of an unsteady jet of gas, register thrust with time, and examine a pulsating flow as it exits from a nozzle. Additional relationships may be obtained when using the instrument for investigating an operating pulse chamber which would facilitate investigation of the operating process of the chamber.

Principal circuits of the instrument and a sample oscillogram of trap displacements are presented.

51. Design of Very Large Hydrogenerator Units

"Prospects for Further Increase in Hydrogenerator Capacity," by A. S. Yeremeyev, Moscow, Vestnik Elektromyshlennosti, No 11, Nov 59, pp 4-8

The article contains the following passages.

"The contemplated construction of new electric stations on rivers with very large water-power reserves would require an installation of about 20 hydrogenerator units, each from 200,000 to 300,000-kw capacity.

"This would complicate, as well as increase the cost of, construction and operation of such stations; thus, it is desirable to increase further the size of each hydrogenerator unit.

"The most feasible cooling method for hydrogenerators is direct fluid cooling, especially with distilled water, which is much more efficient than cooling with oil.

"The article discusses in its first approximation the possibility of the direct fluid cooling method, as applied to a hydrogenerator, to increase power capacity without substantially increasing the physical dimensions of the units. The article also discusses how such an increase in power will affect the electric losses, efficiency, other parameters of the generator, and the weight of current carrying materials.

"Application of direct water cooling will permit automatic maintaining of the temperature constant independently of the load and assure uniformity of temperature without permitting any sharp rises.

"The magnetic-flux conducting steel should be cooled independently of the winding. As the calculations indicate, the heating of the winding at its hottest points should not exceed the temperature of cooling water by more than 20-25°C under normal operating conditions.

"The application of direct water cooling to hydrogenerators permits doubling the generating capacity of each unit while retaining the same physical dimensions as that of an air-cooled unit. The amount of magnetic-flux conducting steel can be decreased to approximately half for each kva capacity, and the amount of copper can be decreased to about one fourth."

## VI. MEDICINE

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### Contagious Diseases

#### 52. Czechoslovak Oral Antipolio Vaccine

"We Are Winning Over Polio" (unsigned article); Prague, Obrana Lidu, 14 Nov 59, p 1

In a brief article discussing the status of the fight against polio in Czechoslovakia, it is disclosed that polio vaccination was begun in Czechoslovakia in spring 1957. This campaign apparently resulted in a

significant drop in the incidence of polio, which, according to data furnished by the Ministry of Public Health, amounted to 302 cases in 1958, or 2.2 per 100,000 inhabitants. The total number of paralytic polio cases through October 1959 was only 200 cases, or 1.6 per 100,000 inhabitants. The article compares these figures with the period 1953-1957 and states that during that time, the incidence of polio was five times greater than it is now.

Also, the article states that preparations are being made for mass vaccination with live-attenuated Sabin vaccine, production of which will probably begin in Czechoslovakia in spring 1960. According to the article, the Institute of Serology and Vaccine Materials in Prague (Ustav ser a ockovacich latek) has made all the required preparations leading to the manufacture of this vaccine. The Sabin vaccine is said to have an average over the "thus far used Salk vaccine" in that it may be used in tablet form and is suitable for oral administration.

#### Immunology and Therapy

##### 53. Control of Anthrax Vaccine

"Periods of Suitability and Methods of Control of STI Anthrax Vaccine," by P. A. Ivashkevich, B. Ya. Mikhaylov, G. I. Rozhkov, and A. L. Tamarin; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 30, No 11, Nov 59, pp 45-47

A study of the period of suitability of STI vaccine for immunization is reported in this article. Eight series of vaccine prepared in 1944-1950 and preserved at 0-4° C were selected for the study. Three-month-old vaccine and a suspension of freshly cultured STI spores served as controls. All the vaccines investigated had been prepared and preserved in accordance with the Instructions on the Preparation and Control of Live STI Anthrax Vaccine for Humans.

The following methods were used in the investigation: (1) a study of the morphology of the spores with the use of electron and ordinary microscopes; (2) the determination of the total quantity (concentration) of spores according to an optical bacterial standard and by direct light in Byurker or Goryayev chambers; (3) the determination of the quantity of live spores by the calculation of mature colonies in dishes and by microcultures; and (4) the determination of harmlessness and immunogenicity on experimental animals (rabbits).

A 50-kv EM-3-49 electron microscope was used. The vaccine was diluted with physiological solution to a concentration of 100-200 million spores per ml and a droplet of the suspension obtained was placed on a

collodion film affixed to a fine metal screen for scanning. Quantities and variations in dimension which were observed are discussed; a table shows results of calculations according to different methods. The following conclusions are presented:

"1. STI anthrax vaccine prepared and preserved in accordance with the instructions maintains its initial biological characteristics for 14 years (the period of observation).

"2. The period of suitability of the vaccine for immunization under the preservation conditions which prevailed can be extended at least 5-8 years.

"3. Electron microscopy, spore calculation in a chamber, and determination of the number of live spores by the microculture method can be employed in addition to the accepted method of STI anthrax vaccine control; in evaluating the vaccine, the total number of spores and the number of viable spores can be regarded as a basic index of its suitability."

54. New Live Brucellosis Vaccine Tested on Cattle

CPYRGHT

"Immunization of Cattle Against Brucellosis With a New Vaccine Containing Live Organisms," by Dr. L. Prohaszka; Budapest, Magyar Allatorvosok Lapja, No 11, Nov 59, p 382

A vaccine containing live organisms was prepared from Brucella strain K<sub>6</sub>. Immunization experiments were carried out with this vaccine in a herd of heifers free from infection. Vaccinated and nonvaccinated animals were later transferred to a farm where they were exposed to natural infection. Following vaccination, the animals produced antibodies in low titers. Agglutinating and complement fixing antibodies which were demonstrable after vaccination usually disappeared 2 or 3 months later. Animals vaccinated with strain K<sub>6</sub> resisted natural infection with Brucella; this resistance was equivalent to that conferred by strain B<sub>19</sub>. No undesirable side reactions were observed after vaccination with strain K<sub>6</sub>. The virulence and immunizing properties of both strains were found to be similar; however, the strains may be readily differentiated by biochemical methods.

55. Combined Smallpox and Live Brucellosis Vaccine Tested

"The Immunological Effectiveness of Smallpox Vaccine Combined With Live Brucellosis Vaccine," by F. A. Shpigunov, Military Medical Order of Lenin Academy imeni Kirov; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 30, No 11, Nov 59, pp 25-28

The author reports a series of experiments performed on animals to determine the effect of live brucellosis vaccine on the immunological effectiveness of smallpox vaccine when both vaccines are administered as an associated preparation, and when they are given simultaneously but in different sites. The following vaccines were used: smallpox, series 121, Leningrad Institute of Epidemiology, Microbiology, and Hygiene imeni Pasteur, administered in the dilution used for humans; and brucellosis vaccine, series 51-2, Institute of Epidemiology and Microbiology imeni Gamaleya, in the form of a suspension containing one billion microorganisms per ml. The associated vaccine was prepared by mixing equal parts of the above dilutions and was administered by the scarification method.

Three groups of rabbits were immunized: the first group, with the mixed vaccine; the second, with both vaccines in different sites; and the third, with smallpox vaccine alone. A table shows the dynamics of the increase in the virus-neutralizing properties of sera from the immunized rabbits.

After a discussion of the results observed, the author concludes that immunological reconstruction (the development of virus neutralizing antibodies) with respect to smallpox vaccine occurred to an equal extent after cutaneous vaccination of animals with smallpox vaccine alone or with smallpox vaccine combined with live brucellosis vaccine.

56. Particle Size Affects Distribution of Antigens in Virus-Infected Tissues

"The Distribution of Specific Antigens Depending on Their Particle Size in Tissues Infected With Viruses, and the Significance of This Phenomenon," by A. Kipps, U. Node, A. Polson, Dzh. Zel'tser, M. Vanden-Ende, Priroda Virusov (The Nature of Viruses), 1958, pp 238-265 (from Referativnyy Zhurnal -- Biologiya, No 21, 10 Nov 59, Abstract No 91575, by A. D. Al'tshteyn)

"RA (soluble antigens) and the particle size of the viruses of P (poliomyelitis), B (rabies), Rift Valley fever, AL (equine anemia), and ZKGO (catarrhal fevers of sheep) in a suspension of newborn mouse brain were studied. The brain suspension was successfully separated into fractions which did not contain virus, but which reacted in the RSK (complement fixation reaction), and fractions which contained virus activity but reacted



weakly in the RSK. The first fraction contained RA (in experiments with P viruses, strains MEF-I, B, and ZKGO). RA appeared in newborn mouse brain in experiments with B virus after the beginning of virus formation. It was established by the agar diffusion method and by ultracentrifugation that the MEF-I strain forms particles with a diameter of 24 and 30 microns in the brains of newborn mice. The number of particles of the first type sharply increases on infection of mature mice, although the MEF-I strain, adapted only to mature mice, forms only particles with a diameter of 30 microns and has a low infection titer. Analogous results were obtained with AL virus (particles of 30 and 50 microns). RA consists of particles with diameters of 8-12 microns. RA of strain MEF-I is formed in the brains of newborn but not mature mice. RA of strain B causes both neutralizing and complement fixing antibodies to be formed in mice. Heating of RA and its virus lowers the capacity to bring about the formation of neutralizing antibodies. RA are characterized by lower serological specificity in the RSK than virus particles in neutralization experiments (experiments with ZKGO virus). It is suggested that RA are more characteristic side products of virus synthesis than its principal components."

CPYRGHT

57. Cortical Inhibition Affects Immune Reactions in Dogs

"The Effect of Slight Inhibition of the Cerebral Cortex on Specific Immune Reactions in Dogs," by A. A. Kranova, Laboratory of Physiology, Ukrainian Psychoneurological Institute; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 30, No 11, Nov 59, p 117

The effect of slight inhibition in the cerebral cortex on specific immune reactions was investigated in ten dogs (six experimental and four control) in which conditioned reflexes had been established. Three injections of dysentery vaccine (prepared from Flexner's bacillus) in doses of 0.5, one, and one ml respectively were given at 7-day intervals. Barbamyl, given with and for 2 days following the administration of the vaccine, produced coma, ataxia, and a hypnotic state in the cerebral cortex. Control animals received dysentery vaccine without additional irritation. The presence of specific agglutinins and of specific and nonspecific phagocytosis in the blood was verified.

Investigation showed that changes in higher nervous activity, chiefly manifested by the development of supraliminal inhibition, occurred in all dogs after vaccination but were more pronounced in the experimental animals. Conditioned reflex activity was strongly inhibited after the first injection of vaccine; the second and third injections did not always diminish conditioned reflexes. The introduction of a soporific at the time of the first vaccination in a dose sufficient to cause complete inhibition in the cortex resulted in augmented agglutinin production and intensive specific and nonspecific phagocytosis. The second and third vaccinations brought about a decrease in all the immune reactions investigated to an equal extent in both experimental and control animals.

The author states in conclusion that the absence of parallelism in conditioned reflex fluctuations and in immunological reactivity indicates that the cerebral cortex does not constantly and precisely regulate the production of specific agglutinins and phagocytosis, but can alter them quantitatively.

58. Use of Live Polio Vaccine

"A Live Vaccine Against Poliomyelitis; (unsigned article); Moscow, Izvestiya Sovetov Deputatov Trudyashchikhsya SSSR, No 281 (13208), 27 Nov 59, p 6

"The Presidium of the Academy of Medical Sciences USSR has investigated the results of the study and use of live vaccine against poliomyelitis in the Soviet Union.

"M. P. Chumakov and A. A. Smorodintsev reported that the total number of persons inoculated with this vaccine in the USSR exceeded 12,211,000 at the end of October 1959. Inoculations were given in 13 union-republics; in a number of cities and oblasts, the vaccine was administered during the height of the polio season (July-September). Observations afforded clear evidence of the antiepidemic effect of the live vaccine. Its harmlessness was established and verified. The final results of the use of the vaccine will be supplied at the beginning of 1960.

"The scientists reported that the manufacture of live vaccine in candy form [sugar-coated] has now begun in Moscow. Its use in place of liquid vaccine has many advantages under mass inoculation conditions. Some 1.5 million children have been successfully inoculated with these confections. The vaccine is well-preserved by refrigeration for 2-4 weeks in this form.

"The Presidium of the Academy of Medical Sciences USSR has recommended a prolonged, thorough study of the live vaccine."

CPYRGHT

59. Quantitative Determination of Antigens and Antibodies

"A Method for the Quantitative Determination of Antigens and Antibodies by Precipitation in Agar," by P. I. Mayorova, Department of Biochemistry, Institute of Epidemiology and Microbiology imeni N. F. Gamaleya; Moscow; Laboratornoye Delo, Vol 5, No 6, Nov/Dec 59, pp 40-43

A simple method of quantitatively determining anatoxins of the gas gangrene group is described in this article; the method is based on the neutralization of antigens by antibodies, double diffusion, and

precipitation in agar in Petrie dishes (Ouchterlony method). The technology of the method, including preparation of the agar and the Petrie dishes, is explained.

The results of titration according to precipitation lines in agar were observed after 1-3 days, depending on the nature and concentration of the components selected for study. *Clostridium septique*, for example, formed precipitation lines more rapidly than *Cl. oedematiens*.

The author concludes that the method described makes it possible to titrate toxins, anatoxins, and sera which form lines of precipitation in agar, but that precipitation lines do not appear when low concentrations of reacting components are used. The sensitivity of the method differs for various preparations and evidently depends on the size of the molecules. The sensitivity of the method is 10 units of activity for *Cl. septique* and 100 units for *Cl. oedematiens*. The results of titration by this method correspond with data obtained through determinations of the activity of antigens and antibodies in mice.

60. Study of Molecular Spectral Analysis in Bacteriology and Immunology

"Experience in the Use of Molecular Spectral Analysis in Bacteriology and Immunology," by V. M. Vadinov, Institute of Epidemiology and Microbiology imeni N. F. Gamaleya, Academy of Medical Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya, Vol 23, No 10, Oct 59, pp 1260-1262

This research concerns the possibility of using gamma rays for "cold" sterilization of bacterial preparations. Special attention is devoted to the study of the physicochemical changes which take place after the irradiation of diphtheria anatoxins by large doses (1.5 million r) of gamma rays.

Curves of individual absorption zones of various preparations before and after irradiation by gamma rays are presented.

Results of the experiments show that the nature of the absorption curves of matching zones of irradiated and unirradiated preparations differ slightly, but that the point of maximum absorption, which occurs at 233 millimicrons, does not change. Evidently these differences are caused by certain physicochemical changes occurring after irradiations.

A study of the absorption spectra of decolorized dyes following the staining of bacteria in suspension indicated that it is possible, judging by the value of the coefficients of absorption, to differentiate suspensions of living bacteria in physiological salt solutions from suspensions of dead bacteria.

Absorption curves of decolorized dye residues are also convenient indicators of the morphological composition of the bacterial that have been partially or completely changed or killed by the effects of various methods.

Pharmacology and Toxicology

61. Chinese Conduct Biological Experiments to Study Rauwolfia

"Domestic Rauwolfia -- New Drug for the Treatment of Hypertension," by Chu Chin, Information Laboratory (情報研究所), Chinese Academy of Medical Sciences; Peiping, K'o-hsueh Hsin-wen (Scientific News), No 34, 28 Oct 59, pp 9,3

This article presents a summary of the results of studies conducted at various institutions in China on the efficacy of China-grown Rauwolfia as a hypotensor. Experimental dogs were the subjects of pharmacological studies undertaken at the Institute of Materia Medica of the Chinese Academy of Medical Sciences. Experiments were conducted on white mice at Kwangsi Medical College to determine the toxicity of the alkaloid extracted from the domestic plant as compared with the toxicity of a similar preparation derived from Rauwolfia grown in India. Clinical observations on the effect of both drugs were made at several hospitals. It was concluded from the reports that the extract from Chinese Rauwolfia has the same hypotensive effect as that of the Indian plant. Although the former acts more slowly, its effect lasts longer. It also has lower toxicity and produces fewer side reactions. The article states that domestic Rauwolfia is to be cultivated in large quantities in China.

Physiology

62. Use of Sound for Restoration of Inhibition

"Time and Conditions for Restoring an Exhausted Inhibitory Process in Response to Sound Irritants," by L. V. Krushinskiy, L. N. Molodkina, and N. A. Levitina, Laboratory of Pathophysiology, Chair of Physiology of Higher Nervous Activity, Moscow State University; Moscow, Zhurnal Vysshey Nervnoy Deyatel'nosti, No 4, Jul/Aug 59, pp 566-572

The results of experiments on 216 rats, reported in this article, showed that the time required for restoring an exhausted inhibitory process can serve as a measure of the strength of the inhibitory function of the nervous system. Rapid restoration of the strength of the inhibitory function of the nervous system is an indication of a strong inhibitory process, and vice versa.

The time of restoration in different rats ranged from 15 seconds to 30 minutes. Individual differences were observed, as the animals were subjected to the effects of strong sound irritations. The rate of restoration increased under the effects of sodium bromide, which was used in experiments on 24 rats.

The method used in evaluating the time of restoration of the exhausted inhibitory process makes it possible to study the course of exhaustion and restoration of inhibition resulting from the action of strong stimuli on the nervous system.

The 240 rats used in the experiments were highly sensitive to sound irritants. Motor excitation of the rats was recorded by means of a plethysmograph.

63. Effect of Light on Electrical Activity of the Dog Brain

"Changes in Electrical Activity of the Brain upon Photic Stimulation of Dogs Reared in Darkness," by I. V. Danilov, Physiology Department imeni I. P. Pavlov, Institute of Experimental Medicine, Academy of Sciences USSR; Leningrad, Fiziologicheskiy Zhurnal SSSR imeni I. M. Sechenov, No 9, Sep 59, pp 1060-1066

The author of this article describes experiments in which four puppies were raised in complete darkness until the age of 7 or 8 months and were then exposed to light.

The animals were blindfolded every time they were taken to the laboratory. When the cover over the eyes was removed, the dogs were exposed to the effects of vision-stimulating, diffused light. This light caused generalized changes in the bioelectric activity of the brain. These changes were manifested by a sharp increase in the amplitude of potentials over the entire cerebral surface but were not accompanied by any change in frequency.

After the animals were kept under normal illumination conditions for some time, exposure to the same vision-stimulating light evoked the usual response of EEG desynchronization.

The author of this article suggests that the reaction of EEG desynchronization appears when a certain level of tonus of the cerebral cortex has been built up.

64. Studies of Higher Nervous Activity

"The Basic Trend of Our Studies of Higher Nervous Activity,"  
by G. V. Fol'bert; Moscow, Zhurnal Vysshey Nervnoy Deyatel'-  
nosti, No 4, Jul/Aug 59, pp 481-488

The author of this article states that all important investigations which he has conducted over a period of 50 years, both as a scientist and as a director of personnel in various scientific laboratories, were based on I. P. Pavlov's theories concerning higher nervous activity. His early experiments were conducted in Pavlov's laboratory. He demonstrated that when one unconditioned stimulus is replaced with another, the conditioned reflex developed earlier will have to degenerate or become inhibited before a new conditioned bond can be formed with another unconditioned stimulus.

Fol'bert studied the chronic chemical changes that take place in the organism of an experimental animal after it has been fed the same food for a long time. Similar studies were conducted later by S. B. Khazen, Ya. Ye. Yegorov, S. S. Fridman, G. P. Konradi, A. N. Nikitina, and A. M. Vorob'yev. These studies substantiated I. P. Pavlov's theory concerning the alimentary center; the results of the experiments conducted showed how well the alimentary center controls the animal's reactions.

A. V. Semernina performed experiments to investigate the possibility of producing exhaustion and fatigue by means of a conditioned reflex. She proved that the inhibitory effects of stimuli are greater if they are applied when the organism is already in a state of inhibition.

Much work has been done to explain the role played by exhaustion and recovery processes in the nervous activity of the organism. O. M. Fugol', A. V. Semernina, and G. V. Fol'bert are continuing this work.

N. O. Vokalyuk demonstrated that sleep, a process of inhibition, not only activates the restorative process, but also accelerates the process of recovery.

Special studies have been conducted to explain the significance of the mechanisms of exhaustion and recovery in the activity of the cortex of the brain, and the importance of conditioning in higher nervous activity.

Experiments conducted by A. A. Kramova showed that increased efficiency is a conditioned reflex formed as result of numerous repetitions which develop one organ or the other in response to a given stimulus.

O. M. Fugol' followed up those experiments and demonstrated that the formation of stereotyped reactions by higher branches of the central nervous system in higher animals is a broader and more general phenomenon than it was thought to be.

Results of experiments with negative conditioned reflexes, together with much data collected by the laboratory of K. M. Bykov, showed that various conditions may be produced in the organism by means of conditioned stimuli.

A systematic study of trace stimuli was begun about 6 years ago. As early as 1905, I. P. Pavlov considered it possible to form conditioned reflexes in response to trace stimuli. However, a systematic study of traces as special stimuli and the course that the resultant reactions follow is not yet known. Nothing is known about the physiology of trace stimuli and trace processes.

Soviet physiologists intend to accumulate experimental material dealing with trace stimuli and to begin a systematic study of trace reactions.

65. Oxygen Content of Blood During Epileptic Seizures

"Cases of the Blood Surrounding the Brain of a Dog in Experimental Epilepsy," by A. I. Nazarenko, Laboratory of Comparative Physiology and Physiology of Aging, Physiological Institute imeni O. O. Bogomol'yets, Academy of Sciences Ukrainian SSR; Kieve, Fiziologichnyy Zhurnal, Vol 5, No 7, Sept/Oct 59, pp 634-638

Experiments were conducted on six dogs to determine the O<sub>2</sub> content in the blood, surrounding the brain, during epileptiform seizures induced by the intravenous injection of a 20% solution of camphor oil in ether. Blood was taken from the Femoral artery and from the sagittal sinus before, at the height, and after the seizure. It was found that, at the height of development of the convulsive seizure the O<sub>2</sub> content dropped in the arterial blood and rose in the venous blood. The variation in the O<sub>2</sub> content in the arterial blood and venous blood was smaller during the seizure and was greater afterwards. The blood flow rate was sharply accelerated during the convulsive seizure. The O<sub>2</sub> content in the blood stream became gradually normal after the epileptic seizure.

66. Motor Reflexes Studied

"New Methods of Studying Motor Reflexes in Man," by K. M. Shteyngart, Laboratory of Higher Nervous Activity, State Institute of Pediatrics; Moscow, Zhurnal Vysshey Neryvnoy Deyatel'nosti imeni I. P. Pavlov, Vol 9, No 5, 1959, pp 782-787

The author of this article describes the parts and the pickup unit of a device designed in 1955 for recording muscular contractions in a human. The device is sufficiently sensitive to record the slightest movements made by the experimental subject. The subject can remain in any position and can converse freely.

This device has provided experimental physiologists with a very convenient and satisfactory aid for investigating motor reflexes in humans, particularly for studying the function of speech muscles.

Possibilities for utilizing this device are unlimited. It may be used to investigate the motor analyzer in the human, the character of forms of motion in ontogenesis, the speech-motor musculature (both under normal and morbid conditions), and motor reflexes when a morbid condition is accompanied by motor disturbances.



Public Health, Hygiene, and Sanitation

67. Description of Hose-Type Gas Masks

"Protection of the Respiratory Organs With the Aid of Hose-Type Gas Masks," by V. S. Frolov and T. N. Anikina; Moscow, Khimicheskaya Promyshlennost', No 3, Apr/May 59, pp 272-273

The hose-type gas mask is a breathing apparatus used in the presence of great concentrations of noxious gases and vapors against which the filter-type gas mask can offer no protection to the lungs or in an atmosphere where an insufficient supply of oxygen exists (less than 16%).

These gas masks have been used successfully while working in enclosed places such as tanks, cisterns, boilers, oil tankers, sewer pits, etc.

The face piece of the hose-type gas mask can be either a helmet or a half-mask (provided there is no need to protect the eyes). The hose-type gas masks are divided into three categories: (1) A breathing tube-type, without the mechanical transmission of air (PSh-1). The open end of the hose is placed in a zone of pure air. The diameter of the 10-meter-long hose is 25 mm. (2) A breathing tube-type, with the mechanical transmission of air, either manually or electrically operated (PSh-2). (3) Line gas masks, with air passed through a hose from a compressor or a compressed-air cylinder.

A basic shortcoming of these gas masks is that the radius of action is limited by the length of the hose (10 meters).

Several physical characteristics of the hose-type gas masks are presented.

68. Vibration Sickness in Factory Workers

"Prevention of Vibration Sickness," by Ye. Osipov; Moscow, Zdorov'ye, No 12, Dec 59, p 27

Scientists of the Institute of Industrial Hygiene and Occupational Diseases, Academy of Medical Sciences USSR, have for many years been conducting research on vibration sickness to determine its symptoms, causes, and methods for its prevention and treatment.

Vibration sickness, according to this report, may arise as a result of extended contact with vibrating machines and instruments. The harmful effect of vibrations becomes intensified when they are accompanied by noises. Vibration may cause dizziness, headaches, unpleasant sensations in the area of the heart, pain in the hands, numbness, and may cause the fingers to turn white.

If vibration sickness is neglected, the efficiency of the person affected decreases. Such an individual should be assigned to some other type of work where there is minimum exposure to vibration.

The Institute of Industrial Hygiene and Occupational Diseases was instrumental in organizing prophylactic stations which use pneumatic instruments in some industrial enterprises of Moscow City and Oblast. These stations have facilities for massaging and bathing hands and for therapeutic gymnastics.

Personnel of the institute examined all workers of the Stantsiya Vodniki Stone-Working Combine and the Lyberetsk Reinforced Concrete Products Plant. Workers of this plant are constantly subjected to local and general vibration produced by machines and instruments. Action was taken to improve the working conditions, and other therapeutic and preventive measures were inaugurated.

The proposal made by the institute that a noiseless process of extrusion be adapted in riveting metal articles was well received. The old pneumatic hammers were replaced by new ones with a vibration-suppressing arrangement. Riveters stopped complaining about pains in their hands soon afterwards.

The laboratory of the institute recommended that riveters be given a break during the day, in addition to their lunch hour. It was recommended that riveters follow a certain procedure in exercising their hands during the break.

69. Effect of Vibration on Vasomotor Reflexes

"Modification of the Vasomotor Reflexes Under the Action of General Vibrations on Man," by V. G. Terent'yev, Institute of Aviation Medicine; Moscow, Zhurnal Vysshey Nervnoy Deyatel'nosti imeni I. P. Pavlov, Vol 9, No 5, 1959, pp 649-656

The author of this article presents results of 358 experiments on 14 healthy men between 20 and 39 years of age; these studies showed that general vertical vibrations with frequencies of 10-70 cycles per second (hertz) and an amplitude of 0.4 millimeter, lasting 4 hours, ordinarily cause no changes in the vasomotor reflexes.

Frequencies of 10-40 cycles per second with amplitudes of 0.8-1.2 millimeters and frequencies of 50 cycles per second with an amplitude of 0.8 millimeter cause changes in conditioned and unconditioned reflexes, manifested by a decrease in vascular reactions, a disinhibition of the differentiation, and an increase in spontaneous oscillations of the plethysmogram.

Frequencies of 10-40 cycles per second with amplitudes of 1.6-2.4 millimeters, 50 cycles per second with an amplitude of 1.2 millimeters, 60 cycles per second with an amplitude of 0.8 millimeter, and 70 cycles per second with an amplitude of 0.6 millimeter cause the distortion or disappearance of the conditioned and unconditioned vascular reflexes. A human organism cannot tolerate vibrations of such intensities and therefore, should not be exposed to them in any industrial establishment.

Vibrations with a frequency of 40 cycles per second and above intensify the vasoconstrictor effect. The development of adaptive mechanisms are noted after exposure to the repeated action of vibrations of tolerable intensities.

Caffeine reduces the harmful effect of vibrations of a general nature and contributes to a more rapid restoration of the conditioned and unconditioned vascular reflexes which were disrupted by the action of the vibrations.

#### Radiobiology

##### 70. Restoration of Regeneration Capacity of Irradiated Tissues

"The Restoration of the Regeneration Capacity of the Extremities of Axolotls Following X Irradiation," by L. V. Polezhayev, Institute of Animal Morphology imeni A. N. Severtsov, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSR, Vol 127, No 3, 21 Jul 59, pp 713-716

A total of 40 one-year-old axolotls were subjected to tests on the restoration of the regeneration capacity of irradiated and subsequently amputated extremities.

Only the extremities were irradiated by 700 r, and a few days after irradiation were amputated at the middle part of the shank. The animals were then subjected to therapy. The organs were fixed, and the regeneration results were compared with those of untreated animals.

Results showed that the restoration of the regeneration capacity of irradiated extremities is possible not only by the method of transplanting unirradiated tissue into them, but also by the more successful method of treating the animals with homogenates prepared from unirradiated tissue; and the restoration of the regeneration capacity by homogenates is attained not by the involvement of irradiated tissues in the processes of regeneration of unirradiated tissues, as is assumed to occur during transplantation, but by assimilation of the homogenates by the irradiated tissues, and by subsequent changes in the biochemical composition and metabolism of the irradiated tissues. Experiments on treating axolotls with homogenates of rat muscles have shown that regeneration occurs in the extremities of axolotls but not of rats. Consequently, the homogenates of rats are assimilated by the tissues of the irradiated extremities of axolotls, but are not the chief source of regeneration.

The author presents the following conclusions:

Treating axolotls with homogenates prepared from muscles of the extremities of axolotls and rats leads to the complete restoration of the regeneration capacity of the irradiated extremities. The participation of native proteins and possibly of nucleic acids of unirradiated tissues is evidently necessary for the restoration of the regeneration capacity of irradiated organs.

71. Infectious Hemorrhagic Syndrome in Radiation Sickness

"The Role of Infection and Changes in Immunological Reactivity During the Development of the Hemorrhagic Syndrome in an Irradiated Organism," by N. N. Klemparskaya and V. F. Sosova; Moscow, Meditinskaya Radiologiya, Vol 4, No 10, Oct 59, pp 82-84

In this article the authors discuss various syndromes which appear in radiation sickness and which are characterized by an allergic reaction of the organism.

In the authors' opinion, two factors play an important role in the pathogenesis of the hemorrhagic syndrome during radiation sickness: (1) the sensitization of the organism arising as a result of the effect of irradiation and caused by the products of tissue destruction; and (2) the so-called disruptive factor which appears in the form of local accumulation of products of tissue destruction caused by infectious agents, or by the death and destruction of cells in various organs as a result of disturbed metabolism during the progress of radiation sickness.

Results of various experiments have established a connection between the hemorrhagic infectious process and the presence in an organism of sensitization to homologous tissue products. This sensitization can be created by the administration of a suspension of homologous tissue or tissue products, or by tissue destruction due to ionizing radiation. The disruptive factor which causes the formation of the hemorrhagic reaction is a local formation of products of tissue destruction following disturbed metabolism and cellular activity after irradiation, or it is caused by bacteria multiplying in the animal tissues.

The direct local administration of homologous tissue products into irradiated or homosensitized organisms exerts a similar effect.

72. Measurement of Radioactive Fallout After Nuclear Tests

"Radioactive Fallout After the Cessation of Nuclear Tests," by V. Santgol'tser; Moscow, Atomnaya Energiya, Vol 7, No 5, Nov 59, pp 480-481

Since 1956, the Chair of Physics of the Medical Faculty at Hradec Kralove (Czechoslovakia) has been conducting (initially in conjunction with the Geophysics Institute and the Department of Meteorology at Hradec Kralove) systematic measurements of the radioactivity of atmospheric precipitations. The author has also conducted regular tests on radioactive fallout after nuclear tests, at present, within 2-3 days, according to the method described in Atomnaya Energiya, Vol 5, No 5, 1958, p 577.

Average indexes of the activity of atmospheric precipitations up to 15 May 1959 are approximately four times as high as the average values for 1958 and approximately twice as high as the average values for the second half of 1958. The greatest activity ( $10.1 \times 10^{-9}$  curies/l) appeared in the rain which fell on 6 April 1959.

Data on the intensity of radioactive fallout are presented in the following table:

Radioactive Fallout From 1 November 1959 to 31 May 1959

<u>Date</u>	<u>Average Intensity per Month (milli- curies/km<sup>2</sup>)</u>	<u>Average Intensity per day (milli- curies/km<sup>2</sup>)</u>
Nov 58	8.1	0.27
Dec 58	104.7	3.4
Jan 59	62.1	2.0
Feb 59	75.1	2.7
Mar 59	31.5	1.0
Apr 59	45.8	1.5
May 59	41.6	1.3

The author discusses total and cumulative radioactivity, and formulas containing time factors and graphs which explain the mathematical calculations of the radioactivity of fallout are presented.

73. Radioactive Fallout in Leningrad Suburbs

"Atmospheric Sr<sup>90</sup> Fallout in the Suburbs of Leningrad," by V. P. Shvedov, M. I. Zhilikina, V. K. Zinov'yeva, L. M. Ivanova, T. P. Makarova, and N. A. Pavlova; Moscow, Atomnaya Energiya, Vol 7, No 5, Nov 59, p 479

Quantitative determinations of atmospheric Sr<sup>90</sup> fallout in the suburbs of Leningrad were begun in 1954. During 1954 and 1955, the estimate was based on observations of the fallout of total products resulting from nuclear explosions (V. P. Shvedov, V. A. Blinov, L. I. Gedeonov, and Ye. V. Ankudinov, Atomnaya Energiya, Vol 5, No 5, 1958, p 577). The calculations were based on data presented by H. Hunter and N. Ballou in Nucleonics, Vol 9, No 5, 1951, p C-2.

In 1956, a selective analysis of the Sr<sup>90</sup> content of many samples of radioactive materials precipitating from the atmosphere was conducted. It was suggested that the average percent of Sr<sup>90</sup> in these samples was the same as that contained in all the active products which had precipitated during the year. Hence, the amount of Sr<sup>90</sup> fallout for 1956 was calculated.

In 1957, a radiochemical analysis of all the fallout products detected was conducted by means of high-walled vessels containing small quantities of acidified water. Strontium and cerium were isolated and the quantities of  $Sr^{90}$  and  $Ce^{144}$  were determined. The amount of  $Ce^{144}$  fallout for 1957 equaled 55.7 millicuries/km<sup>2</sup>.

Results of the analysis for  $Sr^{90}$  fallout are presented in the following tables (in millicuries/km<sup>2</sup>):

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<u>Year</u>	<u>Fallout per year</u>	<u>Residue of Fallout as of 1 Jan 57</u>
1954-1955	1.1	1.0
1956	2.6	2.5
1957	3.4	3.4
Total as of 1 Jan 58	7.1	6.9

74. International Conference in Budapest on Protection Against Radiation

"Successful International Experiments on Preventing Radiation Damage" (unsigned article); Budapest, Nepszabadsag, 6 Nov 59, p 10

A scientific conference began on 5 November 1959 in Budapest on damage caused by ionizing radiation and its prevention. A number of prominent German, Czechoslovak, and Rumanian scientists participated in addition to Hungarian medical scientists and radiation physicists.

After the opening address by Dr Mrs Weil (nee Zsuzsa Leichner), chairman of the Radiology Group of the Trade Union of Medical and Health Workers (Hungarian), Dr Nandor Ratzkoczy, university instructor and chief of the X-ray clinic of the Budapest Medical Sciences University, read the first paper. He noted that a patient should be subjected to X rays and other radiation only if the specialist considered this justified.

Dr Pal Deak, director of the National X-ray and Radiation Physics Institute (Hungarian), reported on experiences which the institute acquired in examinations done at several hospitals and clinics.

Docent Dr Zoltan Zsebok (Hungarian), said that Soviet researchers had done very successful experiments with blood transfusions and with bone marrow and spleen extracts and that, in addition, certain organic compounds displayed good protective results. He noted that very reassuring domestic research was being done at the No 1 Surgery Clinic (Budapest) in conjunction with foreign research.

Dr Gyula Koczkas and Dr F. Gietzelt, professor of Radiology at Humboldt University in Berlin, read a paper on treatment of skin radiation damage. Dr F. Wachsmann, Professor of Radiation Physics at Erlangen, reported on methods for measuring radiation dangers.



Surgery

75. Czechoslovak Artificial Blood Vessels

"Will Mirek Lose His Leg?" by Jarmila Kratochvilova; Prague, Obrana Lidu, 25 Nov 59, p 1

In a brief article, illustrated with a photograph of a segment of a blood vessel made of "synthetic materials," the author relates the story of a soldier who broke a leg and later developed an arterial occlusion the break had healed. This, according to the author, would have meant amputation several years ago. Now, however, according to Prof Jan Navratil, chief of the Second Surgical Clinic of the Faculty Hospital in Brno (who is cited in the article), Czechoslovakia has available replacement blood vessels made by the Research Institute for Weaving (Vyzkumny ustav pletarsky) in Brno. The artificial blood vessels, which are woven from synthetic fibers, are said to conform extremely well to movements of the human body and to accommodate themselves to natural growth.

Professor Navratil is also quoted as saying that experiments are now under way in Czechoslovakia involving the use of plastic heart valves in experimental dogs.

Veterinary Medicine

76. Sources of Erysipelas Revealed

"Sources of Infection in Swine Erysipelas," by A. S. Korotick, Ya. A. Golota, and G. I. Gusha; Kiev, Dopovidi Ukrainskoi Akademii Sil'skogospodars'kykh Nauk, No 4, Jul/Aug 59, p 52

"It has been established by our investigators that rodents and ticks with erysipelas can be a source of infection in addition to swine with this disease. Wild gray rats and mice are infected with the *Erysipelothrix rhusopathinae* pathogens.

"Cultures of the swine erysipelas pathogen were isolated in investigation of adolescent *Ixodes ricinus* ticks and their larvae and nymphs.

"A culture of *Erysipelothrix rhusopathinae* was isolated from trombiculid mites which had been placed on mice infected with erysipelas.

"Swine erysipelas should be placed in the category of natural-focus infections, and this factor should be considered in the control of this infection."

77. Serological Diagnosis of Brucellosis suis

"On the Serological Diagnosis of Brucellosis suis," by Ch. Lehnert, Institute of Veterinary Microbiology and Epizootiology, Karl Marx University, Leipzig; Leipzig, Monatshefte fuer Veterinaermedizin, Sonderheft, Oct 59, pp 65-69

This work reports on experimental investigations of sera of naturally and artificially infected pigs and of uninfected slaughterhouse and breed hogs. The investigations concerned primarily the agglutination titers and the occurrence, recognition, and elimination of incomplete antibodies and nonspecific agglutinations.

The results show that only relatively low titers occur even in acutely infected herds. Even artificially infected pigs build up only small amounts of agglutinins. The pig thus seems to be less capable of building antibodies than the cow. Furthermore, the agglutination titers fall off rapidly. In chronic cases, diagnosis by agglutination alone involves difficulties, whereas the complement fixation reaction gives better results in chronically infected herds. Diagnostic procedures should thus include the complement fixation test. Zonal phenomena occur only in isolated cases; in the case of extended series of dilutions, they are almost insignificant. Only in the case of two sera did the blocking test bring positive or suspected results. Positive sera subjected to the Coombs test showed titer increases by as much as several values in some cases. Five of nine sera from infected herds produced positive reactions to the Coombs test but negative agglutination reactions, whereas sera of healthy slaughterhouse animals showed no reaction. Thus the Coombs test can be effective on animals which have shown no reaction to the usual agglutination tests and, in some cases, even to the complement fixation reaction. Because of its complexity, however, the Coombs test cannot be used for large-scale testing. Better than normal results were obtain in agglutination tests with a hypertonic 5-percent NaCl antigen. No inhibitory substances could be detected when active and inactive sera were used simultaneously for the agglutination. The nonspecific reactions which occurred in about half the sera involved diagnostic difficulties, particularly since 1:20 + + was considered positive. No nonspecific positive complement fixation reactions were observed.

The nonspecific agglutinations occur particularly in adult pigs and in dilutions of 1:10, 1:20, and 1:40, whereas they occur in fewer numbers and much less intensely in younger animals. A feeding shortly before taking the blood sample seems to have no influence, since comparable reactions were obtained from pigs ready for slaughter which had not been fed for 24 hours.

Of all the possibilities investigated, only agglutination at 56 deg C proved suitable for the elimination of the nonspecific reactions. The nonspecific agglutinations can be eliminated, or at least diminished considerably, without appreciable influence on the infection titer. The method is thus recommended for a clarification of paradoxical reactions.

The results of serological investigations, however, remain uncertain as far as the individual animal is concerned; an accurate evaluation is possible only on a herd basis and with epidemiological conditions and allergy tests taken into account.

78. Influence of Hypertonic NaCl Solution on Agglutination Titer in Cattle Brucellosis

"On the Influence of Hypertonic Sodium Chloride Solution on the Agglutination Titer in the Case of Brucellosis in Cattle," by Ch. Lehnert, Institute of Veterinary Microbiology and Epizootiology, Karl Marx University, Leipzig; Leipzig, Archiv fuer Experimentelle Veterinaermedizin, Vol 13, No 5, 1959, pp 851-859

A comparative study was made of 328 cattle sera samples from herds infected with brucellosis with antigen of different sodium chloride concentrations in slow agglutination reactions. In contrast to the agglutination in the physiological sodium chloride medium, antigens suspended in hypertonic solution produced sharper reactions and increased titers, particularly in the case of sera with low titers. Prozones could be eliminated. Agglutinins could still be detected with hypertonic antigen in the case of 20 sera which reacted either negatively or doubtfully with 0.85-percent NaCl antigen and could only be obtained by means of the complement fixation reaction.

Virology

79. Attempts to Produce Pure Neurotropically Modified Foot-and-Mouth Disease Virus

"On Attempts to Purify Neurotropically Modified Foot-and-Mouth Disease Virus," by H. Gralheer, Friedrich Loeffler Institute, Riems; Berlin, Monatsberichte der Deutschen Akademie der Wissenschaften zu Berlin, Vol 1, No 7-10, 1959, pp 639-641

Attempts were made to purify the foot-and-mouth disease virus and, at the same time, to determine its physical and chemical properties, particularly of the neurotropically modified virus. Such properties,

as the sedimentation rate, mobility in an electrical field, and size of the virus particle are characteristic for each type of virus and are extremely important.

Determinations of the sedimentation rate of the foot-and-mouth disease virus have been conducted in many ways. The results of these determinations are so divergent that a new investigation was deemed necessary. The neurotropic virus was chosen because the earlier determinations were done on dermatropic and a tissue-cultured virus, and it was believed that since a completely different tissue was present in the brain, the normal tissue components there should have a different sedimentation pattern than those, for example, which come from extracts of the tongue epithelium.

Pyl had already attempted to purify the neurotropic foot-and-mouth disease virus; he obtained relatively pure virus solutions but with such great losses of virus that the concentration of his preparations were not sufficient to follow the sedimentation on optically in the analytic centrifuge. When the work was to be continued after Pyl's death, the following problems had to be considered:

1. The virus concentration of the initial solution was too small. It had to be at least 1,000 times as great for the characteristic sedimentation band to be visible in the ultracentrifuge.
2. This concentration could best be done in the ultracentrifuge, but the centrifuging of larger volumes in the ultracentrifuge incurred practical problems, and an intermediate concentration of the initial solution had to be done by precipitation and recovered in smaller volumes.
3. Since this concentration was to be accompanied by a considerable increase in the content of nonspecific substances in the solution, the content of such substances had to be reduced beforehand.
4. All these operations had to be done with large quantities of material to avoid rather large virus losses.

These problems were compounded by the fact that the foot-and-mouth disease virus, in comparison with all other types of virus, is stable only in a very narrow pH range, namely 7.2-7.8.

Despite these many problems, the desired concentrations were obtained. By shaking the virus extracts out with chloroform it was possible to obtain solutions which were low in albumin and lipoids, without any virus losses. The first concentration of these solutions was done by semisaturation with ammonium sulfate. After the precipitate was dissolved to 1/10-1/20 of the original volume, further concentration was done in the ultracentrifuge. The "ultrasediments" could be dissolved in such small volumes that the desired 1,000-fold concentration was obtained in this step of the process.

This solution was subjected to a detailed analysis in the ultracentrifuge. Even though the first diagram showed the presence of several components, a rapidly moving component was visible, which, according to quantitative analysis, had a sedimentation rate of 140 S, a value which had already been given in the literature for the dermatotropic virus. This band was found again and again in repeated experiments. By varying the experimental conditions, it was possible to obtain preparations which exhibited only this one band in the analytic ultracentrifuge. The titer and the size of the band observed clearly indicated that this band comes from the virus, and the sedimentation rate of 140 S applies to the virus, especially since preparations of the brains of healthy mice, treated in the same way, never showed this band.

80. Serological Study of A<sub>5</sub> Strain of Foot-and-Mouth Disease Virus

"Serological Investigations of a Foot-and-Mouth-Disease Virus Strain," by A. Heinig; Berlin, Monatsberichte der Deutschen Akademie der Wissenschaften zu Berlin, Vol 1, No 7-10, 1959, pp 637-639

On 11 May 1959 at the Friedrich Loeffler Institute of the German Academy of Agricultural Sciences in Berlin, a meeting of the Class for Medicine, German Academy of Sciences in Berlin, was held at which associates of the institute delivered scientific papers. A brief summary of one of these papers is given below.

During 268 experimental passages in highly sensitive cattle, the A<sub>5</sub> strain lost its complement fixing antigen and failed to form it again after natural infection. The infectiousness and the pathogenicity, however, were retained without change. Since nothing had been reported in the literature on the investigation of strains of this type, detailed serological and immunological studies of this strain were made. The loss of the complement fixing antigen was not sudden, but rather gradual. After about the 230th passage, a decrease in the antigen titer was noticed, which continued steadily until, after about 15 further passages,

the complement fixing antigen was lost completely. The fact that it was an actual loss could be proved by the negative results of the complement fixation reaction with all available type-specific and variant-specific sera. A possible change in the antigenic structure was dismissed on the grounds that numerous attempts to produce a specific complement fixing serum were all unsuccessful. All the sera obtained were A<sub>5</sub> sera; they thus corresponded to the initial material of this series of passages, the different titer values notwithstanding.

During these experiments it was also established that the production of guinea pig sera capable of fixing the complement of the foot-and-mouth disease virus is possible only with guinea pig virus. In the routine production of such sera, the work had to be done with strains which were adapted to the guinea pig, since the guinea pig is not primarily susceptible to all cattle strains. The investigated strain was initially very virulent for the guinea pig; an attempt was therefore made to obtain a complement fixing serum exclusively with cattle virus. In the guinea pig passage there was always a slight change of the antigenic structure. The serum obtained with cattle virus fixed not only all the investigated strains of all types down to a dilution of 1:160 (about a fourfold titer), but also all extracts from normal tongue epithelium.

In the immunological investigations, the virus which was negative in the complement fixation reaction fully retained its immunizing effect and did not change its specific immunogenic behavior in relation to the initial material. It was established that both the cattle which were contaminated and those inoculated with the vaccines of the investigated strain had produced specific antibodies. In the direct Macucci test for antibodies in cattle sera, it was established that the antibodies of these sera reacted only with the lymph of the virus which was negative in the complement fixation reaction, not with A<sub>5</sub> lymph. This surprising observation indicated that the lymph of the investigated strain must contain antigen, otherwise the reaction would have been nonspecific. Testing the lymph of various passages of the antigen-free strain with A<sub>5</sub> serum showed only that the lymph contained antigen, although in the corresponding epithelium itself no method -- not even the more sensitive cold fixation and partial complement fixation reaction according to Schmidt -- could show even traces of complement fixing antigen. The investigation of these lymphs with the sera of A variants showed also that the lymph antigen reacted only with A<sub>5</sub> serum. This proved that the investigated strain was still type A<sub>5</sub> and had not changed its fundamental antigenic properties.

The regular determination of complement fixing antigen in the lymph was the incentive for conducting a series of cattle passages with lymph. In a total of 18 lymph passages, in which the antigen titer of the lymph amounted to an average of 1:40-1:80 in the normal complement fixation reaction and 1:160 — 1:320 in the cold fixation reaction, no trace of antigen could be found despite the high antigen titer of the lymph in the corresponding tongue aphthae. This surprising finding has not yet been explained. It is not understandable why, on the one hand, the lymph always contained antigen in the passage of the antigen-free epithelium and the passage of the lymph had the same result. The possibility that the lymph-antigen and the aphthae-antigen represent two different antigens, for which there is considerable evidence, cannot fully explain these findings.

In numerous investigations of the immunizing and neutralizing antibodies in the guinea-pig inoculation test, in the cross-infection experiment, and in the neutralization test on sucking mice, the results only confirm the above-described findings that the investigated strain lost its complement-fixing antigen and that no fundamental change took place in the antigen structure. On the basis of these findings, the complement-fixing antigen is certainly no integrating component of the infectious particle; nor can it be only a simple decomposition product of the multiplication process. It is probably a case of two different complement fixing antigens, the lymph antigen and the aphthae antigen. Further research is necessary for an understanding of the true character of the complement fixing antigen.

#### Miscellaneous

81. Soviet Doctors in Iraq Conducting Vaccination Campaign

"Soviet Doctors in Iraq" (unsigned article); Moscow, Izvestiya, 27 Oct 59, p 5

In accordance with an agreement between the governments of Iraq and the Soviet Union, a group of Soviet medical workers has been laboring in the Iraq Republic for 3 months now. They plan to vaccinate the population of Iraq against smallpox. Some 1.5 million people have been vaccinated in the northern regions of Iraq in the provinces of Mosul, Kirkuk, Arbil, and Sulaymania.

82. New Institute Formed in Georgian SSR

"Institute of Pediatrics in Georgia" (unsigned article); Moscow, Meditsinskiy Rabotnik, No 100 (1848), 15 Dec 59, p 1

"Tbilisi -- A new scientific research institute of pediatrics has been formed in the Georgian SSR.

"The following seven medical scientific research institutes have been organized in the Georgian SSR during the past 7 years: Oncology, Roentgenology and Medical Radiology, Female Pathology and Physiology, Neurology, Urology, Dermatology and Venereology, and Pediatrics.

"There are 22 research institutes in the Georgian SSR which are handling scientific problems of various branches of medicine. These institutes are under the jurisdiction of the Ministry of Health and the Academy of Sciences Georgian SSR."

CPYRGHT

83. Young Scientists Confer

"Young Researchers Speak," by Yu. Yevlashko; Moscow, Meditsinskiy Rabotnik, No 99 (1847), 11 Dec 59, p 4

According to this article, it has become a tradition for the Institute of Industrial Hygiene and Occupational Diseases of the Academy of Medical Sciences USSR to call conferences of young scientists. In line with this tradition, representatives of various scientific centers and establishments attended the recently held conference. Forty reports were read, the majority of which dealt with the following diseases affecting workers in major industrial establishments of the USSR: diseases of the lungs, the toxicology of industrial gases, the effect of ionizing radiation, vibration, noise, and ultrasound on the organism, and the treatment and prevention of occupational diseases in general.

L. Naumova of the Sanitary-Epidemiological Station of Moskvoretskiy Rayon of Moscow read a report on hygiene and sanitation in industries utilizing beryllium. Beryllium is now used widely in many industrial establishments of the USSR.

Ya. Lamm of the Chair of General Surgery of Karaganda Medical Institute stated that he examined many coal miners and found that many suffer from occupational bursitis. He recommended the use of knee pads made of rubber or sponge to prevent the occurrence of occupational bursitis.



N. Bannova of the Chair of Industrial Hygiene, Central Institute for the Advanced Training of Physicians, spoke on the permissible limits of trichlorethylene in the air. She pointed out the significance of the decomposition of toxic substances in the organism.

N. Chulina of the Institute of Industrial Hygiene and Occupational Diseases, Academy of Medical Sciences USSR, spoke on the effects of ionizing radiation on the entire human organism and on individual systems. She pointed out that initial forms of chronic radiation reaction can be diagnosed by the increase in the diameter and volume of erythrocytes and also by anisocytosis.

Z. Lisichkina of the Moscow Institute of Hygiene and Sanitation imeni F. F. Erisman stated that workers exposed to ultrasound show a tendency to bradycardia and that their skin temperature is above normal.

A. Golubeva and S. Shatrova of the Gor'kiy Institute of Industrial Hygiene and Occupational Diseases reported on the successful treatment of chronic pulmonary suppurations of occupational and nonoccupational origin with staphylococcic antiphagin. S. Shatrova reported on the positive effect of electrosleep in the treatment of occupational diseases in which a neurotic syndrome is prominent. Physicians V. Polonskaya and S. Khmara (Moscow) read reports on the comprehensive treatment of lead intoxications.

Chinese hygienists Liu Yu-T'ang and Yao An-tzu read reports on their work.

84. Ukrainian Hygienists Congress

"Congress of Hygienists of the Ukrainian SSR" (unsigned article); Moscow, Meditsinskiy Rabotnik, No 99 (1847), 11 Dec 59, p 4

This item reports that the Sixth Congress of Hygienists, Epidemiologists, Microbiologists, and Infectionists of the Ukrainian SSR was held in L'vov. Guests from the RSFSR, Belorussian, Moldavian, Lithuanian, Estonian, and other republics took part in discussions; more than 140 reports were read.

P. D. Leshchenko Deputy Minister of Health Ukrainian SSR, read a report on "Sanitary-Epidemiological Conditions of the Republic and the Problems Confronting the Agencies of Sanitation." Prof G. Kh. Shakhbazyan, Corresponding Member of the Academy of Medical Sciences USSR, spoke on "The Principal Trends and Problems of Sanitation in Connection With the Seven-Year Plan for the Development of National Economy of the USSR." Prof L. V. Gromashevskiy, Active Member of the Academy of Medical Sciences USSR, read a report on "The Decrease in Communicable Diseases and the Eradication of Sporadic Cases of Infection in the Ukrainian SSR."

The delegates to the congress and guests criticized the Ministry of Health Ukrainian SSR for its technical backwardness, for poor equipment used in the laboratories, and for the great turnover in sanitation personnel. Ukrainian scientists severely criticized for not making a great enough effort to find effective methods of preventing communicable diseases.

Many delegates to the congress noted that sanitary-epidemiological stations were merged with hospitals in the Ukrainian SSR without proper preparation.

85. Dissemination of Medical Literature

"The Improvement of Propaganda and the Dissemination of Medical Literature," by B. Alekseyev, deputy head of Russian Joint Book Trade; Moscow, Meditsinskiy Reboʻtnik, No 99, (1847), 11 Dec 59, p 3

The author of this article states that there is a constantly growing demand for books for medical practitioners and medical students, as well as books of a popular scientific and educational nature, in the RSFSR. The bookselling network of the Ministry of Culture RSFSR received medical literature valued at 5 million rubles more during the first 9 months of 1959 than that received during the comparable period of 1958.

Although various measures have been taken in many autonomous republics, krays, oblasts, and cities of the RSFSR to satisfy the demand of the reading public for medical literature, there are still many shortcomings in publicity and in the distribution of medical literature. It is necessary, first of all, to increase the number of specialized bookstores. An increase in the number of such stores would better meet the demands of readers of medical literature. There are only three such bookstores in the RSFSR.

People engaged in selling books need the help of medical specialists of various organizations and establishments. Bookselling establishments and publishing houses must coordinate their activities. Medgiz (State Publishing House of Medical Literature), however, is not making any effort to establish a business relationship with the Russian Joint Book Trade. In 1959, Medgiz should have published books covering 492 subjects, but books covering only 218 subjects were published during the first 10 months of the year. Of these subjects, 148 should have been published in 1958. Medgiz should have published 15 textbooks and training manuals but has published only 3 so far. The school year is already in progress, but students have not yet received textbooks on physics and forensic chemistry. No manuals have yet been received on histology and other subjects.

Medgiz promised to publish, during the second quarter of 1959, a book written by a group of authors entitled Znachenije Plodov i Ovoshchey v Pitanii Zdorovogo i Bol'nogo Cheloveka (The Value of Fruits and Vegetables in the Nutrition of Healthy and Sick People). Also the following books: Iskustvennoye Dykhaniye (Artificial Respiration) by G. A. Stepankiy, and Prakticheskoye Rukovodstvo po Operativnoy Kirurgii (A Practical Manual on Surgery) by N. I. Blinov, A. N. Zebol'd, and A. P. Nadein. The year is ending and these books and many others cannot yet be found on the shelves of bookstores.

The situation is the same with books of a popular scientific nature.

86. Hungarians Produce Vitamin B<sub>12</sub> From Anaerobic Sewage Sludge

"Vitamin B<sub>12</sub>," by Bela Molnar, Kobanya Pharmaceutical Factory; Budapest, Magyar Kemikusok Lapja, Oct 59, pp 381-385

This article describes the various ways in which vitamin B<sub>12</sub> can be produced, noting that the first Hungarian experiments in producing vitamin B<sub>12</sub> in 1953 -- started with beef liver--one gram of crystalline vitamin B<sub>12</sub> was produced from each 2 tons of beef liver. A process for extracting vitamin B<sub>12</sub> from the mother liquor of the streptomycin fermentation process was also developed, and work was begun on the B<sub>12</sub> content of sewage purifiers working with living sludges -- "Milwaukee type equipment." "Later, the author adds, "when the need for B<sub>12</sub> was more urgent and when the domestic fermentation capacity was completely used for producing antibiotics we began to examine the sludge in methane-producing anaerobic sewage decomposing equipment and found that its B<sub>12</sub> content was substantially higher than in the living sludge."

The process for deriving B<sub>12</sub> from this anaerobic sludge is described, with the note that a process developed independently in the West is similar. The article also describes the biological functions of vitamin B<sub>12</sub>.

VII. METALLURGY

87. Glass-Insulated Microwire Produced From Molten Metal

"Apparatus for Obtaining Extremely Fine Glass-Insulated Wire From Molten Metal," by V. I. Rybalka and I. K. Shapovalov; Moscow, Byulleten' Tekhniko-Ekonomicheskoy Informatsii, No 6, 1959, pp 9-10

A brief description is given of a special apparatus for continuous production of glass-insulated microwire (20 to 1-2 micron diameter) from molten metal at speeds of 200-250 meters/min in lengths up to 2 km. Apparatus was developed by Prof A. V. Ulitovskiy and V. N. Parkhachev at the Electrophysics Laboratory of the Institute of Metallurgy imeni A. A. Baykov, Academy of Sciences USSR. A thin metal rod and glass tubing in which the rod is inserted are fed horizontally into the working space of a specially constructed inductor where the metal is melted and the glass softened. The molten drop formed on the underside of the inductor is seized, pulled through a water-air cooler (crystallizer), and wound on a spool in a continuous process. Wire diameter and insulation thickness are controlled with the crystallizer. The winding mechanism is equipped with a counter and wire rupture control. Preheating the wire to 650°C before winding decreases the possibility of insulation cracking. Tests of wires produced by this method showed mechanical and electrical properties superior to those produced by ordinary methods.

Successful results have obtained in producing glass-insulated microwire from tin, silver, gold and its compounds, cast iron by employing vacuum and inert media techniques. It is considered possible to produce wires with diameters in tenths and hundredths of a micron by this method. Works are also being conducted by this institute on the production of microwire of varied cross section from high-melting and heavy metals as well as semiconductor materials (germanium microwire with monocrystalline structure).

88. New Nonferrous and Titanium Alloy Thin Strip Mill

"Baby Mill" (unsigned article); Moscow, Izvestiya, 19 Dec 59, p 1

Brief announcement is made of the completion of the 20-roll mill "1200" at the Novo-Krematorsk Plant. Weight of the mill is less than that of one stand of a four-high reversible mill of the same type,

whereas the capacity is about equal. The mill is suitable for rolling steels made from nonferrous metals and titanium alloys into strip in lengths up to one kilometer and "a thickness measured in microns." The mill will be completely automatic and will incorporate an isotope thickness gage.

#### 89. Nitriding Boron

"Kinetic Parameters in Nitriding Boron," by V. M. Sleptsov and G. V. Samsonov, Institute of Powder Metallurgy and Special Alloys of Academy of Sciences Ukrainian SSR; Kiev, Dopovidi Akademii Nauk Ukrain's'koi RSR, No 10, 1959, pp 1116-1118

Investigations were conducted on the diffusion of nitrogen in 99.98% pure boron (particle size less than one micron) at temperatures from 600 to 1,500°C. In the range from 600 to 1,200°C the energy of activation of nitrogen into boron was calculated to be 61.3 kilocalories/mole. Temperature dependence of the coefficient of diffusion in this range is expressed as:

$$D_{600-1,200^{\circ}} = 30,100 \times e^{\frac{-30,650}{T}}$$

At 1,200 to 1,500°C energy of activation equals only 4 kilocalories/mole and temperature dependence of the coefficient of diffusion is expressed as:

$$D_{1,300-1,500^{\circ}} = 20.3 \times e^{\frac{-2,000}{T}}$$

The sharp drop in energy of activation and rate of diffusion of nitrogen at temperatures above 1,200°C is explained as due to termination of the process of rupture of covalent bonds of boron and the formation of a nitride structure with subsequent slow occupation of the structural voids by nitrogen atoms. Migration of these nitrogen atoms occurs between plane lattices of the nitride structure. Energy of bonding between these plane lattices is about 4 kilocalories/mole.

90. Electric Spark Method Discussed

"Electricity Works Metal," by A. Novikov; Moscow, Promyshlenno-Ekonomicheskaya Gazeta, 23 Dec 59, p 3

The advantages and applications of the electric spark method of working metals are discussed in general. This method was originally proposed by B. Lazarenko, Professor and Doctor of Technical Sciences. Research and development on applications of this method are being conducted at the Central Scientific Research Laboratory for Electric Working of Materials, Academy of Sciences USSR.

91. Fabrication of Two-Steel Turbine Disks by Electroslag Welding

"Electroslag Welding of Turbine Disks From Austenitic and Perlitic Steels," by M. M. Timofeyev, Candidate of Technical Sciences, and Engr E. P. Molchanov, Central Scientific Research Institute of Technology and Machine Building; Moscow, Svarochnoye Proizvodstvo, No 11, Nov 59, pp 19-21

Various experiments conducted to perfect an electroslag method for fabrication welding of turbine disks from a rim of austenitic EI612 steel (450 mm outer diameter) and a center portion of perlitic EI415 steel (280 mm diameter) are described. Best results were achieved using flux FTs-7 and experimental flux A containing 30% SiO<sub>2</sub>, 15% MgO, 25% CaF<sub>2</sub>, 22% Al<sub>2</sub>O<sub>3</sub>, and 8% CaO with admixtures of tungsten and molybdenum. The electrode consisted of a centrifugally cast cylinder with a composition selected so that the weld would contain 16% Cr, 25% Ni, 4% Mo, and 4% W. Welding current was 3,500-3,800 amperes at 35-40 volts. Welded two-steel disks showed strengths equal to those of all-forged EI612 steel disks and somewhat higher than those of all-forged EI405 [sic] steel disks. Results of tests are considered to confirm the technological feasibility and economic advantage of such a method. Cost of welded two-steel disks was calculated to be 2.5 to 3 times less than that of all-forged EI612 steel disks. The above work was registered with the Committee on Inventions and Discoveries of the Council of Ministers USSR as No 9924 predated 21 March 1958.

92. Submerged-Arc Welding of Commercially Pure Nickel

"Automatic Submerged-Arc Welding of Commercially Pure Nickel in a Ceramic Flux," by K. V. Bagruanskiy, Candidate of Technical Sciences, and Engrs G. S. Kuz'min and D. S. Kassov, Zhdanov Metallurgical Institute; Moscow, Svarochnoye Proizvodstvo, No 11, Nov 59, pp 6-8

Tests conducted by the Zhdanov Metallurgical Institute in 1956-1958 on welding of 5-10 mm thicknesses of NT nickel sheet (0.2% C, 0.01% Si, 0.1% Fe, 0.01% S and P) and N1 nickel sheet (0.01% C, 0.001% Si, 0.01% Fe, 0.001% S and P) using N1 nickel electrode wire and fused fluxes of industrial grades OSTs-45, FTs-6, AN-348A, AN-60, and AN-20 proved unsatisfactory. Later works produced welds with completely satisfactory properties obtained by using a special ceramic flux developed on the  $\text{CaO}-5\text{CaO}'3\text{Al}_2\text{O}_3-\text{CaF}_2$  system with added reducing agents (composition or process not given) and designated as flux ZhN. Joints welded with wire N1 in flux ZhN exhibited good corrosion stability in a 48-hour test in 25% solutions of hydrochloric and nitric acids at 25°C. Weldments held in concentrated hydrochloric and nitric acids for 25 hours showed complete chemical stability.

Experiments indicated that in automatic welding of nickel in flux ZhN with N1 nickel electrode wire arc length must be kept short, current must be decreased, and welding speed must be low (15 — 20% slower than in welding steels). It is considered possible to weld not only pure nickel but high-nickel alloys such as Nimonic as well as nickel with chromium-nickel steels by appropriate changes in flux ZhN and electrodes.

93. Electroslag Welding of High-Strength Precipitation-Hardenable Steel

"Electroslag Welding of an Age-Hardenable Chromium-Nickel-Aluminum Steel," by B. I. Medovar, Candidate of Technical Sciences, and Engr A. N. Safonnikov, Institute of Electric Welding imeni Ye. O. Paton, and Engrs Ye. Ya. Belkin and O. A. Sharov, Moscow Sovnarkhoz; Kiev, Avtomaticheskaya Svarka No 9, Sep 59, pp 33-44

Basic data on modern high-strength precipitation-hardenable stainless steels are reviewed and a discussion is presented of metallurgical peculiarities in electroslag welding of steels and alloys containing aluminum. Two variations of an electroslag method were developed from a series of experiments in welding the Khl5N9Yu type steel designated SN-2 (EI904). Weld metal with almost the same aluminum content as the parent metal and correspondingly high mechanical properties was obtained by employing electrodes of steel SN-2 with flux ANF-7 ( $\text{CaF}_2-\text{CaO}$ ) and preheating objects to 350°C. Equally satisfactory results were obtained with flux ANF-14 (containing  $\text{SiO}_2$ ) and electrodes of steel SN-7 (EI925) which contained molybdenum instead of aluminum as in the case of steel SN-2.

94. Glues Applied With Aluminum Spot Welding

"Glue-Welded Constructions and Their Use," by V. N. Shavyrin, Scientific Research Institute of Technology and Organization of Production of the Aviation Industry; Moscow, Svarochnoye Proizvodstvo, No 11, Nov 59, pp 8-11

Procedures and test results are presented for two methods of preparing glue-welded structures of aluminum alloys with subsequent anodizing. In one method glue is applied to one surface of the two to be spot welded, and in the other, along the edges of the joint welded. Selection of the method and glue is determined by design of the construction and specified operating conditions. Glue VK-32-200 (with a "phenyl-rubber composition") is applied with Duralumin and steel for long periods of operation up to 200°C or short periods up to 300°C. Hardening must be accomplished by heat treatment. Glue VK32EM (on an epoxy base) shows good adhesion to aluminum alloys and produces an air-tight high-strength bond but requires special handling methods. Best over-all results were obtained with glue FL-4 (an alcohol-acetone solution mixed with a furylphenolacetal resin), originally designated for bonding metals and for anticorrosion coatings. This glue completely seals the spot welded joint, improves joint strength, and is not affected by long contact with fuels.

95. High-Vacuum Electron-Beam Fusion Welding

"Method of Welding With an Electron Beam in a Vacuum," by N. A. Ol'shanskiy, Candidate of Technical Sciences, Moscow Higher Technical School imeni Bauman; Kiev, Avtomaticheskaya Svarka, No 8, Aug 59, pp 3-11

A description is given of the design and operation of the first apparatus developed at the Moscow Higher Technical School imeni Bauman for electron-beam fusion welding in a high-vacuum. Normal operating range of the apparatus is 1,700--15,000 volts. Nonporous ductile joints were obtained with stainless steel, copper, molybdenum, zirconium, and other metals in thicknesses up to 2 mm under a vacuum of  $10^{-4}$  mm Hg. Pulsating beams were required in welding aluminum and magnesium and their alloys. Advantages of the method are high temperature control, good weld formation, and the decreased possibility of weld metal contamination in a high vacuum. Additional information on this method is presented in the article, "Certain Technological Factors in Welding With an Electron Beam in a Vacuum," by B. A. Movchan, D. M. Rabkin, S. M. Gurevich, and S. D. Zagrebnyuk of the Institute of Electric Welding imeni Ye. O. Paton, pages 12--17 of this journal.



96. Soviet Patents in Welding

"Soviet Inventions in Welding" (unsigned article); Moscow, Svarochnoye Proizvodstvo, No 11, Nov 59, p 48

Fifteen authorship certificates in welding from a list of 46 are presented below. Numbers in brackets indicate the number of the journal Byulleten' Izobreteniy (Bulletin of Inventions) for 1959 in which the invention is described.

No 117112 (593633 from 3 Mar 58). V. I. Kalmanovskiy. Method for welding wires made of high-melting metals. [1]

No 94289 (433478/4120 from 22 Aug 50). N. I. Sazonov. Apparatus for spot welding aluminum alloys. [2]

No 117624 (584516 from 14 Oct 57). V. N. Bernadskiy and I. V. Kidro. Method of contact projection-roller welding. [2]

No 94311 (444882/3744 from 15 Aug 51). A. A. Alekseyev, B. V. Zhuravlev, and S. V. Shablygin. Power unit for a contact welding machine. [2]

No 118257 (590030 from 17 Jan 58). K. V. Lyubavskiy, Ye. P. L'vova, and F. F. Larin. Ceramic oxygen-free flux. [4]

No 118066 (592119 from 11 Feb 58). S. V. Lashko, V. V. Orlova, and B. O. Katsman. Heat resistant braze. [4]

No 118120 (592124 from 11 Feb 58). S. V. Lashko, B. O. Katsman, N. F. Lashko, and K. I. Soshnikova. Heat resistant cadmium braze. [4]

No 96071 (443340 from 12 Feb 51). V. N. Filippov. Method of contact electric welding of sheets and components under pressure. [5]

No 94264 (444859/4992 from 14 Jan 52). A. M. Razygrayev. Apparatus for automatic control of the working process of welding machines on a four-position cycle. [5].

No 118460 (592121 from 11 Feb 58). S. V. Lashko, B. O. Katsman, N. F. Lashko, and K. I. Soshnikova. Heat resistant braze. [5]

No 118690 (595697 from 26 Mar 58). V. S. Rastorguyev, L. S. Surikov, Ye. P. Rogozhkin, and A. A. Rakhmanov. High-temperature braze. [6]

No 118923 (602244 from 21 Jun 58). I. A. Zaks and Ye. A. Milyavskiy. Electrode for welding nickel. [7]

No 119282 (582942 from 6 Sep 57). Ya. S. Timofeyev. Electrode for welding high-temperature alloys. [8]

No 119283 (602746 from 26 Jun 58). V. A. Toropov. Electrode for welding high-temperature chromium-nickel steels. [8]

No 119423 (597985 from 22 Apr 58). A. M. Ivanov, V. M. Nikitin, and I. S. Kalitin. Flux for contact-butt electric welding of molybdenum. [8]

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

VIII. PHYSICS

COSMIC RAYS

97. Calculations of Nuclear Showers

Theory of Passage of nuclear Showers Through the Atmosphere," I. P. Ivanenko, Institute of Nuclear Physics, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1045-1049

A method for solution of the equations describing the passage of nuclear cascades through the atmosphere is proposed. The boundary conditions can be prescribed at an arbitrary depth. The proposed method permits one to obtain the solution in a form similar to that obtained by the usual method of successive generations with boundary conditions prescribed at the top of the atmosphere. The form of the solutions for various types of boundary conditions is considered.

98. High-Energy Particles at Sea Level

"Investigation of High-Energy Nuclear-Active Particles at Sea Level," by V. A. Dmitriyev, G. V. Kulikov, and G. G. Khristiansen, Institute of Nuclear Physics, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 893-905

Large bursts in an ionization chamber located under a filter which is efficient in respect to nuclear interactions are studied. It is shown that at sea level the majority of the big bursts ( $\geq 1,000$  relativistic particles) are due to the interactions in the filter of nuclear-active particles with energies  $E \geq 10^{12}$  eV. The spectrum of the nuclear-active particles and their air accompaniment is presented. The accompanying particles can be explained by fluctuations in the development of the nuclear cascade in the atmosphere. The cross section for interaction of  $\sim 10^{13}$  eV particles with nuclei of atmospheric atoms is estimated. Cases of high-energy nuclear-active particle beams have been observed.

Mechanics

99. Design Considerations of Gyroscope With Two Degrees of Freedom

"On the Dynamics of a Gyroscope With Two Degrees of Freedom," by M. Z. Litvin-Sedoy, Moscow; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Mekhanika i Mashinostroyeniye, No 5, Sep/Oct 59, pp 72-83

This article solves the problem of self-oscillation in diffusors by means of the linear traveling-wave method. An analysis of the solution, which is obtained here in general form, affords the possibility of selecting those results which reflect the nature of the phenomenon itself and of rejecting those results which depend on the effect of the linearization. The criteria of stability of operation of the diffusor with detached shock results directly from the solution.

It is known that, for diffusors of the Pitot type (nozzle without central body), the recorded characteristic, in the case of detached shock has no zero angle of inclination. Under ordinary conditions, such a diffusor always operates stably. As a rule, portions of the characteristic of diffusors with a central body have positive angles of inclination. The existence of such portions (and consequently the possibility of the generation of self-oscillations) is connected, apparently, with viscosity, especially since the increase of dissipation in the region of external compression as compared with the dissipation in the straight jump cannot be explained on the basis of the theory of an ideal gas. It is shown that self-oscillations do not initiate immediately after the characteristic passes through a zero angle of inclination, but rather begin from a certain (fully determined) positive value of this angle. This means that not an arbitrary weak dissipation of energy at the expense of viscosity in the region of external compression leads to operational instability of a diffusor with detached shock, but only a certain finite value of this dissipation.

107. Limits of Stationary Flow in Electromagnetic Field

"Investigation of Stationary Discontinuity Surfaces With Abrupt Change of Gas Conductivity in an Electromagnetic Field," by G.A. Lyubimov, Moscow; Moscow, Izvestiya Akademii Nauk SSSR, Otdel'niye Tekhnicheskikh Nauk, Mekhanika i Mashinostroyeniye, No 5, Sep/Oct 59, pp 9-15

This article considers a stationary discontinuity surface on which in addition to the discontinuity of the thermodynamic parameters of flow and velocity, the conductivity of the gas is discontinuous.

It is shown that if the original parameters are such that two plotted curves do not intersect, then there always exists a region of initial values out of which stationary discharge flows are possible. These flows have no analogous flows in ordinary gas dynamics.

An examination of the structure of the surface of discontinuity in the arrangement considered here leads to the conclusion that not all discontinuity surfaces which obey the law of conservation may be considered limits of continuous flow with variable conductivity. Those discontinuity surfaces with conductivity jumps which may be considered limits to continuous flow are either shock waves accompanied by increased magnetic field or cavitation waves accompanied by decreased magnetic field.

The statistical theory of the two-degree gyroscope is based on the proposition that, at each moment, the inclination of the frame of the instrument from its computed position in the body is determined by its relative equilibrium under the influence of the gyroscope moment and the moment of the restoring force. To a certain extent, this proposition is admissible only when the instrument is used for the stabilization of the angular position of the body in space when relatively weak perturbation forces are exerted on the body. However, in the control of irregular angular motions of a body, or in the event of abrupt perturbation effects, an estimate of the angular velocity of a body on the basis of statistical theory may lead to appreciable error in measurement and a generation of false signals. Furthermore, the divergence of the geometrical and mass parameters of the instrument from their ideal values is reflected in actual designs, adding additional distortions to the results of the instrument of the angular velocity of the body. This article investigates the conditions of the production of false signals of an instrument during arbitrary linear and angular motions and computes the more essential deviations of the actual design of the instrument from the projected design.

100. Rarefaction and Boundary-Layer Conditions in Supersonic Gas Flow

"The Laminar Boundary Layer at a Plate in a Supersonic Flow of a Slightly Rarefied Gas," by V. P. Myaznikov, Moscow; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Mekhanika i Mashinostroyeniye, No 5, Sep/Oct 59, pp 127-130

This article considers a laminar boundary layer at a flat plate in the region of a flow with slip for the calculation of the interaction of the external flow and the boundary layer. The calculations show that rarefaction influences the surface friction and the flow of heat, but has no influence on surface friction when the plate is heat-insulated.

101. Flow of Viscous Rarefied Gas Around Flat Half-Infinite Plate

"The Flow of a Viscous Rarefied Gas Around a Flat Half-Infinite Plate," by A. I. Bunimovich, Moscow; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Mekhanika i Mashinostroyeniye, No 5, Sep/Oct 59, pp 16-18

A solution is given of the problem of the flow of a slightly rarefied gas in the boundary layer of a flat half-infinite plate. It is assumed that the change of the viscosity factor ( $\mu$ ) with temperature (T) depends on the formula

$$\frac{\mu}{\mu_{\infty}} = \left( \frac{T}{T_{\infty}} \right)^n .$$

The power dependence of the viscosity factor on temperature suggests an influence by the rarefaction of the gas on the aerodynamic characteristics; the results obtained here differ qualitatively from those obtained in other works (Shidlovskiy, B. P., Izv AN SSSR, OTN, No 9, 1958; Shirokov, M. F., Fizicheskiye Osnovy Gazovoy Dinamiki [Physical Foundations of Gas Dynamics], Fizmatgiz-Moscow, 1958) in which this dependence was considered linear.

102. Low-Aspect Wing Theory and Problem of Ship Maneuverability

"The Application of the Theory of the Low-Aspect Wing to the Solution of the Problem of the Maneuverability of a Ship," by G. V. Sobolev and K. K. Fedyayevskiy, Moscow and Leningrad; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Mekhanika i Mashinostroyeniye, No 5, Sep/Oct 59, pp 27-33

In the calculation of the maneuverability of a ship, the general problem is a determination of the force acting on the hull when it is moving at an angle of drift and angular velocity. The solution of the flow of a viscous fluid around such a body has not been treated sufficiently in the literature. (Solutions have been offered only for ideal fluids.) The only method which affords the possibility of determining the load exerted on the hull is a schematic representation by means of a certain low-aspect-ratio wing, the angle of attack of which is the angle of drift when the angular velocity changes along the length of the ship. It is shown that the wing theory affords the possibility of computing the circulation of velocity around the body during such a motion and, indirectly, takes into account the influences of viscosity.

103. Position of Shock in Gas Flow Around Cone at Mach 4

"On the Position of a Bow Wave in the Case of Asymmetrical Flow Around a Pointed Body by a Stream of Gas at High Supersonic Velocity," by A. L. Gonor, Moscow; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Mekhanika i Mashinostroyeniye, No 5, Sep/Oct 59, pp 117-118.

In various problems of gas dynamics, it is often necessary to know the form of the bow shock wave produced during the flow around a pointed body at a particular angle of attack. When such a body is a circular cone the form of the wave can easily be determined on the basis of an analytical formula given in an earlier work (Gonor, A. L., Izv, AN SSSR, OTN, No 7, 1958).

In engineering practice, there is usually interest in the angles of a sudden change in the plane of the symmetry of flow (on the lee and weather side), depending on the angle of attack, the cone angle, and the Mach number of the flow. A formula is given here for the calculation of these angles, and the results of the calculation of this formula are given graphically, the angles of the shock in the plane of symmetry depending on the angle of attack for various cone angles at Mach 4 and Mach = infinity. These graphics show an interesting change in the position of the waves with increasing Mach number. At Mach 4, the angle of the shock is (in all cases except when the cone angle is 40 degrees) larger on the lee side than on the weather side; the picture is just the opposite when Mach = infinity. For each cone angle, there is a Mach number at which the shock again becomes almost spherical and then flattens toward the body more on the lee side. It is shown that, at a given Mach number, this takes place more rapidly the thicker the cone, whereas for a cone angle of 40 degrees, the change in the position of the wave occurs below Mach 4. For a two-dimensional flow, a similar conclusion is reached for the flow around a wedge.

Since this peculiarity is not noted in the literature (on the contrary, the opinion prevails that the wave on the lee side withdraws much farther from the body than on the weather side), verification was attempted through an experiment in which a study was made of a flow of air around six cone models having subangles of opening of 15, 20, 25, 30, 35, and 40 degrees, with Mach = 4, with the fact that the increase of Mach number is equivalent to the transition of a thick cone taken into account.

Lee photographs were obtained of the compression shocks in the plane of symmetry of flow. The angles of the shocks were measured in three ways: (1) by projecting the negative on the screen and outlining the contour of the shock wave and body, followed by a measurement of the angles with a protractor; (2) by measuring the angles directly on the blown-up photographs; and (3) by measuring the angles through a microscope. The last method proved unsatisfactory, since there was a great disparity of data from one and the same experiment conducted at different times. The first two methods produced similar results, although the general accuracy of the angle measurement was within 20 minutes of arc. The results of the measurements on the photographs were plotted as experimental curves, which were in satisfactory agreement with the corresponding theoretical curves. From the experimental data it follows that with increasing cone angle, the shock actually has a tendency to smooth out the angles in the diametrically opposite planes, causing the angle on the lee side to become smaller. Thus if on a cone with a cone angle of 15 degrees and the initial angle of attack the angle on the weather side is considerably smaller than that on the lee side, this difference disappears with increased cone angle and, at a cone angle of 40 degrees, the experimental value for the angle on the lee side has become considerably less than that on the weather side. A photograph of the flow around a cone (cone angle of 40 degrees, 12-degree angle of attack and Mach = 4) clearly shows that the angle on the lee side is much smaller than that on the weather side.

104. Effect of Oscillating Liquid on Floating Body for Three-Dimensional Case

"The Effect of Long Waves on a Floating Body," by E. A. Perzhnyanko, Moscow; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Mekhanika i Mashinostroyeniye, No 5 Sep/Oct 59, pp 34-40

Since the problem of the action of an oscillating liquid on a floating body is extremely complex even within the framework of the linear theory, nearly all of the many works devoted to this problem consider some sort of approximation. In this article the problem is solved approximately for a shallow depth. This problem was solved for the two-dimensional case by Zhukovskiy ("The Action of an Undulating Shallow Liquid on a Body Floating on Its Surface," Poln. sobr. soch., Vol 2, 1948). Here the three-dimensional case is considered by another method.

105. Critical Reynolds Number for Flow Around Circular Cylinder.

"The Critical Reynolds Number for a Flow Behind a Circular Cylinder" by V. I. Il'chenko, Moscow; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk Mekhanika i Mashinostroyeniye, No 5, Sep/Oct 59, pp 130-132

This article considers the flow around a circular cylinder by a plane-parallel stationary flow of a viscous noncompressible fluid. The question of the stability of the flow is solved by the law of the real part of the arbitrary number  $k$ : when the sign is minus, the imposed perturbations vanish with time; when it is plus, they increase with time.

The critical Reynolds number ( $R^*$ ) is characterized by the loss of stability of the laminar form of flow; for the case of flow around the circular cylinder it is determined by the inequality  $25 < R^* < 30$ .

The results obtained here are in satisfactory agreement with the experimental findings ( $R^* = 20$ ) and with theoretical results obtained earlier (Arkhipov, V. I., DAN SSSR, Vol 123, No 4, 1958). In this treatment, the shape of the body is taken into account precisely by assigning the boundary conditions on the body proper.

106. Supersonic Diffusor Instability

"On Self-Oscillations in Supersonic Diffusors," by O. E. Tsynkova, Moscow; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, Mekhanika i Mashinostroyeniye, No 5, Sep/Oct 59, pp 19-26



A calculation of the viscosity and thermal conductivity of the gas shows that stationary flow is possible only in the case of certain initial parameters. This circumstance leads to the fact that an electromagnetic wave which varies in the initial field parameters can propagate in front of the flow of an ideal gas containing a discontinuity surface with conductivity jumps.

### Nuclear Physics

#### 108. Gammas From a Neutron Source

"Gamma Radiation From a Source Po-0-18," by E. M. Tsenter, A. G. Khabakhpashev, and I. A. Pirkin; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1133-1134

It has been shown in a previous work by the authors (Izvestiya Akademii Nauk SSSR, Ser. Fiz. 21, 1017 (1957) ) that the reaction  $(\alpha, n)$  from a neutron source Po-0 proceeds on the isotope O-18, and is followed by gamma radiation. In the described measurements a neutron source of 120,000 neutrons/sec from a solution of Po-210 nitrate in water enriched 24% with O-18 is used. The recorded spectra of gammas are reproduced in graphs.

#### 109. Relativistic Wave Functions

"Theory of Relativistic Transformations of Wave Functions and the Density Matrix of Particles with Spin," by V. S. Popov; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1116-1126

An expansion is obtained of the wave functions of a particle with spin  $s$  and of a system of two particles with spin  $s_1$  and  $s_2$  over the irreducible representations of the homogeneous Lorentz group; this allows one to give a relativistically invariant classification of the states. For an invariant description of the polarization of free particles, an expansion is found of the density matrix over the irreducible representations of the Lorentz group.

#### 110. Electronic Radiation

"Transition Radiation in a Wave Guide," by K. A. Barsukov, Physics Institute imeni Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1106-1109

The radiation which arises in a wave guide when a charged particle passes through the boundary between two media is considered. It is shown that at ultrarelativistic charge velocities the radiation is mainly directed in the forward direction and its magnitude is proportional to the energy of the particle. Formulas are derived for the total energy of the radiation and its spectral distribution.

111. On  $\mu$  - e Decay

"On Electromagnetic Corrections in  $\mu$  - e Decay," by V. P. Kuznetsov, Moscow Physicotechnical Institute; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1102-1105

Electromagnetic corrections to the angular distribution of electrons have been obtained for the V - A-theory of  $\mu$  - e-decay.

112. Radiative Capture

"Radiative Capture of Neutrons," by D. F. Zaretskiy; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1084-1087

An expression is derived for the partial width of radiative capture of neutrons into states which are described by the shell wave function. It is shown that in the case of s -neutrons, the indicated width is proportional to the reduced neutron width for these neutrons. The relative probabilities for transition to the  $2 p_{1/2}$  and the  $2 p_{3/2}$  shell states are calculated for a number of nuclei. The intensity ratios thus obtained are in good agreement with the experiments.

113. Neutrinos

"Emission of Neutrino Pairs by Electrons and Its Importance In Stars," by G. M. Gandelman and V. S. Pinayev; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1072-1078

Bremsstrahlung emission of neutrino pairs proposed by Pontecorvo is considered. At certain high values of the density and temperature neutrino pairs energy losses may be larger than the amount of energy which is carried off as a result of radiative thermal conduction. Account of neutrino cooling may be significant and in some cases even of decisive importance for the theory of white dwarfs and star evolution and especially of the

dynamics of supernovae explosions. The process under consideration leads to larger energy losses than those expected on the basis of the neutrino production process in nuclear reaction proposed by Gamov and Shonberg in 1941 (Phys Rev., 59, 539, (1941)).

#### 114. Molecular Generators

"Use of Slow Molecules in Molecular Generators," by N. G. Basov and A. N. Orayevskiy; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1069-1071

Some methods of raising the frequency stability of a molecular generator are considered in which molecular beams are used with mean velocities much less than the thermal velocity at room temperature.

#### 115. Hydrodynamical Theory of Particle Production

"Effect of Viscosity in Multiple Production of the Energy Distribution of Secondary Particles," by A. A. Yemel'yanov and D. S. Chernavskiy, Physics Institute imeni Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1058-1061

The effect of viscosity on processes occurring in a simple wave is considered in the hydrodynamical theory of multiple production of particles. It is found that at sufficiently high energies the effect of viscosity on the energy distribution of the fastest particles may be significant.

#### 116. Neutrinos, Leptons, and Fermions

"On Two Types of Neutrinos, Lepton Isotopic Spin, and Universal Four-Fermion Interaction," by Ye. M. Lipmanov, Stalingrad State Pedagogical Institute; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10) Oct 59, pp 1054-1057

It is suggested that two types of neutrinos exist in nature,  $\nu_1$  and  $\nu_2$  which, although having identical longitudinal polarizations may have different lepton charges which form together with the electron and  $\mu$ -meson two isotopic lepton doublets  $(\nu, e)$  and  $(\nu, \mu)$ . The electron and  $\mu$ -meson lepton charges are also opposite. The laws of conservation of isotopic spin, lepton charge, and chirality uniquely specify the nature of  $\mu$ -decay and yield the selection rules which exclude various unobservable reactions involving leptons.

117. Classification of Molecular Terms

"Classification of Molecular Terms With Respect to the Total Nuclear Spin," by Ye. G. Kaplan, Institute of Chemical Physics, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1049-1053

A method is suggested for determination of the nuclear multiplicities of molecular terms for nuclei of arbitrary spin. The relation between the Young schemes and a total spin, on the one hand, and the permutation group and the point symmetry group of the molecule, on the other, is used.

118. Phase Integrals in Multiple Particle Production

"Calculation of Phase Integrals in the Covariant Formulation of the Theory of Multiple Production of Particles," by L. G. Yakovlev, Uzbek State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1041-1045

A method is proposed for exact calculation of integrals over momentum space in the covariant statistical theory of multiple particle production. The method is applicable to other modifications of the theory although the calculations become more complicated. Approximate and exact calculations are performed.

119. Nonconservation of Parity

"Nonconservation of Parity in Strong Interactions Between Strange Particles," by S. G. Martinyan, Institute of Physics, Academy of Sciences Georgian SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10) Oct 59, pp 1034-1040

A modification of Lee and Yang's theory of strange particle parity doublets is considered in which parity conjugation invariance is extended to weak interactions. As a result, nonconservation of parity in weak interactions is found to be closely related to a change in strangeness.

Results of the analysis pertaining to the "forward-backward" asymmetry of the hyperon decay products are compared with the corresponding consequences due to nonconservation of parity in strange particle creation and interaction processes. Both interpretations are found to yield the same results as long as particles with odd strangeness are concerned. The two approaches can be distinguished by studying processes involving  $\Xi$ -hyperons.

120. Nucleon Core Model

"The Nucleon Core Model With a Vibrational Excitation Spectrum of the Core," by D. P. Grechukin, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37 No 4(10), Oct 59, pp 1026-1033

The nucleon + core model with intermediate coupling between the nucleon and phonon excitations of the core has been considered in a number of works as a possible way of describing the spectra on odd nuclei in the atomic weight region in which even-even nuclei possess level spacings similar to the vibrational quadrupole excitations of the nuclear surface (phonons). The state of the nucleon + core system is a superposition of nucleon states and core states with various numbers of phonons. The energy levels and wave functions of the system have been approximately determined by making diagonal the energy matrix which is cut off at a certain number of phonons  $N$ . Convergence of the approximation when the cut-off is carried out at various values of  $N$  is investigated in the present work for the simple model of spinless phonons whose energy matrix retains the main features of the matrix for phonons with spin.

121. Pair Production by Charged Particles

"Effect of Multiple Scattering on Pair Production by High-Energy Particles in a Medium," by F. F. Ternovskiy, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1010-1016

The effect of multiple scattering on pair production by a fast charged particle passing through a medium is considered. The calculations are carried out by a method previously developed by Migdal (ibid, 32,633 (1957)).

122. Jahn-Teller Effect on  $\text{Cu}^{2+}$

"Dynamical Nature of the Jahn-Teller Effect and Its Influence on the Paramagnetic Resonance of  $\text{Cu}^{2+}$ ," by V. I. Avvakumov, Kazan Affiliate, Academy of Sciences USSR; Moscow Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1017-1025

Copper complexes  $\text{Cu}^{2+} Y_6$  are considered in which, in distinction to other paramagnetic complexes, not a unique geometry but an infinite set of geometries within a certain manifold corresponds, in a first approximation, to the energy minimum. The theory of the crystal field is employed to relate the complex geometry with the distribution of the electron density in the  $\text{Cu}^{2+}$  ion. "Geometry degeneracy" leads to a result

that the density may experience finite (of a nonfluctuational nature) distortions. It is demonstrated that the changes in the "crystal" field which corresponds to these distortions should lead to oscillations of the electron cloud of the  $\text{Cu}^{2+}$  ion relative to the nucleus.

The influence of interactions which yield partial stabilization of the complex is also considered. It is shown that even when these interactions are taken into account, the electron cloud continues to oscillate although its frequency is smaller and depends on the mass of the adenda. The influence of the effect under consideration on the hyperfine structure and  $g$  factors in free complexes is analyzed.

123. Photon-Nucleon Scattering

"Scattering of a Photon on a Nucleon in the One Meson Approximation," Ye. D. Zhizhin; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 994-999

Scattering of a photon on a nucleon proceeding via strong interaction is treated with account of exchange of a single  $\pi$  meson. The scattering matrix is computed for angular momentum values up to  $J = 7/2$ . The angular distributions for reactions involving polarized particles are presented.

124. Lifetime of Excited State of Ne-21

"Measurement of the Lifetime of the First Excited State of Ne-21," by A. G. Khabakhpashev and E. M. Tsenter; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 991-993

The lifetime of the first excited level of  $\text{Ne}^{21}$  was measured with the help of a 50-channel time analyzer. The measurements yielded the value  $T_{1/2} = (6.2 \pm 6.2) \cdot 10^{-11}$  sec. A short description of the time analyzer is given.

125. Scattering of Gamma Rays

"Rayleigh Scattering at Small Angles of Gamma Rays From  $^{60}\text{Co}$ ,"  
by S. A. Belskiy and S. V. Starodubtsev, Leningrad Physico-  
technical Institute, Academy of Sciences USSR; Moscow, Vol 37,  
No 4(10), Oct 59, pp 983-990

The integral cross sections for Rayleigh scattering of  $\gamma$ -rays from  $^{60}\text{Co}$  into angles between  $15'$  and  $1^{\circ}00'$  and between  $15'$  and  $2^{\circ}30'$  were measured for U, Pb, W, Ta, Sn, Cu, and Ni. The quadratic dependence of the Rayleigh scattering cross section on the atomic number of the scatterer predicted by the Debye - Franz theory in the small angle region is confirmed. It is shown that the experimental Rayleigh scattering cross section in the indicated angular region exceeds the theoretical cross section values and that with decrease of Z the angular dependence of the scattering cross section becomes more pronounced than that predicted by the theory.

126. Interactions of  $\pi^+$  Mesons and Light Nuclei

"Inelastic Interactions Between 80 - 300 MeV  $\pi^+$  Mesons and Light Nuclei," by A.G. Meshkovskiy and Ya. Ya. Shalamov; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4 (10), Oct 59, pp 978-982

The cross sections for inelastic interaction between  $\pi^+$  mesons and a mixture of C, F, and Cl nuclei were measured for ten values of the  $\pi^+$  meson energy in the region from 80 to 300 MeV. The results are compared with curves calculated on basis of the optical model under the assumption of a uniform distribution of the nuclear charge and a Fermi-type distribution. It is shown that the experimental results satisfy the second type of distribution. The cross sections for inelastic scattering of  $\pi^+$  mesons are measured.

127. Reaction Th-232 ( $\text{C-12}, 4n$ ) Cm-240

"Cross section for Production of Cm-240 by Irradiation of Th-232 with C-12 and C-13 Ions," by L.I.Guseva. B.F.Myasoyedov, N.I. Tarantin and K.V.Filippova; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4 (10), Oct 59, pp 973-977

The dependence of the cross sections of the reactions  $\text{Th}^{232}(\text{C}^{12}, 4n)\text{Cm}^{240}$  and  $\text{Th}^{232}(\text{C}^{13}, 5n)\text{Cm}^{240}$  on the energy of the bombarding particles was determined by irradiating a stack of thin foils and subsequently analyzing the reaction products. The curves for the reaction cross sections have distinct peaks characteristics of reactions of evaporation of neutrons from a compound nucleus. The peak values of the cross

sections for the reactions  $\text{Th}^{232}(\text{C}^{12}, 4\text{n})\text{Cm}^{240}$  and  $\text{Th}^{232}(\text{C}^{13}, 5\text{n})\text{Cm}^{240}$  are respectively  $8 \cdot 10^{-29} \text{ cm}^2$  and  $1.8 \cdot 10^{-29} \text{ cm}^2$ . Comparison of the reaction cross sections obtained by bombarding thorium with the cross sections of other nuclear reactions shows that the cross section for reactions involving evaporation of neutrons does not depend on  $Z^2/A$  in a simple manner.

128. Sputtering of a Cu Single Crystal

"Directed Emission of Particles From a Copper Single Crystal Sputtered by Bombardment With Ions up to 50 keV Energy," by V. Ye. Yurasova, N.V.Pleshivtsev, and I.V.Orfanov, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 966-972

Sputtering of the (100) plane of a copper single crystal was studied for various values of the energy and angles of incidence of argon and hydrogen ions. It is shown that the particles of the sputtered matter retain a favored direction of emission along some crystallographic directions ([100], [110] etc.) when the energy of the bombarding ions is raised up to 50 keV. Thus, a precipitate in the form of separate spots is formed on a screen arranged parallel to the (100) face of Cu. With increase of the ion energy, the pattern of the precipitate changes but is practically independent of the angle of incidence of the particles. The distribution law of the densities of the spots corresponding to the [110] and [100] directions has been studied. The matter in the spots is distributed according to a cosine law. The relief of the (100) Cu plane which arises sputtering by  $\text{Ar}^+$  and  $\text{H}_2^+$  ions with energies up to 50 keV was also studied. The data obtained cannot be explained by existing theoretical investigations on cathode sputtering.

129. Inelastic Scattering of  $\pi^+$  Mesons

"Inelastic Scattering and Absorption of  $195 \pm 15 \text{ MeV } \pi^+$  Mesons by Carbon and Lithium Nuclei," by N.I.Petrov, V.G.Ivanov, and V.A. Rusakov, Joint Institute for Nuclear Research; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 957-965

Inelastic scattering and adsorption of  $(195 \pm 15) \text{ MeV } \pi^+$ -mesons by carbon and lithium ions were studied with a cloud chamber in a magnetic field. The total and differential inelastic scattering cross sections and also the total cross section for exchange scattering and absorption of  $\pi^+$  mesons were determined. The experimental data obtained are compared with the results of calculation of a cascade in the carbon nucleus and it is shown that inelastic scattering of mesons can be satisfactorily described



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on the basis of the pair collision hypothesis. It is shown that primarily only two nucleons of the nucleus participate in the act of absorption of a  $(195 \pm 15)$  MeV  $\pi^+$ -meson. The probability for meson captured by n,p-pairs is 2-3 times greater in this case than the probability for capture by pairs of identical nucleons.

130. Study of Disintegrations in Nuclear Emulsions

"Application of the Potential Barrier Criterion to a Study of Disintegration in Nuclear Emulsions," by P.I.Fedotov, Radium Institute, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 944-949

Disintegrations induced by 660 MeV protons in carbon imbedded as small diamond particles in nuclear emulsions and also disintegrations of light (C, N, O) and heavy (Ag, Br) emulsion nuclei produced by protons of the same energy were studied. An analysis of the carbon disintegrations shows that there is no significant difference in the mechanism of formation of stars containing or not containing an  $\alpha$ -particle ( $R \leq 50\mu$ ). The relative admixture of Ag and Br disintegrations to those of C, N, and O nuclei chosen by the potential barrier criterion is 19%.

131. Anomalies in Internal Friction of Ferromagnetics

"Anomalies in Internal Friction and the Elasticity Modulus in Ferromagnetic Substances Near the Curie Point," by K.P.Belov, G.I.Katayev, and R.Z.Levitin, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 938-943

The temperature dependence of Young's modulus and internal friction has been measured for alloys of the elinvar and coelinvar types and also in nickel and nickel-zinc ferrite. An internal friction peak, jump in Young's modulus and effect of the magnetic field on the dynamic Young's modulus have been detected near the Curie point in alloys possessing the big paraprocess magnetostriction. It is shown that these phenomena are due to redistribution of spins within the domains induced by elastic stresses. The results are treated thermodynamically.

132. Radioactive Decay of Ac-227

"Radioactive Decay of Ac-227 and Excited Levels of Fr-223 and Th-227," G.I.Novikova, Ye. A. Volkova, L.L.Goldin, D.M.Ziv and Ye.F.Tret'yakov; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 928-937

Radioactive decay of Ac<sup>227</sup> was investigated. Alpha decay of Ac<sup>227</sup> was studied with an alpha-spectrometer. A beta-spectrometer in conjunction with an alpha-beta-coincidence circuit was employed to study beta-decay and the spectra of conversion electrons which accompany alpha- and beta-decay of Ac<sup>227</sup>. A fine structure has been detected in the Ac<sup>227</sup> alpha-spectrum. The energies of seven new lines and the intensities of the corresponding transitions have been determined. A number of gamma-transitions between levels of the daughter Fr<sup>223</sup> nucleus have been detected. A level scheme for Fr<sup>223</sup> is proposed. Three levels have been detected in the spectrum of Th<sup>227</sup> which is obtained as a result of beta-decay of Ac<sup>227</sup>. The energies of the levels and the intensities of beta-decay to them have been measured.

133. Spectrum of Internal Conversion Electrons

"Spectrum of the Internal Conversion Electrons Accompanying Alpha Decay of U-233 and the Level Scheme of Th-229," by Ye.F. Tret'yakov, M.P.Anikina, L.L.Goldin, G.I.Novikova and N.I. Pirogova; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10) Oct 59, pp 917-927

The spectrum of internal conversion electrons emitted by Th<sup>229</sup> (daughter nucleus of U<sup>233</sup>) was studied in a beta-spectrometer with a toroidal magnetic field in conjunction with an e -  $\alpha$  - coincidence circuit. The existence of a rotational level which corresponds to the ground level of Th<sup>229</sup> has been confirmed. The energies of the rotational levels have been determined with better accuracy. Gamma-transitions starting from some new levels (29.1, 71.4, 320.0, 366.0 keV and apparently 131.0 keV) have been detected and investigated. Some refinements have been introduced in the U<sup>233</sup> alpha-spectrum. The level scheme of Th<sup>229</sup> is discussed.

134. Proton-Proton Scattering

"Elastic Scattering of 8.5 BeV Protons on Protons," by V.B. Lyubimov, P.K.Markov, E.N.Tsyganov, Chen Pou-in and M.G.Shafranova, Joint Institute for Nuclear Research; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10) Oct 59, pp 910-916

Photographic emulsions were used to study p - p scattering at an energy of 8.5 BeV. The irradiation geometry was such that the incident protons were perpendicular to the plane of the photographic emulsion. Sixty-six events of elastic scattering were found. Scattering on quasi-free protons and other background effects comprised about 2%. The elastic scattering cross section was  $(8.4 \pm 1.1)$  mb. The differential cross section down to  $2.5^\circ$  in the c.m.s. has been derived. Near  $0^\circ$  it is larger than would be expected on basis of the purely absorbing proton model.

135. Measurement of Momenta of Fast Particles

"Measurement of the Momenta of Fast Particles and Investigation of Nuclear Interactions in the  $10^{10}$  -  $10^{12}$  eV Energy Range," by M.I.Dayon and V. Kh. Volynskiy, Physics Institute imeni Lebedev, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10) Oct 59, pp 906-909

A new method for direct measurement of the momenta of charged particles in a magnetic field in the  $10^{10}$  -  $10^{12}$  eV energy range is proposed. This method is based on simultaneous application of spark counters and nuclear emulsions. The possibility of application of the method for measurement of momenta spectra and investigation of nuclear interactions between protons and matter is considered.

136. Bulgarian Cosmic Research Station

Frankfurt/Oder, Neuer Tag, 2 Jan 60

A modern cosmic research station under construction in Bulgaria will soon be completed. It has been erected on the Pik Stalin, the highest mountain of the country, and is located higher than any other cosmic research station of Europe. The station is being equipped with scientific instruments and equipment from Hungary. Its main task will be cosmic radiation research. This is of great importance for the physics of elementary particles and of the atomic nucleus. Scientific instruments are being installed in the building in which Bulgarian physicists are already working. The building covers 187 square meters of space and has been covered with a metal net as protection against lightning.

137. Further Information on Hungarian Subcritical Reactor

"The Csilleberc Subcritical Reactor," by Laszlo Szabados; Budapest, Muszaki Elet, 26 Nov 59, p 6

The core of this reactor contains 20 fuel element bundles whereas 23-24 fuel element bundles would be needed to reach a critical state. A polonium-beryllium neutron source is inserted into the geometrical center of the core through an aluminum tube. A control rod of boron carbide, which also serves as the safety rod, can be placed in the zone through another tube. The container, of about one cubic meter volume, is filled with high-purity distilled water.

"This equipment is the first step in a program planned to take several years and directed towards an investigation of [neutron] multiplier systems using an organic moderator and cooling medium: i.e., the moderator and the coolant are the same liquid].... With this equipment one can measure local changes in the density of thermal neutrons.... One can estimate the critical masses of cores having various geometrical shapes.... The experiences gained from these experiments can be used to plan and build a reactor of domestic design...."

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138. Photofission of U-238

"Fission of Uranium U-238 by  $\mu$  - Mesons," by A.K.Mikhul and M.G. Petrashku, Joint Institute for Nuclear Research; Dubna, July 1958; Bucharest, Revue de Physique, Vol 4, No 3, 1959, pp 355-359

The stopping of  $\mu$  -mesons in plates filled with U-238 has been observed in 26,975 cases. The photofission of U-238 by  $\mu$  -mesons was first forecast by J.A.Wheeler (Rev. Mod. Phys. 21, 113 (1949)) indicating two methods of capture -- the capture by one of the optical orbits with transitions :  $2s - 2p-1s$  and an energy yield of 7 Mev; and by nuclear capture  $\mu^- + p \rightarrow n + \nu$  (B.Pontecorvo, Phys. Rev. 72, 246 (1947)) in which the nucleus acquires 7 Mev energy. An accurate analysis of the cross section of U photofission could not be carried out, but considerations were given to calculations by J.E. Gindler et al. (Phys. Rev. 104, 425 (1956)) who evaluated the photofission branching ratio for excitation energies of 8 to 11 Mev to be approximately 20%.

Plasma Physics

139. Plasma Torus in Equilibrium

"Equilibrium of a Plasma Torus in a Magnetic Field," by V.D. Shafranov; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1088 - 1095

The conditions for equilibrium of a plasma torus with a distributed current in a magnetic field are derived.

140. Instability of a Plasma Pinch

"Convective Instability of a Plasma Pinch," B.B.Kadomtsev; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1096-1101

Stability with respect to axially symmetrical perturbations including perturbations of the entropy wave type are investigated for a plasma column with a distributed current.

141. Energy Losses in Plasma Discharge

"Radiative Energy Losses in Plasma Gas Discharge," by V.D. Kirillov; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1142-1144

Clarification of the mode of energy losses during the heating of hydrogen plasma by Joule heat is attempted. The losses are ascribed either to heat carried away by charged particles, or to losses by radiation. The experimental methods of measurements are described.

Theoretical and Experimental Physics

142. Ferromagnetic Anisotropy

"Contribution to the Theory of the Temperature Dependence of Ferromagnetic Anisotropy," by Ye.A.Turov and A.I.Mitsek, Institute of Physics of Metals, Academy of Sciences USSR; Moscow Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1127-1132

The temperature dependence of the free energy of the magnetic anisotropy in ferromagnetic substances at low temperatures is calculated on the basis of the phenomenological theory of spin waves. It is shown that when the free energy is expressed in the usual way, the rate of

variation of the anisotropy constant of order N with temperature may significantly depend on the magnitude of the ratio of the subsequent, constants to the one at 0° K. Mixing up of anisotropy constants of various orders in the temperature dependence formulas does not appear only if the anisotropy energy is represented in the form of an expansion in homogeneous harmonic polynomials (constructed of the direction cosines of the magnetization vector relative to the crystal axes). In this case the temperature dependence of the anisotropy constants theoretically derived by Zener [1] is found to be only approximately correct in the low temperature region.

143. Magnetization of Ferromagnetics

"Theory of Stability of the Magnetic States of Ferromagnetic Substances During Magnetization," by Ye. I. Kondorskiy, Moscow State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1110-1115

Physical factors which influence the stability of the magnetic states of a ferromagnetic single crystal with respect to external magnetic fields and elastic strains are considered. A formula is derived which yields the minimal value of the magnetic fields and stresses for which equilibrium of the domain boundary passing near non-magnetic inclusions is violated and irreversible changes of the magnetization occur. The familiar phenomenon of strong magnetization of ferromagnetic substances in weak magnetic fields under the effect of shocks or impact can be explained on this basis and formulas are derived which permit one to estimate the irreversible changes in magnetization induced by elastic strains stresses. The observed stability against elastic stresses of magnetic states corresponding to an ideal magnetization curve is explained.

144. Magnetization of Ferromagnetics

"Industrial Magnetization of Ferromagnetics," by L.V.Kirenskiy, M.K.Savchenko and I.F.Degtyarev, Institute of Physics, Siberian Branch of the Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 128, No 2, Sep 59, pp 288-290

Observations showed that the magnetization process does not consist exclusively of a shift of domain boundaries and of a rotation of the magnetization vector to the direction of the field vector. Another process is observed and analyzed -- the reorientation of the domain structure, corresponding to a maximum of permeability and to the highest number of Barkhausen effects. This reorientation is observed by magneto-optical means and reproduced in pictures.

145. Radiation in Hot Ionized Gases

A simple Method for Calculation of the Mean Radiation Ranges in High Temperature Ionized Gases," by Yu.P. Rayzer; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1079-1083

The absorption coefficients of light in high temperature multiply ionized gases are considered. A simple approximate method is proposed which permits one to rapidly estimate the order of magnitude of the range of light averaged over its spectrum. The ranges determine the coefficient of radiative thermal conduction and the emissivity of any gas at various temperatures and densities.

146. Analysis of Lee's Model

"Incompatibility of the Analyticity and Unitarity Conditions in Lee's Model", by K.A.Ter-Martirosian; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1005-1009

It is shown that outside the framework of the Hamiltonian formalism when only selection rules characteristic of Lee's model are taken into account, the analyticity condition leads to contradiction (even in the simplest  $N+0$  sector) with the unitarity condition. Due to the presence of cross symmetry, this contradiction does not arise in the usual meson theories (at least for a static nucleon in the one meson approximation which in the Lee model is analogous to the case of a  $N+0$  sector).

147. Sound Absorption Coefficient

"Absorption of Sound and the Width of Shock Waves in Relativistic Hydrodynamics," by M.T.Zhumartbayev, Institute of Nuclear Physics, Academy of Sciences Kazakh SSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10) Oct 59, pp 1000-10004

The absorption coefficient of sound in relativistic hydrodynamics due to viscosity and heat conduction of the medium is derived. The structure of relativistic low intensity shock waves is considered.



148. Dynamics of a Conducting Medium in a Magnetic Field

"Some Problems Concerning the Dynamics and Heating of a Conducting Medium in a Magnetic Field," by G.S.Golitsyn, Institute of Physics of the Atmosphere, Academy of Sciences USSR; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 1062-1067.

The one dimensional motion of an ideally conducting medium under the action of a magnetic field prescribed at the boundary is analyzed. Confinement of the plasma by a high frequency magnetic field is investigated. Some aspects of the problem of heating a plasma by magnetoacoustic waves are discussed.

149. A Vibrating Disk in Helium II

"The Critical Regime in Experiments With a Vibrating Disk in Helium II," by G.A.Gamtsemlidze, Tbilissi State University; Moscow, Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, Vol 37, No 4(10), Oct 59, pp 950-956

The results of measurement of damping of the oscillations of a disk immersed in helium II are presented. Commencement of the critical regime and the motion of the disk at supercritical velocities were investigated. The dependence of the critical velocity on temperature and oscillation period was studied. The critical velocity was found to depend on the purity of the surface. In this connection its dependence on the number and size of small particles deposited on the disk surface and also on the radius of the region covered by the particles was studied. The dependence of the damping decrement in the supercritical regime on temperature, particle concentration and radius of the particle covered region was also studied.

150. Elliptical Waveguide

"Gyrotropic Elliptical Waveguide," by Ye.S.Kovalenko; Moscow, Doklady Akademii Nauk SSSR, Vol 128, No 2, Sep 59, pp 276-279

The motion of electromagnetic waves in a waveguide filled with magnetized ferrite is solved only for a circular waveguide. (M.A.Ginzburg, DAN 95, No 3 (1954)). The problem is very complicated for an elliptical waveguide, and its solution is obtained in infinite series. The results may be applied to plasma.

151. Electrostatic Generators

"New Types of Electrostatic Generators, Induction and Triboinduction," by G.E.Levin; Moscow, Pribory i Tekhnika Eksperimenta, No 5, Sep/Oct 59, pp 80-85

Two laboratory models of two new types of self-excited electrostatic generators (induction and triboinduction), were developed. Their charge conveyor is a dielectric disk without metallic lining.

152. Jump Discontinuity Problem in General Relativity Theory

"The First-Order Jump-Discontinuity Problem in the General Theory of Relativity," by A.Papapetrou and H.Treder, Berlin; Berlin, Mathematische Nachrichten, Vol 20, No 1/2, May-Aug 59, pp 53-66

It is shown that the difficulties encountered by Stellmacher (Math. Ann., 115, 740 (1938)) in regard to the treatment of the first-order jump discontinuities of the potential  $g_{\mu\nu}$  stem from the fact that implicitly surface-distributed sources were allowed on the jump planes, with the result that Einstein's gravitation equation  $R_{\mu\nu} = 0$  no longer applied. If the existence of such surface-distributed elements as sources of the gravitational field is excluded, the first-order jumps of the gravitation potential can be defined unequivocally. It is further shown that these first-order jumps have the same properties as second-order jumps. All the relationships in this work are in agreement with the propagation conditions obtained by Stellmacher in his discussion of the second-order jumps. The only difference is that, in the laws of propagation established here, the values arrived at by Stellmacher from the second-order jumps are replaced by expressions similarly arrived at from first-order jumps. With the exclusion of surface-distributed elements on the jump surface, the first-order jumps are established unequivocally by the field equations, even for the case of the combined field. Essential jump discontinuities can exist only at zero surface, i.e., at the characteristic surfaces of the Einstein-Maxwell field equations. The perturbations of the combined field corresponding to these jumps thus propagate at the speed of light. Furthermore, the electromagnetic and gravitational waves which correspond to the first-order jumps, like those of the second-order jumps, are purely transversal and sources of radiation.

IX. MISCELLANEOUS

153. New Scientific Research Institute for Transportation and Storage of Petroleum and Petroleum Products

"New Institute in Ufa" (unsigned article); Moscow, Promyshlenno-Ekonomicheskaya Gazeta, 13 Nov 59, p 1

The Scientific Research Institute for Transportation and Storage of Petroleum and Petroleum Products has been founded in Ufa. The new institute will help the workers of various branches of industry to efficiently organize the transportation and storage of liquid fuels.

154. Creation of All-Union Pedagogical Society

"All-Union Pedagogical Society" (unsigned article); Moscow, Izvestiya, 19 Dec 59, p 2

At the request of the Central Committee of the Trade Union of Workers of Education, Higher Schools, and Scientific Establishments of the USSR and the Academy of Pedagogical Sciences RSFSR, the All-Union Pedagogical Society has been created. This voluntary scientific and technical organization has set itself the task of doing work in the field of pedagogical sciences, i.e., the Communist training of the rising generation, strengthening the bond between schools and daily practice, and further development of education in the land.

155. Hungarians Describe Their Systematic Exploitation of Foreign Technical Publications

"Eight Hundred Foreign Subscribers," by Endre Hevesi; Budapest, Nepszabadsag, 12 Dec 59, p 7

According to the article, Hungarian exploitation of foreign technical publications is centralized in the National Technical Library (omk). "Summaries of these articles go to the libraries of factories and of research or planning institutions in press reviews and on cards." The article complains that enterprise leaders frequently fail to use these summaries or to provide funds for documentation.

The article adds, "There is a correct decree which states that one copy of every technical translation must be sent in to the National Technical Library, which will sell copies of translations on file very cheaply (one tenth of the translation fee). Despite this, not even 2.5 persons

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generally ask for any one complete translation." The library publishes journal reviews in 13 specialties, a total of 5,000 copies -- 800 of which go abroad. Although they are not advertised, these summaries of foreign journal articles can be ordered through "Kultura," the enterprise which handles foreign subscriptions to Hungarian journals, the article says.

156. Work of Hungarian Bureau of Standards Described

"The School of Accuracy -- A Visit to the Measures Office" (unsigned article); Budapest, Nepszabadsag, 8 Dec 59, p 9

The article describes the operations of the National Measures Office (Orszagos Meresugyi Hivatal), whose operations apparently do not include scientific research. The article notes that in the past year, the office performed 6 million tests on the accuracy of measures in commercial products and issued 34,000 instrument accuracy certificates for various metering instruments (15 percent of the instruments failed to pass). The office has a 100-ton dynamometer balance which can detect a discrepancy of 2 kilograms when loaded to 100 tons. A pyrometer of Soviet manufacture is used to calibrate all industrial pyrometers in Hungary.

157. New Members Elected to Serbian Academy of Sciences

"New Members of Serbian Academy of Sciences" (unsigned article); Zagreb, Vjesnik, 19 Dec 59, p 10

New regular, corresponding, and foreign corresponding members were elected at a special session of the Serbian Academy of Sciences. Edvard Kardelj (vice-president of the Federal Executive Council), authors Stevan Jakovljevic and Milan Bogdanovic, sculptor Sreten Stojanovic, and Dr Jorje Tadic (professor of Belgrade University) were elected as regular members. Twelve outstanding Yugoslav scientific, cultural, and public workers were elected as new corresponding members. The USSR, France, the US, Austria, Poland, Sweden, Denmark, Italy, and England provided the 23 newly elected foreign corresponding members.

158. Yugoslav Scientists Honored With Foreign Membership in Soviet Academy

"Aleksandar Belic and Pavle Savic Receive Certificates as Foreign Members of the Academy of Sciences USSR" (unsigned article): Zagreb, Borba, 16 Dec 59, p 8

At an official meeting of the Serbian Academy of Sciences, Ivan K. Zamchevskiy, Soviet ambassador to Belgrade, presented certificates of foreign membership in the Academy of Sciences USSR to Dr Aleksandar Belic and Pavle Savic. Dr Belic was cited as the oldest member of the Soviet academy because in 1918 he was elected a corresponding member of the then Russian Academy of Sciences. He was also cited for his great contribution to the development of science and for his role in the creation of the Serbian Academy of Sciences. Pavle Savic was cited for his contributions in physics and chemistry, but particularly for the exploitation of atomic energy for peaceful purposes.

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