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SCIENTIFIC INFORMATION REPORT

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PLEASE NOTE

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

SCIENTIFIC INFORMATION REPORT

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NOTE: Items in this report are numbered consecutively.

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I. BIOLOGY

1. Antibiotics in Fish Preservation

"Miracle Ice," by N. Krasnochub; Moscow, Izvestiya, 16 Jul 59

This brief article states that antibiotics -- penicillin, streptomycin, and biomycin -- are being used experimentally by fishermen to keep fish fresh. The experiments are being conducted by the fishermen who operate from the port of Murmansk. Four to 5 grams of the antibiotic are added to a ton of water before it is frozen. The ice is then used by the fishermen to preserve the fish catch before it is brought to the port.

2. Presowing Irradiation of Cotton Plants Speeds Boll Maturation and Increases Cotton-Wool Yield

"The Effect of Ionizing Radiation on Cotton-Wool Yield," by D. M. Guseynov and R. E. Eyubov; Baku, Izvestiya Akademii Nauk Azerbaydzhanskov SSR, No 3, 1959, pp 77-80

This article presents results of tests explaining the effect of the presowing irradiation of cotton seeds on the maturation of the bolls and on the cotton-wool yield. Four tables summarizing the results are presented. The author presents the following conclusions:

"Under the effect of presowing irradiation of cotton seeds by small X-ray doses (5,000-10,000 r), Co^{60} (2,500-15,000 r), and neutrons (1×10^{7}-1×10^{12} neutrons/cm^2), an increase was noted in the yield of cotton wool.

"In the overwhelming majority of cases the opening of cotton bolls is accelerated by the presowing irradiation of the cotton seeds."

3. Cellulose Content of Irradiated Wheat Plants

"The Effect of X Irradiation on the Cellulose Content of Wheat Plants," I. M. Vasil'yev and N. D. Rybalka, Institute of Biological Physics, Academy of Sciences USSR; Moscow, Biofizika, Vol 4, No 4, 1959, p 507

Tests were conducted on winter wheat No 599. Results are presented in a table entitled, "Cellulose Content in the Leaves of Wheat Plants (in mg of sugar/g dry leaf weight)."

CPYRGHT The authors conclude that "X irradiation of wheat plants by doses as

[redacted]

4. Chinese Studies on Effect of X Irradiation on Potato Tubers

"Some Experiments on the Treatment of Potato Tubers With Ionizing Radiations to Prevent Germination and Deterioration," by Yin Hung-chang (殷 宏 章) and Chao T'ung-fang (赵 同 芳), Institute of Plant Physiology, Academia Sinica [Shanghai]; Peiping, K'o-hsueh T'ung-pao (Scientia), No 8, 26 Apr 59, pp 269-270

The authors state that although many others have investigated the subject of X-ray dosage in the treatment of potato tubers for storage, the problem of dormancy has generally been disregarded. In their experiments, which were carried out between August 1958 and Feburary 1959, they found that 8,000 X-rays applied to potato tubers on the completion of dormancy was as effective as 20,000r applied during dormancy.

Other problems investigated by the authors were the effect of dosage on the inhibition of germination in potatoes, onions, and leeks, and the sugar content of potato tubers after irradiation.

II. CHEMISTRY

Analytical Chemistry

5. An Ionization Detector With a Promethium-147 Radiation Source for Gas Chromatography

"An Ionization Detector With Pm^{147} for Gas Chromatography," by S. N. Ozrianer, G. A. Gaziyev, M. I. Yanovskiy, and V. S. Kornyakov, Institute of Physical Chemistry, Academy of Sciences USSR; Moscow, Zavodskaya Laboratoriya, Vol 25, No 6, Jun 59, pp 760-761

By using α-emitter ionization gas analyzers, one can determine very small quantities of impurities. However, devices of this type are not being applied extensively in gas chromatography because of the high cost of sources of alpha radiation producing ionization and the necessity of working with an open radiation source. Application for this purpose of β - emitting radioactive substances, specifically Sr^{90}, has been described in the literature. However, Sr^{90} emits a hard β - radiation. This reduces the specific ionization of the gas and requires protection from γ - bremsstrahlung. The preparation of sufficiently thin and dense deposits of Sr^{90} is a very complicated task.

In the work described at present, Pm^{147} was used as a source of ionizing β-radiation. The promethium was deposited electrolytically in the form of a thin oxide layer with an area of 2 cm^3 and a relative activity of 2.5 millicuries per cm^2. The half-life of Pm^{147} is 2.7 years. The maximum energy of β - particles emitted by it is only 0.22 Mev.

The detector with promethium was tested on a chromatographic apparatus of a standard type. Chromatograms obtained with the ionization detector were compared with chromatograms recorded with a thermoconductometric gas analyzer of the type GEUK-21 under the same conditions. A mixture of propylene, isobutylene, and pentane was analyzed. The ionization detector was found to be more sensitive and precise than the thermoconductometric detector.

Throughout the whole range of temperatures and velocities of gas flow applied in the course of the experiment, the ionization detector proved to be insensitive to changes in the rate of flow and variations of temperature. This indicates that the new instrument will be suitable for application in the separation of high-boiling substances and measurements carried out at high temperatures.

Fuels and Propellants

6. Density of Solutions of Nitrogen Tetroxide in Concentrated Nitric Acid

"Density of Solutions of N_2O_4 in Concentrated Nitric Acid," by G. L. Antipenko, Ye. S. Beletskaya, and Z. I. Koroleva; Moscow, Zhurnal Prikladnoy Khimii, Vol 32, No 7, Jul 59 pp 1462-1466

The density of HNO_3 - N_2O_4 - H_2O solutions was determined in the concentration range of 0-5% of H_2O and 10-27% of N_2O_4 at temperatures from minus 60° to plus 50°. An empirical formula is proposed for the calculation of the density of these solutions. By using the formula which is given, density values can be extrapolated down to 5% of N_2O_4.

7. Detonation Capacity of Mixtures Containing Nitric Acid

"The Detonation Capacity of Liquid Explosive Mixtures Based on Nitric Acid," by R. Kh. Kurbangalina; Moscow, Zhurnal Prikladnoy Khimii, Vol 32, No 7, Jul 59, pp 1467-1470

Investigation of the detonation capacity of mixtures of nitric acid with nitrobenzene, m-nitrotoluene, dichloroethane, and glycol established that all the mixtures mentioned are explosive and capable of detonation. They detonate with velocities of the order of 6000-7000 meters per second corresponding to their heats of detonation, as well as densities and composition of combustion products. The critical diameters for the majority of the mixtures investigated were found to be very small. Under the circumstances, one may expect that mixtures of nitric acid with combustible materials will readily explode as a result of a blow, shock, or heating. Extreme care is indicated in work with such mixtures. The matter is of importance because nitric acid is used in large amounts in the chemical industry and has also been employed extensively during recent years as an oxidant in rocket propellant mixtures.

Nitric acid with a density of 1.5 grams per cubic centimeter was used in preparing the explosive mixtures tested in the investigation described.

8. An All-Union Conference On Explosions

"All-Union Conference on Problems Pertaining to Explosions," by A. A. Deribas; Novosibirsk, Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR, No 3, Apr 59, p 134

"An All-Union Conference on problems of the application of explosions for industrial and economic purposes was held on 16-20 February 1959 at Novosibirsk at the Institute of Hydrodynamics, Siberian Department of the Academy of Sciences USSR. The principal purpose of the conference was to establish direct contacts between scientists and practical men who work on problems pertaining to the applications of explosions in the national economy. Systematic exchange of experience and results was to be initiated and information on problems that are to the greatest importance from the practical standpoint defined and discussed.

"Seventy-two representatives of 20 organizations located at Novosibirsk, Moscow, and Leningrad participated in the conference. Twenty-four reports were given and discussed. The majority of the reports dealt with major explosions involving thousands or even tens of thousands of tons of explosives. Explosions with an intensity as great as this have been applied only very recently. According to the 7-year plan which was confirmed by the 21st Congress of the CPSU, explosions of this type will be used extensively, particularly in Siberia and in the Far East. The reason is that exploitation of mineral deposits after removal of the overburden is the most efficient method of mining, as has been shown by practical experience. After the overburden has been removed, valuable rock occurrences located at the depth of tens of meters become accesible from the surface, so that manual labor that ordinarily must be done by miners can be dispensed with an an excavator used instead.

"The participants at the conference heard with great interest a report by the foremost specialist on explosions, M. M. Dokuchayev, who told about the project of opening up, in Southern Yakutiya, a major coal seam located at the depth of about 100 meters. It is proposed to set off almost 500,000 tons of explosive there. If the preliminary calculations have been carried out correctly, an economy of tens of millions of rubles or perhaps even hundreds of millions of rubles can be achieved by this explosion.

"A number of communications dealt with safety problems which arise when explosions take place in the vicinity of populated localities. Some reports dealt with general problems pertaining to the theory of explosions. In the communications that were made and the discussions which followed them, problems were discussed that have a bearing on the more extensive practical application of new principles introduced into explosion

technology during the past few decades, i.e., those of applying charges with prolonged action ["udlinennyye zaryady"], using charges with a cumulative effect, drilling by explosions (specifically, spark drilling), etc.

"The conference demonstrated that, in the field of explosion technology, there are many unused reserves and that many institutes, laboratories, administrations, and higher educational institutions which are concerned with problems of the theory and practice of explosions have coordinated their activities to only a very small extent as yet. There is a totally unjustified duplication of effort in this field; exchange of information between interested organizations is inadequate.

"The conference requested the Presidium of the Siberian Department of the Academy of Sciences USSR to create a Scientific Council on Explosion Problems. The composition of this council was confirmed at the concluding session of the conference: it consists of 30 specialists in the field of explosions who are members of different organizations and come from different cities of the country. The council has been charged with coordinating work on explosions carried out by all institutions of the USSR. A resolution was passed by the conference to the effect that scientific work on explosions be published by the rotary press printing method. The published work is to be distributed immediately to all organizations interested."

9. New Results Pertaining to the Structure of Detonation Waves

"The Pulsating and Spin Detonation of Gas Mixtures in Tubes," by Yu. N. Denisov and Ya. K. Troshin, Institute of Chemical Physics, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 125, No 1, 1 Mar 59, pp 110-113

The structure of detonation waves formed by stoichiometric mixtures of hydrogen, methane, and acetylene with oxygen was investigated. Photographic recording of the pattern formed by carbon black deposited on the walls of the detonation tube was applied. Although it is commonly held that normal detonation takes place in these mixtures at atmospheric pressure, improved resolution of the photographic recording indicated typical characteristics of a spin detonation at this pressure, i.e., a striated structure of the afterglow and a wavy contour of the front. The pattern recorded on the wall of the tube consisted of rhomb-shaped imprints, which indicated that pulsating changes of dynamic pressure occurred in the leading detonation front and that a many-headed spin of great frequency propagated. As the initial pressure of the mixture was reduced, the pattern on the detonation tube wall became larger (i.e., the dimensions of the rhombs increased). At the detonation limit, there was a sudden change from the rhomb pattern to the helical trace left by a single-headed spin. On the

basis of the results obtained, it is concluded that there is periodic localization of the chemical reaction in separate sections of the wave front. An important role in this is played by the break in the leading front, a structural element which separates in a pure state and exists independently during a spin detonation. It is considered as experimentally proven that the structure of gas detonation waves in tubes does not form as a result of a simple combination of a shock front and the front of a chemical reaction. The assumption that this combination takes place forms the basis of the present-day hydrodynamic theory of detonation. A combination of this type is unstable, as has been shown by K. I. Shchelkin: presumably, this is the reason why localization of the chemical reaction in separate sections of the detonation front takes place.

10. A Popular Book on Solidified Gasoline

"Tverdyy Benzin" [Solidified Gasoline], by B. I. Losev, M. S. Komskiy, and M. A. Troyanskaya, Gostoptekhizdat, Moscow, 5 standard printed sheets (forms), price 2 rubles; reviewed in Novyye Knigi po Nefti i Gazu Vypuskayemyye vo Vtorom Polugodii 1959 Goda [New Books on Petroleum and Gas To Be Published in the Second Half of 1959], Gostoptekhizdat, Moscow, 1959, 23 pp (p 16)

"This book has been written for a wide circle of readers, including engineering and technical personnel of polar and wintering stations, workers in the fields of automobile transportation and aviation in remote regions, participants in various expeditions and search parties, workers at sovkhozes situated in remote and mountainous regions, mountaineers, hikers, and hunters. Brief information is given on the production of solidified gasoline. Principal attention is paid to methods of transportation, storage, and applications of solidified gasoline for technical purposes and household needs."

[For additional information relative to fuels and propellants, see also item following.]

Industrial Chemistry

11. Development of the Chemical Industry in Eastern Siberia

"Tasks of Scientific Research in the Field of Chemistry To Be Done With the Aim of Promoting the Development of the Industry of Eastern Siberia (Report Given at a Meeting of the Chemical Section, Conference on the Development of the Productive Forces of Eastern Siberia, Held on 22 August 1958 at Irkutsk)," by S. I. Vol'fkovich; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk, No 5, May 59, pp 763-769

In reviewing the industrial chemical developments in Eastern Siberia, it is best to begin with inorganic chemistry and with types of production supplying basic raw materials.

Of great interest is a technical and economic evaluation of the possibilities inherent in industrial conversion of the large available supplies of gypsum into sulfuric acid. This question becomes particularly important if the shortage of raw materials containing sulfur is considered. The fact that deposits of gypsum are found in the vicinity of coal fields suggests that it would be advisable to convert the gypsum into sulfuric acid and cement. In connection with the production of sodium sulfate and sodium sulfide from the brines of Minusinsk, Chita, and Buryat ASSR salt lakes, one may mention that a process for the reduction of sodium sulfate with carbon in shaft furnaces and also in furnaces of the cyclone type has been developed in Kazakhstan. This type of process, the use of which increases the efficiency of the conversion considerably, is actually being applied in Kazakhstan.

Metallic sodium that will replace the magnesium used in the production of titanium must be produced from solid sodium chloride. The production of titanium will expand, primarily because a demand for this material must be satisfied in connection with the construction of high-performance aircraft. Metallic sodium is also required by other consumers.

It is advisable to develop procedures for the gasification of coal in order to supply gas for household needs and industrial applications and also to produce chemicals in conjunction with this. In the field of petroleum conversion, it is necessary to develop methods for the pyrolysis of gaseous hydrocarbons, petroleum distillates, and mazuts which would insure the maximum yields of ethylene, propylene, and aromatic hydrocarbons. Emphasis should be placed on development of methods for the fine purification of gases, particularly purification from sulfur compounds. This refers to the acetylene, ethylene, and propane-propylene fractions produced in connection with the conversion of petroleum crudes rich in sulfur. One must develop the method of sufonating alkylbenzenes with sulfuric acid to produce the detergent sulfanol.

A plan of work to be done in connection with the development of methods for the production of stable polymers of formaldehyde and their treatment has been drawn up. It is necessary to complete the development of a method for the production of acrolein by the oxidation of propylene followed by further conversion of the acrolein into glycerin and epichlorohydrin. One must develop methods for the production of higher alcohols and alkyl sulfates, starting with the hydrogenation of oxidized light paraffins. A method must be developed for the utilization of dimethyl ether, specifically for the production of dimethyl sulfate.

Among the important tasks which are to be accomplished is development of synthetic procedures for the production of aromatic hydrocarbons (e.g., of p-xylene from nonaromatic raw material and of vinyl toluene from toluene and acetylene). Methods must be developed for the utilization of furfural, specifically for the production of tetrahydrofuran and plastics. Of potential interest for Eastern Siberia is the development of methods for the production of organo-silicon and fluoroorganic compounds, as well as of polymers derived from these compounds.

Developmental work on the following methods of production must be organized at industrial enterprises of the Irkutsk Oblast': production of aliphatic alcohols by the oxo-synthesis and production of amines from the resulting alcohols; production of sulfates by the sulfooxidation of paraffins [presumably production of alcohols from hydrocarbons followed by esterification and sulfuric acid]; polymerization of ethylene and propylene at intermediate pressures; production of nitroparaffins under pressure; production of glycerin from propylene over acrolein; production of vinyl aryl ethers and their derivatives; and production of acetylene from hydrocarbon gases.

Of importance also is research on the improvement of technological processes being applied at present. This refers primarily to procedures for the production of tetraethyl lead, hydrogen peroxide, and a number of other substances. Technical and economic investigations must be conducted with the aim of determining the best methods for the synthesis of raw materials such as enant and polyurethanes.

From the standpoint of cost, the conversion of liquid hydrocarbons and of natural gas into acetylene will prove of greater advantage then the production of calcium carbide followed by its conversion into acetylene.

It will be advantageous to consider the role that will be played by oxygen in the development of the chemical industry of Eastern Siberia. During the past 25 years, there have been alternate periods of increase and reduction of interest towards the production of oxygen and its applications in metallurgy, power generation, and the chemical industry. This changing attitude can be explained by the unfavorable economic conditions which exist in the European USSR with respect to the production of oxygen. Whether oxygen is produced in compressor equipment, turboexpansion equipment, or some other machines or perhaps by chemical methods or methods representing a combination of those mentioned above, a decisive factor will be the amount of power that is required.

Exceptionally favorable conditions for the production of oxygen exist in the Irkutsk and Krasnoyarsk regions, as well as other regions of Eastern Siberia where major hydroelectric and thermoelectric power stations that are already in operations or will be constructed are capable of supplying huge quantities of power at a very low cost. For this reason, it is certain that oxygen and air enriched with oxygen will be applied extensively in the chemical industry of Eastern Siberia. One may mention in connection with this the development of the production of ammonia, nitric acid, sulfuric acid, phosphorus, calcium carbide, and acetylene which has been planned in this area, as well as application of many oxidation processes such as the combustion of fuels poor in carbon and rich in sulfur and the roasting of pyrrhotites. All of these processes can be conducted more efficiently with the use of oxygen. It is, therefore, important that work on the applications of oxygen in Eastern Siberia be expanded by every possible means. One must remember that hydrogen is produced in addition to oxygen if electrolysis of water is employed for the production of oxygen. Hydrogen also ought to be applied extensively, mainly in reduction and hydrogenation reactions. The problem of oxygen production is of the greatest importance from the standpoint of improvement of the efficiency of many industrial processes applied in Eastern Siberia.

12. Rare-Earth Elements as Catalysts in Organic Chemistry

"Rare-Earth Elements as Catalysts in Organic Chemistry; Oxides of Cerium, Lanthanum, and Samarium," by A. A. Tolstopyatova and A. A. Balandin, Institute of Organic Chemistry, Academy of Sciences USSR, Redkozemel'nyye Elementy--Polucheniye, Analiz, Primeneniye (Rare-Earth Elements -- Production, Analysis, and Applications), Moscow, Academy of Sciences USSR, 1958, 331 pp (pp 307-313)

Using cerium dioxide as a catalyst, the energies of activation of dehydrogenation of alcohols (methyl, ethyl, and n-propyl alcohol), as well as of cyclohexane, were determined and also the energy of activation

of the dehydration of isopropyl alcohol. Using lanthanum oxide as a catalyst, the energies of activation of the dehydrogenation and dehydration of isopropyl alcohol were determined. Using samarium oxide as a catalyst, the energies of activation of the dehydrogenation and dehydration of ethyl and isopropyl alcohols were determined. It was established that there are differences in the activation energies of the dehydrogenation and dehydration of isopropyl alcohol, depending on whether Ce O_2, La_2O_3, or Sm_2 O_3 is used. There are also differences between the catalytic action of cerium dioxide and that of samarium oxide as far as the decomposition of ethyl alcohol is concerned. The energy of the bonds formed by C, H, and O with cerium dioxide and also the corresponding adsorption potentials were calculated. The results obtained confirm the correctness of the method applied for determining the bond energies, which is based on the multiplet theory.

Inorganic Chemistry

13. Formation of Ferrites With a Spinel Structure as a Result of the Ageing of Metal Hydroxides

"Formation of Ferrites as a Result of the Ageing of Metal Hydroxides," by V. P. Chalyy, Institute of General and Inorganic Chemistry, Academy of Sciences Ukrainian SSR; Kiev, Ukrainskiy Khimicheskiy Zhurnal, Vol 25, No 3, May/Jun 59, pp 285-287

X-ray structural phase analysis proved that when two-component mixtures of metal hydroxides have been aged under water at room temperature, there is interaction of the hydroxides with formation of chemical compounds of the spinel structure (ferrites). The velocity of the reaction by which ferrites of the composition $MeFe_2O_4$ are formed is greatest when two isomporphous metal hydroxides have been coprecipitated, the pHs of the precipitation of which are close to each other and one of the hydroxides is dehydrated easily (e.g., zinc hydroxide). It has been established that there is formation of the ferrites of magnesium, nickel, and zinc under the conditions studied and no formation of the ferrites of copper and cadmium. Investigation of precipitated ferrites of zinc and nickel showed that as ageing progresses, the lattice dimensions of the ferrites gradually approach those of samples synthesized by the authors by heating the material at 900° for 9 hours (cf V. P. Chalyy and S. P. Rozhenko, Doklady Akademii Nauk SSSR, Vol 108, 1956, p 875). This indicates that there is gradual elimination of water from the lattice during the ageing.

Nuclear Fuels and Reactor Construction Materials

14. USSR Work in the Field of Rare-Earth Elements

"Applications of Rare-Earth Elements," by A. P. Vinogradov, Redkozemel'nyye Elementy-Polucheniye, Analiz, Primeneniye (Rare-Earth Elements -- Production, Analysis, and Applications), Moscow, Academy of Sciences USSR, 1958, 331 pages (pp 5-8)

The development of nuclear energy technology had a great influence on the investigation of the individual rare-earth elements. Methods for their production and ways of utilizing them were investigated from this standpoint. Nuclear technology required new materials with definite properties making them suitable for applications in this field; a search for such materials was made among the 15 little-investigated rare-earth elements. In connection with work in the nuclear energy field, it was necessary to investigate all fission fragments formed in nuclear fuel. These fragments consist to a considerable extent of radioactive rare-earth elements. The availability of radioactive rare-earth elements which could be used as tracers facilitated work on the separation and isolation of pure individual rare-earth elements. The control of the industrial production of rare-earth elements also became easier because of the availability of radioisotopes. The properties of actinides could not have been studied without a knowledge of their analogs, i.e., rare-earth elements. Development of methods for the separation of isotopes demonstrated that separation of rare-earth elements is no longer a difficult problem. New methods for the control of the purity of individual rare-earth elements became available, e.g., those of radioactive analysis.

To summarize, increased interest was evinced by physicists, radiochemists, and other investigators towards the specific properties of individual rare-earth elements and individual isotopes of these elements in connection with nuclear energy developments. One may expect that other α- and β-active isotopes will be discovered among rare-earth elements, in addition to the already known α-active Sm. The paramagnetic properties of the isotopes of Gd have not yet been investigated sufficiently or utilized to any extent. The chemistry of Pm isotopes is in its very beginnings. It is possible that radioactive isotopes besides Tu^{170} will prove useful for medical applications.

From the geochemical standpoint, the problem of the formation of naturally-occurring rare-earth elements is of great interest. It is, at present, possible to investigate experimentally the nuclear mechanism of the formation of rare-earth elements by fission, scission, the synthesis of complex heavy nuclei, etc.

In reviewing progress made during the past 2-3 years, one may state that application of the methods of ion-exchange chromatography and of extraction contributed to advances made in the separation of radioactive splinter fractions consisting of rare-earth elements and the separation of rare-earth elements in general. These methods proved to be superior to those of fractional crystallization and fractional precipitation. In the field of ion-exchange chromatography, one may note the use of cation-exchange resins in the form of their copper or iron salts and also in other special forms. By using copper, iron, and other complex-splitting and adsorption-inhibiting cations, the efficiency of the separation could be increased considerably.

Another interesting development in the field of ion-exchange chromatography is the extensive application of complex-formers, including sequestering agents ("complexons") and organic acids such as lactic acid. Furthermore, special ion-exchange resins were developed.

Extraction procedures for the separation of mixtures of rare-earth elements are based on extraction from aqueous solutions of rare-earth complexes of different degrees of stability. Organic solvents such as tributyl phosphate and trifluoroacetone are used for the extraction. Progress has been made in utilizing changes in the valency of rare-earth elements for the purpose of extraction. Progress has also been made in the old methods of fractional crystallization and fractional precipitation.

Improved methods of separation and production led to new applications of rare-earth elements. Some examples are the application of radioactive thulium in portable X-ray equipment for medical purposes and in a soft-radiation defectoscope; addition of cerium to obtain cast iron which is less brittle and to produce types of glass which do not become opaque under the effect of nuclear radiation; and diverse uses of rare-earth elements in metallurgy, glass-making, electronics, and the production of phosphors and luminescent compositions.

The following remarks can be made in regard to work on rare-earth elements in the USSR:

Originally, the inadequate organization of the industrial production of individual rare-earth elements interfered with research in this field. There are many deposits of rare-earth element ores in the USSR. These deposits are well-known. Notwithstanding the availability of raw material rich in elements of the yttrium group, production specialists regarded as advisable the extraction of elements of this group from raw materials such as monazite, which contain all rare-earth elements. This problem requires careful consideration.

As far as chemical methods of separation are concerned, crystallization in the presence of complex-forming agents was developed successfully at the State Institute of Rare Metals. Procedures for separation by ion-exchange chromatography are being developed successfully at Moscow State University, the Physico-Chemical Institute imeni Karpov, etc.

Work on both continuous and semicontinuous methods is being done.

Extraction methods were used for purposes of control, but work on this subject has not progressed further than that. Chemical and spectrometric methods were proposed for purposes of control on the basis of work done at Leningrad State University. One may note in passing that very little attention was paid to the investigation of the properties of rare-earth elements and their compounds and still less to the development of industrial applications of rare-earth elements. As far as this is concerned, some improvement followed research on semiconductors done at the Physico-Technical Institute at Leningrad, the Institute of Semiconductors, the Institute of Silicates (Silicate Chemistry), etc.

One must finally mention work that has been done at the Institute of Geochemistry and Analytical Chemistry. As far as work on chemical methods conducted at this institute is concerned, research on complex compounds of rare elements with the purpose of developing technological and analytical methods was continued (a specific instance is clarification of the mechanism of separation into groups by means of carbonates of alkali metals). As far as utilization of changes in valency is concerned, work has been done on the mechanism of and the role played by complex-formation in processes of the electrolytic reduction of samarium, europium, and ytterbium. In the field of ion-exchange chromatography, the chromatographic separation of rare-earth elements by means of different USSR ion-exchange resins was investigated. The problem in regard to the separation of mixtures of rare-earth elements by means of complex-forming agents of different concentrations was subjected to study. Work was initiated on the separation by extraction and equipment to be used for this purpose. In the field of analysis, X-ray spectrographic methods have been developed and introduced into industrial application. New X-ray spectrographs were designed. Work has been done on the radio-activation determination of rare-earth elements present together in the same mixture, specifically on applications of this method with the use of a γ - spectrometer. On the basis of a collation of work done at this institute, a scheme for the production of concentrates and pure derivatives of individual rare-earth elements was proposed.

In conclusion, one may say that adequate raw material for the production of rare-earth elements is available in the USSR. Furthermore, raw material containing raw earths will be available in quantities amounting to hundreds and thousands of tons in the form of by-products and wastes resulting from different types of production. Methods for separation,

purification, and production control are available in the USSR. Thus, all prerequisities exist for the development of an advanced rare-earth elements industry. Under the circumstances, a persistent effort must be made to develop this type of production as rapidly as possible. With this end in view, research on the physico-chemical properties of individual rare-earth elements and their compounds must be expanded; work in this field is still inadequate. Ultrapure rare-earth metals are not available as yet. Furthermore, research on the applications of rare-earth elements and rare compounds is lagging; this is a shortcoming which delays development of the rare-earth industry.

The principal tasks which must be accomplished are development of new fields for the application of individual rare-earth elements and discovery of new properties of ultrapure elements of this class. This will be possible only when the production of derivatives of ultrapure rare-earth elements has been organized.

[SIR Note: This is a summary of the introductory address given by A. P. Vinogradov at the Conference on the Production, Analysis, and Applications of Rare-Earth Elements, held on 4-6 June 1956 at the Institute of Geochemistry and Analytical Chemistry (Moscow), Academy of Sciences, USSR.]

15. Relationships Pertaining to Transfer of Laboratory Results on Chromatographic Separation of Rare-Earth Elements to Large-Scale Plant Operation

"Chromatographic Separation of Mixtures of Rare-Elements on an Enlarged Scale," by M. M. Senyavin and F. D. Iozefovich, Redkozemel'nyye Elementy-Polucheniye, Analiz, Primeneniye (Rare-Earth Elements -- Production, Analysis, and Applications), Moscow, Academy of Sciences USSR, 1958, 331 pages (pp 91-99)

Work conducted at the Institute of Geochemistry and Analytical Chemistry is described. Complex-forming agents, including citric, tartaric, and acetic acids, ammonium carbonate, etc., were applied in this work. It was established that the USSR cation-exchange resin KU-2 gives the best results as far as chromatographic separation of mixtures of rare-earth elements is concerned. The scale of the experiments ranged from laboratory separations to separations on a pilot-plant and enlarged plant scale.

It was established that a necessary condition in the transfer from small laboratory columns to large power plant columns is preservation of the magnitude of the relative charge, i.e., of the ratio of the weight of the mixture being separated to the weight of the adsorbent. The decisive factor in chromatographic processes is not the linear velocity, but the volume velocity; one may increase, in accordance with this, the velocity of flow of the solution when the process is transferred from a small-scale laboratory column to a full-scale plant column. In all cases, it is preferable to use columns with a high ratio of the height to the diameter (however, this ratio should not be greater than 50).

The principal cost item in the chromatographic production of pure substances is labor. For this reason, it is advisable to carry out chromatographic separations on a large scale with a large number of columns and use automation to the greatest possible extent.

16. Separation of Rare-Earth Elements by the Method of Counter-Current Chromatography

"Separation of Rare-Earth Elements by the Method of Counter-Current Chromatography," by Ye. T. Cherneva, N. N. Tunitskiy, and V. V. Nekrasov, Physico-Chemical Institute imeni L. Ya. Karpov, Academy of Sciences USSR, Redkozemel'nyye Elementy-Polucheniye, Analiz, Premeneniye (Rare-Earth Elements -- Production, Analysis, and Applications), Moscow, Academy of Sciences USSR, 1958, 331 pages (pp 129-137)

Experimental work on the counter-current chromatographic separation of rare-earth elements is described. Information is given on the design of the equipment used. The theoretical aspects of the process are discussed. In the process of counter-current chromatographic separation, the solution containing the ions being separated and grains of the ion-exchange resin move counter-currently to each other (cf N. K. Hiester, A.E.C. Technical Report I, No COO-41 (rev) 1951; II, No COO-59, 1952; Industrial and Engineering Chemistry, Vol 45, No 11, Nov 53, p 2402)

Results obtained in the separation of didymium and of rare-earth elements of the yttrium subgroup are reported. The results of experiments on the separation of didymium are compared with theoretical values. The height of the column and the number of theoretical plates are calculated for the cases of inner diffusion and outer diffusion kinetics. (In the outer diffusion process, the velocity of exchange is limited by the diffusion of ions through the film of liquid which surrounds the grains of the adsorbent; in the inner diffusion process, the diffusion of ions within the grains of the adsorbent constitutes the limiting factor).

17. Electrochemical Methods for the Production of Ytterbium

"Comparative Evaluation of Electrochemical Methods for the Production of Ytterbium," by S. I. Sklyarenko, I. E. Krauze, and V. A. Morozova, Redkozemel'nyye Elementy-Polucheniye, Analiz, Primeneniye (Rare-Earth Elements -- Production, Analysis, and Applications), Moscow, Academy of Sciences USSR, 1958, 331 pages (pp 143-150)

The purpose of the investigation described was development of the most efficient method of separating ytterbium from rare-earth concentrates obtained in connection with the conversion of USSR ores and to make sure that ytterbium and its derivatives are produced in the pure state. Two electrolytic methods for the separation of ytterbium (electrolysis

of aqueous solutions of ytterbium salts in the presence of SO_4 ions and electrolytic reduction of ytterbium from acetate-citrate solutions at a mercury cathode were compared with the method of reducing ytterbium in acetate solutions with sodium amalgam.

On the basis of the results obtained in the separation of ytterbium from solutions containing mixtures of rare-earth elements, the following conclusions were made:

1. Electrolysis of sulfate solutions makes it possible to separate with facility the main quantity of ytterbium contained in the solution representing the initial concentrate; this method is rapid and cheap enough. Among the principal shortcomings of this method is the impossibility of separating all the ytterbium present and the relatively low yield due to considerable losses by reversion of the process.

2. Similar to the method of electrolysis of sulfate solutions, electrolysis of acetate-citrate solutions makes it possible to obtain spectrally pure ytterbium. The shortcomings of this method comprise the high cost due to the high price of potassium citrate, the difficulty of separating the rare-earth elements quantitatively from the mother liquid, and the impossibility of separating all the ytterbium present.

3. Reduction with sodium amalgam of the ytterbium contained in acetate solutions is the only method which makes it possible to separate the total quantity of ytterbium present in a mixture of rare-earth elements. To achieve complete separation, small quantities of iron or samarium salts must be added to the solution. The method is cheap and rapid. By using this method, one can obtain, in addition to spectrally pure ytterbium, spectrally pure thulium and lutecium. One of the shortcomings of the method is the difficulty of designing suitable equipment in which the separation is to be carried out.

18. An X-ray Spectroscopic Method for Control of Industrial Production of Individual Rare-Earth Elements

"Application of X-ray Spectroscopic Analysis for the Control of the Industrial Process of Producing Individual Rare-Earth Elements," by E. Ye. Vaynshteyn, I. F. Shtauberg, and A. T. Mosal'skiy, Institute of Geochemistry and Analytical Chemistry imeni V. I. Vernadskiy, Academy of Sciences USSR, Redkozemel'nyye Elementy-Polucheniye, Analiz, Premeneniye (Rare-Earth Elements -- Production Analysis, and Applications), Moscow, Academy of Sciences USSR, 1958, 331 pages (pp 217-238)

The methods, equipment, and auxiliary appliances are described which were used and developed by the authors in connection with application of the X-ray spectroscopic method of analysis for the control of

industrial production of individual rare-earth elements. Improvements in the technique of conducting analyses by this method made it possible to speed up control considerably and to carry out simultaneously quantitative determination of all 15 rare-earth elements in mixtures by the method of interpolation using standards. A precision of 15-20% (relative) is attained when the procedures described are applied.

19. Spectrochemical Determination of Gadolinium, Europium, and Samarium in Beryllium

"Spectrochemical Determination of Gd, Eu, and Sm in Nuclear Materials; Part 1 -- The Principle of the Method and Its Application in the Analysis of Beryllium," by A. N. Zaydel', N. I. Kaliteyevskiy, and A. N. Razumovskiy, Scientific Research Physics Institute, Leningrad State University, Redkozemel'nyye Elementy -- Polucheniye, Analiz, Primeneniye, (Rare-Earth Elements -- Production, Analysis, and Applications), Moscow, Academy of Sciences USSR, 1958, 331 pp (pp 239-250)

Methods for the concentration of rare-earth elements from Be and a procedure for the spectrographic analysis of the concentrates which has been developed by the authors are described in detail. Application of the method in question for the analysis of the gadolinium, europium, and samarium content in beryllium is described.

20. Determination of Gadolinium, Europium, and Samarium in Thorium and Uranium

"Spectrochemical Determination of Gd, Eu, and Sm in Nuclear Materials; Part 2 -- Analysis of Thorium and Uranium," by A. N. Zaydel', N. I. Kaliteyedskiy, A. N. Razumovskiy, and P. P. Yakimova, Scientific Research Physics Institute, Leningrad State University, Redkozemel'nyye Elementy-Polucheniye, Analiz, Primeneniye (Rare-Earth Elements -- Production, Analysis, and Applications), Moscow, Academy of Sciences USSR, 1958, 331 pp (pp 251-257)

Procedures for the separation and concentration of rare-earth elements from thorium and uranium are described, as well as the results obtained by the application of the authors' method of spectrographic analysis to determine gadolinium, europium, and samarium.

21. Spectrochemical Determination of Gadolinium in Zirconium and Bismuth

"Spectrochemical Determination of Gd, Eu, and Sm in Nuclear Materials; Part 3 -- Analysis of Zirconium and Bismuth for Gadolinium," by A. N. Zaydel' and A. A. Lipovskiy, Physico-Chemical Institute, Leningrad State University, Redkozemel'-nyye Elementy-Polucheniye, Analiz, Primeneniye (Rare-Earth Elements -- Production, Analysis, and Applications), Moscow, Academy of Sciences USSR, 1958, 331 pp (pp 258-265)

Methods for the separation of rare-earth elements from zirconium and bismuth are described, as well as the determination of gadolinium in these elements by the spectrographic method developed by the authors. It is pointed out that bismuth can be used as a reactor coolant; for that reason, it is important to develop a method for the determination of the content in it of rare-earth elements with high cross-section of thermal neutron capture.

Organic Chemistry

22. Arbuzov Reaction of C-phosphinyl-P, P-diaryloxyisophosphazoroyls

"C-phosphinyl-P, P-diaryloxyisophosphazoaroyls," by G. I. Derkach and A. V. Kirsanov, Institute of Organic Chemistry of the Academy of Sciences UkSSR; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 6, Jun 59, pp 1815-1818

C-chloro-P, P-diaryloxyisophosphazoacyls of the type ArCCl = NPO (OAr') are chlorides of iminocarboxylic acids, i.e., analogs of the acid chlorides of carboxylic acids. The authors were interested in learning whether this analogy would hold for the Arbuzov reaction, i.e., whether C-chloro P, P-diaryloxyisophosphazoacyls would react with esters of phosphorous acid analogously to acid chlorides of carboxylic acids, which yield esters of alpha-ketophosphinic acids upon reacting with phosphorous acid esters.

The experiments did show that C-chloro-P, P-diaryloxyisophosphazocyls very readily enter into Arbuzov reaction, even at -15°C, with the evolution of a great quantity of heat and the formation of the corresponding C-phosphinyl-P, P-diaryloxyisophosphazoaroyls (phosphinyl is a radical of the structure H_2PO-), according to the over-all equation:

$$ArC{=}NPO(OAr')_2 + P(OAlk)RR' \longrightarrow AlkCl + ArC(OPRR'){=}NPO(OAr')_2$$

The reaction takes place equally easily with triethylphosphite and the methyl and ethyl esters of phenylphosphinous and diphenylphosphinous acids.

Nine C-phosphinyl-P, P-diaryloxyisophosphazoaroyls were prepared. The analytical data, appearance, solubilities, melting points, and other properties are listed in a table.

23. Synthesis and Study of Derivatives of m- and p-Benzenedisulfonic Acids

"Derivatives of m- and p-Benzenedisulfonic Acids," by A. V. Kirsanov and N. A. Kirsanova, Institute of Organic Chemistry, Academy of Sciences UkSSR; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 6, Jun 59, pp 1802-1813

Although benzenedisulfonic acids have been known for over 80 years, many of their simplest derivatives have not been obtained up to now. Not one phosphorus-containing derivative of these acids has been obtained, although such compounds are of interest, not only as new substances, but also as possible insecticides. These derivatives may also be valuable initial materials for new types of high-molecular compounds.

The aim of this work was to prepare several simple derivatives of m- and p-benzenedisulfonic acids and m, m'-diphenylsulfonedisulfonic acid and to study their properties.

The methyl and ethyl esters of m- and p-benzenedisulfonic acids and of m, m'-diphenylsulfonedisulfonic acid were prepared. The methyl esters of m- and p-benenedisulfonic acids were shown to occupy an intermediate position between the methyl esters of arylsulfonic acids and the methyl esters of nitroarylsulfonic acids, as far as their alkylating capacity is concerned.

The monamide-monochloride of p-benzenedisulfonic acid and a number of N-alkylated amides of m- and p-benzenedisulfonic acids were prepared.

The phosphazo-reaction was carried out with diamides of m- and p-benzenedisulfonic acids. As a result, there were obtained the m- and p-bistrichlorophosphazosulfonephenylenes. Acid tetrachlorides of m- and p-phenylenebisulfoneamidophosphoric acids, m- and p-bistrialkoxy- and bistriphenoxyphosphazosulfonephenylenes, and the tetra-esters of m- and p-phenylenebis-sulfoneamidophosphoric acids were prepared from them. Physical characteristics of the synthesized compounds are listed in five tables.

24. Reactions of PCl_5 With N-chloro-derivatives of Arylsulfonamides

"The Reactions of PCl_5 With the N-chloro-derivatives of Arylsulfonamides," by Ye. S. Levchenko and A. V. Kirsanov, Institute of Organic Chemistry, Academy of Sciences UkSSR; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 6, Jun 59, pp 1813-14

The reactions of PCl_5 with the sodium salts of N-chloramides of sulfonic acids and with the N,N-dichloramides of sulfonic acids proceed almost quantitatively with the formation of trichlorophosphazosulfonearyls and free chlorine.

In the author's opinion, the formation of phosphazo-compounds is greatly favored, but in a majority of cases, this preferential course of the reaction is disguised by rearrangement of the P = N bond into the still more favorable P = O bond.

25. Formation of Esters of Alkylamidophosphonothioformic Acid

"The Addition of Dialkylphosphorous Acids to Alkylisothiocyanate," by K. A. Petrov and A. A. Neymysheva; Leningrad, Zhurnal Obshchey Khimii, Vol 29, No 6, Jun 59, pp 1819-1821

Dialkylphosphites add readily to many substances which contain multiple carbon-carbon, carbon-nitrogen, and carbon-oxygen bonds to form a variety of organophosphorus compounds. According to the authors this method of synthesizing organophosphorus compounds, first proposed by Pudovik (A. N. Pudovik, Usp. Khim., 23, 547 (1953)) has an advantage over the Michaelis-Beeker and Arbuzov reactions and can be used with success in synthetic practice.

In this work, the authors have added dialkylphosphites to alkylisothiocyanates to form the esters of alkylamidophosphonoformic acid

$$(RO)_2POH + RNCS \xrightarrow{RONa} \begin{matrix} RO \\ RO \end{matrix}\!\!>\!P\!-\!C\!<\!\begin{matrix} S \\ O \\ NHR \end{matrix}$$

The reaction takes place in the presence of sodium alcoholate with the evolution of heat. Continuation of heating and the temperature conditions maintained during the reaction have a decisive effect on the yield of the prepared product. The ester of alkylamidophosphonoformic acid was obtained in excellent yield after heating up to 110° for 2-2.5 hours.

26. Toxicity Data on Gamma-hexachlorocyclohexane Presented

"Experimental Data for the Determination of the Toxicity of the Gamma-isomer of Hexachlorocyclohexane and Its Standardization in Foods," by Ye. A. Antonovich, Vopr. Pitaniya, 1958, 17, No 6, 54-59 (from Referativnyy Zhurnal -- Khimiya, No 12, 25 Jun 59, Abstract No 43547 by L. Vol'fson)

The toxicity of technical 98% gamma-hexachlorocyclohexane (I) in powder form and in oil solutions orally fed to warm-blooded animals was studied. Cats and dogs appeared to be most sensitive to the action of I. Single dose of I causes a toxic effect in these animals; the minimum LD (Lethal Dose) for cats and young dogs is 25 mg/kg; and for mice and rats, 50 mg/kg. The LD_{50} for mice and rats amounts to 75 and 100 mg/kg, respectively; the LD_{100} for mice amounted to 200 mg/kg, and for rats, 300 mg/kg. The lowest LD of I for cats in extended ("chronic") experiments was found to be 4-5 mg/kg; a toxic effect occurred at 3 mg/kg, but there was a threshold effect already at 2 mg/kg. The cumulative action of I is less pronounced than that of other chloro-organic insecticides. I affects the nervous system, disturbs the functions of the liver and kidney, and influences the immunobiological reactivity and composition of the blood. Potatoes grown in soil treated with a 2.5% dust of I (100-200 kg/hectare) produce an insignificant change in organoleptic properties. The residual quantity of I in them was ≤ 2.3 mg/kg. The tolerance limit of I in foods should be ≤ 2.5 mg/kg.

27. Polymerization of Hexafluoro-1.3-butadiene

"Polymerization of Hexafluoro-1.3-butadiene," by V. V. Korshak, A. M. Polyakova, and M. D. Suchkova, Institute of Organoelemental Compounds, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR-Otdeleniye Khimicheskikh Nauk, No 6, Jun 59, pp 1111-1115

The polymerization of hexafluoro-1.3-butadiene under pressure and in the presence of various initiators was investigated. Diethylperoxydicarbonate was found to be the most effective initiator for the polymerization of this compound.

The dependence of the rate of polymerization on the nature of the initiator, temperature, and pressure was shown. The thermomechanical properties of the obtained polymers were determined and are described in the text.

28. Synthesis of Esters of Phosphoric and Thiophosphoric Acids Containing Heterocyclic Radicals

"Esters of Phosphoric and Thiophosphoric Acids Containing Heterocyclic Radicals. Report 2. Alkylation of Several Heterocyclic Compounds With Derivatives of Phosphoric and Thiophosphoric Acids," by B. A. Arbuzov and V. M. Zoroastrova, Chemical Institute imeni A. M. Butlerov, Kazan State University imeni V. I. Ul'yanov-Lenin; Moscow, Izvestiya Akademii Nauk SSSR-Otdeleniye Khimicheskikh Nauk, No 6, Jun 59, pp 1037-1040

The purpose of this work was to obtain compounds containing the thiazine, the benzoxazole and the benzothiazole groups and to study their biological properties.

The action of the acid chloride of dialkylphosphoric acid on the potassium salts of 4,6,6-trimethyl-6H-1,3-thiazine-2-thiol, 2-mercaptobenzoxazole, and 2-mercaptobenzothiazole yielded products alkylated in the thiol group instead of the esters of phosphoric acid expected by the authors.

The thiol alkylation products are also obtained in good yield by the action of trialkylphosphites on the disulfides of the above-mentioned heterocyclics.

The preparation and physical characteristics of the newly synthesized compounds are described in the text.

29. New Class of Organoboron Compounds

"Derivatives of 1,5-diborocyclo-octane," by B. M. Mikhaylov and F. B.Tutorskaya, Institute of Organic Chemistry imeni N. D. Zelenskiy, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR-Otdeleniye Khimicheskikh Nauk, No 6, Jun 59, pp 1127-30

Triallylboron reacts with triisobutylboron with the formation of a polymeric product. Alcohols react with the polymer to form 1,5-dialkoxy-1,5-diborocyclo-octanes. PCl_5 reacts with 1,5-dibutoxy-1,5-dicorocyclo-octane to yield 1,5-dichloro-1,5-diborocyclo-octane. This compound reacts with ethylamine with the formation of 1,5-di-(ethylamino)-1,5-diborocyclo-octane.

The detailed syntheses and physical characteristics of the above-mentioned compounds are described in the text.

Compounds of the 1,5-diborocyclo-octane series represent a new class of organoboron compounds.

30. Trialkylorthovanadates Synthesized

"Trialkylorthovanadates," by N. F. Orlov and M. G. Voronkov, Institute of the Chemistry of Silicates, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR-Otdeleniye Khimicheskikh Nauk, No 5,May 59, pp 933-934

Six isomeric butyl and amyl esters of orthovanadic acid were synthesized and are described. These esters were formed as a result of the reaction of vanadium pentoxide with alcohols realized under conditions of continuous azeotropic distillation of the water formed during the interaction.

The authors note that by reacting V_2O_5 with triorganosilanols under analogous conditions, the corresponding organosilicon esters -- tris (triorganosilyl)orthovanadates -- are formed.

31. Chinese Conduct Condensation of Methoxy-acetophenones in Process of Aureomycin Synthesis

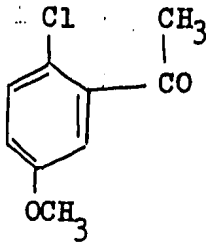
"Stobbe Condensation of 2-Chloro-5-methoxy-acetophenone and of 3-Methoxy-acetophenone," by Huang Yao-tseng (黄 耀 曾) Ni Ta-nan (倪 大 男), and T'ang Ju-jung (湯 如 溶), Institute of Organic Chemistry, Academia Sinica; Peiping, K'o-hsueh T'ung-pao (Scientia), No 13, 11 Jul 59, pp 428-429

The sequence of reactions involved and the intermediate products obtained in the Stobbe condensation of 2-chloro-5-methoxy-acetophenone (I) and of 3-methoxy-acetophenone are described in the main part of this article. The work reportedly was completed in May 1958.

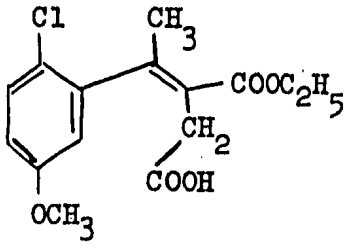
According to the authors, the Stobbe condensation of (I) is the initial step in their proposed route for the synthesis of aureomycin and anhydro-aureomycin. This route they outline as follows:

The cyclization of the condensation product (II) is expected to give a beta-naphthyl formic acid derivative which would be reduced to the aldehyde (III). Another Stobbe condensation reaction, followed by hydrogenation and cyclization is expected to yield (IV). Subsequently, the synthesis of an A ring would yield des-dimethylamino-deshydroxyl anhydro-aureomycin (V).

As for the synthesis of aureomycin, the authors propose first to subject (II) to "internal esterification and then to ring cleavage" in order to obtain the alkoxy acid (VI). Finally, by following the above-mentioned steps, they expect to get aureomycin.



(I)



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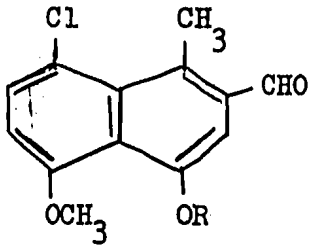

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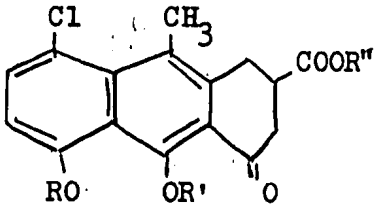
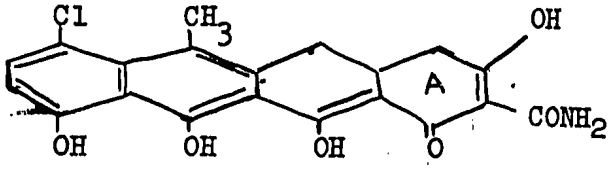


(IV)



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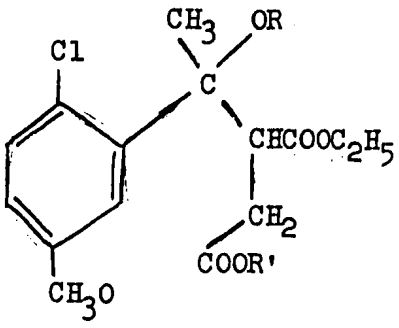


(VI)

[SIR Note: The authors' references consist of earlier papers on research related to tetracyclines, by Huang Yao-tseng et al, which were published with English summaries in 1958 issues of the Peiping Hua-hsueh Hsueh-pao (Acta Chimca Sinica). Titles include the following:

"Experiments on the Synthesis of Substances Related to Tetracyclines

I. Synthesis of 9-Hydroxydecalin-1,3-Dione

II. Synthesis of 2,4,6,-Trihydroxy-5-Keto-5,12-Dihydronaphthacene

III. Synthesis of 1,4,4a,5,12,12a-Hexahydro-6-Hydroxy-11-Methyl-5,12-Diketonaphthacene

IV. Preparation of 4-Methyl-8-Methoxynaphthol-[1] and 1,8-Dimethoxy-4-methyl-naphthoic Acid-[2], Two Useful Intermediates for Desdimethylaminotetrarubein Synthesis

V. Synthesis of 3,5-Dimethoxy-4-Carboxyphthalic Anhydride"

No II and III were presented at the August 1956 meeting of the Chinese Chemical Society. No V was received for publication in September 1957.]

Physical Chemistry

32. Work at the Ural Polytechnic Institute on the Application of Physical Methods in Chemical Research

"At the Physico-Technical Faculty of the Ural Polytechnic Institute," by P. K.; Moscow, Atomnaya Energiya, Vol 7, No 1, Jul 59, pp 78-79

At the Physico-Technical Faculty of the Ural Polytechnic Institute imeni S. M. Kirov (S. P. Raspopin, Dean), scientific research is being conducted in different fields of physics.

At the chair headed by D. A. Borodayev, a betatron with an energy of electrons amounting to 15 Mev was started in December 1958. Work on the effects of radiation on the living organism and investigation of new drugs is planned at this chair. Mice, rats, and rabbits will be used in the work in question. Investigation of the properties of irradiated semiconductors is also contemplated. The assembly of a cyclotron with a rated energy of α-particles amounting to 27 Mev has been completed. The availability of this cyclotron will contribute to the advancement of work in radiobiology, radiation chemistry, solid state physics, investigation of nuclear reactions at intermediate energies, and neutron dosimetry.

The Chair of Theoretical Physics (Chief, Prof G. V. Skrotskiy), jointly with the Chair of Organic Chemistry (Chief, Prof I. Ya. Postovskiy), is conducting research on the structure of organic radicals by the method of electronic paramagnetic resonance. Attempts are being made to correlate the reactivity of radicals with their physical properties. Two installations are being assembled: for the investigation of the superfine structure of the resonance lines of organic radicals in the range of millimeter wave-lengths and for the analysis of the isotope composition of substances by the method of nuclear resonance. By using an EM-3 electron microscope, methods are being developed for the investigation of the structure of ferrites, research is being done on the formation and growth of crystals, and investigations are being conducted on the structure of films consisting of copper sulfide, nickel sulfide, etc. A variant of the sighting (aiming) method has been developed. Theoretical research is being conducted on the width of lines of paramagnetic resonance and the properties of systems containing many interacting particles.

33. Intensities of Infrared Spectra of Methylhalides

"Theory of the Intensities of Infrared Spectra of Methylhalides CH_3Cl, CH_3Br, CH_3I, and their Deuterosubstitutes," by L. M. Sverdlov; Moscow, Optika i Spektroskopiya, Vol 6, No 6, Jun 59, pp 729-744

The intensities of infrared bands and the electron-optical parameters were computed for methylhalide molecules CH_3Cl, CH_3Br, CH_3I, and CD_3J in the first approximation of the valency-optical scheme. Good agreement between the computated and the observed intensities was obtained. It has been shown that the negative dipole end μ_{CH} is located on the C atom and the positive end on the H atom. With an increase in the bond lengths of C-H and C-Z, the dipole moments decrease.

34. Hydrogen Bond in Mercaptans

"Spectroscopic Investigation of Hydrogen Bond in Mercapans," by M. O. Bulanin, G. S. Denisov, and R. A. Pushkina; Moscow, Optika i Spektroskopiya, Vol 6, No 6, Jun 59, pp 754-759

Infrared absorption spectra of liquid C_2H_5SH and C_3H_3SH and their solutions in CCl_4 were investigated within the range of 2300 to 2700 cm^{-1}. On the basis of frequency and intensity changes in the band of valency oscillations of the SH group, the existence of a bond of the S-H...S type in aliphatic mercaptans is concluded. The comparison of spectra of solutions of C_3H_7SH in $CHCl_3$ and $(C_3H_7)_2S$ makes it possible to observe spectroscopic disturbances of the SH group in hydrogen and sulfur. The spectra of solutions of C_3H_7SH in acetone, dioxane, and triethylamine have been obtained.

35. Influence of Ultraviolet Radiation on Phosphorescence

"Influence of the Ultraviolet Irradiation and Temperature on the Luminescence of Phosphors CdI_2-$MnCl_2$, CdI_2-$MnCl_2$-PbI_2," by G. P. Balin; Moscow, Optika i Spektroskopiya, Vol 6, No 6, Jun 59, pp 760-763

The temperature quenching of phosphors with laminar structure of the crystalline lattice, having as base CdI_2 and as activators $MnCl_2$, PbI_2 at various concentrations, is analyzed. The darkening of phosphor produced by ultraviolet irradiation of wavelength 365 mμ and simultaneous action of ultraviolet radiation and temperature is also studied. The investigations and the results are applicable to the red band (675 mμ).

Radiation Chemistry

36. China's Reactor Used in Experimental Polymerization of Styrene

"Radiation Polymerization of Styrene in a Reactor," by Hu Wen-ch'eng (胡 文 潋) and Chang Shih-tse (張 士 澤), Research Institute of the Ministry of Chemical Industry, Peiping; Peiping, K'o-hsueh T'ung-pao (Scientia), No 13, 11 Jul 59, pp 427

This item reports the use of China's first reactor in the experimental polymerization of styrene by irradiation in the absence, as well as in the presence, of solvents. The polymers obtained by applying different combinations of neutron flux intensity and temperature are subjected to comparative analysis.

It was found that the radiation polymer produced by a flux of 3.75×10^{15} neutrons/cm^2 and within a temperature range of 30-50 degrees centigrade was the best. Its molecular weight after irradiation at 30 degrees centigrade was 1.34×10^5, which, according to the authors, is about one order of magnitude higher than that of styrene polymers obtained by chemical means. Its softening point was 120 degree centigrade, 30-40 degrees higher than that of the chemical polymer obtained under corresponding conditions.

The authors state that Nikitina and Bagdasar'yan, Shapiro, and Medvedev, each working independently of the others, found that a solvent such as carbon tetrachloride or acetone had a favorable effect on the radiation polymerization of styrene. However, on the basis of their own experimental results, the authors conclude that when irradiation is carried out in a reactor, a solvent is not necessary to produce styrene polymers of high purity and quality.

[For additional information on radiation chemistry, see also under analytical chemistry.]

III. ELECTRONICS

Automation and Computers

37. Pneumatic Analog Computer

"Pneumatic Analog Computer," by N. D. Lanin; Moscow, Priborostroyeniye, No 7, Jul 59, pp 3-6

The Central Scientific Research Institute of Complex Automation (TsNIIKA) has developed a pneumatic analog computer, designated PVM-1, for solution of linear differential equations with constant factors, as well as simulation of systems of automatic controls, for both actual time scale and for modified time scale. The adder-accumulator and integrator are the basic elements of the computer. A pressure of 0.5 atm is taken as the zero level, so that a pressure above this figure represents a positive value. Pneumatic oscilloscopes or oscillographs can be connected to the output of the computer for visual observation of the examined process.

A third order differential equation was solved on this analog computer with an accuracy of 2.5%. The PVM-1 analog computer is simple in construction and reliable in operation; it can be applied to problems of automatic control of a wide variety of industrial processes.

38. New Computer Mentioned

"New High-Speed Automatic Computer," (unsigned article); Moscow, Priroda, No 7, Jul 59, p 107

A universal electronic computer has been produced by Soviet scientists which surpasses all existing Russian and foreign series computers by its high speed. The efficiency of the logical structure, development of the system of operating and exterior units, and the high degree of reliability of performance make possible solution of the overwhelming majority of the contemporary complicated problems encountered in science and technology. The development of the computer was performed at the level of contemporary achievements of electronics and opens a significant perspective in the further development of computers and control machines. The chief designer of this new computer was Academician S. A. Lebedev. The state commission, under the chairmanship of Academician M. V. Keldysh, recently subjected a research model to a technical trial and analysis and recommended it be applied to series production.

Indicating the enormity or the task, the presidium of the Academy of Sciences of the USSR expressed gratitude and sent dispatches of reward to the scientific workers, designers, and engineers of the Institute of Precision Mechanics and Computer Engineering of the Academy of Sciences, USSR, the Scientific Research Institute of Electronic Computers of the State Committee on Radioelectronics of the Council of Ministers of the USSR, and the Moscow SAM (computing machines) Plant (Moskovskiy Zavod schetno-analiticheskikh mashin).

39. Circuit Analog for the Product of Multidimensional Vectors

"Concerning One More Circuit-Analog of the Scalar Product of Manydimensional Vectors," by G. Ye. Pukhov; Novocherkassk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Elektromekhanika, No 5, May 1959, pp 12-13

In the earlier published work of the author, "Electric Circuit-Analog of the Scalar Product of Many-Dimensional Vectors," IVUZ, Elektromekhanika, No 1, 1959, an electric circuit-analog of the expression

$$a_1 x_1 + \ldots a_n x = b$$

was considered, in which the quantities $x_1 \ldots, x_n$ and b were represented by voltages and $a_1, \ldots, a_n$ by the conductivities of two n-ray stars.

It is proved that a still simpler electric circuit consisting of parallelly connected circuit dividers may be employed as a circuit-analog of (1).

40. Problems of Hydromechanics Solved on Analog Computer

"Application of Electronic Analog Computers to the Solution of Several Problems of Hydromechanics," by L. P. Fel'dman; Novocherkassk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Elektromekhanika, No 5, May 59, pp 3-11

The author recalls the well-known relation between the movement of a compressible fluid in pipes and the propagation of an electric current along a long line with the distributed parameters capacity, self-inductance, and ohm resistance. The differential equations of a one-dimensional flow of a compressible fluid have the form

$$\begin{cases} -\frac{\partial p}{\partial x} = \rho\left(\frac{\partial v}{\partial t} + \alpha v\right), \\ -\frac{\partial p}{\partial t} = E\frac{\partial v}{\partial x}. \end{cases} \qquad (1)$$

Here p is the pressure; v is the velocity of the fluid in the considered section of pipe; ρ is the density of the fluid; E is the reduced modulus of elasticity, taking into account the compressibility of the fluid and the elasticity of the sections of pipe; and α is the coefficient of resistance.

The differential equations describing the electromagnetic processes in a long line have an analogous form (if the leakage currents are neglected); namely;

$$\begin{cases} -\frac{\partial u}{\partial x} = L\frac{\partial i}{\partial t} + ri, \\ -\frac{\partial u}{\partial t} = \frac{1}{C}\frac{\partial i}{\partial x} \end{cases} \qquad (1a)$$

where L, r, and C are relative to a unit length of line.

From comparison of the equations (1) and (1a), it is possible to conclude which are corresponding quantities. The correspondence is given in the table below.

Trickling fluid	v	p	E	$\alpha\rho$	ρ
Electric line	i	u	1/C	r	L

The same solutions are obtained for both problems for boundary and initial conditions of the same form.

The analogies, expressed by the equations (1) and (1a), are generally employed in the following manner: the long line, equivalent to a pipeline with flowing fluid, is simulated by a little chain of quadripoles. In this manner, a section of pipeline of length ℓ_k is replaced by the corresponding quadripole.

For universality of the model, consisting of chains of quadripoles, it is necessary to be able to vary L, r, and C in wide ranges. The processes, in the system proceed sufficiently quickly. These circumstances are obvious and are in the way for a wide application in hydromechanics of these modeling arrangements.

The possibility of another means for the one-dimensional flow of a fluid is indicated. The replacement of a long electric line or pipeline with a system of quadripoles formally corresponds to the transition from the telegraph equations (1) or (1a) to the system of ordinary differential equations (2) or (2a), respectively.

$$-\frac{p_{k+1}-p_k}{\ell_k}=\rho\frac{dv_k}{dt}+\alpha\rho v_k, \qquad (2)$$

$$-\frac{E\,v_{k+1}-v_k}{\ell_k}=\frac{dp_{k+1}}{dt},$$

$$-\frac{u_{k+1}-u_1}{\ell_k}=L\frac{di_k}{dt}+ri_k$$

$$-\frac{i_{k+1}-i_k}{\ell_k}=C\frac{du_{k+1}}{dt}, \qquad (2a)$$

where the index k corresponds to the number of the link on which the pipeline or electric line is broken. It is possible to model the equations (2) or (2a) on electronic, analog computers. (A block schematic of the equation (2) is given.) Modeling on analog computers presents a series of advantages in comparison with the direct physical modeling of chains of quadripoles. The circuit on a computer is formed from standard blocks, enabling easy establishment and fluctuation of the necessary quantities. Control and fixation of the solution are possible by various methods on a computer, as well as by visual observation of the process.

The problem concerning the one-dimensional flow of a compressible fluid in a linear arrangement is considered. If the resistance to the motion of a fluid is a quadratic function of the velocity or has a nonlinearity of another form, then this does not encumber the solution of the problem on an analog computer. During the modeling of the problem directly by a physical chain of quadripoles, this circumstance presents substantial difficulties.

The scope of problems which may be solved on analog machines is very wide. As an example, solution on an analog computer of the problem concerning hydraulic collision in a horizontal pipeline is considered.

41. Computer Code Rings

"Code Rings as a Means of Representing Code Ensemble," by A. N. Radchenko; Moscow, Avtomatika i Telemekhanika, No 7, Jul 59, pp 970-977

The code ensemble can be represented either in a tabular form or, for purposes of greater compactness, in the form of a code ring. It would require 160 code letters to record the complete ensemble of a five-digit binary code in the tabular form, while only 32 code letters would be needed to effect the same records with the aid of code rings. Thus, the code ring system requires only one fifth of the number of elements at the coding device, compared to the tabular representation system.

There are two types of code rings: the A type code ring contains the whole code ensemble in an explicit form, and the B type code ring contains only part of the code ensemble in the explicit form, while the deficient part of the code ensemble can be found by multiplying the initial rings by the operator of cyclic substitution.

The ring method of code ensemble representation becomes more effective as the number of digits in the code increases.

42. Analog-to-Digital Converter

"Converter of Continuous Electric Values Into Digital Form," by A. V. Kalyayev, D. N. Panov, and M. M. Sukhomlinov; Novocherkassk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Elektomekhanika, No 6, Jun 59, pp 25-33

The systems of automatic controls of complex industrial processes are beginning to utilize more of the special digital computers in which the continuous information data are changed into numerical form with the aid of an analog-to-digital converter.

The article describes a circuit developed by the authors, which can perform the following operations: convert continuous electric quantities (current or voltage) into discrete binary code, perform discrete integration of continuous values and deliver at the output information in numerical form, carry out discrete differentiation of continuous values and provide the output in the form of a numerical derivative, and perform functional conversion of continuous values into discrete binary code.

The suggested circuit consists of a detector which converts the continuous values into its modulus, the converter of modulus into sequence of pulses, reversible counter, pulse generator, electron relay, and a delay line.

The analog-to-digital converter based on the described circuit is very simple in construction, yet flexible and convenient for automatic controls.

Components

43. Contactless Magnetic Relay

"Calculation of Contactless Magnetic Relay Characteristics," by P. A. Varlashkin, Moscow Power Engineering Institute; Moscow, Nauchnyye Doklady Vysshey Shkoly, Elektromekhanika i Avtomatika, No 4, 1958, pp 108-120

Contactless magnetic relays are now widely used in systems for automatic control of industrial processes because of certain advantages they possess over the other types of relays (higher sensitivity, longer service life, explosion- and fireproof characteristics, simplicity of construction).

In this work, efforts are made to determine the maximum sensitivity and other parameters of contactless magnetic relays for various operating conditions. The sensitivity of a contactless magnetic relay is characterized by the least value of magnetic intensity of the controlling field and the corresponding magnitude of the feedback factor, at which the desired rated load current is attained. Such a relay can be utilized in various control devices and, according to function performed, operate under conditions of rising current at the output (similar to an electromechanical relay with normally disconnected points) or under conditions of decreasing current (similar to a relay with normally closed contacts).

To determine the maximum sensitivity of contactless magnetic relays, the following characteristic curves illustrating the relationship between various variables were taken: dependence of intensity of controlling magnetic field on the magnitude of feedback factor; dependence of feedback factor on optimum value of field intensity; and dependence of maximum sensitivity of relay on the optimum value of ac field intensity.

The information contained in these characteristic curves as to the values of feedback factor, intensity of magnetic field, and magnitude of control signal is useful in the design of highly sensitive contactless magnetic relays.

Materials

44. A USSR Conference on the Growth of Crystals

"Investigation of the Growth of Crystals," by N. F. Sheftal', Doctor of Geologico-Mineralogical Sciences; Moscow, Vestnik Akademii Nauk SSSR, Vol 29, No 6, Jun 59, pp 120-121

"The growing of new kinds of crystals which are superior with regard to their properties, size, shape, and uniformity of the characteristics of individual crystals is of exceptional importance for the solution of fundamental problems in the most diverse fields of technology, including power generation, radioelectronics, automatics and telemechanics, optics, construction of machines and instruments, and the treatment of materials. In addition to this, research on the growth of crystals contributes to progress in crystal physics, crystal chemistry, physical chemistry, the science of metals, and minerology. In other words, work in this field is of very great importance, both from the practical and from the theoretical standpoint.

"The second All-Union Conference on the Growth of Crystals was held at the Institute of Crystallography, Academy of Sciences USSR, from 23 March to 1 April 1959. More than 600 scientists from 24 cities of the Soviet Union, and visitors from Bulgaria, Hungary, the GDR, China, Poland, and Czechoslovakia participated in the conference. Ninety-six reports were presented, among them 12 by non-USSR participants. Two discussions were conducted: one on the theory of crystal growth and another on the formation of crystals under conditions actually encountered and methods for growing single crystals.

"For all practical purposes, the conference was an international meeting of crystallographers of socialistic countries. The work of the conference was aimed at advancing, by every possible means, activities in the USSR and in the Peoples' Democracies which have a bearing on research in the fields of the growth of crystals and methods of growing single crystals. The basic idea emphasized by Soviet scientists was strengthening of the bond between theory and practical applications. Emphasis on this idea distinguished this meeting from conferences on the same subject conducted in 1949 in England and in 1958 in the USA. An important problem on which the participants at the conference concentrated was improvement of methods for growing single crystals.

"The following problems of cardinal importance were discussed in reports presented at the meeting:

"Growing of single crystals of metals and crystallization of metal ingots; growing of scintillator and optical single crystals, soluble piezoelectric and siegnettoelectric crystals, ferrites and siegnettoelectrics of the barium titanate type, as well as of crystals with a perovskite structure and of some semiconductor single crystals; dislocations in crystals of germanium and silicon and dependence of their formation on the conditions of crystallization; hydrothermal synthesis of quartz, carbonates, and sulfides of lead and zinc; methods for crystallization at ultrahigh pressures; and methods for the direct production from melts of single crystals of the required shape (tubes, plates, etc.). Special problems also discussed included those pertaining to the frequency of the formation of crystallization nuclei, the effect of impurities on crystallization, specific phenomena related to crystallization from solutions, the growth of thin films and tendrils, spiral growth and dislocation, and crystallization of ice.

"The authors of the reports presented extensive data which made it possible to familiarize oneself with experimental and theoretical research on the growth of crystals and work on the artificial growing of single crystals conducted in the USSR and Czechoslovakia, the achievements of Bulgarian scientists in the field of the theory of crystal growth, the status of theoretical and practical investigations on crystal growth in Hungary, and individual investigations conducted by GDR scientists. Of particular interest for Soviet scientists was work on the molecular-kinetic theory of crystal growth, a field in which insufficient work is being done in the USSR.

"An exhibition of artificial crystals was held in connection with the conference. At this exhibition were shown excellent crystals of piezoelectric quartz and single crystals of metals grown in the USSR, synthetic precious stones produced in Czechoslovakia, etc.

"In a resolution passed by the conference, it was noted that considerable progress in experimental and theoretical work pertaining to the growing of artificial single crystals was attained in the USSR during recent years. At the same time, the extent of work done in this field so far does not satisfy the needs of the country. Investigations on the growth of crystals are not merely physical research: they also require the application of scientific data collected, experience acquired, and methods developed in research that have been conducted in the fields of chemistry, physical chemistry, mineralogy, and technology. In connection with this, the resolution pointed out that the best and most rapid way of expanding research in the field under consideration is formation of groups consisting of specialists in all the auxiliary fields mentioned.

"The conference devoted considerable attention to the matter of training scientific personnel, noting the necessity of increasing considerably admissions to aspirantships on crystal growth at the Institute of Crystallography. The training of specialists on crystal growth must be expanded and improved. This includes the training of aspirants at chairs of crystallography, crystal chemistry, and crystal physics of higher educational institutions of the country. Modern laboratories on the growing and investigation of crystals must be created at these chairs. The publication of Soviet and translated works on the growth of crystals and methods for the growing of crystals must be increased.

"The series industrial production of standard types of equipment for the growing of single crystals from solutions and melts, as well as for hydrothermal synthesis, must be organized.

"The resolution of the conference also pointed out the importance of increasing contacts with scientists of the People's Democracies and conducting work in cooperation with them."

45. A Device for Cutting and Drilling by Means of an Electron Ray

"News Items -- GDR" (unsigned item); Moscow, Atomnaya Energiya, Vol 7, No 1, Jul 59, p 89

At the Karl Zeiss Plant, a method has been developed for cutting and drilling quartz, germanium, and other materials by bombardment with an electron ray bundle. A device for working materials by this method has been designed. In appearance, the device resembles an electron microscope. It operates on a current of 10 milliamperes and a potential of 100 kilovolts. The electron bundle is controlled by means of a programming arrangement. The electron ray bundle can be focused on an area having a diameter of one micron. By using the device described, the material being worked can be cut without damaging the crystal structure or introducing any mechanical defects.

46. Application of Rare-Earth Elements in Phosphors

"Application of Rare-Earth Elements in the Chemistry of Phosphors," by V. L. Levshin, M. A. Konstantinova, and Z. A. Trapeznikova, Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR, Redkozemel'nyye Elementy-Polucheniye, Analiz, Primeneniye (Rare-Earth Elements -- Production, Analysis, and Applications), Moscow, Academy of Sciences USSR, 1958, 331 pp (pp 314-322)

The application of rare-earth elements in phosphors is reviewed on the basis of USSR and non-USSR work. The nature of the effect exerted by rare-earth elements in phosphors, the use of rare-earth elements in

fluorescent lamps, electron-ray phosphors containing rare-earth elements, and flash phosphors containing these elements are discussed in some detail. Uses of flash phosphors for the detection of infrared radiation and as sensitive elements in dosimeters for the detection of harmful penetrating radiation are described (the energy of short-wave radiation stored in these phosphors is released by infrared light). Work at the Physics Institute, Academy of Sciences USSR, is described, in which it was established that cerium glasses exhibit a high stability toward β-radiation (i.e., these glasses do not darken under the effect of β-radiation). Such glasses can be used as covers for different β-emitters, specifically phosphors with a permanent action. Ordinary glass or quartz glass containing cerium is sensitive to ultraviolet light, emitting blue luminescence on exposure to ultraviolet radiation. Since the luminescence emitted by Ce-activated glasses has a continuous spectrum, such glasses are superior to uranium-activated glass (which emits luminescense with a band spectrum) for quantitative spectrophotometry in the ultraviolet region. Glasses of this type are also used for visual observation of ultraviolet radiation.

Patents

47. Recent Soviet Patents in the Field of Electronics

"Class 2. Electrical Engineering," (unsigned article); Moscow, Byulleten' Izobreteniy, No 13, 1959, pp 18-24

Class $21a^1$, 503, No 120851., P. A. Kotov, Device for Evaluation of Telegraph Channel Quality.

Class $21a^1$, 36. No 120852. R. G. Varlamov. Device for Conversion of Low-Frequency Mechanical Oscillations From Reed Type Resonator Into Electrical Oscillations.

Class $21a^4$, 35_{12}, No 120853. V. I. Serebrov. Full-Wave Rectifier.

Class $21a^4$, 2905. No 120885. Yu. L. Simonov. Transistorized Circuit With Symmetrical Output for Balancing Amplifier.

Class $21a^4$, 35_{14}. No 120856. V. A. Pruzhanovskiy. Parametric Voltage Regulator.

Class 21c, 46. No 120858. Ye. A. Ivanov and A. A. Trigubovich. Electric Reactance Step-by-Step Motor.

Class 21c, 46_{05}, No 120859. D. V. Svecharnik, Device for Long-Distance Transmission of Linear Displacements.

Class 21c, 47_{01}. No 120860. V. Ya. Ovlasyuk and N. D. Sukhoprudskiy. Remote Control Method and Device for Executing It.

Class 21e, 37_{01}. No 120876. G. A. Vorob'yev. Device for Obtaining Steep Edge Pulses.

Class 21g, 30_{01}. No 120878. L. M. Al'pin. Device for Simulating Problems of Electrical Prospecting and Electrical Well Logging.

Radar

48. Frequency Modulated Radar

"Spectral Analysis of Frequency Modulated Radar Signals," by A. P. Zhukovskiy, Moscow Aviation Institute; Moscow, Nauchnyye Doklady Vysshey Shkoly, Radiotekhnika i Elektronika, No 4, 1958, pp 164-175

In radars utilizing continuous periodic frequency-modulated oscillations, the range determination is relative in character. The information about the range is contained in the detected envelope of the total input signal.

In the case of frequency-modulated radar detection of several targets, it is necessary to utilize spectral analysis, since the differentiation of reflected signals from different targets is based on the difference in beat frequencies. The simplest mode of frequency modulation is harmonic law modulation, which however, has some disadvantages. In multitarget radars, it is necessary to aim at a as narrow as possible beat spectrum band from each target, i.e., approximately a spectral line, difficult to attain with harmonic law modulation. However, symmetrical saw-tooth modulation and the nonsymmetrical saw-tooth modulation are quite suitable for multitarget range finding.

The nonsymmetrical saw-tooth modulation of a radar signal is especially valuable in the case of tracking one designated target, without interference from other close-by targets.

Wave Propagation

49. Transient Processes in Resonant Circuits

"Peculiarities of Transient Processes in Resonant Circuits During Phase Manipulation and Circuit Parameter Manipulation," by A. S. Vinitskiy and P. I. Yevdokimov; Moscow, Radiotekhnika, No 7, Jul 59, pp 19-28

The article aims to fill the gap of available information on the peculiarities of transient processes in resonant circuits during the phase manipulation of exciting oscillations and the manipulations of circuit parameters.

The experimental checking of the peculiarities of transient processes in an oscillatory circuit during manipulation of the phase of excitation voltage was carried out with the aid of a network incorporating an audio-frequency oscillator which supplied voltage to two tubes. The voltage to one of the tubes was supplied at a constant phase, while, to the other, the voltage phase was shifted by means of a voltage phase-shifting circuit. An electronic switch was used for alternate connection of the two tubes. An oscillograph was used to observe the voltage peaks of the two tubes. The resonant frequency of the circuit was chosen at 10 kc, and the switching rate at 40 and 100 per sec.

It was shown experimentally that for cases of small change in phase shift or the circuit parameters, the transient processes in both cases were practically identical.

50. Electromagnetic Wave Propagation in Long Conductors

"Determination of Wave-Propagation Constant in a Long Conductor," by S. P. Belousov and V. G. Yampol'skiy; Moscow, Radiotekhnika, No 7, Jul 59, pp 3-7

A simplified approximation method for calculation of phase velocity and wave attenuation for long-wave, short-wave, or microwave ranges in long conductors suspended above the ground is given. Such an approximation method for the solution of propagation constant does not require cumbersome calculation. Actual calculations were carried out for 2-mm wire suspended 2.5 m above the ground and for distances from 10 m to 3,000 m. Calculations were carried out for dry ground, for ground of medium conductivity, and for wet ground. The calculated values of the propagation constant were within 5 to 10% of the values actually measured.

IV. ENGINEERING

51. Improvement of Generator Protection

"Improvement in Selectivity of Generator Differential Protection by Introducing Auxiliary Resistors in Relay Circuits," by I. D. Kutyavin, L. V. Baginskiy, and A. S. Baginskaya, Tomsk Polytechnic Institute; Minsk, Izvestiya Vysshikh Uchebnykh Zavedeniy, Energetika, No 5, May 59, pp 10-15

Although a series of measures were taken to improve the differential protection selectivity, the number of relay improper operations remains still rather high. However, the differential protection selectivity can be substantially improved by introducing additional resistors in the relay circuits.

Up to the present time, the subject of the effect of various additional resistors on the magnitude of transient unbalance current has not been properly presented in the literature.

A mathematical expression was derived for calculation of the unbalance current, on the basis of which a series of curves were constructed. The theoretical calculations and experimental data have shown that the unbalance current can be limited very effectively by insertion of auxiliary resistors in the relay circuits.

To effect differential protection of generators, in the majority of cases, it is sufficient to connect in series with the relays a resistance of the order of 5 ohms.

52. Fast Method of Starting Steam Turbogenerator Unit

"Investigation of Starting a Uniflow Boiler-Turbine Unit With the Creep Method," by B. I. Shmukler and V. Ye. Shtefan; Moscow, Elektricheskiye Stantsii, No 7, Jul 59, pp 5-13

The conventional method for starting boiler-turbine units from the cold condition by applying superheated steam of rated pressure and temperature is both slow and uneconomical.

A method has been developed at the Moscow Branch of the Central Scientific Research Institute for Boiler and Turbines to speed up the process of starting uniflow boiler-turbine units. This fast method of starting boiler-turbine units was called the "creep" method and consisted in admitting the steam long before it had attained the rated conditions of pressure and temperature, first to the pipe line and then to the turbine.

This method of starting will be used on the new boiler-turbine units (PVK-200, PVK-150), which will be installed in 1959. The schedule for starting a boiler-turbine unit from cold condition was as follows: time from the start of boiler firing to the beginning of pipe line heating was 35 min, heating time of pipe line was 27 min, time from the starting of turbine until synchronization of the generator was 70 min, and time from switching-on of the generator till it assumed the full load was 170 min. Thus, the total time needed with this method to start a boiler-turbine unit from cold state was 5 hr 2 min.

The experiment has proven the feasibility of this method for fast starting of boiler-turbine units with uniflow boilers.

53. Chemical Methods of Water Demineralization

"Treatment of Feed Water for Uniflow Boilers," by S. M. Gurvich and F. G. Prokhorov; Moscow, Teploenergetika, No 8, Aug 59, pp 48-51

Although the practicability of chemical demineralization of boiler feed water has been demonstrated by a 3-year experimental run, the actual application of chemical demineralization on a wide scale is not expected before 1961. Such a delay in the introduction of chemical demineralization of feed water is due to the deficiency of properly designed compound-action filters and the lack of sufficient quantities of proper ion-exchange reagents.

To initiate the extensive application of chemical demineralization at steam generating plants, it would be necessary to considerably increase the production of cation-exchange reagents KU-2 and the anion-exchange reagents AN-2F and EDE-10P, as well as to improve substantially the quality of these reagents.

54. Cost of Factory Building Construction in USSR

"Means for Improving Engineering Standards and Lowering the Cost of Construction of Industrial Buildings and Structures," by F. I. Gusev; Moscow, Promyshlennoye Stroitel'stvo, No 7, Jul 59, pp 2-5

The article contains the following passages:

"The 1959-1965 control figures provide for the lowering of the industrial construction cost during the Seven-Year Plan, on an average, by 4% [per year?] so that it will reach 8% in 1965.

"Abroad, as a rule, the cost of construction of industrial buildings and structures is only one half of the cost of the equipment of the industrial enterprise. However, modern industrial buildings provide the best conditions needed to conduct the technological processes and provide desirable working conditions at this comparatively low cost of construction.

"In the Soviet Union, the cost of construction of industrial enterprises is on the average, 1.5 times higher than the cost of equipment."

V. MEDICINE

Aviation Medicine

55. Problems of Human Existence in Outer-Space Ships

"Prior to Sending a Man Into Outer Space," by Prof D. Rozenblyum; Moscow, Meditsinskiy Rabotnik, No 38 (1786), 12 May 1959, p 2

The author of this article states that scientists and engineers of the Soviet Union have made discoveries which only recently were thought to be foolhardy and fantastic dreams. The third Soviet artificial earth satellite has already made 5,000 revolutions around the earth and, on 2 January 1959, Soviet scientists launched a multistage rocket in the direction of the moon. This proves that man may be able to tread the surface of other planets in the not too distant future.

Aviation medicine, therefore, must find a way to maintain life in a spaceship. Aviation medicine must undertake a profound study of all the dangers and complications which a human occupant of a spaceship may have to face while flying through space and to find the causes and mechanisms of changes in the physiological functions of a human organism. This must be done in close cooperation with experts in rocket technology if all the obstacles are to be overcome.

The chief danger confronting man in outer space is oxygen starvation. Ample information is available on this. A progressive drop in oxygen pressure in alveolar air is encountered as altitude is gained, causing disruption in the process of respiration beginning with pulmonary gas metabolism and ending with tissue respiration. The brain, chiefly the cerebral cortex, is especially sensitive to oxygen insufficiency. Even though powerful enzyme systems which provide an anaerobic phase of respiration, are involved in the respiratory cycle of the brain tissues, the change-over to the utilization of the energy of anaerobic processes during hypoxia is so wasteful and harmful that irreversible changes rapidly appear in the structure of the brain tissues.

A human being cannot avoid suffering from oxygen starvation at an altitude of more than 10,000 meters above sea level even though he may be breathing pure oxygen. Oxygen pressure in the lungs at an altitude of 16,000-17,000 meters, when pure oxygen is breathed, is almost zero. According to the laws of diffusion, therefore, oxygen begins to pass over from blood into alveolar air. Experiments on animals showed that at such altitudes acute anoxia is fatal. To protect the human being from acute oxygen starvation, it is necessary, therefore, to maintain air pressure

and oxygen pressure in the cabin of an interplanetary vehicle at a level which would guarantee normal respiratory processes. The need for such protection is dictated also by other conditions created by rarefied atmosphere. Nitrogen (and at higher levels carbon dioxide also) dissolved in the human body begins to turn into a gaseous state. This leads to the emergence of the so-called altitude decompression disturbances in a number of instances (most often to pains in joints, which at times are very severe).

The process of altitude decompression is closely connected with that of vapor formation. Tissue liquids begin to change into vapors as soon as the outside pressure drops to a level below 47 millimeters (about 20,000 meters above sea level). This process is rapidly reversed upon recompression.

It is clear that a human being taking off into outer space must take along with him a portion of the earth's atmosphere, so to speak, to maintain life and efficiency. This principle has been realized in the present-day outer space jet aircraft, which are supplied with hermetic cabins equipped to maintain normal air pressure.

However, the hermetic cabins of the compressor-ventilating type, widely used in aviation, are designed for comparatively dense layers of atmosphere and are not suitable for flights into outer space. A rocket must have a hermetically sealed cabin insulated from the outside environment, with a closed and forced cycle of air regeneration, and with an artificially maintained microclimate.

A considerable amount of practical experience has been accumulated in selecting a system of air regeneration for a rocket cabin. Professors M. Ye. Marshak, V. A. Spasskiy, L. L. Shik and a well-known aviator A. V. Belyakov (who was the first to make a nonstop flight to the US via the North Pole) remained for a period of 100 hours in a sealed cabin under simulated conditions. This took place in the late 1930s.

The author of this article further states that a movie was shown at the quarters of the Moscow society of physiologists. The film was taken automatically during a flight of Soviet scientific research rockets to an altitude of 100,000-200,000 meters and higher. Animals were aboard these rockets. The film demonstrated that it is possible to maintain the necessary barometric pressure as well as the normal gas composition in these cabins during the entire period of flight, and to completely prevent any development of oxygen starvation, decompression sickness, and symptoms of vapor formation.

Experiments were conducted in which monkeys were sent aloft into the ionosphere. Such experiments were conducted in the US.

Observations made of the behavior of the now famous Layka in a sealed cabin of the second Soviet artificial earth satellite are of great significance. Highly active chemical compounds were used to regenerate the air and to maintain the necessary composition of gases in this biological experiment. Those chemical compounds emitted oxygen and absorbed carbon dioxide as well as an excess of water vapors. The quantity of substances involved in chemical reactions was regulated automatically.

The biological principles involved in supplying the aircrews with oxygen while they are flying in outer space are of great interest. Chlorella algae deserve attention in this connection: exposed to the sun, they actively emit oxygen.

Maintaining proper temperature in the cabin of a space rocket is very important. A system of automatic thermoregulation, designed and constructed by Soviet scientists and engineers, proved its value. The temperature in the hermetic capsules of the third Soviet artificial earth satellite remained within the range of 15°C-20°C above zero while the instruments were functioning.

Another method of protecting the human occupant from the effects of cosmic environment in case of dehermitization of the cabin is the altitute compensating suit and altitude helmet.

The Soviet artificial earth satellites have successfully made thousands of revolutions around the earth. This proves that the danger from meteors in outer space need not be a matter of great concern.

The ultraviolet radiation of the sun in outer space must be considered. Man has already penetrated the ozone zone in modern jet aircraft and in ozone resistant stratospheric balloons. This zone allows passage to the earth's surface of only that part of ultraviolet radiation which adjoins directly the violet terminal of the visible spectrum. Man will be subjected to the harmful action of short-wave ultraviolet rays in outer space. These ultraviolet rays may cause severe burns of the skin and acute morbid photo-ophthalmia. These rays are insidious in that they cannot be felt, because a human being has no receptors for which the rays would serve as adequate irritants. Fortunately, measures of protection from penetration of short-wave ultraviolet rays into the cabin of a space ship do not present any technical difficulty.

The speed of a rocket exceeds by several dozen times the speed of the passage of nerve impulses along the somatic nerves, and even more so their passage along the interoreceptor paths. Ordinary calculation shows that during a simple motor reaction on the visual signal (150 meters/second), the rocket would travel a distance of about 2,000 meters. It must be foreseen that the sensory organs, which are adjusted to terrestrial existence, will not be able to orient the human occupant of a space vehicle to the new conditions sufficiently and in time. For that reason, the resources of modern radioelectronics and automatics must be mobilized for piloting and making navigational computations, etc.

During the most critical part of flight in space (with the motor running) the movements of the pilot are drastically limited by radial acceleration and, with the entrance into the orbit, it is possible that disturbances in orientation in space and in accuracy of movements may take place (in connection with passing over into a condition of weightlessness). Automatic piloting will play a great role under conditions such as this. Furthermore, automatic piloting will permit the pilot to move his body to a position at which the effects of radial acceleration on the organism will be reduced.

Experience accumulated during the launching of scientific research rockets which contained animals and also when the second Soviet artificial earth satellite was placed into orbit showed that prolonged transverse accelerations were tolerated well by animals. Similar data were obtained in experiments with people under simulated conditions.

The cosmic rays to which humans would be exposed in outer space consist of atomic nuclei bearing enormous reserves of energy and possessing exceptionally high penetrating capability. Scientific information concerning the intensity of cosmic radiation, obtained with the aid of artificial earth satellites and information obtained from aboard the Soviet space rocket, will aid in solving the problem of protection of astronauts from the effects of cosmic rays.

The effect of weightlesseness on the organism of animals and humans presents a serious problem. Some knowledge was acquired as a result of observations of animals which had flown through space in rockets: photographs were made automatically, and pulse beats, respiration, and arterial and venous pressure were recorded. Observations made of the dog Layka in its flight in an artificial earth satellite were particularly valuable. All these observations made it possible to draw a preliminary conclusion: the vitally important processes of respiration and circulation, during weightlessness, undergo no substantial changes of any kind.

Published data point to the possibility of the development of vertigo, disruptions of fine motor coordinations, and of illusionary sensations and false ideas in regard to the position of the body when it is in a state of weightlessness of brief duration. However, these symptoms evidently disappear, as the organism becomes adjusted to the condition of weightlessness.

Drastic preventive measures were foreseen by K. E. Tsiolkovskiy. He suggested that, if the need arises, artificial gravitation could be created in the cabin of a space vehicle by substituting the field of terrestrial pull by the field of centripetal acceleration.

In conclusion, the author of this article states that the Soviet scientists and technicians must continue to carry on intensive research to solve the complicated technical problem of the return of the cosmic ship to the earth. He thinks that this problem will be successfully resolved. He states that designing of Soviet artificial earth satellites and the launching of a space rocket which became a satellite of the sun showed the world what heights science and technology have attained in the Soviet Union.

56. Czechoslovak Zero Gravity Experiments

"Five Seconds in a Weightless State," by Daga Minkewitzova; Prague, Zapisnik 59, No 14, 10 Jul 59, pp 16-17

According to this article, the correspondent was present during a zero-gravity experiment conducted under the auspices of the Czechoslovak Institute of Aviation Medicine (Ustav leteckeho zdravi). The experimental flight, which took place in a Czechoslovak-made IL-14, manufactured at Letnany, was conducted at an unidentified airfield on an unspecified date by Dr Dvork, Dr Zeman, and Dr Pekar, all from the institute, with Dr Zeman and Dr Pekar acting in the capacity of test subjects.

According to the account in the source, the aircraft took off from the field and climbed to 2,000 meters. From this altitude, several consecutive zero-gravity experiments, each lasting 5 secs, were done during the experiment, it was shown that normal drinking from a cup or bottle is impossible at zero gravity. One of the doctors had electrodes strapped to his wrists and ankles and his pulse was recorded on an electrocardiograph.

After about 30 minutes, the reporter relates, the aircraft landed and the experiment was completed. Almost all of the members of the test crew were ill and nauseated, including the reporter, who also suffered an extremely severe headache subsequently. The headache was so severe, the reporter asserts, that three different types of headache powders and pills were completely ineffective; in fact she felt as though "someone had scrambled my brains."

The article is accompanied by two photographs, showing the occupants of an aircraft cabin allegedly engaged in zero-gravity experiments.

Epidemiology

57. Hemorrhagic Fever

"Hemorrhagic Fever in Neokuzskiy Rayon," by R. N. Vasil'yeva, Neokuzskiy Rayon Hospital, Yaroslavskaya Oblast; Moscow, Klinicheskaya Meditsina, Vol XXXVII, No 3, Mar 59, pp 57-61

A study of a number of cases of hemorrhagic fever, a disease endemic to the Far East, Crimea, and Omskaya Kalininskaya, and Yaroslavskaya oblasts in the USSR, as well as to a number of other countries, was conducted. An ultravirus is the causative agent of the disease, according to investigations conducted by A. A. Smorodintsev and Churilov. The virus, which has been isolated from the urine of the patients, is characterized by great activity during the entire course of the disease, but disappears from the organism after the temperature drops. A principal symptom of the disease is a severe affection of the kidney, which frequently causes the death of the patient. The investigations established also that the virus is carried by rodents, and is easily transmitted from the animals to man. Prophylaxis, therefore, must begin with the extermination of the animals. Although no specific method of therapy has yet been developed, the author recommends the early administration of antibiotics, vitamins, and cardiacs to prevent complications. Transfusion may be necessary in cases of hemorrhage.

Immunology and Therapy

58. Immunological Shifts Caused by IEM Polyvaccine

"The Study of Immunological Shifts in Persons Inoculated With the Chemical, Associated, Depoted Polyvaccine of IEM imeni Gamaleya With Respect to Dysentery Antigens," by L. V. Devoyno, Institute of Epidemiology and Microbiology imeni Gamaleya; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 30, No 7, Jul 59, pp 10-13

According to this article, a new chemical associated vaccine, adsorbed on aluminum hydroxide, has been developed and produced at the Institute of Epidemiology and Microbiology imeni Gamaleya. The vaccine is described as a combination of complete phenol antigens of typhoid, paratyphoid B, Flexner c and f, and Sonne dysentery bacteria, and purified tetanus anatoxin. Experimental data indicate that the vaccine confers intense immunity in animals vaccinated twice with small doses of antigens. An immunization cycle of two inoculations with a one-month interval has been proposed for immunizing humans with the polyvaccine. Each inoculation is a subcutaneous introduction of 0.5 ml of polyvaccine. The dysentery component consists of 0.05 mg of Sonne antigen and 0.1 mg of Flexner c and f antigen.

For investigating the immunological shifts with respect to the dysentery component of the IEM polyvaccine, blood samples were taken from 93 persons before immunization, from 81 one month after immunization, and from 79 four months after the second inoculation. The serum was examined for the presence of agglutinins, precipitins, complement-fixing antibodies, and defensive properties. The phagocytic activity of the leukocytes was also studied. Three tables are included to show results.

The following conclusions are presented on the basis of the results obtained.

"Vaccination with the associated, depoted, chemical polyvaccine of IEM imeni Gamaleya caused certain immunological shifts with respect to the dysentery component in vaccinates; these shifts lasted during the 4-month observation period.

"The investigations carried out revealed a definite increase in the agglutinin titer after immunization against Flexner dysentery bacteria. Agglutinins were observed in dilutions of 1:800-1:1,600 in most of the persons examined. At the same time, no increase in the agglutinin titer with respect to Sonne dysentery bacteria was observed.

"A slight increase in the preventive properties of the serum in vaccinates was noted, and was manifested by a decrease in the minimum protecting dose.

"Investigation of the phagocytic activity of the leukocytes showed more pronounced phagocytosis one month after immunization; after 4 months, there was a slight decrease in the activity."

59. Psychopathology and Therapy of Q Fever

"Clinical Course and Psychopathology of Q Fever," by V. N. Il'ina, A. S. Poletayev, G. K. Ushakov, L. K. Khokhlov, Z. I. Galkina, V. N. Salyayev, and A. A. Stolyarchuk, Chair of Psychiatry, Infectious Diseases, and Pharmacology, Yaroslavl Medical Institute, and the City Clinical Infection Hospital; Moscow, Zhurnal Nevropatologii in Psikhiatrii imeni S. S. Korsakov, Vol LIX, No 3, 1959, pp 295-303

A report on the observations which were conducted on 85 patients suffering from Q fever is presented. In the majority of cases, the onset of the disease was sudden and was accompanied by headaches and high temperatures. The initial stages of the disease were marked by a feeling of exultation and euphoria. The patients frequently remarked that had if it not been for the high temperatures, they could have continued their normal daily activities. In the second stage of the disease, this feeling of exultation was replaced by a sense of depression and symptoms of melancholia. Other neurological disturbances were observed in the patients: animation of tendinous reflexes, tremor of the fingers when the hands were extended. The patients complained of chills, severe headaches, and hyperhidrosis. The possibility of the development of Q fever psychoses in some cases made advisable the cautious utilization of rickettsia for the purpose of pyrotherapy.

Antibiotics were successfully applied in the therapy of the disease. Synthomycin was administered to 38 of the patients; biomycin to 26 of the patients; and a combination of syntho- and biomycin to 21 of the patients. The antibiotics, when applied in relatively large doses (1.8 grams in 24 hours), were highly effective against the disease. The number of observations, however, was insufficient to establish which of the antibiotics was the more effective when used in the therapy of Q fever.

60. Aminazine Therapy of Schizophrenia

"Aminazine Therapy of Patients Suffering From Prolonged Schizophrenia," by R. I. Zolotnitskiy and D. A. Brandus, Kiev Psychoneurological Hospital imeni I. P. Pavlov; Kiev, Vranchebnoye Delo, No 5, 1959, pp 497-500

Aminazine was used in the treatment of 60 male patients suffering from schizophrenia for the following periods of time: less than one year -- one patient; 3-5 years -- 12 patients; 5-10 years -- 35 patients; over 10 years -- 12 patients. Aminazine was administered in the form of a 2.5-percent solution, twice a day, in addition to insulin-shock and electrospasmodic treatment. The results and conclusions were as follows: 30 of the patients with prolonged histories of the disease have shown improvement, although other methods of therapy previously applied proved unsuccessful; aminazine was found to be the most effective of all active methods of therapy in cases of prolonged schizohphrenia; the length of the period of the illness cannot be taken as a criterion that the pathological process in schizonphrenia is irreversible.

61. Therapy of Pyocyanic Meningitis

"Data on the Clinical Course and Therapy of Pyocyanic Meningitis," by F. Ya. Roze and A. B. Chernomordik, Clinic of Nervous Diseases of the Dnepropetrovsk Medical Institute and the Microbiological Laboratory of the Dnepropetrovsk Institute of Epidemiology and Microbiology; Moscow, Zhurnal Nevropatologii i Psikhiatrii imeni S. S. Korsakov, Vol 59, No 3, 1959, pp 304-306

Contrary to the opinion held abroad that antibiotics are ineffective when used in the therapy of pyocyanic meningitis, the author claims that some antibiotics -- penicillin, levomycetin, gramicidin, and others -- can be effectively used in the therapy of the disease. The author cites several cases of the successful treatment of the disease with antibiotics. Observations established that before the drugs are applied, it is necessary to determine the resistance of the bacterial cultures to the different antibiotics and other antimicrobial, preparations. The cure of patients afflicted with pyocyanic meningitis is possible if the proper antibiotic is selected and used.

62. Burn Therapy

"On Burn Auto-Antibodies," by N. I. Kuznetsova and S. V. Skurkovich, (Moscow) Laboratory of Immunology, Virology Institute imeni D. I. Ivanovskiy, Academy of Medical Sciences USSR, and Pathophysiological Laboratory, Central Institute of Hematology and Blood Transfusion, Ministry of Health USSR; Moscow, Vol 3, No 4, Jul/Aug 59, pp 57-60

Experiments carried out on dogs established that under the effect of burns, substances which differ from the specific antigens of normal blood and tissues are formed in the blood and tissues of the burned animals; these auto-antigens are toxic; the organism responds to the formation of these substances by the formation of specific antiburn antibodies; and sera obtained from burn convalescents are highly effective in the therapy of burns.

Oncology

63. Persistent Macrocytosis -- Warning Symptom of Malignancy

"The Problem of the Diagnostic Significance of Changes in the Diameter of Erythrocytes in Malignant Neoplasms," by L. I. Khokhlov, Clinic of Therapeutic Faculty No 2, Military Medical Academy imeni S. M. Kirov, on the Base of the Clinical Hospital imeni Chudnovskiy; Moscow, Voprosy Onkologii, Vol 5, No 6, Jun 59, pp 699-706

The purpose of this research was to study the change in the diameter of erythrocytes in malignant neoplasms and the possibility of using this data for diagnostic purposes.

Tests were conducted on three groups of people (104 cancer patients, 57 patients with different diseases but no cancer, and a group of healthy people). Ten tables and two graphs explain hematological results.

The author presents the following conclusions:

"A systematic measurement of the diameter of erythrocytes in patients suspected of cancer is an essential additional diagnostic method for the early detection of cancer.

"The appearance of persistent macrocytosis in patients with chronic anacidic gastritis and gastrointestinal polyposis is a warning sign with regard to the possible development of malignancy."

64. Effect of Sarcolysin on Tissue Cultures

"Effect of Sarcolysin on Normal and Tumorous Tissue Cultures," by Ye. A. Timofeyevskaya, V. sb.: Vopr. etiol. i patogeneza opukholey (Problems of Etiology and Pathogenesis of Tumors), M., 1957, 79-83 (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 9, 10 May 59, Abstract No 12037, by I. Elman)

"Sarcolysin [Hydrochloride of d,l-para-di (chlorethyl)- aminophenylalanine, Lekarstvennyye Sredstva, by M. D. Mashkovskiy, Moscow, Medgiz, 1957, pp 607-609] in doses of 100 and 75 gamma per milliliter completely arrested the growth (96 percent) of rat and human connective tissue cultures. In a dose of 50 gamma per milliliter, it inhibited the growth of human connective tissues by 52-54 percent, and of rat connective tissue cultures by 47-54 percent; it almost completely arrested the growth of sarcomatous tissue of two rat and nine human sarcomas (78-94 percent). A similar dose of sarcolysin arrested the growth of melanoma by 58-61 percent. In a dose of 25 gamma per milliliter, sarcolysin exhibited a more expressed inhibitory effect on sarcomatous tissue culture than on that of normal tissue, while in a dose of 0.5 gamma per milliliter, it somewhat accelerated the growth of normal and tumorous tissue cultures. Differing from embiquine, sarcolysin exhibited a more expressed inhibitory effect on the growth of human and rat sarcoma cultures than on the growth of connective tissue cultures."

65. Blastomogenic Effect of Cerium Dependent on Dose

"On the Blastomogenic Effect of Cerium (Ce^{144})," by Yu. I. Moskalev and V. N. Strel'tsova, Academy of Medical Sciences USSR; Moscow, Voprosy Onkologii, Vol 5, No 6, Jun 59, pp 669-675

Radioactive cerium belongs to the group of rare earth metals having mixed beta- and gamma-radiations. The blastomogenic properties of Ce^{144} have been little studied. This article concerns the cancerogenic effect of Ce^{144} depending on the quantity of the isotope administered and the sex of the animals.

Tests were conducted on 824 three-month-old white rats of both sexes, and the amounts of radioactive cerium administered intraperitoneally were 0.8, 0.5, 0.25, 0.06, 0.025, 0.01, and 0.005 microcuries/g.

The authors present the following conclusions:

"After the administration of Ce^{144} to rats, osteosarcomas, leukoses, and tumors of the hypophysis, adrenals, thyroid gland, gastrointestinal tract, liver, kidneys, ovaries, and of other tissues appeared.

"By the administration of 0.8-0.25 microcuries/g Ce^{144}, the tumors that appeared were essentially in the bones, liver, kidneys, and the hemopoietic tissue; the smaller amounts (0.06-0.005 microcuries/g) caused neoplasms in the endocrine glands.

"The frequency and the rate of appearance of osteosarcomas vary in proportion to the amount of Ce^{144} administered. The optimum dose of irradiation for osteosarcoma is $\sim$ 50, and the minimum is 2.1 kilorad.

"Osteosarcomas develop somewhat more frequently in males. In females, neoplasms in the endocrine glands (hypophysis) predominate."

66. Radioactive Strontium-Induced Osteogenic Sarcomas in Dogs

"Osteogenic Sarcoma in Dogs Injured by Sr^{90}," by N. N. Litvinov, Academy of Medical Sciences USSR; Moscow, Voprosy Onkologii, Vol 5, No 6, Jun 59, pp 675-681

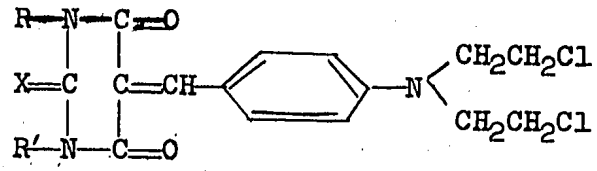
Tests were conducted on dogs to study the development of osteosarcomas caused by radioactive strontium.

Radioactive strontium was injected intravenously into 16 dogs (0.2, and 0.15 millicuries/kg), and it was ingested with food (0.5 millicuries/kg). These doses induced chronic radiation sickness which was followed by osteosarcomas in four dogs. Two of these dogs developed multiple sarcomas with different histological structure. The tumors were noted on the 610th, 620th, 880th, and 935th day after the administration of the radioactive substance. In three dogs, the tumors appeared in the metaphysis region of the long, tubular bones: the humerus, radius, and the tibia and fibula. In one dog, the tumor appeared in the parietal bone. Eight tumorous nodes were noted in the four animals. Five of these tumors were osteoplastic in nature, two were osteolytic, and one was mixed.

67. Chinese Research on Carcinostatic Agents

"Studies on the Chemotherapy for Tumors (VI), Synthesis of p-Bis (β-chloroethyl) aminobenzylidene Derivatives," by Tsou Heng-liang (鄒 恆 亮) and Lin Han-ch'ing (林 汉 清), Shanghai Research Institute of the Pharmaceutical Industry, Ministry of Chemical Industry; and Yuan Ch'eng-yeh (袁 承 业), Institute of Organic Chemistry, Academia Sinica; Peiping, K'o-hsueh T'ung-pao (Scientia), No 14, 26 Jul 59, pp 457-458

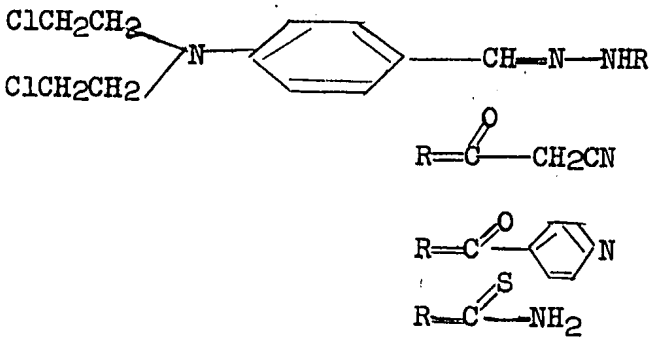
The authors report the synthesis of certain p-bis (β-chloroethyl) aminobenzylidene derivatives in their search for carcinostatic agents. Eight different compounds represented by the formula



were prepared by the condensation of p-bis (β-chloroethyl) aminobenzaldehyde with compounds containing active methylene. They are presently being subjected to bio-assay.

The authors point out that their work was almost completed when R. C. Elderfield's report on the synthesis of similar compounds was published in the Journal of Organic Chemistry, 23: 1749 (1958).

Eight other p-bis (β-chloroethyl) aminobenzylidene derivatives reportedly were prepared by action of hydrazines or semicarbazides on p-bis (β-chloroethyl) aminobenzaldehyde. Three of them, which are represented by the formulas given below, when administered intraperitoneally in dosages of 100 milligrams per kilogram, demonstrated inhibitory effect on white mouse sarcoma 180.



68. Toxicity of Manganese Oxides

"Toxicity of Aerosols of Manganese Oxides," by E. N. Levina, Tr. Nauchn. Sessii Leningr. n.-i., in-ta, Gigiyeny Truda i Profzabolevaniy, posvyashch. itogam raboty za 1955 (Works of the Scientific Session of the Leningrad Scientific Research Institute of Labor Hygiene and Occupational Diseases Devoted to the Results of Works for 1955), L. 1958, 209-214 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 59, Abstract No 51648, by R. S. Vorob'yev)

"Rabbits, rats, and mice were subjected to the effects of the dusts of the following manganese oxides: Mn_3O_4 (I); Mn_2O_3 (II); and MnO_2 (III). The exposure to the dusts was carried out daily for 4-5 hours for periods of 3 1/2-6 months in a special chamber, and by a method of individual dusting. The concentrations of manganese during the experiment varied as follows: (I) -- from 0.002 to 0.67 milligrams per liter; (II) -- from 0.07 to 0.675 milligrams per liter; (III) -- 0.005 to 0.42 milligrams per liter. Aerosol dispersion did not exceed 3 microns. The toxic effect was manifested by a loss of weight, particularly under the effect of (II). Trophic disorders (loss of hair) and vegetative disturbances (salivation, drop in body temperature, bradycardia) were noted. Under the effect of (III), a mouse consumed 86 milliliters of O_2 per hour, while the control consumed 100-115 milliliters per hour. Depressed function of the thyroid gland was observed in rats receiving I^{131}. The inhalation of manganese oxides produced macrophagal and granulematous nodules in the lungs; the inhalation of (III) led to the development of massive mucoid pneumonia in rabbits. Premises on the greater toxicity of the lower oxides of manganese were not confirmed."

69. Effect of Chlortetracycline on the Intestines

"Effect of Chlortetracycline on the Irritability of the Intestinal Chemoreceptors. Report 1. Effect of Chlortetracycline on the Irritability of the Chemoreceptors of the Intestine Under the Influence of Acetylcholine," by A. V. Loginov and S. L. Volynskaya, Sb. Nauchn. Trud. Leningr. n.-i. In-t Antibiotikov (Collection of Scientific Works of the Leningrad Scientific Research Institute of Antibiotics), 1958, 1, 275-280 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 59, Abstract No 51542)

"Experiments conducted on cats established that one or 2 milliliters of chlortetracycline in a concentration of 1.0-2.5 milligrams per milliliter has a temporary effect on the chemoreceptors of the intestines,

inducing interoceptor reflexes which are manifested by a rise in blood pressure and occasionally by an increase in the respiration rate. The interoceptor reflexes induced by the administration of acetylcholine diminish (by 20-83 percent) after a repeated administration of chlortetracycline."

70. Effect of Phenothiazine Derivatives on the Uterus

"The Effect of Phenothiazine Derivatives on the Contractions of the Uterus and Its Sensitivity to Acetylcholine, Histamine, and Oxytocin," by Bela Szugyelik and Laszlo Kocsar, Orv. hetilap (Hungary), 1957, 98, No 31, 844-845 (from Referativnyy Zhurnal -- Biologiya, No 11, 10 Jun 59, Abstract No 51419, by A. N. Ivanov)

"In experiments carried out on rabbits, hares, rats, and cats in vivo and in vitro (on isolated uteri in intact and pregnant stages, or in a stage of involution following parturition), it was found that under the influence of largactil and phenergan the frequency and magnitude of uterine contractions induced by the administration of acetylcholine, histamine, and oxytocin were considerably reduced. The sensitivity of the animals to acetylcholine, histamine, and oxytocin was considerably decreased on the preliminary administration of largactil in doses of 10-20 milligrams. The administration of largactil in a dose of 2.5 milligrams per kilogram of body weight or of phenergan in a dose of 3 milligrams per kilogram of body weight to the animals considerably reduced spontaneous uterine contractions when the uterus was in a state of involution (6-12 hours after parturition). The authors assert that the effect of phenothiazine derivatives on the uterus is caused by the depression of enzymatic processes or by the paralysis of the sympathetic and parasympathetic nerve terminals. A direct antispasmodic effect on the smooth muscles is also a possibility."

71. Quinocide -- An Effective Antimalarial Preparation

"Quinocide - 6-methoxy-8-(4'-aminopentyl)-aminoquinoline Dichlorohydrate," by V. I. Stavrovskaya, Materialy po obmenu peredov. opytom i nauchn. dostizh. v khim.-farmatsevt. prom-sti (Materials in Exchange of Advanced Experience and Scientific Achievements in the Chemicopharmaceutical Industry), 1958, No 1/12, 92-96 (from Referatvinyy Zhurnal -- Khimiya, No 13, 10 Jul 59, Abstract No 46820, by A. Vavilova)

"An effective antimalarial preparation is quinocide (I) -- yellow crystals with a bitter taste, melting point 226-227°C, readily soluble in water; solubility in alcohol is 1:50 (20°), 1:10 (in boiling alcohol), and 1:30 in boiling absolute alcohol; insoluble in ether, benzene. (I) is obtained according to the scheme: a -- gamma-acetopropyl alcohol -> 2-aminopentanol-5 (II); b -- (II) + HBr -> hydrobromide of 2-amino-5-bromopentane (III); c -- (III) + 6-methoxy-8-aminoquinoline -> 6-methoxy-8-(4'-aminopentyl)-aminoquinoline (IV); d -- (IV) -> (I); (I) is filtered, washed with absolute alcohol, dried in a vacuum at 40-50°. Yield 96%."

Physiology

72. Analysis of Sound-Induced Shock-Hemorrhagic Syndrome

"Physiological Analysis of the Shock-Hemorrhagic Condition," by A. P. Steshenko; Moscow, Nauchnyye Doklady Vysshey Shkoly, Biologicheskiye Nauki, No 1, 1959, pp 74-79

The purpose of this research was: (1) To study the initial development of the symptoms of shock-hemorrhagic condition after the onset of the initial irritation caused by sound stimulation and to establish the extent to which this condition depends on the intensity of the reactions of an animal. (2) To explain how the initial symptoms of a shock-hemorrhagic condition are changed by the effect of factors which increase or decrease the death rate of the animals (thyroidin and carbon dioxide).

Tests were conducted on four groups of rats: normal, hyperthyroidized, normal animals kept in an atmosphere containing 8.5% CO_2, and hyperthyroidized animals kept in an atmosphere containing 8.5% CO_2. Results are presented in four tables, and the author draws the following conclusions:

"As a result of the transitory effect of sound irritation (1.5 - 2 min), the hyperthyroidized rats, as compared with control animals, showed a significantly greater decrease in blood pressure and body temperature and an increase in the blood hemoglobin content.

"These changes were especially strongly expressed in those cases in which spasmodic fits appeared in the animals in response to the sound irritation, and were somewhat weaker if the irritation produced only motor excitation.

"Changes which are characteristic of the shock condition are more weakly expressed in animals subjected to the effect of sound irritation in an atmosphere with a higher CO_2 content. This effect of carbon dioxide is due, evidently, to the decreased excitability of the central nervous system."

73. Adrenal Cortex Affected by Sleep-Inducing Drugs

"Effect of Sleep-Inducing Drugs on the Function of the Adrenal Cortex," by K. Kryge and Kh. Khanson, Chair of the Faculty of Therapy, Tartu State University; Moscow, Problemy Endokrinologii i Gormonoterapii, No 3, May/Jun 59, pp 39-42

A single dose of 0.5-1.0 gram of pentothal given to patients under treatment in the therapeutic section of the Tartu clinical hospital produced a considerable intensification in the activity of the adrenal

cortex. This is the conclusion reached by the authors of this article. They state that an increase in the excretion of 17-ketosteroids was noted in 18 of 33 patients. This increase in the excretion of 17-ketosteroids ranged between 25% and 222% above normal level the average increase was 109%). An increase in corticosteroid excretion was observed in 12 of 17 patients who were given pentothal by mouth. This increase ranged between 38% and 200% (an average increase of 81%).

The fact that no increase in the secretion of the adrenal cortex hormones was noted in some of the patients following the administration of a sleep-inducing drug was probably due to the functional peculiarities of their central nervous system, as well as to the delay in hormonal reaction caused by the inertness of the system.

The desensitizing effect of sleep-inducing drugs (and of some other causes which affect the inhibition of the central nervous system) is possibly connected, to a greater or lesser extent, with the activation of the diencephalo-hypophyseal-adrenal system when the cerebral cortex is inhibited.

74. Bulgarians Study Effects of Vitamin PP on Higher Nervous Activity

"The Effect of Vitamin PP on Higher Nervous Activity," by N. A. Nikolov, C'vrem. Med. (Contemporary Medicine), No 7, 57, pp 8-15 (from Meditsinskiy Referativnyy Zhurnal, No 5, May 59, p 56)

"It was established that vitamin PP in small doses (3 mg/kg) increases the strength of the excitatory process in the cerebral cortex, and with repeated application to animals in a state of hypnotic inhibition, vitamin PP eliminates this inhibition. Repeated administration of large doses of vitamin PP considerably decreases the excitation of the cortex. The experiments showed that vitamin PP is highly significant for toning the cerebral cortex."

Public Health, Hygiene, and Sanitation

75. Preservation of R. burneti on Various Objects

"The Problem of the Preservability of Rickettsia burneti on Environmental Objects," by V. F. Ignatovich, Institute of Epidemiology and Microbiology imeni Gamaleya; Moscow, Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii, Vol 30, No 5, May 59, pp 125-126

"A comparative study of the preservation of Rickettsia burneti on environmental objects was made to determine possible time limits for the existence of secondary reservoirs of Q fever.

"The methodology of the experiments was as follows: 2 ml of a suspension of an egg culture of Rickettsia burneti, Grita strain, in a dilution of 10^{-4} (the indicated amount of culture contained a 10^5 - 10^6 infecting dose for a culture of embryos) was applied to sterile weighed portions of wool (0.4 g), sand (8 g), mud (8 g), and sawdust (1 g), the weighed portions with the rickettsial culture applied were dried under partial vacuum (200-700) to a visibly dry state, after which they were preserved at different temperatures -- 4-6° C, 15-20° C, and 34-36° C; the relative humidity of the air fluctuated from 53-68%; elution of Rickettsia from the surfaces of the samples was done with a phosphate buffer (pH, 7.0) by careful agitation of the test samples in a shuttle apparatus. Observation of the preservability of the Rickettsia was carried out in vivo; the quantity of viable Rickettsia was calculated by titration of the test samples on chick embryos.

"The experiments showed that the preservability of Rickettsia burneti on objects in the environment depended on the temperature factor; the survival rate was prolonged with a decrease in the preservation temperature. Besides, the nature of the substrate on which the Rickettsia were preserved played an essential role: Rickettsia were detected for the longest time in the wool samples. At a lower preservation temperature (4-6° C), Rickettsia were preserved in these samples in significant quantity (10^4 infecting doses) for 5 months, they were still detected after 12 months, and died toward 16 months. A large quantity of Rickettsia (10^3 infecting doses) survived for 1-2 months at 15-20° C in the wool samples; however, the small quantity of Rickettsia which remained (5-10 infecting doses) was detected after 4, 5, and 7 months, and the results of biological tests were negative after 9 months. The time which viable Rickettsia could be detected in wool samples was shortened to 1-2 months under increased temperature conditions (34-36° C).

"The dynamics of the disappearance of Rickettsia in mud and sand samples were almost identical. A large quantity of viable Rickettsia (10^3 - 10^4 infecting doses) was preserved for 2 months at 4-6° C in these samples. A considerable decrease in infection titers occurred toward the seventh month, and the death of all the Rickettsia, within 9 months. The Rickettsia in the samples of mud and sand survived for 4 months at a moderate preservation temperature (15-20° C); viable Rickettsia were not observed after 2 months at a high temperature (34-36° C).

"More rapid disappearance of Rickettsia was observed in the sawdust samples. Viable Rickettsia were detected at a low temperature (4-6° C) after 2 months (the biological test was negative after 7 months). Rickettsia were not detected in the sawdust samples after one month with a temperature range of 15-36° C. It is possible that the poor preservation of Rickettsia in the sawdust in comparison with other substrates is connected with the presence of resinous substances in the sawdust.

"The results obtained attest to the long survival of Rickettsia burneti on infected objects in the environment. If the fact that the emanation of Rickettsia into the environment under natural conditions occurs with a large amount of protein (in our experiments, the Rickettsial suspension contained around 0.05% protein), is taken into account, it may be assumed that the survival rate of Rickettsia will be considerably greater."

76. Hungarians Will Equip Trucks for Virus Aerosol Immunization of Poultry

"A New Inoculation Process Against Chicken Cholera" (unsigned article); Budapest, Ujitok Lapja, Vol XI, No 13, 5 Jul 59, p 18

A new inoculation process for chicken cholera has been developed by Dr Bela Toth, manufacturing chief of Phylaxia [a Hungarian biologicals enterprise]. Chicken cholera, like human influenza, is spread by droplets emitted into the air from infected animals. Thus, inoculation can also be accomplished by dispersing the attenuated virus in a fine mist or aerosol. The inventor has constructed a special atomizer and accesories for this spray inoculation. The apparatus is already beyond the experimental stage and is a prototype of future machines.

Inoculation with the new equipment is done in a closed chicken coop. During the inoculation period, the doors, windows, and ventilators must be closed, and the prescribed concentration and quantity of virus must be atomized and directed above the heads of the animals. The animals must inspire the aerosol for a definite period, usually 15 minutes. Great care must be taken with 3-week-old chicks, but with older animals there is no danger of overdosage.

This method is economical only on a large scale, in cases of several hundred or several thousand animals. It can be advantageously used on state farms and cooperatives but, should be used only by an experienced veterinarian. The veterinarian will carry the equipment in his truck, introducing a rubber hose into the coop for purposes of inoculation.

Radiology

77. Determination of Air Contamination by Radioactive Substances and Filters for Collection Seen Necessary

"Contamination of Atmospheric Air by Radioactive Substances," by Yu. V. Novikov, Inform, Byul, Mosk. N.-I In-t Sanitarii i Gigiyeny (Information Bulletin of Moscow Scientific Research Institutes of Sanitation and Hygiene), 1958, No 19-20, 47-49 (from Referativnyy Zhurnal -- Geografiya, No 6, Jun 59, Abstract No 17740, by N. M. Tomson)

"Artificial contamination of the air is determined by calculating natural background radioactivity, which fluctuates within definite limits depending on various conditions. During the cooling of atomic reactors, a secondary induced activity develops. Water, heavy water, air, helium, sodium, potassium, lead, bismuth, and mercury are used for cooling. With air cooling radioactive argon which connot be collected is formed. During the processing of uranium and plutonium fission products, the air can be contaminated by radioactive iodine, strontium, yttrium, niobium, ruthenium, cesium, and cerium. Methods must be designed for determining them in the air, and filters must be designed for their collection."

78. Cataracts of Both Eyes Developed From Exposure to Superhigh Frequency Electromagnetic Field

"Cataracts of Both Eyes Developed as a Result of Short Exposure of Superhigh Frequency Electromagnetic Field of High Density," by Docent I. S. Shimkhovich and V. G. Shilyayev, Chair of Ophthalmology of Military Medical Order of Lenin Academy imeni S. M. Kirov (head, Prof B. L. Polyak); Moscow, Vestnik Oftal'mologii, No 4, Jul/Aug 59, pp 12-16

In recent years a new occupational hazard has appeared in civilian and military engineering due to the extensive use of superhigh frequency (SHF) electromagnetic fields. There are no data in Soviet ophthalmological literature describing the effect of these fields on the human organ of vision. This article describes one case of occupational cataract in both eyes by decimeter range radio waves.

The visual acuity decreased rapidly, and limited opacities developed in the crystalline lens of both eyes after a brief exposure to the field (about 0.3 w/cm^2 in density).

Prophylaxis should include both collective and individual measures, such as a systematic control over the efficient shielding of the installation, the measurement of power flux density, in the work area surrounding the waveguides, etc. One should remember that power flux density exceeding 0.05 w/cm^2 can cause severe thermic changes in the eyes (P. I. Gapeyev, 1957). According to the data of most authors who have studied this problem the best means for individual prophylaxis is the shielding of the eyes by net goggles made of copper or brass wires. They safely protect the eyes even when the power flux density is very high.

79. Effect of Whole Body X-Irradiation by Fractional Doses on Higher Nervous Activity and Conditioned Reflex Activity

"The Effect of Whole Body X-Irradiation by Fractional Doses on Conditioned Reflex Activity in Dogs," Ye. S. Meyzerov, Institute of Biological Physics, Academy of Sciences USSR; Moscow, Biofizika, Vol 4, No 4, 1959, pp 460-470

A study of the effect of irradiation by fractional doses on the central nervous system is regarded by the author as a necessary step in investigating the role of the time factor on the function of the cerebral cortex and as a very important step toward understanding the mechanism of radiation reactions in higher organisms. In the research described in this article, the effect of comparatively small daily doses of X irradiation 3-15 r on higher nervous activity in dogs was investigated. The method is described in detail, and the results are presented in four tables which are discussed. The author draws the following conclusions:

"1. Following X irradiation by fractional doses, severe disturbances in the higher nervous activity appear 3-4 months prior to the onset of marked external symptoms of radiation sickness, which confirms the higher sensitivity of the cerebral cortex to this form of irradiation.

"2. Whole body X-irradiation by fractional doses produces a significant weakening of both the excitatory and inhibitory processes and a drop in the working capacity of cortical cells when total irradiation doses amount to 500 r.

CPYRGHT

"3. Unconditioned reflexes remained normal in all of these experiments, even during severe disturbances in the higher nervous activity.

"4. In certain cases, a phase of improvement is observed in the higher nervous activity of the irradiated animals. This improvement is not imaginary, as suggested by M. I. Nemenov, but real, as confirmed by special tests. In the ensuing phase, the increase in conditioned reflexes is accompanied by the impairment of the higher nervous activity.

"5. In individual cases, the phase of improvement in the higher nervous activity of the irradiated animals, as well as the appearance of severe disturbances in the functions of the cortex during the premortal period, together with normal conditioned reflexes, we consider as symptoms of compensation processes."

80. Temperature Disorders Following Irradiation by Massive X-Ray Doses

"Temperature Disorders in Dogs Under Massive Radiation Effects," by N. A. Volokhova; Moscow, Meditsinskaya Radiologiya, Vol 4, No 6, Jun 59, pp 22-27

The purpose of this research was to study the reactivity of temperature regulating centers in dogs under the effects of 15,000 and 30,000 r X-ray doses.

Tests were conducted on four series of dogs: one group irradiated by 15,000 r, to which pyrogen was administered before and after irradiation; one group irradiated by 30,000 r, to which pyrogen was administered before and after irradiation; one group to which B. mesentericus was administered intravenously before irradiation; and another group exposed to heat for 2 hours before and for 6 hours after irradiation by 15,000 and 30,000 r doses.

Data presented in the form of three tables and two graphs show differences in temperature curves with regard to degree and duration of the hyperthermic phase and duration of survival and time of death with regard to the temperature curves. Various theories are presented to explain these temperature disorders.

CPYRGHT The author presents the following conclusions:

"Changes in body temperature in dogs during the course of the sickness have a phasic nature.

"A difference was noted in the temperature changes due to irradiation by 15,000 and 30,000 r.

"Irradiated dogs preserve their ability for temperature regulation when the temperature of their external environment is raised.

"Disturbances in chemical regulation can serve as an indirect index of the effect of ionizing radiation on the vegetative centers of the diencephalon."

81. Cyclic Solar Radiations Linked to Fluctuations in Leukocyte Count

"Frequency of Functional Fluctuations in the Leukocyte Court Synchronized With Fluctuations in Solar Activity," by N. A. Shul'ts, Sochi Territorial Administration of Health Resorts, Sanitariums, and Rest Homes; Moscow, Problemy Gematologii i Perelivaniya Krovi, Vol 4, No 7, Jul 59, pp 41-42

A total of 15,000 observations were conducted in 1957 on patients from nine different sanitariums of the Sochi Health Resort Administration the frequency of functional leukopenia and changes in solar activity were investigated. Results, presented in a diagram, indicate that these occurrences were parallel.

The sequelae of the solar effect on hemopoietic tissue probably should be considered as the indirect result of the initial effect of solar activity on the organism as a whole, but especially on the central nervous system. In the author's opinion, the recently noted incidence of functional leukopenias and lymphocytoses is cyclie in nature and is synchronized with cyclic variations in solar radiation.

Surgery

82. Soviet Resuscitator

"A Resuscitator of Humans," by M. Kokhlov and L. Vernikov, Promyshlenno-Ekonomicheskaya Gazeta; Moscow, 21 Jun 59, p 3

The authors of this article report that a meeting of the workers of the Stalingrad Medical Equipment Plant was called. A. G. Anan'yev, the director of the Scientific Research Institute of Experimental Surgical Instruments, gave a talk at this meeting on the need for an increase in

 the production of medical instruments. He began his talk by saying: "Let

CPYRGHT us imagine a situation in which the heart of a patient failed during a complicated operation; so-called fibrillation, the beginning of clinical [redacted] He further stated that Soviet scientists have come up with a new device called a "defibrillator or resuscitator of a human being." With the aid of high-frequency electric current, this device forces the heart to contract and

CPYRGHT expand at regular intervals. "It is regrettable," he said, "that produc- [redacted]

The director of the institute also talked about other medical instruments which were recently invented by Soviet scientists. One of these instruments is the electric blade (Elektronozh). Bloodless operations can be performed easily with this instrument. But manufacture of this instrument also has been limited. M. G. Anan'yev appealed to the workers of the plant to speed up production of the newest medical instruments.

The workers of the Stalingrad plant of medical instruments decided to back-up the efforts of workers of the Vladimir plant. They decided to re-equip their plant and to quadruple production in the next 7 years. Since it was difficult to obtain steel, bronze, lacquer, and other material, they decided to replace metal with plastics.

Carbolite was the only plastic material used by the plant before. It was decided to use caprone, as well as polystyrene and aminplast. Utilization of plastics will bring in an annual income of over 600,000 rubles and will reduce by 850,000 the expenditure of standard man-hours.

An enterprising group of people got together to develop a method of better utilization of plastics by the industry. This group consisted of the following: V. Petrov, N. Uskov, Yu. Svitnev, and technician B. Bogatyr'kov. Workers of the service station, Kirsanov and Tkachev, have been of great assistance to the group. Production was mechanized and an assembly line method was put into operation.

The workers of the Stalingrad Medical Equipment Plant reacted with speed to the appeal of scientists, and were the first in the country to launch the production of complex instruments. Doubtless the workers of the Stalingrad plant will soon give the country a portable "defibrillator", instruments for short-wave diathermy, and other medical equipment for preserving the health of the Soviet man.

83. Medical Instruments

"Technology to the Aid of Physician," by L. Yunin; Moscow, Meditsinskiy Rabotnik, No 45 (1793), 5 Jun 59, p 1

The laboratory of medical electron instruments and apparatuses of the Institute of Medical Implements and Equipment of the Ministry of Health USSR has been functioning now for several years. Much has been done at this laboratory to promote the use of radio electronics in medical practice. Important problems must be solved in the next few years. New developments in electronics will arm physicians with improved instruments and devices and mechanize the work of medical workers, says L. Yunin, the author of this article.

The control of narcosis was conducted, until recently, in a primitive manner. The need for a more objective appraisal of narcosis increased as surgical technique improved. Electronics contributed greatly toward solution of this problem. The electroencephalograph was invented for that purpose. A graphic record made by an electroencephalograph during surgery makes possible to regulate the flow of narcotics into the human organism.

Engr T. Ye. Timofeyeva and designer A. A. Pushkarev invented an electronic device which automatically counts pulse beats. This device is called a "pul'stakhometer," and is easy to operate. A miniature photoelectric transmitter is attached either to a finger or to an ear lobe. The indicator on the dial of the device shows the number of beats, but the physician does not have to watch the dial continuously, because he can hear the pulse beats.

It is known that the human organism does not function in an identical manner over a period of 24 hours and that the stress on the heart, therefore, is not uniform. Studies can be conducted to determine how the heart reacts to stress resulting from physical effort of a human being while he is at work or while taking part in some game that requires physical exertion. Such studies can be conducted by means of a portable electron instrument. A tele-electrocardiograph which provides a cardiogram of a worker at work or of an athlete taking part in a distance run is installed in a laboratory. The designers of this apparatus are T. Ye. Timofeyeva, V. A. Antsilevich, and V. A. Alekseyev.

The Institute of Medical Implements and Equipment, Ministry of Health USSR, is taking an active part in the efforts to improve methods of diagnosing cancer. An ultrasound locator may be of great help in this effort. The first experimental series of ultrasound devices for detecting tumors in the organism has already been developed and is in production. M. D. Gurevich invented this device. The tumorous portion of the body may be observed on the screen of an electron-beam tube (oscillight) in a form of a conditioned topographical picture: it is accomplished with the aid of a translucent pulse-type ultrasound beam.

Considerable effort has been exerted to simplify certain medical work. Work is now being done to complete a device for the automatic control of laboratory analyses. The device, invented by N. M. Florianovich and R. A. Kapitanov, is supposed to facilitate and expedite calculation of erythrocytes and leukocytes during blood analysis.

The author concludes his article by saying that the laboratory of medical electron instruments and apparatuses is now exploring the possibility of inventing an electron paramagnetic resonator to be used in testing biological fluids and elements of cells within the next few years.

A photograph accompanying the article shows Senior Technician V. Il'inskaya and Surgeon N. Matveyev looking over the apparatus used in diagnosing malignant neoplasms.

Veterinary Medicine

84. Influence of Properties of Aluminum Hydroxide in Foot-and-Mouth Disease Vaccines

"Research On the Dependence of the Effectiveness of Adsorbed Foot-and-Mouth Disease Vaccines on the Properties of Aluminum Hydroxide. Report 1. Preparation and Distinguishing Features of Aluminum Hydroxides," by A. F. Olechnowitz, Department of Chemistry, Friedrich Loeffler Institute, Riems; Leipzig, Archiv fuer Experimentelle Veterinaermedizin, Vol 13, No 3, May/Jun 59, pp 345-357

Earlier investigations of the influence of the aluminum hydroxide in foot-and-mouth disease vaccines did not sufficiently consider the chemical nature of the adsorption. A complete picture can be obtained only if the properties of the hydroxide are considered in connection with the conditions of preparation. The "prehistory" of an already manufactured product cannot be determined with certainty.

In the work described here, a series of aluminum hydroxides was prepared systematically, and the properties of these hydroxides were found to be closely connected with the conditions of preparation. The hydrogen ion concentration of the precipitating medium was found to be a determining factor for the preparation and adsorption behavior of the hydroxides. It essentially determines the character of the primary product with respect to modification, crystal size, and charge. The rate of aging is also influenced by it. When the pH value was increased, the electropositive charge, and thus the alkalinity of the hydroxide was reduced. The acidic properties increased, in keeping with the amphoteric behavior of aluminum.

The manufacturing and aging process of the aluminum hydroxide were followed very well with the aid of an adsorption of Congo red. This method (which is often and unjustly considered unreliable) leads, if proper experimental procedures are followed, to unequivocal results which are in good agreement with the conclusions drawn on the basis of the manufacturing process.

The adsorption of Congo red and casein is based primarily on polar processes. In the series of hydroxides produced in this work, the reduction in adsorption paralleled a reduction in the positive charge, and an increase in the pH value of the adsorption medium reduced the adsorption of the negatively charged adsorbents, which attained minimum solubility and thus maximum adsorbability in the slightly acid medium. Increasing the crystal size had an analogous effect in this series of hydroxides.

The isoelectric point of the foot-and-mouth disease virus lies in the slightly acid medium. In the pH range of 7-9 it has a negative charge. An increase in adsorption at higher pH values has no connection with this. The investigations here indicated that the reduced adsorption at pH 9, is keeping with the theory, actually occurs, which is in agreement with earlier findings of other authors.

In all cases involving aluminum hydroxide, it must be remembered that it can be found in a metastable state, which can be influenced by a change of the medium, the changes toward the alkaline side being practically irreversible.

The conclusions drawn with respect to the effect of the chemical property of the aluminum hydroxide on the adsorbed foot-and-mouth disease vaccine will be discussed in a future work.

85. Virus Abortion and Brucella abortus in a Sheep Herd

"Virus Abortion and Brucella Abortus in a Sheep Herd," by K. H. Enke, H. Liebermann, and B. Schuckmann, Office of Veterinary Research and Animal Health, Rostock; Leipzig, Monatshefte fuer Veterinaermedizin, No 15, 1 Aug 59, pp 473-475

A report is given on a culture of Brucella abortus obtained from a sheep fetus. The epidemic in this herd was, without doubt, dominated by virus abortion, and the brucellosis must be considered an accidental, accompanying infection which was probably transmitted from the herd of cattle.

86. Practical Value of Protective Inoculation of Cattle With Killed Brucellosis Vaccine

"On the Protective Inoculation of Cattle With Killed Brucellosis Vaccine," by P. Dobberkau, Goldbeck, Kreis Osterburg/Altmark; Leipzig, Monatshefte fuer Veterinaermedizin, No 15, 1 Aug 59, pp 479-480

With the "Dessau" killed brucellosis vaccine, it is quite possible, even in extensively infected herds, to reduce the number of cases of abortion in a relatively short time to the point where serious economic losses can be spared.

According to the experiences of the author, all the animals of a herd, insofar as they are used for breeding, without regard to the condition of pregnancy at the time, should be inoculated twice at brief intervals. After 6-7 months, at least one booster shot, two if possible, should be administered. The inoculation is well tolerate; any swellings which occur require no special attention.

Since brucellosis at present is again increasing, the author suggests that the "Dessau" killed vaccine be introduced generally in combating brucellosis, after the instructions for use have been revised.

Miscellaneous

87. History, Present Activities, and Future Plans of Hungarian Pharmaceutical Research

"Report on the Work of the Pharmaceutical Industry Research Institute," by Gyula Horvath, Pharmaceutical Industry Research Institute; Budapest, Magyar Kemikusok Lapja, Vol XIV, No 4, Apr 59, pp 155-157

"The Pharmaceutical Industry Research Institute was formed on 1 January 1950 and in 1952 was combined with the Central Biochemical Industry Research Institute, which was established in 1949.

"During the first 5-6 years of its operation, the institute primarily developed production procedures for drugs already known, and introduced these procedures into the factories. During the last 3-4 years there has been increasing opportunity for research on new, original Hungarian medicines.

"When judging the productivity of the institute, it should be remembered that there is no substantial organic chemistry industry in Hungary. Thus, our procedures, in many cases, had to start with the processing of the simplest primary materials, and this requires considerable extra work.

"The successes achieved in the industrial research work of the institute are demonstrated by the fact that 40-45 percent of the value of the products of the pharmaceutical industry and 25 percent of Hungarian medical exports resulted from procedures developed by the institute.

"Fifty percent of the research work being done at the institute is devoted to the development of synthetic organic compounds; 33 percent is devoted to the problems of antibiotics and fermentation; 7 percent to problems of plant chemistry; and 10 percent to problems of biochemistry. In 1950, 7.2 percent of all the expenditures were for basic research, whereas in 1950, 20 percent was spent on basic research.

"In the period 1950-1958, the institute successfully solved the problem of production and introduced into production more than 60 substances or compounds. Among these, the most significant were the following: p-amino-salicylic acid (PAS); Isonicotinic acid hydrazide (Isonicid); Chloramphenicol (Chlorocid); Vitamin C; Vitamin B; Xanthine-carbonic acid-diethylaminoestermethobromide (Pepsulan); Sulfaguanidine; 2-sulfanilamido-4, 6-dimethyl-pyrimidine (Superseptyl); Ni-p-toluolsulfonyl-N2-butyl-carbamide (Bucarban); Digilanid C.; Digitoxin; Dextran; Streptomycin; Oxytetracycline; Heparin; 2-Benzyl-4,5-imidazoline (Tolazolin); Degranol; Hibernal; Progesterone; Estrone, synthetic; Testosterone; Desoxycorticosterone acetate; Oxytocin, synthetic; V-penicillin; Alpha-phenyl-alpha-ethyl-glutarimide (Noxiron); and 2-methyl-2-n, propyl-1,3-propane diol-dicarbamate (Andaxin).

"Of all research expenditures, 4.6 percent were used for unsolved projects which became obsolete.

"From an industrial and economic viewpoint, the more outstanding substances developed were Chloramphenicol and Oxytetracycline; from the chemical viewpoint, the most noteworthy was the 26-step synthesis of Oxytocin; and from the viewpoint of basic research, the most significant was the development of Degranol, a cytostatic preparation, which has received international recognition.

"Among the important technological problems solved are the following: development of new-type sterile air filters for use in fermentation, a method of metallic natrium dispersion; a method of oxonization; a method for the semisynthetic production of estrone; a method for the large-scale chlorination of mannitol; the industrial Craiq process; and the use of complex metal hydrides for reduction procedures.

"We are now concerned with several technological problems: the development of new type desiccators, and several problems of fermentation technology (continuous sterilization, automatic antifoam dosing, and instrumentation).

"The following developments are noteworthy among our basic researches conducted in recent years:

"Antituberculosis compounds. We prepared more than 100 new compounds and examined their antituberculosis effect. This research did not result in the development of a new more powerful drug, but it allowed us to draw interesting conclusions concerning the interdependence of structure and effect.

"Chromone derivatives. We produced several chromone derivatives which dilate coronary arteries, and in animal experiments these showed certain advantages over natural khellin.

"Complex metal hydrides. We produced the boron hydrides of alkaline earth metals and we developed a use of these in selective reductions.

"New antibiotics. Earlier, we produced a new antibiotic called Evericin; however, due to its toxicity it could not be used clinically. We are now seeking new antibiotics, and several antibiotics discovered by us are being investigated.

"Antitumor materials. We have independently produced nearly 40 compounds. Investigations have been completed on some of these and are under way on the rest. As a result of this work, Degranol has already been proved clinically effective, and has been introduced here and abroad. Other preparations are now undergoing clinical tests. During our research, we uncovered several instances of the interesting interdependence between the chemical structure of substances and their cytostatic effect.

"Since 1950, workers of the institute have published about 250 scientific articles in domestic and foreign journals. The institute has applied for about 200 patents; a number of these were submitted abroad.

"We work in close cooperation with the Chemical Research Institute of the Hungarian Academy of Sciences, the Medicinal Plants Research Institute, the Organic and Synthetics Industry Research Institute, the Szeged University Microbiological Institute, the Organic Chemistry, Pharmacological, and Biological institutes of Debrecen University, the General Chemistry and Physical Chemistry faculties of the Technical University, the Organic Chemistry and Chemical Technology faculties of the Lorand Eotvos Science University, the No 1 Pathology and Experimental Cancer Research Institute of the Budapest Medical University, and the Oncological Institute.

"Since last year, we have been developing promising cooperation with the All-Union Medical Chemistry Research Institute in Moscow.

"At present, the institute is dealing with the following important basic projects:

"The synthesis of peptides with a hormone-like effect. In cooperation with the Organic Chemistry Institute of the Lorand Eotvos Science University and the Kobanya Pharmaceutical Factory, we are trying to synthesize polypeptides which will have a hormone-like effect.

"The production of oxytetracycline derivatives. We are trying to produce several new derivatives of oxytetracycline which will have advantageous pharmacological properties.

"The development of new antibiotics. We are continuing the examination of the strains collected and isolated by us in the interest of discovering new antibiotics.

"The production of antituberculosis compounds. In animal experiments, ethylthiocarbonyl-glycin, first produced by us, shows a better antituberculosis effect than PAS. We have produced, for antituberculosis examinations, several derivatives of ethylthiocarbonyl so as to study the interdependence of structure and effect.

"Investigation of Elastase. We are further refining the industrial production procedures worked out by us for the new elastolytic enzyme discovered by Academician Balo and by Ilona Banga, and we are seeking new areas for its medicinal use. In the course of experiments so far, elastase has shown good results in treating pulmonary abscesses.

"Examinations of domestic medicinal plants. We are trying to isolate hitherto unknown materials with medicinal effects from our domestic medicinal plants.

"We are also striving to produce new phenethiazine derivatives, antitumor materials, psychotropic materials, ataractics (daytime tranquilizers), sulfonamides, and anticold preparations.

"Industrial Projects:

"During the year, we will probably complete the development of production procedures for the medically important corticosteroids. We are industrializing the isolation procedures we developed for convallatoxin-, and protoveratrine A. We are conducting experiments on the production of properdine and relaxin; and we have planned to investigate compounds which decrease the cholesterine content of serum.

"We have planned to begin the production of several new preparations (phenethiazine derivatives, blood pressure reducing compounds, ganglio-blocking materials, central nervous system tranquilizers, and anti-Parkinson's disease compounds).

"The scattered location of several of our departments somewhat hinders the research work of the institute. This situation will be corrected in a few years when we build a central building for our institute. Construction will begin in 1960 and will be completed in 1964 or 1965.

"As research in the factories increases, we plan to turn more and more to basic research. Our superior authority, the Ministry of Heavy Industry, agrees with this plan."

VI. METALLURGY

88. Study of Microstructure and Physical-Mechanical Properties of Rare-Earth Metals and Their Alloys

"Study of Microstructure and Physical-Mechanical Properties of Rare-Earth Metals and Their Alloys," by Ye. M. Savitskiy and V. F. Terekhova, Redkozemel'nyye Elementy, Polucheniye, Analiz, Primeneniye (Rare-Earth Elements, Production, Analysis and Applications), Moscow, Academy of Sciences USSR, 1958, 331 pp (pp 299-306)

The rare-earth metals are becoming more widely used in metallurgy, especially as alloying elements of ferrous, nonferrous and light metals. It was proven conclusively that the addition of cerium subgroup metals will improve the heat resistant properties of magnesium alloys.

At the Laboratory of Rare-Metal Alloys of the Institute of Metallurgy Academy of Sciences USSR, the study of rare-earth metals is being conducted in the following three principal fields: the study of physical-chemical properties of rare-earth metals, such as mechanical and electrical properties of the pure metals at various temperatures; the study of rare-earth metal alloys and the construction of phase diagrams; and the study of the effect of addition of rare-earth metals to the alloys of other metals. The experimental data in this report were obtained at the laboratory prior to 1955.

The laboratory has investigated the mechanical properties of lanthanum in the temperature range of 20-800°C, cerium in the range of 20-600°C, and praseodymium in the range of 20-800°C. The temperature for polymorphous transformation and the temperature ranges for highest ductility of lanthanum, cerium and praseodymium were obtained with the aid of mechanical tests. Hardness, ductility at slow and impact compression, tensile strength and ductility in tension, and behavior in extrusion of lanthanum were determined. The dependence of mechanical properties of lanthanum, cerium, and praseodymium on temperature were plotted in plain and semi-logarithmic coordinates.

At room temperature, lanthanum, cerium, and praseodymium have a hexagonal lattice structure and are not capable of appreciable plastic deformation. At higher temperatures, the hexagonal lattice transforms into a body-centered cubic lattice, which is capable of considerable plastic deformation. Due to the presence of impurities, polymorphous transformation occurs in the following temperature ranges: 500-600°C for lanthanum, 350-400°C for cerium, and 500-600°C for praseodymium. The temperatures for maximum ductility (plasticity) were determined to be as follows: 700°C for lanthanum, 450°C for cerium, and 700-750°C for praseodymium.

The principal methods used in construction of phase diagrams for lanthanum and cerium alloys were: metallographic examinations, thermal analysis, and hardness and electric resistance measurements. The alloys were prepared in zirconium oxide crucibles. The cast samples were annealed at 550°C for 1-2 hours.

Microscopic examination of cast, deformed, and annealed samples has shown that alloys containing 40, 60 and 80% cerium have a single-phase structure of solid solution type, indicating the existence of a continuous series of solid solutions between these two metals. (La and Ce).

The laboratory has studied the effect of rare-earth metals on high melting iron- titanium- chrome- and magnesium-base alloys. Experiments with introduction of rare-earth metals into steel and iron were just recently begun in the laboratory. However, it was definitely established that the addition of rare-earth metals to steel and iron greatly improves their ductility.

89. Use of Rare-Earth Metals in Cast Magnesium Alloys

"Use of Rare-Earth Metals in Cast Magnesium Alloys," by N. M. Tikhova and V. A. Blokhina, Redkozemel'nyye Elementy, Polucheniye, Analiz, Primeneniye (Rare-Earth Elements, Production, Analysis, and Applications), Moscow, Academy of Sciences USSR, 1958, 331 pp (pp 323-329)

A very popular magnesium alloy in the USSR is the ML-5 grade (8.5% Al, 0.5% Zn, 0.2% Mn), which, however, has a low resistance to creep at somewhat elevated temperature. The creep resistance of this magnesium alloy can be substantially increased by adding the rare-earth metals of the lanthanum-neodymium series. The tensile strength of magnesium alloys also increases with the addition of lanthanum, praseodymium, and neodymium. Neodymium is the most potent of rare-earth elements in improving the mechanical properties of magnesium alloys, probably due to its high solubility in magnesium. Alloying magnesium with lanthanum is impractical because the mechanical properties of such alloys are low at room temperature, and the creep strength at elevated temperatures is not superior to that of plain magnesium alloys. The most practical way of adding the rare-earth metals to magnesium alloys is by means of the misch metal which contains about 50-65% cerium.

In the USSR, an experimental magnesium alloy ML-11 (3.0% misch metal, 0.5% Zn and 0.5%Zr) is now in trial production stage. Small additions of misch metal are used for grain refinement of widely used magnesium sheet alloy MA-8 (1.7% Mn, 0.15% misch metal). Addition of misch metal (1.25 -1.50%) to a high strength magnesium alloy (4.5% Zn, 0.7% Zr) considerably improves the density of castings and reduces the tendency toward hot brittleness. Thus, at 250°C, the creep strength of ML-10 magnesium alloy is 3-3.5 kg/mm^2, the endurance limit is 7-8 kg/mm^2, and the tensile strength is 14 kg/mm^2. The fluidity of magnesium alloys treated with rare-earth metals, however, is lower than that of untreated magnesium alloys.

The magnesium-neodymium alloys should be heated to 530°C for 8-12 hours, cooled in air, and aged at 200°C for 8 to 16 hours.

In conclusion, it can be said that the addition of rare-earth metals to magnesium alloys will improve their heat-resistant properties so that their range of high-temperature application is raised to 250-300°C, which is roughly 150°C better than that for untreated Mg-Al-Zn alloys.

90. New USSR Books on Nonferrous Metallurgy

"Prospekt Na Knigi Metallurgizdata, Vypuskayemyye Vo 2-m Polugodii 1959 g" (List of Books To Be Published By Metallurgizdat in the 2d Half of 1959), Metallurgizdat, Moscow, 1959, 16 pp

The following books will be published by Metallurgizdat in the second half of 1959:

K. B. Lebedev, Metallurgiya Reniya (The Metallurgy of Rhenium) -- for engineers, technicians, and scientific workers; price 5 r.

A. Yu. Polyakov, Metallurgiya Vanadiya (The Metallurgy of Vanadium) -- for production engineers and workers at laboratories and design and planning organizations; may also be of use to students at higher educational institutions; price 3 r.

G. B. Samsonov and V. I. Konstantinov, Tantal i Niobiy (Tantalum and Niobium) -- for engineers at industrial enterprises, scientific research institutes, and students; price 10 r 50 k.

Yu. M. Shashkov, Metallurgiya Poliprovodnikov (The Metallurgy of Semiconductors) -- for engineers and technical workers at industrial enterprises and scientific research institutes; price 5 r.

Primeneniye Redkozemel'nykh Elementov Dlya Legirovaniya Staley i Splavov (Application of Rare-Earth Elements as Alloying Components for Alloy Steels and Alloys) (Collection of articles by different authors) -- for engineers, technicians, and scientific workers in the fields of ferrous and nonferrous metallurgy, machine building, and instrument construction; also students at higher technical educational institutions; price 11 r 50 k.

VII. PHYSICS

Atomic Energy Developments

91. Figures on Atomic Power Station Being Built in Voronezh

"One More Atomic Power Station," by I. Vinogradov; Moscow, Pravda, 14 Aug 59, p 1

The following figures were given in a newspaper article describing construction activities associated with the Voronezh Atomic State Regional Power Station: rated capacity, 420,000 kw; type, water-water; fuel, 44 tons of enriched uranium providing 6 months of continuous operation; water temperature and pressure in core, 275° at 100 atm; water pressure in turbines, 29 atm; three turbogenerators rated at 70,000 kw each; weight of reactor without water, 420 tons; height of ventilating stack, 120 meters; high-strength steel jacket enclosing core, 3.8 meters in diameter and 12 meters high; and efficiency of station, 26.3 percent.

92. Military Applications of Atomic Energy in Aviation and Rockets

Atomnaya Energiya v Aviatsii i Raketnoy Tekhnike (Atomic Energy in Aviation and Rocket Technology) edited by Engr Lt Col P. T. Astashenkov, Publishing House of the Ministry of Defense USSR, Moscow, 1959, 501 pp

A collection of articles covering the development of atomic and thermonuclear weapons and their various carriers, atomic defense in aviation, and the applications of atomic defense in aviation and rocketry is contained in a book intended for officers of the Soviet Army, Air Force, and Navy. The book draws heavily on US sources.

A list of the titles of the articles and their authors follows:

"Achievements of Science and Technology for the Good of Mankind," by Academician I. V. Kurchatov

Nuclear Weapons and Their Carriers

"Aircraft, Interplanetary Rockets, and Other Carriers of Thermonuclear Weapons," by Maj Gen Engr Tech Serv G. I. Pokrovskiy, Professor, Doctor of Technical Sciences

"Flight Control of Interplanetary Rockets," by Engr Lt Col I. Kucherov, Candidate of Technical Sciences, and Engr Capt D. Gladkov

"Types of Rocket Weapons," by Engr Lt Col V. Glukhov, Candidate of Technical Sciences

"Aircraft and Rockets as Carriers of Tactical Nuclear Weapons," by Engr Lt Col P. Galin

"Guided Missiles With Atomic Charges in Aviation and Air Defense," by Engr Lt Col A. Petrov

"Homing of Aviation Rockets," by Engr Lt Col I. Kucherov, Docent, Candidate of Technical Sciences, and Engr Capt D. Gladkov

"Certain Trends in the Development of Jet-Powered Guided Missiles," by Engr Lt Col A. Fedorov

"On the Effectiveness of Rocket Weapons," by Engr Lt Col V. Glukhov, Candidate of Technical Sciences

"Jet Engines for Carriers of Nuclear Weapons, by Engr Lt Col A. Petrov

"Aerodynamics of Supersonic Flight," by Lt Gen Engr-Tech Serv V. Pyshov, Professor, Honored Worker of Science and Technology

"Materials for Carriers of Nuclear Weapons," by Engr Lt Col V. Parfenov, Candidate of Technical Sciences

"Modern Atomic Bombs and Missiles," by Engr Lt Col M. Arkhipov, Docent, Candidate of Technical Sciences

"Modern Thermonuclear Bombs and Missiles," by Engr Lt Col M. Arkhipov, Docent, Candidate of Technical Sciences;

"On the So-Called 'Clean' Hydrogen Bomb," by Engr Lt Col M. Arkhipov, Docent, Candidate of Technical Sciences

"Military Radioactive Substances," by Lt Col A. Kamov

"On Air Combat Orders Under Conditions When Guided Missiles Are Employed in Aerial Combat," by Engr Lt Col B. Surikov

"On Air Combat Orders Under Conditions When Antiaircraft Missiles Are Employed," by Engr Lt Col B. Surikov

"Application of Pilotless Missiles From Bombers," by Engr Lt Col B. Surikov

Effect of Atomic Weapons and Atomic Defense in Aviation

"Effect of Atomic Weapons on Airfields," by Engr Lt Col M. Pavlov

"Atomic Defense of Airfields," by Engr Lt Col M. Pavlov

"Effect of the Luminous Radiation From an Atomic Explosion on Aviation Equipment and Airfield Installations," by Engr A. Pavlenko

"Smoke-Defense Against Luminous Radiation," by Capt 1st Rank A. Zheludev, Docent

"Harmful Effects of Penetrating Radiation From an Atomic Explosion and Defense Against It for an Air Supply Base," by Engr Capt B. Zhilov

"Flight in the Cloud From an Atomic Explosion," by Engr Lt Col N. Litvinenko, Candidate of Technical Sciences

"Effects on Flyers Under Radioactive Contamination of Airfield and Equipment," by Engr Lt Col N. Litvinenko, Candidate of Technical Sciences

"Field Dosimetry Devices, Their Basic Components, and Quality Indication," by Engr Lt Col S. Avdonkin

"Developing Methods of Radiation Surveying and Dosimetric Control," by Lt Col A. Kamov

"Air Radiation Surveying," by Engr Lt Col V. Syrnev, Candidate of Technical Sciences

"Decontamination of Aircraft," by Engr Lt Col R. Rubkov

"Sanitation Measures," by Col Med Serv A. Lavnikov

Problems in the Utilization of Atomic Energy in Aviation, Rocketry, and Other Forms of Technology

"Modern Trends in the Development of Aviation Engineering," by Lt Gen Engr-Tech Serv A. Ponomarev

"Progress of Atomic Technology and Aviation and Problems of Banning Nuclear Weapons," by Engr P. Astashenkov

"Thermonuclear Energy, the Basis of Future Power," by Academician I. V. Kurchatov

"Work on Controlled Thermonuclear Reactions," by Academician I. V. Kurchatov

"Cosmic Flights," by Maj Gen Engr-Tech Serv G. Pokrovskiy, Professor

"The Atmosphere as a Source of Energy," by Maj-Gen Engr-Tech Serv G. I. Pokrovskiy, Professor, Doctor of Technical Sciences

"Atomic Tug or Pilotless Aircraft?" by Maj Gen Engr-Tech Serv G. I. Pokrovskiy, Professor, Doctor of Technical Sciences

"From Ordinary Aviation Fuels to Nuclear," by Engr-Lt Col V. Parfenov, Candidate of Technical Sciences

"Protection From Nuclear Radiation on Atomic Aircraft," by Engr Lt Col A. Sedov, Candidate of Technical Sciences

"Use of Radio-Guided Aircraft in Testing Atomic and Thermonuclear Weapons," be Engr Lt Col N. Nikolayev

Armed Forces of the Soviet Union, the Dependable Guardian of Peaceful Labor

"Speech of Marshal of the Soviet Union R. Ya. Malinovskiy at the 21st Congress of the CPSU"

"Speech of the Representative of the President of the Council of Ministers USSR D. F. Ustinov at the 21st Congress of the CPSU"

"Speech of I. V. Kurchatov at the 21st Congress of the CPSU"

"On the Subject of Belligerent Statement of Certain American, English, and West German Generals and State Officials"

"Literature Used in Preparing the Articles for the Book "Atomic Energy in Aviation and Rocket Technology"

Atomic and Molecular Physics

93. Luminescence and Absorption in a Nuclear Reactor

"Measurement of Luminescence and Darkening of Glasses During Their Irradiation in a Nuclear Reactor," by G. Ya. Vasil'yev, A. F. Usatyy, Yu. S. Lazurkin, and A. A. Markov; Moscow, Doklady Akademii Nauk SSSR, Vol 125, No 6, Apr 59, pp 1219-1222

A specially devised apparatus is described which permits simultaneous measurement of the luminescence and darkening of transparent materials irradiated in a nuclear reactor. Both phenomena are closely related and facilitate measurement of the luminescence yield of a specimen of finite thickness, since only a knowledge of its darkening is required. A quartz spectrum was used for comparison because its luminescent band was within the boundaries of the specimen. It is suggested that the characteristic kinetics of the darkening of quartz are due to the abundance of several types of color centers responsible for interaction and mutual transitions.

94. Polarization of Radiation

"Polarization of Radiation of Helium Atoms Excited by Electron Impact," by G. G. Dolgov; Moscow, Optika i Spektroskopiya, Vol 6, No 6, Jun 59, pp 717-722

Polarization of radiation is measured for four lines of helium : 5016, 4921, 4471, and 3889 Å. The polarization has a nonmonotonic relation to the energy of incident electrons. The maximum polarization is at a distance of 5 to 10 ev from the threshold. The observed effect is explained on the basis of the semiclassical model.

95. Temperature of Electrode Vapors Measured

"The Temperature of Electrode Vapors in a Spark Discharge," by N. K. Sukhodrev and S. L. Mandel'shtam; Moscow, Optika i Spektroskopiya, Vol 6, No 6, Jun 59, pp 723-728

Results of measurements on lines Al III, Sn IV, and Si IV indicate the temperature of electrode vapors in the spark to be about 30,000-35,000° instead of the previous evaluation of ~ 10,000° K, which should be ascribed to the peripheral vapor cloud. The higher temperature is close to the channel temperature of 30,000-40,000°C, and thus supports the assumption that the heating and excitation of electrode vapors occur during their passage through the spark channel.

96. Temperature Dependence of Infrared Absorption

"Investigation of the Temperature Dependence of the Intensity of Infrared Absorption Bands in Liquids," by F. A. Bazhulin and V. N. Smirnov; Moscow, Optika i Spektroskopiya, Vol 6, No 6, Jun 59, pp 745-753

Quantitative measurements of intensities of infrared absorption bands have been made on a number of liquids at various temperatures. A departure from the relation derived theoretically has been found. The observed effects are discussed.

97. Light Stored in Phosphors

"Dependence of the Total Light Stored on Levels of Various Depths Upon the Excitation Density," by Yu. M. Popov; Moscow, Optika i Spektroskopiya, Vol 6, No 6, Jun 59, pp 764-768

A phosphor with two adherence levels of different depths is analyzed. It is assumed that from the adherence levels the electrons are ejected by thermal vibrations of the lattice into the conduction zone. The probability of a thermal ejection from the adherence level is expressed on the basis of the principle of detailed equilibrium by the probability of capture by this level. It is shown that in a steady-state system the ratio of number of electrons stored on deep levels to the number stored on higher levels is proportional to the product of two factors, one of which represents the ratio of the total number of deep levels to higher levels, and the other always decreases with an increase in the excitation density.

98. Radiationless Recombination in Luminescence

"Influence of the Radiationless Recombination on the Saturation Effect in Cathodoluminescence," by Yu. M. Popov and V. P. Shabanskiy; Moscow, Optika i Spektroskopiya, Vol 6, No 6, Jun 59 pp 769-775

Kinetic equations for the number of particles in the conducting zone and on adherence levels, applied in luminiscence problems, are solved. Processes of triple recombination are taken into account in these equations because they are essential at high densities of the free charge carriers. By triple recombination is meant a process of radiationless recombination, which is the reverse of the process of electron ionization from traps by conduction electrons or holes. It is demonstrated that these densities of free electrons and holes correspond to the nonlinear section of cathodo-luminescence yield, which appears at a sufficiently strong irradiation. Numerical evaluations and the form of the curve for yield versus radiation intensity conform with experiment. The energy balance for electrons in recombination processes is compiled and the electron temperature is evaluated.

99. Measurements by Interference

"New Interferometric Method of Measuring Dispersion of Liquids," by I. N. Shklyarevskiy; Moscow, Optika i Spektroskopiya, Vol 6, No 6, Jun 59, pp 780-783

A new interferometer method is described for measuring the dispersion of liquids in the visible and ultraviolet parts of the spectrum. The method is free from the effect of phase jump and permits more accurate measuring.

100. Interference Light Filters

"Multilayer Dielectric Interference Light Filters," by T. N. Krylova; Moscow, Optika i Spektroskopiya, Vol 6, No 6, Jun 59, pp 784-787

Characteristics of interference light filters consisting of alternate layers of dielectrics (titanium dioxide and silicon dioxide) obtained from easily hydrolyzed compounds are described. Replacing the transparent silver layers in the interference filters with multilayer dielectrics resulted in filters which transmitted up to 80% of the light over a small band width. The use of these substances yielded specimens of stable filters for a range of 380-850 mμ.

101. Speed of Light

"Application of Electron Optical Converters for Accurate Measurement of the Speed of Light Propagation," by K. S. Vul'fson, Moscow City Pedagogical Institute imeni Potemkin; Moscow, Doklady Akademii Nauk SSSR, Vol 125, No 6, Apr 59, pp 1223-1224

A special electron optical device previously described by Ye. S. Zavoyskiy and S. D. Fanchenko (DAN, 100, No 4, 661 (1955)) and giving a practical time resolution of 10^{-13} sec, has been used for accurate measurement of the speed of light. The error in measurement does not exceed 10^{-6} sec.

Solid State Physics

102. Structural Diffusion

"Investigation of the Relation of the Structural Diffusion Coefficient to Temperature," by V. P. Tsvetkov, Voroshilov Mining and Metallurgy Institute; Moscow, Doklady Akademii Nauk SSSR, Vol 125, No 6, Apr 59, pp 1235-1237

The relation of the structural diffusion D to temperature is studied for bismuth and the equation D = D(T) is analyzed. Radiographic data were used for plotting curves of atomic distribution following a previously described method (A. Ye. Glauberman and V. P. Tsetkov, DAN , 106, 623 (1956)). The experimental curves were compared with the theoretical curves for several lattices, and one of these lattices, the diffusion coefficient of which describes best the structure of liquid Bi, was chosen. It was found that a densely packed hexagonal lattice fits best.

103. X-Ray K-Absorption Spectra of Titanium

"Fine Structure of X-Ray K-Absorption Spectra of Titanium in Titanates of the System BaO-TiO_2 in Piezoelectric Crystals," by E. Ye. Vaynsteyn, M. N. Bril', and Yu. F. Kopelev, Institute of Geochemistry and Analytical Chemistry imeni Vernadskiy, Academy of Sciences USSR; Odessa Pedagogical Institute imeni Ushinskiy; Moscow, Doklady Akademii Nauk SSSR, Vol 126, No 4, Jun 59, pp 744-747

The fine structure of X-ray atomic absorption spectra in piezoelectric materials is studied in an attempt to clarify the symmetry and the magnitude of the internal field of crystals. For this purpose several compounds of the system BaO-TiO_2 are investigated.

104. Anomalous Skin Effect of Metals in Infrared

"Anomalous Skin Effect and the Optical Constants of Copper, Silver, Gold, and Nickel in the Infrared Region of the Spectrum," by I. N. Shklyarevskiy and V. G. Padalka; Moscow, Optika i Spektroskopiya Vol 6, No 6, Jun 59, pp 776-780

By using previously obtained values of optical constants of Cu, Ag, Au, and Ni Optika i Spektroskopiya, 4, 792 (1958); ibid. 6, 78 (1959)) and on basis of the theory of anomalous skin effect, the concentration of conduction electrons, the relaxation time, and the product of the speed on the Fermi limit and the diffusion coefficient (1-p) are computed. The computations are made under the assumption that the conductivity of the thick metallic deposits in vacuum equals the conductivity of large pieces of metal.

105. Surface Reactions in Germanium

"Field Effect and Reactions at the Surface of Germanium," by H. Flietner, Heinrich Hertz Institute, Berlin-Adlershof; Leipzig, Annalen der Physik, Vol 3, No 7/8, 1959, pp 414-427

Reactions which take place at the surface of germanium specimens with various conductivities were followed with the aid of the field effect. It was found that the effect of ozone produces an increase of the number of "fast" terms. In a surface not previously treated with ozone, this increase of "fast" terms was accompanied by a disappearance of "slow" acceptor terms. These "slow" acceptor terms, as the result of oxygen adsorption, are converted by the ozone treatment into "fast" acceptor terms, which correspond to the bonding possibilities of free electrons at free valences of surface atoms. The effect on the "fast" terms is made completely reversible by the moist atmosphere. The charge in the "slow" terms, however, is retained. This means that at the surface, the H_2O causes a type of bonding which involves no change of charge. One type of bonding with these properties is the GeO_2 bonding. In a surface pretreated with ozone and moisture, a second ozone treatment likewise causes an increase of the number of "fast" terms, but without a simultaneous change of charge in the "slow" terms. This is understood to indicate that ozone likewise separates the GeO_2 bond and creates possibilities for the bonding of free electrons at free valences.

106. Surface Conductivity of Germanium During Slight Band Distortions

"Surface Conductivity With Allowance for the Scattering of Charge Carriers at the Surface During Slight Band Distortions," by H. Flietner, Heinrich Hertz Institute, Berlin-Adlershof; Leipzig, Annalen der Physik, Vol 3, No 7/8, 1959, pp 396-413

The conductivity of space-charge edge layers parallel to the surface of semiconductors is computed with the scattering of the charge carriers at the surface taken into account. The calculations were made for slight band distortions (bending), such as occur as a result of the field effect. The necessary integration of the Poisson equation produced a diagram from which the potential curve in the space-charge edge layers can be traced for an arbitrary value of band distortion and arbitrary position of the Fermi level inside the semiconductor. Numerical extrapolations were prepared for germanium.

107. Multiparticle Correlation

"A Method for Taking Correlation Into Account in a Many-Particle System," by Chen Chun-Sian, Moscow State University imeni Lomonosov; Moscow, Doklady Akademii Nauk SSSR, Vol 125, No 6, Apr 59, pp 1238-1241

A general method for taking correlation into account in a multiparticle system leads to a system of integral equations derived from Green's function for a multiparticle system. An approximation method is used to solve the equations. A binary approximation of this method yields at once all results previously obtained (K. A. Brueckner et al, Phys. Rev. 97, 1344 (1955); J. Bardeen et al, Phys. Rev. 108, 1175 (1957)). The method is similar to those suggested by N. N. Bogolyubov (ZhETF, 34, 58 (1958)) and H. Ursell (Proc. Cambr. Phil. Soc., 23, 685 (1927)).

108. Nonexistence of Singularity-Free Solutions of Field Equations

"On the Question of the Existence of Singularity-Free Solutions of the General-Relativity Field Equations Which Could Represent Particle Models," by A. Papapetrou and H. Treder, Institute of Pure Mathematics, [East] German Academy of Sciences, Berlin; Leipzig, Annalen der Physik, Vol 3, No 7/8, 1959, pp 360-372

In this work the existence of singularity-free solutions, periodic with respect to time, of the gravitation equations is discussed. On the basis of the asymptotic behavior of periodic fields, it follows that such a solution could be periodic with respect to time only in a finite internal region of the three-dimensional space in which the gravity field is strong, and that this internal region would have to be attached to a stationary outer field by means of an abrupt transition surface. From Stellmacher's investigations (Math. Ann., Vol 115, 1938, p 740) on the transitions compatible with the field equations, it follows that this transition surface would have to be a smooth null hyperplane. A geometric theorem on smooth hyperplanes is then derived, from which it is seen that such a transition plane cannot exist. Accordingly, Einstein's theory of the pure gravitational field permits no singularity-free solutions which are periodic with respect to time, and thus permits no models of stable particles.

A discussion of the properties required for singularity-free solutions (periodic with respect to time) of the Einstein-Maxwell field equations for the combined gravitation-electromagnetic field leads to the same negative answer.

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