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CENTRAL INTELLIGENCE AGENCY  
INFORMATION FROM  
FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT [ ]  
CD NO. [ ]

50X1-HUM

COUNTRY USSR

DATE OF INFORMATION 1950

SUBJECT Scientific - Miscellaneous, Stalin Prize winners

DATE DIST. 30 Mar 1951

HOW PUBLISHED Pamphlet

50X1-HUM

WHERE PUBLISHED Moscow

NO. OF PAGES 8

DATE PUBLISHED May 1950

SUPPLEMENT TO REPORT [ ]

50X1-HUM

LANGUAGE Russian

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SOURCE Novyye Dostizheniya Sovetskoy Nauki i Tekhniki, Moscow, 1950, "Pravda" Publishing House, 30 pp, [ ]

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1949 ACHIEVEMENTS IN SOVIET SCIENCE AND TECHNOLOGY

Prof V. I. Kuznetsov

The following is a brief digest of a lecture presented at the Society for the Dissemination of Political and Scientific Knowledge in Moscow on an unspecified date in 1950.

In his introduction, Kuznetsov stresses two points: (1) The USSR today possesses a large, powerful army of almost 150,000 scientists who work in some 3,500 institutes, experimental stations, and laboratories doing scientific-research work. (2) According to a Tass report of 25 September 1949, the USSR has possessed atomic weapons since 1947. (no further information given).

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Physics and Mathematics

Physics and mathematics are fields that have been particularly expanded during the Soviet era. The large numbers of physics institutes established at universities has facilitated the preparation and training of a large group of personnel in these fields.

Among the Stalin Prize Laureates for 1949, the work of the following is particularly noteworthy.

Academicians S. A. Ambartsumyan and B. Ye. Markaryan, for their work in determining new types of stellar systems being formed within our galaxy. At present, 21 associations have been identified and there are several hundred and perhaps thousands remaining to be identified.

G. A. Shayn was awarded the Stalin Prize for spectral studies of stellar atmospheres. His studies open up a completely new field and present much new data for the explanation of many physical processes which take place on stars.

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Shayn has written a great number of important works in the field of stellar spectroscopy. He is credited with compiling the largest and most accurate up-to-date catalog of the velocity of light of stars. He was the first to show that, in addition to the usual bands of molecular carbon in the spectrum of so-called "cold" stars there are also bands representing molecules having one atom replaced by heavy carbon. Shayn's most interesting work however, has been conducted in the past 2 years. In that work he has shown that in certain stars the percentage of heavy carbon isotopes is very large, in some cases as much as one third the number of carbon atoms.

The Stalin Prize was awarded to M. V. Vol'kenshteyn and others for a collection of works published as a two-volume monograph entitled "Oscillation of Molecules." As a result of Vol'kenshteyn's work, it was possible to establish a theory of the oscillation spectra of complex molecules. Studies on the structure and properties of glass, liquid fuels, plastics, caoutchouc, ploymers, etc., would not be possible without the deep, fundamental, theoretical analysis in the monograph.

D. D. Ivanenko was awarded the Stalin Prize for his work on the theory of the so-called luminescent electron and for recent work on the problem of electrodynamics, part of which was published in his monograph, "Classical Theory of Fields." The major part of the monograph is devoted to the theory of elementary particles and intranuclear interrelationships from the viewpoint of the classical theory of fields. The author was able to show that many important problems of the theory of the atomic nucleus and elementary particles can be rapidly solved by means of the simple classic method without recourse to complex quantum calculations.

In line with work in the field of physical sciences, Stalin Prizes have also been awarded for work in applied physics. This once again calls attention to Soviet preference for scientific work closely related to the scientific and practical requirements of the national economy.

Several Stalin Prizes have been awarded for inventions. For example, V. P. Linnik supervised a project which finally resulted in the manufacture of a series of optical instruments for evaluating the fineness of a finished surface and for determining microhardness. Seven pieces of equipment were developed, among which were an interference microscope, a small profilograph, a microinterferometer, equipment for determining microhardness, and others.

Stalin Prizes were also awarded to V. K. Prokof'yev and others for the development and introduction into industry of new methods for spectral analysis of metals and alloys. They recommended a method of selecting a sample of the material to be tested for a spectral analysis, utilizing an electric-spark method of transferring matter from the sample being tested to a selected electrode. The analysis proceeds by activating an electric-spark discharge between the sample to be studied and a fixed copper electrode. After a while, the sample is replaced by an electrode composed of the same material as the fixed copper electrode, and an arc is formed between them. Then, on the basis of the duration of a spectral line, it is possible to determine the concentration of the element being studied.

A group of associates under the general supervision of B. K. Shembel' developed a new state standard for reproducing units of frequency. This standard makes it possible to reproduce specified frequencies of oscillations with an accuracy up to one part in two ten billionths per hour and one part in two billionths for a 24-hour period. The qualitative characteristics of this frequency standard exceed the quality of similar standards in foreign countries.

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The Stalin Prize was also awarded to A. G. Nagatkin and others for developing and introducing into series production new types of pressure gauges for high pressure and high accuracy. These gauges feature a new flexible element in place of the usual Bourdon tube.

#### Technical Sciences

In the Soviet era, technical sciences have received a very important impetus by the formation, in the Academy of Sciences USSR, of the Department of Technical Sciences. There was also formed a large network of so-called subsidiary scientific research institutes and design bureaus which are rapidly solving some of the more complex problems relating to industrial machinery, instruments, and apparatus.

Much significance has been placed on work in the field of technical sciences by engineers, inventors, etc., in developing new industries and re-equipping existing industries.

Among the Laureates of the Stalin Prize for 1949 are such leaders in the technical sciences as V. Z. Vlasov who was awarded the Stalin Prize for his work "The General Theory of Shells" and "Structural Mechanics of Thin-Walled Elongated Systems." Works of this type are of fundamental importance due to the wide application of shells in construction technology. For example, in cases where previously it was necessary to create heavy dead weight frameworks, it is possible to use a light, thin-walled shell. Vlasov set before himself the task of spanning the gap between the mathematical theory of shells, on the one hand, and strength of materials, on the other, and to establish a bridge between mathematical theory and practical problems of construction.

Vlasov worked for 20 years in the relatively new field of structural mechanics of thin-walled structures and finally developed methods which yield clear and simple results suitable for wide-scale application in practical construction. Today Vlasov is the recognized leader of the Soviet school of the theory of shells. His theory of shells has been adopted in the design of ferroconcrete coverings and spans and has resulted in great economies as well as improved architectural achievements.

D. L. Timrot and his scientific associates received a Stalin Prize for studying the thermal properties of steam under high temperatures and pressures. These scientists were the first to conduct wide-scale complex research on the fundamental properties of steam in the heretofore unknown regions of super-high pressures. Data on the properties of steam in these regions had, prior to this, been very limited. The thermal conductivity of steam was completely unknown and data on viscosity revealed a wide divergence in opinions. Timrot and others developed new methods which were far in advance of achievements in foreign countries in this field. On the basis of results obtained from these studies, it was possible to compile steam tables which, for the first time, have a completely scientific foundation. The significance of this work is clear when one considers that the fundamental tendency in steam engineering is to use high-pressure and high-temperature steam which results in great fuel economy.

#### Geology

Achievements of Soviet geologists must not be overlooked. On the basis of minerals, the USSR appears to have the most abundant resources in the world. It is impossible to identify any one particular territory of the USSR where one or another mineral cannot be found.

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Wide-scale studies of the natural resources of the USSR were conducted during the Stalin Five-Year Plans and resulted in the development of many deposits of coal, petroleum, ores, and other minerals.

A Stalin Prize was awarded to the famous Soviet geologist V. A. Obruchev for his unique and unprecedented scientific work "History of Geological Exploration in Siberia," which should prove to be an invaluable guide for other geological studies in Siberia. In this five-volume work the author discusses the history of geological studies in Siberia from the seventeenth century to 1940, and gives a condensed, comprehensive analysis of more than 15,000 scientific works which were written as a result of various geological studies in Siberia.

A prize was also awarded to M. V. Tronov for his scientific works "Contemporary Glaciation in the Altay" and "Notes on Glaciation in the Altay." These works were based on a large volume of factual material, particularly that which he gathered over a period of 30 years of research. As a result of many expeditions, Tronov was able to identify and study more than 550 glaciers which comprises about three fourths of the total number of glaciers in the Altay.

Tronov, on the basis of a comprehensive analysis of all the physico-geographical factors involved, determined conditions for the formation and development of glaciers and was able to establish the characteristic forms and types of glaciers in the Altay. He was also able to establish a certain uniformity in the geographical distribution of glaciers depending on a combination of climatic and topographical factors and also gave an analysis of the change in climate for the past hundred years and its relationship to changes in glaciation in the Altay.

#### Biology

The outstanding development in the field of biology was the exposure of reactionary Mendelistic and Morganistic theories and a resulting greater understanding of Michurinian biology. In addition, several scientists received awards for noteworthy achievements in this field.

A prize was awarded to Academician Ye. N. Pavlovskiy for his scientific work "Manual of Human Parasitology and Studies of Vectors of Communicable Diseases" [1948]. In this book he gives a generalization of the results of more than 30 years' activity in this field in which he was supervisor and organizer of large and extensive parasitological works. The book is, in itself, an encyclopedia on medical parasitology in which Pavlovskiy unfolds his new ideas and theoretical generalizations. Many original conclusions are included in the long chapter on blood-sucking ticks and great attention is given to the basic transmission of tick typhus, the transmitter of tick encephalitis, Marseilles fever, and some of the other ticks having great significance in human diseases. The work conducted by Pavlovskiy has resulted in a fundamental revision of USSR parasitological science.

A prize was also awarded to K. I. Skryabin for his three-volume scientific work "Trematoda of Animals and Humans" [1947 - 1949] in which the characteristics of more than 600 types of trematoda are listed. This is the first attempt in world literature to represent the characteristics of all species of trematoda (thirty-six families) which may be found in animals. The work has great theoretical as well as practical significance for the veterinarian, the medical doctor, the zoological technician, the biologist, and for all other specialists dealing with parasites who will find in these volumes information on differential analysis of diseases and data for conducting comprehensive therapeutic measures.

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A. P. Okladnikov was awarded a Stalin Prize for the discovery, study, and description of the skeleton remains of paleolithic man and some notes on their material culture. This was revealed in his scientific work "Teshik-Tash (Paleolithic Man)." Through a systematic and planned program for uncovering and studying skeleton remains, Okladnikov was able to confirm many of the theories formulated more than 20 years ago by one of our most famous zoologists and paleontologists, P. P. Sushkin, and also contributed important new data on the evolution of man.

Great interest was displayed in work done by M. M. Gerasimov, who was able to solve problems which for many years have been considered unsolvable by foreign scientists. He was able to establish a direct relationship between the structure of the bones of the skull and the structure of the soft tissues of the face, which makes it possible to reconstruct the facial features of any person on the basis of skull remains. Gerasimov in the past few years has been able to reconstruct the facial features of more than 70 types of human beings from prehistoric man to contemporary man. Through this method, he was able to recreate the facial features of Yaroslav Mundry, Andrey, Bogolyubskiy, Timur, Ulug-bek, and others. In an attempt to check Gerasimov's methods, a number of experiments were carried out in which skulls were given to the author and recreated facial representations were later checked against existing photographs. These tests fully confirmed the value and reliability of Gerasimov's method. His research undoubtedly has great significance for anthropology, archaeology, ethnography, and history.

#### Agrobiology

A group of Ukrainian animal husbandry technicians supervised by A. Ye. Yatsenko were awarded the Stalin Prize for developing a new highly productive breed of cattle. The weight of this new breed is approximately 600 kilograms for cows and one ton for bulls. The yield of the cows for a 300-day lactation period is approximately 3.5 to 4 tons. This breed is now widely distributed in the Ukraine and in some of the neighboring republics.

Very interesting work was done by some Kazakh animal husbandry specialists. A group of technicians under the supervision of N. S. Butarin conducted interspecies hybridization of a wild-mountain ram with finewooled sheep. As a result, a new breed of fertile, fine-wooled sheep was created, known as the Kazakh Arkharo-Merino species, and characterized by their ability to pasture the year round under the mountainous conditions of Kazakhstan.

A group at the Gor'kiy Agricultural Institute supervised by A. A. Kapatsinskaya, together with kolkhoz animal husbandry technicians of Gor'kiy Oblast, were able to produce a new breed of sheep which provides good meat and semicoarse wool. Their average weight is approximately 100 kilograms and they are particularly suited to life under the conditions of Gor'kiy Oblast.

The Stalin Prize was also given to various selection specialists in the field of cotton growing. For example, V. P. Krasichkov, collaborator of the Tadzhik Experimental Station on Cotton Growing, was awarded a Stalin Prize in 1949. Krasichkov developed a new type of fine-fibered cotton which ripens much earlier than some of the cotton plants currently in use. It is reported to be resistant to disease.

Khadych Baychurov, agronomist at the Kazan State Selection Station, was awarded a Stalin Prize for developing a new type of winter rye which is capable of producing a much higher harvest than most of the rye planted in that region. This rye is now widely grown in the Tartar, Mordovin, and Chuvash ASSR, and in a number of central oblasts of the USSR.

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I. N. Semchenkov and others who are agronomists at the Siberian Selection Station obtained remarkable results in developing a new type of winter wheat with high harvest yields. This wheat has received wide adoption in the Altay and Krasnoyarsk krays and in a large number of oblasts in Siberia.

Important biological work having great practical significance had been completed in recent years by a large group of scientific workers under the supervision of I. I. Zakharov. As a result of prolonged studies, they were able to establish the possibility of acclimatizing Black Sea grey mullet in the Caspian Sea. More than 20 years ago, a large number of young grey mullets were released in the Caspian Sea. At present, this species of fish has been completely acclimatized and is reproducing so prolifically that commercial fishing is now entirely feasible. For several years, a group of scientific workers under the supervision of G. V. Nikol'skiy have been conducting important studies on Amur River fish. The results of this work led to great improvements in fish economy on the Amur River, and permitted the establishment of a system of practical measures for increasing fish productivity in the basin of the Amur. As a result of these works, there has been an increased fish catch in this region. There is no doubt that the achievements of workers in the field of agronomy, animal husbandry, and general farm work have opened up inexhaustible possibilities for expanding the supply of foodstuffs and raw materials of the Soviet Union.

#### Machine Building

In the field of machine building, one of the fundamental branches of Soviet industry, a Stalin Prize was awarded to N. P. Kovalev for the manufacture of a new-type 102,000-hp turbine for use at the Dnepr Hydroelectric Power Station. These water turbines are among the largest in the world, with respect to size and power, and represent the first practical use of a fully welded spiral chamber of unusual dimensions. These turbines are fully automatic. Tests have shown that they are far superior to similar US turbines.

Workers of the Ural Plant for Heavy Machine Building, under the supervision of G. L. Khimich, developed a Soviet rail-rolling mill which, with regard to productivity, originality of design, mechanization, and automatic control of the individual, as well as whole groups of machines, is superior to similar equipment now in use in the USSR and abroad. The automatic and remote-control equipment on this mill permits a decrease of 60 people in operating personnel.

The Stalin Prize was also awarded to a group of engineers of the Gor'kiy Milling Machine Plant, under the supervision of B. I. Petyashin, for developing high-productivity cantilever-type and heavy milling machines. New high-productivity methods of machining metals, in particular high-speed milling, necessitated completely new designs for machine tools, with emphasis on milling machines. Emphasis has been placed on increased rigidity, improved control methods with fewer auxiliary cycles, and higher spindle speeds, which permits use of less skilled personnel and even multiple operation of machines by one worker. These machines have operating characteristics which are superior to foreign makes, and require fewer operators. Among heavy-duty machine tools developed by this plant, special mention should be made of the three-sided plano-milling machine and the face-milling machine for pillars of high buildings.

#### Metallurgy

Metallurgy has always received the attention of the party, state, and, particularly, Stalin, due to its importance to the national economy. This year, as in past years, the list of Stalin Prize Laureates contains many workers of the metallurgical industry. Among them are the engineers of the Ural Plant for Heavy Machine Building, supervised by A. G. Taleysnik, who were able to develop a large mold-making machine with a high loading capacity and with fully

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mechanized system of supplying molding sand and removing used sand. Conversion to the mechanized method has increased productivity more than 2.5 times and has doubled the annual casting capacity of each square meter of mold space while increasing quality of the castings. This machine is considered to be more economical than the best available makes abroad.

At the Metallurgical Plant imeni A. K. Serov, a group of engineers, headed by M. Kh. Lukashenko, developed a new method for forced feeding of blast-furnace charge. As a result of this method, the utilization factor for the blast furnaces was greatly increased, as was the average annual output of cast iron per worker. The method has also been introduced at other metallurgical plants in the USSR and will have a profound influence on the successful attainment of the goal set forth in Stalin's historic speech of 9 February 1946, namely, to achieve a cast-iron production of 50 million tons.

Over a number of years, Academician I. P. Bardin and a group of his associates have successfully solved problems of utilizing oxygen in metallurgy, long before similar work was started abroad. This method has revolutionized the production of cast iron and steel. Today, many cast-iron mills in the USSR utilize oxygen blast in their furnaces; as a result, they produce cast iron which contains considerably less gases and has a more compact structure and superior characteristics to cast iron produced by the old method. The actual application of the oxygen blast in metallurgy was done by a group of engineers under L. I. Levi, who were awarded Stalin Prizes.

Another group of engineers headed by B. S. Mil'man was awarded the Stalin Prize for developing new techniques of producing high-strength cast iron. This new type of cast iron has twice the tensile strength of cast iron used in industry at present, and also has increased impact strength and plasticity, which factors make it a fully satisfactory substitute for steel and malleable cast iron in many applications, and at reduced costs.

#### Mechanization of Labor

One of the fundamental trends of our technical policy has been a continual and greater mechanization of heavy and labor-consuming work. In 1949, Stalin Prizes were awarded to a group of engineers of the Dnitrovskiy Plant under M. B. Arvan for developing a multibucket excavator suitable for digging trenches, laying water pipes, constructing irrigation canals, and excavating foundations for large buildings. The excavator is mounted on a caterpillar track. The earth which is dug up is dumped on a belt conveyer and dropped along one side of the trench.

Inventor M. A. Stolyarov designed a very valuable machine intended for the mining of construction stone directly on rock deposits possessing a strength of 110-250 kg per cm. The machine is capable of handling various lengths and widths of stone.

The Stalin Prize was also awarded to a group of engineers headed by Ya. I. Balbachan for developing a new loading machine of unprecedented design for use in vertical mine shafts, which resulted in a 50% decrease in working force and a 35% increase in shaft cutting speed, as compared with the old manual methods.

Another group of engineers under the supervision of M. K. Galushko developed an original design for mine elevator cars for transporting miners along inclined shafts. These new cars are being widely used in the Donbass, where most of the shafts are of the long, sloping type.

In the field of agricultural machinery, a Stalin Prize has been awarded to Volkov [initials omitted], the designer of a one-man-operated cotton-picking machine which can take the place of 20-25 men.

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A Stalin Prize was awarded to mechanic M. V. Obryvko of the Yelan' Kolenovskiy Sugar Plant for designing a new type of machine for digging up sugar beets. This machine can dig up 50 tons of sugar beets per hour. The actual cost of loading and digging up sugar beets can be cut in half with this machine.

S. A. Kuznets, chairman of the "Proletar" Kolkhoz in Cherkassk Rayon, Kiev Oblast, has developed a new machine for working the soil which is particularly suited for fields on which kok-sagyz is being grown.

#### Construction

Great strides are being made in the construction of industrial, cultural, and residential buildings. V. N. Yung and others were awarded the Stalin Prize for developing new types of cement, namely, an expansive, an aluminous, and a water-repellent cement. The expansive cement acquires water-resistant properties upon hardening and has proven to be a most valuable construction material for subway tunnels, mine shafts, foundations, etc., while, at the same time decreasing costs due to increased work productivity. The aluminous cement has quick-drying properties which make it suitable for many applications. The water-repellent cement is characterized by its ability to resist moisture and to preserve its full effectiveness over long periods of storage.

In 1946, an experimental ceramics plant was organized in Kiev in which numerous experiments were conducted on the development of new types of ceramics. It was established that hollow ceramic parts could be manufactured out of most of the clays from Ukrainian deposits. In 1949, many factories started the manufacture of hollow ceramic blocks and ceramic facing plates. The wide use of these constructional and architectural ceramics resulted in a saving of more than 9.5 million rubles in a 9-month period. Zhukov and others were awarded the Stalin Prize for the development of these ceramics.

In the glass industry, the outstanding event was the development of a new heat- and sound-insulating glass material known as "foam glass." I. I. Kitaygorodskiy and others were awarded a Stalin Prize for this development.

In general, the foam glass resembles blocks of hard, porous material which are created as a result of blowing gases through molten glass. It is very light, has very low heat conductivity, and relatively high mechanical rigidity, which makes it a most valuable constructional-insulating material. It is water-, frost-, and fire-resistant, and is easily worked and colored. It is easily bonded by cement and can be used in conjunction with bricks, stones, or any other construction materials. The use of foam glass in large buildings results in a great saving in weight, which in turn reflects in savings of material necessary for the construction of building foundations. It is estimated that a square meter of foam glass blocks is 20 times lighter and 2 - 2.5 times cheaper than its brick equivalent.

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