

# Space

# INTELLIGENCE NOTES

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SPACE SYSTEMS INFORMATION BRANCH, GEORGE C. MARSHALL SPACE FLIGHT CENTER

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FROM THE WORLD PRESS

KHRUSHCHEV SAYS NO TO U.S. MOON HIT CLAIM. On May 10 Premier Khrushchev told a group of transport workers that despite the claims of American scientists, no United States rocket had hit the Moon. He said tauntingly that the Soviet marker on the Moon was getting lonesome waiting for an American companion.

The Soviet criticism of American efforts came as a jolt to the American-Soviet amity in the space field during the tour of Maj. Gherman S. Titov, the Soviet astronaut. He and Lieut. Col. John H. Glenn Jr., the United States astronaut, had spent hours together and had made a joint television appearance.

Scientists in the United States dismissed Mr. Khrushchev's speech as "nonsense."

"We hit the Moon with Ranger 4," said a spokesman for the Jet Propulsion Laboratory in Pasadena, Calif.

The laboratory had made the rocket Ranger 4, had tracked it through space and had reported that it had landed on the far side of the Moon April 26 after a 64-hr flight.

In Washington, officials of the National Aeronautics and Space Administration said they, too, were certain that Ranger 4 had hit the Moon.

A spokesman said the impact had been determined by tracking radio signals from the rocket and through the laws of physics and mathematics. This was how the Soviets had determined that their own Moon rocket had hit the Moon in 1959, the spokesman said.

Mr. Khrushchev voiced his disbelief in the American claim, which was the first officially expressed in the Soviet Union, in a speech marking Russia's National Railway Day holiday. He added that the Soviet technology that had put a Russian rocket on the Moon could also provide better railways.

The Soviet Premier did not refer to Ranger 4 by name but said: "The Americans have tried several times to hit the Moon with their rockets. They have proclaimed for all the world to hear that they had launched rockets to the Moon, but they missed every time."

Mr. Khrushchev made the statement at a Kremlin meeting of transport workers.

The Ranger 4, a fantastically complex spacecraft, was launched from Cape Canaveral, Florida on April 23. It proved something of a disappointment because of a mechanical failure that made it impossible for the craft to conduct sophisticated moon-measuring experiments.



Nonetheless, American scientists hailed the feat as a major step in space research. They said that the fact that Ranger 4 had hit its target without guidance along the way indicated that future spacecraft could be shot to the Moon with accuracy.

It was estimated that the instrument-packed 730-pound Ranger 4 may have landed less than 1,000 miles from the Soviet craft that hit the Moon September 14, 1959.

"The Soviet pennant on the Moon has been awaiting an American one for a long time but in vain and is becoming lonesome," Mr. Khrushchev said. (Source: New York Times, May 11, 1962)

~~1004~~  
SOVIETS ASK PERMISSION TO BUILD TRACKING STATION IN AUSTRALIA. Russia is reported to be seeking permission from the Australian Government to establish tracking stations in Australia--or on Australian territory--for its satellites. The Melbourne "Herald's" Canberra correspondent understands an agreement is almost complete. If so, it would overcome the blind spot in observation of Soviet satellites when they are orbiting the Earth over the South Pacific and Indian Ocean regions.

American tracking teams and equipment have been admitted to Australia for some time and play an important part in the American space program. Any agreement with Russia would stipulate that its tracking station should not be used for military purposes. (Source: Manchester Guardian, May 16, 1962)

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MYSTERIOUS FACTORS CLAIMED CAUSE OF GENETIC CHANGES. The Soviet Union's leading space medicine scientist said recently that mysterious "factors acting in space flight" have been found to cause genetic changes in a variety of living organisms.

Prof. Vassily V. Parin of the Soviet Academy of Sciences reported his nation's findings in the field of space biology to the Third International Space Symposium of the Committee on Space Research (COSPAR).

Just what these hereditary changes may mean for the human space traveler is not now known, nor did Parin offer any predictions beyond saying that "it is necessary to try to reveal hereditary changes, and adaptive phenomena which always accompany the evolution process wherever it takes place."

U.S. biologists attending the COSPAR meeting said the Soviet findings were interesting, but said the reported results were so vague that it would be difficult to interpret them meaningfully.



Parin reported, for example, that fruit flies carried aloft in Soviet spacecraft had shown a "considerable increase in gene mutations." He also reported that the cell division process in sprouts from pea, corn and wheat seeds was significantly accelerated during space flight.

In one case--employing fungi cultures--the Soviets found that a type of the fungi insensitive to radiation germinated and developed colonies six times greater than the same fungi maintained as a control on Earth. At the same time, however, a type of the fungi that was highly sensitive to radiation had its germinal activity decreased by 12 times that of the control fungi.

Parin did not elaborate on these results, but U.S. scientists suggested that radiation was not a factor in causing this increase and decrease in the reproductive ability of the two fungi.

Parin himself did rule out radiation, however, as a cause for hereditary changes noted in other organisms sent aloft. "It is obvious," he said, "that the reason of the effect observed should be sought not in radiation, but in some other factors acting in space flight which are very unusual for the life of seeds on the Earth."

The Soviet scientist reported on a wide range of Soviet space biology experiments carried out in five flights of Russian spacecraft--some of which were in orbit for 24 hours. Although Parin's overall conclusions on the influence of space flight on man do not differ markedly from what U.S. scientists have anticipated, his paper did demonstrate that the Soviets have been doing more than the U.S. in conducting biological experiments in space.

To date, the U.S. has not sent aloft a civilian biological satellite. The few biological experiments that have ridden into space on NASA vehicles have only been in space for a few hours.

The Defense Department, on the other hand, is known to be carrying out intensive biological experiments in its Discoverer satellite program. The results from this military program, however, have not been made known, even to those biologists who are conducting similar research programs for NASA. (Source: Washington Post, May 4, 1962)

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SOVIETS OPERATE NEW REACTOR FOR RESEARCH. A new thermal reactor designed for research in power engineering, physics, biology, and physiology has been put into operation at Minsk. (Source: Pravda, May 23, 1962)

DISCOVERY OF RARE TYPE OF NUCLEAR DECAY REPORTED. Experimental proof of a rare type of nuclear decay, never before observed, was reported during the XIIth Session of the Scientific Council of the Joint Institute of



Nuclear Research. In a major series of experiments directed by Yu. D. Prokoshkin, the splitting of a positively charged pi-meson into a neutral pi-meson, a positron, and a neutrino was detected. The experiments were based on the hypothesis of Ya. B. Zel'dovich and S. S. Gershteyn; the results are in excellent agreement with their theory.

This discovery points the way to the establishment of a general law for the decay of elementary particles. Another report, presented by B. M. Pontecorvo and R. M. Sulyayeva, dealt with an experimental investigation of the capture of negatively charged mu-mesons by nuclei of  $\text{He}^3$ . (Source: Izvestiya, May 27, 1962)

#### FROM THE SEMITECHNICAL LITERATURE

SOVIET INVESTIGATIONS OF GALAXIES. Soviet magazine Nedelya, No. 8, February 1962, reports that one of Einstein's effects has been used for the first time in astronomical practice for estimating the physical parameters of cosmic objects.

G. Idlis and S. Gridneva, Kazakh astrophysicists, have succeeded in almost doubling the number of galaxies with measured masses through the use of this method. According to the report (which does not describe the method), 16 such galaxies have been studied. (Source: Joint Publications Research Service, No. 13419, April 15, 1962, p. 1)

SOVIETS MAY SEARCH FOR ANTI-MATTER. Since cosmic ray particles "live" in the galaxy about  $10^8$  years and travel about  $10^{26}$  cm in their lifetime, and since some cosmic radiation may be of metagalactic origin, it is possible that the study of primary cosmic rays may give information concerning anti-matter, at least in our galaxy. So states N. L. Grigorov and co-authors in an article appearing in Iskusstvennyye sputniki zemli, No. 10, 1961.

The discovery of anti-protons in primary cosmic rays would not definitely prove the existence of anti-matter in cosmic rays, but the discovery of a complex nucleus made up of anti-nucleons would be indisputable proof of the presence of anti-matter in the universe. Nuclear photoemulsions carried aboard the second spaceship-satellite were studied in the hope of finding among the particle tracks those which were made by anti-nuclei (the end of the track should end with an annihilation star). But no star pattern among the 320 on the emulsions was found which met the criteria characteristic for the annihilation of a multiple charged particle.

The authors also discuss the proposition that if anti-matter is dispersed in the solar system in the form of individual atoms, it would be possible to estimate the upper boundary for the density of such anti-matter. The specific procedures for making such a determination are given. (Source: Joint Publications Research Service, No. 13419, April 15, 1962, p. 26)



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WAS TITOV HYPNOTIZED DURING FLIGHT? It is strongly believed by U.S. experts that USSR cosmonauts are being instructed in how to achieve a yoga-like trance for spaceflight. This opinion is the consensus of experts on hypnotism who were polled on their ideas concerning use of hypnotism for space travel. Almost all of the 32 experts are officials of either The International Society for Clinical and Experimental Hypnosis, The American Society for Clinical Hypnosis, or The Society for Clinical and Experimental Hypnosis. Membership in these groups generally requires a doctor's degree in medicine, psychology, psychiatry, or dentistry and several years specialty experience in hypnosis.

One psychiatrist theorized that Gherman Titov was in a hypnotic trance during his flight. Evidence pointing to this is the fact that he was able to sleep 8 hr during what must have been a rigorous and exciting flight. In addition, Titov has been quoted as saying, "We cosmonauts have been trained by physicians to fall asleep instantly, when desired, and to wake up exactly at a given time."

Several advantages of hypnosis for spaceflight were discussed by the experts polled. These include:

1. Ability to withstand reduced sensory input or to increase ability to function "really alone" for prolonged periods.
2. Improved eidetic memory. Hypnosis would help astronauts to recall each sensation.
3. Improved intellectual efficiency.
4. Autogenic training--a specialized method of relaxation training.
5. Increase capability to withstand accelerations and shock impacts.
6. Thermal tolerance and controlled metabolic activity.
7. Tranquilization.
8. Relief of discomfort.
9. Creation of a "real" simulation during training.
10. Counteraction of unpleasant effects of weightlessness.
11. Aid in selection of astronauts.
12. Distortion of time so flight passes more rapidly.

(Source: Missiles and Rockets, April 30, 1962, p. 50)

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CHINESE PLAN WEATHER MODIFICATION TESTS. A brief article taken from Jen-Min Jih-Pao (Peiping), a Communist Chinese newspaper, appeared in the Soviet Ekonomicheskaya Gazeta, No. 10, March 5, 1962. It states that Chinese scientists will expand experiments this spring in utilizing mountain glaciers in Sinkiang for irrigating arid regions near the cities of Hami and Urumchi.

Rainmaking experiments will be conducted, and catalysts will be used for accelerating melting of glaciers in the upper reaches of rivers in the Urumchi area. Water thus obtained will be stored in reservoirs in the mountains until needed. (Source: Joint Publications Research Service, No. 13419, April 15, 1962, p. 4)



~~SECRET~~

ONE-MINUTE DELAY IN LAUNCH OF VOSTOK 1 REVEALED. The launch of Vostok 1 on April 12, 1961, was delayed one minute by an electrical fault on the pad, according to an article in Pravda of April 11, 1962. The fault was discovered in the hatch mechanism. Test engineer L. Maryanin recalled that the chief designer ordered the removal of the hatch. When this was done the engineers found Gagarin sitting calm and smiling on his couch listening to music.

Maryanin commented: "Seeing the splendid mood of the cosmonaut the mechanics felt better too. They quickly inspected everything and found that a bracket which sealed the control contacts was a little bit loose. It took them literally one minute to put everything right. Again they wished the cosmonaut a good trip to the cosmos and locked the hatch."

April 12, the Supreme Soviet has decreed, is to be observed annually as Cosmonautics Day in honour of Gagarin's flight. (Source: Flight International, April 19, 1962)

~~SECRET~~

S-51 PROJECT LAUDED BY BRITISH ROYAL AERO CLUB. Although the US-UK ionosphere satellite has long had official approval and is now successfully orbiting the Earth, it is interesting that little has been written in the U.S. concerning the general British opinion on S-51. A recent issue of Flight International, the official organ of the Royal Aero Club, published an editorial which gives the feeling of at least this group. Following is a partial excerpt of the editorial:

"The frustrations of launch-pad delays at Cape Canaveral were experienced last week for the first time by Sir Harrie Massey and his team of British scientists responsible for the experiments aboard the joint US/UK ionospheric satellite. The delay was ironic in that the launch vehicle is the highly reliable Delta and that the countdown progressed to within six minutes of the scheduled launch time.

"As we of Flight International have seen and heard at first hand in visits to the National Aeronautics and Space Administration's Goddard Centre in Maryland, and Headquarters in Washington DC, the joint satellite programme has been a highly successful practical exercise in international collaboration. The US team was impressed by the high ability of the British university scientists, who themselves are most appreciative of the generosity and thoroughness with which NASA has tackled the job.

"In co-operation with the United States of America, Britain is taking her first modest step into space. This is good." (Source: Flight International, April 19, 1962)



FROM THE TECHNICAL LITERATURE

ASTRONOMY AND ASTROPHYSICS

PROPERTIES OF THE YELLOW HAZE OBSERVED ON MARS (1956). I. K. Koval' and A. V. Morozhenko have reported in the Astronomicheskii zhurnal (Soviet Astronomy-AJ), Vol. 39, No. 1, January 1962, that the optical depth in red and infrared light of the dust cloud observed on Mars in 1956 has been computed. With the assumption that all particles in the dust cloud are identical, the particle radius was determined to be  $1.45 \mu$ . A general expression for the settling time of such particles as a function of height and particle density was derived; the settling time from a height of 1 km of particles with radii of  $1.45 \mu$  and densities of 1, 2, or  $3 \text{ g/cm}^3$  was found to be 122, 60, and 40 days, respectively. (Source: Dept. of Commerce, A.I.D. Press, No. 722, June 5, 1962, p. 2)

WATER ON MARS. According to N. A. Kozyrev, in an article published in Zarya vostoka on April 27, 1962, analysis of spectrograms has revealed that light scattering by the Martian atmosphere is caused by particles, the quantity of which increases near the poles. These particles scatter green light especially well. In terrestrial conditions green light scattering is caused by ice crystals in the atmosphere; comparison of terrestrial with Martian conditions indicates the existence of water on Mars. Kozyrev further believes that the red color of Mars depends on the properties of its atmosphere. The terrestrial atmosphere reflects blue light and therefore appears blue; the Martian atmosphere absorbs blue light and acquires a reddish color. (Source: Dept. of Commerce, A.I.D. Press, No. 707, May 14, 1962, p. 6)

"TUNGUS WONDER" RESOLVED.\* Soviet scientists, in a final report on their study of the big explosion that shook Siberia June 30, 1908, have concluded that it was caused by a comet that blew up and rained fragments on the Earth.

The Moscow radio said the Soviet Academy of Sciences proved that the object was a comet, rather than a meteorite, by canvassing scientific records in Britain, the United States, Australia and Asia.

One of the most spectacular natural phenomena in modern history, the blast killed 1,500 reindeer and felled trees over an area of 700 square miles. The chief of a Soviet expedition that studied the area in the summer of 1961 had previously rejected any theory that the blast was caused by an atomic weapon fired from some other planet.

\*For earlier articles on Tungus, see Vol. 2, No. 6 and Vol. 2, No. 12 issues of SIN.



The broadcast said records in foreign countries showed that the light given off by the object as it plunged toward Earth was seen only east of the Greenwich Meridian in the British Isles.

By narrowing down the reported sightings of the light, the Soviet scientists concluded that it came from the tail of a comet. These tails always point away from the Sun.

The scientists said the comet's head exploded and rained down its pieces on Siberia at a time when the tip of the tail, preceding it in flight, was about nineteen miles from the Earth. (Source: New York Times, June 1962)

## BIOSCIENCES

PHARMACOLOGICAL PROTECTION FROM RADIATION EFFECTS. Sulfur-containing derivatives of pyridoxine (vitamin B<sub>6</sub>) has been viewed with interest for some time as a substance which increases resistance to the effects of ionizing radiation. Because of this interest, L. A. Petrova states in the January issue of Zhurnal obshchey khimii that methods have been developed at the Institute of Experimental Medicine, Academy of Medical Sciences USSR, for synthesizing isothiuronium and disulfide derivatives of pyridoxine from the corresponding halogen derivatives obtained from the isopyropylidene derivative of 5-chloropyridoxine. The syntheses of the following pyridoxine derivatives are described in detail: 2-methyl-3-amino-4-isothiuroniummethyl-5-aminomethylpyridine, 2-methyl-3-hydroxy-4-hydroxymethyl-5-isothiuroniummethylpyridine chlorohydrate and bromohydrate, and bis(2-methyl-3-hydroxyl-4-hydroxymethyl-5-methylene-pyridine) disulfide. (Source: Dept. of Commerce, Current Review of Soviet Technical Press, April 6, 1962, p. 674)

EFFECTS OF MICROWAVES ON THE CENTRAL NERVOUS SYSTEM. Investigation of the specific (nonthermal) effects of microwaves, with a field intensity of less than 10  $\mu\text{W}/\text{cm}^2$ , on the central nervous system has shown that while a brief exposure to microwaves intensifies the reactions of conditioned reflexes to stimuli, continuous action of microwaves inhibits these reactions.

Yu. A. Kholodov, reporting in the April 1962 issue of Priroda, states that experiments have shown microwaves to induce changes in sensitivity to auditory, light, and olfactory stimuli; however, the changes in skin, digestive, and circulatory-system receptors are very slight, indicating that microwaves affect the first link of the reflex arc and have a direct effect on the central nervous system, specifically, on the cerebral cortex and the diencephalon. It has now been shown that most, and possibly all, of the electromagnetic spectrum has a direct effect on the central nervous system.



While the mechanism of this phenomenon is not yet fully understood, current Soviet opinion is inclined to the view that the magnetic component of the electromagnetic field is the agent responsible, since a constant magnetic field induces an effect similar to that of a variable field. (Source: Dept. of Commerce, A.I.D. Press, No. 717, May 28, 1962, p. 2)

## CHEMISTRY

ELECTROSYNTHESIS OF OZONE. The electrosynthesis of ozone has been carried out at Moscow State University in a series of five experiments to determine the effect of the intensity of discharge on the productivity of the ozonizer, power consumption, and concentration of the ozone produced. Results of this work are reported on by Yu. V. Flippov and Yu. M. Yemel'yanov in the Zhurnal fizicheskoy khimii, Vol. 36, No. 1, January 1962.

Ozone was synthesized by passing 3, 6, 10, 20, and 30 liters/hr of oxygen, automatically regulated at a constant pressure of  $775 \pm 0.1$  mm Hg, through 7.3- to 109-w discharges across the 1-mm gap of the ozonizer. It was shown that while the value of the factor  $U/v$  (intensity of discharge over gas flow rate, in units of w·hr/liter) does not affect ozone concentration directly, an increase in  $U/v$  causes an increase in the temperature in the concentration zone, which in turn affects ozone concentration (i.e., higher temperatures cause more rapid ozone decomposition and, hence, lower concentration). Maxima of ozone concentration appeared at different constant oxygen flow rates when  $U/v$  was increased from 0 to 24, the highest being 11 vol percent of ozone at an oxygen flow rate of 6.0 liters/hr and at  $U/v = 5$ .

The experiments showed the importance of cooling the electrodes during the electrosynthesis of ozone. The electrodes were cooled with  $CCl_4$  circulated under pressure and held at  $20^\circ \pm 0.05^\circ C$  by a thermostat. Power loss owing to the conductance of water precluded its use as a coolant. (Source: Dept. of Commerce, Current Review of the Soviet Technical Press, April 6, 1962, p. 675)

## CRYOGENICS

CRYOGENICS FOR HEAVY-FORCE FITS. G. A. Bobrovnikov, reporting in the March 1962 issue of Vestnik mashinostroyeniya (Russian Engineering Journal), discusses an application of cryogenics now being studied for use in Soviet industry.

Since in many cases the use of presses for heavy-force fits and heating for shrink fits is inconvenient, and since these methods do not always provide for the required interference and often cause excessive stress,



strain, and even cracking in assembly, investigations have been carried out using cryogenics for heavy-force fits. Liquid nitrogen or solid carbon dioxide with denatured alcohol is used as the cooling medium, the former being superior. To decrease losses of the cooling medium several units for parts of different sizes were built. The use of cryogenics was found to be particularly advantageous for large parts of complex shape, since transportation to and from the press or the heating furnace is eliminated and mating parts can be assembled directly at the assembly line. The method is recommended for heavy-force, medium-force, tight, and wringing fits. (Source: Dept. of Commerce, A.I.D. Press, No. 708, May 15, 1962, p. 2)

## GEOPHYSICS

RELATION BETWEEN ECCENTRICITY OF GEOMAGNETIC FIELD AND THE TRIAXIALITY OF THE EARTH (HUNGARY). When secular variation of the Earth's magnetic field is represented in a system of coordinates whose orientation depends on the adjusted secular variation itself, the rate of the secular variation exhibits simultaneous increases and decreases over the whole globe at periods of about 50 years. Orthogonal projections of vector diagrams representing the secular variations of the total intensity on planes passing through the Earth's center show that this phenomenon has a symmetry center near Pakistan. It is suggested that this symmetry center has some bearing on the shifting of the geomagnetic center. One of the characteristic features of this eccentricity is the fact that, in large parts of the Pacific, the magnetic horizontal intensity is higher by about 10,000 gammas than in the antipodal regions of the Atlantic.

During more than 100 years of observations, the geomagnetic center has been shifting WNW at a rate of 0.2 deg a year, and its eccentricity has increased from 300 to 400 km. This rather high rate of shifting indicates that the eccentricity cannot be directly related to the distribution of the continents over the Earth or to the crustal and mantle structure. The great units of the Earth's structure do not undergo any significant changes rapid enough to be accounted for by such short-period variations as the magnetic secular changes. The eccentricity must therefore originate below the crust and mantle, i.e., in the core.

The eccentricity of such large masses could conceivably affect the figure and gravity field of the Earth to a measurable extent. The triaxiality of the Earth, i.e., the ellipticity of the equator, can be attributed to the internal mass-distribution of similar eccentricity, and, significantly enough, the direction of the magnetic eccentricity agrees, within the limits of the measuring accuracy, with the major axis of the equator of the triaxial Earth.



G. Barta, writing in Acta technica, Vol. 37, Nos. 1-2, 1961, calculated the change of gravity acceleration on the Earth's surface caused by the displacement of the inner core and obtained values for the difference of the equatorial major and minor axes and for the inequalities of the gravity force which agree well with the observed values. (Source: Dept. of Commerce, A.I.D. Press, No. 704, May 9, 1962, p. 4)

GEOPHYSICAL AND ASTRONOMICAL ASPECTS OF SOVIET SPACE RESEARCH. V. I. Krassovsky, head of the Institute of Atmospheric Physics, USSR Academy of Sciences, reported recently on certain aspects of Soviet space work. He stated that Russian space research policy is based on the belief that although much may be achieved by means of automatic probes, the full conquest of space depends on flights by research vehicles carrying highly trained men.

Soviet space research began with the launching of numerous geophysical rockets, but the actual breakthrough into space took place in the Soviet Union on October 4, 1957, when the very first artificial satellite was placed in orbit around the Earth. It was followed by other satellites, space probes, and spaceships, some of them carrying biological material. Gradually, the space vehicles were improved and more information was gained about the environment in which they moved, the factors affecting experiments, and the activity of living organisms in outer space. Progress in scientific investigations and space-vehicle design made possible manned flight into space.

In support of manned space flight, many geophysical and astronomical experiments have been conducted. The comprehensive geophysical and astronomical investigations so far conducted may be grouped under the following headings:

1. Evaluation of the hazard, to artificial satellites and spaceships, from micrometeorites.
2. Measurement at different distances from the Earth of hard penetrating and ionizing radiation dangerous to living organisms.
3. Density measurements in the upper atmosphere, related to the drag of artificial satellites.
4. Measurements of the concentration and nature of charged particles in the upper atmosphere and outer space, because these affect radio communication in space.
5. Measurement of the soft components of ionizing radiation in the upper atmosphere. Predominantly this related to corpuscular radiation, as the intensity of hard electromagnetic radiation was known approximately and biological shielding against it presented no difficulties.
6. Studies of the important properties of the Earth and the Moon as celestial bodies. These include the magnetic fields that account for the accumulation of hard penetrating particles; the features of the Moon's reverse side; and many other factors essential to further experiments.



In all these studies, automatic equipment was used; the readings were relayed to the ground by radio. In many cases, the direct relaying of readings was supplemented by an electronic memory that would store the information until a command was given to relay it to Earth, and by instruments that were recovered.

Investigations carried out by means of artificial Earth satellites, space probes, and geophysical rockets have yielded information essential for the design of manned satellites and spaceships. At the same time, this information is of independent interest from the viewpoint of pure science, as it has led to the discovery of new phenomena--such as the accumulation of penetrating particles in the terrestrial magnetic field--and to the more accurate determination of many quantities that were not precisely known before, such as the density and ionization of the upper atmosphere. This mass of new information is currently exciting much lively discussion and speculation. A large number of stimulating hypotheses have been advanced, for example, in explanation of the origin of penetrating radiation in the terrestrial magnetic field. The future holds out promise of still more successful investigations with still better equipment. (Eight figures and 42 references included with original article.) (Source: Endeavour, Vol. XXI, No. 82, April 1962, p. 65-72)

#### HYDRAULICS

PNEUMATIC RELAY. The Laboratory of Pneumohydraulics of the Institute of Automation and Telemechanics, Academy of Sciences, USSR, is reported by Știința și tehnica, No. 3, March 1962, to have produced for the first time a pneumatic logical element (see Figs. 1 and 2). The major disadvantage of this relay, as compared with similar electronic devices,

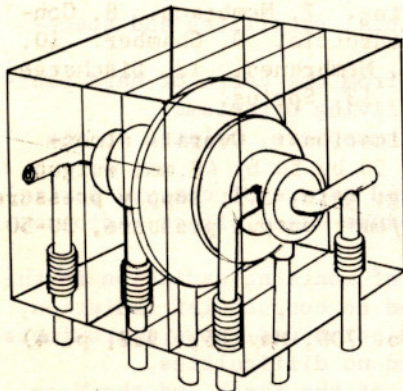


FIG. 1

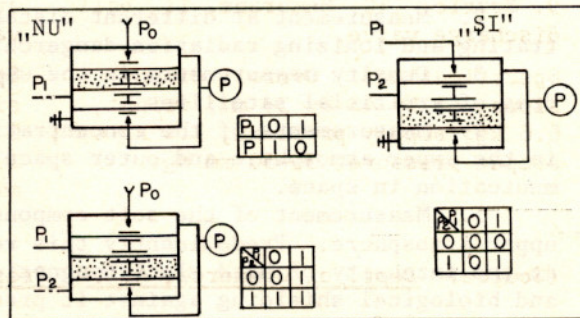


FIG. 2

Y - feed line;  $\text{---} \text{||} \text{---}$  - air contact;  $p_1$  and  $p_2$  - independent variables (inlets); P - logical algebraic functions (outlets)



is its low operating speed. It is suggested therefore that pneumatic relays, which are cheaper, more reliable, and less complicated, be used in those chemical, heat-energy, and metal processes where highly reduced speeds can be used. (Source: Dept. of Commerce, A.I.D. Press, No. 710, May 17, 1962, p. 2)

PNEUMATIC AMPLIFIERS. Figures 3 and 4 show the basic diagrams of two high-accuracy quick-response pneumatic devices--Fig. 3 for power amplification and Fig. 4 for power and pressure--developed at the Scientific Research Institute of Heat and Power Engineering Equipment. A. D. Petrenko reports in Priborostroyeniye (Instrument Construction) that these amplifiers are designed for use in pneumatic devices with primary transducers of the flapper-nozzle type. They are at present used in a number of instruments mass-produced at the "Tizpribor" Plant of the Moscow Municipal Sovnarkhoz and the "Teplokontrol" Plant of the Tatar Sovnarkhoz.

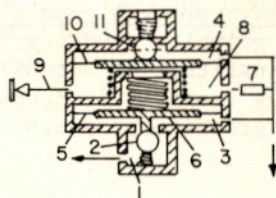


FIG. 3

1. High pressure chamber. 2. Ball valve. 3. and 4. Output chambers. 5. Membrane. 6. Pressure spring. 7. Constant throttle. 8. Chamber. 9. Nozzle. 10. Membrane. 11. Ball discharge valve.

Specifications: Overall dimensions, 46 by 46 by 38 mm; weight, 0.6 kg; supply pressure, 1.4 kg/cm<sup>2</sup>; output pressure, 30-50 mm Hg.

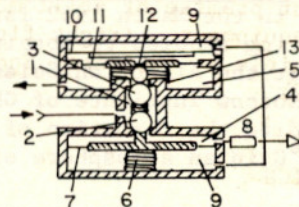


FIG. 4

1. High pressure chamber. 2. and 3. Ball valves. 4. and 5. Chambers. 6. Spring. 7. Membrane. 8. Constant throttle. 9. Chamber. 10. and 11. Membranes. 12. Discharge valve. 13. Spring.

Specifications: Overall dimensions, 50 by 50 by 48 mm; weight, 0.75 kg; gain, 2.5; supply pressure, 1.4 kg/cm<sup>2</sup>; output pressure, 30-50 mm Hg.

(Source: Dept. of Commerce, A.I.D. Press, No. 708, May 15, 1962, p. 4)

#### MATERIALS

INCREASING THE LOW-TEMPERATURE RESISTANCE OF POLYMERS. The Scientific Research Institute of Rubber and Latex Products has reviewed methods for increasing the low-temperature resistance of polymers. Inadequate



resistance is due to glass transition or crystallization, which increase the rigidity and brittleness of the material and cause the loss of its elastic properties. The glass-transition temperature of polymers can be lowered by plasticization; their tendency to crystallization can be reduced by modification or copolymerization which, however, do not lower the glass-transition temperature. Therefore, to increase the low-temperature resistance of a crystalline polymer, both plasticizers and modifiers must be applied, or copolymerization followed by plasticization of the copolymers must be used.

The recent achievements of Soviet scientists in this field are mentioned in an article by V. V. Chernaya and R. L. Vol'chenko which appears in Uspekhi khimii (Russian Chemical Reviews), Vol. 31, No. 3, March 1962, pp. 336-350. (Source: Dept. of Commerce, A.I.D. Press, No. 714, May 23, 1962, p. 4)

GAS-IMPERVIOUS GRAPHITE PRODUCTS. P. A. Tesner and I. M. Timofeyeva reported in the March 1962 issue of Khimicheskaya promyshlennost' on a method being studied to obtain gas-impervious graphite products. They state that the All-Union Scientific Research Institute of Natural Gas and the Moscow Institute of Chemical Technology imeni D. I. Mendeleev have studied the formation of carbon films on graphite products treated at  $\sim 1000^{\circ}\text{C}$  in an atmosphere of hydrocarbons.

The hydrocarbons decompose on the graphite surface at a rate proportional to their concentration; the rate is reduced by hydrogen absorbed by the carbon surface. The process is complicated by the diffusion of the hydrocarbons into the pores of the graphite and the counterdiffusion of hydrogen liberated during the reaction. Examination of the properties of the films showed that their density passes through a minimum as their formation temperature increases from  $1100^{\circ}$  to  $2100^{\circ}\text{C}$ , and that, when formed at  $1000^{\circ}$  to  $1025^{\circ}\text{C}$ , they attain a hardness surpassing that of diamonds.

Experiments conducted with a mixture of 40 percent natural gas and 60 percent nitrogen showed that the deposition rate of carbon decreases as treatment time increases and attains a constant value after the closing of all the pores. Progress of the reaction into the depth of the material increases with (1) a decrease in the process temperature and hydrocarbon concentration, and (2) an increase in the initial concentration of hydrogen in the gas.

Fully gas-impervious products can be obtained after the closing of all the pores, i.e., when the minimum thickness of the carbon layer on the product surface becomes equal to one-half the diameter of the largest pores. The treatment not only yields a gas-impervious outer film but also increases the density of the material considerably. For optimum



results the process should be conducted in two steps: (1) at low temperature and hydrocarbon concentration, to increase the density of the material, and (2) at a higher temperature, to obtain the necessary carbon film on the surface of the graphite products. (Source: Dept. of Commerce, A.I.D. Press, No. 718, May 29, 1962, p. 3)

#### METALLURGY

CORROSION OF STEELS IN LIQUID METALS (CZECHOSLOVAKIA). The effect of stress on the corrosion of ČSN 17 246 (AISI 321) and ČSN 17 102 (AISI 501) steels in a circulating liquid lead-bismuth alloy (44.5 percent Pb, 55.5 percent Bi) at 550°C has been studied reports A. Dvořák in Strajřirentsvi, Vol. 12, No. 1, 1962. It was found that as the stress increased from 3 to 18 kg/mm<sup>2</sup> for 17 246 and from 1.5 to 10 kg/mm<sup>2</sup> for 17 102, their corrosion rates also increased from 0.09 to 0.18 mm/year and from 0.22 to 0.47 mm/year, respectively. In the 17 246 steel a selective corrosion, i.e., the dissolution of nickel from the surface layer, is predominate; as the nickel content in the surface layer drops, the austenite becomes less stable and transforms to ferrite, which is also attacked by the liquid alloy. In the 17 102 steel only intergranular corrosion was observed. (Source: Dept. of Commerce, A.I.D. Press, No. 716, May 25, 1962, p. 6)

INVESTIGATION OF MOLTEN METALS BY MEANS OF GAMMA RAYS. A. I. Belyayev reports in Izvestiya vysshikh uchebnykh zavedenii tsvet. metallurgy, No. 2, 1961, that he has determined the absorption of  $\gamma$ -rays (from <sup>60</sup>Co) as they pass through a layer of molten metal by measuring the counts per minute.

An investigation of pure metals showed that their degree of absorption of  $\gamma$ -rays increases basically with an increase in the atomic number and density of the metal. Deviations are found, however, particularly for Cu and Sn.

A closer correspondence is obtained between the degree of absorption and the volumetric electron density of molten metals, as was previously found in the case of fused salts. For binary fused systems of metals, the degree of absorption of  $\gamma$ -rays increases basically with an increase in the content of the component with the higher atomic number and higher density. Here, too, a closer correspondence is found between the variations in the counts/min and the volumetric electron density. (Source: Metallurgy, No. 8, Part B, 1961, p. 5)

MAGNETIC PROPERTIES OF BERYLLIUM AT TEMPERATURES FROM 300° TO 4.2 K. In the Zhurnal eksperim i tear. fiz., 40, No. 2, 1961, B. I. Verkin and associates report that they used the Faraday method, with a vertical gradient in fields up to 10 k oersted, to measure the magnetic properties. A balance of bracings with photoelectric compensation was also used..



The angular dependences of the magnetic susceptibility  $\chi$  of 2 ~ 99.99 percent pure specimens and two In specimens were determined in a temperature region of 300° to 4.2°K. It was found that the angular dependences of  $\chi$  in Be (above 20°K) and In are described by the cosine law. Dependence of the main values of  $\chi$  on temperature is characteristic for small electronic groups. It was determined that  $\chi$  of In is very sensitive to impurities. (Source: Metallurgy, No. 7/8, Part A, 1961, p. 15)

## METEOROLOGY

WEATHER CONTROL BY DISPERSION OF CLOUDS. In the winter of 1959-60 the Institute of Applied Geophysics, Academy of Sciences USSR, made pioneer experiments near the town of Aktyubinsk to evaluate changes, resulting from artificial dispersion of clouds, in the meteorological parameters of the lower atmospheric layers. V. I. Belyayev and I. S. Pavlova state in Seriya geofizicheskaya, No. 1, 1962, that the tests were undertaken with the assumption that the elimination of cloudiness over a sufficiently broad territory and the concomitant changes in meteorological parameters might influence the course of climatic processes on a large scale. Tentative evaluation of the various techniques employed for dispersion of supercooled clouds indicates that considerable changes in weather parameters at Aktyubinsk were attributable to cloud dispersion. (Source: Dept. of Commerce, A.I.D. Press, No. 715, May 24, 1962, p. 2)

## NUCLEAR POWER

NUCLEAR BATTERIES. Kliment Šoler, reporting in Pokroky matematiky, fyziky a astronomie, gives a general description of the development and the principle design of various types of nuclear batteries. Nuclear batteries can be classified into the following types:

1. Directly-charged nuclear batteries. They consist of a primary source of energy ( $\alpha$  or  $\beta$ -emitter) and a suitable collector electrode. A  $\beta$ -battery, used to charge the Soviet DK-0.2 pocket dosimeter is described by G. D. Orlovoy and E. G. Kardash: The primary source consists of 12 millicuries of Sr-90/Y-90 (but tests with Pm-147, H-3, and Er-196 isotopes are presently being performed); the insulator consists of a 15  $\mu$ -thick polyethylene layer; the collector consists of 4 mm thick Mg with a 4 mm thick Pb coat to reduce the Brems-strahlung on the surface of the cell to 2  $\mu$ r. This cell is very small, delivers 300 V, a short-circuit of  $10^{-10}$ A, and has a capacity of 10 mmF.

2. Semiconductor (p-n) junction nuclear batteries deliver larger amperages, but lower voltages. They consist of a Ge or Si crystal with p-n junction, covered with a thin layer of 50 millicuries of Sr-90/Y-90. The Ge cell has an emf of 30 mv and a short-circuit current of  $2.5 \cdot 10^{-5}$ A; the Si cell has an emf of 250 mv and a short-circuit of  $1 \cdot 10^{-5}$ A. The



efficiency of these batteries drops rapidly since the crystal lattice is damaged by the radiation. This can be prevented either by using a suitable scintillator (a phosphor which converts the radiation into light which, in turn, is used to excite the p-n junction), or by using a soft  $\beta$ -emitter such as Ni-63.

3. Contact-potential nuclear batteries employ an isotope to ionize a gas which is situated in an electric field obtained by the contact-potential difference of two electrodes. The ions produced in the gas move under the influence of the electric field to produce a current. The efficiency of this battery type is rather low (approximately 1 percent) and a recombination of ions must be prevented by choosing a suitable gas and an advantageous electrode pair. Argon with an addition of tritium-containing hydrogen is considered a suitable gas, a suitable electrode pair is  $PbO_2/Mg$  which gives an emf of 1.6 v.

4. Thermoelectric nuclear batteries employ thermocouples which absorb heat produced as radioactivity. This battery type is capable of exploiting all three types of radiation ( $\alpha$ ,  $\beta$ , and  $\gamma$ ), however, its efficiency is very low (0.2 percent).

In conclusion, the author states that batteries reach considerably higher efficiencies when excited by Sun light instead of nuclear radiation (solar batteries). (Source: Dept. of Commerce, English Abstracts, Series IV, April 1962, p. 25)

EXPERIMENTAL STAND FOR HEAVY-WATER NUCLEAR REACTOR. Yu. G. Abov and colleagues have reported in Atomnaya energiya, Vol. 12, No. 2, February 1962, on their work relative to a nuclear reactor program.

Figure 5 shows the schematic diagram of a special experimental facility used for determining critical dimensions (e.g., critical water level) of heavy-water reactors with rod-type fuel elements. Five types of fuel channels (see Fig. 6 and Table 1) were studied.

The temperature and concentration of the heavy water in all experiments were  $18^\circ \pm 5^\circ C$  and  $99.7 \pm 0.5$  percent, respectively. The critical water level was measured with an accuracy of  $\pm 1$  mm. Experimental results, whose total error is  $\pm 2$  percent, make it possible to obtain more accurate design calculations for the reactor. (Source: Dept. of Commerce, A.I.D. Press, No. 677, April 2, 1962, p. 2)

#### PHOTOGRAPHY

COMPARATIVE CHARACTERISTICS OF NEW TYPES OF X-RAY FILMS. K. S. Bogomolov and coworkers of the Scientific Research Institute of Photography and Cinematography, Moscow State University, have reported in Industrial Laboratory, on the basic characteristics of new types of x-ray films. The results of their investigation indicate that the relative sensitivity of different films depends on the wavelength. With an increase in wavelength, the difference between the sensitivities of various films decreases.



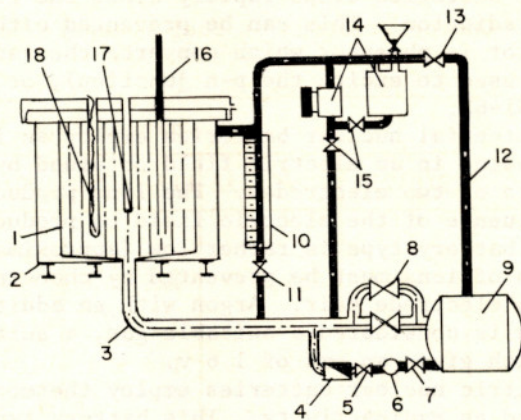


FIG. 5. Experimental Stand

1. Inner tank, 3 mm in diameter and 3.5 m high (outside surface covered with 0.5-mm cadmium sheets);
2. Outer supporting tank;
3. Connecting pipe;
4. Checkvalve;
5. and 7. Electrically operated gate valves;
6. Pump;
8. Water discharge valve;
9. Discharge tank;
10. Water level indicator;
- 11., 13., and 15. Manually operated valves;
12. "Breathing" line;
14. Unidentified;
16. Control rods (two safety and one regulating);
17. Neutron source;
18. Boron neutron counters.

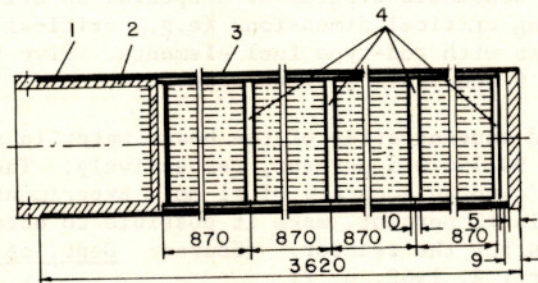


FIG. 6. Fuel Channel

1. Steel head with top grid plate for uranium rods;
2. Outer cylinder;
3. Shielding;
4. Spacing grid plates.



Table 1. Characteristics of Fuel Channels Tested

Characteristics	Channel type				
	88/0.252	100/0.252	112/0.252	100/0.208	112/0.230
Outer cylinder diameter (mm)	102 x 3	114 x 3	126 x 3	114 x 3	126 x 3
Shielding cylinder diameter (mm)	90 x 1	102 x 1	114 x 1	102 x 1	114 x 1
Total weight of outer and shielding cylinders of a channel (kg)	12.13	14.45	15.84	14.45	15.84
Total weight of the four spacing grid plates (kg)	0.421	0.500	0.600	0.500	0.600
No. of uranium rods per channel	126	163	205	134	187
Coefficient relating to uranium-rod arrangement in the channel	0.252	0.252	0.252	0.208	0.230
Maximal and minimal lattice pitch studied	26,19	29,21	29,23	29,21	29,23



Recently the photochemical industry in Russia has started production of new types of x-ray films which considerably differ from each other with respect to photographic properties.

The main purpose of the authors was to determine all of the basic characteristics of the new films. Included were the sensitometric characteristics for visible light, white x-ray radiation for a tube voltage of 80 kv, and soft monochromatic radiation with different wavelengths that are widely used in x-ray analysis.

Four tables are included with the article. Table 1 provides the basic characteristics of the films investigated, which were obtained by using the x-ray tube spectrum for a voltage of 80 kv. Table 2 provides data on the relative sensitivity of the films for monochromatic x-ray radiation with different wavelengths. Table 3 provides data on the relative sensitivity of films in combination with a UFDI intensifying screen and the values of the corresponding intensification factors. Table 4 pertains to dynamics of the conservability of record specimens of x-ray films.

With the exception of the method used for determining sensitometric characteristics by using soft x-ray radiation, methods used for obtaining most of the above characteristics are well known and are not discussed. (Source: Industrial Laboratory, Vol. 27, No. 9, September 1961, p. 1119-1124)

## PHYSICS

INFRARED MASER ACTION IN SEMICONDUCTORS. A theoretical argument is presented by O. N. Krokhin in Fizika tverdogo tela (Soviet Physics--Solid State), Vol. 4, No. 3, March 1962, to show that at low temperatures the probability of radiative transitions of excitons in semiconductors is higher than that of the recombination of free current carriers. This situation is considered favorable enough to make possible a population inversion with a comparatively low concentration of excitons.

Negative absorption occurs when stimulated emission exceeds absorption by free carriers and excitons. Under conditions of low temperature and high pumping density, the condition for negative absorption (maser action) is expressed by the requirement that the total absorption cross section be smaller than a certain magnitude which is a function of exciton recombination probability, emitted wavelength, phonon energy, exciton bond energy, and temperature. For silicon, given an emission wavelength of  $1.1 \mu$  and a temperature of  $4^\circ\text{K}$ , the total absorption cross section should be smaller than  $0.4 \cdot 10^{-16} \text{ cm}^2$ . (Source: Dept. of Commerce, A.I.D. Press, No. 709, May 16, 1962, p. 3)



USE OF EMPIRICAL CONSTANTS IN SHIELD DESIGNING. An attempt is made by B. I. Sinitsyn and S. G. Tsylin, reporting in Atomnaya energiya, Vol. 12, No. 4, April 1962, to generalize and interpret critically various research results related to the determination and use of removal cross sections and to analyze the possibility of expanding the field of application of empirical constants in design calculations for various types of neutron shielding. Removal cross sections for homogeneous and non-homogeneous media are considered.

The following conclusions are reached:

1. If there is no great distortion of the neutron spectrum emitted from the reactor in the 2- to 3-mev energy range, then the removal cross sections determined by G. Chapman and C. Storrs can be used in practically all cases for media containing hydrogen; the exceptions are light elements (e.g., beryllium, boron, and carbon) for which the removal cross section in this energy range increases and must be taken into account for accurate calculations.

2. The removal cross sections measured in heterogeneous media can also be applied in calculations for homogeneous media; the difference in cross sections in these two cases probably does not exceed 5 to 10 percent for all elements.

3. In calculations for homogeneous media the removal cross sections can be applied at any distances from the source. The absolute deviation from accurate calculations in this case does not exceed 25 to 30 percent for certain intermediate distances from the source (about 2 to 3 relaxation lengths).

4. In calculating dose rates by applying the removal cross sections, the dose attenuation for hydrogen must be used.

5. For detectors with an effective energy threshold of 3 mev, the cross sections obtained from the inverse relaxation length in media not containing hydrogen are in almost complete agreement with the removal cross sections obtained by Chapman and Storrs.

6. With an increase in the effective energy threshold of the detector the minimum distance from the source decreases.

7. In assigning the upper group in multigroup calculation methods, the cross sections determined by Chapman and Storrs can be used.

8. Asymptotic cross sections for a group in the energy range from 1.4 to  $\infty$  mev are close to the removal cross sections of Chapman and Storrs.

9. For a more detailed description of the spatial distribution of fast-neutron energy ( $E > 1$  mev) it is desirable to have a large selection of empirical constants corresponding to various energy groups in the range from 1 to 18 mev.

(Source: Dept. of Commerce, A.I.D. Press, No. 713, May 22, 1962, p. 2)

SENSITIVITY OF LASER RECEIVERS. The availability of monochromatic coherent sources of light, made possible by the invention of laser devices, has made many radio techniques, and particularly phase discrimination and



coherent transformation of signals, suitable for use in optics. The threshold signal power detectable by a quantum-mechanical amplifier at  $10^{14}$  cps is  $10^{-23}$  w/cycle. Thus laser amplifier sensitivity can be better than that of bolometers, although this does not take account of fluctuations which are due to the instability of the pumping action below the saturation level. However, the sensitivity of quantum-mechanical counters is even greater. The time constant of a quantum counter with a paramagnetic crystal is 1 to 10 msec. In contrast to the amplifier, the quantum counter can attain a sensitivity threshold limited only by background noise. A simple theoretical derivation shows that the counter is capable of detecting single quanta of light. A formula for determining the minimum detectable number of signal quanta in the presence of noise is given; this number is a function of noise power, resonator bandwidth, and relaxation time for the pumping level.

This note pertains to an article by N. V. Karlov and A. M. Prokhorov which appeared in Radiotekhnika i elektronika, Vol. 7, No. 2, 1962. (Source: Dept. of Commerce, A.I.D. Press, No. 691, April 20, 1962, p. 1)

#### PRODUCTION ENGINEERING

HIGH-SPEED SPINDLE FOR INTERNAL GRINDING. The Institute of Machine Tool Development has designed a spindle for the internal grinding of bore-holes, 2 to 6 mm in diameter, having a nominal speed of 100,000 rpm and working in the 80,000 to 120,000 rpm speed range. The spindle is operated by a Pelton-type free-jet turbine with oil at a pressure of 100 atm. The spraying portion of the nozzle is very short to minimize losses. The temperature of the oil is  $30^{\circ}\text{C}$ , and its pressure between 70-120 atm. The oil, streaming at a great velocity is sprayed, its particles colliding with each other and with metal particles. By applying a suitable filter this misty mixture can be used to lubricate the ball bearings in which the spindle is mounted.

In view of the extremely high rotation speed, special bearings had to be used. The ball bearings are prestressed and tapered. During rotation, the centrifugal forces press the balls against the outer ring of the bearing, developing a high stress which can be determined as a function of the ball-size. At the optimum ball size there is a minimum of stress. The ball-bearing can, therefore, be selected according to the ball-size required.

The critical speed was found to be 180,000 rpm. The natural frequency of the apparatus was tested by suspending the spindle on the places of bearing support and placing an iron-core electromagnet (with 0.1 to 0.5 mm airgap) near the shaft, the magnet being fed by a 20 to 20,000 cps, 5 w sound-generator. Upon increasing the frequency of this generator, the sound produced by the shaft, under the effect of the excitation corresponding with its own frequency, becomes stronger. Further measurements were carried out on the shaft with mounting the other components of the apparatus successively.



In the various stages of assembling the following critical speeds were obtained: (1) the bare shaft, 420,000 rpm; (2) with grinding-stone holder, 320,000 rpm; (3) with the turbine, 300,000 rpm; and (4) with the grinding stone, 290,000 rpm.

The tolerance is not more than  $0.5 \mu$  for the ball diameter. For the bearing cage several kinds of plastics have been tested [not specified in the article], but no final decision has as yet been taken. The most important requirements for the bearing cage are: high heat resistance, low friction coefficient, and a high degree of purity (no inclusions).

The axial prestressing must be based on the geometry, the load, and the thermal expansion of the ball bearing. Excessive prestress shortens the useful life of the ball-bearing, while, when it is insufficient, the balls "slip", which can be observed by the whining of the spindle. The ball-bearing parts must have an accuracy of at least  $2 \mu$ , they must be very carefully assembled, and cleanness (dust-free atmosphere) should be observed.

The ball bearing parts (shaft and two external rings) were produced in the Debrecen Antifriction Bearing Factory. Static rigidity tests were carried out by gauging the displacement under the effect of load applied on the shaft support, with a  $0.1 \mu$  scale induction apparatus. Temperature in the proximity of the surface was determined as a function of the running time, by a thermistor placed in a bore hole in the external ball-bearing ring. After a running time of 3 hr, there is no more considerable temperature rise above  $38^{\circ}\text{C}$ . The rotation speed was measured by an ultra-stroboscope developed by the same institute, the torque on the shaft by an instrument which eliminated mechanical contact: an aluminum disc was mounted on the shaft, rotating between the poles of an electromagnet.

At present the service life of ball-bearings is being tested. They do not show any sign of defects after 500-hr operation. (There are 9 figures with the original article appearing in Gep, No. 2, 1961, pp. 75-78.) (Source: Dept. of Commerce, English Abstracts, Series IV, April 1962, p. 26)

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Beier, Walter and Erich Dörner, Probleme der Raumflugmedizin (Medical Problems in Space Flights). Leipzig: VEB Georg Thieme Verlag. 1961.

The following book review was made by Mr. Ingram Jobst.

"These two well-known authors and reviewers of biological and medical problems, from a point of view of physical observation, have turned toward a very topical problem.



"Problems and results of a science were compiled which is still at the very beginning of its great development. In addition, to physical principles, this book compiles problems of astrobiology; e.g., the question of how the human organism withstands the effects of forces caused by great changes in speed. Questions of floating in space, lack of oxygen, radiation effects, and other cosmo-biological problems resulting from space flights are discussed in it. It is shown that cosmonautical flights in spaceships are not adventurous experiments but planned scientific advances into cosmic ranges which can only be made possible and safe by coordination of all branches of science. Everybody who is interested in the development of space flight, also with regard to their medicobiological viewpoint, will be pleased to resort to this book for information on the difficulties connected with it." (Source: Jena Review, 1, 1962, p. 50)

O. Schöne and E. Schwenk, Rohrleitungen in neuzeitlichen Wärmekraftanlagen; Planung Berechnung und Ausführung (Pipe Systems in Today's Heating Facilities; Planning, Calculation, and Execution). Berlin: Springer-Verlag. 1961.

This book comprehensively treats the design, layout, and installation of piping in thermal power installations. It covers inter alia pipe diameter calculations; pressure and temperature drop; thermal expansion; the manufacture of various types of pipe, pipe connections, flanges, expansion bellows, and condensation arresters; measuring instruments for pressure, temperature, etc.; and supports for piping.

A list of relevant German specifications are given, and there is also included a list of 130 or so references to other German literature on piping and associated subjects.

Much of the data are presented in tabular and graphical form, and the book contains numerous line drawings. (Source: The Chartered Mechanical Engineer, April 1962, p. 246)

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