TWENTIETH ANNIVERSARY OF THE SIBERIAN BRANCH OF THE ACADEMY OF SCIENCES OF THE USSR

"... Through Siberia will Russian might increase,"
(M. V. Lomonosov)

"To organize a Siberian Branch of the Academy of Sciences of the USSR and to construct for it a science city near Novosibirsk. To consider as the principal task of the Siberian Branch of the Academy of Sciences of the USSR every kind of development of theoretical and experimental research in the area of physicotechnical, natural, and economical sciences, directed toward the solution of the most important scientific problems and of the problems contributing to the most successful development of the productive forces of Siberia and the Far East." (From the Resolution of the Council of Ministers of the USSR of May 18, 1957.)

The Siberian Branch of the Academy of Sciences of the USSR (AN SSSR) is 20 years old. Its composition includes the following scientific centers: Novosibirsk (22 institutes), Irkutsk (8 institutes), Krasnoyarsk (3 institutes), and Tomsk (3 institutes), as well as the branches of Yakutsk (6 institutes and 2 sections) and Buryatsk (3 institutes).

The Siberian Branch is a collective of scientists which possesses a high scientific potential and is capable of successfully solving urgent problems of science and technology. A total of 35,000 people work in the Siberian Branch, of whom about 16,000 are scientific and scientific – technical workers. Among them are 64 academicians and corresponding members of the AN SSSR, 333 doctors, and 3073 candidates of sciences.

In an address of the General Secretary of the Central Committee of the Communist Party of the Soviet Union (CPSU) L. I. Brezhnev to the ceremonial session dedicated to the 250th anniversary of the Academy of Sciences of the USSR, it was noted that the Siberian Branch "has securely occupied a position in world science."

The work performed by scientists of the Branch has been recognized by 9 Lenin Prizes, 4 State Prizes of the USSR, 8 Lenin Komsomol Prizes, 12 name prizes of the Academy of Sciences of the USSR, and 2 international prizes. Among the scientists of the Branch there are 8 Heroes of Socialist Labor.

The principal tasks of the future development of science in the Siberian Branch follow from the resolutions of the 25th session of the CPSU on the principal directions of development of the national economy of the USSR in the Tenth Five-Year Plan. It is necessary to provide for the further development of fundamental and applied scientific research, to concentrate attention on the most important problems of scientific-technical progress, to increase the effectiveness and quality of scientific research, and to assure the further perfection of the forms of communication between science and industry. The role of the Academy of Sciences of the USSR as the center of theoretical research and the coordinator of scientific work in the country is elevated.

The performance of these tasks requires the dissemination of scientific publications (and thereby of the new scientific ideas and advances themselves) by the periodical scientific journals. This is one of the important paths for the elevation of the scientific-technical level of wide circles of specialists. The Journal of Applied Mechanics and Technical Physics (AMTP), one of the first scientific-technical journals published by the Siberian Branch, participates in this crucial business along with other publications.

The journal AMTP was founded in 1960 on the initiative of the President of the Siberian Branch Academician M. A. Lavrent'ev and Academicians P. Ya. Kochina, Yu. N. Rabotnov, and S. A. Khristianovich. During

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1960-1965 the Chief Editor of the journal was Academician Yu. N. Rabotnov and since 1966 it has been Corresponding Member of the AN SSSR L. V. Ovsyannikov. Besides the presently active composition of the editorial board of the journal, it has included Academicians P. Ya. Kochina, M. A. Lavrent'ev, and R. Z. Sagdeev and Corresponding Members of the AN SSSR É. I. Grigolyuk, A. A. Koval'skii, Yu. E. Nesterikhin, and I. I. Novikov. The journal was originally published in Moscow; since 1975 it has been published in Novosibirsk. The traditional authors' collective has become firmly established around the AMTP. About a third of the authors are Siberians. The AMTP has connections with dozens of cities of the USSR and the individual articles of foreign authors (Bulgaria, Hungary, Italy, Peoples Republic of Korea, Poland, Rumania, USA, Sweden, Czechoslovak Socialist Republic) have been published. The journal is published in the USA in an English translation.

The journal was intended to be multiprofiled, which is reflected in its name. Principal attention is paid to the most important current problems of applied mechanics and technical physics, represented in the work of those institutes on which the journal rests for the most part: the Institute of Fluid Dynamics, the Institute of Nuclear Physics, the Institute of Thermophysics, the Institute of Theoretical and Applied Mechanics, the Computational Center, etc. Thematically, the published articles are about evenly distributed among four principal fields:

plasma physics and dynamics,

gas dynamics and explosion physics,

fluid dynamics and thermophysics,

mechanics of solids.

In the 102 issues of the AMPT the reader can find many interesting and significant articles. It is difficult to enumerate the names of the great Soviet scientist-authors of the journal and to name all the publications which have left a notable wake in science. For example, a series of articles of Corresponding Members of the AN SSSR B. V. Voitsekhovskii, R. I. Soloukhin, and their colleagues on gaseous detonation was published at the start of the 1960's. These articles were included in a cycle of reports which were later awarded the Lenin Prize. The article of V. M. Kuznetsov, M. A. Lavrent'ev, and E. N. Sher "On the directional throwing of ground using explosive material" (1960, No. 4) had a considerable effect on the development of practical applications of explosion mechanics.

The article of Corresponding Member of the AN SSSR S. S. Kutateladze "Effect of the temperature factor on subsonic turbulent gas flow" (1960, No. 1) provided the start for a cycle of reports on the theory of a boundary layer with a vanishing viscosity which earned the Jacobs Prize and the I. I. Polzunov Prize of the AN SSSR. The report of S. K. Godunov, A. A. Deribas, and N. S. Kozin "Wave formation in explosive welding" (1971, No. 3) developed into a cycle of reports awarded the A. N. Krylov Prize of the AN SSSR. An important class of transfer processes in toroidal thermonuclear systems was analyzed in an article of A. A. Galeev, R. Z. Sagdeev, and G. Fyurt (1968, No. 6). The reports of V. E. Zakharov on the power-law spectra of weak turbulence (1967, No. 2; 1965, No. 5) made an important contribution to plasma physics. The content of R. K. Mazitov's article (1965, No. 1) "On the damping of plasma waves" went into textbooks on plasma physics.

Besides the regular articles, the AMTP carries major thematic articles and reviews and provides information on international and all-union conferences on the thematic matter of the journal.

The editorial board and editorial workers of the Journal AMTP are also ready in the future to promote the search for and successful development of new and promising directions in applied mechanics and technical physics.

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In the first 100 issues of the Journal of Applied Mechanics and Technical Physics (1960-1976) 2859 articles were published, including those from:

Moscow: 1342,
Novosibirsk: 822,
Leningrad: 133,
Voronezh: 57,
Kiev: 56,
Khar'kov: 46,
Tomsk: 36,
Sverdlovsk: 23,
Perm': 22,
Kazan': 19, etc.

Original articles and reviews on the following divisions are published in the journal:

1. Physical processes in liquid and gas streams and gasdynamic and electric-discharge lasers.

2. Questions of applied mechanicsand technical physics in the problem of controlled thermonuclear synthesis.

3. Electric discharge in continuous media.

4. Combustion and explosion, shock waves, equations of state of continuous media.

5. Mechanics of superhigh parameters (the state and motion of matter at superhigh pressures, velocities, and temperatures, the interaction of powerful radiation pulses with matter, etc.).

6. Hydroaeromechanics.

7. Filtration theory.

8. Thermophysics.

9. Mechanics of a deformable solid.

10. Diagnostic methods in studies of physicochemical and gasdynamic processes.

EFFECT OF RATE OF REPLACEMENT OF WORKING GAS ON CHARACTERISTICS OF A CO_2 LASER WITH A CLOSED CYCLE

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In the development of continuously operating powerful CO_2 lasers having a self-maintained glow discharge and convective cooling of the working mixture the main problem is the obtainment of uniform glow discharges in large gas volumes moving with high velocities: In such discharge instabilities develop which lead to a transition to a mode of arc-like burning in a narrow filament – contraction. In connection with the thermal limitation (destruction of the inversion upon heating of the working medium), to increase the output power of CO_2 lasers it is necessary to proportionally increase the flow rate of the working mixture through the discharge zone, which (in turn) raises the necessity of repeatedly using the same gas. This is realized in lasers with a closed cycle of gas flow [1].

Work with a closed cycle considerably complicates the obtainment of a volumetric glow discharge. It is noted that under the conditions of a closed cycle instabilities in the plasma of a glow discharge develop at lower pressures and velocities of the gas stream and at lower levels of the specific energy input [the electric power applied per unit mass of the gas stream in W/(g/sec)] than in work in an open cycle, i.e., when the gas is ejected into the atmosphere after a single use [1]. This produces changes in the chemical composition of the working gas due to chemical reactions in the plasma of the gas discharge [1-3] and the appearance of impurities from structural elements [1]. The necessity arises of continuously restoring the composition of the working mixture in the working circuit through partial evacuation and the admission of fresh gas. In this case it is obvious that the higher the rate of gas replacement, the better the original composition of the mixture is restored. At present not only is there an absence of reports in which the effect of the rate of gas renewal on the laser characteristics is analyzed, but also in the majority of publications no information is provided on the choice of the rate of replacement of the working gas.

The present report is devoted to a study of the effect of the rate of gas renewal on the characteristics of a closed-cycle CO_2 laser. We will characterize this rate by the ratio of the flow rate of gas continuously re-

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