work of science in university, industry and in its own laboratories.

During the war we have learned much about the methods of organizing science, and about the ways of encouraging and supporting its activities.

The development of atomic energy is a clear-cut indication of what can be accomplished by our universities, industry and government working together. Vast scientific fields remain to be conquered in the same way.

In order to derive the full profit in the future from what we have learned, I urge upon the Congress the early adoption of legislation for the establishment of a single Federal research agency which would discharge the following functions:

1. Promote and support fundamental research and development projects in all matters pertaining to the defense and security of the nation.
2. Promote and support research in the basic sciences and in the social sciences.
3. Promote and support research in medicine, public health and allied fields.
4. Provide financial assistance in the form of scholarships and grants for young men and women of proved scientific ability.
5. Coordinate and control diverse scientific activities now conducted by the several departments and agencies of the Federal Government.
6. Make fully, freely and publicly available to commerce, industry, agriculture and academic institutions the fruits of research financed by Federal funds.

Scientific knowledge and scientific research are a complex and interrelated structure. Technological advances in one field may have great significance for another apparently unrelated. Accordingly, I urge upon the Congress the desirability of centralizing these functions in a single agency.

Although science can be coordinated and encouraged, it can not be dictated to or regimented. Science can not progress unless founded on the free intelligence of the scientist. I stress the fact that the Federal Research Agency here proposed should in no way impair that freedom.

Even if the Congress promptly adopts the legislation I have recommended, some months must elapse before the newly established agency could commence its operations. To fill what I hope will be only a temporary gap, I have asked the Office of Scientific Research and Development and the Research Board for National Security to continue their work.

Our economic and industrial strength, the physical well-being of our people, the achievement of full employment and full production, the future of our security and the preservation of our principles will be determined by the extent to which we give full and sincere support to the works of science.

It is with these works that we can build the highroads to the future.

DISCUSSION

THE PROGRESS OF SOVIET PALEOBOTANY

THERE has been a rapid development of paleobotany in the USSR during the past twenty-five years in connection with the extensive geological survey that has covered the entire country. The work done by paleobotanists has helped explain the origin and development of plant life and has provided a basis for the theories of botanists and geographers; it has also helped support the theories of Darwin, which are the main basis of all evolutionary teaching.

During this period paleobotanists have achieved good results in various parts of the USSR; Lower Devonian floras have been discovered in Siberia (*Leptophelum, Asteroxylum, Aneurophyllum, Duisbergia protolepidium, Orestovia* and *Poetria*); in the Timan Mountains we have found Archeopteris, while Permian floras were found on the River Pechora, in the Paichoi Mountains and in the Caucasus Mountains.

Important papers have been published on the Carboniferous floras of the Donets and Kuznetsk coal basins.

Triassic floras have been found at Vladivostok (Pleuromeja), in Bashkiria and in Armenia. The remains of a Greenland flora (Furbula) have been found in the Urals.

Jurassic floras have been described in many parts of the Soviet Union; the Jurassic age of the shales of the main Caucasian chain, in the district near Chkalov (formerly Orenburg), on the River Embe, in Samarskaya Luka, at Orsk, in the Crimea and in the Pamirs has been established; rich floras found in the Irkutsk basin in the Transbaikal region, in the Amur basin (River Bureya) have been described. A number of papers have also been published on the Jurassic flora of Central Asia.

Some valuable discoveries were made in studying the plants in the Cretaceous deposits of various parts of the Soviet Union—in Kamchatka, Northeastern Asia, Central Asia and the Caucasus. These discoveries have helped explain the origin of the modern angiosperms.

The study of Tertiary floras throughout the Soviet Union has produced still more important results. This study has been made throughout the whole territory from the Pacific Ocean to the western frontiers

of the country. The remains of these floras are of various ages, some of them as young as Pliocene. The greatest number of species was found in the Lower Oligocene in the vicinity of Lake Nor Zaisan in Kazakhstan. An especially rich find was the Sarmatian flora near the Black Sea. The Lower Pliocene flora found in the Goderz pass numbers about one hundred varieties. Investigation has shown that in some places floras of different types existed simultaneously, a fact which disrupts the principle of Homotaxis.

A lot has been done by way of studying Quaternary floras in ancient peat deposits. The chief features in the development of the Pleistocene floras have been described and analyzed by Academician V. N. Sukachev. The method of pollen analysis has given good results in studying the past of plants. Dr. A. Yarmolenko's work on plant anatomy is worthy of special note.

About thirty specialists have been working in the sphere of paleobotany for the past twenty-five years. We have suffered a number of losses in our ranks on account of the war. Active workers in the field to-day are: Dr. M. Z. Brits (Tashkent), Professor A. V. Hachlov (Tomsk), Professor B. V. Baranov (Kazan), Professor Kristofovich (Leningrad), Dr. E. N. Kara-Murza (Leningrad), Dr. S. N. Naumova (Moscow), Professor L. M. Krelshchetovich (Moscow), Professor M. T. Neuberg (Moscow), Professor T. B. Novopokrovsky (Rostov-on-Don), Professor P. A. Nikitin (Novosibirsk), Professor T. W. Palibin (Leningrad), B. V. Prynada (Irkutsk), Dr. G. P. Radchenko (Moscow), Dr. I. M. Pokrovskaya (Leningrad), Dr. M. T. Chirkova (Moscow), Dr. A. I. Turutanova (Leningrad) and Academician V. N. Sukachev (Moscow).

I. V. PALIBIN

WEAR IN ENGINE CYLINDERS

IN an illuminating and thought-provoking booklet entitled "Wear," D. Landau, industrial applications engineer with the Nitralloy Corporation, has discussed, as one of the topics in his treatise, the wear in cylinders and pistons. As Landau points out, this problem has received a great deal of attention at the hands of automotive engineers and merits this emphasis because of its importance.

In Fig. 1 is shown Fig. 5 from Landau's article; it indicates that "The greatest wear occurs at the top end of the piston travel under the topmost ring and decreases from there down." At this upper point the piston has the maximum pressure applied and at the turning point it is at rest for an instant. No matter how closely the piston rings are fitted some of the compressed gas[1] gets past them, so that at the upper end of the travel of the piston the best conditions exist for the passage of the gas particles between the piston ring and the cylinder at an enormous speed for these gas particles. At the instant the piston stops at the upper end of the stroke more gas gets by and at a higher velocity than at any other

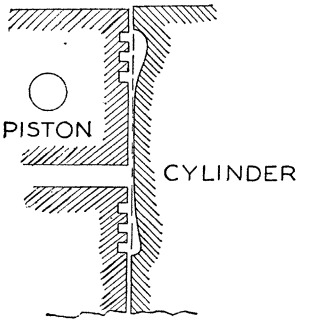

FIG. 1. Taken from Landau's article. (Fig. 5.) The greatest wear on the cylinder comes at the upper end of the stroke.

point along the path of travel of the piston in the cylinder. This is exactly where the greatest wear comes, as Landau has pointed out.

I should like to raise with automotive engineers the question as to how much of a role the forces arising from the principle of Bernoulli comes into this picture?

The principle of Bernoulli[2] states that in a state of steady flow of an incompressible fluid the hydrodynamic pressure will be least where the velocity of flow is greatest. The old Venturi meter, Fig. 2, is a good illustration. The rate of flow at 2 is greater

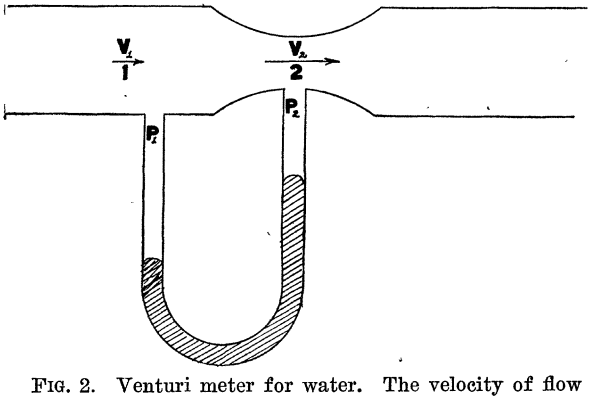

FIG. 2. Venturi meter for water. The velocity of flow at 2 is greater than at 1 and, therefore the pressure P_2 is less than P_1.

[1] Some oil particles are also forced past the piston rings, but as Taub points out, when oil is lacking the wear is greatest and the reason is to be found in part by this high speed of travel of the gas particles past the piston rings. Alex Taub, *Automotive and Aviation Industries*, March 1, 1944.

[2] See *Scientific American*, October and November, 1927.