IN MEMORIAM JÓZSEF VARGA

It is ten years now that death put an end to the so richly creative and successful life of Professor *József Varga*, member of the Hungarian Academy of Sciences, twice winner of the Kossuth Prize, the great Hungarian pioneer in chemical engineering.

Ten years is not a very long time, and there are surely many among us in whose memory there still lives the unfaded picture of the inspired scientist, of the great teacher of numerous generations of engineers. Here among us live and work Prof. Varga's many co-workers and pupils, of whom more than one is a member of the Academy, professor at one or other of our Universities, a well known research worker or leading specialist in industry, and many of whom knew József Varga intimately. Nevertheless, I should like, to recall in a few words the main milestones of a brilliant carrier.

József Varga was born in Budapest, on February 8, 1891, and qualified as a chemical engineer at this University in 1912. Imre Szarvasy, then Professor of the Chair of Electrochemistry, soon recognized Varga's quite uncommon gifts and took him on the staff of his Institute where Varga became assistant in 1913 and two years later Assistant Professor. In 1916, at a then relatively early age, he obtained the degree of Doctor of Technical Sciences.

In Szarvasy's Institute Varga was first engaged in the chlorination of methane, and also succeeded in the saponification under pressure of methyl chloride to prepare with practically quantitative yield methyl alcohol from the chloride. This result aroused Varga's interest in the reactions taking

place under pressure which later played such an important role in his work. He soon found an opportunity to complement his laboratory practice with works experience at the natural gas sources near Magyarsáros in Transylvania.

After the end of World War One he returned to the University where he became "Privat-dozent" in 1921 and still in the same year Professor Extraordinarius. From this date onwards, with the progressing illness of the then Professor of Chemical Technology, Ignác Pfeifer, the teaching of this subject became more and more Varga's task and he was finally promoted to be Head of the Chair of Chemical Technology in 1923.

His obligations at the University seemed not to interfere with his activities in industry. In 1921 he finished on the spot the methane decomposition experiments begun during the war and developed them into a commercial process. He maintained this threefold activity — teaching, research and industrial implementation — till the end of his life. He reorganized the teaching of chemical technology, following in the footsteps of his famous predecessors, Vince Wartha and Ignác Pfeifer, in the spirit of his threefold objectives. His lectures created a living link between science and industry.

His activities as researcher were always aimed at the solution of problems which might further the most economic processing of our Hungarian raw materials. Such a problem was, for instance, the preparation of Hungarian bauxite cement which was but a short deviation from Varga's main scientific line, or the processing of Hungarian coal and coal distillation products to industrially valuable commodities, first of all to benzine.

Vargha first tried to produce light benzine-like fractions at relatively low pressures and temperatures from the tar of Hungarian lignite and the heavier fractions of coal (anthracite). However, he soon became interested in the Bergius type high pressure catalytic hydrogenation processes. In 1929 he published a report on the hydrogenation under pressure of a Hungarian eocene lignite, resulting in a 57 per cent yield of liquid products.

These experiments had led Varga to the fundamental discovery that in the hydrogenation of coal and coal products sulphur does not act as a catalyst poison, but on the contrary, sulphur and its compounds greatly promote certain hydrogenation processes. This discovery induced Varga to try to eliminate the incertitude due to the changing sulphur content of coal by the deliberate addition of elementary sulphur and of sulphur compounds. This hypothesis which for years was the subject of lively discussion received its hallmark when the German Patent Office accepted the patenting of the process based on what was later called the Varga effect. In 1935 the Nitrogen Works in Pét built a plant for hydrogenation of daily ten tons of lignite tar oil by the Varga process.

Hydrogenation of lignite lost its topicality with the discovery of the Hungarian petroleum fields. Varga, who always reacted rapidly to the topical

problems of national economy, began to investigate the possibilities of the hydrogenation of petroleum products processed from Hungarian crude oil. This led to his greatest work, namely to the hydrogenation under medium pressure of Hungarian petroleums containing asphalt.

As a recognition of his scientific merits he was elected correspondent member of the Hungarian Academy of Sciences in 1932. Because of his broad and imaginative conceptions, extending to all branches of Hungarian industry he was chosen in 1939 to be head of the Ministry of Industry and Commerce. During his office as Minister the oil fields at Lispe were opened up, the foundations of the Alumina Industrial Works at Almásfüzitő laid, and the Ajka Power Station and the Pét Nitrogen Works expanded. In 1943 he resigned of his own free will his post as member of the Cabinet, because as an honest patriot he was against the participation of Hungary in the war and against the exploitation by the industrial policy of Germany.

After the Liberation of the country Prof. Varga displayed extraordinary energy in the reconstruction of the heavily damaged Chair of Chemical Technology and in the continuation of his research work. He put his rich storehouse of knowledge and experience and his untiring creative power full-heartedly at the service of the liberated Hungarian people. He set a fine example when participating in the implementation of the scientific and industrial objectives of the building of socialism.

He continued his research work on the path he had chosen. He succeeded in finding a compromise between the opposite reaction conditions necessary for cyclization and hydrogenation, respectively, so that he was able to hydrogenize lignite tar oil at medium pressures. This he achieved by way of the hydrogen liberated during the cyclization of benzine which he fed together with the oil into the reactor. On this basis a so-called hydrocrack process was worked out by which asphalt containing coal and lignite tars were diluted with their own middle oils and could thus be cracked instead of at 700 atm. at 70 atm. with lower hydrogen consumption than required by any of the known hydrocracking processes, giving at the same time a higher yield of motor fuel. The commercial applicability of the method was proved by the continuous experiments carried out in the "Otto Grotewohl Combined Works" in the GDR.

Varga carried out these experiments partly in the High Pressure Research Institute founded in 1951 whose first director he was. In 1952 he took over the Chair for Petroleum and Coal Processing Industries at the University of Heavy Industries in Veszprém. The State of the working people paid due tribute to his outstanding achievements. The newly organized Hungarian Academy of Sciences elected Varga to the rank of ordinary member, and the Government rewarded him twice — in 1950 and 1952 — with the Kossuth Prize. The entire Hungarian society mourned his sudden death in 1956.

József Varga was put to eternal rest ten years ago, but his lifework did not end with his death. The seeds which this great scientist and engineer-teacher has sown, his scientific and educational conceptions fell on a fruitful soil. Many of his pupils occupy chairs at our Universities, others are in leading industrial positions or in research institutes, more than one of them has acquired the highest scientific qualifications. Let us now consider more closely how posterity has used József Varga's great spiritual inheritance.

We are well aware that of all branches of chemistry the branch Varga was engaged in, namely chemical technology is most liable to the laws of change. Realization of any given chemical technological procedure depends not only on its scientific and technical foundations, but also on complicated economic and industrial-political factors, and last but not least on the actual situation in raw material supplies. We have to consider that, when evaluating the fate of the hydrocrack process in the period immediately before and after Varga's death two unforeseen events — the swamping of the Nagylengyel oil fields and the "Friendship oil pipe line" constructed for the utilization of the Soviet petroleum treasures along the river Volga, have brought about a fundamental change in the motor fuel situation in Hungary. But in other relations, too, in the last ten years the possibilities of oil imports have relegated into the background all over Europe the former autarchistic trends and the problem of processing residues has — at least for the time being — been taken off the agenda.

These facts, however, do not in the least diminish the importance of the truth that a technology of pioneer significance even in world relation had been created from Hungarian intellectual and material resources, namely the hydrogenation process at medium pressures which is now generally called the "Varga process" and that unlimited perspectives are open to this process in the refining industries.

As a result of the activities of the High Pressure Research Institute founded on the initiative of József Varga, and of the untiring teaching and educational work of the Professor, a conviction ripened and grew roots in the leaders and specialists of the Hungarian chemical industry namely that the commercial introduction of medium and high pressure technologies is one of the evident possibilities for the rapid development of this branch o industry.

It is a further proof of Varga's perspicacity that as far backf as 1950—1951 he already emphatically called attention to the necessity of the introduction of benzine reforming with platinum catalysts and to the importance of the refining processes based on hydrogenation. He started research in this direction in his Institute at the same time. It was not Varga's fault that the first Hungarian benzine reforming plant was put into operation — with the effective cooperation of the High Pressure Research Institute — no sooner than the autumn of 1964.

In the course of the elaboration of the Varga process — which we may regard as a model — considerable intellectual capital accumulated in the Institute; the technological and engineering experiences gathered made their incentive effect felt beyond the actual task to be solved. Varga was the first to direct attention to the elaboration of the hydrogenation processes in the organic chemical industry; in the University Department under his leadership work on a high pressure catalytic hydrogenation process of glucose solutions began as far back as 1954. Though actual industrial interest turned to this process only in 1959, this earlier work finally led to a new up-to-date sorbitol technology which was put into commercial operation on the basis of the NaKI* patent in the Pét Nitrogen Works in 1962.

In 1956 Vargha directed the first hydrogenation experiments of triglycerides for the production of fatty alcohols. In the following years a new process was worked out in this field which was put into operation at the Pét Nitrogen Works on the basis of the patent granted to the Institute.

Varga's conceptions extended to the research in furane chemistry which in 1959 resulted in a new process and patent for the production of furfuryl alcohol; this was put into commercial production in 1965 by the Nitrogen Works in Pét after several years of pilot plant experiments in the Institute.

Varga was fully (and correctly) aware that an adequate workshop capacity, moreover in certain fields independent mechanical engineering research are indispensable tools in research and even more so in commercial implementation of high pressure technologies: without suitable reactors and other equipments, such as feeding devices, control and registration instruments, it is impossible to study these processes.

In this respect Varga always tried to preserve his independence, while at the same time he did everything in his power to build a fruitful cooperation by using his earlier personal contacts with the hydrogenation plants in the GDR where this technology has already a certain tradition. To no small degree this cooperation is the merit of the here present dr. Richard Birthler, Technical Director of Erdölverarbeitungswerk Schwedt, former specialist at Böhlen, as a result of this cooperation a close link in the spirit of mutual assistance has developed in the last 15 years, manifest among others in occasional common research programs.

Several experiments which Varga had once started and abandoned for one reason or another have again become topical. An example of these are his 12—13 years old researches concerning the utilization of Hungarian natural gases rich in carbon dioxide.

* Nagynyomású Kutató Intézet = High Pressure Research Institute.

As engineer and practician Varga believed it inadmissible to pass from laboratory experiments by extrapolation directly to commercial scale production. He fought vigourously for the installement of laboratory and pilot plant reactor systems of different sizes. The fundamental truth of his standpoint is evident from the fact that up to now it has proved impossible to realize a change of scale of several orders by pure calculation when working with multiphase catalytic hydrogenation processes.

József Varga's scientific conceptions live and make their effect felt not only in the Institute and University Departments he once led. His outlook as an engineer, his concentrated research methods, assert themselves through his pupils in the industrial research institutes, just as in the Technical Chemical Research Institute of the Hungarian Academy of Sciences which was actually founded after Varga's death. Varga, as a member of the Academy, was untiring all through his life in his efforts to ensure the scientific status and prestige of chemical technology. Today we may well say that indeed he did reach his objective.

József Varga's educational conceptions still have their beneficial effect felt on our higher educational system. As the Chemical Technological Department of the Budapest Technical University has acquired its particular engineering character under Varga, so did his characteristically engineering mentality and outlook influence the training of chemical engineers. Varga was one of the first to recognize that the differentiation of industry demands from the young engineers more and more specialized knowledge, which must result unavoidably in a certain specialization of their training. Thus, by maintaining the firm theoretical foundations, the technological curriculum must be subdivided in such a way that the engineer on leaving the university shall be immediately able to participate in production work.

This objective may be reached by the constant selection and supplementation of the technological subjects which should always correspond with the highest actual level of industry. To develop the engineer's mentality in the students they must be in touch with industry already during their university years — partly by way of works practice, partly within the university where they may study the technological processes on the pilot plant scale. The scale effect, so often emphasized in research, should be manifest in the training of engineers, too.

Varga's, the educationalist's, ideas have materialized in the University of Chemical Industry in Veszprém, one of whose spiritual inspirators he was, and also in the reforms of higher education in the elaboration of which he took an active part. Thanks József Varga's pioneer activities in our universities the teaching of chemical engineering and chemical operations as independent subjects has obtained place and a dominant role beside general chemical technology and the specialized technologies.

With all what I have said I wished to present József Varga, who ten years after his death still lives and creates. Ten years are not enough to give a historical perspective by which we may assign a proper place in the universal history of science to such a manifold and rich carrier. But I am firmly convinced that a later generation will find for József Varga the place he deserves, in the Pantheon of the great Hungarian pioneer scientists.