140th anniversary of the birthday

Evgeny Oskarovich Paton



E.O. PATON — OUTSTANDING SCIENTIST, TEACHER AND ORGANISER OF SCIENCE AND MANUFACTURING (140th anniversary of the birthday)

Evgeny Oskarovich Paton was born on the 5th of March 1870 in Nice (France) in the family of the Russian consul. He received his secondary education in a gymnasium in Breslau (Germany), where along with a fundamental training in exact sciences he also acquired a perfect knowledge of the German, French and English languages. In 1888 he entered the Engineering Department of the Royal Saxon School of Technology of Dresden (now the Dresden Polytechnic Institute), which he brilliantly finished in 1894. After the graduation, he was offered a post of a junior member of the research staff of the Institute. But, brought up by the family in the patriotic spirit, the young engineer firmly resolved to devote himself to serving his Motherland, and in 1895 he moved forever to Russia.

To have the right for engineering activity in Russia, in that same year E.O. Paton entered the fifth year of the St. Petersburg Road Engineers Institute, within eight months passed 12 exams, completed several projects, and already in May 1896 received the diploma of a Russian engineer. Upon graduating from the Institute, Evgeny Paton started working as a scientific assistant under the supervision of Prof. F.S. Yasinsky at the Institute and at the Technical Department of Track Maintenance of the Nikolaevskaya Railroad Administration. The talented professor had a great and beneficial influence on the young specialist. Next year, 1897, Evgeny Paton started his teaching work at the just arranged Moscow Engineering School of Communications. Here he met professors L.D. Proskuryakov, L.F. Nikolai, N.A. Belelyubsky and M.N. Gersevanov, the joint work with whom exerted a beneficial effect on formation of the young scientist.

In the age of 31 he defended his thesis, received the degree of a junior scientific assistant and was appointed a professor of the School. Evgeny Paton devoted seven years of his life to the Moscow Engineering School of Communications. During those years he worked out his own teaching principles, and commenced his many years' work on writing manuals and preparing teaching aids on bridge construction. He developed a very strict order of day for himself, beginning at 6 a.m., and meticulously followed it all his life.

E.O. Paton was continuously working at selfimprovement, thoroughly prepared his lectures, and was very exacting and demanding to students. He tensely worked on development of the courses of bridges, carefully processed a large amount of reference sources, and verified and checked designs over and over again. Two volumes of manuals on railway bridges, and examples of designs of wood, iron and stone bridges were published within a short space of time. The name of E.O. Paton — a young bridge construction professor — became widely known, and his books were quickly sold out.

In 1904, the young professor was invited to run the Chair of Bridges at the Kiev Polytechnic Institute (KPI). Soon Evgeny Paton was elected a dean of the Engineering Department of the Institute. He leaped vigorously into foundation of a museum and laboratory of bridges with a special library. In addition to teaching, Evgeny Paton gave much consideration to writing of manuals, designing and constructing of bridges. The Mukhransky bridge in Tbilisi, two bridges across the Ros River, the Kiev Footbridge over the Petrovskaya alley, ceilings of the KPI halls and «Metropol» hotel in Moscow, etc. were built under his leadership.

During the First World War, Evgeny Oskarovich energetically started designing bridges by an assignment of the Military Department. He developed an original design of sectional bridges, called the Paton bridges, which found wide application for the military needs.

In 1918 Evgeny Paton published the «Restoration of Bridges» manual, and worked on designs of new bridges. In 1920 he founded the Kiev Bridge Testing Station at the People's Commissariat of Communications, and was running it for ten years. About 150 bridges of dif-



ferent systems in Ukraine, Belarus, Volga region and Kazakhstan were inspected and tested under his leadership and with his personal participation during those years. E.O. Paton collected extensive factual data, which he used in his teaching and design work.

In 1920, the White Poles, while retreating, blew up a very beautiful structure — the chain bridge across the Dnieper River in Kiev. In 1922, E.O. Paton undertook to restore the bridge, contributing all his indomitable energy to that deed. Evgeny Oskarovich was not only the author of the original design, but also an organiser of the building activity. Owing to his inventiveness, ability to resolve the most complicated problems and persistently overcome difficulties, the bridge named after Evgeniya Bosh started functioning in June 1925.

In 1925–1929, E.O. Paton was intensively working on designs of new bridges. He participated in All-Union and international competitions, justly winning appreciations and first prizes. As a whole, Evgeny Oskarovich devoted 35 years of his scientific, engineering and teaching activities to bridge construction, designed 40 bridges, and published over 160 studies dedicated to various aspects of bridge construction. Many of his students became famous scientists, engineers and production managers. His election a full member (academician) of the All-Ukrainian Academy of Sciences (VUAN) in 1929 was well deserved. E.O. Paton with a good reason is considered the founder of the bridge construction school in Ukraine.

Much success had been achieved by that time in design of iron bridges, but the process of their construction remained very labour-consuming and imperfect. That prompted him to look for new technologies. While preparing a new edition of the «Iron Bridges» manual, Evgeny Oskarovich included into it a section on the use of welding for construction of bridges.

He saw the ways of radically improving fabrication of bridge spans in a new method for joining metals, i.e. electric welding. And E.O. Paton made a bold and far-sighted decision – to study welding by involving the fundamentals of metallurgy, metal science, electrical engineering and physics, i.e. new issues for a bridge constructor.

He had to start out of nowhere: no equipment, no qualified people and no premises were available. Four workers and three rooms in basement - this is what the electric welding laboratory of VUAN was initially. Then the Electric Welding Committee was founded on a voluntary basis at VUAN, where E.O. Paton was the organiser and permanent chairman. The intensive work was deployed on this spare base, aimed at investigation of strength of welded structures, popularisation and application of electric welding in manufacturing, transport and building. At that early stage E.O. Paton put forward an idea of establishing a specialised research institution to address all the problems arising in development of the welding industry. The Presidium of VUAN approved establishment of such an institution in 1933, and on the 3rd of January 1934 the official status of the Electric Welding Institute was determined by a resolution of the Government.

From the very beginning E.O. Paton provided for such an organisational structure of the Institute that should consist of research and experimental production departments, design bureau and workshops. That was the origin of the world-first specialised welding research and engineering centre, the activities of which, in contrast to classical academic organisations, were not limited to conducting purely fundamental research, but from the very outset were aimed at finding end-to-end solutions for real problems of the national economy: from in-depth theoretical research to commercial application of the research and development results.

The Institute was widening the area of research. First of all, the comprehensive investigations were conducted to study welded structures, their strength under various service conditions, stresses and strains.

Unlike the majority of the research efforts in the Western Europe, which were conducted on small laboratory-scale samples (which is much simpler and less expensive), the Electric Welding Institute tried to carry out experiments on welded assemblies, beams and girders close to the full-scale ones. That required building of big testing facilities, but, in return, gave more accurate and reliable results.

Investigations of welded structures conducted by the Institute immediately attracted much attention and were positively assessed.

The second important area of research appeared soon — mechanisation and automation of arc welding. Based on a wide life, scientific and industrial experience, E.O. Paton came to



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a conclusion that success in a new cause could be achieved only through making a very difficult, but essential step — mechanisation and automation of welding, replacement of a hand and skill of an electric welding operator by an automatic welding device. This task is still of high importance.

The targeted fundamental research launched by E.O. Paton and his disciples became a theoretical base of the welding science and transformed it into a powerful source of technical progress, which led to revolutionary fulfilments in many industries. Monographs and articles of associates of the Institute also contributed to that. A demand arose for qualified welding engineers, and in 1935 Evgeny Oskarovich arranged a Welding Chair at the Kiev Polytechnic Institute.

In the pre-war years the Electric Welding Institute was active in development of reliable equipment for automatic open-arc welding. However, manual welders-stakhanovites first left behind sophisticated and expensive automatic arc welding devices both in the quality of welding and productivity. By comprehensively studying the problem and concentrating the scientific potential of the Institute, together with the Institute's team, Evgeny Oskarovich developed a new method for submerged-arc welding. It provided a several times increase in productivity and dramatic improvement of the quality of the welds. Submerged-arc welding became a commercially reliable and economically advantageous process, and was widely recognised as early as in 1940. To externsively apply the new method, it was necessary to develop automatic devices, fluxes and wires, and arrange their production within the shortest possible period.

Evgeny Paton requested assistance from the Government. At the end of 1940 he was summoned to Moscow. As a result, the resolution on wide application of submerged-arc welding was prepared and then approved by the Government in a short space of time. The resolution provided for introduction of the new method at 20 largest factories, arrangement of production of the required equipment, fluxes and wire, and expansion of the Electric Welding Institute. E.O. Paton was appointed the State Councillor and a member of the Board for Machine Building at the USSR Council of People's Commissars. The resolution became a historical event in development of the Soviet welding technology. In March 1941, E.O. Paton was awarded the Stalin Prize of the USSR of the first degree for the development of the method and equipment for high-speed submerged-arc welding. An enormous energy of E.O. Paton and of the entire team of the Electric Welding Institute ensured successful implementation of the resolution of the Government. The scales of application of submerged-arc welding were rapidly growing.

The Great Patriotic War that began on the 22nd of June 1941 was a real ordeal for the entire Soviet Union.

The Academy of Sciences of the Ukrainian SSR and most of its institutes were evacuated to Ufa. E.O. Paton requested the Evacuation Commission to evacuate the Electric Welding Institute to the Urals. The Institute moved to the Urals Wagon Building Factory (Uralvagonzavod) in Nizhny Tagil, which became an arsenal of weapon and ammunition for the front. At the urgent request of E.O. Paton, the Institute took a direct part in arrangement of manufacture of armoured tank bodies by focusing its efforts on application of submerged-arc welding in production of weapon and ammunition.

The activity of E.O. Paton during the war years was especially fruitful. Under the most difficult conditions he deployed the exploration and design work aimed mainly at development of high-speed automatic welding of amour steels to manufacture the armoured bodies of tanks. Under severe condition of the war time, associates of the Institute led by E.O. Paton were the first in the world to solve the most complicated scientific and technical problems associated with automatic welding of armour: they elaborated the reliable technology (V.I. Dyatlov, T.M. Slutskaya, B.I. Ivanov), investigated the processes occurring in the high-power welding arc burning under a flux (A.M. Makara, B.E. Paton), and developed new welding fluxes.

The output of tanks was arranged within the record-breaking terms at the Factory, and the first threatening machines T-34 went out from its gates in January 1942.

At the end of 1942, the Institute developed automatic devices with a constant wire feed speed. The principle of self-adjustment of the welding arc underlying these automatic devices made it possible to simplify design and facilitate manufacture and maintenance of the automatic devices, as well as widen their capabilities in application. In addition to the tank manufacturing plants, the Electric Welding Institute introduced automatic welding at other defence enterprises as well. Line production of high-explosive air bombs, missiles for Katyushas, as well as other weapon and ammunition for the needs of the front by using high-speed automatic submerged-arc welding was arranged for the first time in the world. By the end of 1944, automatic submerged-arc welding had been applied at 52 factories.

Evgeny Oskarovich and a number of associates of the Institute were awarded the orders of the USSR for successful application of automatic submerged-arc welding in industry.

On the 2nd of March 1943, E.O. Paton, the first of the Ukrainian academicians, was awarded the title of the Hero of Socialist Labour of the USSR for the outstanding achievements in ensuring a rapid manufacture of tanks.

In summer 1944, Evgeny Oskarovich returned to his home city Kiev liberated from fascist occupants by the Soviet Army.

That was the beginning of the second life of the Electric Welding Institute. The Institute was given a building in Gorky Street.

The war years hardened and strengthened the team of the Institute, which retained its capacity and enthusiasm for work. By using developments of the Urals period, before the end of 1945 the Institute introduced automatic submerged-arc welding at 12 major enterprises. In that year the Institute was named after its founder and leader.

The Institute was rapidly growing and developing under the leadership of E.O. Paton. Profound scientific investigations were expanded, multiple developments appeared, books and monographs on various problems of welding were published.

The range of issues addressed by Evgeny Oskarovich in those years was continuously widening. New and new social and state responsibilities were added to his duties on managing the Institute. Evgeny Paton was elected a Vice President of the Academy of Sciences of the Ukrainian SSR, giving up much effort to its activities. He was twice elected a Deputy of the Supreme Soviet of the USSR. E.O. Paton actively participated in addressing the state matters, and gave much concern to his voters. The high authority and reputation of Evgeny Oskarovich and of the Institute he headed were continuously growing not only in the USSR, but also abroad. The Electric Welding Institute by right took up a leading position in the world among research institutions involved in welding. None of the countries, even such a rich and developed country as the USA, had such a research and development centre.

Welded bridges remained a subject that was particularly close to Evgeny Oskarovich. Despite a very busy schedule, he never stopped dealing with them by developing and realising the ideas hatched out for many years.

The acme of many years' activities of Evgeny Paton was construction of the all-welded road bridge across the Dnieper River in Kiev instead of the Evgeniya Bosh Bridge ruined in the war time. He did not live only about three months to see realisation of his dream. The grand opening of the bridge named after E.O. Paton took place on the 5th of November 1953. The bridge is a structure with a long span, all its elements welded with the automatic devices being joined on site by using automatic submerged-arc welding. The E.O. Paton Bridge is still one of the biggest all-welded bridges in the world. The fiftieth anniversary of the Bridge was celebrated in 2003.

Evgeny Oskarovich Paton lived a long life filled up with continuous and incessant creative work. He had a rare diligence and extraordinary energy. The major part of his life he was busy working for 12–14 hours a day.

The contribution of E.O. Paton to the scientific and technical progress, training of engineering staff and formation of the scientific school was marked with the orders of the Russian Empire and orders of the USSR, namely: order of St. Stanislav, order of St. Anna, two orders of Lenin, Gold Star of the Hero of the Socialist Labour, two orders of the Red Banner of Labour, order of the Patriotic War of the 1st Degree, and order of the Red Star. He was awarded the title of the Honoured Scientist.

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