

plasmatron nonconsumable electrode–item made 160 A, of plasmatron nonconsumable electrode–filler wire was 210 A; duration of pulse of the arc current being 0.1 s for plasmatron nonconsumable electrode–item and 0.3 s for plasmatron nonconsumable electrode–filler wire; surfacing rate made 8.72 m/h, consumption of plasma argon showed 4 l/min and 18 l/min of argon for shielding.

Degradation of quality of formation of the deposited bead at pulse duration increase should be noted.

CONCLUSIONS

1. It is shown that efficiency is increased and penetration depth of the base metal is reduced at plasma twin-arc surfacing with side feeding of filler wire and alternating burning of straight polarity pulse arc.

2. It is determined that duration of the current pulses should not exceed 0.3 s for providing good formation of the deposited metal.

3. The unit for plasma surfacing by filler wire with alternating burning of pulse arc was developed. The unit is universal since other methods of plasma surfacing can also be realized.

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3. Gladky, P.V., Pereplyotchikov, E.F., Ryabtsev, I.A. (2007) *Plasma surfacing*. Kiev: Ekotekhnologiya.
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Memorable dates

AT THE ORIGINS OF INTEGRATED DEVELOPMENT OF WELDING PRODUCTION

80 years ago Evgeny O. Paton for the first time in the world put forward an idea about integrated development of the theory and practice of welding and started forming specialized research and design organization with the purpose of solving various tasks in the path of progress of welding production

In 1929 academician Evgeny Oskarovich Paton, known bridge-builder, takes a decision to apply welding in bridge construction, and organizes an electric welding laboratory. The scientist rather quickly designed rational welded assemblies of span structures, machines and boilers, developed methods of strength testing and analysis of welds, began designing the bridge decking, started consulting designers and production specialists. Welding was already applied in bridge repair and construction in the USSR and other

countries, but many specialists were unwilling to eliminate riveting and bolted joints, fearing failures which occurred in bridges across the Albert channel in Belgium. For three years E.O. Paton with several associates performed a large scope of work to study strains, developed a number of welded structures and proved that the designers did not take into account the features of welding and simple replacement of technology lead to catastrophies. He came to the conclusion that the success of welding development and introduction depends on solving a number of problems, lying in metallurgical, electrical engineering and many other planes. Having made sure that weld quality depends on welder's qualifications, E.O. Paton poses the task of developing a reliable process of welding with automatic machines.

In 1932 in the All-Ukrainian Academy of Sciences off-site sessions in Kharkov (at that time capital of Ukr. SSR) and in the cities of Donbass region, E.O. Paton made presentations to production teams and general public on the problems and advantages of welding production. His article «Paths of electric welding development during the Second Five-Year Plan period» was published in specialized journals and as individual brochures in Russian and Ukrainian. It gives a comprehensive analysis of the condition of



E.O. Paton among the participants of 1st All-Union Conference on submerged-arc welding (1940)

arc and resistance welding, proves the need for wide application of advanced technologies, sets forth the idea of the decisive role of welding mechanization and automation, and outlines the ways to solve the defined problems.

In 1933 the level of scientific work, which was performed by the laboratory led by E.O. Paton, already corresponded to the requirements for an academic institute. Establishment of such an institute was approved by the Presidium of the All-Ukrainian Academy of Sciences on January 3, 1934. In keeping with the government act the Institute was granted the official status of Electric Welding Institute (EWI), and E.O. Paton remained its director to the end of his life. He established the world's first specialized welding research institute, with a structure which ensures fast performance of the entire work cycle from scientific-technical idea and special research up to creation and introduction of technologies and equipment. Design Department continued designing apparatuses, feeding electrode wire with different coating systems. At the same time, the Institute intensively developed various processes for welding zone protection and weld quality improvement. Meanwhile, E.O. Paton continued designing welded structures and providing consultations for their production. In 1930 welding began to be used for manufacture of sugar plant equipment and seeders. In 1932 «Leninskaya Kuznitsa» plant in Kiev welded the first ship from the river ship series. In 1933 welding of steam boilers was mastered in «Krasny Kotelshchik» plant in Taganrog.

In 1935 EWI developed A-66 welding head, providing welding fire feed rate depending on arc voltage drop. By the end of 1930s Technology Department performed metallurgical investigations, developed the compositions of USSR's first fused fluxes, silicon-manganese wire and technology of high-speed semi-submerged arc welding of structural steel with bare wire.

In June 1940 single-pass automatic welding of a butt weld of 13 mm sheet at 30 m/h speed was demonstrated at a conference at EWI. The new welding process made a great impression on production specialists — it turned out to be 11 times more efficient than manual arc welding.

On December 20, 1940 an Act of the USSR Soviet of People's Commissars and CC of AUCP(b) on introduction of automatic submerged-arc welding during a six month period at 20 major plants of the country was published. E.O. Paton was appointed member of the Council on Machine-Building at USSR SPC; he was entrusted with fulfillment of this Act. At the same time he was charged with the functions of Head of Electric Welding Department at TsNIITMash (in Moscow), while remaining to be EWI Director. In January 1941 E.O. Paton's dream was implemented at V.M. Molotov Plant of Metal Structures — automatic welding of beams of span structure of a bridge across the Dnieper was set up. Evgeny Paton was awarded Stalin Prize of the first degree.

A.N. Kornienko, Dr. of Sci. (Hist.)