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How the Welding Equipment and Technology Market Works and Lives

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Abstract: The article examines the current state of the welding equipment and technology market, including key trends, the structure of supply and demand, and innovative solutions in the field of automation and digitalization of welding processes. The main market players, the impact of global and local economic factors, as well as current challenges and prospects for the development of the industry, were analyzed. Special attention was paid to the transition to energy-efficient and intelligent equipment, which are in demand in various industries - from shipbuilding to high-tech industries.

Keywords: Welding Equipment, Welding Technologies, Welding Market, Automation, Digitalization, Industry, Innovation, Production Technologies, Energy Saving, Welding Equipment.

Welding is a reliable and technologically efficient, and often the only possible and most effective way to create permanent connections of structural materials, which determines the development of welding equipment, materials, and technologies.The main material used in various industries and construction remains steel, despite the introduction of light alloys, polymer materials, and composites. The positive trend of global steel production growth, despite a slight slowdown in recent years, determines the growth in the volume of welding production and the production of welding equipment, as well as the volume of scientific research and development on the creation of new and improvement of existing equipment and technologies. At the beginning of the 21st century, the volume of welding production was estimated at approximately $40 billion, of which about 70% came from welding materials and about 30% from equipment. Welding processes, by the breadth of application and the gross volume of the final product, occupy half (!) of all production work. It is difficult to name any branch of the national economy where welding has not been applied.Welding will remain the most in-demand process in industry and construction in the future with high productivity based on the application of automation, robotization, computer technology, and modeling processes. Let's consider the trends and development paths of welding and welding production in the near future.

Development trends of welding equipment. In global and European welding markets, there is an increase in the share of materials and equipment for mechanized welding methods and a decrease in the share of manual welding. Thus, in global welding production, the leading positions will be occupied by semi-automatic and automatic arc welding types, mainly due to the reduction in the share of manual welding. At the same time, the consumption of coated electrodes for arc welding is reduced (in the future, their number will decrease by 15-20%). However, manual arc welding positions during installation and repair work will remain even with increasing consumption of automatic carriages (Fig. 1) and trolleys. Technological equipment for manual welding is developing and improving mainly through the use of thyristors and inverters.Due to the increase in the volume of mechanized and automated welding methods, there is a growing need to create new welding machines, primarily with reduced mass and dimensions, which will expand the possibilities of their practical application. New mechanisms based on different principles than those previously used are expected to be used, for example, the use of converters with increased number of electric current phases, increased efficiency and power factor, fully controlled remotely with synergetic equipment and technological process regulation using computer. The development of robotics will contribute to the further automation of connection processes. For example, in Figure 2, the Fronius company's CMT Twin robotic tandem

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welding system with two independent microprocessor power sources is presented (Figure 2). New semi-automatic and automatic welding control systems will expand their practical application possibilities. An example can be the ADF-1000 welding head of the ITS company (Fig. 3), equipped with a monitoring and video surveillance system for the welding process.

Fig. 1. Use of Railtrac-1000 (ESAB) remote-controlled automatic welding carriage during installation

Fig. 2. The use of robots in welding production

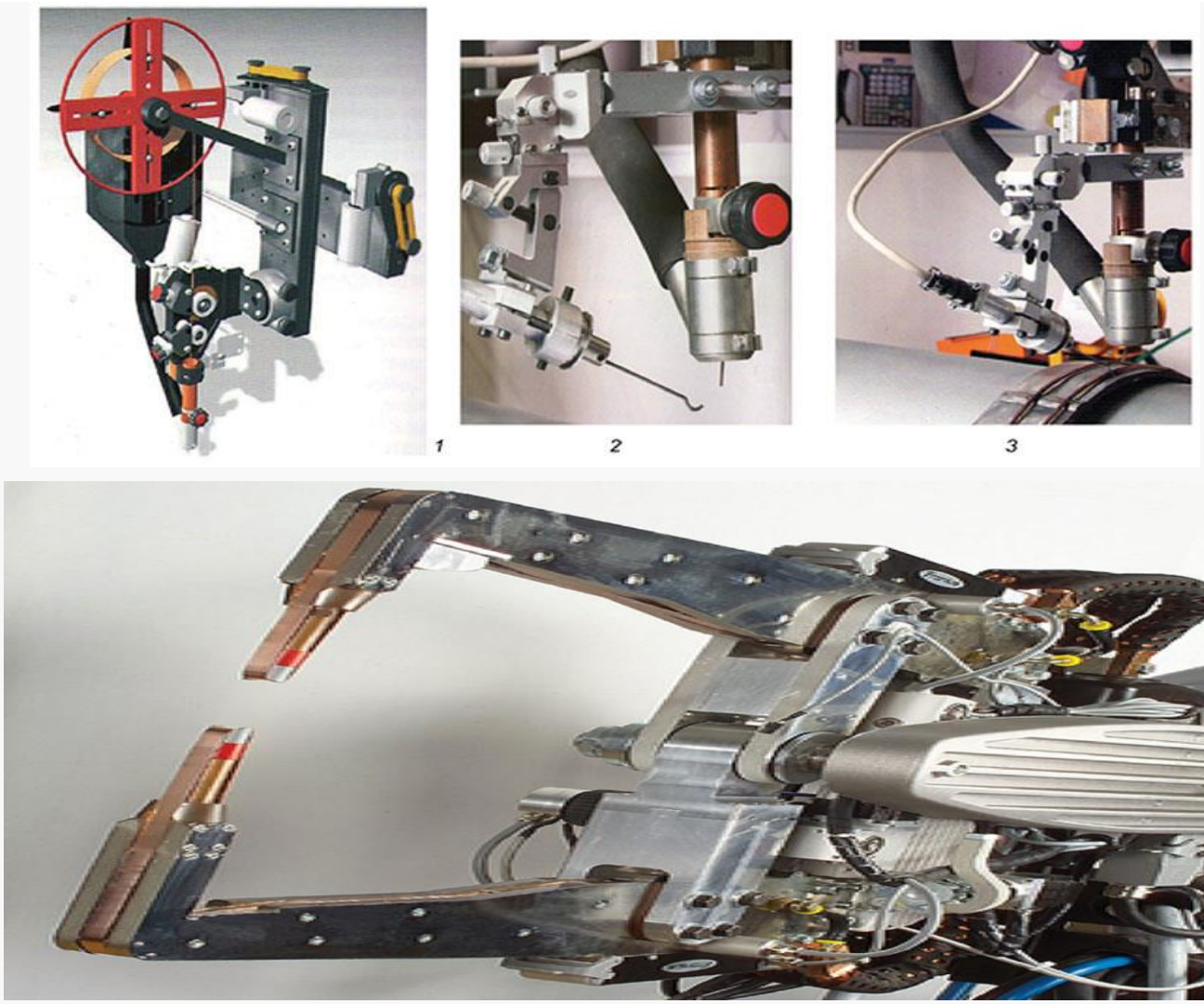

Fig. 4. Delta Spot - Fronius welding tongs.

The use of contact welding methods in relevant industries is not decreasing. The development of equipment and technologies for this type of welding will continue. The welding equipment market offers a wide selection of contact welding equipment. Figure 4 presents a new contact welding equipment that significantly increases the service life of the electrodes, improves the quality and productivity of welding sheet structures.

Application of welding technologies to new materials. In many branches of industry and construction, light metals and their alloys, as well as composite materials, are increasingly being used, and their introduction into various industries has necessitated the development of new modern welding technologies and the improvement of existing ones. For these alloys, not only arc welding is used (**Fig. 5**), but also laser, electron-beam, plasma-arc, and microplasmic welding. These types of welding are typically used in thin metal joints in the electronics industry, instrument making, as well as in aircraft and rocket construction and other industries. Significant progress has been made in the application of such types of welding as diffusion, friction welding with stirring (Fig. 6), and others, as evidenced by the expansion of their application in many industrial fields.

Fig. 5. Argon-arc welding of titanium alloy products

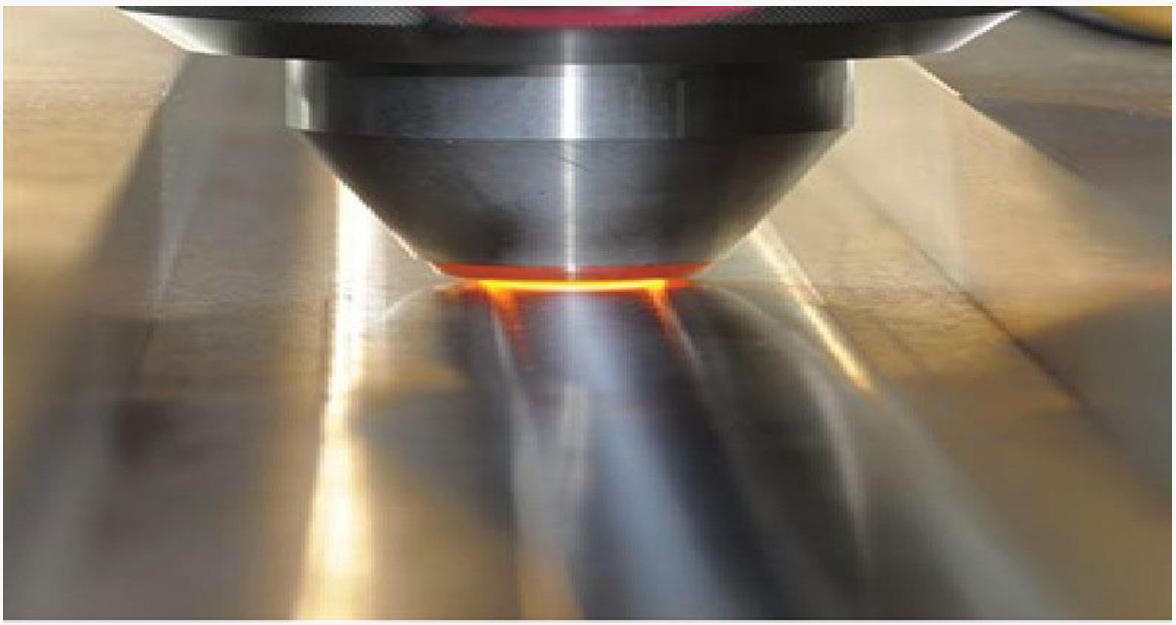

Fig. 6. Miscible friction welding of aluminum alloys

Currently, composite materials are increasingly being used, and their areas of application are constantly expanding. To connect elements from these materials, appropriate technologies are needed, which in most cases are still in the development stage. Therefore, carrying out work in the field of production of improved equipment for welding new materials is necessary and relevant.

Improvement of materials for welding. Ensuring the quality of manufactured welding materials, as well as developing new materials for both traditional welding methods and new progressive technologies, is an important task. The increasing role of automation and mechanization in welding dictates the need to increase the production of continuous and powdered welding wire.The main factors determining the increase in the volume of continuous wire consumption are its quality, the constancy of the chemical composition, the qualitative state of the wire surface achieved by copper plating or electrolyte-plasma treatment. The use of powder wire significantly increases the productivity of the welding process (approximately by 30%), while significantly reducing spraying. Recently, more and more preference has been given to the use of powder wire, which is made by molding a cold-rolled strip of a given size into a round profile, which is then filled with powder mixture. Similar wires were developed for welding many steel grades, including corrosion-resistant ones. The main factor determining the increase in its consumption volume compared to rolled wires, which have a non-hermetic longitudinal connection, is its quality, characterized by the absolute protection of the flux

core from possible saturation with moisture from the atmosphere. The core remains dry during long-term storage even without packaging and does not require roasting before use. Welding with such wire is possible with semi-automatic machines designed for continuous cross-section wire. For example, in industrially developed countries, when welding metal structures mechanically, a mixture of active and inert gases is preferred. For arc welding with a melting electrode, a mixture of argon and carbon dioxide in different proportions, Sorgon, is widely used. Triple gas mixtures of argon with carbon dioxide and with oxygen or helium are less common. Adding helium to the active protective gas argon positively affects the quality of the seams, leads to an increase in arc tension and its energy, which in turn improves the fusion of the seam and its shape. Welding steel metal structures in a mixture of protective gases based on argon and helium also has advantages compared to welding in CO_2 and a significant (6-8 times) decrease in spraying. In addition, the formation of the weld is improved, the mechanical properties of the weld metal and the alloy boundary metal are enhanced, and sanitary, hygienic, and environmental conditions are improved during welding. The existing volumes of using automatic welding under flux will be maintained in the near future, therefore, the requirements for flux quality are increasing. Abroad, only ceramic agglomerated fluxes are used instead of molten ones. Unfortunately, agglomerated fluxes are significantly more expensive than molten ones, and this hinders their application.Although the consumption of coated electrodes for arc welding has decreased, they are still widely used in installation and repair work. In our country, modern highly mechanized plants have been built, producing hundreds of thousands of tons of high-quality electrodes annually.

LITERATURE

1. Белоусов, В. В**.** Сварочное оборудование и технологии. — М.: Машиностроение, 2018. — 320 с.*Подробно рассматриваются современные виды сварочного оборудования, их применение и рыночные тенденции.*
2. Рыжков, А. Н**.** Современные сварочные технологии: учебное пособие. — М.: Лань, 2019. — 240 с.*Анализируются современные технологии сварки и их влияние на рынок.*
3. Головачев, В. Г**.** Автоматизация сварочных процессов. — СПб.: Питер, 2020. — 288 с.*Описаны пути автоматизации сварки и их роль в повышении производительности и конкурентоспособности.*
4. Смирнов, И. В. Экономика и организация сварочного производства. — М.: Инфра-М, 2017. — 256 с.*Рассматривается экономика сварочного производства, управление затратами и рыночные механизмы.*
5. Умарова, Шахноза Олимовна; Жураев, Абдуллажон Ибрагимович; ,"ВЫБОР ЭЛЕКТРОДОВ ДЛЯ СВАРКИ ТЕПЛОУСТОЙЧИВЫХ, ВЫСОКОЛЕГИРОВАННЫХ СТАЛЕЙ И ЦВЕТНЫХ МЕТАЛЛОВ",Новости образования: исследование в XXI веке,1,6,624-634,2023,
6. Умарова, Шахноза Олимовна; Жураев, Абдуллажон Ибрагимович; РАБОТОСПОСОБНОСТЬ СВАРНЫХ СОЕДИНЕНИЙ ПРИ НИЗКИХ ТЕМПЕРАТУР,

   Новости образования: исследование в XXI веке,1,6,635-647,2023,
7. Жураев, АИ; ,ТЕХНОЛОГИЯ СБОРКИ И СВАРКИ ГЛУШИТЕЛЯ АВТОМОБИЛЕЙ УЗАВТО НА ЗАВОДАХ АО УЗ ДОНГ ВОН И АО АВТОКОМПОНЕНТ,ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ,16,2,94-98,2023,
8. Jurayev, AI; Yuldasheva, M; ,KATTA SIG'IMLI REZERVUARLARNI PAYVANDLASH TEXNOLOGIYASI,ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ,15,6,29-31,2023,
9. Jurayev, AI; ,NUQTALI KONTAKTLAB PAYVANDLASHDA METALL SOCHRAMALARNI OLDINI OLISH,ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ,15,7,133-138,2023,
10. Жураев, Абдуллажон; ,ЦИЛИНДРИК ЮЗАЛАРГА КОНТАКТ ПАЙВАНДЛАБ ҚОПЛАМА ҚОПЛАШНИ ТАДҚИҚ ҚИЛИШ,Scientific Impulse,1,7,786-792,2023