E.O. Paton Electric Welding Institute of the National Academy of Sciences of Ukraine

International Scientific-Technical and Production Journal

The Paton WELDING JOURNAL

Issue 01 2019

Published Monthly Since 2000

English translation of the monthly «Avtomaticheskaya Svarka» (Automatic Welding) journal published in Russian since 1948

Founders
E.O. Paton Electric Welding Institute, NASU
International Association «Welding»

Publisher
International Association «Welding»

Translators
A.A. Fomin, O.S. Kurochko, I.N. Kutianova
Editor
N.G. Khomenko
Electron galley
D.I. Sereda, T.Yu. Snegiryova

Address
E.O. Paton Electric Welding Institute,
International Association «Welding»
11 Kazimir Malevich Str. (former Bozhenko Str.),
03150, Kyiv, Ukraine
Tel.: (38044) 200 60 16, 200 82 77
Fax: (38044) 200 82 77, 200 81 45
E-mail: journal@paton.kiev.ua
www.patonpublishinghouse.com

State Registration Certificate
KV 4790 of 09.01.2001
ISSN 0957-798X
DOI: http://dx.doi.org/10.15407/tpwj

Subscriptions
$384, 12 issues per year,
air postage and packaging included.
Back issues available.

CONTENTS

INTERNATIONAL INDUSTRIAL FORUM-2018

XVI International Forum took place on November 20–23 in Kyiv on the territory of the International Exhibition Center. This event starting from 2005 is included in the list of leading world industrial exhibitions, being officially certified and recognized by the Global Association of the Exhibition Industry (UFI) and year by year remains the largest exhibition event of machine-building topic in Ukraine.

The International Exhibition Center acts as the exhibition organizer. It provided excellent conditions for many companies and plants, which for many years choose Industrial Forum as an area for demonstration of their novel developments and place for meeting with wide range of specialists and potential partners.

352 enterprises and companies from 32 countries in the world have participated in the International Industrial Forum. In particular, China, Czechia and Turkey formed their national expositions. Total area of exposition made 22000 m^2, exhibition was visited by more than 12000 specialists.

In scope of the Forum the following international specialized exhibitions took place:

- Metal working (metal processing technologies, equipment);
- UkrVtorTekh (commission techniques and equipment);
- UkrCasting (equipment and technologies for casting production);
- UkrWelding (technology, equipment and materials);
- Hydraulics. Pneumatics;
- Bearings (rolling bearings, sliding bearings, free parts: balls, rolls, clamping sleeves, technologies, equipment and tools for bearing production);
- UkrPromAutomation (automation of production, automated systems for regulation of technological processes , automation of industrial objects);
- Lifting-transport, warehouse equipment;
- Samples, standards, templates, devices (control-measurement devices, laboratory and testing equipment, metrology, certification);
- Industrial safety (protective means, safety of working zone);
- National exposition of enterprises from Turkey.

First Vice-Prime Minister of Ukraine — Minister of Economic Development and Trade of Ukraine Stepan Ivanovich Kubiv visited the International Industrial Forum, made a speech during its opening and then attentively took a look at expositions of the enterprises of machine-building branch of Ukraine.

Enterprises of the domestic machine-building complex demonstrated in a worthy manner on their booths their products and developments. Metal working direction traditionally was presented by Avantis (Zhitomir), MIOS Company (Drogobych), Prigma-Press (Khmelnitsky), Motor Sich (Zaporozhie), Chernigov Mechanical Plant and others.

Micra LLC (Kyiv), Microl (Ivano-Frankovsk), Novotest (Novomoskovsk), Tekhnopolis Company (Kyiv) and other companies presented their developments in the field of instrument making and industrial automation. Krankomplekt plant (Zaporozhie), Alexandria Crane Systems, SPG Stankompromimport (Kharkov) and many

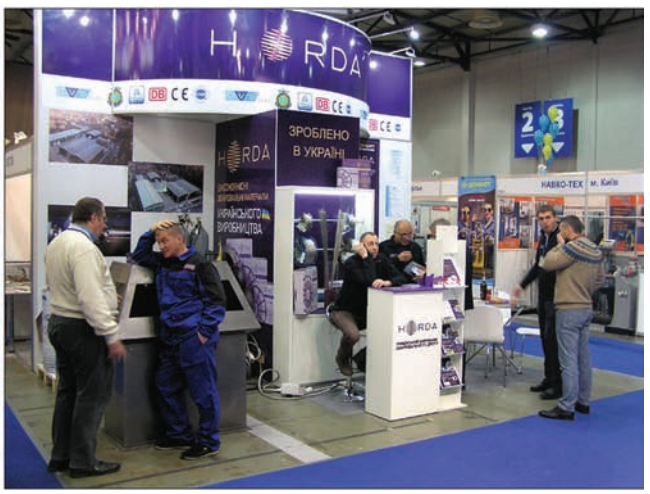
other manufacturers and designers of equipment and technologies can be outlined among the manufacturers of lifting-transport and warehouse equipment.

For the second consecutive year the Industrial Forum demonstrated the expositions of significant number of enterprise-manufacturers of laser equipment. It was presented on the booths of Jinan Bodor CNC Machine Co., Ltd (PRC), Abplanalp Ukraine (Kyiv), engineering subdivision ALISTA, Dnepropolimermash (Dnepr), Aramis (Cherkasy), El-Sel Group, Mashintech (Kyiv), Storozhuk (Kyiv).

Exposition of industrial tool traditionally impressed by perfect quality and variety of products, presented by permanent participants — Doss Instrument, ZCC Cutting Tools Europe (Germany), AV POLYSTAR (Kharkov), Industrial Company Golden Fleece, Ukraine (Kyiv), PKP Komkor (Dpenr), Microtech (Kharkov), Pnevmomaster (Kyiv), Praktyka Ukrayna (Dnepr), Tsentr Innovatsionnykh Tekhnologiy LM (Dnepr), Stankoinstrumentimport (Kyiv) and other manufacturers and suppliers of instruments.

Exhibition section «UkrWelding» of the Forum included demonstration of achievements in such directions:

- equipment and technology for welding and cutting;
- equipment for brazing, surfacing and related technologies;
- equipment for thermal treatment of materials and welded structures;
- equipment and technologies of welding consumables production;
- instruments and materials for welding, cutting, brazing;
- automation of welding processes.



The participants of the exhibition, domestic and foreign presented significant number of equipment and materials for implementation of innovative technologies in welding branch. Demonstration of equipment operation for wide audience of specialists took place at the booths of Ideal (Odessa), Ukraine (Kyiv), Binzel Ukraine, Fronius Ukraine (Kyiv region) and series of others during all four days of the exhibition.

Among the domestic leaders in the field of welding and related technologies there were next companies, which presented their products and technology, namely Machine building factory Vistec (Bakhmut, Donetsk region), Vitapolis (Kyiv region), Autogenous equipment plant DONMET (Kramatorsk, Donetsk region), Energiya Svarka (Zaporozhie), Sumy-Electrode, Techvagonmash (Kremenchug, Poltava region), TM.Weltek (Kyiv), Triada Ltd. (Zaporozhie) and others.

For the first time among the participants of «UkrWelding» Exhibition there is Oliver (Minsk). It presented to the visitors a wide range of modern welding consumables (wires and coated electrodes) of Oliver production.

Robotics complexes at the booths of Binzel Ukraine (Kyiv region), KB Robotics Engineering (Kyiv region), Sammit (Dnepr), Techvagonmash (Kremenchug, Poltava region), Triada Ltd. (Zaporozhie), Fanuc Ukraine (Kyiv) continuously attracted attention of the specialists.

Equipment for plasma cutting was presented on the booths of Ukrainian production companies Artel Ltd. (Nikolaev), Zont, UG-Stankoservice (Odessa), Techmach (Odessa) as well as Favoryt AM (Lvov).

Comparing the Industrial Forum-2018 with earlier carried it is possible to note a rising attention to innovative technologies, experience of their implementation into domestic production and expansion of the sales market of the products in the European direction.

A.T. Zelnichenko, V.N. Lipodaev

INTERNATIONAL CONFERENCE «WELDING AND RELATED TECHNOLOGIES — PRESENT AND FUTURE»

On December 5–6, 2018 in Kiev at the conference-centre «DEPO» a representative International Conference «Welding and Related Technologies – Present and Future» was held, organized by the National Academy of Sciences of Ukraine, the E.O. Paton Electric Welding Institute, the International Institute of Welding and the International Association «Welding». The Conference was dedicated to the 100th anniversary of the National Academy of Sciences of Ukraine. In it more than 200 representatives of academic institutes, branch research institutes, universities, scientific, design and engineering centers, industrial and commercial enterprises, chiefs and managers of business structures, etc. took part. Among the Conference participants the foreign scientists from Austria, Bulgaria, Great Britain, Germany, Georgia, Israel, Kazakhstan, Canada, China, Poland, Slovakia and Switzerland participated. Among the honored guests of the Conference, Ms. Cecile Mayer, Executive Director of the International Institute of Welding, was present.

The beginning of the Conference was preceded by a musical greeting from the string ensemble «Kyiv Soloists» and greetings of Academician A.G. Naumovets, Vice-President of the NAS of Ukraine and Mr. Liao Bing, President of the Academy of Sciences of Guangdong Province (China).

During December 5 and the first half of December 6, 18 reports of scientists on the most important scientific and applied achievements in recent years in the field of welding and related technologies, as well as long-term development of these directions were presented and discussed at the plenary sessions.

Among the speakers there were well-known scientists Liao Bing (China), U. Reisgen (Germany), A. Pietras (Poland), L. Gelman (Great Britain), S.I. Kuchuk-Yatsen-






ko (Ukraine), L.M. Lobanov (Ukraine), I.V. Krivtsun (Ukraine), V.T. Nazarchuk (Ukraine), S. Keitel (Germany), J. Kleiman (Canada), M. Beloev (Bulgaria), V.V. Kvasnitsky (Ukraine), N. Enzinger (Austria), F. Kolenic (Slovakia), I.S. Gakh, Z.T. Nazarchuk, V.M. Nesterenkov, S.V. Akhonin (Ukraine).

The plenary report of B. E. Paton «Modern achievements and developments of the E.O. Paton Electric Welding Institute in the field of welding and related technologies» was presented by L. M. Lobanov.

On December 6, in parallel with the main reports of the Conference, at the youth section «Welding and related technologies» the reports of young specialists were presented.

On the afternoon of December 6, in the reading hall of the E.O. Paton Electric Welding Institute over 150 poster reports were presented. The exposition included the following sections:

- technologies, materials and equipment for welding and related technologies (52 reports);
- strength, stress-strain state, nondestructive testing, technical diagnostics (30 reports);
- surface engineering (28 reports);
- ecology, welding in medicine, new materials, certification and standardization of welding production (15 reports);
- section of young specialists (27 reports).

The exchange of opinions in discussing the scientific information was mutually beneficial.

By the beginning of the Conference, the plenary reports were published in the form of paired issues of the journal «Avtomaticheskaya Svarka» (Nos 11–12, 2018) and «The Paton Welding Journal» (Nos 11–12, 2018), and also in the Proceedings of the poster reports.

During the Conference, its participants were given the opportunity to familiarize themselves with the updated exposition of the demonstration hall of the E.O. Paton Electric Welding Institute.

Also, on December 6, the XX Council of the International Association «Welding» was held, at which the results of the work of the Association for the reporting period and the directions of future works were discussed. By the decision of the IAW Council, the authorities of Academician B.E. Paton, the President of the IAW Council and Dr. A.T. Zelnichenko, the IAW Director, were prolonged until 2020.

On December 7, for the participants of the Conference from Bulgaria and Poland a trip to the plant of the Company «Vita Polis» (Boyarka town, Kiev region) was organized, where they familiarized themselves with the production of welding wires of stainless and special steels, which were not previously produced in Ukraine.

A.T. Zelnichenko, V.N. Lipodaev

ROBOTIZATION OF WELDING PRODUCTION — ARGUMENTS «FOR»

In the recent past, in the engineering industry of Ukraine a persistent stereotype has emerged that industrial robots are expensive machines, which require a highly professional personnel and should be rationally applied in the conditions of mass or large-scale production. This myth is based on the following facts.

Robotic complex for welding of rear tail boards of dump trucks

Firstly, when calculating the effectiveness of implementing a robotic and technical complex (RTC), incomplete methods are often used. They take into account a direct piece-rate salary of welder, but at the same time the following items are missing:

- direct and indirect taxes on basic salary;
- additional salary;
- expenses for maintenance of back rooms (changing rooms, showers, toilets, canteens, etc.);
- coefficient, accounting for the probability of continuous operation of the RTC due to the absence of working shifts, vacations, sick leave, unproductive losses;
- reduction in costs for welding consumables (wire, shielding gas) and electricity;
- reduction in labor intensity for cleaning of welds;
- elimination of costs for training and recertification of qualified welders.

Secondly:

- unwillingness and inability of personnel at the enterprise to master the new technological processes.

Hence, the forced administrative measures emerge, like additional inviting of new specialists to the existing staff, which threatens the recoupment of investments and creates antagonism in the team. Here it should be mentioned about the problematic nature of inviting the programmer-operator of the RTC of an appropriate level of training to the project.

Robotic complex for welding of transverse carriage beams

Thirdly:

- it is believed that robotic welding is intended for large volumes of products — for example, mass production of cars. At the same time, the model range should not change during several years;

Robotic complex for welding of container walls

• lack of flexibility of RTC. Most managers believe that their enterprises produce rather small batches of goods in order to invest in a robotic system.

Fourthly:

• robotic and technical complexes often break down, their repair is expensive and takes a lot of time. It is difficult to find specialists in repair and maintenance.

These are the main myths which make us think that industrial robots are expensive technologies which require a highly professional personnel and should be rationally used only in mass or large-scale production.

Now let us look how things on the outlined problems are going in reality.

On the first problem. By applying the real basic data on the cost-effectiveness of using RTC of the own enterprise, you will have the expected payback period of investments, which will help you to make a well-grounded decision. A recommendation is that basic data should reflect real values and not be «far-fetched».

As a result, you will receive a payback period on investments and can make a well-grounded decision.

Robotic complex for welding of heating boilers

On the second problem. Since the appearance of welding robots, manufacturers have constantly improved the process of writing working programs, striving to simplify it as much as possible and at the same time to make life for the future operator-programmer easier. Today, this problem has been solved with the help of the program Kinetiq, developed by the Robotiq Company (Canada), a fundamentally new program for training robots. The similar programs also exist at other developers. This technology allows the operator to manually move the welding torch of the robot along the entire weld line, and then, using the remote control, to entry the movement trajectory into memory and determine the welding parameters.

Robotic complex for welding of side boards of dump trucks

On the third problem. Modern RTCs are capable to quickly replace tools in automatic mode. Therefore, it is advisable to surround the robotic welding device with various removable tools. The robot can be programmed for all day operation only in position A with a specific set of tools, or alternately in positions A, B and C, producing small batches of each part. The sockets for tools are designed for quick replacement. The operator only needs a couple of movements to completely change one set to another. The robot stores many different programs in memory and it remains only to switch-over the program to make the robot start welding of a completely different part.

Here are just a few examples of RTC configuration.

You do not need to choose configuration and completing parts of the RTC on yourself. You need to correctly make a technical assignment for the required complex and contact the specialists.

The Scientific and Production Tekhvagonmash Company has been an integrator of the robots Fanuc in Ukraine for 10 years. As a rule, the proposal includes several options for solving the problem.

You will have only to make a choice in favor of one of them. Our company, in addition to the delivery of equipment, performs assembly and mounting, develops technology and trains the customer's personnel.

On the fourth problem. Modern complexes, as a rule, are equipped with USB output, which allows transferring programs, created remotely using offline programming, to the robot memory. In addition, they are provided with a function of Internet connection for online communication with the supplier carrying out warranty or post-warranty support. As the practice shows, 99 % of failures of a complex occur because of the error of the operator or programmer of the RTC (a part is incorrectly installed in the RTC, a poor-quality assembly for welding, an error in creating a program, etc.). These errors are easily diagnosed and eliminated on site. The remaining 1 % is the failure of the program. Diagnostics and elimination are performed remotely without the time losses. In extremely rare cases, it is necessary that a specialist-integrator arrive to the site. Here the decisive factor is the geographical distance and the obligation of the supplier. The terms of warranty or post-warranty service should necessarily be taken into account in the contract for delivery.

A few more reasons in favor of the RTC effectiveness

Increase in efficiency

One of the main ways to justify the costs on a robot is to compare the efficiency of the RTC with the efficiency that you currently have, using manual or semi-automatic welding. In many cases, robot welding is performed 2–5 times quicker than using any other method. This means that for each hour you will produce 2–5 times more parts than you produce now. For example, the system of tandem MIG welding which simultaneously uses two arcs, combined by a robot, can increase efficiency by several times.

High reliability

Let us admit that hired workers are sometimes unreliable, they may not appear at work or they may have a bad day. Robots are reliable, they can work around the clock without a rest or a lunch break. In addition, having robots, you will forget about the staff turnover. They are loyal to your company and will not leave after their training by you.

Ability to increase volumes

When you sign a new contract, or wish to expand the range of performed works, robots will easily cope with the additional volume. And since they occupy less working space than people, during expansion of production, you will not have to worry about buildings, renting or purchasing additional areas. In most cases, robots are paid back within six months.

Guaranteed quality

Each time, robot will perform the same welding at the same point. Thus, it helps manufacturer to improve quality and efficiency. Having robots, the company invests in goods in advance without the need to correct defects after their occurrence as often happens in the case with manual or semi-automatic welding.

To check the welds, made by the robot, a visual inspection is usually sufficient. In semi-automatic or manual welding, additional tests may be needed, such as selective destructive testing, radiography or color flaw detection.

Savings on welding consumables

Buying a robot will reduce overlapping of a rather large weld, which often occurs during manual performing. During the work of electric welder the strength margin is already preset into each weld, which is made by him. As a result, he usually uses more filler metal than it is necessary and also makes an excessive weld reinforcement. The accuracy of the robot is much higher, it uses as much filler material as necessary. Moreover, in robotic welding, spattering is lower and, as a result, the consumption of welding wire is 10–15 % lower.

Reduced costs for training

As we have already mentioned, today it is very difficult to find a skilled worker. In changing economic conditions, it turns out that the labor market lacks qualified welders. Ever more young people are seeking for higher education. This means a shortage of young specialists who would replace the specialists of retirement age. The companies spend huge sums of money on search and training of welders, which are much higher than they realize themselves. Moreover, during the work requiring keeping in compliance with the rules of technical operation, welders should constantly pass retraining and prove their skills. Some enterprises even provided workers with their own training centers. As compared to the salary of a qualified welder, it is much cheaper to hire someone who will simply load and unload RTC.

Quality control during welding

The modern software of robots allows companies to improve the process of production control. For example, the software for arc tracking which monitors, records, and makes reports with welding data in real time mode. The data can be transferred to the central storage database via the Internet (local network). Other software automatically corrects errors and provides a quick solution to the problem in the case of an unexpected error of the robot, if it occurs. And finally, protection with the password and making the log of events will provide a current report of any changes in the process of robotic welding over a certain period of time. All these software packages are developed to help companies in maintaining a high standard of quality even in case of personnel replacement.

Conclusion

We hope that these arguments will help you to make a well-grounded decision in favor of robotization of your production. For most manufacturers, robotization and automation should only be a matter of time. If you are going to install a robot for the first time, choose a reliable integrator who in close cooperation with you will develop a system, corresponding to your individual desires. For any project on welding automation the technical support and training are also important. Remember that the tasks of automation and robotization are to reduce the production costs and improve the quality of welding.

Be sure, robots will help you to achieve these goals!

I.N. Shalaevsky, Head of Marketing Department.
Scientific and Production Company Tekhvagonmash

*Calendar of January**

January 1, 1932

Date of birthday of Anatoly Yakovlevich Ishchenko, a famous scientist, corresponding member of the NAS of Ukraine, Honoured Worker of Science and Technology of Ukraine. He made a significant contribution to the fundamentals of the theory of welding aluminum and magnesium alloys, in particular, concerning the problems of formation of oxide films, crystallization cracks during welding, interaction of the components of alloys with arc plasma, electron and laser beams.

January 2, 2009

Date of death of Daniil Andreevich Dudko, a prominent scientist in the field of welding and materials science, academician of the NAS of Ukraine, Honoured Worker of Science and Technology of Ukraine (1921–2009). He worked at the Electric Welding Institute, made a significant contribution to the research and development of processes of submerged-arc and carbon dioxide welding, electroslag welding, metallurgy, development of plasma-arc and microplasma welding methods and new spraying technologies. At the active participation of D.A. Dudko many developments were introduced in rocket production, electronics and power engineering. He is the author of more than 900 scientific papers.

January 3, 1927

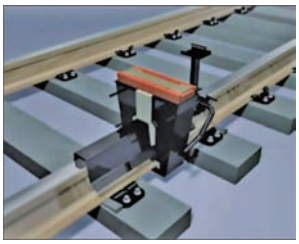
One of the patents of the American Company «Harnischfeger Corporation» on modernization of the excavator was published. Applying modern technologies and welding, in 1935 this company for the first time in the world implemented the project of the first all-welded excavator. A year later, the company introduced the world's first all-welded hoisting crane with a box-type boom.

January 4, 2004

The construction of a missile boat of the Project 022 (Houbei class) was started, which is one of a series of 83 Chinese catamarans. This is the world's first missile-armed catamaran. It was designed according to the stealth technology. It is noteworthy that for creation of missile launch facilities, friction stir welding was applied.

January 5, 1935

Wilhelm Alert patented an improved method of thermit welding for railway tracks. In his device he applied a higher temperature, creating a special design which separated a welding zone with a high temperature from the base metal. Alert significantly simplified the system of joining and also used a preheating of the edges to be welded.



January 6, 1933

Date of birthday of David Mikhailovich Kaleko. He developed the scientific fundamentals of the technology of welding ferrous and nonferrous metals with a small section by an arc, burning during a discharge of capacitors, and the means for control of this process. He participated in creation of an installation for spot welding of aluminum alloys, automatic machines for percussion capacitor-type welding of parts of the electronics and radio industry. D.M. Kaleko also developed medical implants and tools of metal with a shape memory effect. He is the author of more than 172 scientific papers, including three monographs.

*The material was prepared by the company Steel Work (Krivoy Rog, Ukraine) with the participation of the editorial board of the Journal. The Calendar is published every month, starting from the issue of «The Paton Welding Journal» No.1, 2019.

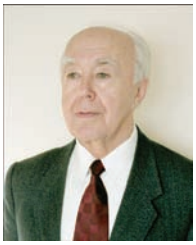
January 7, 1935

Date of birthday of Valery Nikolaevich Kubasov (1935–2014), Soviet cosmonaut. On October 16, 1969, on the spacecraft Soyuz-6, the pilot-cosmonauts G.S. Shonin and V.N. Kubasov were the first in the world to perform welding in space. After depressurization of the inhabitant compartment, the cosmonaut-operator V.N. Kubasov, who sat in the descent vehicle, conducted experiments in automatic mode on plasma, electron beam and arc welding using consumable electrode.

January 8, 1910

The use of acetylene welding in the construction of pipelines for water supply was began, namely during the development of a natural water source in the United States. The construction of the three-kilometer pipeline was carried out by Central Colorado Power Co. The pipeline consisted of 200 sections of different diameters. The work took more than a year and a significant amount of carbide and oxygen was spent.

January 9, 1928



Date of birthday of Boris Alekseevich Movchan, an outstanding scientist in the field of materials science of metal and organic materials (amorphous, nanocrystalline, dispersion strengthened, laminated and porous) and protective coatings, as well as in the development and implementation of electron beam technologies and creation of new functional materials. B.A. Movchan is the academician of the NAS of Ukraine, the author of about 360 scientific papers and more than 100 patents for inventions.

January 10, 1972

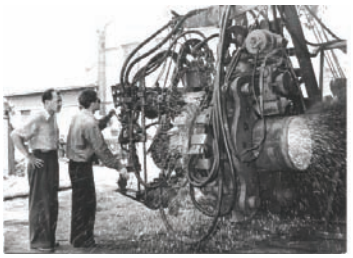
Ship «Savannah», an experimental civilian vessel with a nuclear power unit, was taken off from the US Navy. It was created to demonstrate a potential for the peaceful use of nuclear energy. It was constructed in the late 1950s in the USA using the technology of arc welding with coated electrodes. The manufacturing process was controlled in detail using X-ray equipment. The vessel was in service since 1962 to 1972. It is one of four ever built merchant ships with a nuclear power unit. In 1981, «Savannah» was transferred to the exposition of the «Patriots Point Naval and Maritime Museum» in Monte Pleasant, South Carolina, USA.

January 11, 1805

Date of death of Fontane Felice (1730–1805), Italian chemist and naturalist. He discovered a water (coke) combustible gas, which is produced from washing of burning hot coal with water and consists of hydrogen and carbon monoxide. Half a century later, this gas was actively used for heating the parts to be welded. In the 1930-1940s, forge welding and «water gas welding» were noted as separate varieties of the production process. In the same years, it was confirmed that the last of these methods can be used to weld sheets with a thickness in the range from 4 to 80 mm using a hammer or roller conveyers.

January 12, 1951

The scientists of Electric Welding Institute (N.G. Ostapenko, V.K. Lebedev, S.I. Kuchuk-Yatsenko, V.A. Sakharnov) for the first time in the world developed the method of flash-butt welding of rails using ring transformers applicable to joining of rails, pipes and other products. Flash-butt welding machines with ring transformers have 10–20 times lower short-circuit impedance in comparison with standard ones.



January 13, 1975

Beginning of Soviet-French Scientific Experiment ARAKS directed on investigation of ionosphere and earth magnetic field. An experiment technology has a lot of common points with the technology of electron beam welding as well as also uses kinetic energy of electrons in electron beam. The experiment is one of the world-known achievements of the PWI.

January 14, 1943

The patent was issued for a technology of tungsten electrode welding in helium to the staff members of Northrup Aircraft Inc. T.R. Piper, V.H. Pavleck and R. Meredith. Earlier at the end of 1941 R. Meredith developed a technology of argon TIG welding using direct current of reversed polarity and then using alternating current from IF transformer with high-frequency add-on.

January 15, 1958

It was an order for US Navy atomic submarine Thresher (SSN-593). Later on it went down in the Atlantic ocean together with all crew. Thresher accompanied by rescue vessel ASR-20 Skylark put to sea for deep submergences. The aim of submergences was check of strength of vessel body at limiting for submarine depths (360 m). Due to the crack in the sea-water line weld an engine compartment of the submarine started to be filled with water. After loss of the submarine the investigation revealed numerous cases of technology violation, application of sub-standard materials and bad quality control of welds.

January 16, 1943

Tanker Schenectady fractured in two when returning to the base after a year of successful marine tests. The crack appeared in a sharp angle of the manhole on a deck, immediately passed through the deck and along the both shipboards until backbone. The message informed: «Schenectady tanker of 7320 t capacity fractured on smooth water at the wall of ship-building plant». Regardless the war, this event received wide publicity in the scientific press and served as a stimulus for development of the researches in the field of welding.

January 17, 1781

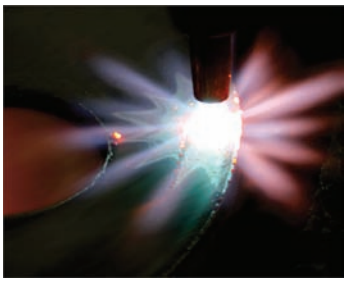
Birthday of Robert Hare (1781–1858) — American chemist. He designed a structure of oxygen-hydrogen torch. Works on development of reliable equipment were carried out in parallel with searching a gas composition for welding. First of all it was necessary to design the torch which would provide good mixing of gases with oxygen, high concentration of heat at the nozzle tip and explosion safety. Hare torch proposed in 1802 was one of the first devices deserving attention.

January 18, 1861

Birthday of Johann Wilhelm Goldschmidt (1861–1923) — well-known chemist. He entered the history as inventor of thermit welding method. The process taking place in this method sometimes is called «Goldschmidt reaction» or «Goldschmidt process». In 1898 Johann Goldschmidt for the first time performed thermit welding of two iron bars after their preliminary moulding and filling of the joint place with thermit mixture. After mixture burning the formed liquid pool was so overheated that provoked submelting of the edges and after solidification was transformed into the weld. Slag came to the surface and was easily removed from the place of joining.

January 19, 1833

Birthday of Henry Wilde — British scientist-engineer. In 1860th Henry Wilde welded the edges of wires of relatively large diameter with indirect electric arc applying the theories of Volta and Devy and primitive electric power sources. Henry Wilde was granted with a patent for his invention, which is known believed to be «electric welding patent».



January 20, 1925

A.O. Smith Company registered one of their patents for welding of pipes. Company developed a method of resistance and flash welding and started practical application of the technology in production of longitudinally welded pipes with 5 mm wall thickness and 500 mm diameter, which were welded along the whole length (12 m) using machines of 5000 kV·A. In 1920th the engineers of the company developed a coating for welding rod, which they used in production till 1965 as well as the first method for arc welding of high-pressure pipes.

January 21, 1942

Fabrication of the first tank T-34, shell of which was for the first time welded using automatic welding. The welding technology was developed by the specialists of Electric Welding Institute. Efficiency of automatic welding was 10 times more than that in manual one.

January 22, 1971

Tamara Markovna Slutskaya (PWI) developed shelf-shielded activated electrode wires for arc welding. Addition of small quantities (5–7 wt.%) of salts of alkali and alkali-earth metals improves arcing stability in welding in CO_2 or its mixtures.

January 23, 1975

Boris Sergeevich Kasatkin, major scientist in the field of welding metallurgy, Corresp. Member of the NAS of Ukraine was awarded the E.O. Paton Prize of the NAS of Ukraine for a series of works on «Heat-hardened low-alloy high-strength steels for welded structures». Production of high-strength steels has been developed and mastered with his personal participation. These steels have been applied with success in manufacture of excavators, road bridges, mine skips, attachments, hydraulic works and other critical constructions. He is author of more than 300 scientific works, including eight monographs.

January 24, 1927

Birthday of Igor Konstantinovich Pokhnodnya, an outstanding scientist in the field of welding, academician of the NAS of Ukraine, Honoured Worker of Science and Technology. He made a significant contribution into the theory of welding processes (melting and transfer of electrode metal, absorption and desorption of gases by molten metal, influence of the electrode coating type on metal melting and transfer in welding). He participated in development of many grades of low-toxic and high-efficient electrodes and flux-cored wires; organized mass production of low-toxic welding consumables in several USSR enterprises. He is author of more than 900 scientific works, including 28 monographs.

January 25, 2004

«Opportunity» rover, delivered by rocket carrier Delta II, landed on Mars. This was the first rocket model, manufactured with application of friction stir welding. Pioneer Company Boeing started experimental application of the new joining method. Owing to its reliability, this method became applied in rocket construction.

January 26, 1946

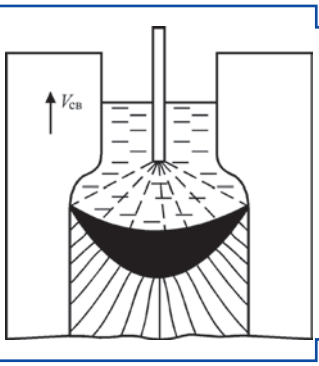
Konstantin Konstantinovich Khrenov, major scientist in the field of welding, academician of the NAS of Ukraine, Honoured Worker of Science and Technology, was awarded the USSR State Prize «For development and introduction of the methods of electric welding and cutting under the water». During the years of World War II the laboratory led by K.K. Khrenov together with specialized teams performed a large scope of work on underwater repair of vessels, destroyed bridges and port facilities. He is author of more than 200 scientific works.

January 27, 1983

The longest undersea tunnel Seikan connecting the Japanese islands of Honshu and Hokkaido, has been completed. Final length of this railway tunnel was 53.9 km, including the underwater part of 23.3 km. The tunnel goes 100 m lower than the seabed level. The rails do not have any bolted butt joints; they are welded into one 54 km long section. This, apparently, is the longest welded railway track in the world.

January 28, 1951

B.E. Paton and G.Z. Voloshkevich (PWI) for the first time created a fundamentally new process of electroslag welding of metals. It is designed for joining items of practically unlimited thickness in one pass. ESW became widely accepted in the USSR and abroad, fundamentally changing the technology of fabrication of thick-walled metal structures.



January 29, 1907

Swedish engineer, Oskar Kelberg, invented coated electrodes for welding and was granted a patent for the invention. His attention was drawn to welders' observation that the weld properties improve in those cases, when the electrodes or zones to be welded, were «stained» with lime, which contaminated the welding sites after making acetylene from calcium carbide. The same effect was produced by contamination, remaining on the wire surface after its drawing, which was conducted with application of lime.

January 30, 1991

John Bardeen, US physicist, died (1908–1991). After the end of World War II John Bardeen joined the Bell Company, where, working together with William Shockley and Walter Brattain, he participated in development of semiconductor devices, which can both rectify and enhance the electric signals. In 1956 Bardeen shared the Nobel Prize with Shockley and Brattain «for semi-conductor studies and discovery of the transistor effect». The transistor is one of the main components of the welding inverter.

January 31, 1964

Vladimir Ivanovich Trufiakov (PWI), known scientist in the field of bridge construction, Corresp.-Memb. of the NAS of Ukraine, Honoured Worker of Science and Technology of Ukraine, proposed and experimentally substantiated application of local explosion as a method of strengthening treatment of joints on large-sized structures. He also significantly developed the concepts of the effect of stress concentration, residual welding stresses, welding defects, frequency and kind of load on metal fatigue resistance. He is author of more than 240 scientific publications, including three monographs.

The journal Editorial Board will be grateful for additions and clarifications to the Calendar. Kindly send the materials to the following E-mail address: journal@paton.kiev.ua