ANALYSIS OF THE GLOBAL ENGLISH-LANGUAGE PUBLICATIONS IN THE FIELD OF PRESS-FORGING EQUIPMENT AND THE APPLICATION OF ADVANCED TECHNOLOGIES OF METAL WORKING BY PRESSURE

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The article is dedicated to analysis of the global English-language publications in the field of press-forging equipment and the application of advanced technologies of metal working by pressure. To increase the competitiveness of the modern press-forging equipment at the international market was made the analysis of leading publications in the field of technology of metals processing by pressure. Analysis of essays by leading Japanese, German, Chinese, Korean and American scientists and the Internet-editions of the industrial enterprises showed the main areas of work in the development of new press-forging equipment and modern technologies for processing metals by pressure in foreign countries.

Статья посвящена анализу зарубежных англоязычных публикаций в области кузнечно-прессового оборудования и применения передовых технологий обработки металлов давлением. С целью повышения конкурентоспособности отечественного кузнечно-прессового оборудования на международном рынке был сделан анализ иностранных изданий в области технологии обработки металлов давлением. Анализ публикаций ведущих японских, немецких, китайских, корейских и американских ученых, а также интернет-изданий промышленных предприятий показал современные направления работы в разработке новых прессов и технологий для обработки металлов давлением за рубежом.

Стаття присвячена аналізу світових англомовних публікацій в області ковальсько-пресового обладнання та застосування передових технологій обробки металів тиском. З метою підвищення конкурентоспроможності вітчизняного ковальсько-пресового обладнання на міжнародному ринку був зроблений аналіз іноземних видань в області технологій обробки металів тиском. Аналіз статей провідних японських, німецьких, китайських. Корейських та американських вчених, а також інтернет-видань промислових підприємств показав основні важливі напрями роботи у розробці нових пресів і сучасних технологій для обробки металів тиском за кордоном.

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Forging equipment – class industrial equipment that integrates machinery, mechanisms and manual devices designed for the bulk processing of metals (cutting, punching, pressing, bending, etc.). Modern forging equipment is very diverse in their function, form, performance and design. Important characteristics of each model of forging equipment is the type of drive that creates the main effort.

The method of creation of the working force depends largely on the price of equipment, its capacity, efficiency, performance, reliability, operation, maintenance, and other parameters.

Today is forging equipment widely used in primary treatment of rolled metal and in the manufacture of finished products ready for further use (installation). Thus, the need to improve press-forging equipment can occur in various spheres and at different stages of production.

Forging production largely determines the level of development of all engineering. Forging and stamping produce millions of products of different types, mass, shape, size. The most critical and heavily loaded parts are made of forged and stamped forgings. At the last time are increasingly being introduced mechanization and automation of processes of forging and stamping. On the basis of modern achievements of electronic and computer engineering create a fundamentally new system of control of machines and technological processes are used by different manipulators, robots etc. In some plants, the embedded device management software monitors and ensures the accurate size of the forging by the forging on hydraulic presses.

So for us is important the experience of our foreign colleagues in the development and improvement of press-forging equipment and the creation of new technologies of metals processing by pressure.

Therefore, we studied a lot of foreign publications in recent years. In our article we have reviewed 4 foreign editions in English.

For us has the interest the international conference of Japan Society for Technology of Plasticity (JSTP) and its International Conference on Technology and Plasticity (ICTP) [1]. Each year, JCTP organizes more than 60 international conferences, workshops, and numerous seminars and colloquia. The researchers publish their reports in the book on pages of e-magazine after the conferences. There are regular reports on the work of the conference on its website. This is the JSTP Open e-journal. Since JSTP Open e-journal aims to provide a free and highly accessible opportunity for sending out information, the submission method and process are concise and the articles could be published in the various forms of abstract, fast report or poster.

We have statistics of participants of Presentations in ICTP. In 2000-2016 years there are publications of representatives about from 30 counties. In 2016 were 3 publications on web-site of e-journal about the work of conferences in 2002 from 27 October till 1 November in Yokohama, Japan. This conference “The 7th ICTP international Conference on Technology and Plasticity” is held in 2002 [2].

For example, in 2002 according to this conference and the publications in e-journal on the results of its work have attended 28 countries.

By the number of participants which published their reports in the field of processing of metals by pressure leading positions occupied scientists from countries such as Japan, China, Germany, Korea, Iran (according to statistics of presentations Japan occupies the first place -133, Germany-38, China-26, Korea – 12, Iran - 8). There were the publications of European countries and the USA, Australia, Russia and Ukraine too, but their number was low (Austria – 2, Denmark – 3, Poland - 6, France – 9, the USA – 9, Australia – 2, Russia – 3, Ukraine - 2).

There were next work sections at the conference: «Cold forging», «Hot forging», «Super Plasticity», «Sheet Rolling», «Simulation», «Materials», «Hydroforming of tubes», «Roll forming, tube forming», «Rod, bar, wire, shape rolling», «Bending, straightening», «Incremental forming», «Powder compaction», «Sintering forming», «Composites», «Joining», «Extrusion», «Tribology» and other.

The most important themes of publications were dedicated: «Low Pressure Precision Cold Die Forging of Machine Part Having Both Internal Gear and External Gear» written by the authors K. Ohga, F. Murakoshi, H. Ando, K. Miyoshi, K. Kondo (Japan); «Net Shape Forging of an External Helical Gear with Boss and Internal Spline» by K. Kondo, K. Ikushima, H. Inoshita, M. Ogura, K. Ono (Japan); «Improvement of Tool Life in Cold Forging» by T. Matsuda (Japan); «Extension of Forming Limits in Forging of Less Ductile Light Weight Metals by Means of Superimposed Hydrostatic Pressure» by F. Meiners, S. Roehr, R. S. Juergensen (Germany); «Development of Product Design System for Cold Forged Gears Considering Addendum Profile Shift» by J. H. Song, Y. T. Im (Korea); «A New Cold Working with Local Superplastic Deformation for a Metal Bar» by T. Iura, N. Okabe, X. Zhu, K. Mori (Japan); «Research on the Superplastic Forming of Superalloy Inconel 718» by K. F. Zhang, H. J. Lu, D. Z. Wu, G. Q. Chen, X. C. Jla (P.R. China); «Modeling of Localized Plastic Deformation via the Adaptive Mesh Refinement» by A. R. Khoei, A. R. Tabarraie, S. A. Gharehbaghi (Iran); «Formation of Shock Lines in Multi-Stage Sheet Metal Forming» by Y. Abe, K. Mori, O. Ebinara (Japan); «Principle of Hydroforming Influenced by High Viscous Fluid Flows» by H. S. Niehoff, F. Vollertsen (Germany); «Numerical Approach to Minimize Tool Wear in the Sheet Metal Forming» by C. Hwang, R. Golle, H. Hoffmann (Germany); «Reverse Process Simulation for Forging Using the Medial Axis Transformation» by M. Wienstroeer, H. Mathieu (Germany); «Research on Hydroforming of Tubular Components with Changeable Cross-Sections» by S. J. Yuan, X. S. Wang, G. Liu, L. H. Lang, H. Y. Li, Z. R. Wang (P.R. China); «Crush Behavior of Strengthening Structures with Various Hat-Shaped Cross-Sections of Materials with Various Strengths» by M. Yamashita, M. Goton, T. Takahashi, Y. Sawairi (Japan); «2000KN Multi-Point Forming Press and its Application to the Manufacture of High-Speed Trains» by M. Li, W. Fu, Y. Pei, Z. Sui (P.R. China); «Experimental and Theoretical Examinations for Reshaping Process of Pipe with Pentagonal Cross Section» by H. Moslemi-Naeini, M. Kiuchi, T. Kitawaki, R. Kuromatsu (Iran); «Investigation of Metal Foam Fabrication by Powder Compaction and Induction Heating Process» by S. W. Youn, S. H. Lee, C. G. Kang (Korea); «Development of Semi-Solid Isostatic Pressing Method for Powder Compaction» by F. Tsumore, S. Shima, H. Kume, A. Kakitsuji, H. Miyamoto (Japan); «Engineering Calculation of Deformation Force for Hot Repressing of Powder Sintered Preform» by S. Z. Hong, Z. P. Zeng, J. H. Wang (P.R. China) and more others reports.

We also drew attention to the next foreign book and its publications «Spectrum Metal Forming» - The Magazine for the Metalworking Industry by Siemens AG, for example, issue October 2012 [3]. This edition is dedicated to new forging press equipment and new technologies of metal-forming of leading foreign producers. In this edition are offered an extensive portfolios of solutions for servo-presses that are gaining increasing recognition worldwide. It is only possible to achieve

this success because they constantly adapt the products to current requirements. The Press Line Simulation software is an additional highlight in the already extensive portfolios. It is used for comprehensive programming, analysis, and simulation of multistage presses with the aim of exploiting their potential to the fullest. Combining the planning simulation tool with automation is the most important innovation they have introduced in this area.

This edition consists of 9 several sections. We reviewed the most important publication in each section:

1. Press simulation. In this section are submitted 2 articles. The first article is called „Shortest Possible Set-Up Time for Press Lines" [3, pp.4-5]. The article is dedicated to press line simulation (PLS). If the many independent process steps of a press line are simulated, it is possible to optimize tools, material flows, and press movements on the PC. The result is fast production start-up and high cycle rates. The second article is "Productivity Boost for Press Lines" by Volkswagen AG, Germany [3, pp.6-7]. The manufacture of body panels in the Volkswagen press shop involves frequent product and tool changeovers.

2. Press automation. In this section is submitted 1article. The article is called «Automation Made Easy» by AP&T AB, Sweden [3, pp.8-9]. By using standardized electrical equipment, AP&T, a Swedish workflow automation specialist, has housed all the automation in one control cabinet and as a result has g greatly reduced costs.

3. Servo-presses. In this section are submitted 3 articles. The first article is called „ Servo-electric Hydraulic Pumps" by Lasco Umformtechnik GmbH,

Germany [3, pp.10-11]. The article is dedicated to the press manufacturer Lasco uses an electric servo-pump control for mass forming and the optimization of large hydraulic presses, thus achieving energy savings as well as improved dynamics. The second article is "New Approaches in

Metal Forming" by ebu Burkhardt GmbH, Germany [3, pp.12-13]. A servo-electric drive and control unit expands the possibilities of cutting-edge automatic punching machines. The machine manufacturer is delighted with the flexibility gained as a result. The third article is «Pioneering Drive Concept» by Andritz Kaiser GmbH, Germany [3, pp.14-15]. Andritz Kaiser has been able to significantly increase the productivity and energy efficiency of its stamping and forming presses by combining the time-tested drag link system with an innovative servo drive concept.

4. Deep drawing presses. In this section is submitted 1article. The article is called « Optimally Tested» by S. Dunkes GmbH, Germany [3, pp.18-19]. The article is dedicated to S. Dunkes has developed a frame deep drawing press that can be used in the auto parts industry to comprehensively try y out tools for subsequent usability.

5. Forging presses. In this section is submitted 1article. The article is called

« Hot Rolls» by TMP, Russia [3, pp.20-21]. The article is dedicated to the Russian company TMP successfully managed to increase the throughput of hot mills by increasing the degree of the production process automation. Programmed control systems and robotic handlers helped them to achieve this aim.

6. Hydroforming machines. In this section is submitted 1article. The article is called «Precise Repeatability» by Silfax, France [3, pp.26-27]. The article is dedicated to the Sinumerik 840D sl CNC has enabled tube-bending machine manufacturer Silfax to hydroform tubes for exhaust gas recirculation.

Our attention was drawn to an article «Selection of Forging Equipment» written by Taylan Altan and Manas Shirgaokar, The Ohio State University [4]. The Engineering Research Center for Net Shape Manufacturing at The Ohio State University (ERC/NSM) is one of the leading university associated groups in North America conducting R&D and providing education in metal forming (stamping, sheet & tube hydroforming, forging) since 1986. In addition to training students, they

conduct R&D projects for government agencies, e.g. National Science Foundation and for a Consortium of companies worldwide as well as individual companies, on a confidential basis.

The article «Selection of Forging Equipment» by Taylan Altan and Manas Shirgaokar was dedicated such main points as "Process Requirements and Forging Machines", "Classification and Characterization of Forging Machines", "Characteristic Data for Load and Energy", "Time-Dependent Characteristic Data", "Characteristic Data for Accuracy", "Hydraulic Presses", "Mechanical Presses", "Screw Presses", "Hammers". The article contains information on the principles of operation and the capacities of various types of forging machines.

At this article is said, that developments in the forging industry are greatly influenced by the worldwide requirements for manufacturing ever larger, more precise, and more complex components from more difficult-to-forge modern materials [4, p.1].

The increase in demand for stationary power systems, jet engines, and aircraft components as well as the ever-increasing foreign technological competition demand cost reduction in addition to continuous upgrading of technology. Thus, the more efficient use of existing forging equipment and the installation of more sophisticated machinery have become unavoidable necessities. Forging equipment influences the forging process because it affects deformation rate, forging temperature, and rate of production. Development in all areas of forging has the objectives of increasing the production rate, improving forging tolerances, reducing costs by minimizing scrap losses, by reducing preforming steps, and by increasing tool life, and expanding capacity to forge larger and more intricate and precise parts.

CONCLUSION

Analysis of foreign publications on the topic of the research showed that the main development in press-forging equipment and new technologies in the field of metal forming is conducted in countries such as Germany, China, Korea, Iran, the USA etc. In these publications contains material about the modern press-forging equipment and technologies of processing of metals by pressure, which will help Ukrainian researchers to improve their knowledge and to learn opinion from the experiences of leading foreign experts.

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Статья поступила в редакцию 15.04.2017г.