Dear Reader,

In 2014 we celebrate the 90-year anniversary of OTTO JUNKER GmbH. Anniversaries are a good opportunity to stop, reflect and set targets for the future. Looking back we are pleased that so many customers have shown loyalty to our company for decades. At the same time, we are proud to say that we have won an ever-increasing number of new customers all over the world. Without our customers and the confidence they place in our capabilities we would not celebrate this anniversary today. This makes us feel committed and motivated to continue offering innovative solutions and products perfectly tailored to suit customers’ specific requirements.

Equally important to our success are our committed and highly experienced employees. Many of them hail from the Eifel region and Aachen or they have studied in Aachen. International business has brought others from countries like the Czech Republic, the P.R. of China, the United States, the United Arab Emirates, the Netherlands, Belgium and many more. The fact that many of our employees have been working with us for a very long time makes sure that the invaluable treasure of practical experience and theoretical expertise is safeguarded in our company. This is confirmed by a large number of employees celebrating their 25th or 40th anniversaries every year. Sometimes we can celebrate even 50 years of employment which is an extremely rare anniversary nowadays. Our staff of more than 600 people worldwide constitutes an excellent knowledge base which is available to the benefit of our customers. Moreover, almost 30 apprentices provide the basis of our next generation of in-house professionals.

Close cooperation with our customers and the long-term employment of our professional staff form a solid foundation enabling us to satisfy our customers’ needs in the time to come. For this we translate customers’ requirements and suggestions into the development of the right technical solutions and products. According to the corporate maxim of our company’s founder the ongoing technical development of machinery and equipment is indispensable for a company’s success. Bearing this in mind we cooperate closely with the Technical University of Aachen (RWTH) and the Aachen University of Applied Sciences (FH). Furthermore, the Otto Junker Foundation has promoted the academic training of young engineers and supported key research projects for many years. As a matter of fact, this close cooperation with the universities has formed the basis of numerous innovations in our company and will continue to do so in the future. Accordingly, we shall not only continue but increase our efforts in the field of research and development. At the same time, selective investment into new machinery, equipment and buildings for our manufacturing sites in Lammersdorf, Boskoop and Shanghai is on the agenda as well. Expertise in planning, operation, maintenance and upkeep of the ever more sophisticated equipment is gaining increasing importance to our customers’ successful production. This is why our target is not only to supply cutting-edge industrial furnaces but also to focus on technical support in this field. To this end, the newly established Junker Academy will offer specific training courses. Launch of the Junker Academy is scheduled for the September celebrations of our anniversary. Plant-specific seminars are envisaged on major topics including equipment planning and upgrades as well as maintenance and operation. Various training courses will impart both theoretical and practical knowledge to the participants. Our intention is to conduct these seminars twice a year and to make them a permanent institution. Our detailed training program will be published in the near future. We would greatly appreciate your interest in the Junker Academy.

As you see, together with you, dear reader, we have good reason to face the future with full confidence even after 90 years. I hope that reading the following articles will be enjoyable and interesting to you.

Yours sincerely,

Markus D. Werner
President and CEO, OTTO JUNKER GmbH
For more than 90 years, OTOOTTO JUNKER has been defending its leading international role in the manufacture of sophisticated industrial furnace systems for metallurgical applications and as a supplier of 'ready for installation' steel castings. This is good reason for celebrating our 90-year anniversary in early September 2014 with our partners, customers and staff.

Several thousand industrial furnaces built by OTTO JUNKER are in use worldwide. They are needed wherever demand exists for dimensionally accurate forgings, castings and high-quality semi-finished products such as plates, strips, foils, sections or tubes consisting of diverse metals. Our equipment is used for melting, casting and heat treating metals.

Otto Junker founded the company in 1924

Founded in 1924 at Lammersdorf in the Eifel region, our company has dedicated itself to metal processing from its earliest days. Otto Junker established his enterprise to market the water-cooled mould invented by his father. In the years that followed our company's founder dedicated his efforts to the development and production of innovative machinery and equipment, maintaining close relations with the Technical University of Aachen (RWTH) all the time in the awareness that continuous technical development is indispensable for a company's success.

OTTO JUNKER Foundation acts as sole owner

Thus, it was only logical that the foundation he set up in 1970 and which became the sole owner of OTTO JUNKER GmbH after Dr. Otto Junker's death should define the promotion of science and technology and the support of young engineers at RWTH as its main objective. Our close cooperation with the University of Aachen's departments of electrical engineering and metallurgy has remained the basis for key innovations until this day.

OTTO JUNKER GmbH helps to improve energy efficiency

Industrial furnace building faces exacting demands. Apart from the need to meet process parameters ever more rigorously and to address pressures for more powerful equipment all the time, issues of power efficiency increasingly take center stage. After all, industrial furnaces account for approx. 40 % of today’s industrial energy consumption, and almost 70 % of the energy demand of every foundry or casthouse is expended on the melting operation. Through its development and use of energy saving furnace technology for both melting and heat treatment needs OTTO JUNKER has greatly helped to improve energy efficiency. Compared to conventional technologies and equipment, the savings thus gained may amount to as much as 30 %.

Synergies exist between the high-grade steel foundry and the company's equipment construction business units

Today's products often call for new metals or materials having greatly improved properties. For the production of such materials, special industrial furnaces are necessary. OTTO JUNKER addresses these requirements via a number of successful developments, e.g., induction furnaces for refining silicon for photovoltaic applications and equipment for the high-quality heat treatment of components made of novel aluminium alloys. The exploration of new application fields, the technological refinement of steel casting processes and the further expansion of our machining capabilities characterize the activities of OTTO JUNKER's in-house high-grade steel foundry. Synergy effects are tapped through the cooperation between equipment design and manufacturing units and our own foundry.

The company’s key strategy has remained unchanged since its foundation. The aim is to pursue innovation in an effort to develop new products and improve existing ones so as to strengthen our manufacturing base at the Lammersdorf site. In the context of the above we continue to focus on customer benefits and customer satisfaction in everything we do.

Dietmar Trauzeddel (+49 2473 601 342)
Construction to start soon on new staff facilities building

Along with numerous investments in new machinery and equipment, the improvement of our employees’ living and working conditions remains a prime objective in the further development and expansion of the Lammersdorf site.

One of many such projects is the planned erection of a new staff facilities building. The new building is to accommodate exemplary-standard changing rooms and sanitary facilities for up to 120 male and 10 female production floor employees working in our foundry and furnaces-building operations.

The new single-storey building, with its surface area of over 400 sq.m., will go up on the lawn across from the gate, right in front of one of the foundry shop buildings. It will consist of a modular steel structure, with enough spare load-bearing capacity to support the potential addition of a second storey later on.

Features of the new building will include separate ‘black’ and ‘white’ locker rooms for changing and storing work wear and personal clothing separately, in line with legal requirements. A dedicated fresh air supply and extraction system will ensure a good indoor climate, and additional functions such as the direct ventilation of locker cabinets will improve ambient hygiene while allowing clothing to dry fast and odor-free. The showers and washing rooms will be finished to a high standard and are to be equipped with modern fittings and amenities.

An advanced autonomous central heating plant using a gas-fired condensing boiler, an air supply and extraction system with heat recovery capability, and a building execution fully conforming to the Energy Savings Ordinance will ensure appropriate energy savings. The envisaged future utilization of waste heat from the melting furnace water recoling systems for the hot water supply to the showers will contribute to this goal.

At the time of writing the project was nearing the contract award stage. Its completion is scheduled just in time for the 90-year anniversary celebrations.

Dietmar Trauzeddel (+49 2473 601 342)
Coreless vacuum induction furnaces made by OTTO JUNKER: designs and applications

50 years of successful vacuum technology

Successful vacuum furnace systems have been part of OTTO JUNKER’s portfolio for 50 years. However, to enable us to provide a technically and economically optimized solution for every application environment, a second alternative furnace design was developed and is proving its merits in practice by now. This makes OTTO JUNKER the only manufacturer capable of offering its customers a choice between two different vacuum furnace designs.

In our Otto Junker News issue No. 20 of January 2012, we had already reported on the use of vacuum coreless induction furnaces in the distillation of zinc.

Supplementing that article, let us today take a look at the two different furnace designs starting out from some typical applications, e.g.,

- Deoxidation of high-grade steel melts
- Carbon reduction of molten steel
- Degassing of melts
- Distillation of zinc and other low-melting alloying elements
- Production of high-purity metals including pouring under vacuum
- Production of super-alloys

These applications place quite distinct requirements on the given furnace technology, so the development of two different furnace configurations has been found to be the right approach.

The two furnace designs differ essentially in terms of the position of the induction coil relative to the vacuum zone. In the second, more recent development characterized by a fully-enclosed structure, the vacuum zone extends to the entire furnace including the coil and the power and water connections.

The enclosed design supports processes with a higher vacuum of up to $10^{-2}$ mbar, or even up to $10^{-4}$ mbar in special cases. Higher power ratings and larger furnaces are also possible and even pouring of the molten metal can take place under vacuum. As a result, this solution is preferred, e.g., in the production of high-purity metals which need to be melted, alloyed and poured under vacuum.

The furnace capacity may amount to as much as 25 tonnes (in the case of steel), with power ratings up to 8,000 kW.

The advantages of the other furnace solution lie in the fact that a more cost efficient, elevated voltage level can be used and that the unit’s investment cost and space requirements are lower. This design is preferred for evaporation and distillation processes since the coil will not be under vacuum, contrary to the zinc distillation system outlined above. Furnaces of this type are characterized by a maximum capacity of 10 tonnes and power ratings of up to 3,000 kW.

Both furnace types are carefully engineered to ensure strict compliance with all relevant safety codes and environmental regulations.

Dietmar Trauzeddel (+49 2473 601 342)
We have been pleased to note that some renowned customers turn to OTTO JUNKER for both their melting and pouring furnace technology needs. Some information about two such contracts is presented below.

The purchase orders placed by GUSS-Ex for the Minsk Motor Plant in Belarus call for the supply of a medium-frequency melting furnace plant consisting of two 1.5-tonne furnaces with a rated power of 1,200 kW, in addition to a pouring furnace with a useful capacity of 2 tonnes for melting and pouring cast iron materials.

The two furnaces of the Monomelt system each possess their own independent frequency converter designed to operate at 250 Hz. Assuming a molten metal temperature of 1,500 °C, the system needs 44 minutes per heat, equivalent to a throughput of 2.1 tonnes/hour. A water recooling system with a glycol-free air-to-water cooler, bi-directionally tiltable extractor hoods and an M2 TouchControl type melt processor with a 15” display unit complete the scope of supply. The air-to-water cooler has sufficient capacity to support integration of the cooling circuit of the pouring furnace.

The pouring furnace has a power rating of 200 kW, enough to superheat the molten iron even at a holding power input of 110 kWh/h. Our scope of supply includes the complete furnace unit, the electrical equipment, level monitoring, the stopper system, and the operator control desk with the teach-in stopper control system.

The Magotteaux company of Belgium has ordered several melting furnaces plus a pouring furnace from OTTO JUNKER for its facility in Thailand. The equipment is intended for the production of special steel casting alloys.

The medium-frequency melting installation consists of three furnaces with a capacity of 6 tonnes and two frequency converter systems with a nominal output of 5,000 kW. The operating frequency is 420 Hz. The system needs an estimated 33 minutes to melt down a charge and heat it to 1,550 °C. Two evaporative cooling towers, a JOKS melt processor with secondary remote control capability, and a set of advanced furnace extraction hoods are included in our package.

The pouring furnace, with its useful capacity of 10 tonnes and a power rating of 350 kW, is custom-designed for this special alloy, particularly as far as the inductor channel and its filling and pouring siphons are concerned. Its power consumption for holding the melt at 1,650 °C amounts to 200 kWh/hour. The power input is infinitely variable thanks to the use of an IGBT frequency converter system.

The stopper mechanism and stopper control system will be contributed by the customer.

Dietmar Trauzeddel (+49 2473 601 342)
Second DUOMELT system ordered by Teksid Iron Poland

Since the end of 2012, the first DUOMELT medium-frequency melting system supplied to Teksid Iron Poland Sp. z o. o. has been successfully melting cast iron in a production environment.

The customer’s recent order for a second high-powered system attests to the good performance of this melting plant. The decision to acquire a second system of identical design, even at the detail level, marks a next step in the customer’s ongoing modernization of their melting operation. The fact that no technical changes in equipment technology were called for reflects a high level of customer satisfaction.

The new DUOMELT system again consists of two 12-tonne coreless induction furnaces having a maximum capacity of 14 tonnes. The power supply of around 10 MW is handled by a thyristor-based converter system designed for an operating frequency of 250 Hz. A water-cooled transformer is used for connection to the high-voltage supply system.

The system achieves a melting rate of just over 20 tonnes per hour at a melt temperature of 1,500 °C. Accordingly, a furnace charge can be melted down and superheated to the target temperature in less than 35 minutes.

The furnace unit with its weighing device, bi-directionally tiltable extractor hood, emergency tilting system and slag gripper will be equipped with the JOKS furnace control system to monitor and automatically control the melting process.

The cooling water returning from the furnace and frequency converter system is cooled back down by the patented eco-friendly air-to-water cooler. This cooling system requires neither glycol nor additional heating but remains frost-proof even under critical conditions. Our scope of supply also comprises a water treatment system to recondition the cooling water in the frequency converter circuit.

Since the start of this year, work is in full progress on the detailed design and planning of the system. Its delivery to the customer, upon completion of manufacture and subsequent factory inspection, is scheduled for the summer.

Once all equipment is installed on site, the system will be commissioned under the guidance of OTTO JUNKER experts.

Andreas Liffmann (+49 2473 601 208)
In 2012, OTTO JUNKER was awarded a contract for the supply of the entire heating line for 18" and 21" logs and billets for one of the world's largest extrusion presses (120 MN) which is situated in the SAPA / CHALCO (Aluminium Corporation of China) joint venture's plant in Chongqing/China. The profiles produced here are intended mainly for use in the Chinese transport industry.

It is known that China intends to expand its extra-urban railway network to a total of at least 120,000 km in the next few years. Moreover, a € 100 billion program was launched last year to improve the country's urban railway systems. Otto Junker GmbH is proud to be able to contribute to these projects. The heating line consists of a vertical magazine for approx. 1,200 tonnes of aluminium logs, a cold saw, and 6 parallel induction heaters plus the requisite handling and conveyor systems moving the metal from the feeding station to the press loader. OTTO JUNKER will supply all equipment as well as the entire materials handling software. The package is divided into a local portion (handling/conveying equipment, log magazine) and the supply of core components (IGBT switch-gear cabinet, control system, induction coil, etc.). The local portion will be provided via JMS, OTTO JUNKER GmbH's Chinese subsidiary. All project management and design services will be performed exclusively ex our company's headquarters plant in Lammersdorf. All necessary identification data of each loaded log are scanned by a barcode reader and then stored in a PC-based product tracking system along with the storage location (rack No., position No.). Upon withdrawal of a log from the magazine, full data tracking is provided, i.e., the system generates data packages which are supplemented with actual data during the processing cycle, and finally transferred to the extrusion press for each individual billet.

A standard software ("Factory Talk") is used for this purpose. It goes without saying that the system also supports the return of remaining log lengths into storage, e.g., in case a job is changed or aborted.

Like all modern induction-type billet heaters made by OTTO JUNKER, the equipment is powered via an IGBT converter system. This transistor-based converter technology was developed around 10 years ago by our in-house R&D department. Apart from its high efficiency and low maintenance needs, it provides the advantage of stepless power control. The performance of this technology has since been proven in more than 170 systems spanning both billet heating and induction melting applications.

At present the extrusion press sourced from a Chinese supplier is in its testing phase, so the heaters supplied by OTTO JUNKER have been made ready for production to feed the billets needed for running-in the press upon request.

Günter Valder (+49 2473 601 328)
Orders from China

Dual furnace plant for melting and recycling of aluminium

At the end of last year, OTTO JUNKER in conjunction with OTTO JUNKER Metallurgical Equipment (Shanghai) were awarded a Chinese customer’s contract for the supply, installation and commissioning of two identical standalone medium-frequency melting furnaces for melting aluminium ingots, dry chips and foil bales. Based on the design drawings and technical specifications supplied by OTTO JUNKER, a number of components are to be manufactured or purchased in China either by the customer or by Junker’s subsidiary company in Shanghai.

The two installations incorporate Monomelt technology and each consists of a 7.5-tonne coreless furnace powered via a frequency converter delivering a nominal 1,600 kW. The operating frequency was made adjustable in a range from 80 - 120 Hz to suit application needs. Similarly, the unit’s melting rate varies with the type of charge material. For melting ingots, a rate of 3 tonnes/h is targeted whereas with chips and foil bales the furnace is expected to deliver 2.4 tonnes/h in each case. When processing chip and foil charges, it is intended to operate with a liquid heel of 40 % of full capacity. Both of the above figures apply to a melt temperature of 750 °C.

Each furnace system is to be equipped with its own JOKS melt processor with the full software package for monitoring and controlling all equipment functions. All legends and diagram text will be in both English and Chinese. A hydraulic power-pack, a furnace weigher, an emergency tilting capability and a water recooling system with heat exchanger complete the package. The extractor hoods for each furnace, tiltable in one direction, will be supplied by the customer, as will be the high-voltage transformers. Key subassemblies and systems are to be manufactured and supplied by Junker’s subsidiary company based in Shanghai/China. These include the furnace body and furnace cradle including the hydraulic cylinders, the hydraulic powerpack, the pit guard structure, the emergency tilting system and the heat exchangers.

At the time of writing this item, work had just commenced on the design of the equipment. Its delivery to the Chinese customer is scheduled to take place eight months after the starting date of the contract. Apart from supervision of installation, Junker experts will provide the necessary commissioning and melt control support.

Dietmar Trauzeddel (+49 2473 601 342)

Chip melting furnace now successfully in use

The Monomelt system supplied to this customer includes a 6-tonne furnace powered by an IGBT converter with a rated output of 1500 kW. The furnace system is designed to melt aluminium chips, i.e., it uses a liquid heel and an operating frequency of 70 Hz. This was another contract for which Junker’s local subsidiary, OTTO JUNKER Metallurgical Equipment (Shanghai), produced key mechanical subassemblies and supplied further major components such as the transformer and the hydraulic unit.

Following its installation and commissioning, the chip melting furnace passed its acceptance tests last spring. The event marked the temporary end of a successful cooperation with this customer.

Dietmar Trauzeddel (+49 2473 601 342)
The Chicago Faucets Company has purchased an INDUGA Type 1011 automatic low-pressure die casting system for its production of sanitary components and faucetry made of low-lead brass. In the US market, components carrying drinking water must not exceed a lead content of 0.25 % as of January 2014.

The newly developed low-lead brass grades are silicon-alloyed; this calls for the use of specially designed and sized furnace inductors if the proven inductor performance and long service life are to be preserved.

In compliance with the new drinking water regulations, Chicago Faucets has revised its production planning and resolved to install additional casting capacity in the short term. The low-pressure casting system ordered from INDUGA last March has been in production service successfully since early November 2013.

Low-pressure casting equipment for companies in Taiwan and China

The Yi Tzen Precision Instrument Company Limited of Taiwan was founded in 1979 with the objective of producing water meters in the DN 13 through DN 25 nominal size range. For more than 10 years, it has been the Taiwan Water Company's most important vendor.

Now, going to build a new foundry on a greenfield site, Yi Tzen is glad to have INDUGA by its side to benefit from this competent partner's valuable know-how in the production of faucetry and water meters. Yi Tzen manufactures all its products in-house and is proud to have all its manufacturing facilities exclusively in Taiwan.

To improve its production of brass components for high-quality water meters, Yi Tzen bought a new LPDC 1011 type low-pressure casting system from INDUGA in July 2013 for its factory in Tainan City. INDUGA has scheduled delivery of this equipment for February 2014.

The new low-pressure casting system will enhance productivity in the manufacture of the water meters while ensuring a very high level of product quality.

As far back as in June 2013, INDUGA had successfully started up a Type 1011 low-pressure die casting system in the Japanese faucetry manufacturer TOTO’s new plant in Dalian/China. Apart from the production of sanitary faucets for the Asian market, the new fully automatic line is intended to supply products for the global market in the future as well.

TOTO thus continues to place trust in the proven products of INDUGA / INDUGA-KWC, who had supplied equipment for numerous production sites throughout Asia in the past. TOTO's headquarters facility in Japan alone is equipped with no less than eight low-pressure die casting systems.

Alejandro Hauck (+49 2473 601 724)
For many years, OTTO JUNKER GmbH has been the market leader in the fields of heat treatment and surface finishing equipment for copper strip. One of our unique selling points to be emphasized here is that alongside the core unit, i.e., the actual strip flotation furnace, we develop and design all necessary conveying, cleaning and final surface treatment systems entirely in-house.

Growing requirements regarding the strip range (width, thickness) to be treated, ever increasing operating temperatures and the quest for higher energy efficiency prompted our engineers to undertake an in-depth revision of our furnace concept which had proven its viability for many years. As a result of this development process the patented “2VX®” strip flotation furnace [1] can now be presented, Fig. 1. The development of this strip flotation furnace took place in close cooperation with the Department for Industrial Furnaces and Heat Engineering at the Technical University of Aachen (RWTH). The first development step consisted in the identification of future demands on a strip flotation furnace. The features thus defined were then realized in a 3D model, drawing on our long history of operating experience. In a second step this model was then employed to optimize gas flow patterns with the aid of computational fluid dynamics (CFD), placing special emphasis on the following aspects:

- low pressure losses;
- high dynamic pressure at the nozzles with a very uniform pressure distribution;
- efficient heat transfer from the heating system to the fluid, without any streaks or hot spots;
- no openings into plenum chambers from the outside.

Fig. 2 shows a specimen result of the modelling calculations. After a series of optimizing steps, a model of the strip flotation furnace in its fluid dynamically optimized form thus became available. In a third step, it remained to be verified that this design would minimize mechanical stresses and could thus be expected to yield a long service life. This was validated by linking the CFD model to an FEM (finite element method) software to ensure that stress levels on the inner casing would be minimal, subject to the following requirements:

- uniform stress distribution, even under the influence of temperatures;
- ability to support rapid high-gradient temperature changes;
- a maximum stress figure clearly below the 100,000 hours limit.

From Fig. 3 it is evident that the iterative process obtained by coupling the two computational methods has successfully removed nearly all stress peaks from the fluid dynamically optimized design. Special supports and suspension elements with cradle joints are key to achieving this. This outcome formed the basis for step 4, which consisted in a verification of the results on a 1:1 model in OTTO JUNKER GmbH’s technology center. The newly developed “2VX®” strip flotation furnace owes its name to the mirror symmetry it exhibits in two planes. The first plane of symmetry is the vertical plane relative to the center of the fan, the second one is the horizontal plane in which the strip passes between the top and bottom jets. While the first of these planes of symmetry is critical to achieving optimum flow and thermal characteristics, the second has the advantage of using identical parts for the top and bottom jet systems. On the one hand, this reduces engineering and manufacturing time and costs, so that the customer will benefit from a shorter turnaround time. On the other hand, identical parts economize on spare parts.

The new furnace design has been introduced in the market and the first favourable operating experience has by now been gained.

Günter Valder (+49 2473 601 328)