Manufacturing capability

High technology meets craftsmanship

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Dear Reader!

Our achievements in this past year are a clear indication that we are heading in the right direction. At the same time, they motivate us to continue on our path of raising the company’s long-term strength. Our aim is to accomplish this goal by further expanding our technology leadership on the one hand while continuously driving up efficiency levels on the other.

The strategy confirmed by the Supervisory Board and endorsed by the shareholder enables us to further accelerate our pace, within an appropriate time frame and financial budget, whether in developing new and refining existing products, continuing to make selective investments in new machinery and equipment, or providing skill enhancement and training to our equipment construction and foundry staff.

Starting out from our core competence in the three business segments, we are determined to further explore existing fields of application while opening up new ones at the same time. Likewise, we intend to utilize OTTO JUNKER’s uniquely broad-based position still more effectively for the benefit of our customers, much as we are already using new products and techniques from the field of induction furnace manufacture in our high-grade steel foundry or as we are embodying induction heating in our thermoprocessing equipment. Mathematical simulations shall be employed still more extensively on trial set-ups at our Tech Center. While it may be true that OTTO JUNKER development projects take a relatively long time to complete at times, we believe this is necessary to address our customers’ challenges in a sustainable manner.

One further essential objective will be to keep on expanding our technical capabilities in the fields of metallurgy and process engineering. This ambition will be reflected in selective staff training as well as in the recruitment of new employees. Numerous developments have been and continue to be pursued in coordination and close cooperation with our customers. Our aim is to see the enhancement of our technological market leadership draw superior customer satisfaction, regardless of where on earth our customer is located and which OTTO JUNKER Group company is serving him.

To illustrate the approach outlined above, let us consider induction technology as an example. Our designers and electrical engineers have put years of work into the development of induction furnace systems featuring advanced frequency converter systems that are now successfully in service all over the world. In the last few years we have managed to tap new application sectors for this technology – e.g., in recycling fine-sized charge materials or in silicon refining – and have devised appropriate technical solutions for the specific circuitry required. We are committed to the ongoing pursuit of this development path. At present, our engineers are endeavours to resolve specific issues which arise in this context by developing our induction furnace into a metallurgical reactor. Further current projects include the refinement of our vacuum furnace technology and of the induction-heated ladle system INDULADLE.

Moreover, the induction principle is to be exploited more extensively for other heat-treatment processes, i.e., beyond billet heating applications. Over and above this strategic course aimed at boosting our technology leadership we have launched an efficiency improvement program designed to measure continuous improvements in existing processes and workflows. Covering all areas and departments, this scheme will allow us to question many givens and to make adjustments for enhancing customer benefits.

Indeed, in all our deliberations, our focus remains on the advantages which our work brings to the customer. To this end we shall rely on an intense exchange of information and experience with users on the one hand, while on the other, we shall benefit from the creative and constructive design input, resourcefulness, experience and skills of our employees in charting the specific direction of our efforts and in achieving their successful implementation.

Yours sincerely,

Markus D. Werner
President and CEO
Co-operation agreement concluded with CAN-ENG Furnaces International Ltd.

The co-operative agreement between OTTO JUNKER GmbH and CAN-ENG Furnaces International Limited has laid the groundwork for a further improved, more efficient customer service and advisory support.

Thanks to their complimentary product ranges, OTTO JUNKER and CAN-ENG will enhance each other’s abilities to serve world-wide users of thermal processing equipment with a complete portfolio of melting, pouring, process heating and heat treating systems for complex thermal processing applications. Moreover, customers will thus benefit from comprehensive advice and projects implemented in joint enterprise.

To support customers in North America including Canada, OTTO JUNKER and CAN-ENG would invite enquiries for either group’s products to be forwarded to the nearest geographical sales office. Key contacts are Tim Donofrio, Vice President, Standard and Aluminum Products, CAN-ENG Furnaces International Ltd. at tdonofrio@can-eng.com, and Jan van Treek, Sales Manager, Thermoprocessing Plants, OTTO JUNKER GmbH at jvt@otto-junker.de.

Founded in 1964, CAN-ENG Furnaces International has grown to become a leading designer and manufacturer of thermal processing equipment for ferrous and non-ferrous metals.

CAN-ENG product lines include batch and continuous aluminium heat treating equipment for the automotive and fastener industries, steel plant furnace systems (specializing in tube, bar, and plate quench and temper furnace technologies), and continuous mesh belt atmosphere furnace systems for the heat treatment of production components like fasteners, stampings, bearings and automotive parts.

CAN-ENG Furnaces International Limited’s head-office and manufacturing facility is located in the heart of the Niagara Peninsula at Niagara Falls, Ontario/Canada, and employs 100 people in their engineering, manufacturing, sales and administrative groups. CAN-ENG services its customers globally through an international network of business development, service and agency offices.

For more information visit www.can-eng.com
The production of high-grade castings on automated moulding lines poses high demands regarding dosed filling of the sand moulds. The use of pressurized pouring furnaces with stopper and pouring control system, much like stopper-controlled unheated pouring units, certainly represents a very good technical solution to satisfy these requirements. The entire equipment architecture of a pouring furnace with a pour control system based on laser distance measuring is illustrated in Fig. 1.

Along with the fact that such moulding machines may operate at cycles of under 10 sec., it is necessary at times to employ pouring curves with major changes in metal flow, and such curves must then be reproduced with accuracy and precision. The metal flow control accuracy depends, among other factors, on the technical characteristics of the stopper actuator system fitted on the pouring furnace. For its precise operation, fast and accurate positioning of the stopper are essential. Additional requirements include an adjustable high stopper closing pressure, automatic nozzle wear compensation, and appropriate cleaning devices.

The new electrical stopper actuator (Fig. 2) developed by OTTO JUNKER meets these demands with a high degree of reliability.

In the new actuating system, the stopper is moved via a genuine linear drive unit using magnetic force, i.e., without relying on any mechanical linkage. The pushing rod (secondary part) with its machined spiral-shaped groove and a hollow stator shaft (primary part, 2-pole wound laminated core) remain separated by a defined air gap, so the unit operates without wear. Due to the low self-retention action of this assembly the stopper will drop under its own weight in the case of a power failure, thus closing off the pouring nozzle. However, it can be raised manually into a mechanical snap-lock position by means of a simple lever device. The stopper will also move into this snap engagement upon power down when the operator de-energizes the system. When re-starting of the pouring system, power is switched on and the stopper moves out of this home position automatically.

Other features of the new system include an adjustable high stopper closing pressure, automatic nozzle wear compensation, and appropriate cleaning devices.

The new stopper actuating system was subjected to long-term trials under production conditions at Ergocast Guss GmbH. Given the encouraging results of these tests, the new actuator is now to be used in other pouring furnace projects as well and will likewise be used for the stopper mechanisms of unheated pouring systems.

Klaus Kalbskopf (+49 2473 601 537)
New concept for homogenizing rolling slabs

In an aluminium hot-rolling mill, continuously cast slabs are pre-heated to the rolling temperature before entering the hot-rolling train. With certain alloys this must be additionally preceded by a homogenization treatment. Often, the homogenizing and preheating steps are carried out in the same furnace system.

Until today such operations were commonly performed in pit-type or pusher furnaces, two solutions which differ substantially in terms of their operating conditions and technical features. Now, Otto Junker has developed a new furnace design which combines the advantages of these two furnace types without exhibiting any of their drawbacks. The main principle lies in the use of chamber furnaces in which the slabs are preheated in an upright position. Each slab is loaded into the furnace, and afterwards retrieved therefrom, individually with the aid of an automatic loading and unloading system (see illustration). An efficient convective heat transfer is ensured by an appropriately designed nozzle arrangement. The design is such that multiple furnaces are served by a single conveying and charging system, with the option of adding more furnace chambers later.

The key features of the new furnace design can be described thus:

- high-convection preheating and cooling of slabs, with attendant short dwell times;
- low energy consumption;
- uniform heating of the entire furnace load via OTTO JUNKER’s special nozzle system;
- high degree of automation in the heating cycle, including all conveying, loading and unloading steps – once the slab has been placed on the conveyor, all measuring, centering and handling operations are carried out fully automatically;
- high flexibility, given that it is not necessary to heat slabs strictly in batches (the dwell time of individual rolling slabs in the furnace may vary);
- easy step-by-step expansion through addition of more furnaces;
- small equipment footprint, no need for complex foundation work or high shop bays served by cranes;
- accurate temperature management thanks to the use of contact thermocouples or mathematical modelling;
- furnace temperature control is based on air and metal temperature sensing as well as on a computer-based temperature curve.

OTTO JUNKER has been able to convince a renowned U.S. aluminium company of the merits of this design and has been awarded a purchase order for the supply of this innovative furnace system. The project is to be implemented in two erection phases. The first phase will comprise the delivery of four chamber furnaces with the associated handling system including measuring devices, conveyor technology, slab upending and downending equipment, and the sophisticated controllers managing all conveying, heating and cooling functions. Each furnace can accommodate 8 large or up to 16 small slabs and has fans and control zones in numbers commensurate with the application.

In the second phase the customer may opt to have additional furnaces installed.

Our teams are currently working hard on building the equipment for the first erection phase. Delivery to the U.S. customer is planned to take place in the early summer of 2013.

Bernd Deimann (+49 2473 601 241)

Basic principle of the new furnace type
Acieries Hachette & Driout, the French company based in St. Dizier, has ordered a flexible medium-frequency furnace plant from OTTO JUNKER for its alloyed steel melting operations.

Our solution will incorporate DUO-CONTROL technology, relying on one 4-tonne and one 8-tonne coreless furnace. Power is to be supplied via a converter system rated for a 400 - 500 Hz operating frequency range. The nominal energy consumption of the 4-tonne furnace is 4,000 kW; the 8-tonne unit can be provided with a nominal 4,800 kW. At a 1,550 °C melt temperature this corresponds to a mains power demand of 490 kWh/t for the small furnace and 500 kWh/t for its 8-tonne counterpart.

Melting rates of 8.5 and 10 tonnes/hour, respectively, are achieved in this manner. Both coreless furnaces will be equipped with bi-directionally tiltable exhaust hoods and with our stepless back-tilting feature allowing the furnace to be tipped towards the rear by a maximum of 20 deg. The 8-tonne furnace will receive a de-slagging spout to facilitate slag removal. In addition, the furnaces will be equipped with an OCP crucible monitoring system.

The cooling water returning from the furnace and power converter circuits will be recooled in an air-to-water cooler requiring no glycol. The entire system is to be controlled and monitored by an M2F-TouchControl melt processor.

Work is now ongoing on the engineering and production of this equipment which is scheduled to be delivered to the French customer in the summer of this year.

The Otto Junker GmbH received from another steel foundry in France the contract to design, manufacture and installation of a new modern medium frequency melting furnace (MFT).

The new melting system forms part of a project to expand and update production operations for the foundry’s line of heavy-duty undercarriage parts for railway cars.

The contractual equipment will be of the DUOMELT type, comprising two 6-tonne furnaces as well as a power converter and switchgear system rated for 4,800 kW at a nominal frequency of 250 Hz. For metallurgical treatment...
Work is currently underway on a complete induction furnace system for a customer in Sweden. Rated for a melting output of 15 t/h of cast iron, the plant is intended to produce various cast iron grades including ductile cast iron (SG iron).

Our project comprises a 12-tonne coreless furnace system in a DUOMELT configuration that will be powered via an advanced frequency converter capable of handling 8,000 kW. Thanks to multi-frequency technology, the furnaces can be run at either 250 or 125 Hz at the user’s choice.

The lower of these frequencies serves particularly for melt carburizing or stirring down alloying elements. Both processes are accelerated by the more vigorous bath movement.

The two coreless furnaces will each be fitted with a stepless back-tilting device which allows the unit to be inclined by 20° for more convenient de-slagging. Furthermore, our scope of supply will include the water re-cooling system and two charging chutes equipped with add-on hoppers for holding alloying agents.

In addition to the JOKS melt processor interfaced with a spectrometer, a JOKS-GATT system will be employed for controlling and monitoring the charging process. Connectivity of the JOKS system to the higher-level plant management network is ensured via an Ethernet link.

The entire workflow from charging to pouring proceeds as follows:

Charge material is picked up in accordance with the selected recipe by the charging crane using its electric magnet. This material is then weighed and placed in the charging chute. Once all charge materials specified by the recipe are present in the chute, the latter moves automatically to the alloying elements station. The JOKS-GATT programme then computes the amount of alloying elements to be added in order to obtain the desired melt composition. Accordingly, these elements are then weighed and conveyed to the add-on hopper mounted on the charging chute.

Upon receipt of a signal the chute moves to the empty furnace, docks to the exhaust hood and starts loading the furnace with charge materials and alloying agents. The electric power input is activated and controlled to match the ongoing charging process.

Upon termination of the charging cycle the melt is heated to a temperature of around 1,500 °C. De-slagging is carried out and a molten metal sample is taken for analysis. The spectrometer transmits the result of this analysis directly to the melt processor, which calculates the amounts of alloying elements still to be added if the melt composition does not conform to the final specification.

Alloying elements are then added if necessary. Depending on their type and quantities, the power converter may be switched to 125 Hz mode for this operation to facilitate stir-down.

The melt is then heated to the exact tapping temperature, whereupon it can be poured into the individual ladles.

The entire process is controlled, monitored and documented via the JOKS and JOKS-GATT systems installed.

Dietmar Trauzedd (49 2473 601 342)
This contract for the supply and installation of two complete induction heaters for aluminium billets was completed in 2012 with the successful commissioning of both systems which have since been serving in the customer’s production operation to his entire satisfaction.

Given that OTTO JUNKER’s contract involved a replacement of the existing magnetic heaters, the planning had to take into account the infrastructure in place so as to ensure an effective integration of the new equipment.

Arranged in parallel, the two systems each comprise an induction heater with 6 coil sections, an IGBT frequency converter system, the billet handling and conveying equipment, and the control and operating hardware and software.

The frequency converter is rated for a power output of 1500 kW, enough to heat billets measuring 415 mm in diameter and up to 1600 mm in length. At a target metal temperature of 480 °C the system thus achieves a throughput of 8 billets per hour.

The IGBT converter system provides an infinitely variable power supply to the individual coil sections and ensures an optimum repeatability of the specified billet temperatures even with application of a temperature profile (taper heating).

The billet handling and conveying system comprises the entry and exit swinging tables, a longitudinal roller conveyor as well as an overhead cross conveyor.

For conveying the billets inside the induction heater, they are placed in support troughs which are advanced by a rack and pinion drive system.

One advantage of OTTO JUNKER’s trough conveyor system lies in the fact that there is no relative movement between the billet and its carrier and hence, damage to the billet surface is prevented.

The installation is operated from the press desk where the PC with its TFT touchscreen is fitted.

The software comprises all necessary functions for manual, semi-automatic and automatic operation of the system. Moreover, the following operating modes and features are provided:

- Data input, process visualization, data storage
- Blind heating sequence
- Product data tracking

The two systems were fully installed in close cooperation with SAPA BOLZANO’s specialists. The subsequent performance tests proved the validity of the selected design and confirmed achievement of the agreed performance parameters.
OTTO JUNKER was entrusted with the task of designing a coreless furnace capable of carrying out a melt refinement process involving plasma treatment. Once the furnace was filled to its nominal capacity, an active gas plasma was to be applied to the melt surface. The surface bath movement and hence, mass transfer was to be maximized while metal spillage was nevertheless to be avoided.

At the same time, the temperature was to be kept as constant as possible over a treatment cycle of several hours, taking into account the heat input caused by the plasma burner.

Based on this specification, a furnace system with a crucible capacity of around 100 litres was designed, built and commissioned. Along with a conventional melting mode (230 Hz, 300 kW), this system provides a stirring mode at reduced heat input in which the frequency and power input are steplessly adjustable independently of each other. The operating frequency ranges from 33 - 100 Hz, i.e., starting out from a bottom value below the mains frequency. Moreover, in stirring mode the two coil sections of this furnace system can be operated at two different phase angles in the manner known, e.g., from linear motors.

This design provides hitherto unknown flexibility as regards the independent control of its thermal power input and melt flow characteristics. An illustration of this is given in Figs.1 - 4 for the example of an aluminium melting operation. Fig. 1 illustrates the situation in melting mode at a power input of 120 kW and an operating frequency of 230 Hz. Figs. 3 - 4 depict conditions at 28 kW/24 Hz and a phase angle of 0°, +90° and -90°, respectively.

A comparison between Fig.1 and Fig. 2 makes the role of the operating frequency impressively clear. At 34 Hz, a mere 28 kW of power suffices to produce approximately the same flow velocity in the bath as at 230 Hz and 128 kW. Moreover, Figs. 2 - 4 graphically illustrate the impact of the phase angle on bath movement.

The furnace system fulfils its intended operating purpose in a fully satisfactory manner, yet the technology employed here opens up much wider perspectives. On the one hand, the low-frequency operating regime in conjunction with a phase shift enables engineers to design high-turbulence induction mixers providing ideal conditions for metal-slag reactions.

At the same time, the increased magnetic penetration depth obtained at the low frequency supports the choice of a much thicker crucible wall compared to conventional coreless furnace, which is an indispensable requirement for such metallurgical tasks.

Fields of application include, e.g., secondary metallurgical operations in steelmaking or copper refining steps in making semi-finished products.

Moreover, this technology necessarily provides benefits when it comes to recycling fines.

Wilfried Schmitz (+49 2473 601 441)

Fig. 1–4: Impact of power, operating frequency and phase angle of currents in the coil sections on the intensity and patterns of bath movement
Anhui Xinke New Materials Stock Co. Ltd., the Chinese copper strip manufacturer based in Wuhu City, Anhui province, had signed a contract for the supply of two induction furnace systems with INUGA in October 2012. As part of a drive to expand production capacity, the equipment is intended to provide copper-iron alloy stock for the production of leadframe strip of high electrical conductivity.

For melting down copper cathodes and return scrap, a 10-tonne medium-frequency coreless furnace with a rated power of 3,000 kW at 250 Hz is to be provided by OTTO JUNKER GmbH. The system can achieve a maximum melting rate of 7.5 tonnes/hour.

The furnace will be equipped with a stepless tilting feature allowing the vessel to be tipped backwards by up to 20° to facilitate de-slagging.

From the melting furnace the liquid metal will be transferred directly to a mobile sidewell-type pouring furnace equipped with a 300 kW coreless inductor. Both furnace systems are to be fitted with power converter and switchgear equipment based on IGBT technology, apart from receiving the most advanced process control technology. Our scope of delivery will likewise comprise the water recooling systems as well as the charging equipment for the melting furnace.

Delivery of these furnace installations is slated for October 2013. The customer aims to commission the production line in April 2014.

Alejandro Hauck (+49 2473 601 724)

Heat treatment line for copper alloy strip is awaiting shipping

OTTO JUNKER is about to deliver a complete strip annealing line for the recrystallization treatment of cold-rolled strip in various copper alloys. At its core is an electrically heated strip flotation furnace designed to operate with a controlled gas atmosphere.

In addition, our scope includes the associated degreasing, pickling, washing and passivating stages.

The line is designed to process strips made of diverse copper alloys, including some brass and bronze materials.

The strips to be treated downstream of a cold-rolling process measure between 0.1 and 1.5 mm in thickness and between 300 and 600 mm in width.

Given the various sizes and materials as well as the different deformation ratios of the individual strips, the system must meet very exacting process control and supervision standards in order to attain the specified close tolerances.
Introduction of the Integrated Management System

With the launch of the integrated management system for its Lammersdorf production site OTTO JUNKER not merely meets the increasingly exacting demands of customers and partners in the equipment construction and foundry business but also goes for a clear improvement of its own processes in the fields of energy management, environmental and occupational safety. Production processes, specifically in the foundry but also in equipment construction, have a direct impact on the environmental, energy and occupational safety situation and are therefore of specific interest. The management system is built around the creation and continuous upgrade of risk assessments and on the evaluation of environmental and energy criteria. For our equipment construction activity it is not just in-house production processes which matter, the requirements on environmentally sound design which is consistent with safety standards and hence, in line with CE principles, are of particular relevance. The system is intended to yield a clear definition of the respective legal requirements and applicable regulations and, more specifically, to regulate the implementation thereof at the operational level in a manner that is both unambiguous and traceable. As a result, it is intended to provide superior transparency and clarity in mapping the requisite activities and their realization.

The integrated management system is designed in particular to provide improvements at the following levels:
- environmental / occupational safety;
- legal certainty;
- market access;
- relations with authorities and with the public;
- loan and insurance terms.

Moreover, the system will create the prerequisites for applying for electricity tax and eco-tax relief for the next few years – a fact which is of particular importance with regard to foundry operations. One key principle governing the new system is that its harmonization with the existing Quality Management (QM) structure must be ensured in order to benefit from synergy effects. In this context, the existing QM system process descriptions will likewise be represented in the form of flow diagrams for the sake of achieving improved clarity and transparency.

The system is based on the following standards:
- ISO 14 001 (environmental management)
- ISO 50 001 (energy management) and
- OHSAS 18 001 (occupational safety management).

Furthermore, for the equipment construction activity it incorporates ISO 14062 (integration of environmental aspects into product design), as well as CE requirements. The system will be established using standardized documents throughout the entire company. First steps towards the introduction of the new system were initiated in late 2012. As early as in the summer of 2013, it is intended to test the effectiveness of the integrated management system as part of a certification drive.

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