Successful Foundry Investment: The New Machining Centre
Dear Reader!

With the present issue of Otto Junker News we would like to update you once more on interesting new orders received for melting and heat treatment systems, as well as on plant and equipment investments currently being made at the level of our furnace manufacturing operations, high-grade steel foundry, machining and assembly divisions.

Having concluded the past year 2011 with good results once again and considering our current backlog of orders on hand, the Otto Junker Group is looking ahead to 2012 with optimism.

Accordingly, we are now directing our attention to a range of projects aimed at investing in the future. These include investments in production facilities at our Lammersdorf headquarters site as well as the successful repositioning of assembly and manufacturing activities in our subsidiary company, Junker Industrial Equipment, at Boskovice/Czechia. Apart from the foregoing, investment is being made in the form of technical development to lay the groundwork for industrial innovations from which our customers will benefit. In our two Tech Centers we are developing new processes and equipment components aimed at raising the energy and resource efficiency of melting and heat treatment plants alike. Some of these improvements will be presented and discussed with users in June 2012 on the occasion of a Customer Day organized by our company's induction melting equipment division.

Our development units proceed on the basis of a predefined master plan. Project Boards have been set up to address specific fields, with expert input from departments ranging from sales to on-site installation. We also cooperate regularly with the relevant institutes of the Technical University of Aachen (RWTH) and the Aachen University of Applied Sciences (FH).

One recent investment, our third 5-axis drilling and milling centre, has already been put into service producing high-precision machine parts. Designed for use on our customer's microchip manufacturing lines, these items must meet industry's known exacting standards of dimensional accuracy and surface finish quality. Our production of these parts is therefore carried out in air-conditioned workshops.

In the field of vacuum melting metallurgy we have been able to secure two contracts that merit special mention. Both involve recycling systems designed to remove zinc from molten metal by a distillation and separation process so as to make this element available for subsequent re-use – a perfect example of resource efficiency. As far as energy efficiency is concerned, special mention should be made of a recently commissioned aluminium annealing installation relying on a newly developed mathematical model. This model provides a 'holistic' overall plant control capability which enables the user to save fuel and hence, reduce emissions by around 8,300 tonnes of CO₂ per year.

I hope you will find the reading interesting and enjoyable.

Yours sincerely,

Dr. Hans Rinnhofer, Chairman of the Board of OTTO JUNKER GmbH

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Our trade fairs and events in 2012:

- **Große Gießereitechnische Tagung**

- **Metallurgy-Litmash Russia 2012**
  - 28. - 31.05.2012, Moscow

- **Aluminium/Copper China**
  - 06. - 08.06.2012, Shanghai

- **4th International Cupola Conference**
  - 14. - 15.06.2012, Dresden

- **ACHEMA**
  - 18. - 22.06.2012, Frankfurt/Main

- **FOND-EX**
  - 10. - 14.09.2012, Brünn

- **Metaurgia (Brazil)**

- **Aluminium**
  - 09. - 11.10.2012, Düsseldorf
Innovation Day to review innovation in induction furnace technology on June 21 – 22, 2012

OTTO JUNKER Junker stands for innovative induction furnace engineering and has impressively demonstrated its leadership through numerous ground-breaking developments. As a German furnace manufacturer the company feels bound to a high standard of excellence in research and development. In line with this commitment, the OTTO JUNKER Foundation promotes the academic training of young scientists and supports key research projects at the Technical University of Aachen (RWTH).

The triumphant progress of induction heating technology and the evolution of medium-frequency furnace systems into a reliable, energy-efficient melting resource noted for high flexibility and exceptional metallurgical process capability are owed, not least significantly, to the dedicated efforts of OTTO JUNKER GmbH. The company is determined to continue on this track in a consistent and focused manner. The aim of our Innovation Day is to discuss pending research projects and to seize on suggestions for new solutions amidst experts from across the foundry industry.

To this end, OTTO JUNKER will be presenting several development projects to the assembled participants for critical review before proceeding to drive these solutions further to the manufacturing stage. The expert opinions, criticism and stimulation thus received are very important to OTTO JUNKER for retaining its focus on practical industry needs and expectations. Aside from the presentation of innovative designs pursued in recent years, the following projects will be put forward for discussion:

- INDULADLE – induction heated ladle
- New optical systems for inspection and monitoring of the refractory lining
- Energy efficient coil concepts
- Process-oriented IGBT technology for new applications and power ranges plus new control concepts

The above new developments will be demonstrated in a series of workshops to provide a sound basis for specific evaluation.

Dietmar Trauzeddel (+49 2473 601 342)

Candidates defend their bachelor theses at Aachen University of Applied Sciences

Aside from the close relations traditionally linking OTTO JUNKER with the Technical University of Aachen, a mutually fruitful cooperation has been pursued for close to 10 years with the Aachen University of Applied Sciences. Under the scheme, practical operational challenges relating to production management and manufacturing technology are examined by students as part of their degree theses under the supervision of their professors. A focused and practically relevant approach to the various subjects is ensured via the support of OTTO JUNKER's respective departments and the hands-on experience of shopfloor production conditions afforded to the young researchers. In December, several candidates from Prof. J. Gartzen's degree programme successfully defended their bachelor theses before an OTTO JUNKER steering team. Issues examined by the students included, e.g., the optimization of furnace and capacitor manufacturing, the insulation of induction coils and furnace yoke cooling technology. With their theses, the candidates not merely furnished proof of their ability to conduct application-oriented research on their own initiative but also managed to develop important suggestions and proposals for the ongoing improvement of OTTO JUNKER's operations.

Business contact fair 'bonding 2011' held in Aachen

A student initiative designed to provide students with insights into their future career environments and to bring together students and companies has been organizing 'contact' fairs all over Germany for a number of years. Every year Aachen is one of the venues and, as in previous years, our company attended the 2011 event with an info stand.

From November 28 to 30, our human resources manager and experts from OTTO JUNKER engineering units representing several disciplines talked to the students and faced their questions.

The numerous visitors – mostly students, but also recent graduates and job beginners – were thus given a chance to gain first-hand information about the career and training opportunities available in our company.

Our objective was to present OTTO JUNKER as a potential employer and to attract the interest of many prospective job candidates and applicants. Brisk demand was noted especially for internships, research placements and graduation projects.
Vacuum-type induction furnaces are becoming increasingly widespread for removing undesirable alloying elements, as well as for the production of high-purity, low-gas alloys and for melting special materials. Typical applications include the following:

- Deoxidation of high-grade steel melts
- Carbon reduction of molten steel
- Melt degassing
- Distillation of zinc and other low-melting alloys

The design of OTTO JUNKER’s vacuum-type coreless induction furnaces guarantees a high level of operating safety and reliability since only their actual melting chamber is evacuated whereas the induction coil with its power and water inputs remains outside the vacuum.

A cooling air system arranged between coil and crucible lining protects the furnace shell from overheating while also permitting continuous temperature monitoring of the refractory lining via the cooling air ducts distributed along the circumference of the crucible. This design prevents electric glow discharge and any hazardous contact between cooling water and molten metal in the case of a breakdown.

**To illustrate the operation of a vacuum furnace for zinc distillation, let us look at the following specific project:**

Overall, the plant essentially comprises a vacuum-type coreless induction furnace with the necessary ancillary equipment including a frequency converter and switchgear system, zinc condenser, filter unit and vacuum pump.

**The distillation proceeds as follows:**

- The charge material is melted in the furnace under atmospheric pressure. Once it is molten, the furnace is sealed off with a hood and connected in vacuum-tight manner to the zinc condenser and filter unit arranged beside the furnace.
- An appropriate vacuum is then generated by the vacuum pump and the melt temperature is raised to approx. 1,000 - 1,050 °C, causing the zinc to evaporate intensely.
- The resulting zinc vapours are passed into the unheated condenser and condense there. The condenser design ensures that the temperature exceeds the melting point of zinc at all times but will never rise too high. Accurate temperature management and partial cooling of the vessel make for an optimum process.
- When the condensation step is completed, the condenser is disconnected from the furnace and the molten zinc is drained into a ladle. The alloy left in the melting furnace is removed in the same manner.

This complex process calls for accurate monitoring and control of all operating parameters, especially temperatures, pressure and electric power. These functions are performed by a furnace control system designed specifically for this application.

At present, such vacuum-based zinc distillation systems are being built for customers in Germany, India and Canada. Some are in their manufacturing stage, others are being assembled.

Dietmar Trauzeddlel (+49 2473 601 342)
Innovative process model by OTTO JUNKER for aluminium strip annealing

The German Federal Ministry of Environment is making available 1.5 million Euro from its Environmental Innovation Programme for a pilot project currently under implementation at Aluminium Norf GmbH in Neuss (North Rhine-Westphalia).

Advanced annealing furnaces will make it possible to work in a much more energy-efficient manner and save approx. 8,300 tonnes p.a. of CO₂ emissions compared to prior practices with previous equipment.

Aluminium Norf intends to employ innovative, energy-efficient annealing furnaces embodying the most advanced equipment technology in its cold-rolling lines. The use of an on-line process control system will enable the company to save huge amounts of energy in its annealing operation by feeding the strip at its "as-rolled" temperature instead of cold. So far, the annealing furnaces used to be controlled on the basis of trials and metallurgical experience, which called for a defined furnace temperature and for cold strip at the beginning of the annealing cycle. This meant that the strip had to be cooled down first after the upstream rolling step, resulting in the loss of valuable residual heat. With the new system, temperature measurements carried out both on the strip and inside the furnace permit the computer-controlled determination of a real-time thermal balance. This enables the heat input into the annealing furnaces to be reduced to exactly what is needed.

Based on an annual output of 180,000 tonnes of product, the project will save 4,857,705 kWh of electrical power and 9,804,600 kWh of natural gas compared to the previous equipment.

Energy saving coil: more orders booked

The innovative coil design developed by OTTO JUNKER (see OTTO JUNKER NEWS 15 of December 2008) to gain 5 – 9 % savings in energy consumption depending on the charge material is attracting mounting interest from our customers, especially for upgrading existing coreless induction furnaces. Accordingly, new orders were received in the past few months for a number of coreless-type furnaces serving in cast iron as well as aluminium and copper melting applications.

It deserves to be recalled here that the new coil type has been successfully in use for several years in the copper melting furnaces of Schwermetall Co. based in Stolberg/Germany.
Buderus Guss GmbH in Breidenbach appreciates high production performance of OTTO JUNKER’s melting system and pressurized pouring furnace

To upgrade its existing melting capability, the company had opted for the installation of a DUOMELT coreless induction furnace plant comprising two 12-tonne furnaces powered via a 10,000-kW frequency converter system. The 12-pulse converter with filter unit is designed to operate at a frequency of 250 Hz and enables the system to deliver up to 17.6 tonnes of molten cast iron per hour in Duomelt mode. The water recooling system is integrated into a cooling tower circuit and has separate cooling circuits for the furnaces and for the electrical equipment.

Two charging chutes, slag gripper equipment and a JOKS melt processor complete the package. The melt processor is interfaced with the spectrometer and can also be operated from a parallel desktop PC featuring an appropriate display unit. It is thus possible to control and monitor the entire system from a control station remote from the operator cabin.

A new pouring furnace was fitted on an automatic moulding line for the controlled production of automotive castings. At a cycle time of around 11 seconds, the system is to pour up to 65 kg of liquid metal per mould. The pouring furnace has a useful capacity of 10 tonnes and is heated by a 350-kW inductor. Consuming 140 kWh/h in holding mode, the unit has plenty of power left for adequate superheating of the molten metal.

Automatic movement of the pouring furnace along and across the mould line is controlled by means of a laser system ensuring accurate positioning above the mould sprue cup. The bath level in the pouring spout is likewise laser-controlled.

OTTO JUNKER’s pouring level control system ensures an accurate compliance with the specified pouring curve. The appropriate pouring curve is programmed and saved via a teach-in system and subsequently reproduced automatically. The actual metal level in the sprue cup is detected by the laser-based distance measuring system and correlated automatically with the target level in the memorized pouring curve. In the event of a discrepancy, the stopper is opened or closed as required.

The culminating point of this major investment project consisted in the formal handover of OTTO JUNKER’s equipment to Buderus Guss GmbH in early October.

Dietmar Trauzeddel (+49 2473 601 342)

Orders from Poland and Thailand

Teksid Iron Poland Sp z o.o. of Skoczow (Poland) has placed an order with OTTO JUNKER GmbH for the projecting, delivery and start-up of a DUOMELT tandem melting furnace system comprising two coreless furnaces with a capacity of 12 tonnes each and a furnace rating of 10,000 kW.

The power converter will be of proven DUOMELT design. Our scope of delivery will also include newly developed extractor hoods plus water recooling equipment including a glycol-free air/water heat exchanger. Commissioning of the entire furnace installation is scheduled for the summer of 2012.

A company based in Thailand, Yamaha Motor Parts Manufacturing Co. Ltd. ordered a MONOMELT coreless-type melting furnace system from OTTO JUNKER. The plant is intended to melt steel or cast iron, depending on requirements.

The 2-tonne coreless induction furnace will be powered via an IGBT converter system with a 1,000 kW output rating and an operating frequency of 500 Hz. A water/water heat exchanger and a melt processor with M2F touch control panel will complete the installation. The system will be shipped in the early summer of 2012.
New IGBT switchgear system and modern water recooler provide key advantages.

MAFO Systemtechnik AG of Teisendorf had been using two OTTO JUNKER triple-frequency coreless induction furnaces for melting gray iron successfully since the mid-1960s.

In early 2011, the company entered into detailed discussions with OTTO JUNKER experts to review the options for modernizing its furnace technology, and a blue-print was developed jointly. The revamping project has by now been concluded and the upgraded plant is back in full-scale production service.

The upgrade involved the installation of an IGBT switchgear system embodying DUOMELT technology for power supply to the two furnaces having a capacity of 500 and 250 kg, respectively, plus the installation of a glycol-free water recooling system. For plant control purposes, an advanced PLC was fitted and an operating and control cabinet featuring a PC and an integrated monitor.

All other equipment, and especially the coreless induction furnaces, remained unchanged in their entirety.

The advantages obtained by this upgrade can be summarized as follows:

- substantial energy savings of more than 20 %, with corresponding gain in melting capacity
- increased plant reliability and safety in operation
- reduced idling times and infinitely variable power control

Compared with the potential installation of an all-new melting plant, the upgrade involved much lower investment costs and was completed in less time.

Jürgen Rollesbroich (+49 2473 601 498)

Conversion from zinc pots to aluminium-silicon coating
INDUGA receives landmark contract from ArcelorMittal Florange

INDUGA is excited to have received the contract for converting a galvanizing line into an aluminium-silicon coating facility. The technology of coating sheet steel with aluminium-silicon is considered an innovative one, meeting today’s ever more exacting standards in automotive manufacturing.

ArcelorMittal, the world’s largest steelmaker, aims to be among the first to supply such sheet to the automotive industry as of the 2nd quarter of 2012.

In order to implement this new steel sheet coating process, one of the two zinc pots delivered by OTTO JUNKER in 1991 will be revamped accordingly, e.g., by fitting it with three more powerful channel-type inductors. The pot capacity will thus be raised to a total of 120 tonnes of liquid AlSi alloy. The scope of this project comprises the supply of the channel-type inductors upgraded from 500 to 600 kW plus three new IGBT frequency converter systems made by OTTO JUNKER.

For INDUGA this is a landmark contract since it will certainly strengthen our position versus competitors in a number of current projects in the field of advanced steel sheet coating.

Alejandro Hauck (+49 2473 601 724)
BREMBO Czech s.r.o in Ostrava ordered a second heat treatment line for brake components

Brembo, the major Italian manufacturer of brake components, is systematically expanding the capacity of its subsidiary operations in Czechia. Following the successful commissioning of an OTTO JUNKER heat treatment plant at the company’s Ostrava site in mid-2011, a contract for the supply of a second line of identical design was awarded to us at the end of last year. The specification called for low energy consumption and easy maintenance as key plant design criteria.

Intended use of the equipment is the heat-treatment of aluminium alloy castings, e.g., automotive suspension parts. Accordingly, each plant comprises a solution annealing furnace, a quench tank and an artificial aging furnace. For technological reasons, the overall treatment time per part varies between 4 and 6 hours due to the time-consuming diffusion processes involved in many cases.

The compact U-shaped arrangement shortens the conveying movements and minimizes the equipment footprint. Flexibility is increased by the fact that each furnace is equipped with its own conveyor system.

The individual castings are placed in baskets and pass through the various stations in a stacked arrangement. The maximum charge weight including baskets amounts to 2,500 kg.

The solution annealing furnace is directly gas-fired. Powerful fans ensure uniform heating. The annealing furnace exhaust heat is recovered in a heat recovery system and made available for heating the artificial aging furnace. To this end, the exhaust gases are collected and fed to a booster which provides additional heating power on demand.

A separate sand collector ensures that residual sand from the castings is reliably removed from the airflow.

Following the solution annealing cycle, the entire load is cooled in the water quench tank and subsequently passed to the artificial aging furnace where the desired physical material properties are finally established at temperatures of 150 or 190 °C. A precisely homogeneous temperature distribution is of particular importance here to achieve the specified 3 °C tolerance within the load.

All handling and conveying operations, movements and treatment times – as well as the duration of the quench immersion cycle – can be controlled either automatically by the equipment or manually by the operator. A semi-automatic operating mode is likewise provided.

With the first plant having fully satisfied the requirements of day-to-day production for several months now, we are confident that the customer will be able to put the second plant into successful operation in mid-2012.

Klaus Berns (+49 2473 601 258)

CURRENT NEWS

Aleris Dingsheng Aluminium Co. Ltd., a joint venture between Aleris Aluminium and Dingsheng Aluminium, has entrusted OTTO JUNKER with an order for a coreless induction furnace for the foundry at its Zhenjiang site (Jiangsu Province). The 6-tonne unit will be used for melting chips as well as for special alloys. Aleris has been relying on OTTO JUNKER’s proven induction furnaces at its Koblenz/Germany site for many years, benefitting from the exceptionally low melting loss afforded by these systems due to their special design for instant chip stir-down. The Dingsheng project will additionally embody advanced IGBT power converter technology which combines all advantages of the highly efficient parallel oscillating circuit converter with a constant power factor at the converter input. Moreover, OTTO JUNKER’s IGBT converter poses very low demands on cooling water quality due to its reliance on indirect water cooling.

Otto Junker will supply the core equipment components from Germany while realizing about 40 % of the project in China through the services of JMS Shanghai, an OTTO JUNKER subsidiary.
OTTO JUNKER strip processing lines have commenced production at CHINALCO SHANGHAI Copper

CHINALCO Shanghai Copper Co., Ltd., a company evolved out of the Shanghai Non-ferrous Metals (Group) Co., Ltd., is a Chinese enterprise with a long tradition in the manufacture of copper and copper-alloy strip. As early as in the 1990s, OTTO JUNKER supplied the first strip processing line comprising a strip flotation furnace to this customer.

In the context of CHINALCO SHANGHAI’s ambitious project of setting leading standards in the manufacture of copper products while simultaneously expanding their strip processing capacity from 70,000 to 120,000 tonnes/year, OTTO JUNKER had recently delivered a state-of-the-art annealing line built around a strip flotation furnace, in addition to two strip cleaning lines.

The equipment successfully entered production service in the summer of 2011.

While the technology and key components were supplied by OTTO JUNKER from Germany, a substantial part of the systems was built locally by JUNKER Shanghai, a wholly owned enterprise of OTTO JUNKER / Lammersdorf, based on OTTO JUNKER quality standards.

The strips are annealed continuously with minimum tensile force at speeds up to 100 m/min, either in air or in a protective gas atmosphere attaining a residual oxygen content of as little as 10 - 22 bar partial pressure.

The protective atmosphere mixing plant, which delivers a mix of disassociated ammonia and nitrogen, was likewise supplied by OTTO JUNKER.

Apart from its engineering leadership in copper strip treatment technology which OTTO JUNKER has succeeded in maintaining for many decades, the company’s local presence yields decisive benefits.

OTTO JUNKER’s sales office in Beijing and its Shanghai manufacturing site with its service base ensure a competent and timely customer service, both in and after the production launch stage.

CHINALCO SHANGHAI not merely aims to enhance its high product and service standards but is also committed to international environmental protection targets. In line with that policy, e.g. a number of standards reflecting the German Water Resources Act “WRA” requirements were implemented.

Klaus Schmitz (+49 2473 601 532)
New Turkish brass foundry to receive melting furnaces and ancillary equipment from INDUGA

In late 2010, the Istanbul-based FIRAT Co. – the largest manufacturer of plastic building materials in Turkey – placed an order with INDUGA for the supply of induction melting furnaces for their new brass foundry. The new foundry is intended to ensure the in-house supply of brass bar stock for the manufacture of valves, couplings and threaded unions for plastic piping systems.

During manufacture and machining of these components, large quantities of wet brass chips are produced which are to be returned directly into the production cycle. INDUGA, in cooperation with OTTO JUNKER, will provide the furnace installations including the charging chutes and exhaust gas cooling equipment.

For melting the Ms 58 brass chips, a coreless induction furnace from OTTO JUNKER will be employed with a capacity of 4 metric tonnes.

Power is supplied via an IGBT frequency converter system with a rated output of 1200 kW. The selected 60 Hz operating frequency and heel-based furnace operating regime will ensure a rapid stir-down of chips. With a heel of around 1600 kg, the net melting time per 2,400 kg charge material comes to less than 50 minutes and the energy consumption amounts to 290 kWh/t. All functions of the furnace system are controlled and monitored by a M2F melt processor.

In addition to the above, INDUGA will supply a mains-frequency coreless melting furnace for melting down recycled scrap. With its capacity of 3.5 tonnes and a power rating of 600 kW, this unit can deliver 3 tonnes of molten metal per hour.

The two melting furnace systems will alternately feed molten brass via an appropriate system of launders into the holding and pouring furnace of a 2-strand horizontal type continuous caster.

In early December 2011, the furnaces and ancillary equipment passed factory acceptance at our Lammersdorf site and are now ready for shipment.

Alejandro Hauck (+49 2473 601 724)

Korean business partners order more melting furnaces

Following the successful supply in 2010 of a brass melting furnace to the renowned Seowon Co. Inc. of Korea, another contract for a copper melting furnace was now awarded to us.

The new melting equipment will consist of a 12-tonne medium-frequency coreless induction furnace with a 2,000 kW IGBT power converter of MONOMELT design. The latter will feature a multi-frequency capability enabling the unit to be run at either 150 or 75 Hz depending on process needs.

Deachang Co. Ltd., a leading Korean company, is a long-standing business partner of OTTO JUNKER. Their most recent repeat order calls for the supply of a coreless induction furnace system for melting brass. The 8.8-tonne coreless furnace will be heated via an IGBT converter system rated for 1,600 kW and delivering a 100 Hz operating frequency.

The systems are scheduled to be shipped this spring and in mid-2012, respectively.
Upgrading continues – Focus now on the process management system

Following the successful commissioning of another 5-axis machining centre and the new ventilation system last year, we now embark upon another investment project.

These controllers provide local monitoring only, and with restricted capabilities; moreover, they impose limits at the control and adaptation level. In addition, the PLC systems in place lack connectivity and compatibility with other control equipment.

The aim now is to fit all foundry equipment with state-of-the-art standardized S7-type controllers linked by Profinet technology. Their installation will create the prerequisites for central monitoring and control from an industry-standard PC in the control room.

From a production management viewpoint, the following benefits can be identified:

- equipment can be operated and parameterized from the foreman’s office or from a central control room,
- in the case of a malfunction, remote diagnostics can be performed from the foreman’s office or from a smartphone/external PC,
- a central process monitoring capability is provided,
- a high-speed data link is established for remote maintenance and
- back-up of equipment data is centralized.

The commercial benefits can be summarized thus:

- reduced energy consumption thanks to optimized, mutually adapted process sequences
- improved equipment productivity due to
  - early detection of malfunctions
  - advance notification of maintenance cycles
  - transfer of production control data from ERP to the equipment
  - increased equipment flexibility and hence, higher throughput

A time frame of 2 – 3 years has been set for this challenging and extensive project. Custom design of the system is a key requirement and, needless to say, planners have considered that the conversion to modern control technology must proceed without interfering with ongoing production operations.

In line with this systematic approach, some foundry equipment – e.g., the melting operation including the load shedding system for the melting furnaces (Automatic power limitation), the automatic moulding machine and the foundry extraction systems – have been fitted with modern control technology already.

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