



## Maximising opportunities for foundry businesses

As the impact of the global financial crisis spreads further across manufacturing industry, Rautomead Limited has embarked upon a programme of assisting organisations in the metals processing sector with advice on how they might position themselves to take advantage of renewed growth when an economic upturn occurs.

Comments Rautomead Sales Manager, Guy Henderson, "While for many, the obvious route may appear to centre around scaling back on overheads and production, in many cases, there is real benefit to be gained by implementing more controlled continuous casting techniques, by investigating the virtues of smaller-scale casting to become independent from larger metals manufacturers, by maximising the capabilities of older casting machinery and by considering the opportunities to produce new materials and products.

"At Rautomead Limited, we can assist non-ferrous metals processing companies with all of these things in order to help them plan towards a successful future. We are able to provide the expertise, equipment and know-how to produce semi-finished 'near net shape' bars and hollow sections in house."

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## *Foundry business: creating a more controlled manufacturing sequence*

In the foundry sector, Rautomead's continuous casting technology can often replace existing processes to provide a much more efficient, economic and controlled manufacturing sequence. Examples include:

- Continuous casting of lengths of hollow bronze bearing alloys as opposed to static casting of individual hollow pieces
- Continuous casting of small diameter alloy wires in place of billet casting and extrusion or bar casting and rolling
- Continuous casting of copper wire rod for continuous rotary extrusion to strip in place of billet casting and conventional extrusion

Rautomead Limited has been supplying continuous casting equipment to the non-ferrous metals industry for more than



thirty years. Indeed, Rautomead continuous casting technology currently exists for:

- Horizontal continuous casting of solid or hollow billets
- Upward vertical continuous casting of small diameter hollow bars and shapes
- Upward vertical continuous casting of alloy wires
- Horizontal casting with QDC (Quick Die Change) technology for batch production
- Horizontal and vertical (downwards) casting for small batches of high purity materials used in the electronics and jewellery industries

### **Economies on a small scale**

The fact that continuous casting can be economic on a relatively small scale (50 – 500 tonnes per month) has already led to several producers installing Rautomead technology at locations where metal making activity was previously not possible and where process scrap arisings and off cuts were sold for recycling.

Ownership of their own metal manufacturing equipment has enabled these organisations to develop techniques for the production of new alloys and sections shapes and equipped them with the flexibility to react and respond to changes in market demand.

To discuss the opportunities available to your business, call Rautomead on **+44 (0) 1382 622341** or email: [sales@rautomead.com](mailto:sales@rautomead.com)



### **Over 30 years of leadership**

A founder of the business in 1978, Sir Michael Nairn has provided over 30 years of leadership and has played a significant role in developing Rautomead Limited into the world-class organisation that it is today. He will remain with the company as active Chairman.

### **Assuring future success**

Discussing the appointment, Sir Michael commented that he was delighted to have been able to arrange such a carefully planned succession strategy; one designed to assure the future security of Rautomead as a proud, independent Scottish-based technology company, as well as its ongoing business success.

# **Well-planned management succession strategy ensures smooth transition at Rautomead**

### **Global presence**

Rautomead Limited currently employs a total staff of 36 in Dundee. There are presently over 300 Rautomead continuous casting installations in service in 47 countries around the world. The company aims to be technically innovative in its chosen field and combines world-wide sales and marketing of its products with outstanding life-long technical support.

Adds Sir Michael Nairn, "I am delighted to welcome Brian Frame to Rautomead Limited. He has a strong technical background with international experience and comes to Rautomead from Texol Technical Solution Plc, where he has been Managing Director for the past eight years."



# Quick Die Change Technology Receives European Patent

Widely recognised for its ability to reduce typical casting die change time from around thirty hours to about one hour, Rautomead's Quick Die Change (QDC) technology has been granted a European Patent.



*"time saving benefits"*  
Brian Frame

Available on new Rautomead RT 650 and RT 850 horizontal casting models, and as a retrofit opportunity on most Rautomead RT & RX continuous casting machinery already in service, the recently introduced QDC technology enables casting dies to be changed without first cooling the furnace. With a significant reduction in die change time, a 20% to 40% improvement in operating efficiency, according to the length of each casting campaign, is also achievable.

Comments Rautomead Managing Director, Brian Frame, "Quick Die Change is a significant advancement in continuous casting technology, one that offers considerable time-saving benefits to users and further underlines Rautomead's position as a leading provider of continuous casting equipment."

## Most significant engineering step to-date

"Rautomead has been building graphite-furnace-based horizontal continuous casting machines for the production of bronze, nickel-silver and brass alloys for over thirty years," he continued. "Although designs have evolved over that time as a result of continuing programmes of product improvement and in response to customer needs, Quick Die Change is by far the most significant engineering step to-date in improving the up-time performance of this equipment. With the reassurance of a European Patent to protect the innovation, we have the confidence to continue our investment effort in the research and development of future technological advancements that will benefit Rautomead customers."

## Stability, strength and metallurgical cleanliness

Rautomead machines operate at temperatures from around 1,000 deg C to 1500 deg C, according to the alloys in production. Hallmarks

of Rautomead furnace designs have been the use of a graphite containment system for the molten metal, electric resistance heating and inert gas protection of the internal hot working components of the machines. Advantages of the use of graphite crucibles include the stability, strength and metallurgical cleanliness of the material at these elevated temperatures. Customers also have experience of eight and ten years' typical service life from a single crucible in these machines.

## Rapid die change

As graphite erodes quickly in air at such high temperatures, it has, until now, been necessary to cool the machine down to change the casting dies to avoid internal damage to the furnace. With QDC technology, a non-graphitic protective sleeve is used between the casting die assembly and the other internal hot working components of the machine, enabling the casting die to be changed immediately the molten metal has been cast out.

## Re-heating costs all but eliminated

In casting campaigns involving more aggressive alloys, where die life may only be five days, the increase in efficiency using QDC is over 40%. An added technical advantage of the new QDC technology is the avoidance of regular thermal cycling of the casting machine, thus greatly reducing the inherent stresses borne by the equipment in such a pattern of operation. In terms of operating cost, not only is there substantial extra productive time available, but energy, labour and inert gas costs in re-heating the machine between die changes are all eliminated.

# Copper Alloy Casting Development

## Conductor Alloy Wire Rod

While high conductivity copper and, to a lesser extent, oxygen-free copper meet the majority of market needs for copper in electrical conductors, other specialist applications call for low-alloyed copper conductors (generally defined as less than 2% alloy addition) to impart to the end-product additional tensile strength, creep resistance, thermal stability or higher softening temperatures, while still benefiting from the good electrical and heat conductivity of the copper itself. Individual market volumes are relatively modest, but premiums over the LME copper price are higher, relating the value of the alloying elements and the complexity of the manufacturing processes required.

### Copper Alloys in this category include:

#### Copper-Silver (0.01% - 0.12%Ag)

Provides greater creep strength in elevated temperature applications without loss of conductivity. Used in motor windings and in trolley wire.

#### Copper-Tin (0.2% - 0.4%Sn)

Provides greater tensile strength with modest loss of conductivity. Used in trolley wire.

#### Copper-Magnesium (0.1% - 0.5%Mg)

Provides high tensile strength with modest loss of conductivity. Rapidly work-hardening alloy. Used in high-speed trolley wire.

#### Copper-Cadmium (0.7% - 1.2% Cd)

Provides an excellent balance of high tensile strength with reduced loss of conductivity. No longer accepted in some applications on account of toxicity of Cd fume.

#### Copper Chromium (0.3% - 1.4% Cr)

Provides good high temperature strength and stability with good conductivity. Precipitation hardening. Contact wire for high-speed rail. Resistance welding tips.

#### Copper Chromium Zirconium (0.5 -1.2% Cr: 0.03 - 0.10% Zr)

Contact wire for high-speed rail. Resistance welding.

## Engineering Alloy Wire Rod

A wide range of more dilute copper alloy wire rods is used in non-conducting applications, taking advantage of the other properties of copper, including heat conductivity, corrosion resistance and malleability, especially in association with the properties of the alloying elements.

The following list describes those alloy groups which are commonly continuously cast and which are subsequently drawn to wire:

#### Tin-bronzes (5% - 8% Sn)

Usually continuously cast at approx 19mm, rolled, annealed and drawn to wire. Applications in wire mesh for screens and conveyor belts.

#### Nickel-silvers (typically 18% Ni, 27% Zn)

Usually continuously cast at approx 19mm, rolled, annealed and drawn to wire. Uses of nickel-silver wire include zippers, spectacle frames, jewellery and musical instruments.

#### Binary brasses (35% - 40% Zn)

Usually continuous cast at 8mm, drawn and annealed. Used in high precision Electrical Discharge Machining (EDM) applications.

#### Special brasses (30% Zn & other minor alloy additions)

Usually continuous cast at 8 - 12mm, drawn and annealed. Used in wire mesh for screens, with particular sub-sea applications.

This group of copper wire rod alloys should be distinguished from a separate group of copper-based engineering alloys which are also continuously cast in the form of solid bars, flats and hollow sections.

# New entry-level copper rod caster makes Rautomead technology even more accessible



RS CC 3

A new entry-level range of copper rod casting machines has been developed by Rautomead Limited to offer all the advantages of the company's proprietary casting technology at an exceptionally competitive price.

The new models, named 'RS CC' have been designed specifically for the production of CuOF and CuAg wire rod and is available either as a 1, 2, 3 or 4 strand machine for 8-22mm diameter rod. The rod may be used for high quality wire drawing applications, or as feedstock for Continuous Extrusion Technology. Output capacity from 1,000 – 3,600 tonnes per year.

The result of a significant market review, and by utilising the company's innovative culture and internal processes, the RS CC models share many of the unique technical features of the larger Rautomead RS wire rod casting machines, and provide customers with a unique entry point into production of the highest quality oxygen-free copper.

In an effort to minimise customer investment, the RS CC models have been

designed to provide users with the option to arrange local manufacture and supply of selected component parts of the continuous casting equipment, according to designs and information provided by Rautomead.

## Key features of the new Rautomead RS CC entry-level model include:

- Highest quality oxygen-free rod
- Either 8mm or 12.5mm - 22mm cast rod diameter
- Up to 3,600 tonnes per year
- Chopped cathode feed
- Graphite furnace
- Simple technology
- Safe operation
- Low capital cost
- Low operating cost

## THE ECONOMICS OF WIRE ROD PRODUCTION – Can it work at a smaller scale?

**In a hypothetical situation of perfect competition, in which all resources are allocated and used efficiently, conventional copper redraw rod for electrical conductor applications would be manufactured as 8mm diameter HC copper rod, using large production capacity CCR plants, probably installed close to the copper refinery.**

Equally, in such a perfect market, the place of the smaller types of upwards-vertical continuous casting plant would be to meet the demand for "special" products, defined in terms of:

- Less common copper wire rod sizes
- Conductor alloys
- Special applications calling for oxygen-free rod
- Engineering alloy wire rods

As we live in a very imperfect world, however, in which a myriad of factors distort the economist's theory of perfect competition, the market for copper and copper alloy wire rod behaves no differently from any other.

Thus, examples are found of production from high capacity CCR plants being diverted from standard 8mm HC copper rod production to produce relatively small runs in larger sizes of rod or of silver-bearing copper. In some geographical areas, the business risk associated with multi-million dollar investment required for a new CCR plant has been considered too great, giving rise to a succession of smaller oxygen-free copper rod plants to satisfy local demand.

In other areas, the existing CCR rod plants are now old and are not being replaced. This, similarly, has led to investment by the local wire and cable industry in a battery of smaller oxygen-free copper rod plants to protect their vital supplies of redraw rod as their principal manufacturing raw material and to secure the future of their businesses.

### Conclusion

*There can be no doubt that the majority of the world's growing demand for copper redraw rod will be HC copper and will be manufactured using one of the well-developed CCR processes. Separately, there are specific smaller market applications where the upwards-vertical continuous casting processes have both technical and commercial advantages. In between these two extremes, there will remain cross-over points, where for reasons of imperfect market competition, the upwards-vertical process, in particular, will be found making 8mm copper redraw rod for use in conventional building wire applications.*





# Copper rod casting machine for Thai transformer manufacturer...



Rautomead Limited will deliver and install an RS 2200/5 machine at Tusco Trafo Co. Ltd., of Bangkok, Thailand in 2009.

A progressive and professionally-run company, Tusco Trafo are transformer manufacturers who are investing both in a BWE Conform™ machine to make small copper strips and a Rautomead copper rod machine to manufacture the feedstock rod for the Conform™ machine. The Rautomead team first met the directors of Tusco Trafo at the Dusseldorf Wire exhibition in April 2008.

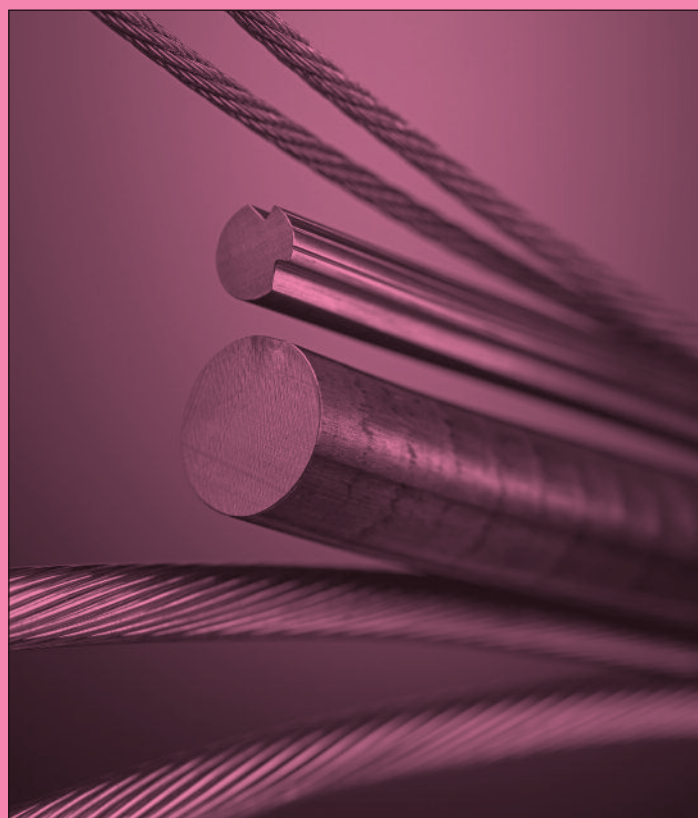
In addition to the Tusco Trafo order, there are a number of similar investment projects under negotiation with other potential customers involving the use of Rautomead machines in tandem with Conform™ machines with copper strip as the final product.

## ...and upward-vertical caster for Barcelona

Rautomead have supplied an RS 3000/5/CuMg upward-vertical copper rod casting machine to La Farga Lacambra of Barcelona. With a unique 200-year history, La Farga Lacambra is one of Spain's leading copper processing companies and can trace its origins back to bell-founding and canon manufacture.

La Farga Lacambra is also a leading technology company, which has developed its own process for making fire-refined copper rod directly from scrap.

The new Rautomead casting machine is expected to be used for production of oxygen-free copper, as well as CuMg and CuSn alloys. Successful casting trials carried out recently at Rautomead's Scottish-based technology centre were a key factor in securing this significant new order.



# Rautomead secures Gold in China

Rautomead Limited has been successful in securing several contracts with Chinese companies looking to produce high quality gold bonding wire. The manufacture of high purity (99.999%) gold bonding wire of 0.05mm - 0.03mm diameter demands technical knowledge and expertise, exacting quality control standards and first-class production equipment.



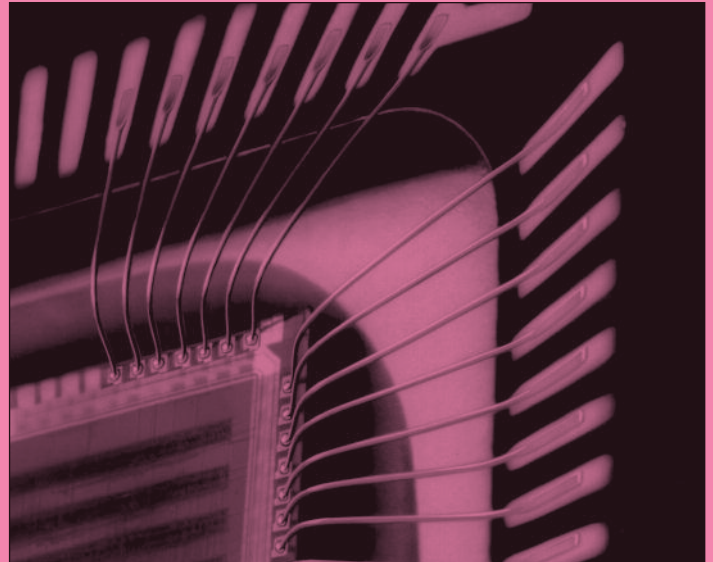
Rautomead has supplied many continuous casting machines to manufacturing companies within the precious metals industry worldwide, for the production of: gold and silver coins, jewellery, dental alloys, electronic solder materials, sputtering targets and gold bonding wire. All Rautomead casting machines for precious metals processing feature a graphite crucible and electric resistance heating technology.

## Specially adapted technology

For the processing of high purity gold to make wire rod for subsequent drawing to fine (bonding) wire, a specially adapted and enhanced version of Rautomead's renowned RMJ model casting machine is required.

Those special features include: high purity graphite crucible, a furnace lid assembly that can be closed and sealed, inert gas supply to cover the metal and protect the furnace and a withdrawal design to avoid contamination of the cast wire rod.

Rautomead have supplied several continuous casting machines for bonding wire production to the Heraeus GmbH Company and have commissioned similar machines for other customers in Korea and China.



## Horizontal continuous casting machine

The most recent Rautomead machine to be commissioned in China was a horizontal continuous casting machine for production of gold bonding wire. This new machine was installed in South China, at Guangzhou Jiabo Bonding Wires Technology Co. and is a model RMJ, rated at 30 kVA.

The machine will be used to melt and cast a single strand of 7mm diameter gold rod for subsequent drawing down to bonding wire. Special features of this machine include the use of a graphite crucible furnace with crucible capacities of either 1.1 or 2.5 litres, an argon gas feed to protect the surface of the molten gold and special neoprene-covered withdrawal rolls to avoid damage to the soft cast material.

## Rautomead gold caster

Further endorsement of Rautomead's position in the gold processing industry has been shown by signature of a contract to supply a gold bonding wire casting machine to Guangzhou Litao Science & Technology Co. of Zengcheng, Guangzhou, China. This will be the ninth Rautomead machine to have been built for gold bonding wire production. Renowned for their robust construction, which ensures many years of reliable production, several Rautomead machines are more than twenty years old and are still in daily use.



## New Sales Engineer for Central European and Middle Eastern markets

David Ormond has joined Rautomead Limited as Sales Engineer, with special focus on the Central European and Middle Eastern markets.

With considerable operational, design, management and business expertise across the light, medium and heavy manufacturing sectors, David was previously employed by Optos PLC, manufacturers of optical scanning equipment.

Guy Henderson, Rautomead Limited Sales Manager, commented, "With his considerable engineering and operational expertise, we believe that David will make a significant contribution to our international sales effort."

## Rautomead to exhibit at Interwire Expo, Cleveland, USA

*Booth 3474, I-X Center, Cleveland, Ohio – April 27 – 30 2009*

Rautomead Limited, will present a range of equipment for the casting of special alloy wire rod and large diameter non-ferrous rod at Interwire Expo 2009. The main focus of the continuous casting specialist's attendance will surround the manufacture of oxygen-free copper, copper-magnesium, copper-silver, copper-tin and copper-cadmium alloys of 0.315" - 1.18" diameters, in capacities ranging from 6.0 million to 60 million pounds-per-year. At the same time, Rautomead will present equipment for the manufacture of near net shape high quality zinc wire and brass wire rod.

## Project Finance

In providing a total solution to customers' continuous casting projects, Rautomead is now able to offer financing packages whereby the cost of the project may be funded over 3-5 years. These arrangements can be negotiated in parallel with other commercial and technical negotiations in conjunction with Rautomead's international financing partner and can apply to the purchase of a single machine, or to a substantially larger turnkey project, of which continuous casting is only one stage of the process route. Financing is considered on a case-by-case basis and usually avoids the need for a bank guarantee as security.

The full range of Rautomead continuous casting technologies – complete with comprehensive specifications and literature downloads - can be viewed at [www.rautomead.com](http://www.rautomead.com)

## 2009 Diary Dates In addition to Interwire Expo, Rautomead will also be exhibiting at:

|                        |           |          |                          |
|------------------------|-----------|----------|--------------------------|
| MJSA Expo              | New York  | USA      | 8 – 10 March             |
| IWCC Technical Seminar | Barcelona | Spain    | 8 – 12 March             |
| Interwire              | Cleveland | USA      | 27 – 30 April            |
| Wire Russia            | Moscow    | Russia   | 12 – 15 May              |
| Metal                  | Kielce    | Poland   | 29 September – 1 October |
| Wire South East Asia   | Bangkok   | Thailand | 13 – 15 October          |

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