

“What’s new in technology?”

Report by the Technology Roadshow team

Introduction

How do you keep up-to-date with new technology developments? A question that we are frequently asked, “What is new?”, tells us that manufacturers do find it difficult to keep up-to-date. Well, on your behalf, our Technology Roadshow team have been roaming the major European Jewellery Fairs this year in a bid to find out what is new in both machine and materials technology. Their discoveries are the subject of this review.

This review does not claim to be comprehensive, nor does mention of any new development necessarily imply endorsement of the product or company by World Gold Council and the Roadshow team.

New Alloys and Products

Talking to all the major European alloy producers, it is very clear that, with the imminent arrival of the European Directive and associated legislation against nickel in jewellery (see the article on nickel allergy in this issue), they are all developing improved **nickel-free white golds** that do not contain large amounts of expensive palladium. Alloying with metals such as manganese, iron and germanium seems to be the common thread of development. Expect to hear announcements of new white golds over the next 12 months.

Leg.Or, Italy, announced 2 new **master alloys** for gold jewellery as additions to their current range: one is claimed to be nickel – and palladium-free for use in 9 ct white golds and the other is suitable for yellow 21 and 22 carat golds with improved hardnesses, similar to those of 18 ct gold.

A new semifinished product was shown by **C. Hafner**, Germany. It is a special mat of fibres with a random texture, called ‘**Fasermatte**’, in 18

carat yellow gold made by a patented process. The fibres are made by spin casting, laid randomly on a ceramic support and sintered together in a furnace under a reducing atmosphere. The resulting fibre mat has an uneven attractive structure that can be used by designers to make innovative jewellery.

Furnaces

A number of new developments have been exhibited. We spotted a **programmable furnace** for age hardening carat golds by **Maule**, Italy which allows close control of the heating, soaking and cooling cycles and thus optimum hardening of the charge. Atmosphere control is achieved by repeated evacuation and flushing with nitrogen.

An interesting development by **IECO**, Italy, sees the return of annealing gold alloys in a **salt bath**. Different salts allow annealing at temperatures up to 700°C in crucibles 400 or 500 mm dia., allowing charge weights of up to 30 kg in the form of sheet or coils of strip or wire. Automatic loading of the charge into the molten salt gives rapid attainment of the annealing temperature, constant throughout the work, and is followed by automatic unloading and quenching into water within 20-30 secs. A thin coating of salt on the gold as it emerges from the bath prevents oxidation and is dissolved off in the quench water. Shorter processing times are claimed compared to conventional annealing furnaces. Safety features avoid the chance of water getting into the molten salt or salt splashing or being ejected from the bath.

A new **belt furnace** by **Bertoncello**, Italy, has the belt supported by a special steel plate, thereby avoiding contact between the belt and base of the furnace

chamber, which, in turn, avoids cooling of the furnace base by the moving belt and consequent distortion of the chamber. This allows faster belt speeds with up to 20% greater throughput and longer furnace chamber lives.

Control of furnace emissions during combustion of burnable wastes such as sweepings, papers, waste cloth, filters and polishing wheels, etc is an important aspect in preventing atmospheric pollution for which legislation is becoming increasingly severe. A new small, resistance heated **incinerator** made by **Ciroidi** was shown by **FIOA**, Italy, with a working volume of 20 litres. With fully automatic operation, it is suitable for treating a wide range of burnable waste materials. The fume is scrubbed before release to the atmosphere and the equipment meets all EC environmental regulations.

Burn-out ovens for investment casting are described below.

Equipment

There is a continuing evolution and improvement in machinery for jewellery manufacture. For example, a new **automatic chain welding machine, model S2/V**, for curb and cable chain was exhibited by **Sisma**, Italy. This incorporates a new electronic control system and a number of design improvements which leads to faster welding speeds and the ability to run the machine unattended for longer times.

Pirotechnia, Italy, have a new **diffusion bonding hot press** suitable for joining copper or iron sheet to carat gold as the first stage in making hollow products, for bonding copper or brass to gold to make rolled gold or for joining gold solder to gold sheet to make solder flush strip for stamping. The metals are hot

pressed between two stainless steel platens with a working area of 30-50 cm length by 8 cm width. The furnace, when working with copper and copper alloys, operates at 600-650°C as against the 800°C or more of similar plants. In this way, there is better control of the diffusion and the thickness of the final product is very constant, with reduced scrap.

The manufacture of gold wire rope (or cable) is seeing increasing application for jewellery and a number of rope-making machines are commercially available. One that caught our eye was the **Omega cable machine** by *Lorenzato*, Italy. This automatic machine, which is electronically controlled and relatively compact, makes the cable vertically using a system of 12 wire spools to create a rope of 7 or 19 wires, which is then coiled automatically.

The machining and diamond cutting of jewellery, chain and watchcases is also becoming more sophisticated with developments in machines and computer control (CNC) to provide more rapid, flexible and accurate working in 5 or more axes. For example, *Faimond*, Italy, was exhibiting its new **WT Evolution machine** for automatic CNC diamond cutting of chains and *Posalux*, Switzerland showed their range of machining centres with up to 9 axes including their **FCT-2000-7CNC** universal programmable 7 axes machine.

CAD/CAM and Rapid Prototyping technologies are also seeing increasing application in the industry for new jewellery design and tooling, leading to more rapid product development. A new **Rapid Modelling technology** for jewellery is the **Meiko LC-510 system**, by *Meiko*, Japan, shown by *Mikron Research*, Italy. This rapid system produces 3-D models to a high degree of precision and is compatible with lost wax casting, enabling the rubber moulds to be produced directly from the model.

Analysis and Assay

It is encouraging to see several companies exhibiting compact, self contained equipment for assaying and analysing carat gold materials and jewellery. For in-house quality

control in manufacturing, X-ray fluorescence is a non-destructive technique that finds increasing application as it is rapid, relatively accurate and affordable. Instruments are available from several manufacturers that are tailored to meet the specific needs of the jewellery industry. A newcomer to the jewellery scene was the **XRF instrument** by *CMI*, USA, shown by *FOV*, Italy, which is available with a range of measuring tables; the software can print out almost instant assay reports automatically.

Investment Casting

The propensity to defect formation, especially gas porosity, in investment casting is determined in large part by the thermal instability of the gypsum-based investment mould. This typically limits the maximum burn-out temperature to 750°C and the casting of alloys with high melting points, such a palladium white golds often require use of more expensive investments such as the phosphate bonded types. A new gypsum-based **investment powder, Gold Star Ultima**, was launched this year by *Hoben International*, UK, which allows higher burn-out temperatures up to 850°C and is capable of withstanding higher alloy casting temperature up to 1300°C, making it suitable for palladium white golds. Hoben also have a new **investment vacuum mixer, the Maxivac 35**.

Investment casting is a complex process comprising many stages, each of which must be carried out correctly, if quality castings are to be obtained. Production of waxes is an early part of the casting process and there continues to be newcomers to the vacuum wax injector market and evolutionary advances in the technology. A newcomer to the European market is the Japanese company, *Tanabe Kenden Co* with their type **TIW 209 wax injector**, marketed by *Mikron Research*, Italy. This has separate control of wax pot and injection nozzle temperature as well as an optional autoclamp facility.

An advanced new **wax injector, the Intellijector**, by *Memco Inc*, USA features computer control and a true vacuum wax injection which it is claimed enable improved accuracy

and repeatability. The rubber moulds are contained in special mould clamp chambers in which a real vacuum is produced prior to wax injection, eliminating air bubbles in the wax. The computer control enables the optimum settings for each rubber mould to be computed and stored.

There are few new developments in the field of investment casting equipment, although the overwhelming trend is to static vacuum technology. Some factories are completing their range by adding more models of static 'pressure over vacuum' casting machines. For example, **Neutec**, USA, has two new machines of this type, **the J-z and J-zP tabletop induction heated casters** capable of casting 15 flasks per hour and incorporating many advanced features of its larger machines. A lower cost, non automatic machine, the **J-2 tabletop model** is also relatively new. The Japanese company, **Yasui**, also has a less expensive **manually operated casting K2 machine**. The Italian company, **Aseg Galloni**, has improved its static vacuum machine, **model PCM**, in terms of process monitoring and control and has a new 'broken arm' **centrifugal caster, model Fusus New**, with induction melting and computerised vacuum controls. Designed for platinum, this gives good results also for gold alloys, because it enables casting under inert atmosphere.

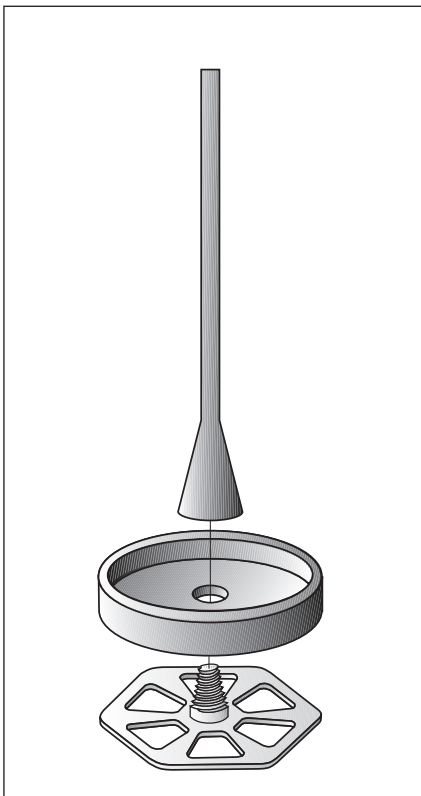
also reduces the total metal required for casting as it has less volume than the conventional cone shaped button of the traditional rubber base. Tree assembly should also be easier.

In the field of **burn-out ovens**, there are some interesting developments aimed at ensuring good temperature distribution and uniformity. This is achieved by forced air circulation ovens, with improved heat insulation and a refractory steel shield interposed between heating elements and the flasks. A fan in the oven roof forces air from the chamber over the heating elements and back into the chamber at the bottom. The German company, **Schultheiss**, has ovens of this type. The Italian company, **Promec**, makes similar ovens, made-to-measure with advanced features and a simpler type of oven is made by **Hispana** of Spain. It is interesting to note that both these latter 2 companies specialise in heat treatment furnaces for the steel industry. These are good examples of transferring technology from the more advanced industries into the jewellery industry which we see more frequently in these times.



The Neutec J-z machine

An interesting new development is a **new central sprue system, 'Neusprue'**, by **Neutec**, USA (see Figure) which includes the 'button' in a carefully engineered design. Designed by finite element analysis, this sprue system has two claimed advantages: (i) its shape minimises metal turbulence during casting, reducing defects and (ii) the shape



Neusprue system by Neutec



Neusprue system during tree assembly

Finishing

There are an increasing number of equipment companies entering the finishing machine market with their versions of established technologies, such as tumblers, vibratory, centrifugal disc and magnetic machines. A variation on the theme, not so new but one that I had not previously seen, is the **Drag Finishing machine, series DF** from **Otec Präzisionsfinish**, Germany which, it is claimed, overcomes the difficulties of polishing the inside surfaces of jewellery such as rings and eliminates the need for final manual polishing. In this approach, the items being polished are rotated in a double axis motion and dragged through a stationary container containing the media. The process involves the use of special frames to hold the jewellery stationary in the moving mass of media, an approach which was started many years ago by **Manfrid Dreher**, Germany and is now being evaluated by several finishing companies. This drag technique can give very good results, similar to hand polishing, but offering the high consistency typical of mass finishing.

Improvements to existing equipment continue and include use of new materials. In the case of 'turbo' barrels, a weak point can be the gap between barrel wall and the rotating disc, which can widen due to frictional heat in operation. The Italian company, **MetalFinishing**, have developed use of low expansion plastics and the German company, **Otec**, has built equipment with contacting parts on both sides of the gap made in ceramic materials. Gap tolerances are very tight and the danger of leakage of abrasive media, which can damage the gap and impair the drive motor, is effectively eliminated.

Editor's Note: We plan to review new technology developments on a regular basis. If you have something new in jewellery manufacturing technology, then why not tell us about it? Write to the Editor, Gold Technology, World Gold Council, Kings House, 10 Haymarket, London SW1Y 4BP, U.K., Fax: +44 20 7839 6561.