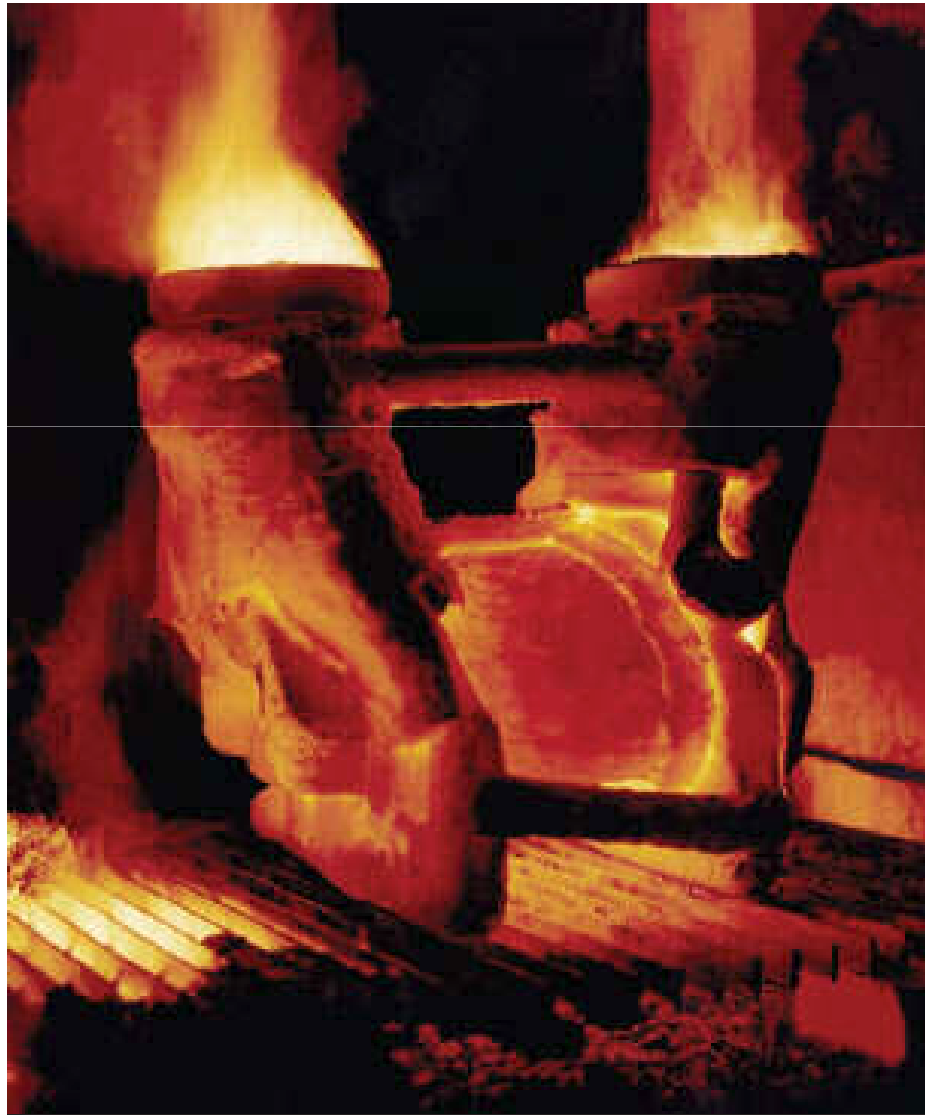


Investment Casting

The Lost Wax Process



Blayson



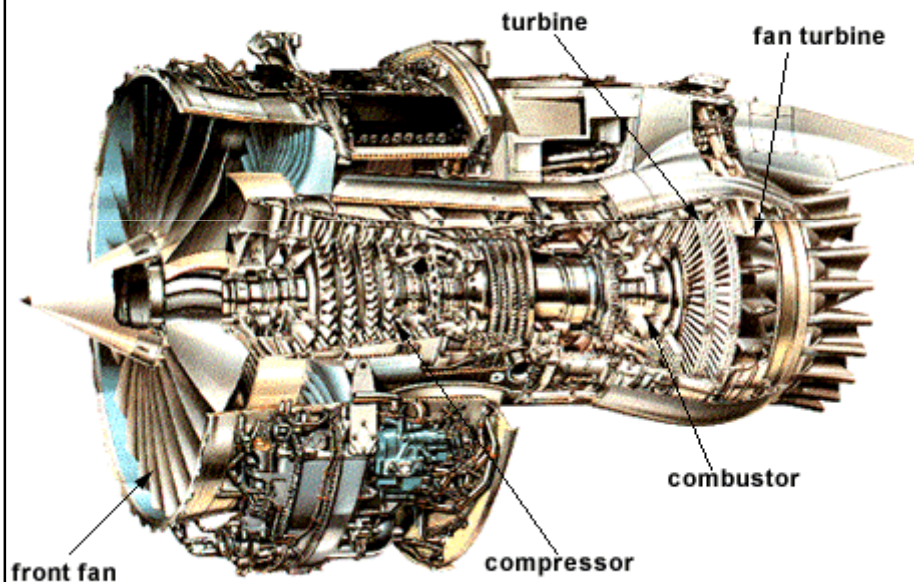
The 'Lost Wax' Process

- Archaeological evidence suggests the origin of modern “Investment Casting”, formerly known as the “Lost Wax Process”, dates to around 4000 BC
- The origins are believed to be in N Africa, M East & Asia. The cup shown depicts the process
- Clay was used for moulds to produce Jewellery and Statues in Gold and Bronze alloys. The picture shows lost wax castings found in the tomb of Tutankhamun



Ancient Egyptian investment castings from the tomb of Tut-Ankh-Amun.

Demands of Industry



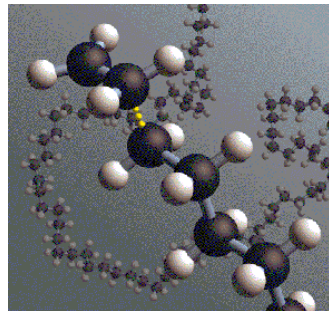
- 20th century saw the commercial development of the process in the dental industry
- WW2 necessitated the mass production of near finished components, which led to the major industrial development of the process
- Modern industrial manufacture demands ever more sophisticated castings, only achievable through investment casting
- Today the lost wax process influences and benefits everyone's daily life

Wax - Key to the Process



- Wax is the oldest thermoplastic material known to man
 - softens with heat allowing it to be easily shaped
- Originally Patterns were made from various natural materials
 - bees wax
 - tallow
 - resin
 - tar
- Today the name 'wax' applies to any substance having wax-like properties
 - more accurately described as an industrial moulding compound
- If the pattern is wrong, the casting will be wrong - it follows that the choice of wax is critical

Modern Wax

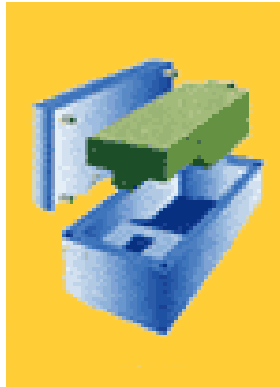


- To meet the demands of modern manufacture complex compounds are required and are formulated using a wide variety of raw materials
 - Paraffin and Microcrystalline wax
 - Hard Wax
 - Resins
 - Polymers
- Many variations are formulated to suit differing requirements
- Key properties such as melting point, hardness, viscosity, expansion and contraction, setting rate, etc are all influenced by the structure and composition of the wax compound

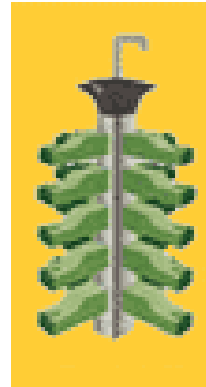
Investment Casting – the Process

- The process uses metal moulds to produce expendable wax-based patterns of the part to be cast
 - can be extremely complex and may incorporate cavities
- The patterns are mounted and 'invested' (coated) with a ceramic material by building up successive layers of 'sand' and liquid binder until a suitable 'shell' is formed
- The wax is removed from the shell using high pressure steam
- The shell is fired in a furnace to 1000°C resulting in a precision mould into which the molten metal can be poured
- After cooling, the mould is broken open, the casting is removed and is then finished

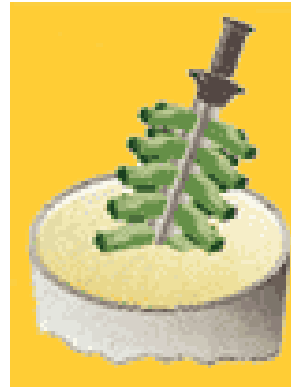
Process Schematic



Wax injected into metal die to make wax pattern



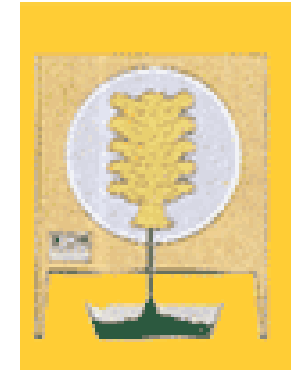
Patterns assembled onto runner bars



Dipping the assembly into a ceramic slurry



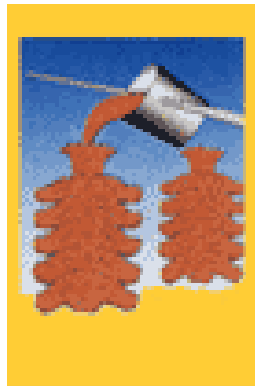
Building the shell with layers of ceramic particles



Dewaxing with high pressure steam



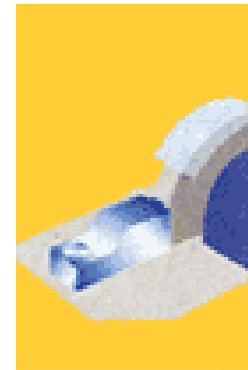
Firing the shell



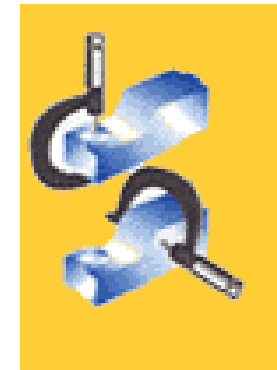
Casting – pouring the molten metal



Removing the ceramic shell



Finishing the cast piece



Inspection of the finished casting

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Courtesy of European Investment Casters' Federation

Why Use Investment Castings?

- Investment casting occupies a key position in the range of industrial foundry processes
 - it offers a distinctive method for the production of accurate, high quality castings
 - UKTI describes it as “the jewel in the crown of the UK foundry industry”
- A flexible process
 - suitable for limited production runs especially via rapid prototyping
 - at the same time ideal for mass production
- Consistently produces accurate near finished castings with little waste
- Can use a wide range of metals and alloys
- Offers unlimited design flexibility for external and internal configurations

Served Industries

Communication

Marine

Power Generation

Aerospace

Construction

Medical

Shipping

Electronics

Sport & Leisure

Defence



Investment Castings Benefit Everyone



- Automotive industry – cars, trucks, motorbikes
 - from turbowheels to the ‘Flying Lady’; including racing (esp. F1)
- Dental - bridges & crowns
- Aeronautics – engines & airframe
- Electronics - casings
- Energy generation
- Farming equipment
- Food processing
- Space
- Microwaves



- Defence – guns to missiles
- Leisure – golf, marine fittings, brewery equipment
- Jewellery
- Medical – surgical implements, prostheses
- Pumps, valves
- Petrochemical plant
- Textile machinery
- Etc.



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Summary

- The ancient Lost Wax Process is more relevant today than ever
- Investment Castings touch and influence all our lives and lifestyles
- Without them the modern world would not be the same
- Wax is the key material