# A Simple Guide to Aluminium Casting

by Graham Robertshaw

# Castings through the ages

## Key milestones in metal casting

- Although it is difficult to establish when casting first began, archaeologists have unearthed vital clues from the Middle East dating back **5000 years**.
- **3200 B.C.** A copper frog, the oldest known casting in existence, is made in Mesopotamia. Copper was a popular material for metal working due to its high ductility (The ability to bend).
- **3000 B.C.** The Bronze Age starts in the Near East. Bronze alloys are used in casting, offering key benefits such as low weight and a low melting point. Bronze tools and weapons are cast in permanent stone moulds at this time.
- **3000-2500 B.C.** Early use of investment (lost wax) casting of ornaments and jewellery. Artefacts from this period have been unearthed in various regions, including the Near East.
- **1971 A.D.** Graham Robertshaw joins the foundry industry

- Most cast artefacts found today are ‘GIFTS  to the gods’

- Many are found as ritual gifts in burial grounds or rivers.

- It is evident that one of the main casting method was gravity die but using carved stone instead of metal as we use today

# The first Major Cast Iron Construction

## Ironbridge Telford. The birthplace to the Industrial Revolution

Dovetail with peg

Mortice & Tennon joint

## In the vicinity there is a living museum with a foundry

# Aluminium today

- The aluminium used in most commercial foundries is ‘secondary’, meaning it is made from recycled materials. (Not Primary)
- Aluminium has developed into many different alloys for different applications.
- The most commonly used alloys:

  LM2, LM4 & LM27 are commonly used alloys for general engineering

  LM6 is used for components requiring ductility

  LM25 is normally heat treated to give excellent mechanical properties and this alloy is the **most commonly used in the automotive industry**.

# Melting aluminium


- Most foundries use certified ingots plus the returns from runners & feeders
- Mainly in gas fired crucible furnaces, however, electrical furnaces are also used.
- Modern furnaces are recuperating furnaces saving up to 30% gas
- Melting temp of Al is approx 600°C. Casting aluminium is generally 720 - 760°C

# Sand & Gravity Die casting

Air-Set Sand

Gravity Die

Permanant Mold

# To sum up - The Casting Process

1) Make the pattern/die.
2) Make a sand mould or prepare the die.
3) Melt the metal.
4) De-gas the metal otherwise hydrogen pin hole porosity – nitrogen.
5) Additives – modification alloys or grain refining.
6) Let the metal sit in the furnace until the casting temperature.
7) Pour the metal into the mould/die.
8) Ensure the area is free of standing water – chance of explosion- expands x 1700
9) Ensure the molten metal fills the cavity.
10) Top up feeders with hot metal to get directional solidification.
11) As the metal starts to solidify, molecules attach themselves to substrates forming clusters and grow into 'grains'.
12) Once cooled the mould is broken down and the casting removed for fettling & finishing

# Thank you for listening

# Your questions please

# Now it's my Question Time!

1. Approximately, how long ago were the first castings made.
2. What does a casting have in common with an apple.
3. What is the more apt name the Americans use for a Gravity Die.
4. What is the most common solid element on earth.
5. Which is the most common aluminium alloy used in automotive production.
6. Which famous London statue is cast Aluminium.
7. What is the name given to recycled aluminium alloy.
8. What is the name of the stick of aluminium used when melting in a furnace.
9. What is the approximate casting temperature for aluminium.
10. What is the most common metal on earth.