Auto components Manufacturing

Unit I

Engine Components

ENGINE COMPONENTS

- **Engine Block**

Engine Blocks (Cylinder Blocks) are **the large casings that contain the Cylinder and its internal components, intake and exhaust passages, coolant passages, crankcases, and other internal** components.

Cylinder Block

- **Parts of Cylinder Block**

A typical cylinder block will include

cylinder walls,

coolant passages and

cylinder sleeves.

https://youtu.be/hJkwUVSpNPw

Manufacturing of Engine Blocks

- Manufacturing of engine blocks are **mainly done using sand casting**, although die casting also used it is more cost effective as the die wear out easily due to the high temperature of the molten metal. The casted engine block is then machined to get the surface finish and coolant passages.

Manufacturing of Engine Blocks

- Sand casting is quicker than using plaster, and it is used for engine blocks and other parts that **do not need a refined surface**. The sand is prepared and the metal is poured. Then, the engine blocks cools before it can be machined

Purpose of Engine Block

- The purpose of the engine block is **to support the components of the engine**.
- Additionally, the engine block transfers heat from friction to the atmosphere and engine coolant.
- The material selected for the engine block is either grey cast iron or aluminium alloy.

Components of an Engine Block

- **Cylinders**. These are the spaces where pistons travel. ...
- **Oil Passages** or Galleries. These allow oil to reach the cylinder head and the crankshaft.
- **Deck**. This is the top surface of the block where the head of the cylinder sits.
- **Crankcase**.

Sand Casting of Engine blocks

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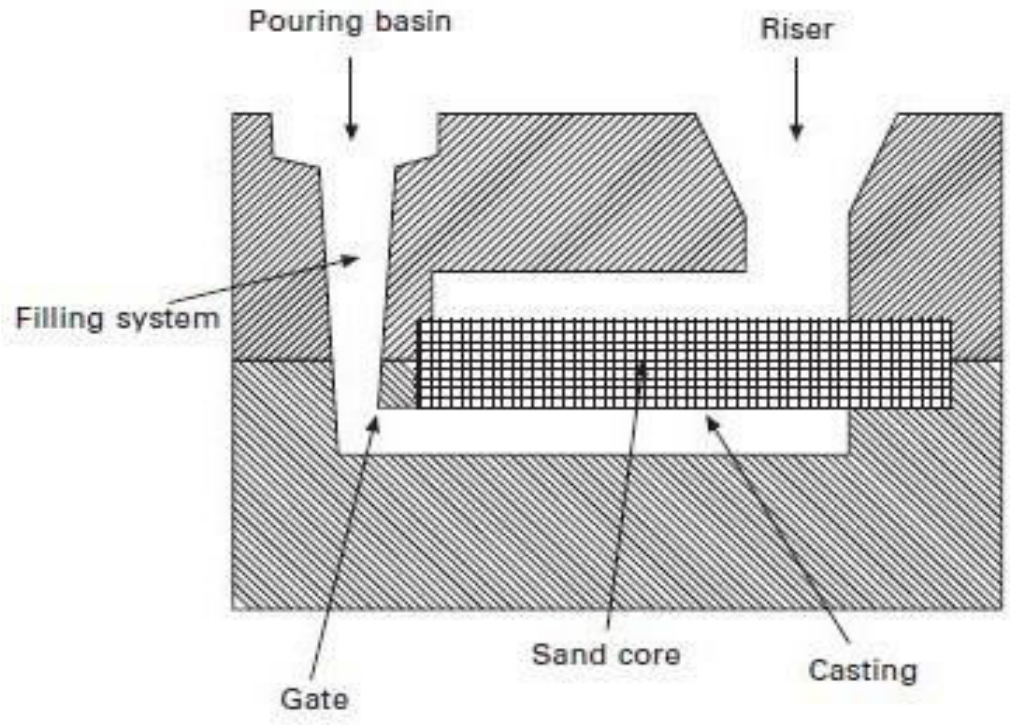
Sand Casting of Engine blocks

- The iron used for this block is the gray cast iron having a pearlite-microstructure.
- Sand casting is the method widely used in the production of cast iron blocks. This involves making the mould for the cast iron block with sand.
- Molten metal is poured immediately into the mold, giving this process very high productivity. After solidification, the mold is destroyed and the inner sand is shaken out of the block. The sand is then reusable

Sand Casting of Engine blocks

Figure shows a schematic view of a sand mold used to shape a tube. This mold includes a sand core to make the tube hollow. The casting obtained from using this mold shown in figure. Usually, molten metal in a ladle is gently poured into the cavity under the force of gravity using a filling system



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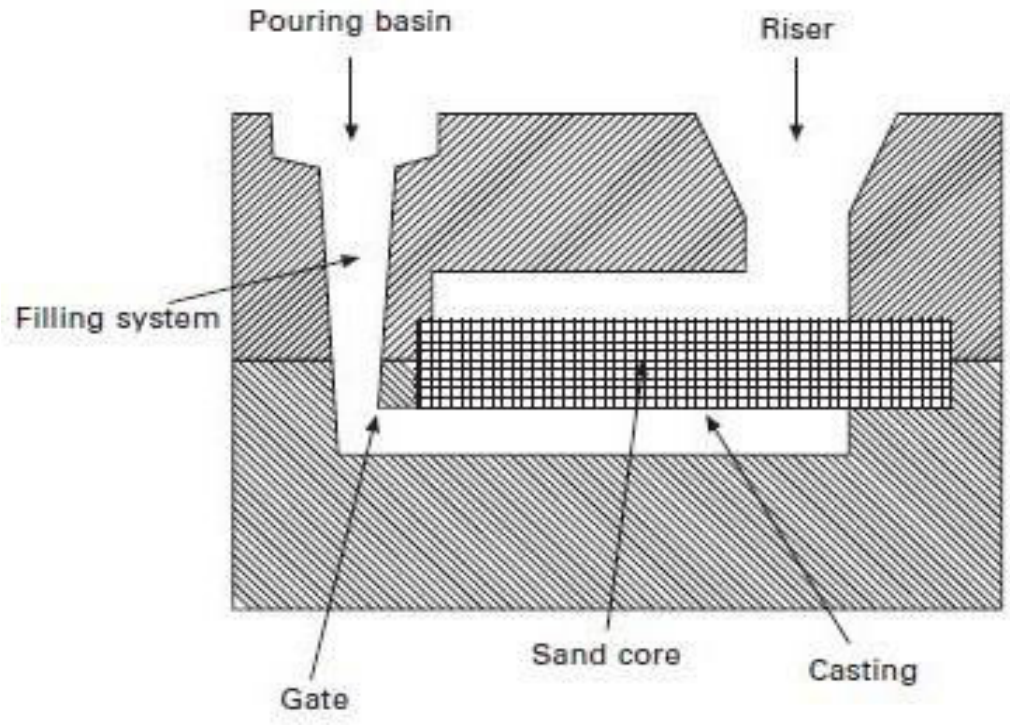
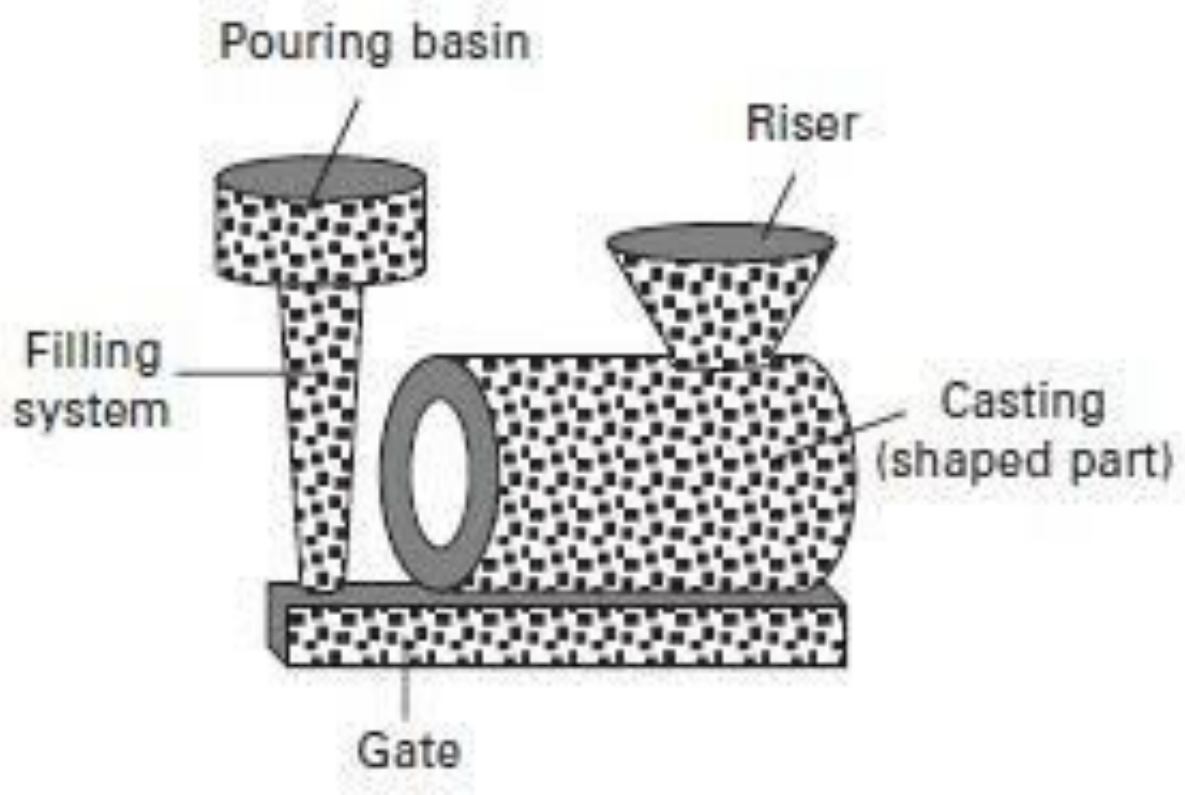


Sand Casting of Engine blocks

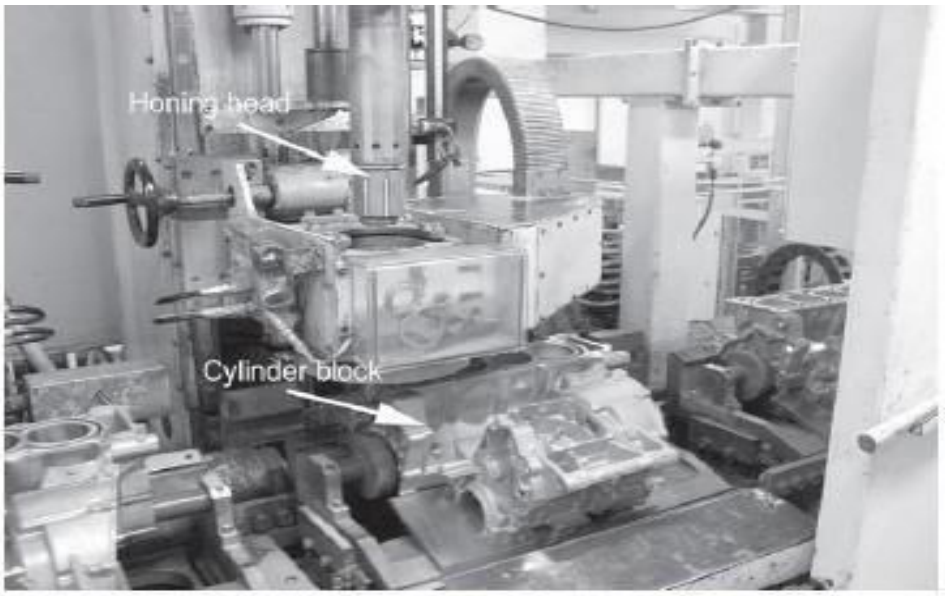
- The sand core forming an inside hollow shape is made from a dry sand component. The bore as well as the coolant passages in the cylinder block is shaped as cored holes.

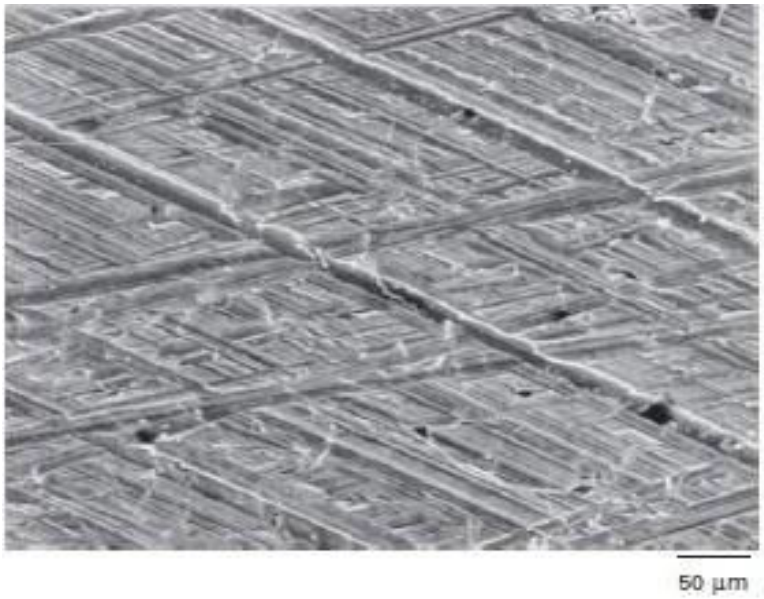


Honing Process

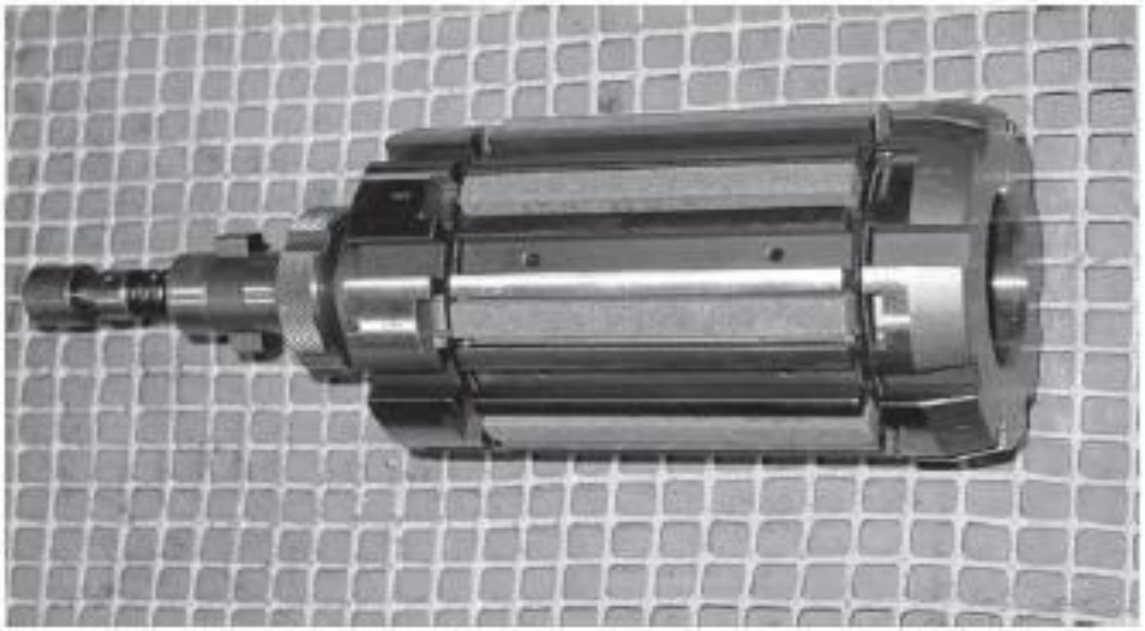
A finishing process called **honing** is used to give accurate roundness and straightness to the cylinder bore. The whetstone grinds the bore by exerting an expanding pressure. The vertical motion of the head together with revolution generates the crosshatch pattern and the profile of the crosshatch pattern is determined by the sharpness of the whetstone

The figure in figure shows a micrograph of a honed cylinder surface. The honing whetstone carved the crosshatch pattern. The grooves of the crosshatch hold the lubricating oil during engine operation.



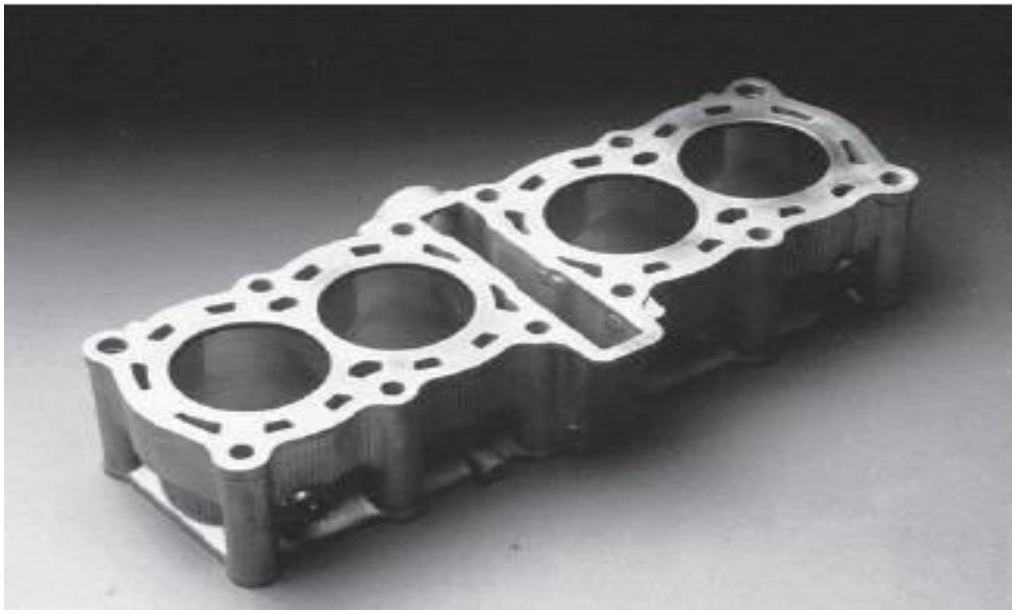


Honing Tool Head

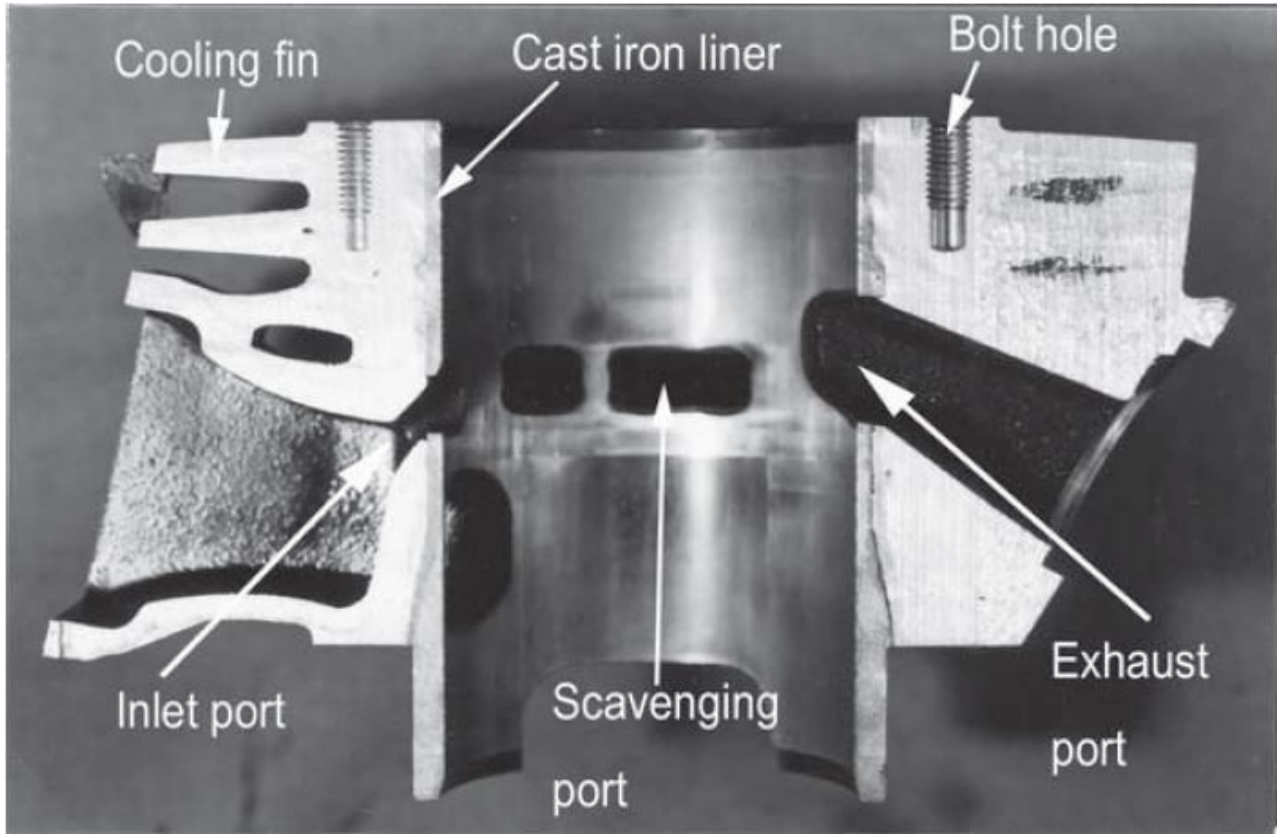


Water-Cooled Cylinder Block

- This process generates a Ni layer dispersing SiC particles. Figure shows a water- cooled cylinder block coated with this plating



Casting technologies for aluminium cylinder blocks



Crosscut view of an air-cooled two-stroke cylinder

Crank Shaft

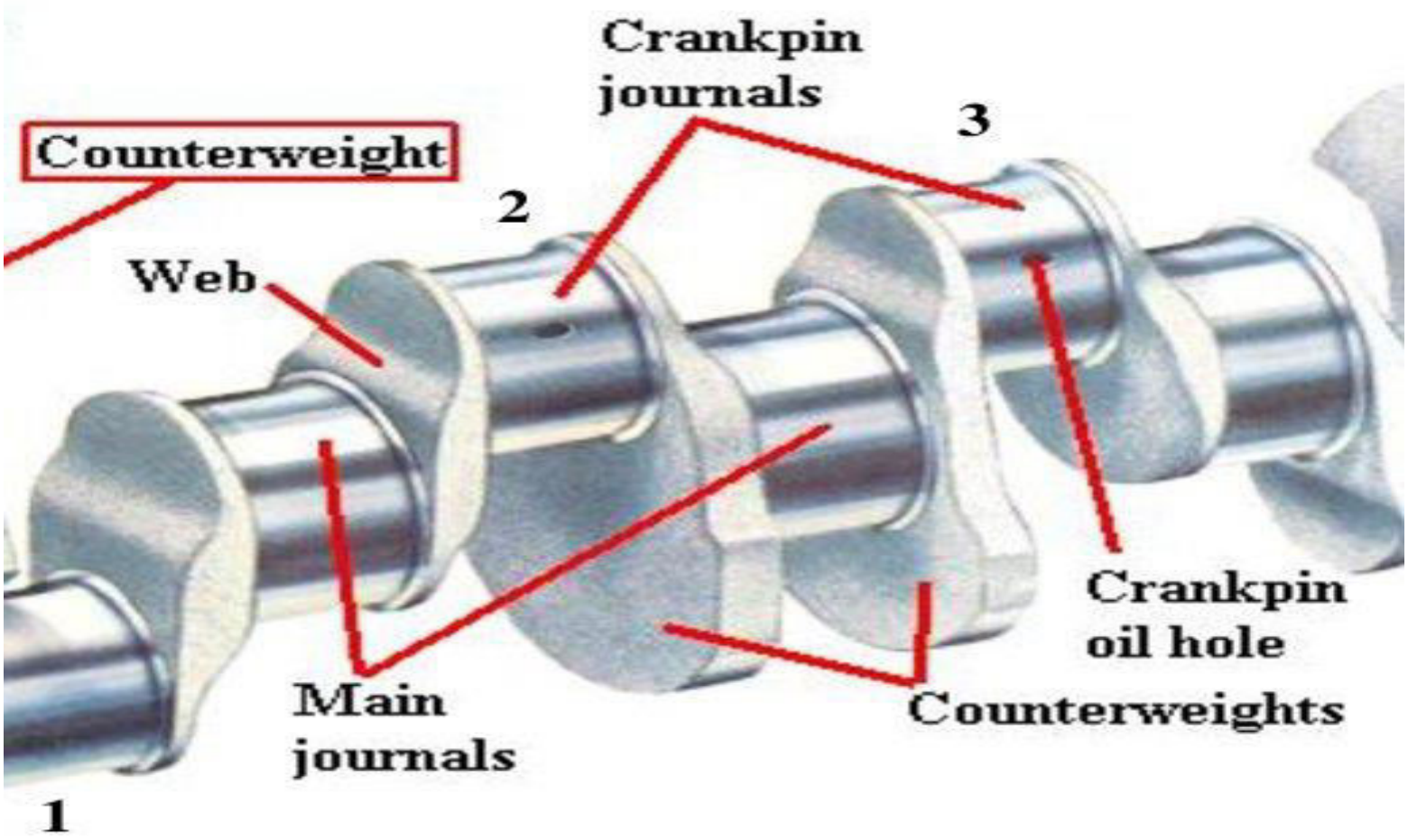
- The crankshaft is essentially the backbone of the internal combustion engine.
- The crankshaft is **responsible for the proper operation of the engine and converting a linear motion to a rotational motion**.
- A shaft consisting of a series of cranks and crankpins to which the connecting rods of an engine are attached.

Crank Shaft

Components of a crank shaft

- **A crankshaft comprises the following components:**
- Main journals.
- Crank pins.
- Crank webs.
- Counterweights.

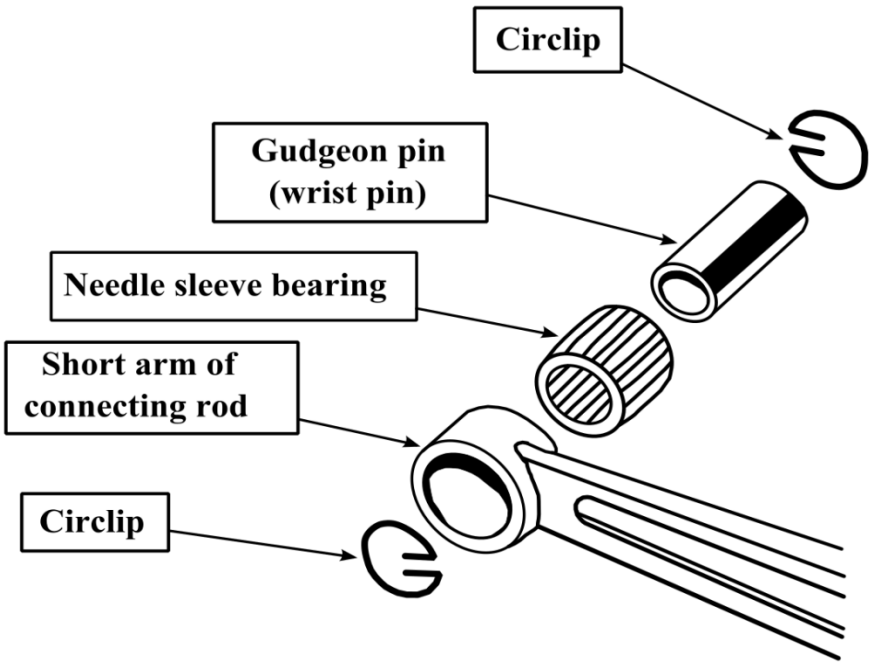
Components of a crank shaft



Crank Shaft & Pistons

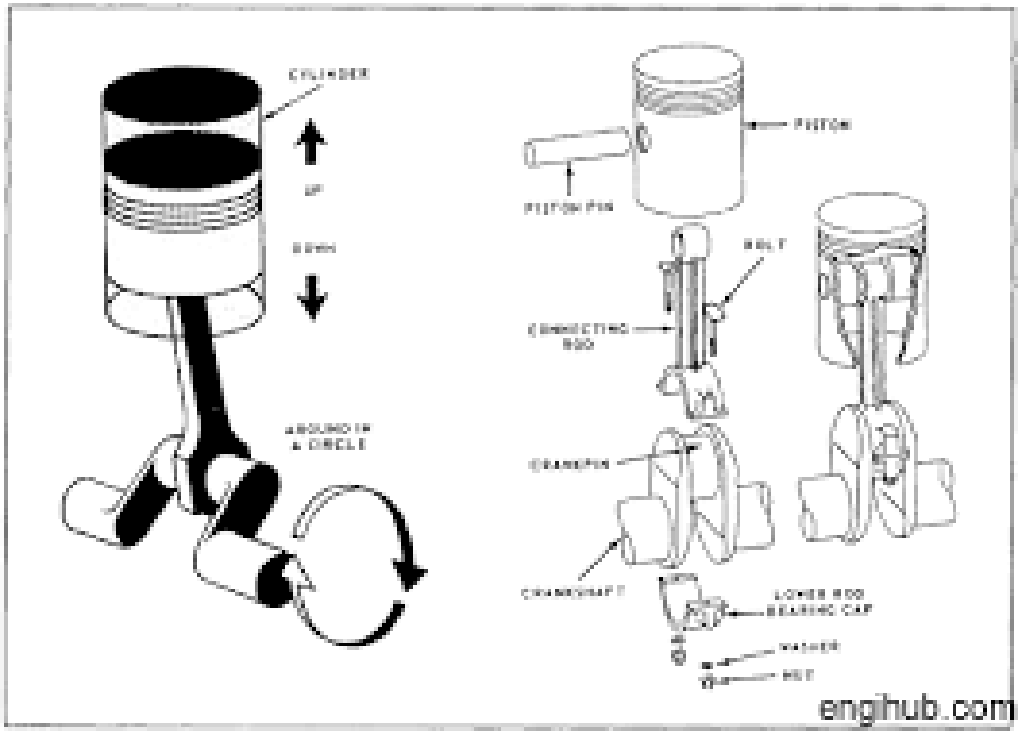
Connecting Rod & Gudgeon Pin

- In internal combustion engines, the gudgeon pin **connects the piston to the connecting rod**, and provides a bearing for the connecting rod to pivot upon as the piston moves.



Gudgeon Pin or Piston pin

- The piston pin also known as wrist pin, or gudgeon pin, provides a pivot point between the **piston and connecting rod**.



Forging

- Forging is **a manufacturing process involving the shaping of a metal through hammering, pressing, or rolling**.
- Compressive forces are delivered with a hammer or die.
- Forging is often categorized according to the temperature at which it is performed
- cold, warm, or hot forging.

Types of Forging process

- **Hot Forging.** Hot forging requires the metal to be heated above its recrystallization temperature. ...
- **Cold Forging**. ...

1. Drop Forging Process. ...
2. Press Forging Process. ...
3. Roll Forging Process. ...
4. Upset Forging Process. ...

Casting & Forging

- Casting is the process in which metal is heated in a furnace until molten. While in the liquid state, the metal is poured in a die, or mold, to create a component shape.
- Forging is the process in which thermal and mechanical energy is applied to ingots to cause the alloy to change shape while in a solid state.

Casting & Forging

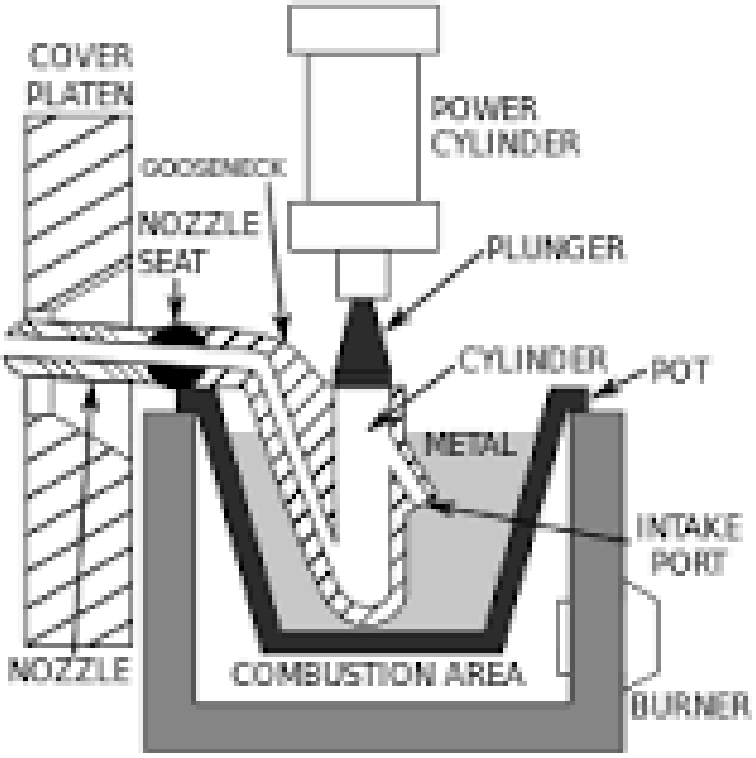
- Casting and Forging are two different manufacturing methods.
- **Casting** is when the material is heated above its melting temperature and poured into a mould where it solidifies.
- **Forging** is physically forced into shape while remaining in a solid state – although it is frequently heated.

Casting of Piston

- Gravity Casting
- Squeeze Casting
- Machining and finishing

Casting of Piston

- In the piston, or gooseneck, process the plunger and its cylinder are submerged in the molten metal, the metal being admitted through a hole in the top of the cylinder when the plunger is retracted; the advance of the plunger forces the metal into the die cavity

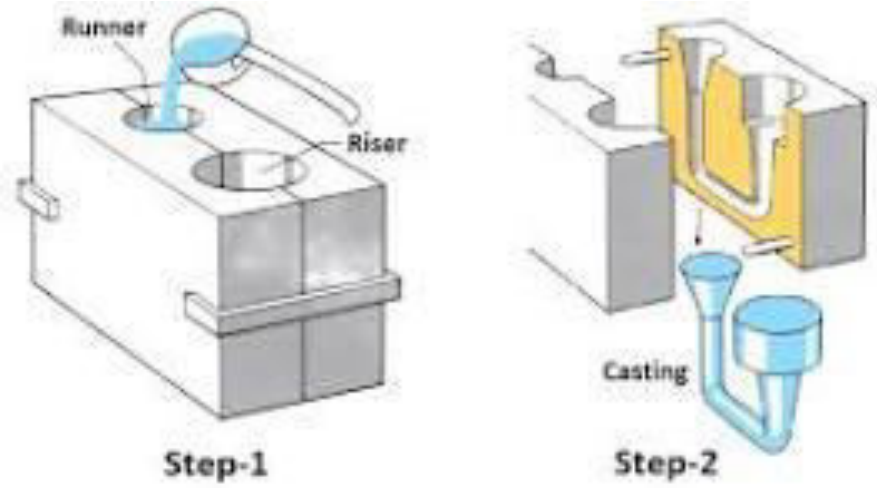


Gravity Casting

Gravity casting is the known processes for fabricating metals and metal alloys.

It **involves the pouring of molten metal from a crucible into a mould under only the force of gravity, without the use of pressurized gases, vacuums,**

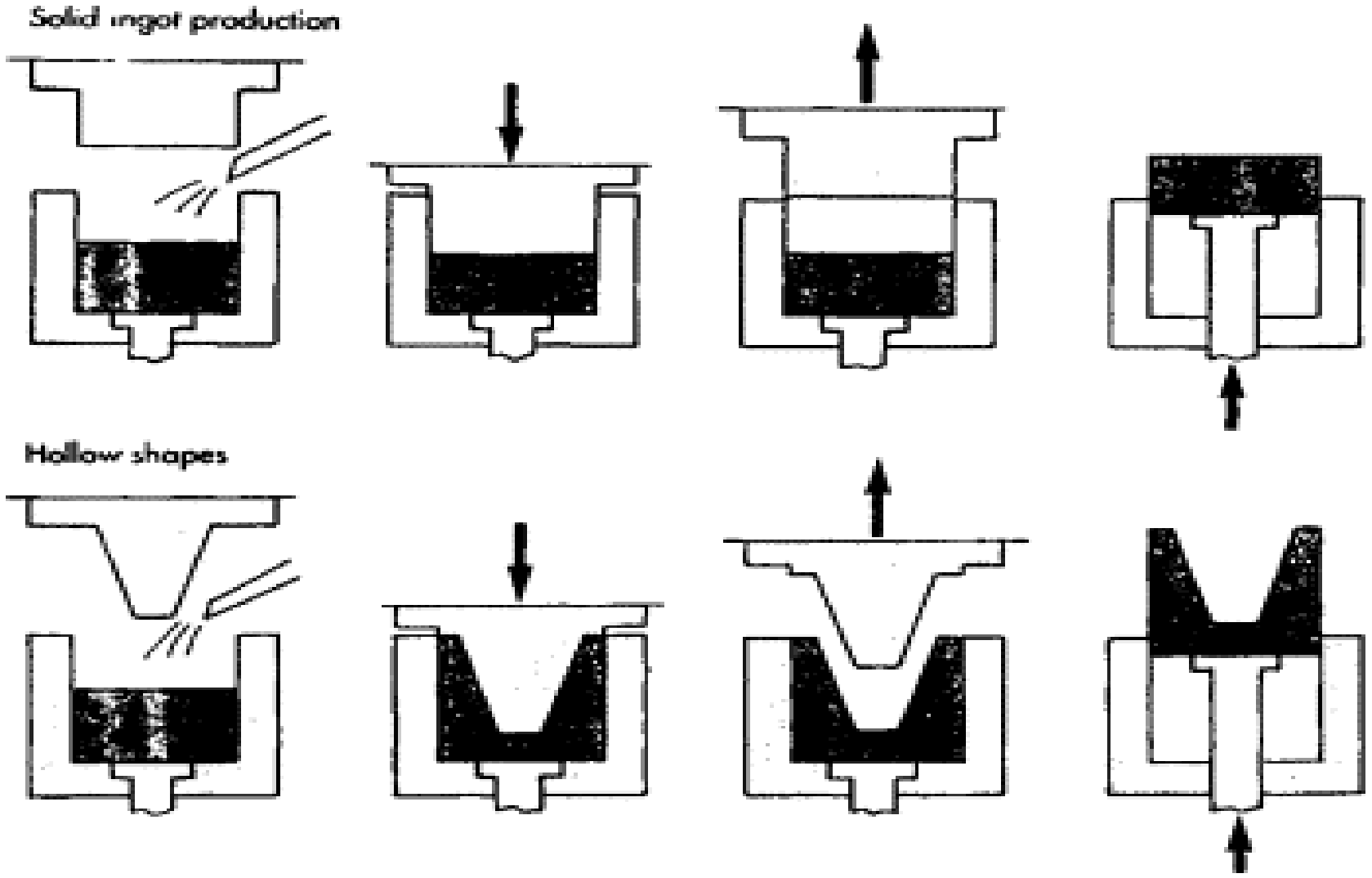
or centrifugal force



Squeeze Casting

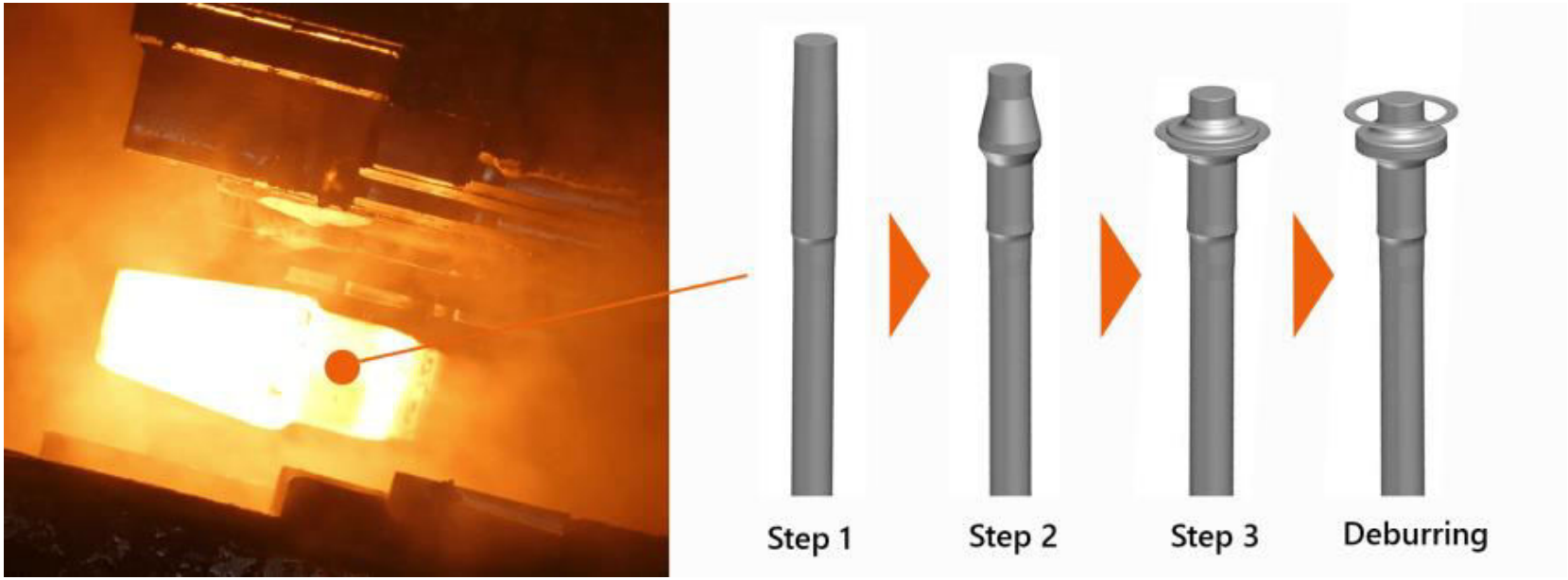
- Squeeze casting, also called liquid forging.
- It is a hybrid metal forming process that combines permanent mould casting with die forging in a single step in which a specific amount of molten metal alloy is poured into a preheated and lubricated die and subsequently forged and solidified under pressure.

Squeeze Casting



Upset forging

- Upset forging involves **locally heating a metal bar and then, while holding it firmly with special tooling, applying pressure to the end of the bar in the direction of its axis to deform it**. The process allows the production of long parts with a forged end.



Upset forging of valves

- Upset forging **increases the diameter of the workpiece by compressing its length**.
- Based on the number of pieces produced, this is the most widely used forging process.
- A few examples of common parts produced using the upset forging process are engine valves, couplings, bolts, screws, and other fasteners.

Heat treatment

- Heat treatment involves the use of heating or chilling, normally to extreme temperatures, to achieve the desired result such as hardening or softening of a material.
- Heat treatment techniques include

1. Annealing,

2. case hardening,

3. precipitation strengthening,

4. tempering, **5. carburizing,**

6. normalizing and 6. quenching.

Surface treatment

- Surface treatment is an additional process applied to the surface of a material for the purpose of adding functions such as rust and wear resistance or improving the decorative properties to enhance its appearance.

Engine bearing manufacturing

Metal bearing balls are manufactured from steel wire or rod.

During the first step in the process, the wire or rod is cut into small pieces called slugs.

The volume of material for the slug is slightly larger than that of the finished ball.

The excess material is removed in subsequent machining steps.

3 main components of a bearing

Bearings usually consist of the following components:

Two rings or discs with raceways.

Rolling elements in the form of rollers or balls.

A cage which keeps the rolling elements apart and guides them.

Bearing used in engines

- These include **ball bearings, roller bearings, ball thrust bearings, roller thrust bearings and tapered roller thrust bearings**.