

FORGING SHOP

Definition & Applications:

- Forging is a process of shaping the metal components in cold or hot condition by the application of impact or pressure but the primary difference between various forging methods is the rate which the energy is applied to the work piece.
- Forging is generally used for those components which require high strength and resistance to shock or vibration sudden impact of load and uniform properties.

Applications:

Automobiles

Chassis of all vehicles
Front and Rear axel
Wheel drums
Spring blades
Rocker arm
Gear shifter
Connecting rod

Railways

Railway wheels
Railway tracks

General

D. E. Spanners
Ring Spanner
Wrenches
Cutting Pliers
Hammers



Forging Methods:

Hand Forging

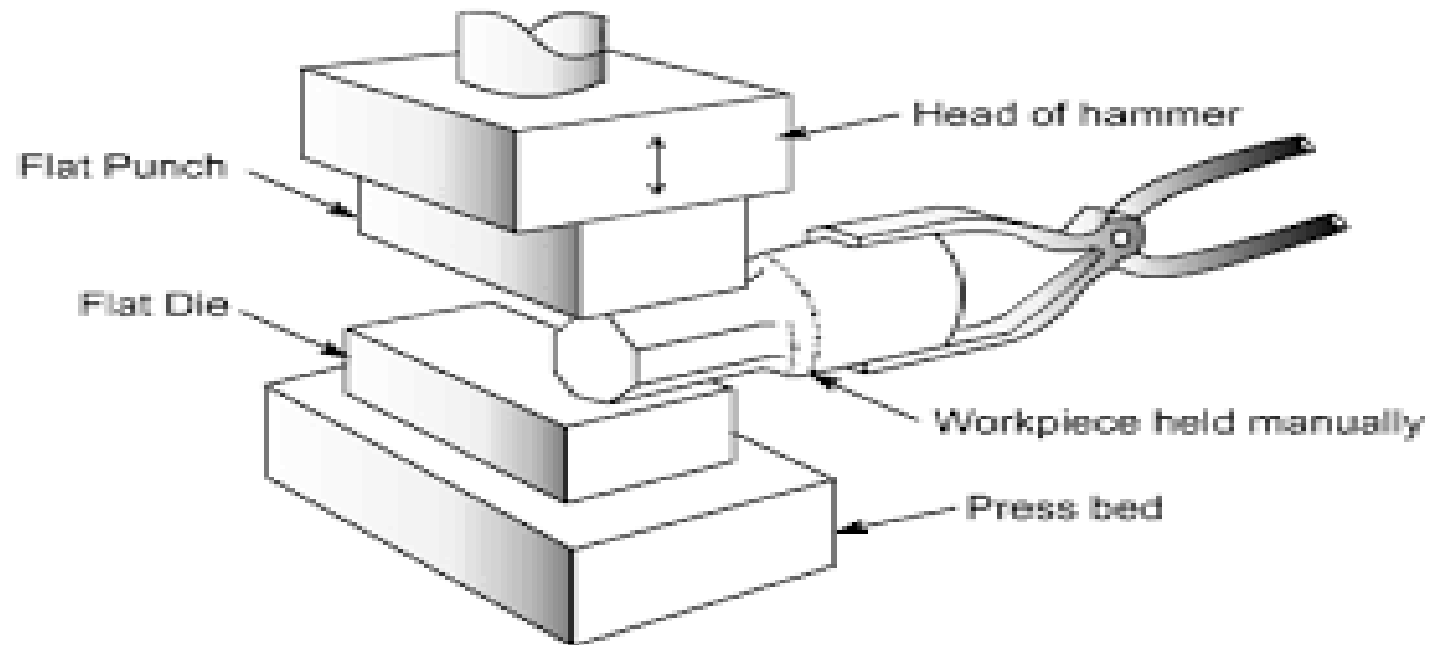
- Also known as blacksmithing and is the simplest form of forging.
- Heating the raw metal until it is plastic state in an open hearth furnace.
- Hammering is done on anvil by smith/sledge hammer with use of open face dies to get the desired shape and size by judgment of an individual.
- Hand forging provides the forged item with a superior grain flow compared to other methods. This is due to the bending of the metal as it's hot and therefore the item is much stronger and long lasting after forging.



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Drop Forging

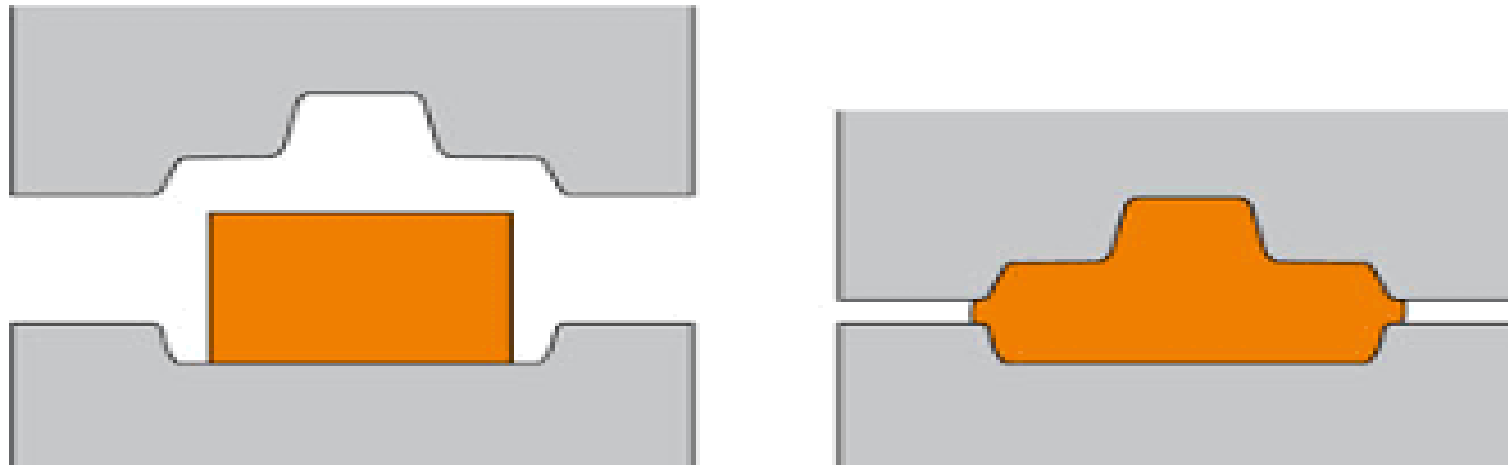
- Power hammer is dropped onto a heated piece of metal in order to shape it into the desired shape.
- This method is used to produce large number of small and medium sized forging of similar parts.



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Press forging

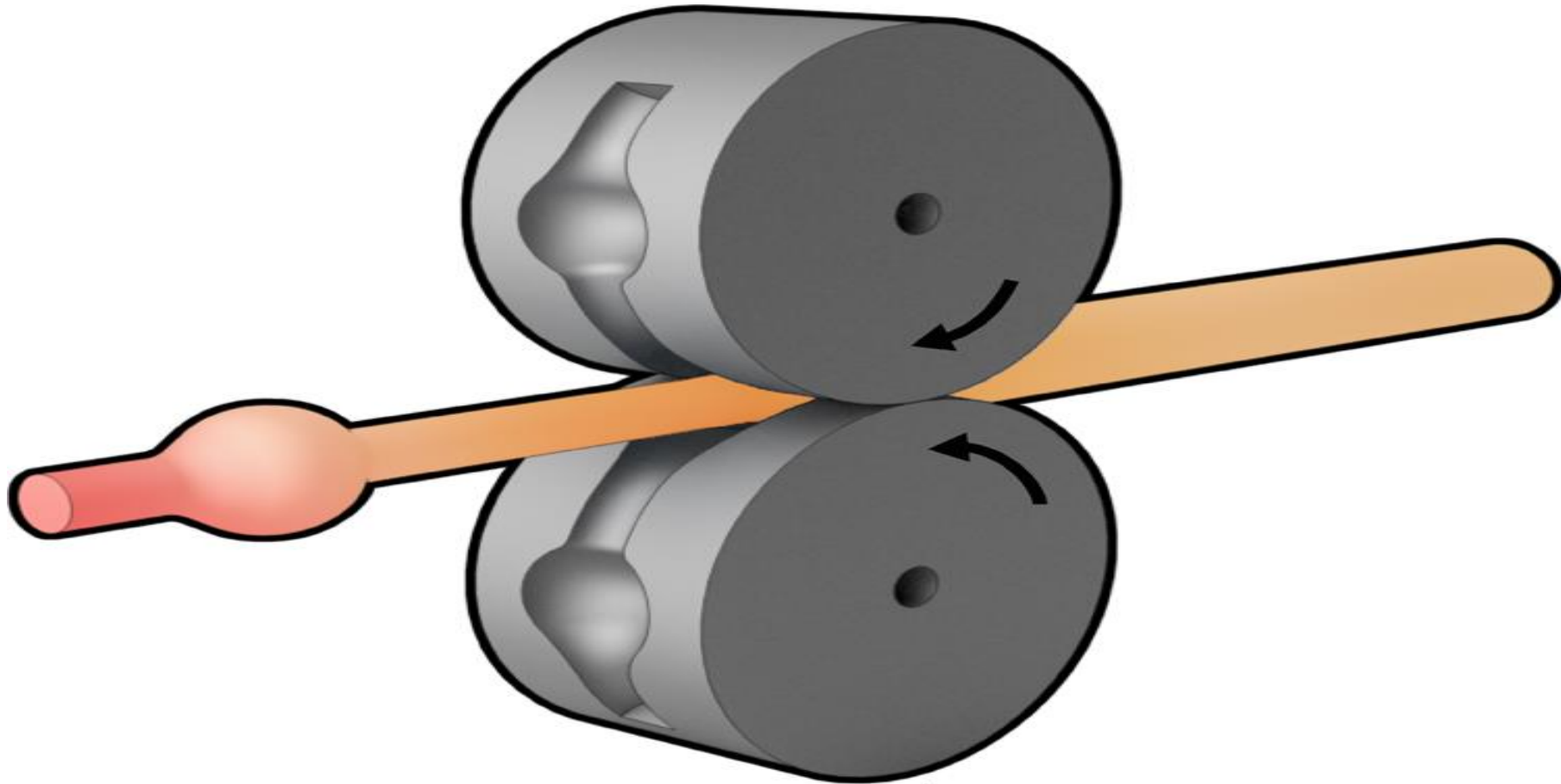
- Press forging is similar to drop forging except that it uses continuous extrusion pressure applied by a hydraulic press. This process increases the length of the workpiece and reduces the section of the workpiece.
- The key difference between drop, hand forging and press forging is that in the former method a sudden impact force is applied on the die, while the latter exerts a gradually increasing pressure on the die.
- It completes the operation in a single stroke.



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Roll Forging

- Forging process where the workpiece is fed through two specially shaped rolls to create a long product with varying cross section.



Forging Operations:

Drawing down: The operation of spreading or thinning action and is accomplished by striking the work piece with flat dies. Due to impact of die on metal its thickness is reduced and length is increased.

Upsetting: This is just opposite to drawing and involves increasing of the cross-sectional area usually by pressing or hammering in the direction parallel to the original ingot axis.

Punching: It is the process of producing hole generally cylindrical by using a hot punch over a cylindrical die.

Drifting: It is the opening out of holes previously punched.

Bending: It is one of the most important processes of forging and is very frequently used. Bends may be classified a sharp cornered bends or more gradual bends. The operation is performed by hammering the metal over the edge of the anvil or over a block of metal held in vice.

Condt:

Welding: Metal like wrought iron and steel are welded by pressing or hammering together surface after they have been raised to the correct welding temperature at 1350°C when the metal is white hot. The operation of such a type of welding is performed in forge shop. And hence is also called ***forge welding***.

Cutting (Hot and Cold Chisels): In order to perform a rapid cutting operation by chiseling, the metal is heated in black smith fire to a temperature of $850-900^{\circ}\text{C}$ and then hammer blows are directed on the chisel head. If the thickness of metal to be cut is more than two notches or grooves are made 180° apart.

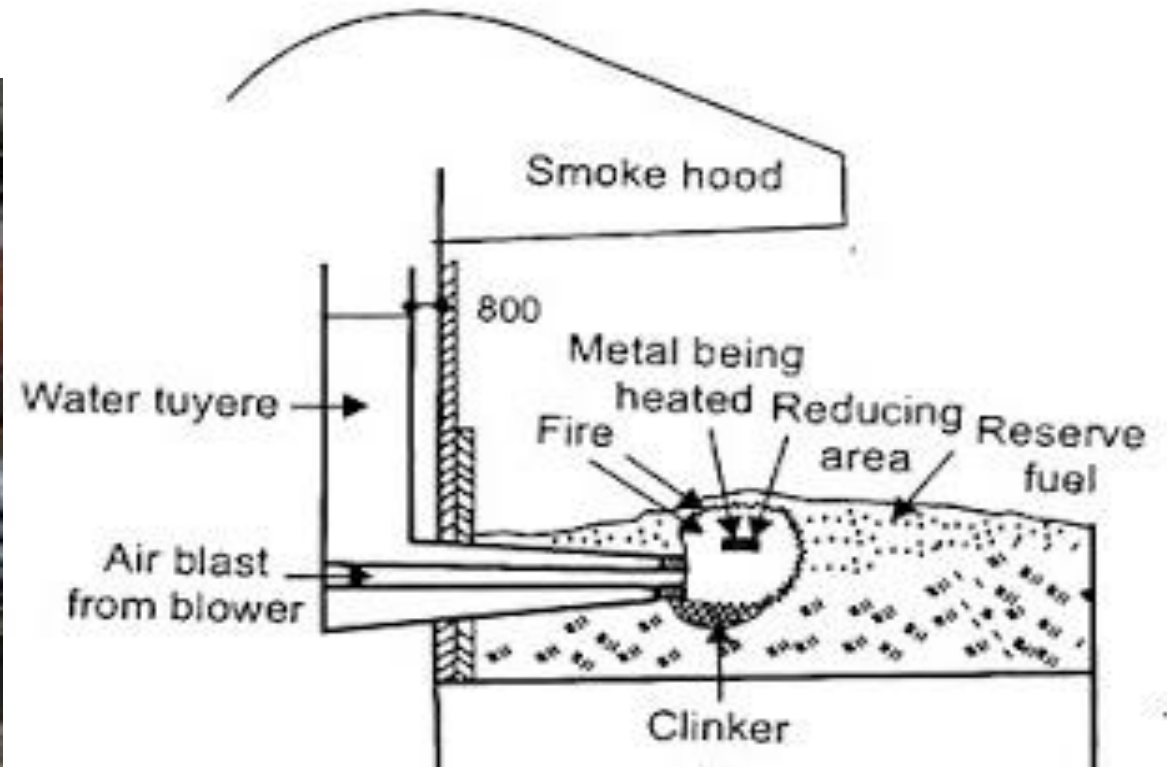
Swaging: It is a process of finishing a round or hexagonal section of bar between a pair of swages of the appropriate size. These may be separate tools for top and bottom or these may be held together by a long spring handle.

Twisting: It is also one form of bending. Sometimes, it is done to increase the rigidity of the work piece. Small piece may be twisted by heating and clamping a pair of tongs on each end of the section to be twisted and applying a turning moment.

Forging tools & equipment:

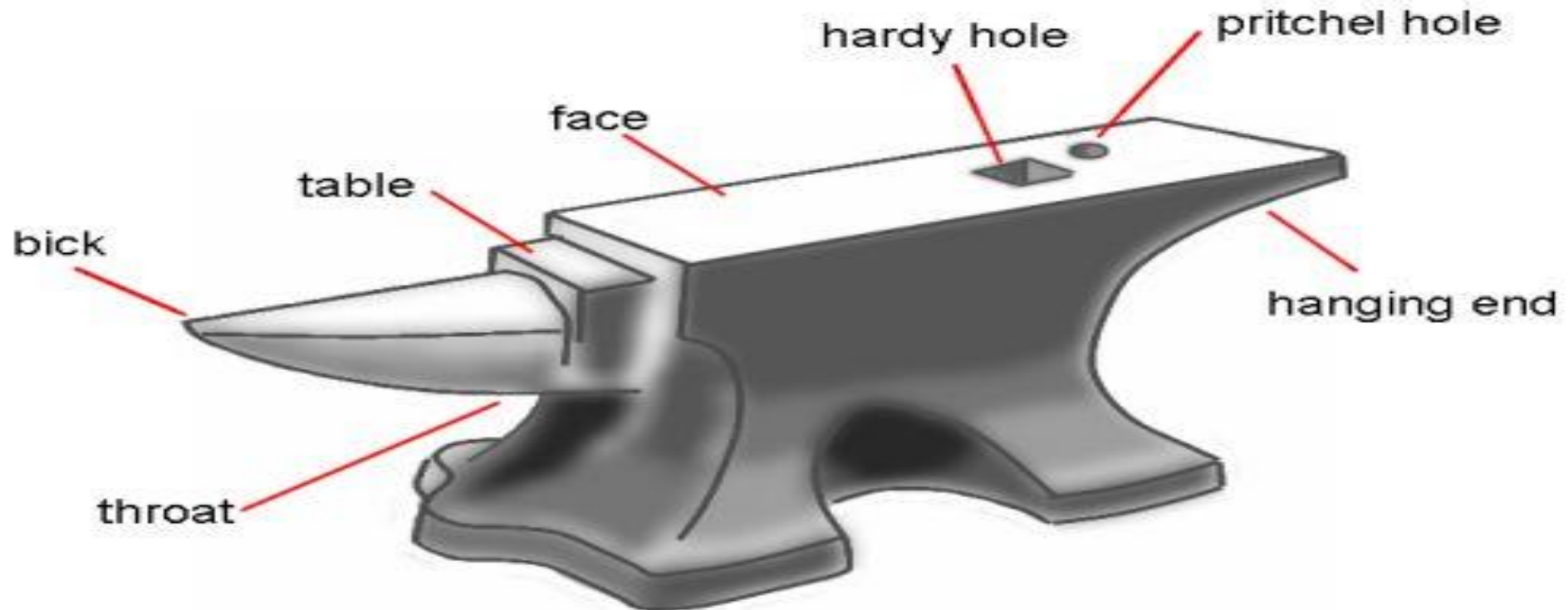
Hearth or Furnace:

- Heating of metal is done in Hearth. It is shallow dish or tray of mild steel with lining of fire clay or refractory material to withstand heat during combustion of fuel.
- Open hearth or closed hearth.



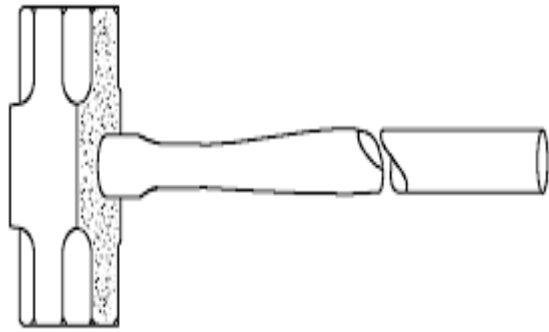
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Anvil: It is used as a mount for pairs of tools between which the work is forged by hammer blows. The main body of the anvil is made of mild steel with a hardened top face welded on. The beak is soft and with an increasing diameter of cross section. Beak is useful for producing bends of different radii. The ledge between the beak and the anvil face is soft and can be used as a base for cutting operation with hot chisels.

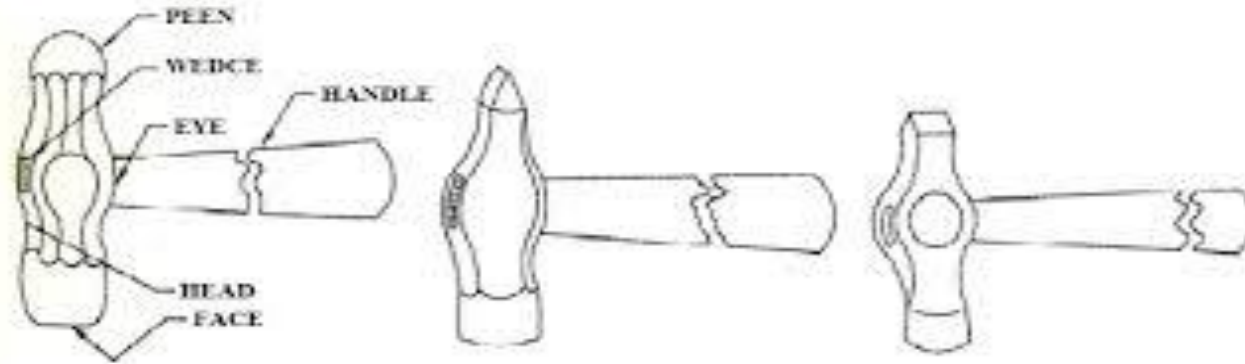


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Sledge hammer: It is a very heavy hammer with a long handle. It may weigh from 4 to 16 kg. These are used for heavy work. The length of the handle increases with the weight of the head.



SLEDGE, BLACKSMITH'S
DOUBLE-FACED

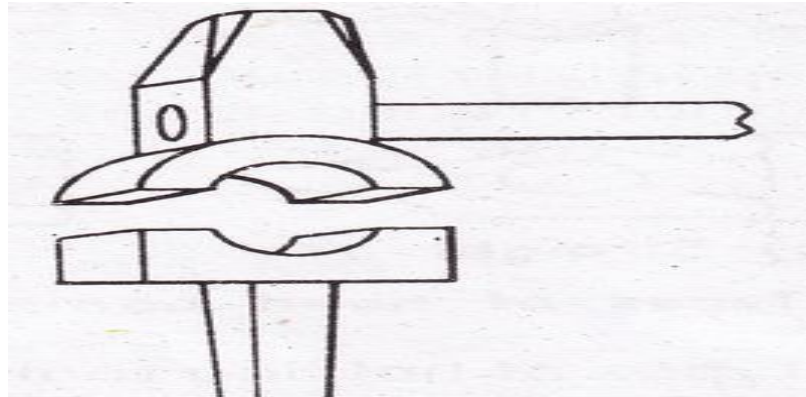


Ball peen hammer

Cross peen hammer

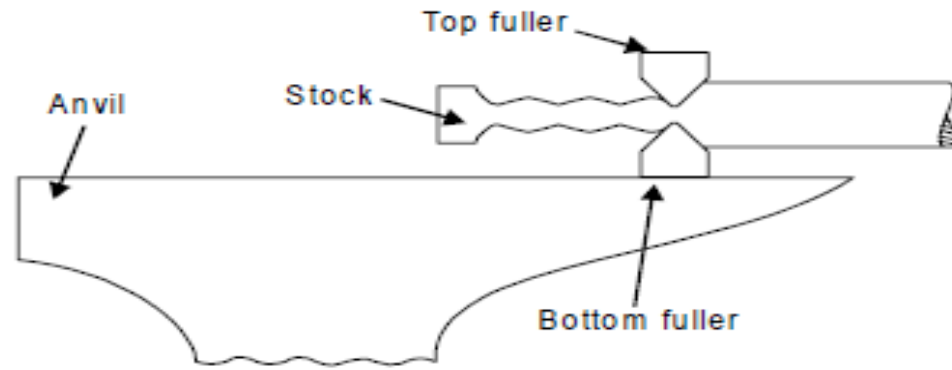
Straight peen hammer

Swages: It is used for forging work which has to be reduced or finished to round, square or hexagonal form. They are supplied in pairs, top and bottom.

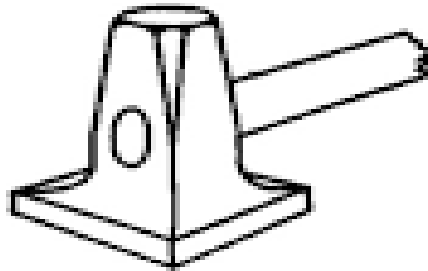


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Fullers: These are blunt nosed chisels and are used to reduce the thickness of hot metal. It is made in top and bottom tools as in the case of swages. Fuller is made in various shapes and sizes according to needs, the size denoting the width of the fuller edge.



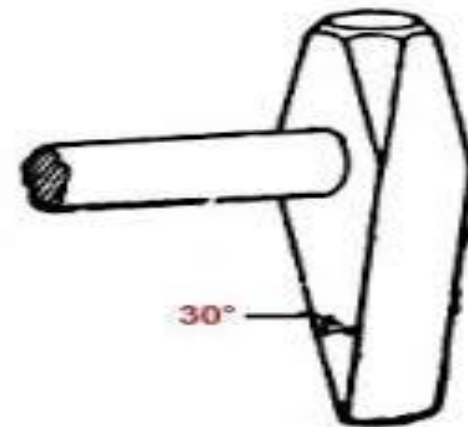
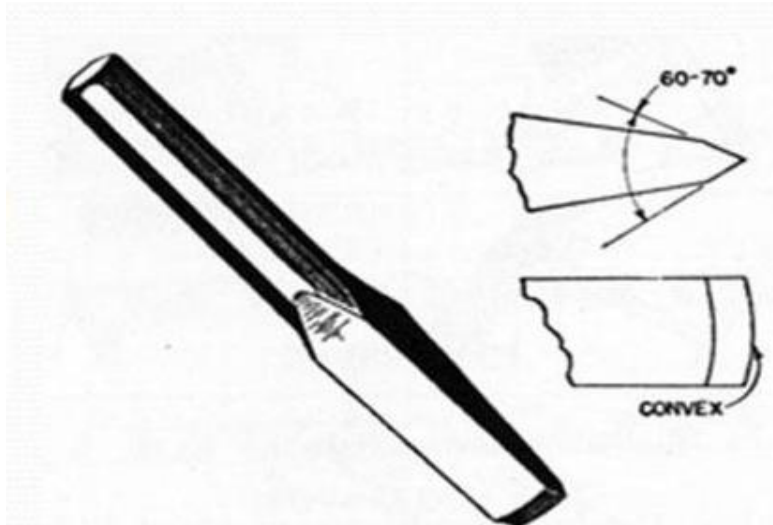
Flatter: This is used to flatten and smooth the metal. It is used under a sledge hammer to flatten and smoothen the metal, particularly after its thickness has been reduced using fullers.



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Chisel: Chisels are used for cutting metals and for nicking prior to breaking.

- **Cold chisel:** It is used for cutting cold metal.
- **Hot chisel:** It is used for cutting hot metal.
- The main difference between the two is in the edge. The edge of a cold chisel is hardened and tempered with an angle of about 60° , whilst the edge of a hot chisel is 30° and the hardening is not necessary. The edge is made slightly rounded for better cutting action.



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Hardie: This is a chisel fitted in to a hole in the anvil with its cutting edge at the top. There is usually one for hot and another for cold use.



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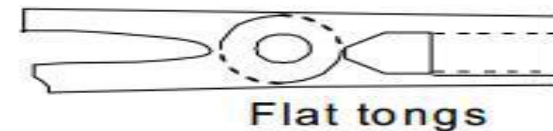
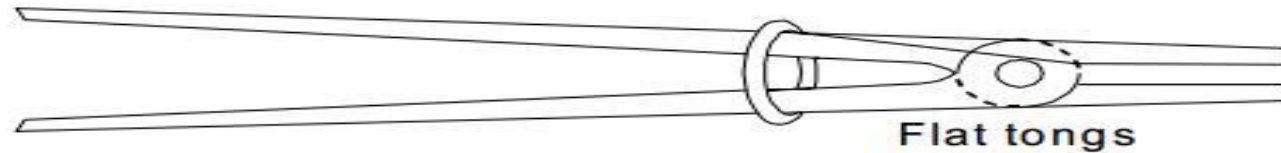
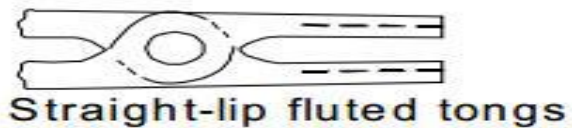
Tongs: These are used to hold hot metal pieces. Various shapes of blacksmith's tongs are available.

Straight-lip fluted tongs are commonly used for holding square, circular and hexagonal bar stock.

Rivet or ring tongs are widely used for holding bolts, rivets and other work of circular section.

Flat tongs are used for mainly for holding work of rectangular section.

Gad tongs are used for holding general pick-up work, either straight or tapered.



Safe Practices:

- Hold the hot work downwards close to the ground, while transferring from the hearth to anvil, to minimize danger of burns; resulting from accidental collisions with others.
- Use correct size and type of tongs to fit the work. These should hold the work securely to prevent its bouncing out of control from repeated hammer blows.
- Care should be exercised in the use of the hammer. The minimum force only should be used and the flat face should strike squarely on the work; as the edge of the hammer will produce heavy bruising on hot metal.
- Wear face shield when hammering hot metal.
- Wear gloves when handling hot metal.
- Wear steel-toed shoes.
- Ensure that hammers are fitted with tight and wedged handles.

Working Steps (Square section):

- Calculate the final length of the model to be forged of the given round rod.
- Place the given round rod in the Hearth furnace in suitable place.
- Switch on the blower and set the temperature range up to 900-1000°C in control panel.
- The job is heated to red hot temperature.
- Place the heated job in between open-faced Bottom & Top Die, which is set on Anvil.
- Draw down the heated work piece to calculated length with the help of hammer, tong & flatter.
- The process is carried approximately until the circular rod is transformed into desired shape and with desired dimensions.
- The work piece is re-heated to carry out bending operation.
- Bending is carried out on Leg vice as per dimensions.
- With the help of flatter, open faced dies finish the work piece to the final dimension and surface finish, cool the specimen by dipping in water.