

SMITHY SHOP

INTRODUCTION:

Smithy is one of the manufacturing processes in which metals are processed to get the desired size and shape by applying mechanical force or by heating the metal and then applying smaller amount of force. Black Smithy or Hand forging is an ancient trade. It is employed only for relatively small components. Nowadays machines are also used in forging the components where huge force is to be applied.

Normally, the heating of metal is done in open fire or hearth (it is like a small furnace). The fuel used for furnace may be coke/coal or charcoal.

TOOLS USED IN SMITHY SHOP:

Tools used in Smithy is broadly classified as follows:-

Supporting Tools

Striking Tools

Holding Tools

Cutting Tools

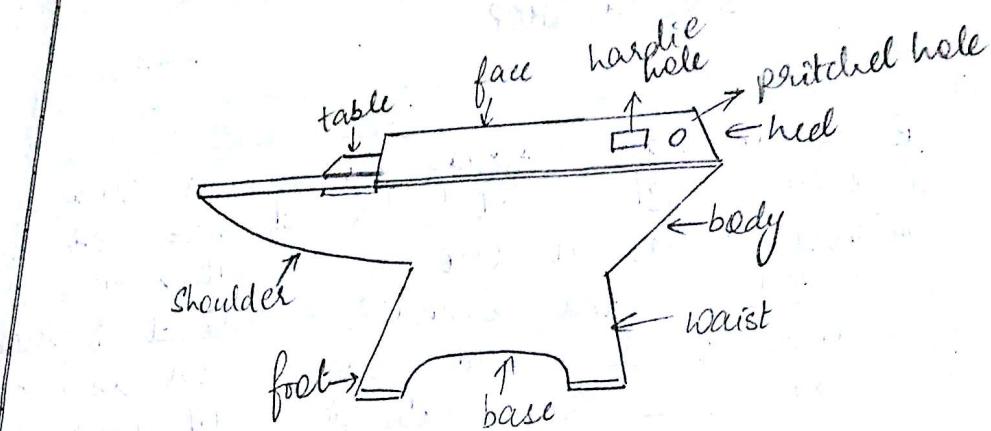
Finishing and shaping Tools

Supporting Tools:

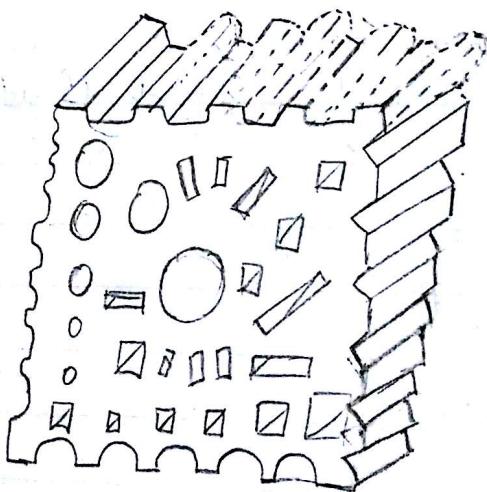
Anvil:

- It is most oftenly used Smithy tool without which we cannot carry out any Smithy process.
- It is used as a support when hammering is performed. It is made up of solid wrought iron or cast steel.

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Anvil-tool nomenclature



Swage block

- The top surface of the anvil has some square and other round shaped holes. This is used when the hot pieces are inserted into them to get the required shape. In particular, it is used for bending small operation.
- The round hole called pincet hole is used for bending small workpieces and hardie hole is used to hold square shank tools like hardies, swages and fullers.

Swage Block:

- It is supporting tool used in a forge shop.
- It is made up of Cast Iron or Cast Steel
- It is used for squaring, sizing, heading, bending and forming operations.
- It may be used either flat or edgewise in its position.
- For general applications, width of the swage block is 0.25m or slightly more.

Striking Tools

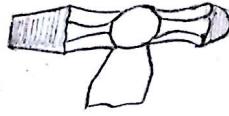
Two different types of hammers are used in forging operations

- i) The hand hammer used by smith
- ii) The sledge hammer used by the striker.

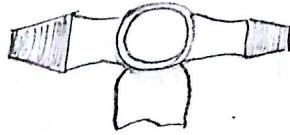
Hand Hammers:

The weight of this hammer varies from 0.5 kg to 2 kg. These hammer heads are made up of cast steel and

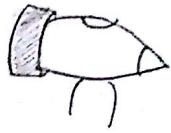
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Ball Peen Hammer



Straight Peen Hammer



Cross Peen Hammer

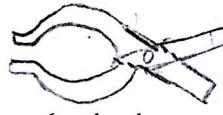
Hand Hammer



Sledge Hammer



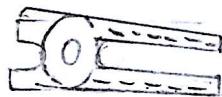
Flat tong



Gad tong



Ring tong



Straight lip fluted tong

Holding Tools

ends are hardened and tempered.
These hammers are classified as:-

- a) Ball peen hammer
- b) Straight peen hammer
- c) Cross peen hammer

Sledge Hammer:

It is used for heavy work only. It has flat ends on both sides. The weight varies from 4.5 to 5.5 kg for ordinary hammer and around 9 kg for heavy work, handle being about one metre long. Handle is made up of either cast iron or wood.

Holding Tools

Generally tongs are used for holding purposes. It is made up of Mild Steel.

Types of Tongs:-

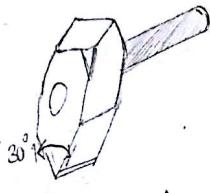
- i) Flat Tong
- ii) Gad Tong
- iii) Ring Tong
- iv) Straight lip fluted Tong

Cutting Tools

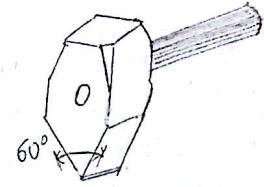
It is used for cutting and necking metals prior to breaking. Two types of chisel are normally used:-

- i) Cold Chisel
- ii) Hot Chisel

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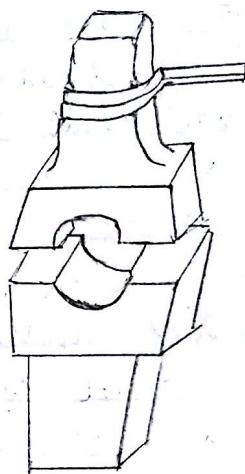


Hot chisel

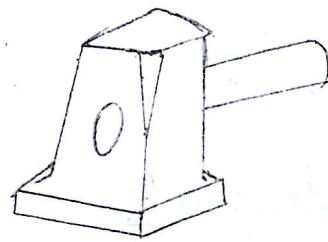


Cold chisel

Cutting Tools

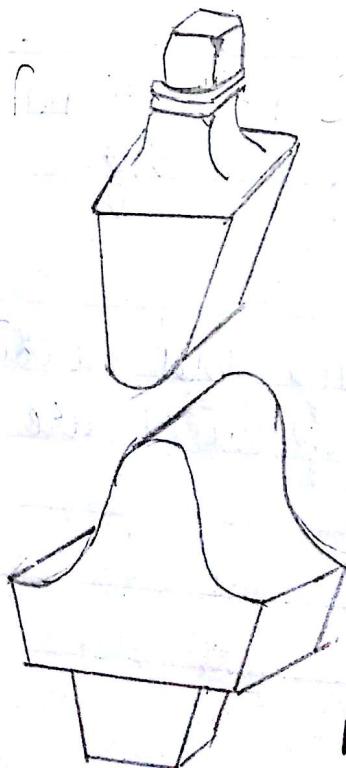


Swages



Flatter

finishing And Shaping Tools



Fuller

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Cold chisel:

It is made up of tool steel with a cutting angle of about 60° and its edge is hardened and tempered.

Hot chisel: It is made up of low carbon steel and has a cutting angle of 30° . Its edges does not require hardening.

Finishing and Shaping Tools
These tools are used to give the desired form and shape.

Swages:

They are used for work which has to be reduced and finished to round, square or hexagonal form. It is made up of high carbon steel. The swages may be in separated top and bottom halves.

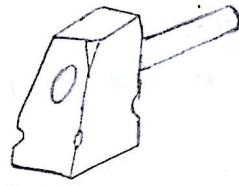
Flatters:

The flatter is used after the job has been forged into shape with a hammer and marks can be seen on job surface. Flatter is used to achieve better surface finish especially when the surface area is large. It is used to provide smoothness and accuracy to the job of work.

Fullers:

Fullers are a set of two tools, the top tool and bottom tool. The top tool is provided with a handle and the bottom tool has a square shank which fits into the

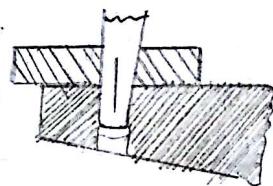
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Set Hammer



Punch



Drift

finishing And Shaping Tools

Square hole of the anvil. Fulfess are used to form grooves. They spread the metal and can reduce the thickness of the workpiece.

Set Hammers:

A set hammer is used for finishing off surfaces to a good smooth surface in restricted area such as corners, undercuts. A set hammer is useful for working hot-metal and forcing it into corners and narrow places.

Punch:

Punch is used for making holes in the heated component. Holes of any shape such as round, oval or square shapes may be made with punches of different shapes.

Drift:

Once the punch has made a hole in the heated metal workpiece, the drift can be employed to enlarge this hole to a particular shape and size.

Common Smith Forging Operations:-

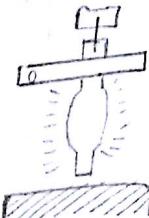
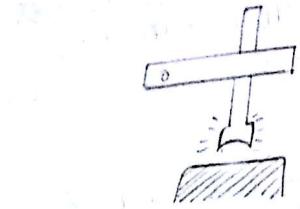
So many operations can be carried out by means of heating the work piece and hammering operations.

The typical smith forging operations are:-

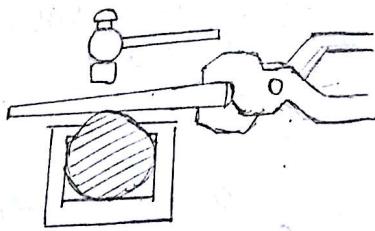
- 1) Upsetting or Jumboing
- 2) Drawing down
- 3) Setting down
- 4) Heading and drifting
- 5) Bending
- 6) Forge Welding
- 7) Cutting
- 8) Fullering

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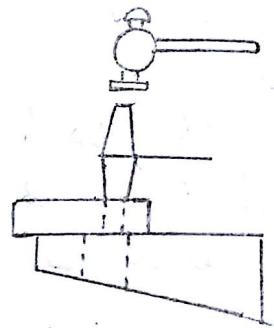
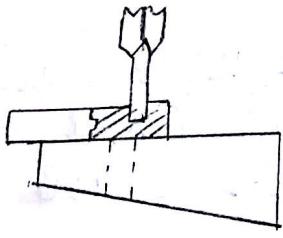
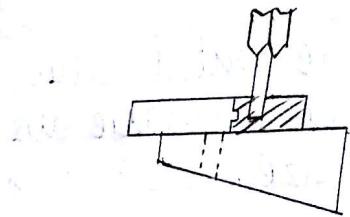
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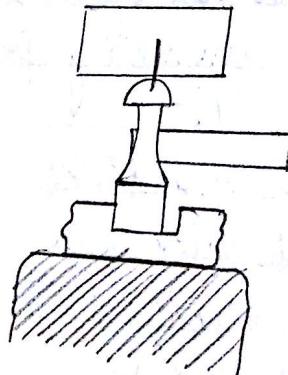
Upsetting



Drawing Down



Drifting and Punching

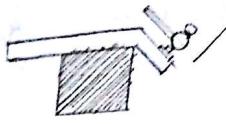


Set Down

- 1) Upsetting or jumping:
It is one of the processes of increasing the thickness of the job and reduce the length by application of hammering operation.
- 2) Drawing down:
It is the operation of increasing the length of the bar or job by reducing the thickness.
- 3) Setting down:
It is the process of local thinning down of the workpiece by hammering.
- 4) Punching and drifting:
Punching is the process of making holes on the workpiece. After punching, hole can be enlarged by hammering a tapered drift into the hole until the required bore size is reached.
- 5) Bending:
It is one of the main operations to bend the workpiece as required. It is carried out on the anvil by hammering.
- 6) Forge Welding:
It is one of the method of joining metals or bars by heating and hammering.

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Bending

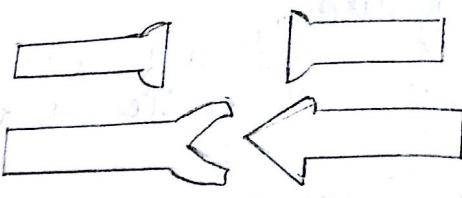


Forge Welding

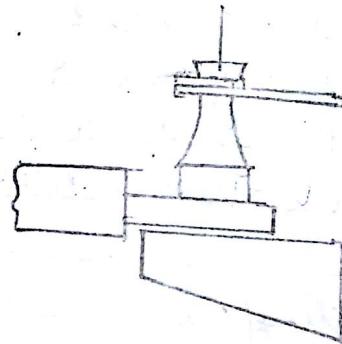
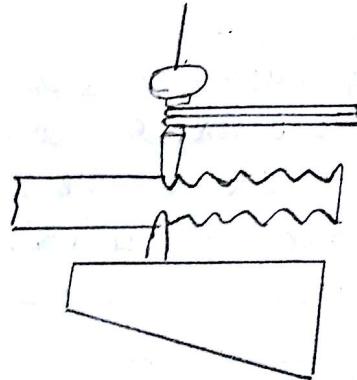
Step 1:



Step 2:



Step 3:



Fullering

7) Cutting off:

It is a form of chiselling operation where a long piece of stock is cut into several specified lengths.

8) Fullering:

It is one of process of spreading the metal along the length of the bar of workpiece by hammering and in which the job is kept between fullers.

TYPES OF FORGING:

Based on machine used for operations, forging is classified as

i) Hand forging:

In which the metals are processed to get the desired shape and size by striking it with a hammer is called hand forging or smithing or blacksmithing.

ii) Machine forging:

In which the process of forging is carried out by using forging machine is called machine forging.

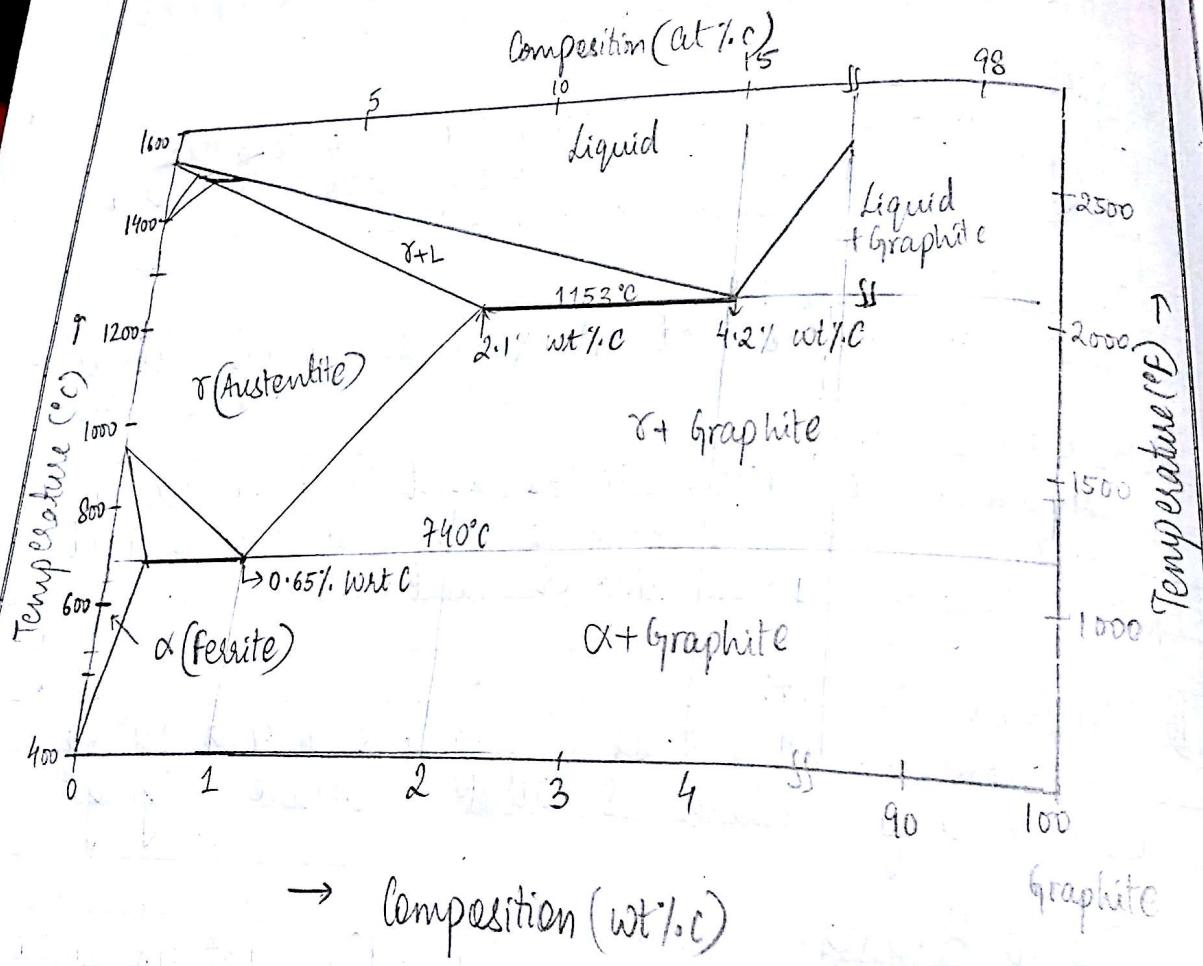
iii) Drop forging:

In which the top die is raised to certain height through mechanical device and dropped it to hit the hot metal piece kept at the bottom die. Wrench and other tools are made by drop forging.

Based on the temperature prevailing in the operation forging is classified into two types:

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IRON-CARBON PHASE DIAGRAM



→ Composition (wt% C)

(a) Cold forging: It is the process of making desired shape of the metal by hammering but without heating is called cold forging. Applicable only for soft metals.

(b) Hot forging: It is the process of making desired shape of the metal by hammering the metal after heating is called hot forging. Using this method hard materials can also be forged.

APPLICATIONS OF SMITH FORGING

- It is used to fabricate components like bolts, nuts, broke, keys, tongs, wrenches, springs etc.
- It is also used to fabricate agricultural tools and links used in various mechanisms.

ADVANTAGES OF SMITH FORGING

- The Smith forging components have high strength and give great resistance to impact and fatigue loads.
- It improves the grain structure of the metal so that its mechanical properties are also improved.
- Better surface finishing can be easily achieved.
- Raw material loss is almost nil.

DISADVANTAGES OF SMITH FORGING

- It is very difficult to achieve the accurate dimensions and J. tolerances,
- Some metals may break while forging.
- There is some limitation to achieve the shaped size.

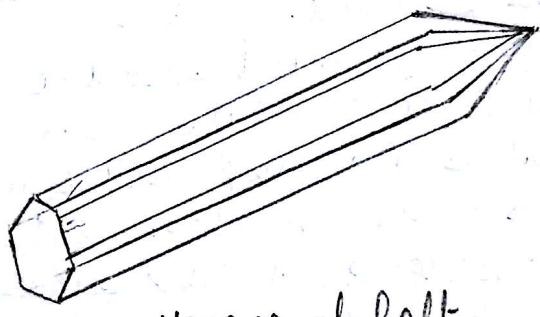
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<u>Material</u>	<u>Temperature (°C)</u>
Al and Mg Alloy	350-500
Copper	600-950
Forging Brass	600-950
Mild Steel	750-1300
Wrought Iron	900-1300
Medium Carbon Steel	750-1250
High Carbon Steel	800-1150
Alloy Steel	800-1150
Stainless Steel	940-1130

SAFETY PRECAUTIONS FOR SMITHY

- ① The furnace should never be operated without permission and knowledge of how it is operated.
- ② When handling the forged work, an operator should watch for hot material and identify it in some manner if it is left lying on the floor.
- ③ Proper tongs should be selected to hold the work and keep it from slipping.
- ④ Care should be taken while putting the work back into the furnace, because the furnace is very hot and can cause burns on hands and face.
- ⑤ Care from flying pieces of hot metal should be taken while hammering hot piece of metal.
- ⑥ Care and thoughtfulness can help reduce accidents.
- ⑦ Operator must always wear an apron and a full sleeved shirt while working in forging shop.
- ⑧ Operator should always wear shoes and not slippers or sandals.
- ⑨ Operator should exercise precautions not only with respect to own safety but that of his fellow workers also.

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Hexagonal Belt

Longer side of the hexagonal belt is called the belt width and shorter side is called the belt thickness.

AIM: To make a hexagonal headed bolt on end of a round rod

MATERIAL SUPPLIED: M.S. Round Rod

TOOLS REQUIRED:

- 1) Induction furnace
- 2) Tong
- 3) Hammer
- 4) Anvil
- 5) Flatters
- 6) Other relevant tools

SEQUENCE OF OPERATIONS:

- 1) Heating
- 2) Flattening
- 3) Forming Hexagonal Shape
- 4) Checking
- 5) Cooling

WORKING STEPS:

- 1) Using ends of workpiece kept in tonge, is put in the furnace to attain the temperature for red hot condition.
- 2) Now workpiece is taken from furnace and kept on anvil for further processing.
- 3) The hammering process is carried out to flatten the one end of the workpiece.

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- 4) Again it is heated and hammered to form hexagonal shape.
- 5) Now the workpiece is cooled using water to avoid deformation and to attain maximum hardness.

RESULT: Thus hexagonal bolt is made from given round rod