

INTRODUCTION TO SMITHY WORKSHOP

Forging is the oldest method for producing small articles for which accuracy in size is not so important. The parts are shaped by heating them in an open fire or hearth and shaping them by applying compression forces using hammers. The shop in which various forging operations are carried out is called SMITHY SHOP. A metal like steel can be shaped in a cold state but the application of heat lowers the yield point and makes permanent deformation easier. Forging operations can be accomplished by hand or by a machine hammer. Forging process may be classified into hot forging and cold forging, and each passes specific merits - demerits. Almost all the metals can be forged.

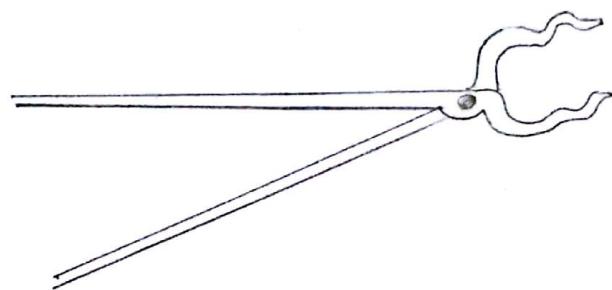
SMITHY AND FORGING OPERATIONS

The forging methods are commonly used for changing the shape of raw materials into finished form in Smithy shop. The hand forging operations are :-

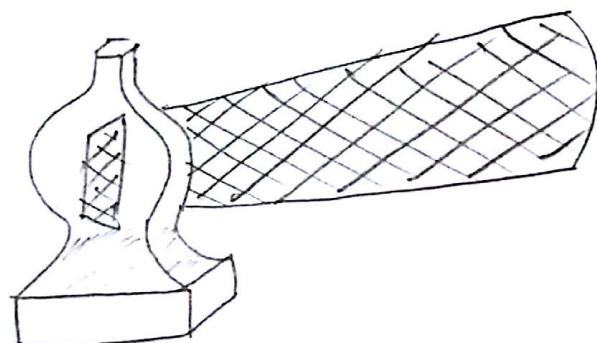
- (1) Upsetting
- (2) Drawing
- (3) Drawing Down
- (4) Cutting
- (5) Setting Down
- (6) Purching
- (7) Flattening
- (8) Fullering
- (9) Forge welding
- (10) Swaging

- 1) Drawing Out - Used to reduce the thickness of a bar and to increase its length. It may be carried out by working the metal over the ham of anvil. Then by hammering it on anvil face.
- 2) Fullering - This operation is generally used in forging shop. It involves heating the stock in the blacksmith hearth. Then stock is placed on fuller fixed on anvil. The fuller is put over the stock and hammering is done to reduce this cross-section of job at required time.
- 3) Upsetting - Also known as jumping operation which is carried out to increase the thickness of a bar or to reduce its length. Generally, the increase in thickness is only local. The operation is just opposite to drawing and involves increase the cross-sectional usually by hammering.

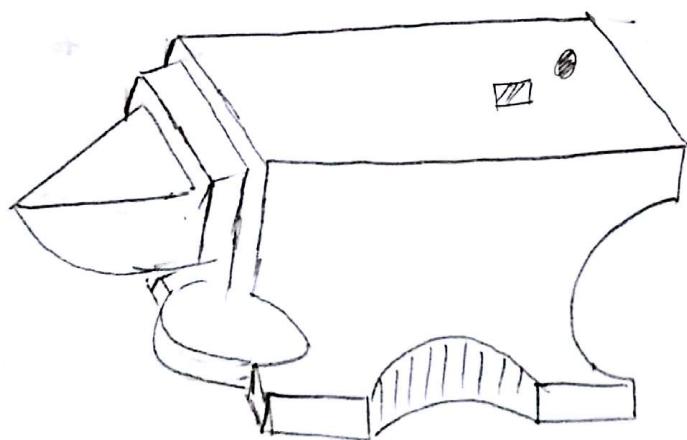
- 4) Bending - It is very commonly used forging operation in forging shop to give a turn to a metal rod/plate. It is accompanied by spreading of the metal in the inside of the bend and narrowing at outside. The simplest method of bending a piece of metal in hand forging is to support it on anvil and to strike its free end with hammer.
- 5) Punching - It is a main forging operation used for producing hole in metal plate by using a tool called punch. The metal plate is placed over the hollow cylinder and punch is placed above it at required location where hole is being made.
- 6) Cutting - It is a main forging operation to cut out a metal rod or plate into two pieces with the help of a chisel called and hammer when the metal is red hot. A hot/cold cut is used for cutting it is best to cut half through the workpiece to turn it one and cut from other end.
- 7) Forge Welding - It is a process of joining two metals together to increase the length by hammering them when they are at forging temperature. It is performed in forging shop and thus called forge welding.



TONGS



FLATTER



ANVIL

COMMON HAND FORGING TOOLS

To carry out forging operation manually certain common hand forging tools are used. The main hand forging tools are.

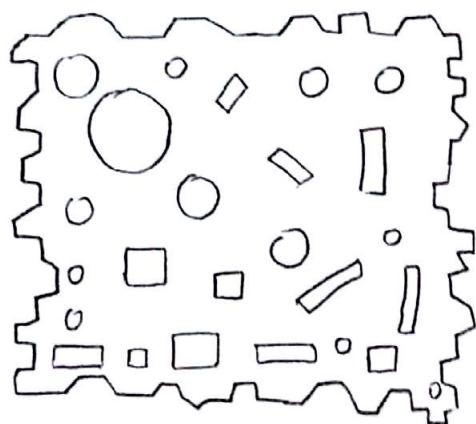
1. Tongs - They are generally used for holding work while doing a forging operation. Various kinds of tongs are:
 - Flat tong used for rectangular section
 - Rivet / Ring tong used for holding rivets, bolts and other work of circular section
 - Gad Tong used for holding general pick up work.
2. Flatter - Commonly used in forging to give smoothness and accuracy to work which have already been shaped by fullers and swages
3. Anvil - Most commonly used tool in forging shop. Acts as a support for blacksmith's work during hammering. Body of the anvil is made of mild steel with a tool steel face welded. On the body, but the beak used for bending isn't still faced. Round hole in anvil called perithel is used for bending rods and act as a die for hot punching operation. The square or hardie hole is used for holding square shank.
4. Shovel - shovel generally used in forging shops. It is used to place coal/ coke in furnace. It is also used to set coal pieces in furnace and remove ash from it.



SHOVEL



POKER



SWAGE BLOCK

- 5 Poker - It is employed for removing clinkers from the furnace and to move the comfort coal pieces in furnace.
- 6 Swage Block - Mainly used for heading, bending, squaring, sizing and forming operations forging jobs. It may be used either flat or edge wise in its stand.
- 7 Bleak Iron - Also called small anvil made of forged steel commonly used as anvil for small forge work.

APPLICATION OF FORGING

Almost all metals and alloys can be forged, the low and medium carbon steel aren't forged readily. Forging is generally carried out in carbon alloy steel, wrought iron and Al alloy. Stainless steel, nickel based super alloys are forged especially for aerospace uses.

Producing of crankshaft alloy steel is a good eg. which is produced by forging. Forming process are almost most important manufacturing technique utilized widely to make small tools, automobile trucks etc.

ADVANTAGES OF FORGING

- 1) Forged parts posses high ductility and offers high resistance to impact and fatigue load.
- 2) Forging refines the structure of metal.
- 3) It results in considerable saving in time, labour and material as compared to production of similar item by cutting from a solid stock and then shaping it.
- 4) Forging distorts the previously created unidirectional fibre as created by rolling and increase the strength by setting the grains.
- 5) Because of intense working, flaws are rarely found so have good reliability.
- 6) Reasonable degree of accuracy can be obtained.
- 7) forged parts can be welded easily.

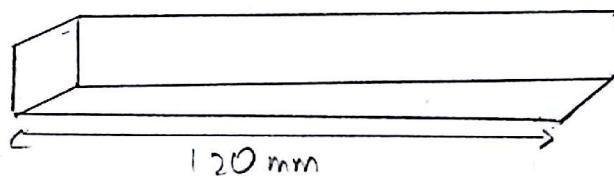
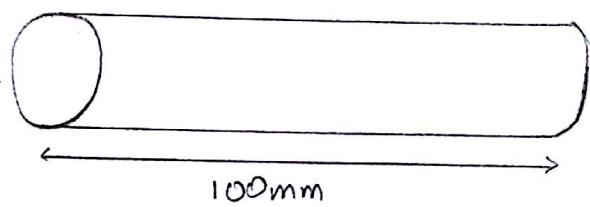
DISADVANTAGES OF FORGING

- 1) Rapid oxidation in forging of metal surface at high temp. results to scaling.
- 2) The close tolerances in forging operations are difficult to maintain.
- 3) It is limited to simple shapes and has limitations for parts having undercuts etc.
- 4) Some materials are not easily worked by forging.
- 5) Initial cost and maintenance is high.
- 6) Metal get cracked if heated below specific temperature.

SAFETY PRECAUTIONS

- 1) Always avoid use of damaged hammer.
- 2) Never strike a hardened surface by a hardened tool.
- 3) No person should be allowed to stand in line with flying objects.
- 4) Always use proper tongs according to the type of work.
- 5) Anvil must be moisture free from moisture and grease while in use.
- 6) Always wear proper clothes, foot wear and goggles.
- 7) Handle of the hammers should be tightly fitted in the head of hammers.
- 8) Always put out the fire in the forge before leaving the forge shop.

Aim: To forge a cylindrical bar into square bar.



JOB PROCESS

Objective - To forge a round bar into a square bar

Operation - Drawing down-hot forging

Material Used - Mild steel

Tools - Steel foot ruler, hand hacksaw, anvil, tonge, hammers, open hearth furnace, platters.

Procedure -

- 1) Do dimensional marking on the raw material using scale
- 2) Cut the work piece on the marked point from the length by holding it in bench and using hacksaw
- 3) Fire the open hearth furnace using steam coal and let it active sufficient temp.
- 4) Insert the workpiece using tong in the fire and allow it to gain forge heat to a very high temperature Piece turns red hot.
- 5) Take out the red hot job to the anvil using Tong.
- 6) Start hammering to convert the cross section from round to square.
- 7) After few strokes chang the face while hammering and so on.
- 8) Only 60-70% job is done (square cross-section). Now reverse the job and repeat the procedure
- 9) Keep on doing till the job is completed.

Precautions -

- Use hammers and tongs with care.
- Never use hand to put the cylindrical rod from furnace
- Spray of water should be frequently done to avoid dust in the shop
- Keep working place free from oil.
- while doing an operation, select the tools according to nature of the job.

JOB 2

Objective : To form a square Allen key from a mild steel round bar

Operation : Cold forging and bending

Material Used : Mild steel Ø6mm X 150mm

Tools and Equipment Used : Steel foot rule, hand hacksaw, Anvil, ball peen or cross peen hammer.

Procedure :

- 1) Do dimensional marking on the raw material using Steel Foot Rule (scale) 150mm length on a 6mm round ms bar
- 2) Cut the workpiece on the marked point from the length by holding it in bench vice and using hand hacksaw
- 3) Hold the round bar on the Anvil with one hand and start hammering with the other hand.
- 4) Keep on hammering the job on its entire length, along with the axis of the work piece length to convert the round cross section into a square cross section through out

Teacher's Signature.....

- 3) keep changing the face of the workpiece for hammering intermittently so that straight and in-line edges are developed.
- 4) Continue this until the entire job is made square cross-section through out.
- 5) Please ensure that there are no hammering impressions on the faces of square work piece
- 6) If required use the platter to remove the hammering impressions (dents)
- 7) Now make perpendicular bend on the work piece with 50mm small side of job and 100mm length of the job.

Teacher's Signature