

S. No.	Name of the Experiment
01.	Wood working and Carpentry shop.
02.	Bench work and fitting shop.
03.	Welding shop.
04.	Smithy shop
05.	Sheet Metal shop

Experiment- No. 1

Wood working and carpentry shop

Introduction -

In this chapter students will study the materials and the tools used in the carpentry shop. The major raw material used in the carpentry shop is wood and the other helping materials like nails, screws, paints and glues. The wood is available in the market are different in the shapes and the sizes. The process is done in the wood work are available are sawing, marking, turning etc. wooden furniture, doors, windows, and patterns are generally made in the carpentry shop.

Wood: The wood is available in the nature in the form of wood. The useful part of the wood is cut and used in the carpentry shop or work. Trunk is the most useful part of the tree.

Timber: The wood is obtained from the fully grown tree is cut and prepared for the engineering purpose. The wood is known as timber. The timber have three forms, when it is in the form of a complete tree then it is termed as the

the stationary, and after cutting the tree in the p...
logs it is rough form then after it is commercial

Types of wood :

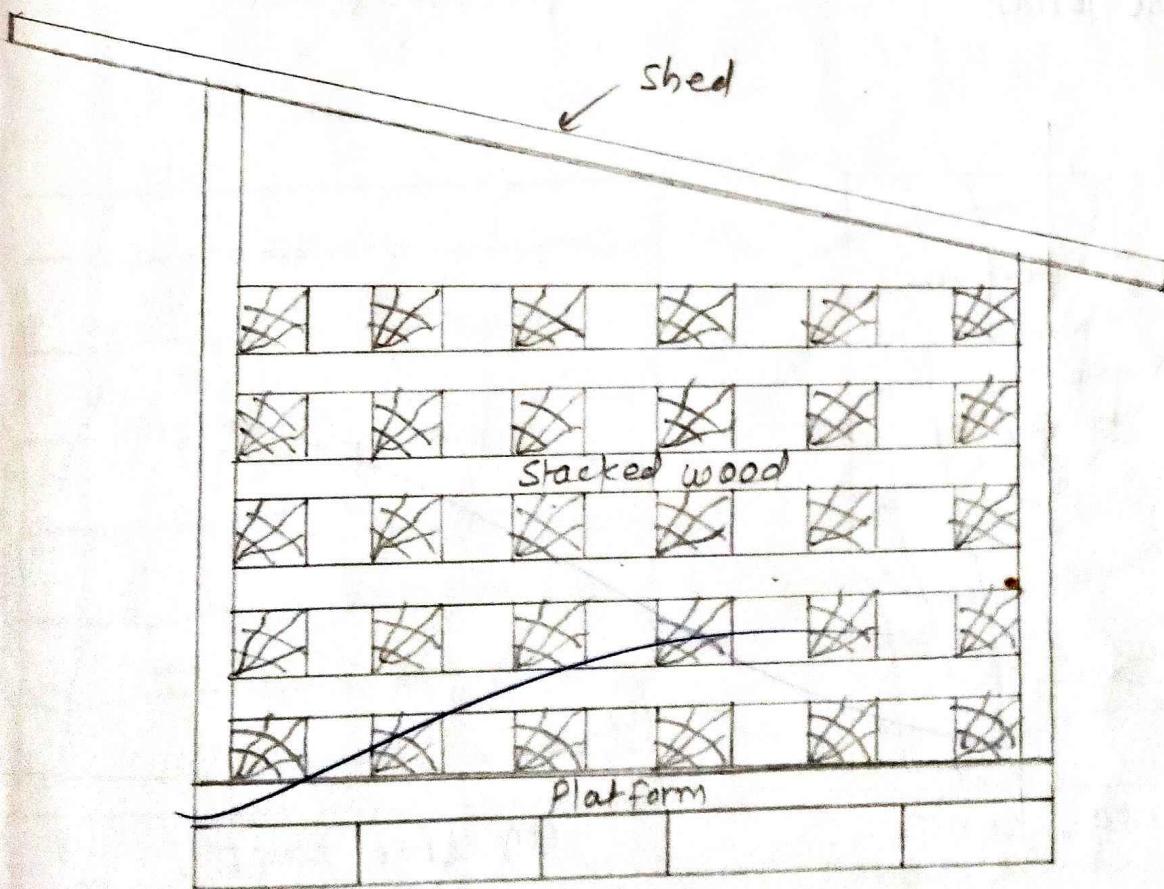
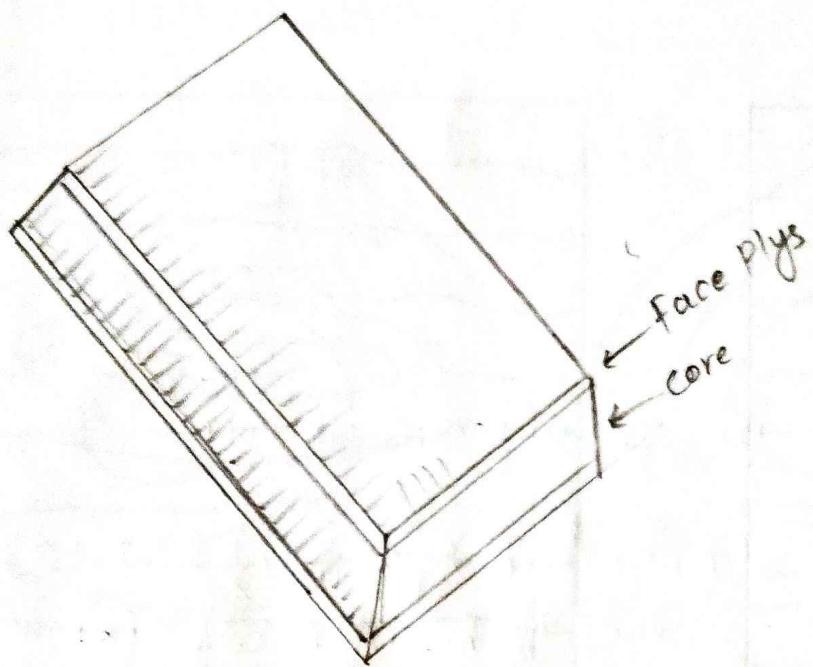
Wood is generally classified into categories as under:

- ① Softwood (deodar, kali, chir)
- ② Hard wood (Teak, shisham, sal, Mango),
- ③ Ply wood (Teak, Oak, deodar).

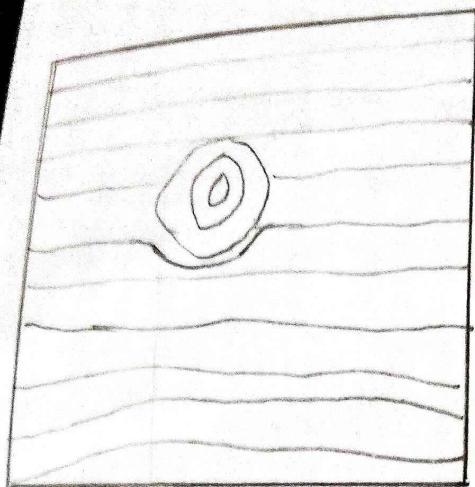
Structures of wood -

The structures of wood shown in the figure 1.6. The main parts described as under.

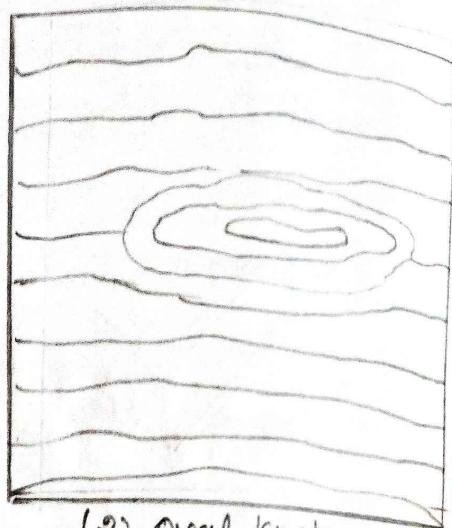
- ① Pith or Medulla - It is central part of tree. It feeds the sap from roots to leaves. It has a dark color.
- ② Heart wood - The portion surrounding the pith is called heart wood. The percentage of moisture is less than the central part.
- ③ Sap wood - The part of the trunk between the heart wood and Cambium layer is known as the sap. It is light in weight, softer and the weaker.
- ④ Cambium layer - The rings adjacent to the bark are known as the Cambium layer.



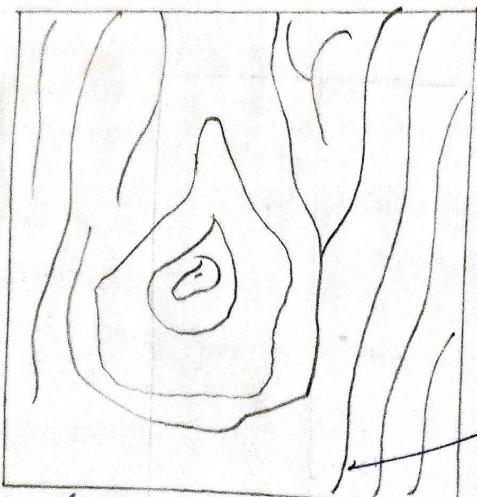
Natural seasoning



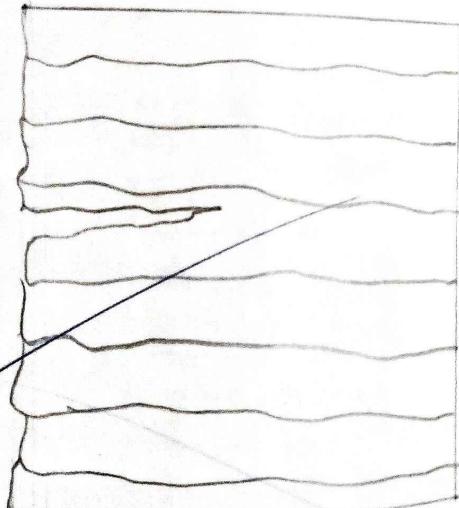
(1) Circular knot



(2) Oval knot



(3) Irregular knot

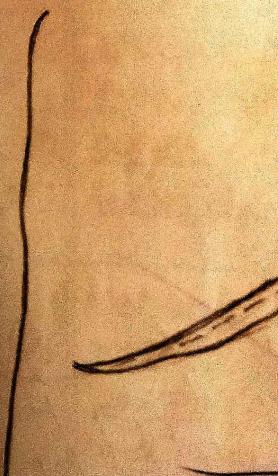


(4) Line knot

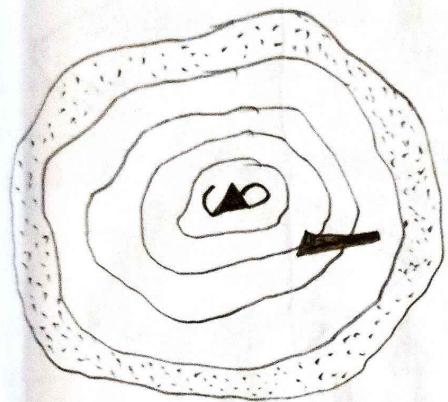
(iv)



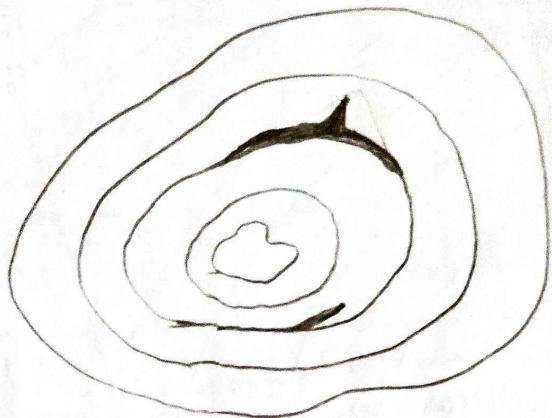
Heart sha



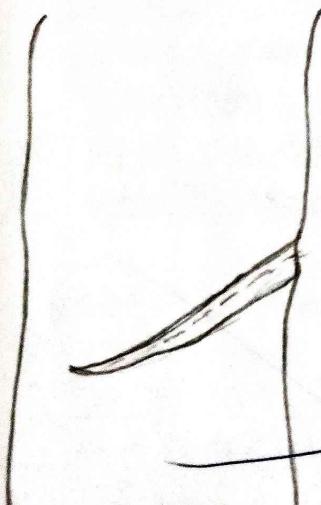
Twisted sha



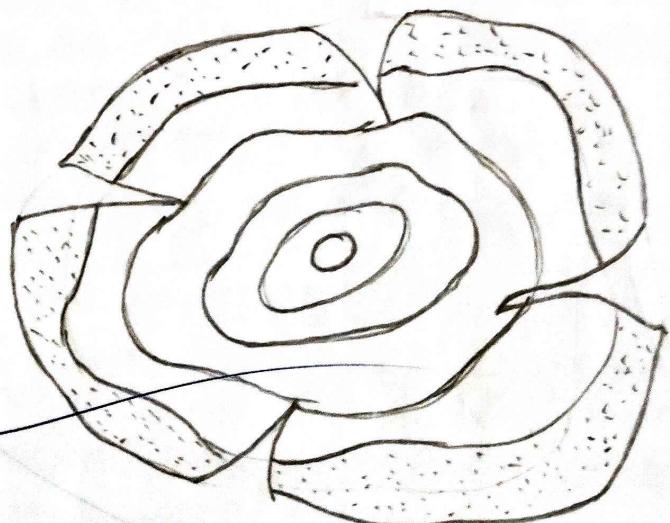
Heart shakes



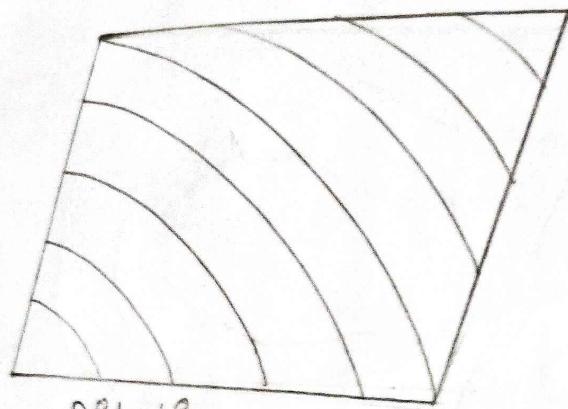
Ring shakes.



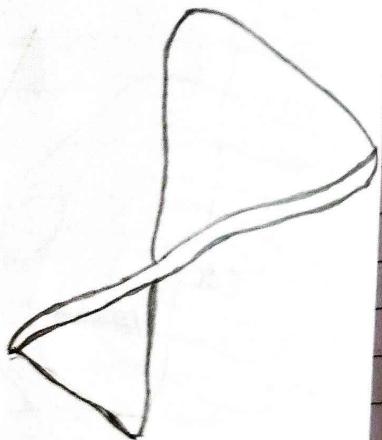
Twisted shakes.



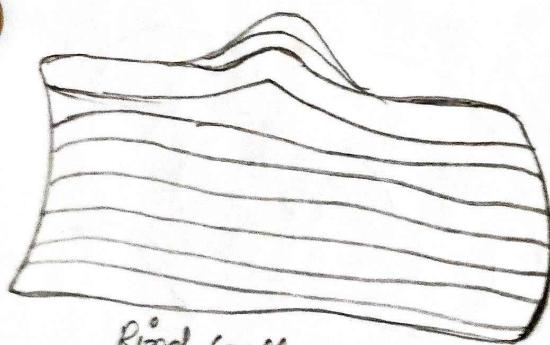
Peripheral shakes.



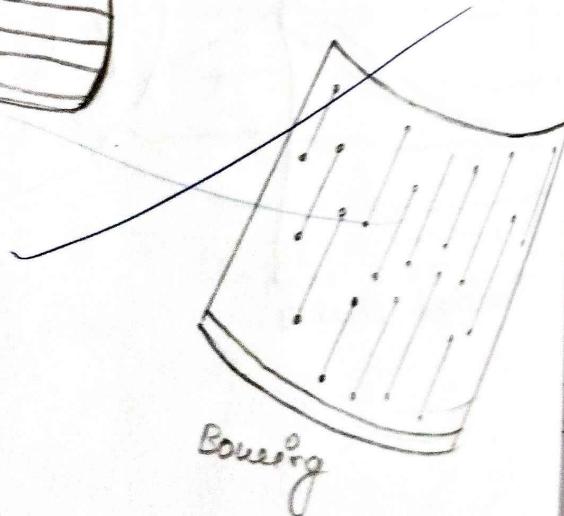
Distortion.



Twisting.



Rind crall



Bowing

⑤ Bark - The cover for

⑥ Medullary pits up to

⑦ Annual rings around the added to

Defects in following a
It can be

⑧ Natural defects in tree due

(i) Defects are

(ii) Some defects

Natural
knots = knots in the tree and the non disturbed.

There are live knots -

① Dead knots -

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- Date _____
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- ⑤ Bark - The outer surface of the tree act as the cover for the inner portion is known as the Bark.
 - ⑥ Medullary rays - These are the radial layers starting from pith up to the Cambium layer.
 - ⑦ Annual rings - These are concentric layers of wood around the pith. Every year one such layer is added to the trunk of the trees.

Defects in wood. -
following are the common defects occurring in the wood and it can be divided into the following categories.

- (i) Natural defects are the defects which are caused in the tree due to the abnormality in the growth.
- (ii) Defects are caused due to the sealing operations.
- (iii) Some defects are also there due to termites or insects.

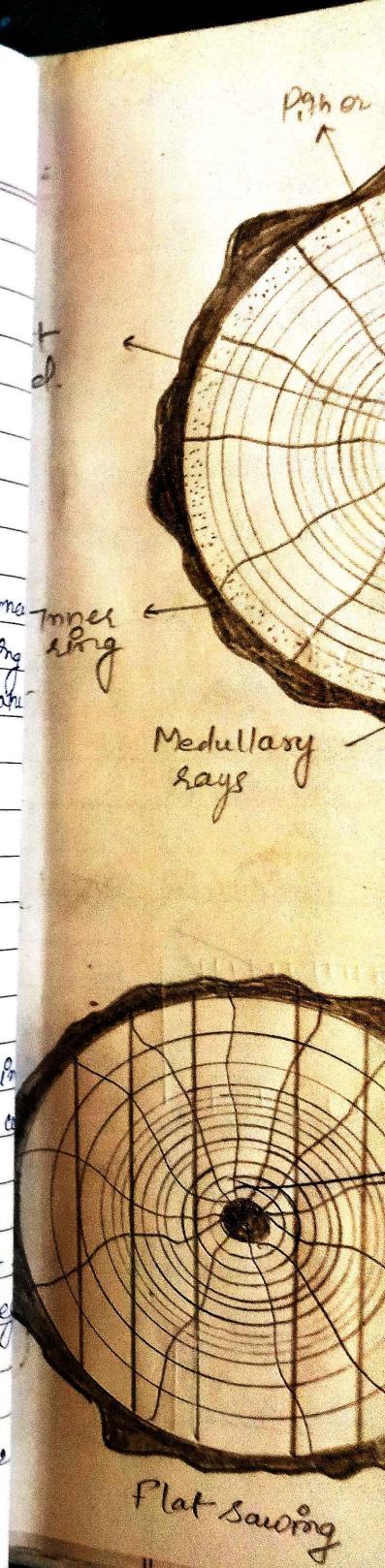
Natural Defects:-

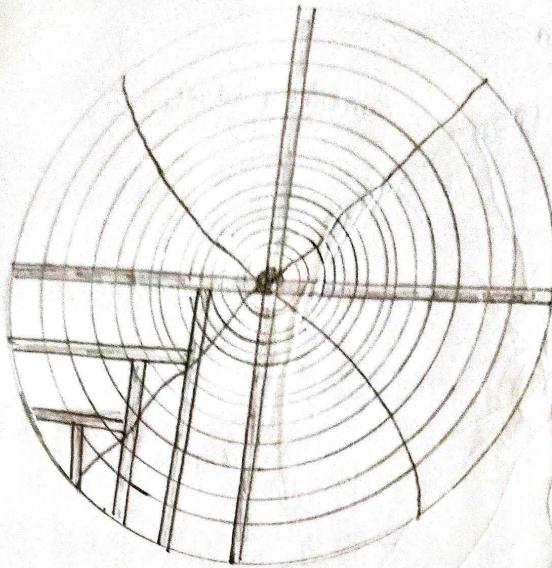
- ① knots: knot is the centre of irregular growth part of the tree. The fibre cells of tree are wrapping around it and the normal shape of the internal structure is disturbed.

There are two types of knots:-

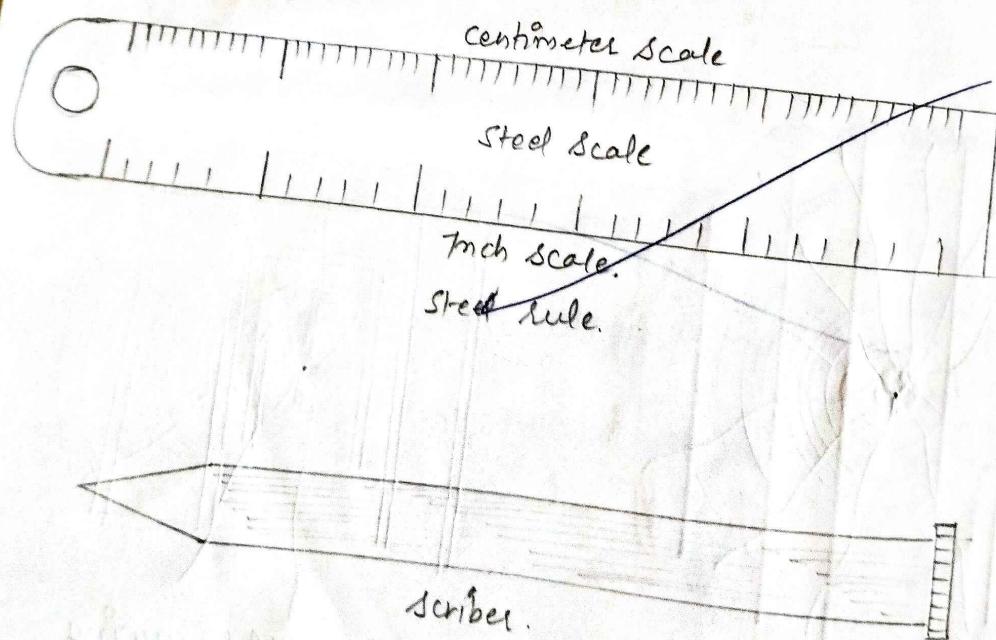
- ① live knots - these occurs after felling of the tree.
- ② Dead knots - these occurs after felling of the tree.

- The knots are classified according to their shapes.
- ① Circular knots
 - ② Oval knot
 - ③ Irregular knot
 - ④ Star knot
 - ⑤ Symmetrical knot
 - ⑥ Group knot
- ② Shakes - Shakes are produced by internal and external diseases of the tree. When there is a delay in cutting the tree even after complete maturity at that time, the grains of the tree evaporates.
- There are many types of shakes.
- ① Heart-shakes
 - ② Ring-shakes
 - ③ Twisted shakes
 - ④ Peripheral shakes
- ③ Twisted grains - When trees are affected by fast cutting, their grain becomes twisted. It is very difficult to cut the tools due to twisted grains.
- ④ Ring Gall - It is uneven broken part of the tree. It generally appears where branches are cut or broken.
- ⑤ Distortion - Due to the uneven moisture in the wood.





Quarter sawing. Sawing of wood.



Scriber.

(10)

Shape of
the seas

⑥ Surface
the tree
surface
easily.

Defects

⑦ Shakes -
place b
in crack

⑧ Distortions
in the
limits.

⑨ Honey
Substan
dry f

Defects

Fungi
are tu

Shape of wood is distorted. It is caused by the improper seasoning. Twisting and bowing occurs generally.

⑥ Surface Hardening - As the outer part dries faster than the inner part, stresses are developed on the outer surface of the wood. Hacking can not be done easily.

Defects during seasoning operations:

① Shakes - During cutting sometimes heavy impact takes place between the tree and the ground which results in cracks inside the timber radially or during conversion.

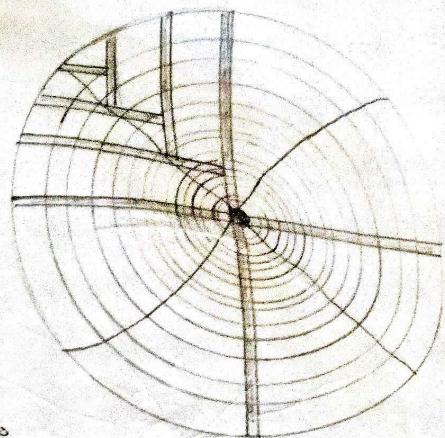
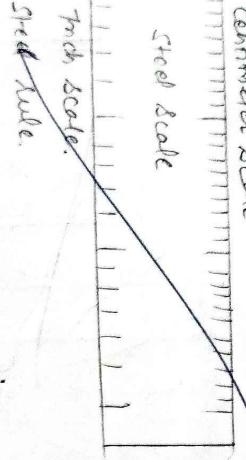
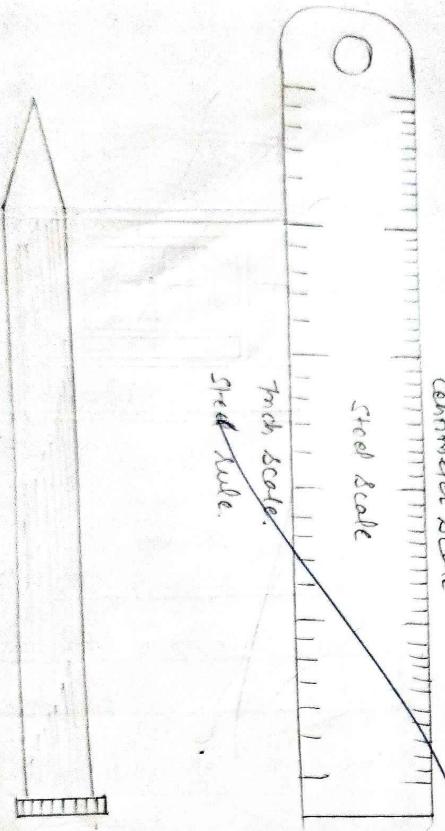
② Distortion - This defect occurs if the machine contents in the wood is lesser than the lower permissible limit.

③ Honey Combing - Due to the presence of hygroscopic substances in the wood, the inner portion of the wood dry faster than the external portion.

Defects due to the termite and the insects:

Fungi attack the wood and cause the decay. More are two forms of defects.

Scriber.

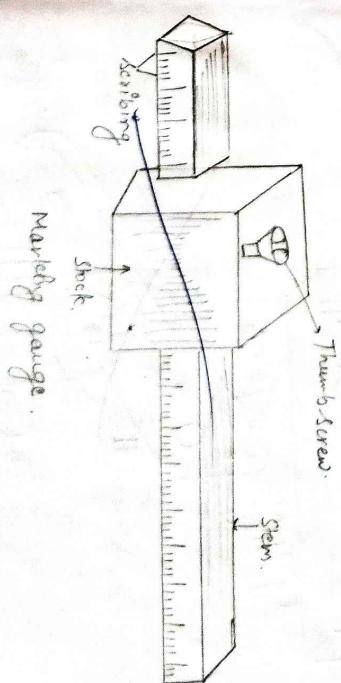
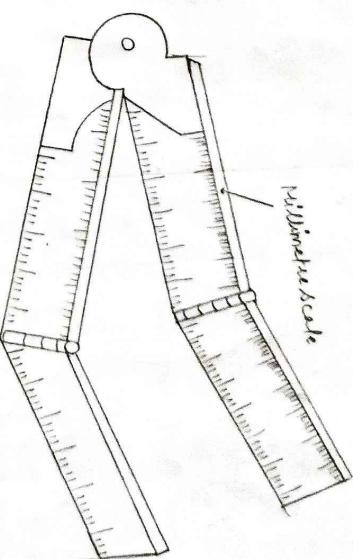


- ② Dry rot - It is a dark borer in colour and breaks up of liberty because it is developed in the tapered of the wood which becomes lighter in weight.
- ③ wet rot - It is found in the portion of wood which is effected by the fungi and it appears out the borer.

- ④ Termite: There are several factors that affect the life of the borer. For example - unlike termite which affects the timber and makes it bad wood from the inside and it can be controlled by anti termite treatment.

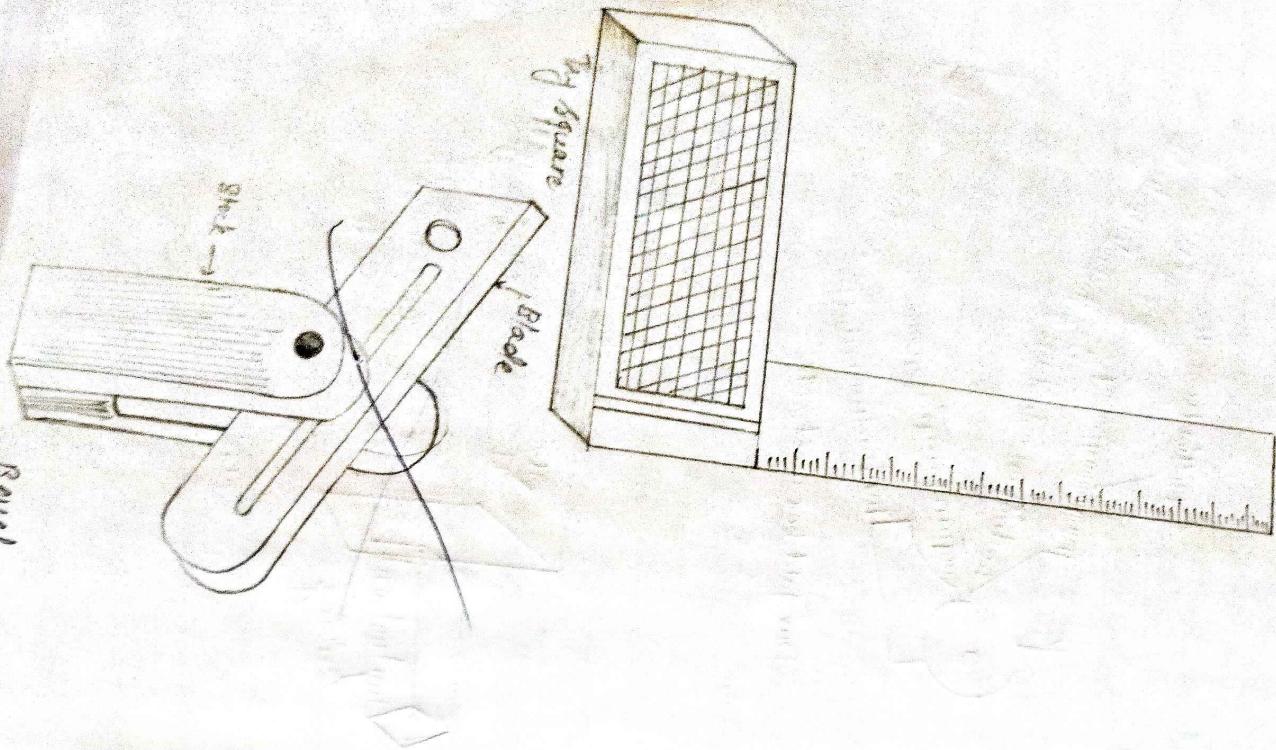
carpentry Tools

four fold box wood rule



marking gauge.

- ① Measuring tools
② Working tools
③ Cutting tools
④ Planing tools
⑤ Drilling and Boring tools
⑥ Holding devices



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Measuring tools -
(a) **Fold box wood rule.** It is generally 2 feet long and is folded from three places. It is marked with inch and millimetre scale. The inches are further divided in to 8 and 16 parts, where as the centimeters are sub divided in to millimeters. It is used for the making the measuring.

(b) **Steel Rule.** It is made up of a steel stainless steel and is marked with scales. In this scale also there is graduation in both inches and the centimeters and inches and centimeters are also further divided in to smaller divisions. In this scale the conversion table for different units is also mentioned.

(c) **Contractor's scale.** It is also a rule type scale used for making patterns. Casting allowances and added to the scale.

(d) **Tape.** It is made up of a flexible thin steel strip. It is folded around a centre pin attached with a small handle. It is graduated.

Marking Tools -

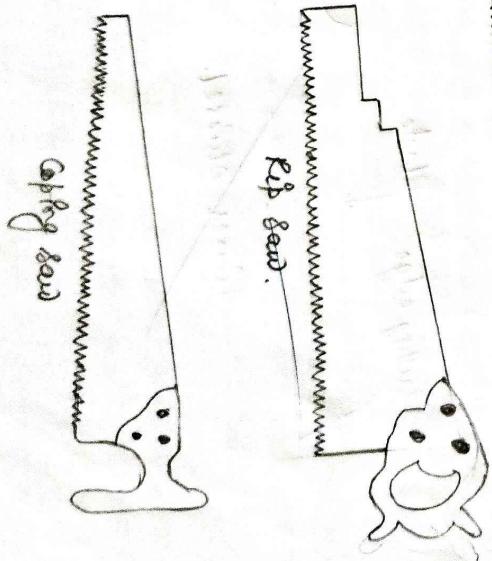
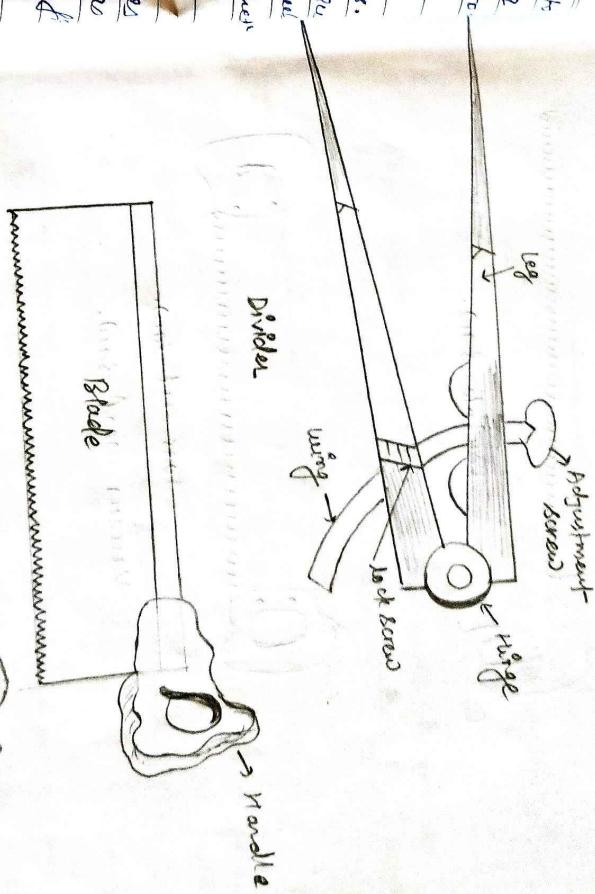
(a) **Pencil.** Lead pencil is generally used for marking purposes.

Bevel.

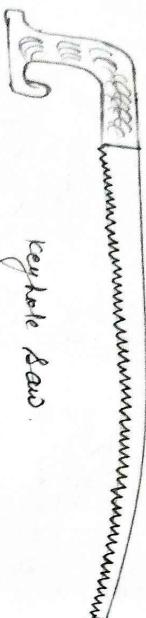
- (b) Scraper: Scraper has a sharp conical edge used to even hard surface. It is used for measuring marking the parts and lines on the wooden block before processing.
- (c) Marking Gauge: It is used to draw parallel lines. movable portion of the gauge is adjusted for 90° position and is registered on the stem. The piece will sides be called as stock and marking iron is fixed on the stem.
- (d) Mitre Gauge: It is used to draw two parallel lines working similar to marking gauge except it has sharp edges. one fixed and second adjustable on it.
- (e) Try Square: It is used to draw lines at the right angle or to check the squareness of the planned part. It is made up of the steel blade with heavy base.
- (f) Bavel: It consists of a wooden handle fitted with an adjustable blade as shown in the figure. The blade is rotated by 100° with respect to handle. It is used marking various angles.
- (g) Compass/ dividers: These are used for dividing the equal parts and for drawing arcs and circles.

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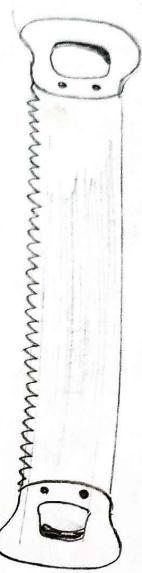
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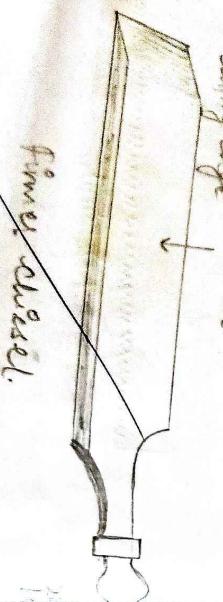
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keyhole saw.



cross cut saw.



handsaw.

(15)

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Page 19)

Cutting Tools:
Saw and the chisel are used as cutting tools in the carpentry shop.

Saw: A saw is a multi-toothed tool made up of the thin sheet - attached with a wooden handle. It is used for the smooth cutting.

Different types of saw are -

① **Rip Saw:** It is hand saw from 80cm to 150cm long. Containing one to one and half teeth per cm. cutting blade placed in the forward stroke backward stroke is ideal.

② **Tenon Saw:** It derives its name from the tenon form of joint. It is a thin saw. ranging from 20cm to 40cm. in length and it is supported by back of enough iron or brass; hence it is called a back saw.

③ **Coping Saw:** It is used for cutting quick on sharp curve either internal or external. It consists approx. 10cm teeth per cm.

④ **Compound Saw:** It is a short narrow saw, tapering toward the point, used for cutting sweeps and large interior curves by hand, sometimes formed as a hilt saw.

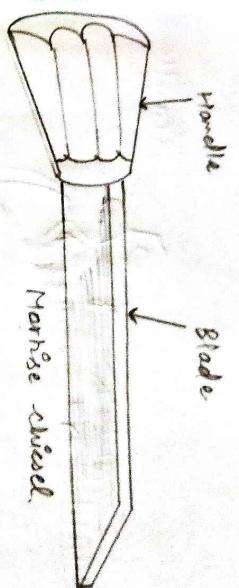
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(v) Keyhole saw or pod saw - It is used for cutting thin curves where it is impossible to use other saw.

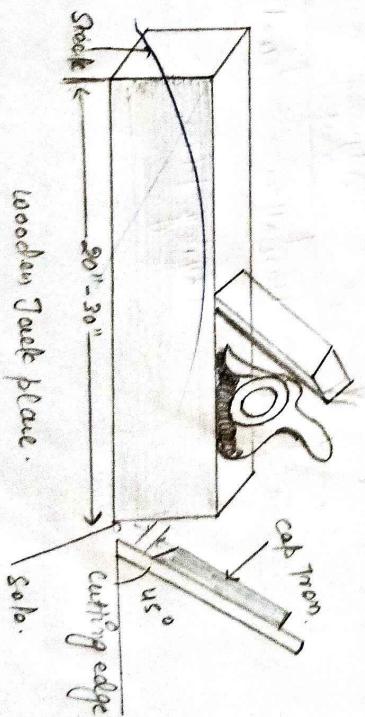
(vi) Cross-cut saw - It is saw provided with two handles at each end, used for cutting heavy timber in the grain.

(vii) Bow saw - It consists of a wooden frame, a bar, jaws and two handles. The blade is tightened with the help of string and lever.

(viii) Chisel - There are three types of chisels commonly used in carpentry shop.



Orange chisel.



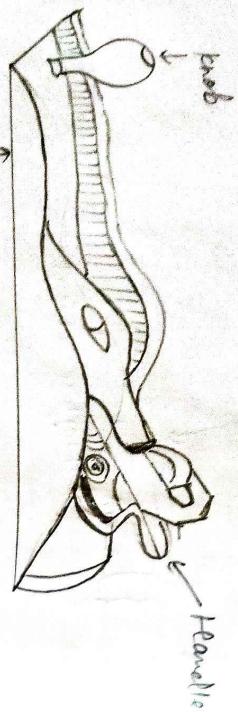
Wooden Jack plane.

Cap iron.

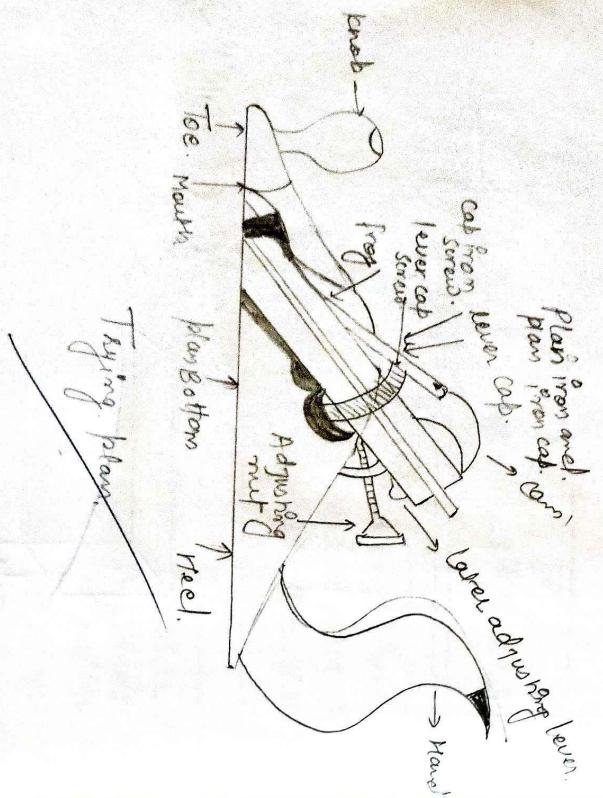
Stick.

20"-30"

ols



Bottom.



March 20th

- Hanwell

Orange schivel - It is used to formish curved holes. Orange schivel are two types i.e., inside and outside.

Planning Tools

① Planes - Planning tools are used for smoothing purpose, for shaping proper size and for forming curved wooden strips. Many types of planes are used in carpentry.

(a) wooden jack plane - Its length is 20"- 30" and used for the general purpose. It consist of a wooden body called stock, bottom face is called as sole.

(b) From Jack plane - This plane is used for the better finish. This plane is cast iron. This plane has rigid and stronger body.

(4) Trywing plane - The lengths of this plane is 20"-30" and looks like a Jack plane. It is used after surfaces are already planed by the iron Jack plane for making up true.

(d) Rebate plane - This plane is used for the preparation of the edge of plane board. It is mostly used for the household furniture.

(2)

Plough plane - This plane is used for making the plane. Some have there is also another plane called the plane. It is used for the producing the curved plane.

(2)

Spoke shave. It is shown in the figure, the blade of spoke shave can be adjusted. In case of smoothing concave inside surfaces a spoke shave having round bottom is used.

(2) Rasp - It is also known as the rasp file. It is a finishing tool used to make the wood surface smooth, remove sharp edge, finishing fillets and other projection from

Drilling and boring tool -

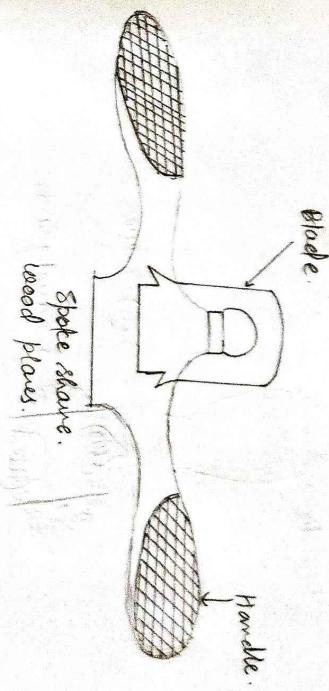
The drilling and boring tool are used to make hole a wooden piece. Commonly used drilling and boring are -

(a) Hand drill -

Hand drill consist a spindle, drill chuck, crank handle and two bevel gears. Bevel gears are fitted on the spindle. The handle is pressed in to wooden piece while rotating the drill. Thus hole is formed.

(b) Ratchet - Brace:-

It consist of a crank, a head, a ratchet and ratchet



(2) **Spoke shave** - It is also used for making the spoke hole. It is also another plane. Called 'T' plane. It is also a smaller plane. Called 'T' plane. It is also used for the producing the curved form.

(3) **Spoke shave** - It is shown in the figure, the blade of spoke shave can be adjusted. In case of smoothing or coarse surface a spoke shave having 20 mm. is used.

(2) **Rasp** - It is also known as the rasp file. It is a hand tool used to make the wood surface smooth, remove sharp edge. Polishing pellets and other material surface.

Drilling and boring tool -

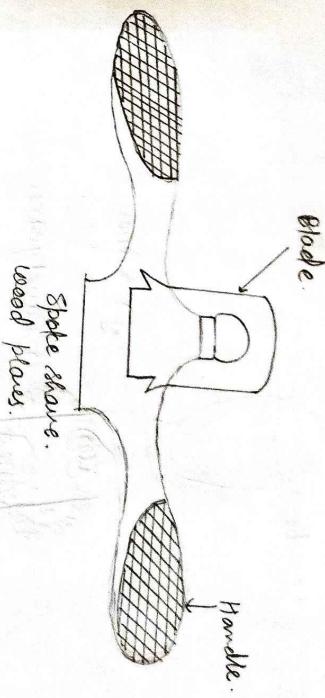
The drilling and boring tool are used to make hole a wooden piece. Commonly used drilling and boring are.

(a) **Hand drill** -

Hand drill consists a spindle, drill chuck, escamk and two bevel gears. Bevel gears are fitted on the bit. The handle is pressed in to wooden piece where not the drift. Thus hole is formed.

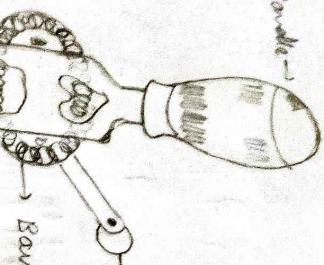
(b) **Ratchet-Brace** -

It consists of a crank, a head, a ratchet and the chisel.



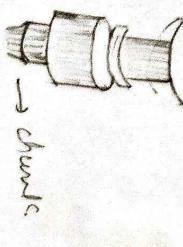
Handle →

lever



→ gears

→ gears

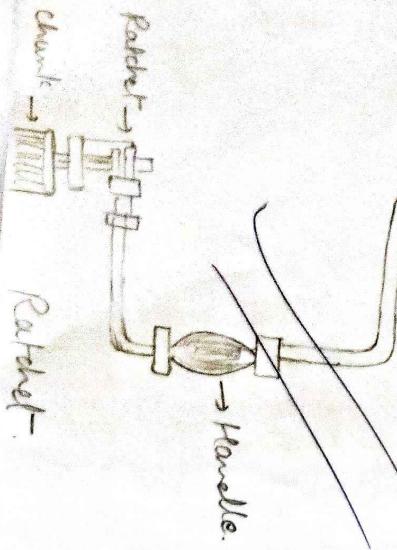


→ hand drill.

Head

→ chuck

→ crank.



Ratchet →

Chuck →

Ratchet →

for holding the drill. The head is pressed into one hand and the crank is rotated by the second hand.

(3) **Chisel drill**:- Chisel drill is a very simple type of a drilling tool. It consists two parts one is chisel and second is handle.

Holding tools -

(1) **work bench**:- It is a table which is made up of 3'x3' or 4'x4' size of the table is 6'x3'.

(2) **Bench Hook**:- It is a simple type of the holding tools used for supporting the wood while working on it. It is used for on work bench.

(3) **clamping vice**:- clamping vice is used for sawing, fitting, or cutting more than one strip of wood at the same time.

(4) **C-clamp**:- C-clamp is a simple type of the clamping device. It is generally used to paste two wood with another wood for alignment purpose.

striking tools -

striking tools are used for the force the nails or
pins to the wood.

Wood striking tools are as under -

(i) Cross peen Hammer.

(ii) claw hammer.

(iii) mallet.

④ Cross peen Hammer - It has a cast steel body and
wooden handle. The body has two parts face and

⑤ Claw Hammer - It is used for striking as well as for
the nails from the wood. The material of the wood

case steel. Its weight varies from 0.85 kg to 0.75 kg.

⑥ Mallets - It is used the chisel which have the iron
handle. It is made up of the hard wood and is
irregular in shape.

shaping tools -

shaping tools are used for the force the nails or
pins to the wood.

Wood shaping tools are as under -

① Cross peen Hammer.

② claw hammer.

③ mallet.

Date _____
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Wood working processes.

different processes that are carried for wood working
are as follow -

① Marking and Measuring.

② Sawing.

③ Planing.

④ Mortising and Tenoning.

⑤ Boring.

⑥ Moulding.

⑦ Tonguing and Grooving.

⑧ Robing.

① Marking and Measuring - Before starting any process
part of all the job is measured by the various
Measuring tools and then it is marked properly.
Finally the marking is done then after planing again
the marking is done.

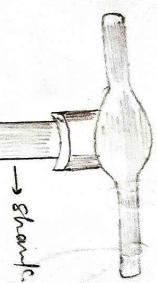
② Sawing - It is done for the cutting of raw material
of given size and removing the extra materials. The
Cutting should be started from the tip of the saw and
followed by the entire length of the saw.

③ Planing - The operation is performed on the wood to
smooth the surface of the wood. Initially the Jack plane
is applied followed by the trying plane for the

Smoothing and the finishing.

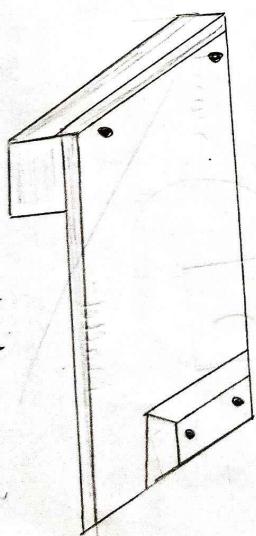


Hawell.



(31)

Cranked-drill



Bench hook.

- ⑤ **Rebating** - This process is used for producing a slot along the edge of a plank. either longitudinal or cross.
- ⑥ **Teaing and Grooving** :- In case when the desired are very wide for example specially wide make the holes and enclosures.

Mortise and Tenoning - Mortise is in the form of cavity that forms the female part and tenon a protrusion on the other part that is a male part both of them is are fitted to form the Mortise a joint.

⑤ **Boring** - This is operation for the production of circular holes in the wooden article. first the the hole is located and then holes are drilled by bits for desired size and depth.

⑥ **Moulding** - This process is used for the producing wooden items that are used for decorations as done by special plane called as the Moulding plane.

Wood working Machines -

In modern workshops, wood working machines are used. Instead of the hand tools. Machines having the following advantages over the hand tools -

More production.

Less fatigue to workers.

Saving in time.

More accuracy.

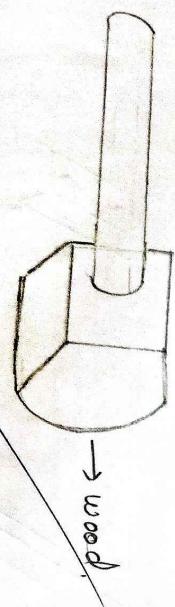
④ Wood working Lathe -

A wood working lathe consists of a cast iron bed. A head stock, tail stock, tools rest, live and dead centres and driving mechanisms. It is used for producing round symmetrical tools.

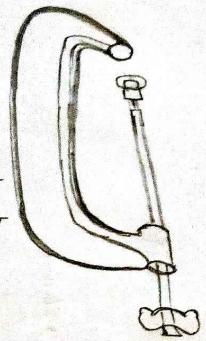
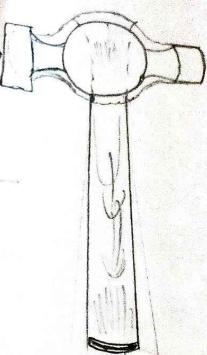
⑤ Circular saw -

It is generally used for cross cutting of the wood. After operation, slope grooving, rebating, tenoning, chamfering, tapering etc., are performed on the machine. The wood is fed against a rotating cutter. Main part of the circular saw is the fly cutter.

Mallet



Cross beam Hammer.



⑥ Thickness planer - The thickness planer is a machine in which wooden planks and boards are planed evenly to desired thickness. Such planers are

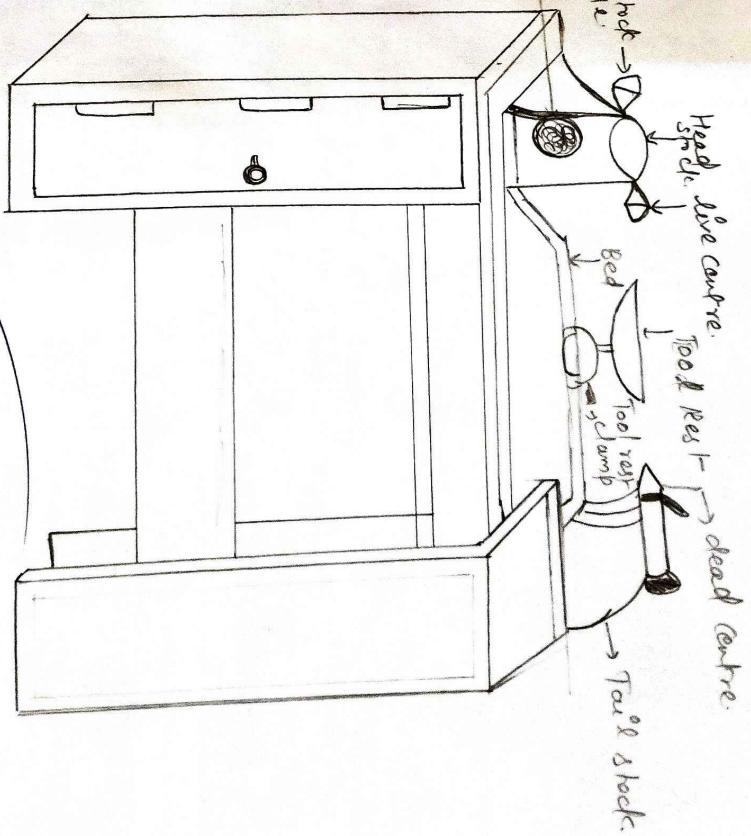
Manufacture in two varieties. Viz. 1. Single Surfacing. A Single Surfacer has only a head and cuts from the top side only. The down comes from other heads; one cutting from the top the other from the bottom of the stock, thus finishing size of a single operation.

① Band saw - Band saw consists of a table, guide pulley, belt and previous adjusting screws. It is used to saw the wooden frames before use.

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Bench Work of fitting shop.

Introduction :-

Bench fitting work is very important work in engineering. In fitting shop Bharatpur Material is removed with the help of hand tools. It is done for making repair and manufacturing purpose. The person is working in the fitting shop is called fitter. The fitter should have complete knowledge of the tools used in the shop. Commonly used tools are, Hack, saw, files, chisel etc.

Classification of Metals :-

- ① Ferrous Metals - e.g. Mild Steels, Cast Iron, High Speed Steel.
- ② Non-Ferrous Metals - e.g. Copper, Brass, Aluminium, Tin.

① Ferrous Metals :-

To produce Ferrous Metals the percentage of Iron is very high. These are commonly used for the engineering purposes. Some other Materials like Carbon Sulphur, Nickel etc. are also mixed into Ferrous Metals to change the properties.

Some Ferrous Metals are discussed below -

(1) Steel - Steel is a mixture of Iron and carbon. It is widely used in engineering purposes.

(2) Alloy Steel - Alloy steel is made by combining some percentage of additional elements into plain carbon.

(3) Cast Iron - The iron containing carbon more than 2% known as Cast Iron.

(i) Cast iron are of two types -

(i) Grey Cast Iron.

(ii) White Cast Iron.

(4) Wrought Iron - Wrought Iron is almost pure iron containing 98% of iron.

(5) High Speed Steels - High speed steels are used for high cutting tools working at high speed.

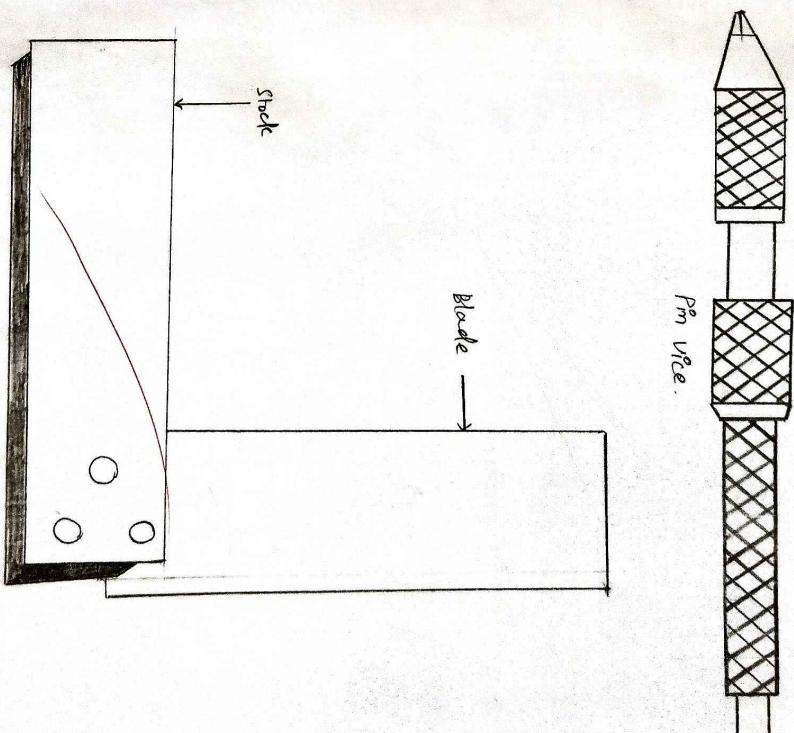
(6) Spring Steel - It is used for making spring or blade.

Non-fersous Metals -

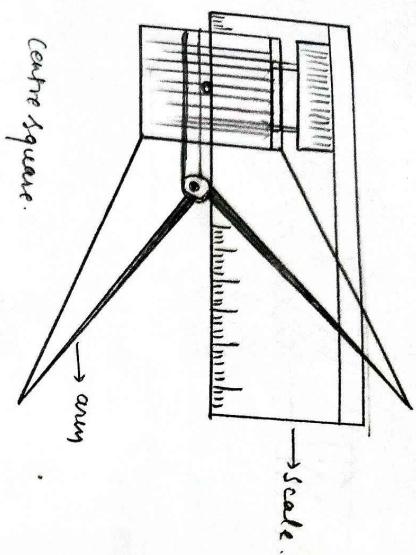
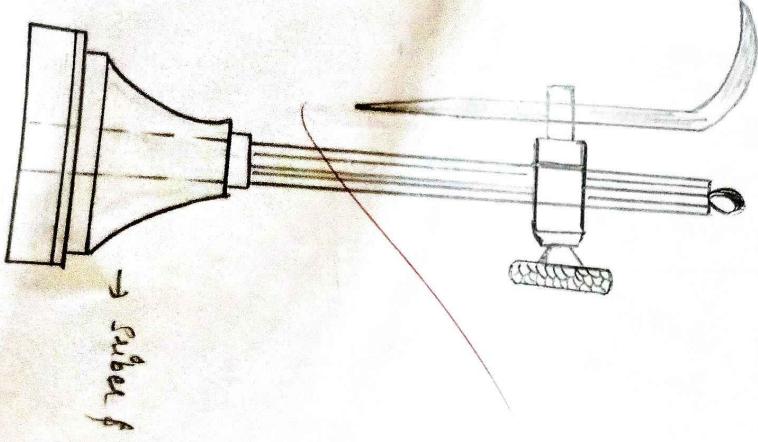
The metals which contains negligible or no quantity of iron are known as non-ferrous metals. Copper, aluminum, brass, bronze, iron, lead are few common examples of non-ferrous metals. Also with 20% of iron.

Wrought iron is made of

Wrought iron is made of



Try square.



Centre Square.

110

→ Subs of Surface Change

(1) Copper - It is widely used in engineering industry.

(13) Copper - Cu malleable when hot. Copper is very soft, ductile having reddish brown colour.

(2). Brass - Brass is an alloy of copper and zinc. There is no effect of corrosion on brass.

(3) Bronze - It is an alloy of Tin and Copper. It is a wear-resisting material.

(u) CuNi Metal - CuNi Metal is an alloy of Copper & Nickel. It is used for making bearings.

(5) Aluminium - It is a soft material with a silver colour.

It is very light and have good electrical power, Conductivity.

Toots weed in the following shop -

~~Putting~~ shop tools are classified as under.

①	Clamping tool
②	Measuring and Handling Tools

- (B) Socking heels
- (C) Threading heels.

reading rules.

Clamping Tools -

The clamping tools are used for holding shape the workpiece and this is used for holding the jobs during various holding operations.

Different types of vices are as follows -

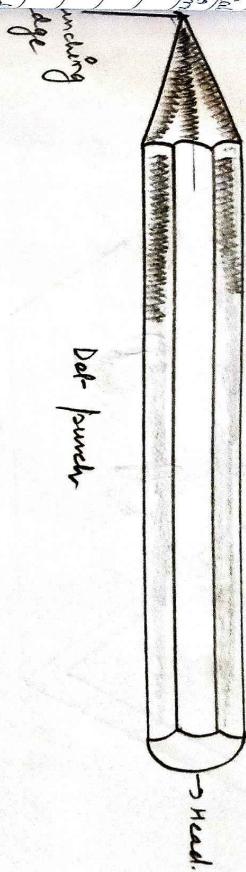
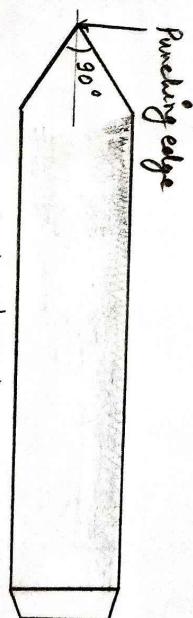
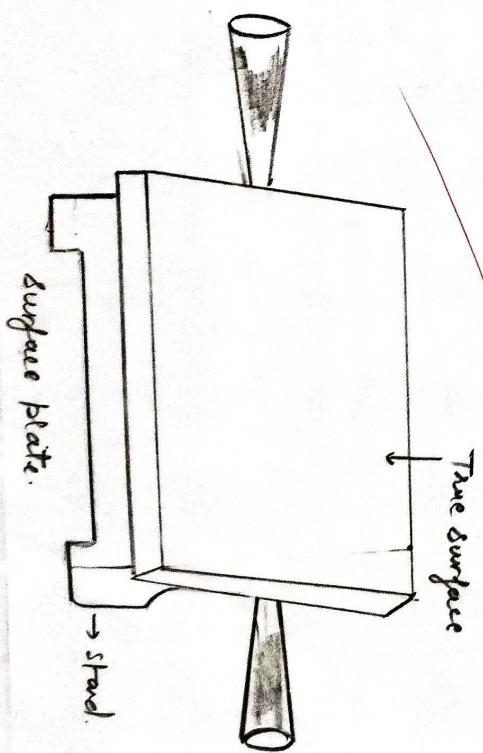
(a) Bench vice: It is commonly tool used for holding jobs. It consists of a cast iron body and cast iron jaws.

(b) Leg vice: It is made of mild steel and the jaws are cast iron steel. It is stronger than the parallel vice and used for heavy work.

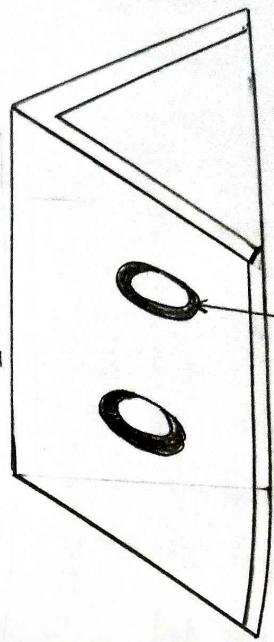
(c) Hand vice: Hawl vice is used for gripping the shape. These are made in different shapes and sizes.

(d) Pin vice: Pin vice is used to hold wire or small diameter rods. It is also used for gripping small chisels.

(e) Pipe vice: It is used for holding the pipes. It consists of a vice head, screws with square threaded, these vice can be fixed on the bench or it can be graduated.



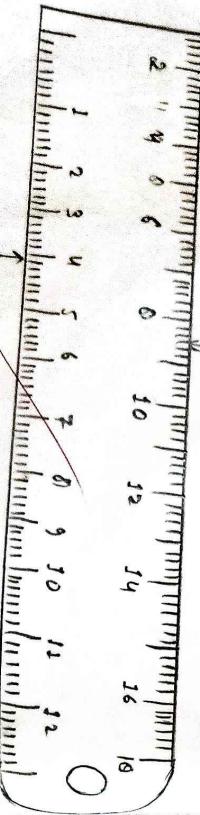
Holes for clamping Bolts.



Measuring and Marking Tools-

Date _____
Page _____

- (a) Try square: It is used for checking squareness of two surfaces. It consists a blade made up of steel which is attached to the base at 90° .
- (b) Bevel protractor: It consists of a steel dial divided from 0° to 360° division. The dial can be rotated around the centre.
- (c) Combination set: It is a multipurpose instrument that can be used as a protector, a level, a wire, a centre square, and a try square.
- (d) Centre square: A centre square is used to find the centre of the round job.
- (e) Scriber and Surface Gauge: Scriber is made up of high carbon steel and is hardened from the front edge.
- (f) Universal marking Surface Gauge: It consists a heavy base, a scriber and a bar. It is used for the marking purpose.
- (g) Dot punch: It is used for marking the dotted lines. It is made up of high carbon steel on high speed steel.



centimetre scale.

inch scale

steel rule



(b) Centre punch: It is like a dot punch except the angle is 90° . It is used to mark the centre point of the hole before drilling.

(c) Surface plate: Surface plate is used for testing the flatness of the surfaces. It is made up of the cast iron.

(d) Angle plate: It consists the cast iron which has the metal one standing at right angle to each other.

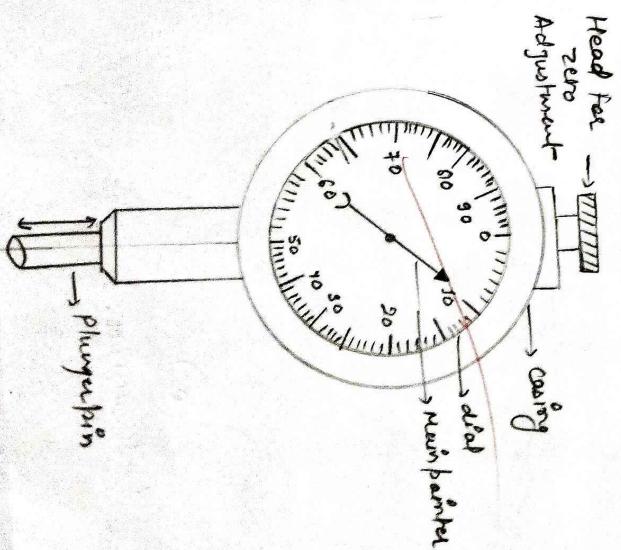
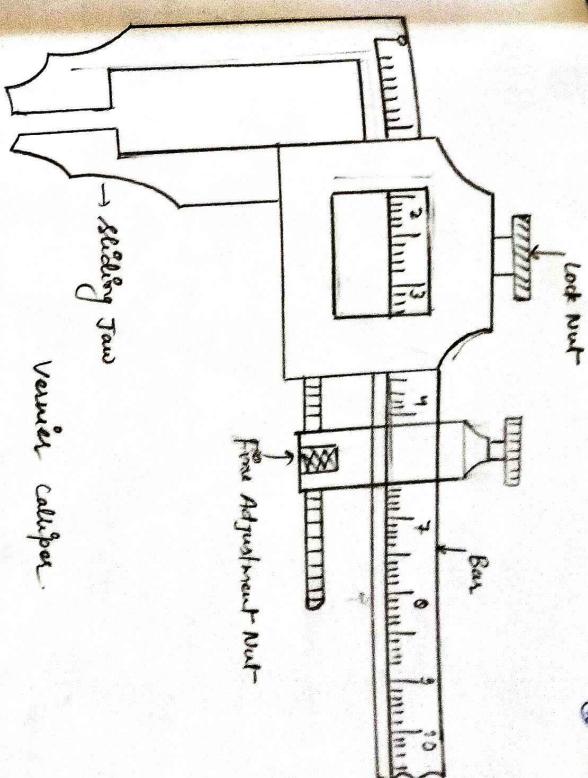
(e)

V-block: It is used for supporting as well as for purposes. Round jobs are generally placed on it for centre line etc.

(f) Steel rule: These are made up of less stainless steel and are available in many sizes ranging from 1 ft to 8 ft.

(g) Vernier calliper: Vernier calliper is the precision tool used for measuring lengths and diameters. It is used for measuring external and internal dimensions.

(h) Micrometer: It is used for measuring diameters of any jobs. It is more precision than vernier calliper. It consists of a box type frame.



- (b) Centre punch: It is like a slot punch except the angle is 90° . It is used to mark the centre of the hole before drilling.

(i) Surface plate: Surface plate is used for testing the flatness of the surfaces. It is made up of the cast iron.

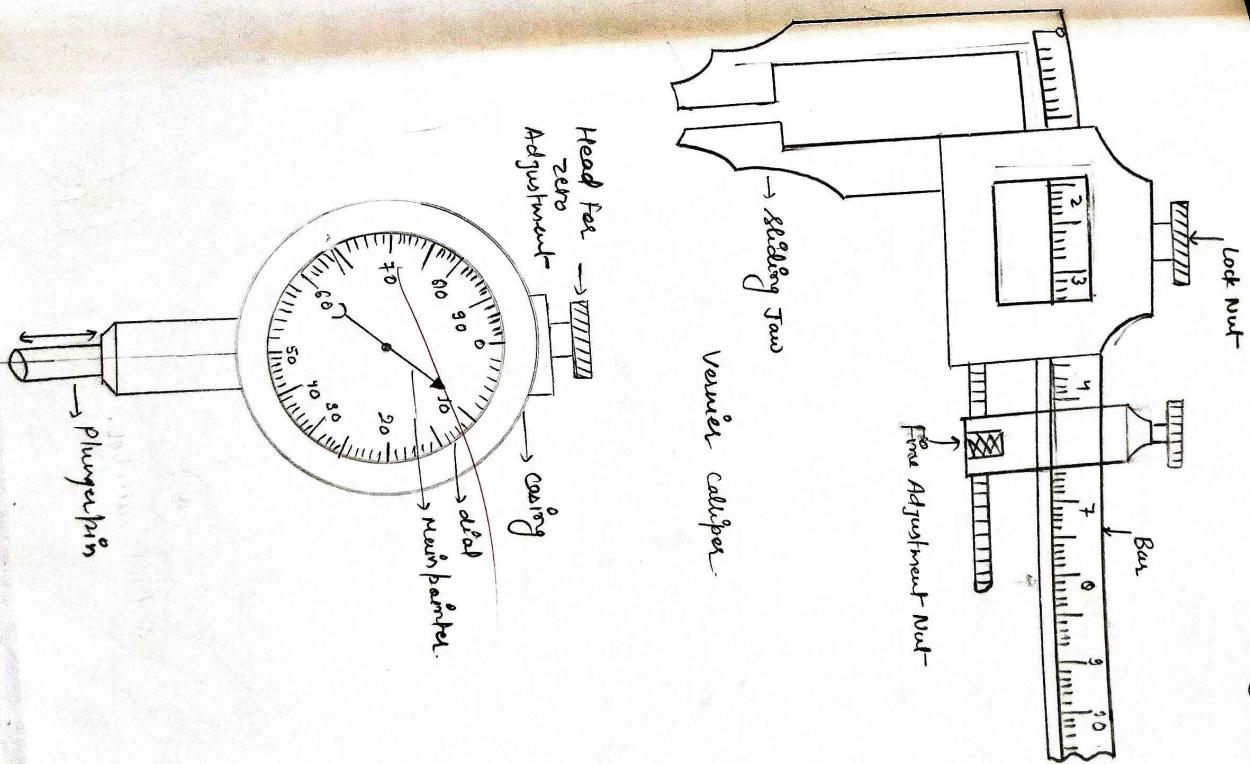
(j) Angle plate: It consist the cast iron which has two 90° angles standing at right angle to each other.

(k) V-block: It is used for supporting as well as for our purpose. Round jobs are generally placed on it in centre line etc.

(l) Steel rule: There are made up of two stainless steel and are available in many sizes ranging from 1 ft to 8 ft.

(m) Vernier calliper: Vernier calliper is the precision tool used for measuring lengths and diameters. It is used for measuring external and internal dimensions.

(n) Micrometer: It is used for measuring dimensions of any jobs. It is more precision than vernier calliper. It consist of a block type frame.



Dividers: A round gauge in which a pointer moves over a graduated scale. The movements is magnified through links.

Dividers: These are made up steel. Dividers have two sharp legs.

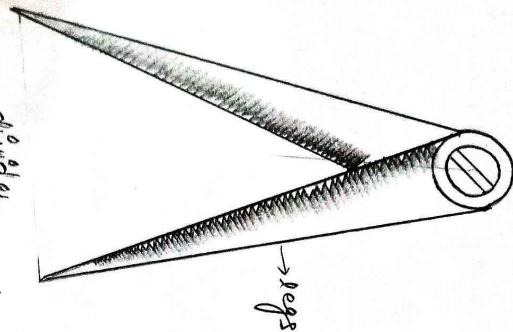
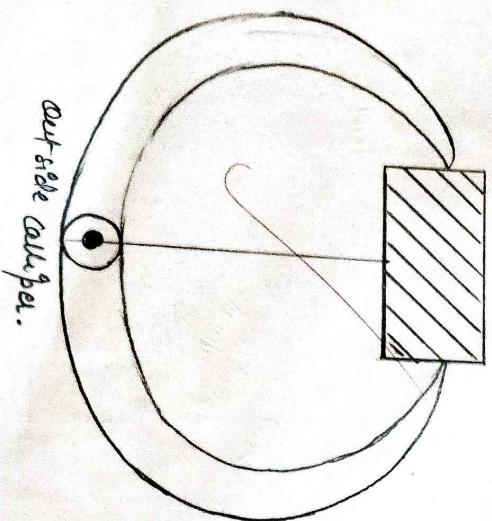
Callipers: It is generally used to measure the inside or outside diameters. It is made in different size and types.

Gauge: It is a thin wire with a head.

Depth Gauge: It consist of a stainless steel and had a beam. The beam is graduated in inches or millimeters.

feeler Gauge: It is used to check the gap between two mating parts. It consist the equal number of metal leaves.

Radius Gauge: It is just like a feeler gauge.



outside calliper.

(iii) **wire gauge:** the figure shows you the wire gauge used to check the diameter of wire. It is made of a sheet sheet disc.

Cutting tools:

(a) **Hack saw:** Hack saw is used for cutting rods, flats.

The blade of the Hack saw is made up of the high carbon steel, on high speed steel. And the frame is made up of mild steel.

(b) **file:** file is a multi-pointed tool. It is used to material by rubbing it on the metal. files are classified in the number of teeth, shapes and degree of coarseness of files on the basis of gradation:

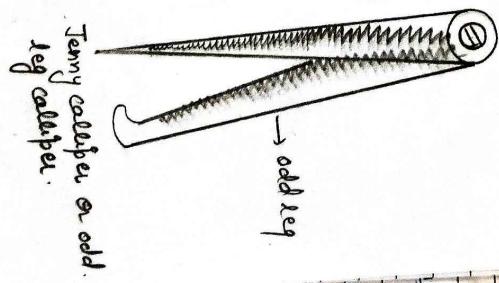
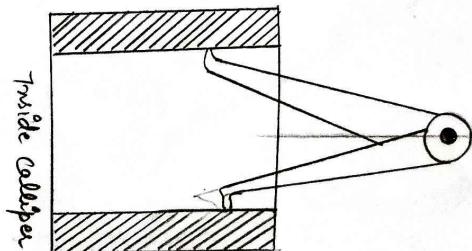
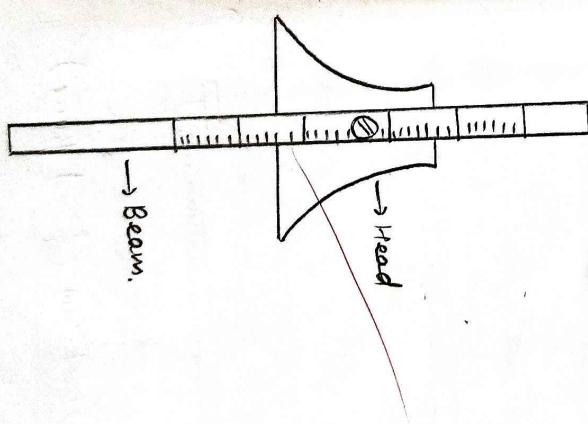
0 Rough (20 teeth per inches)

② Bafford (30 " " " " " ")

③ Second cut (40 " " " " " ")

④ Smooth file (50-60 " " " " " ")

⑤ Dead smooth (100 " " " " " ").



(c) **chisels:** There are used for chipping away the from the work piece. These are made up of the high carbon steel generally 6" to 8" long. The is flattened and a sharp cutting edge is made on the bottom sole.

Striking tools:

Hammer are only tools generally used for striking on fitting shop. These are used for driving, fitting, punching etc. A Hammer consist a heavy iron head and a wooden handle. The weight ranges from 0.25 kg to 2 kg. The main types of Hammer are as under and are shown in the figure.

Miscellaneous tools:

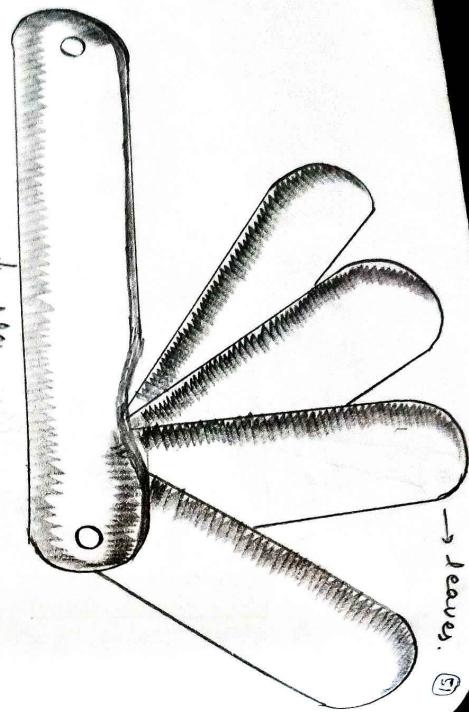
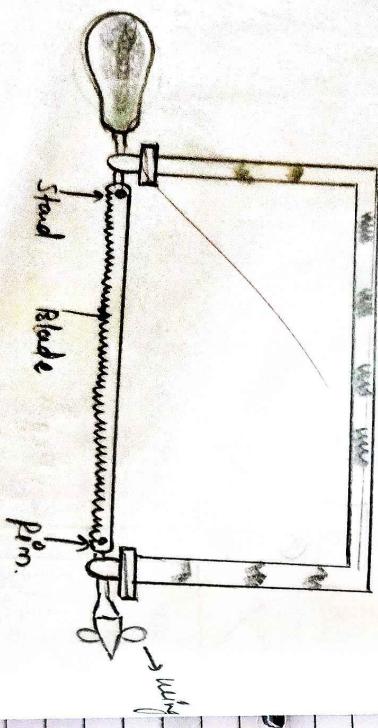
Drill: The tool used for making round holes is called drill. It is made up of high speed steel. The parts of a twist drill are shown as under.

Reamer: Reamer is used to finish the drill hole. It has many cutting edges. Commonly used reamers are shown below.

Counter Bore: Counter Bore are taper cutting used to make the holes cone shaped from the upper end. It is used to fitting screws and Nails.

Counter Bore: It is used to enlarge a portion of hole. It is also made for fitting the heads of bolts and screws.

Hacksaw (sawed frame).



Tap: Taps are used for making internal threads. They are inserted in to the face of the hole at a given angle.

Bench working Processes:

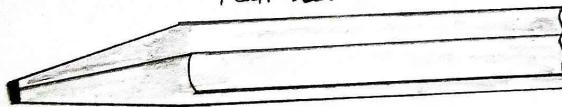
It consists of number of operations that are performed manually.

- ① Marking
- ② Chipping
- ③ Sawing
- ④ Boring
- ⑤ Drilling
- ⑥ Tapping
- ⑦ Peening

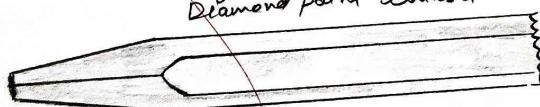
(c) Marking: It consists of number of operations that are performed manually.

(d) Chipping: It is the first and major part of operations performed in the bench working. Once the accuracy of the product depends upon this.

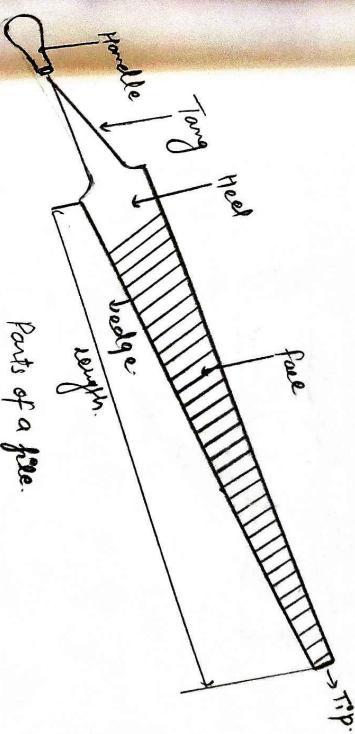
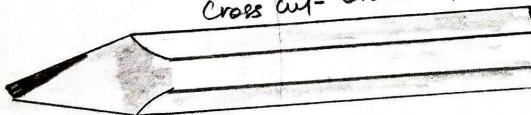
Half round chisel.

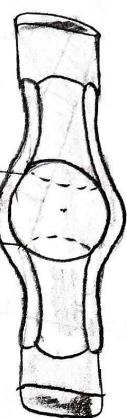


Diamond point chisel.

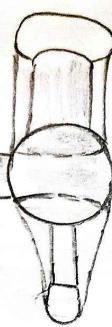


Cross cut - chisel.





Bar pean hammer.



Cross pean hammer.

Sawing: It is the operation which is required to cut the metal in the different types and shapes. It should be done slowly, and standing position is appropriate for this operation.

Planing: It is an operation which is performed by the help of planer. The pressure for cutting should be exerted in the forward stroke and backward stroke is light.

Scrapping: This is a manual operation done in a fitting shop for producing the more accurate parts than obtain by planing.

Drilling: It is an operation done to produce holes either blind or through in a metal piece by the help of drills that are discussed earlier.

Tapping: It is an operation of cutting the internal threads by the help of tap and tap holder manually. It is already discussed earlier.

Dieing: It is the process of cutting external threads by the die and the die holder. It is also discussed earlier.

Drilling Machines:

The following drilling machines are generally used:

- (1) Bench drilling machines.
- (2) Hand drilling machines.
- (3) Portable drilling machines.

(1) Bench drilling Machine:

Figure shows the bench drilling machine part machine. It is used for drilling, reaming, Countersinking and Counter boaring etc.

(2) Hand drilling Machines:

It is used for making very small holes. The part of this machine is rotated by Crank. It is held in the handle with left hand while crank is rotated with right hand.

(3) Portable drilling Machine:

It is used for drilling small size holes. The machine is compact and small in size. It can be easily moved to the work place for drilling. A small motor is attached on drilling machine. A small

Experiment- No. 3

Welding shop-

Introduction-

Welding is a process of joining two materials with the help of heat and pressure or by some other means. The cost of welding is very less as compared to the other processes and forms a strong joint. For this reason it is largely used in the following fields of engineering, manufacturing of machine tools, autoparts, truck parts etc. fabrications of farm machinery and equipments. fabrication of buildings, bridges and ships. Construction of Busses, furnaces, railways, cars, aeroplanes, sockets and needles.

(5) Manufacturing of television set, refrigerators, kitchen, cabinets etc.

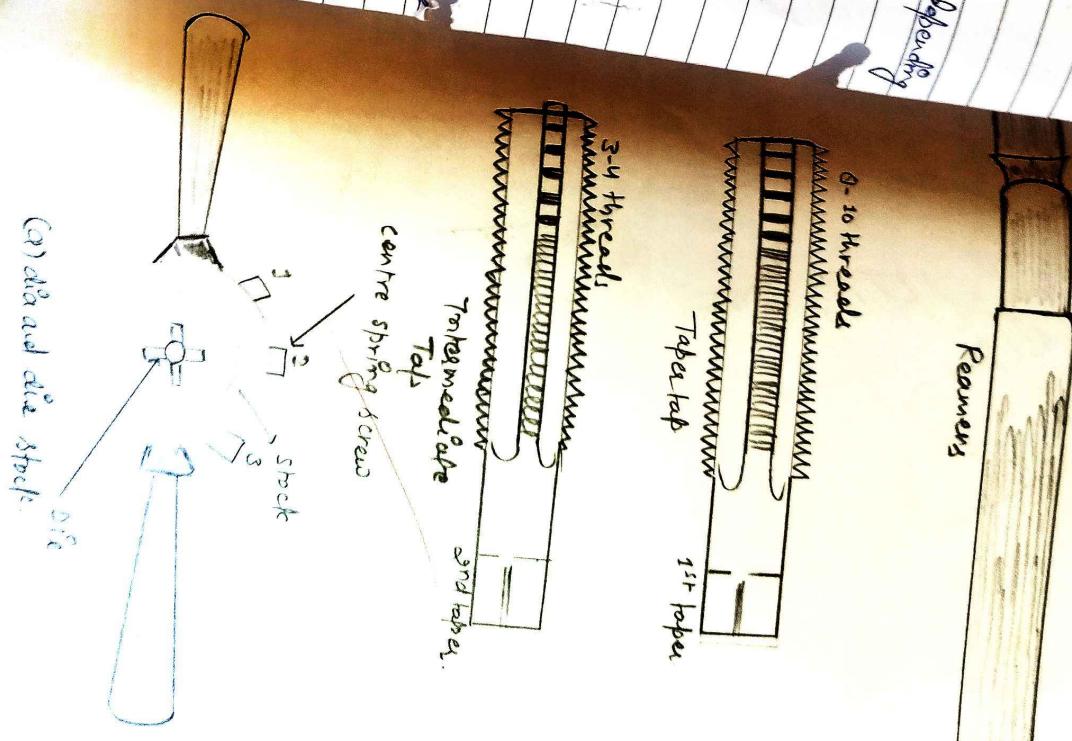
Ham purpose of welding is to join two pieces, for this tribally temperature of the parent metal is raised up to melting point, then filler metal is used as the supplement for metal. A homogeneous mixture is formed at the joint when it is allowed to cool off to form a weld. This is fusion welding. The parts that are to be joined are brought to the plastic stage and then apply the external pressure to join them. It is pressure welding. In the bolts above, used the source of heat as follow for

Types of welding.

Many types of welding process has been developed depending upon the field of their application. Some of the processes are listed below -

- ① forge welding.
- ② electric arc welding.
- ③ gas welding.
- ④ spot welding.
- ⑤ seam welding.
- ⑥ car. arc welding.
- ⑦ flame arc welding.
- ⑧ TIG welding.
- ⑨ MIG welding.
- ⑩ plasma arc welding.

Forge welding - This welding is done by the blacksmiths. Two similar metals are heated up to homogenous mixture in the furnace. Then it is hammered so that pores are removed. It is cleaned and made free of any foreign material.



ex. In furnace from forge welding, it is generated from chemical energy. i.e. Arc welding, gas welding, flame welding etc.

Types of welding.

Many types of welding processes have been developed depending upon the field of their application. Some of the processes are listed below -

- ① Forge welding.
- ② Electric arc welding.
- ③ Gas welding.
- ④ Spot welding.
- ⑤ Seam welding.
- ⑥ Plasma arc welding.
- ⑦ Flame welding.
- ⑧ TIG welding.
- ⑨ MIG welding.
- ⑩ Gas-nitrogen welding.
- ⑪ Plasma arc welding.

① Forge welding -

This welding is done by hot blacksmiths. The plastic stage of the process are heated up to

a homogeneous mixture to be formed. Then it is hammered so that

to be joined should be cleaned and made free of any foreign

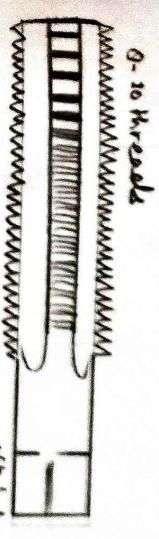
particles, this is done by the brushing.

② Gas welding: Gas welding is the process in which the gas flame is used to raise the temperature of the metals to be joined. The metals are heated up to melting. The metal then

and on cooling it solidifies. A filler metal may be used.



Peacock



0-10 threads

3-4 threads



Tape tap

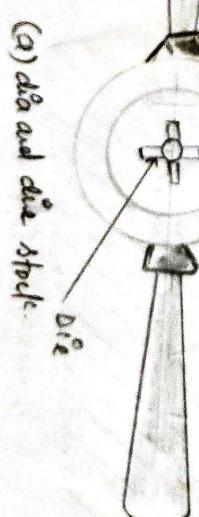
1st taper

2nd taper

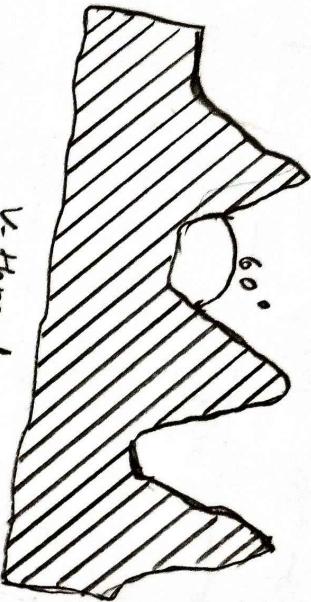
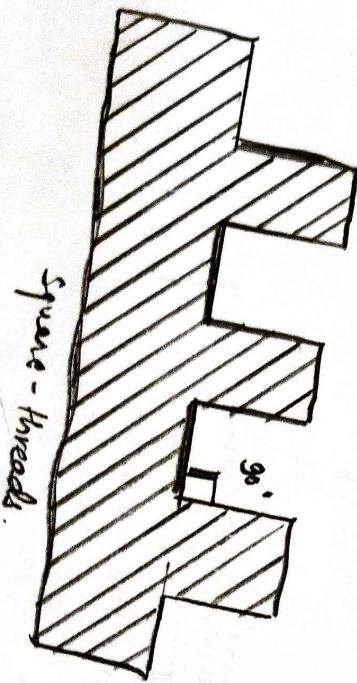
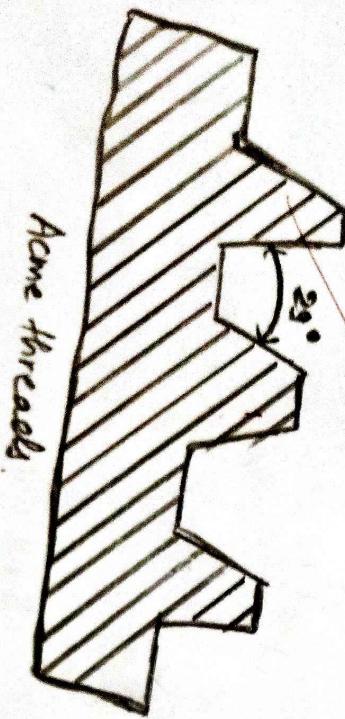
Centre spring screw

Stock

Die



(a) dia and die stock.



Screw threads:



There are many types of threads available in engineering.

(1) British Standard Whitworth thread (B.S.W): The thread is generally used on bolts and nuts. It is a V-shaped thread having an angle of 68° .

(2) Metric threads: Metric threads are also V-shaped threads. Thread angle is kept 60° in Metric threads.

(3) Square thread: The shape of the square. Such threads are less stronger than V-shaped threads. wear and tear is also less. These are used in screw jacks.

(4) Acme threads: It is a modified form of square threads. These threads are stronger than square thread. The thread angle of acme threads is 29° . In lead screws shaft of lathe, acme threads are used.

1/65
10/10

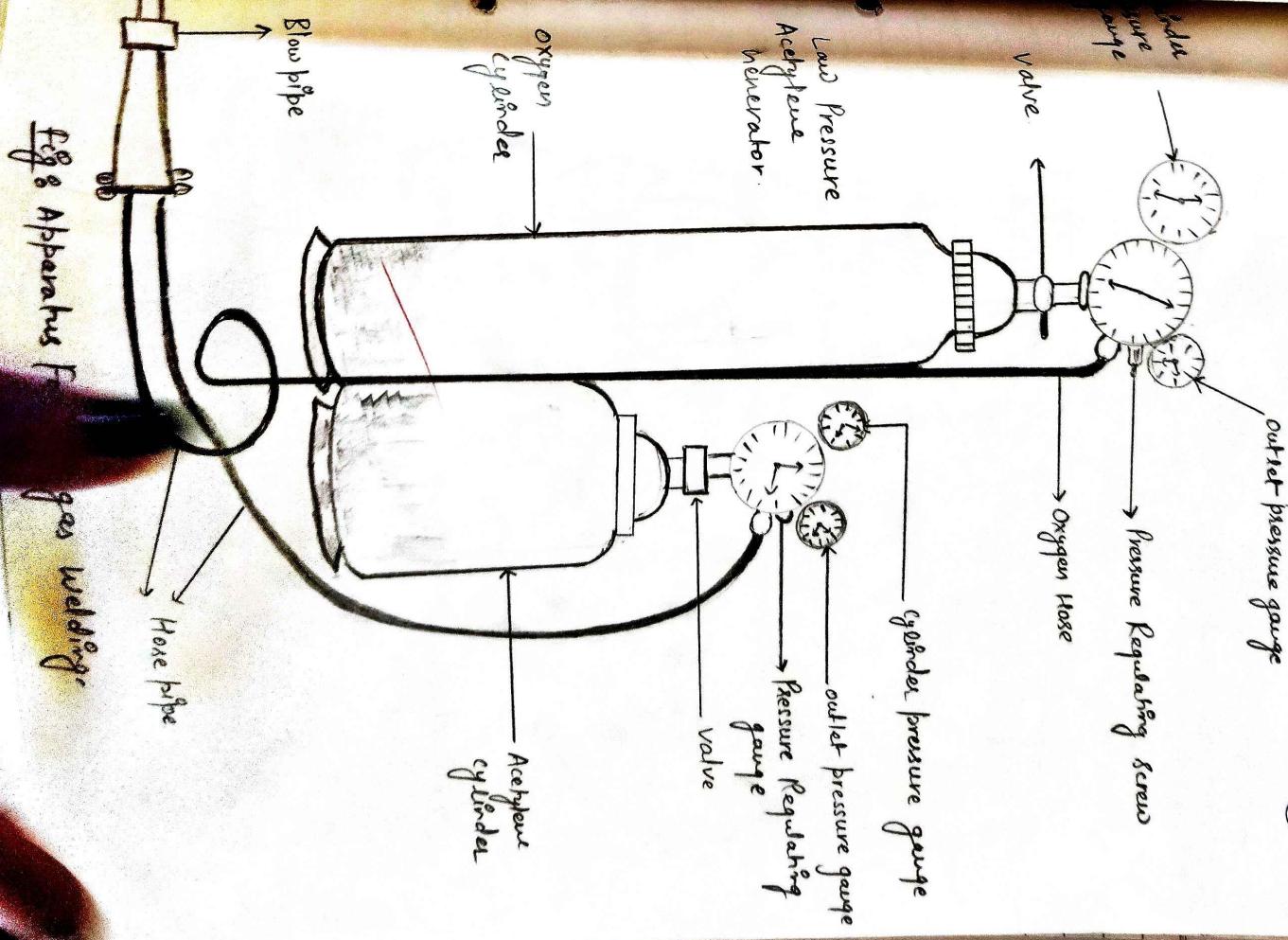


Fig 8 Apparatus for gas welding

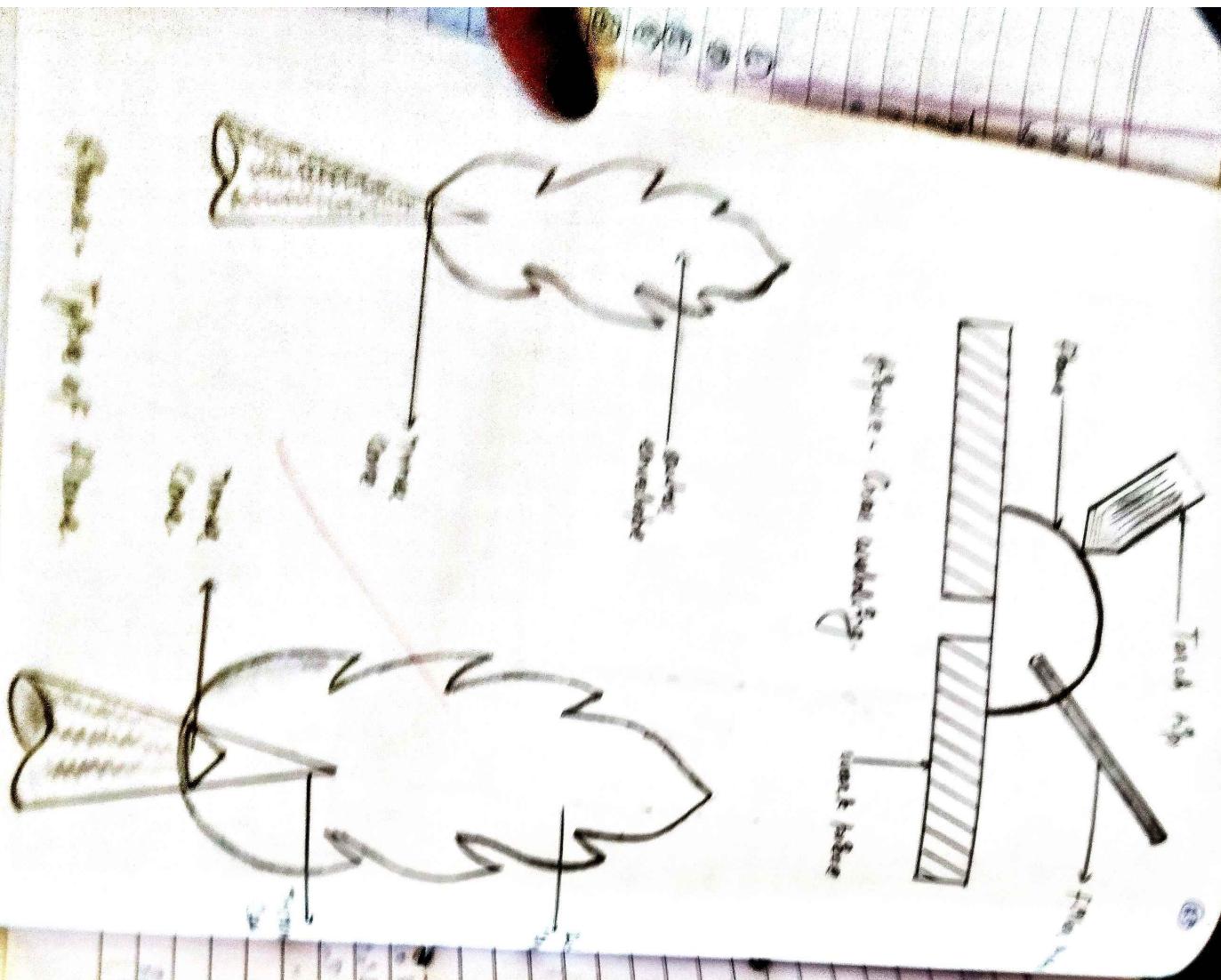
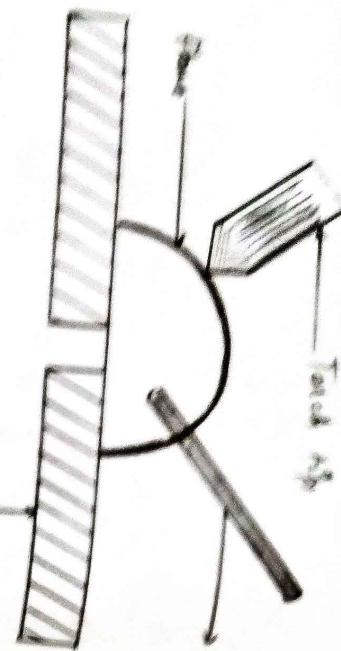


Fig. Gas welding

work pipe



oxy-acetylene welding

The process of oxy-acetylene welding can be used about all metals and they are especially suitable for low temperature flame (heat) to be produced by this method. There are two system of oxy-acetylene welding.

- High pressure system:
- Low pressure system (the oxygen and acetylene are taken from low pressure cylinder).

(a) Low pressure system:

In this system oxygen & the fuel gas oxygen cylinder and the acetylene cylinder connected by two sets of valves.

Gas + oxygen \rightarrow Combustion

Acetylene + oxygen

Acetylene

oxygen

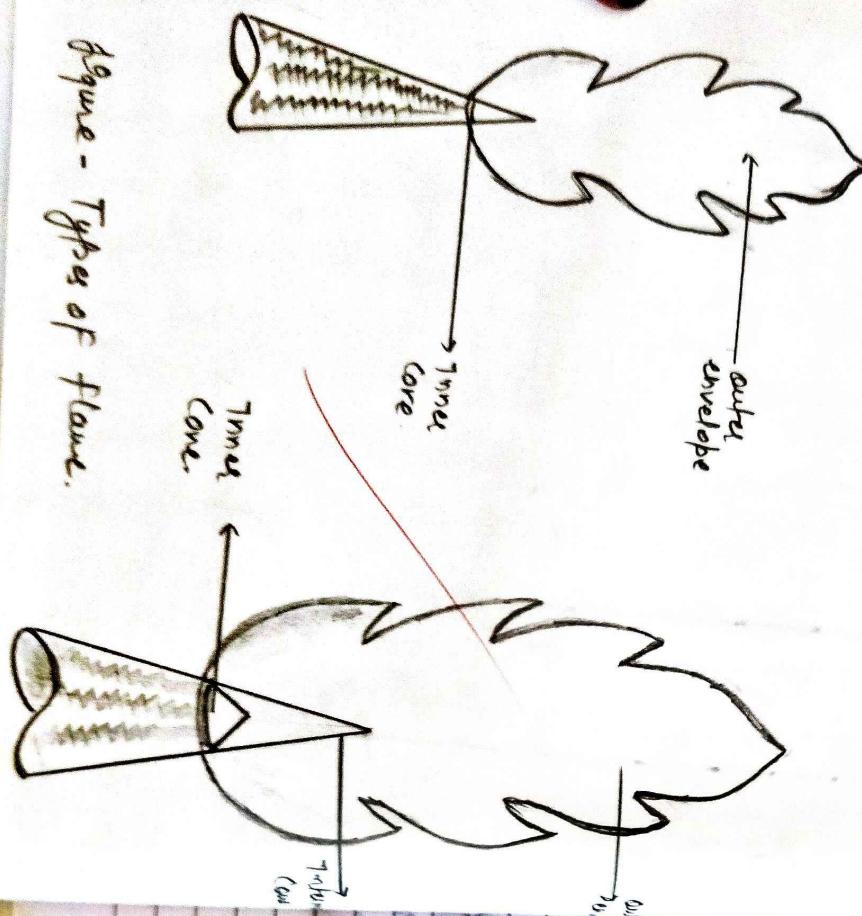
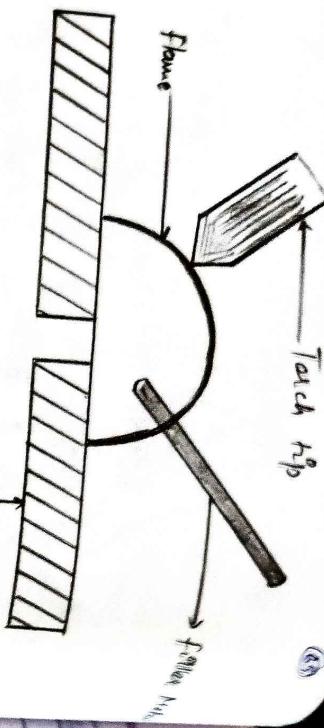


Figure - Gas welding.



Date 56

to the heating action heat to carry made during the end combustion. Many combinations of gases are used in gas welding. But the most common of them is oxygen and acetylene.

(i) Low pressure system:
In this system oxygen is taken from high pressure cylinder and the fire flame is produced by the action of calcium carbide and water.

$$CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2$$

(ii) Principle of oxy-acetylene welding:
A very hot flame is produced by burning the gases coming through the torch tip. The edges to be welded are heated up to melting. A filler metal is also added to complete the welding. Thus molten metal on future when solidifies on cooling forms a welded joint.

Apparal

Apparatus used for oxy-acetylene Clegg pressure as shown in the figure (and consists of the following):

- | | |
|----------------------|-----------------------|
| ① oxygen cylinder | ⑥ Torch |
| ② Acetylene cylinder | ⑦ welding tip. |
| ③ Pressure gauge | ⑧ pressure regulation |
| ④ valves | ⑨ lighters |
| ⑤ Hoses | ⑩ tank |

⇒ Good knowledge + 1 more knowledge is more knowledge

There are three types of gas welding techniques -

(b) Rightward welding.

verende velding.

leftward welding - It has welding for a P-112-112

To degree back plate. And the offer was 7
300 to 400. In the other 9. In ~~the~~

edges and headed in opposite directions. On the Method Branch high and tall, after the Northern Hotel

hopped towards the left and moved slowly in the

Techniques illustrated in the figure.

kept at 40 to 50 degrees. In night wood welding the torch

He was very, very well dressed.

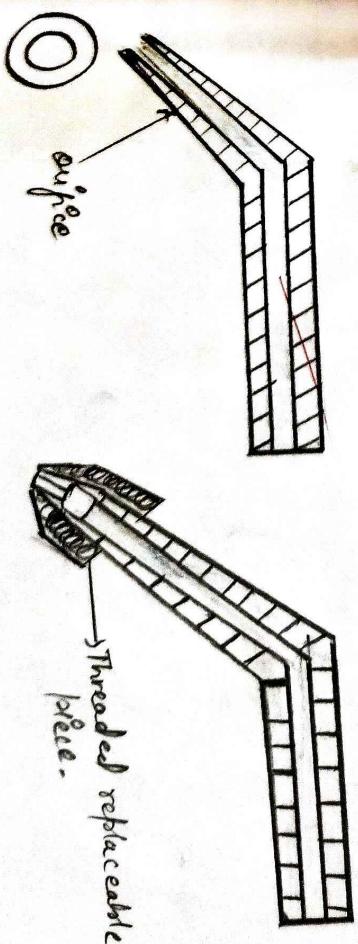
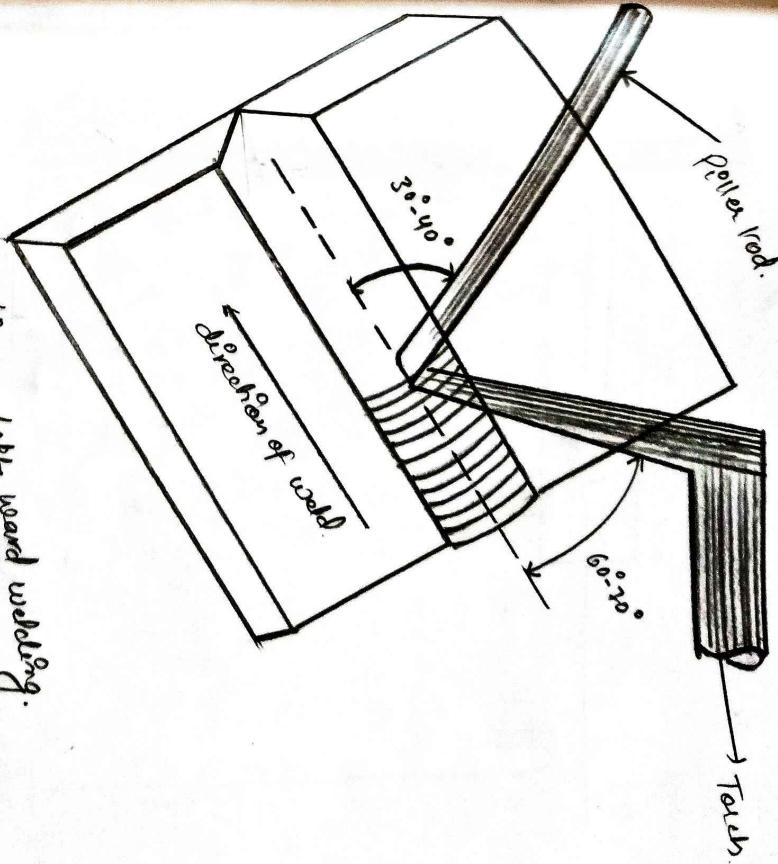
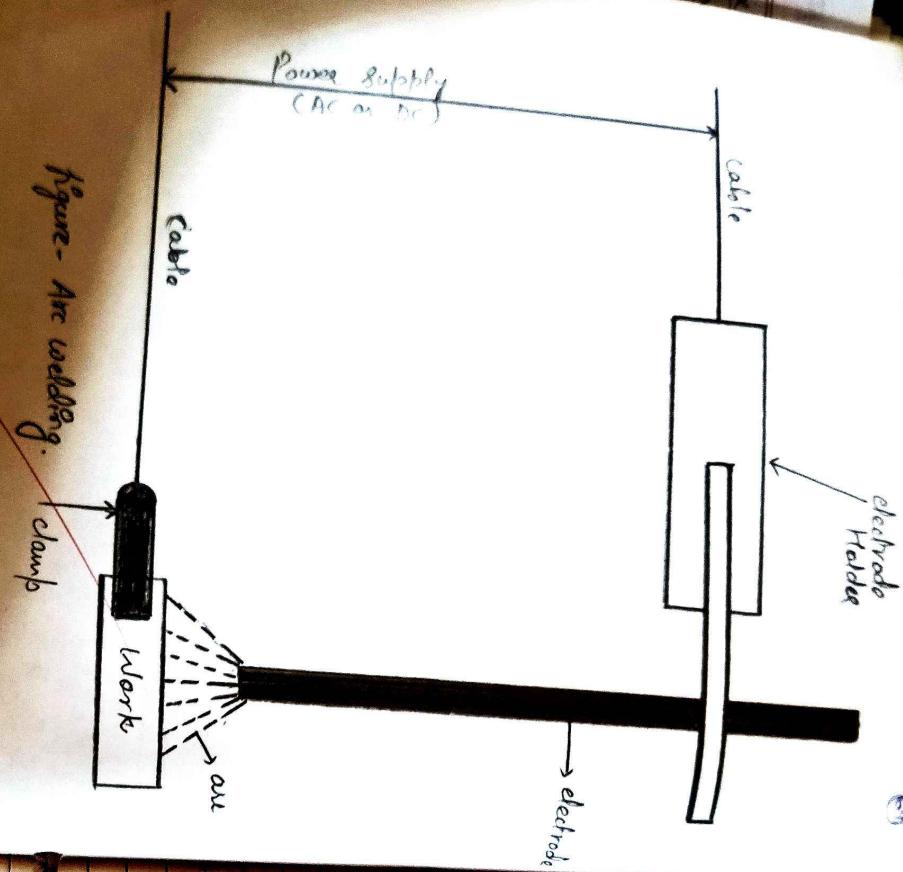


Figure - leftward welding.





Torch is moved towards right as shown in the figure. Larger board welding is done for heavy sections only.

(3) Vertical welding - This is a method by which metal of any thickness can be welded. In case the thickness of the sheet is lesser than welding from one side, it will be sufficient but for thicker sheets welding should be done from the both side. Preparation of edges is not required.

Arc welding - In which the electric arc is produced to give heat for the purpose of joining two surfaces is called electric arc welding.

Principle -

Power supply is given to electrode and the work. A suitable gap is kept b/w the work and electrode. A high current is passed through the circuit. An arc is produced around the area to be welded. This electric energy is to be converted in the heat energy producing a temperature of 3000°C to 4000°C . This heat melts the edges to be welded and molten pool is formed. On solidification, the welding joint is obtained.

equipments used for Arc welding -

Various equipments used for arc welding are,

(1) DC welding equipments.

(2) AC motor: Generator set

(3) Diesel engine: Generator set

(4) Transformer: Rectifier welding set.

(5) AC equipment:

(6) welding transformer set.

(7) Equipment Accessories -

(8) Leads.

(9) Holders.

(10) Connectors

(11) Ground Clamp.

(12) Operators tools -

(13) Clipping Hammer

(14) Wire brush

(15) Arc shield

(16) Closed block -

Spot welding -

It is a method used for making spot welds per shot up to 10 mm thickness. It is expressed by the figure

Date _____
Page - 71

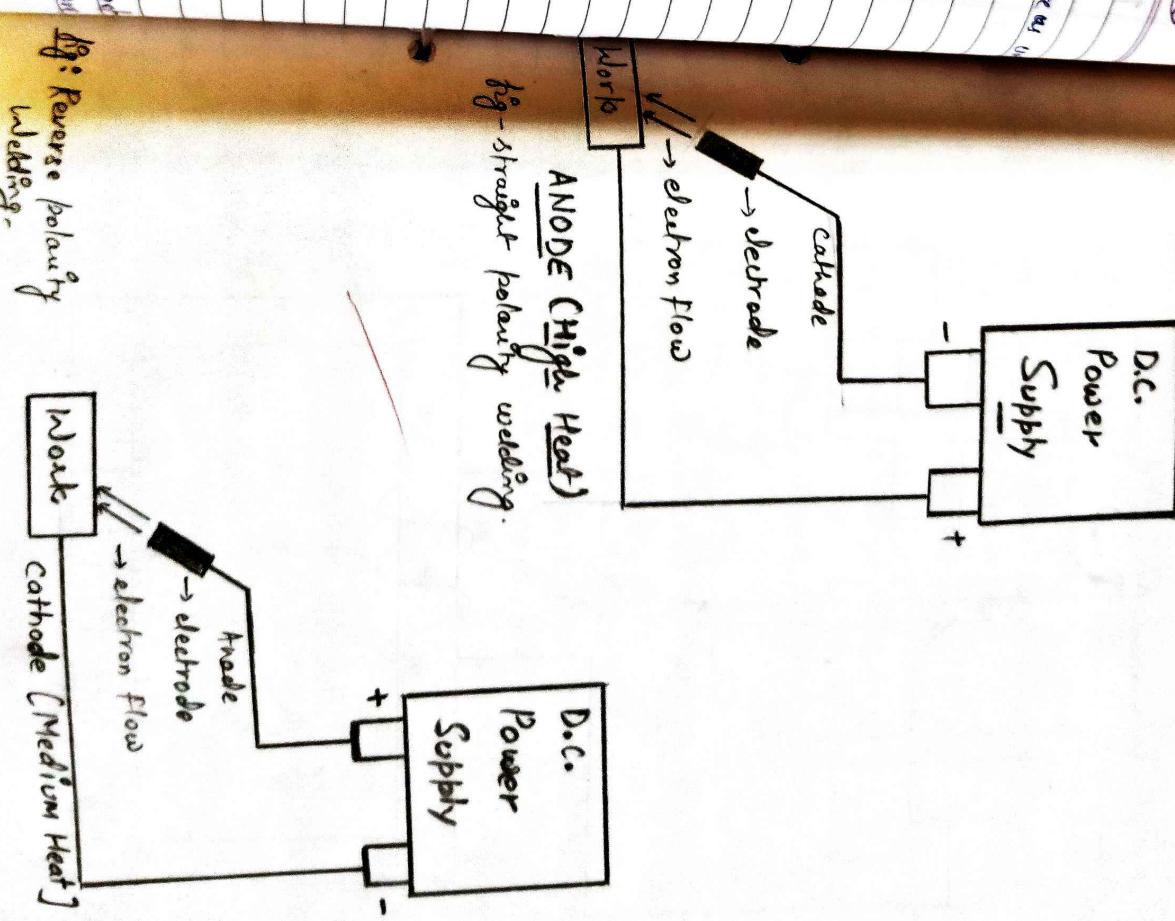
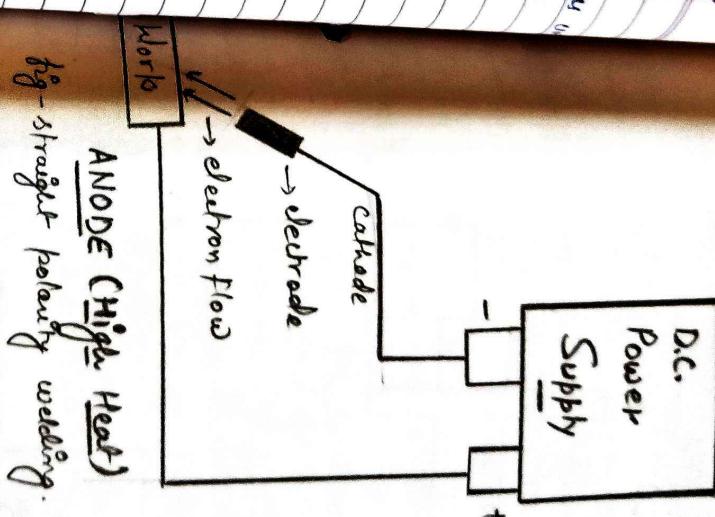


Fig: Reverse polarity welding.

72

equipments used for arc welding -

Various equipments used for arc welding are -

- (a) DC welding equipment:-
- (b) AC rotary: Generator set
- (c) Diesel engine: Generator set
- (d) Transformer: Rectifier welding set.

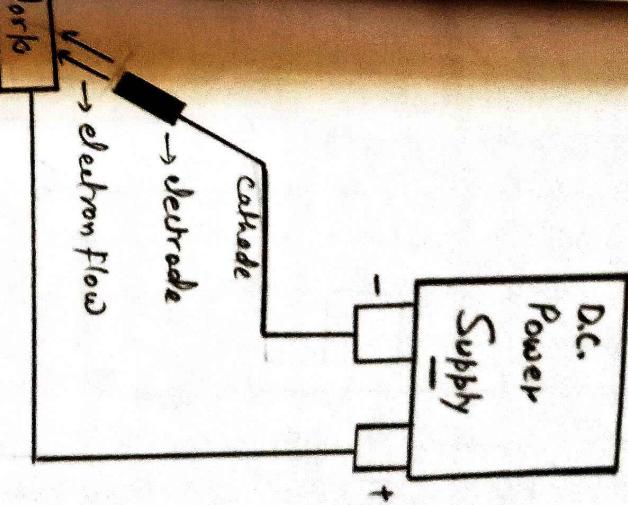
- (e) AC equipment:
- (f) welding transformer set.

- (g) Equipment Accesories.

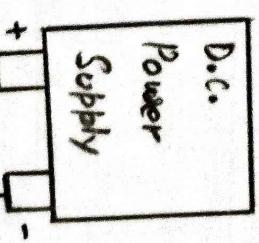
- (h) Leads.
- (i) Holders.
- (j) Connectors

- (k) Ground Clamps.

ANODE (High Heat)
big-straight polarity welding.



Work cathode (Medium Heat)



~~if: Reverse polarity welding.~~

Spot welding -
It is a method used for making lap welds for sheet up to 19 mm thickness. It is expressed by the figure

shown below -

It consists of a transformer having primary and the secondary windings & a welding pad A. This welding consists of two arms, fixed & a movable arm C, and the other fixed arm D, for E_2 , both these arms are connected by the secondary coil of the transformer.

Spot welding

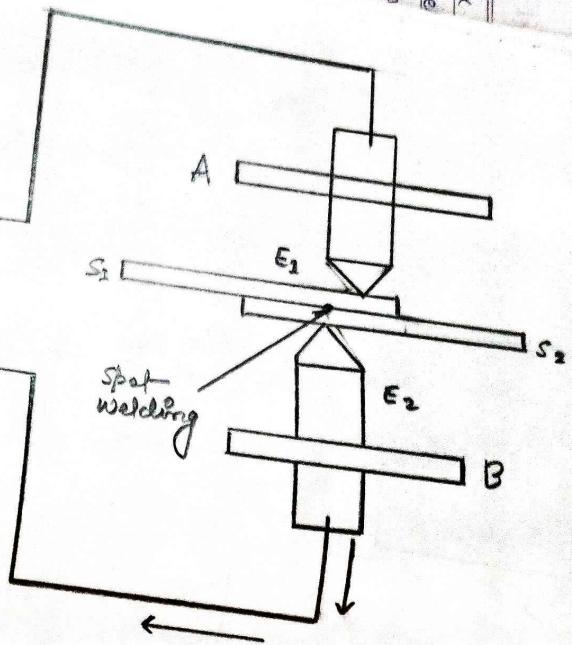


Fig: Spot welding.

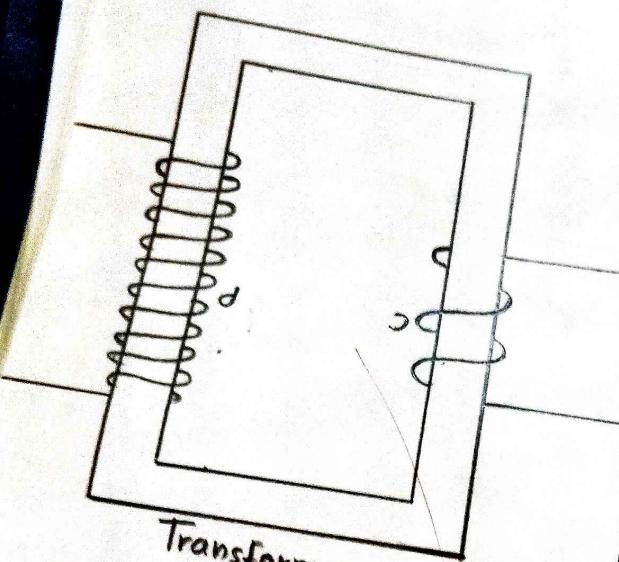
It consists of a transformer having primary and the secondary windings & a welding pad A. This welding consists of two arms, fixed & a movable arm C, and the other fixed arm D, for E_2 , both these arms are connected by the secondary coil of the transformer. The height of the transformer is adjusted to the adjoining surfaces of the workpiece. The pressure is applied by the fixed and movable arm as a result the temperature of the adjoining surfaces is brought up to the melting point, and it is joined due to the external pressure. This principle is based on the spot welding machine in which the pressure is applied by lever fixed in the lower part of the machine that is operated by the foot.

Seam welding -

The principle of the seam welding is same as that of a spot welding, only the difference is that the type of spot welding is replaced by rotating wheel as shown below.

As a result it is continuous welding process whereas spot welding is intermittent in nature.

In this process two natural sharp is fed between the two rotating wheels that act as a electrode, a supply of high amperage and the low voltage is maintained.



between the electrodes. Before welding the surface is cleaned by brush. It is a very fast cooling to avoid spatters of the joints obtained by seam welding.

Exch.

1. Tungsten Inert Arc welding or TIG.
2. It is a process in which electrode is held in a holder in such a way that it holds the electrode also ensure supply of inert gas around the electrode that create an inert-atmosphere around the arc.
3. Cooling during the welding is done by the electrode by supply of water or gas. It is a process which is continuous or intermittent welds. Filler Metal used in this Method is process. It is used to Al-Alloys, Cu-Alloys, Mg-Alloys, Nickel-Alloys etc.
4. Metal Inert gas welding.

In this case electrodes is in the form of continuous wire that is fed in to the arc. Speed of the wire controlled by the electric Motor. The electrode holder for the wire is electrode and it also ensure supply of inert gas to the arc. That create an atmosphere which provides an inert atmosphere for the arc. This is for welding the low alloys, Steels, aluminum alloys, Magnesium alloys and Cu-Alloys.

Welding is done with high speed.

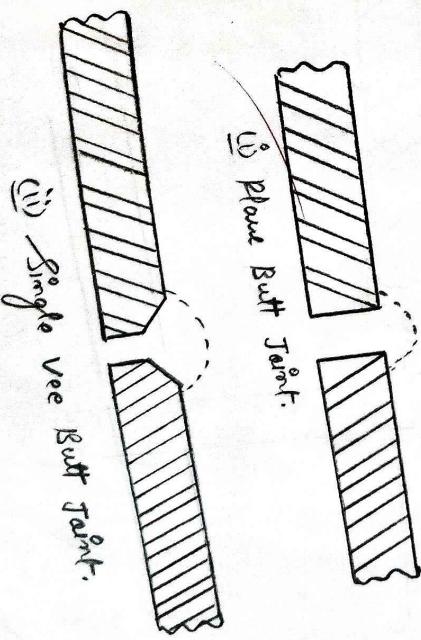
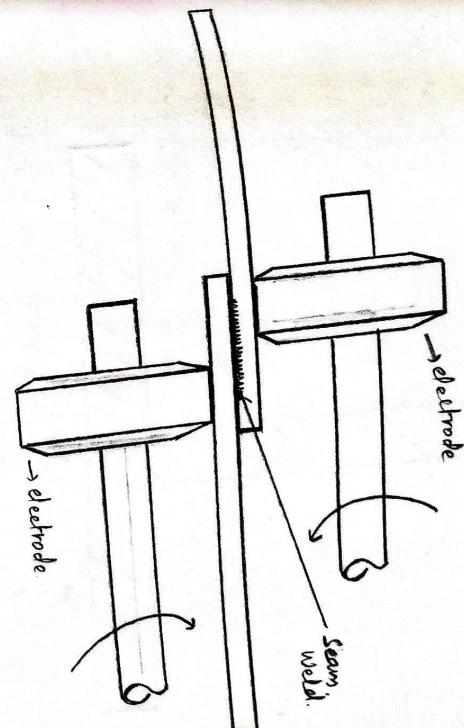
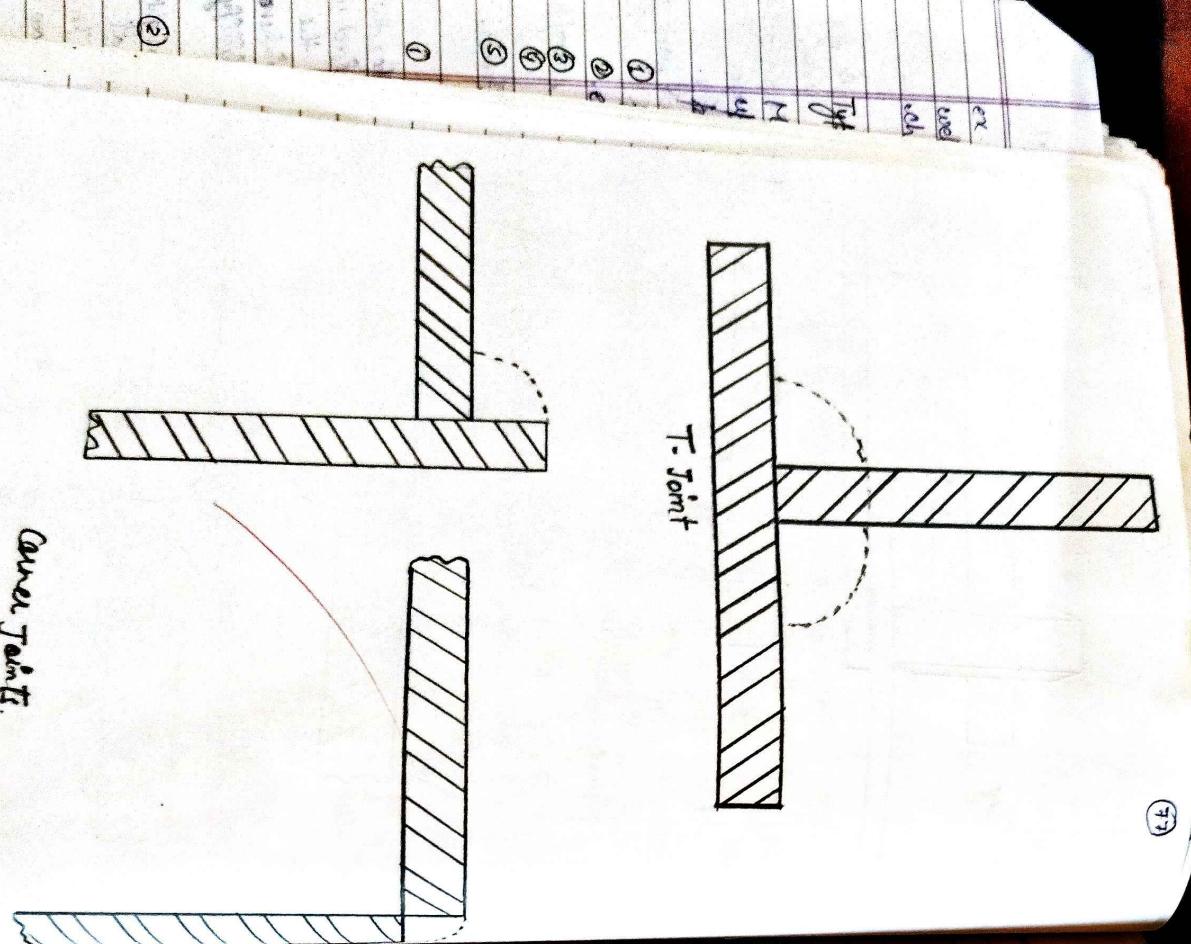


figure - Seam welding.



Cover Joints.



77

Date _____
Page 77

Plasma arc welding -
Plasma process find mixture of the gases such as argon, triplexes, hydrogen and helium is passed through an electric arc. due to heat of the ionised. The metal to be as plasma and if is passed through welding torch. the plasma and if is passed through welding torch. the piece of the metal to be joined is heated through the plasma and tungsten electrode is used as filler material with water as a cooling agent. This can be used for the cutting.

Soldering and Brazing -

Soldering -
Soldering is the process of joining two metals by using a low temperature metal alloy. The metals used for soldering are known as solder. Solders are of two types:

- ① Hard solder.
- ② Soft solder.

Hard solder is an alloy of copper and zinc while as the soft solder is an alloy of tin and lead.

Application - widely used for sheet metal work in building, automobile, ship building, aircraft, etc.

Soldering is widely used for joining the wires, radio and television work, for

IND
RH

Bm 2182

the process of joining two metal surfaces by
adding a non-ferritic alloy such as Nickel, Iron
above until a 1% Ni-Fe alloy is used.

Processor - Intel Pentium 4 3.2 GHz RAM - 1.5 GB Hard Disk - 120 GB OS - Windows XP Pro

The various Methods used to melt the following metals

1. Gas torch heating.
2. Furnace heating.
3. Boiling.
4. Electrical heating.

Appleback

Applica

exchangers, pipes and fittings. 111. Reichert. 1907

Types of flame -

~~Three types of flowers:~~

most fragrant flower

300

High Flame -

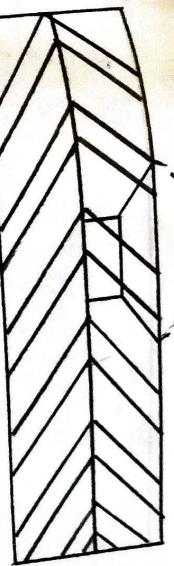
we'd been everywhere we'd been, and we'd seen a lot more.

and β also used for

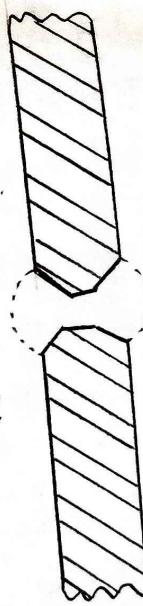
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Bat

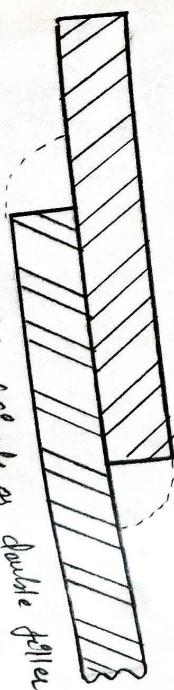
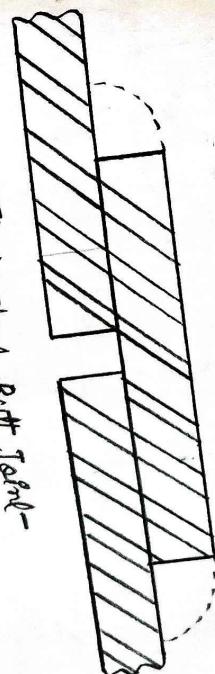
Plug or Rivet-Butt Joint



double vee Butt Joint



Single strap Butt Talm-



Lap Tackett (Single or double follicle)

81

Date _____
Page 81

- ① Carburising flame - when the volume of acetylene infused is more than oxygen, carburising flame is formed. Thus flame is used for welding steel, monel etc.
- ② Neutral flame - It is known as balanced flame. oxygen and acetylene gas are mixed in equal volumes. Neutral flame is used for normal welding of sheets, cast iron etc.

Arc welding:-

- ① Straight polarity welding - In straight-polarity welding, workpiece is made anode and the electrode electrode is made cathode as shown in the figure. electrons flows from cathode to anode thus heat is produced at the materials to be welded.

- ② Reverse polarity welding - In reverse polarity systems, the work is made cathode and the electrode is made anode. Thus welding is done specially for thin sections. Ac welding has the advantage of being cheap equipment used is simpler than dc welding. A transformer is used to increase the current output at the electrode. In dc welding circuit is shown in the figure. the current vary from 150 to 1000 Amperes depending upon the types of work.

difference between the soldering and brazing -

S.No.	Brazing	Soldering
1.	Followed by the melting	Purer Metal

T-Joint :-
cuban free surfaces are to be welded at right angles,
the joint is called T-Joints. (Angle 90°).

Corner joints:-
In this joints the edges of two sheets are joined and kept at right angle to each other.

3. High pressure and temp. do not affect the point. Palmer care often by high point

4. equipment cost of more.	Unrestricted equipment cost
----------------------------	--------------------------------

Types of Tents - very few.

5
Base type of patients are classified as follows:

Buff Taint:
In this type of Taint, the colour turns brown or tan.

Some example of the Bratt points are shown in the figure.

30. that the corner was used in tabling two) overlap being of other plates. (Tabling a corner joint)

② To prevent corrosion of welded metal.

③ To reduce the viscosity of molten metal.

④ Maintenance of steady arc in case of arc welding.

To prevent oranges from the hot surfaces.
The method of Mother Hiegel

To prevent oxidation of rubber, Metallo-Heptad is used in case of To reduce the viscosity.

To reduce the viscosity of
the latex in case of
the formation of a sheath.

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111

3. I prefer to think of the "real" self to realize its potential.

- Supply books and equipment are used by a supply teacher.

- 100

- 10

Welding defects -

The following are the common defects and the reason

Sl.no	Defects	Reasons.
1.	Low penetration of Metal i.e. to each other.	(a) incorrect current speed of welder.
2.	Cracks in welded Metals.	(a) wrong selection of electrodes.
3.	Poor appearance.	(a) faulty electrodes.
4.	Inclusions -	(b) Irregular weld shape.
5.	High carbon.	(c) wrong arc cooling.
6.		(d) over heating due to high current.
7.		
8.		
9.		

Experiment No.4

Smithy shop



Introduction:
The process of giving a desired shape to a metal piece by

Heating and hammering is known as forging. The metal piece is heated up to desired temp. Is known as the forging temperature. The processes involved in the forging are pressing, hammering, swaging, bending and planishing etc. when the forging Is done by the hand tools manually then it is called hand forging. when the same is performed by the power hammering it is called power forging. In case of the deep stamping than it is drop forging. In this process the metal is heated to the plastic stage either in furnaces or in a furnace. Forging is widely done auto forge or in a furnace. Forging is widely done auto and manual industries. It has the following advantages over other machining processes.

- Improper removal of slag
- Wrong current settings.
- Wrong clearance b/w the electrodes and work piece.

5. Poor flow.

- Wrong current settings.
- Wrong clearance b/w the electrodes and work piece.

6. Scoring of welds.

- High current
- Long arc
- Faulty electrodes.

7. Poor flow.

- Wrong current settings.
- Wrong clearance b/w the electrodes and work piece.

8. Scoring of welds.

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- Faulty electrodes.

101. Poor flow.

- Wrong current settings.
- Wrong clearance b/w the electrodes and work piece.

102. Scoring of welds.

- High current
- Long arc
- Faulty electrodes.

103. Poor flow.

- Wrong current settings.
- Wrong clearance b/w the electrodes and work piece.

Heath: The iron bottom culture has as ascertained as known
Tugere: A pipe has been found

Hood: the upper part of the furnace is called hood. It is made up of the mud sheet sheet- and fire brick inside it.

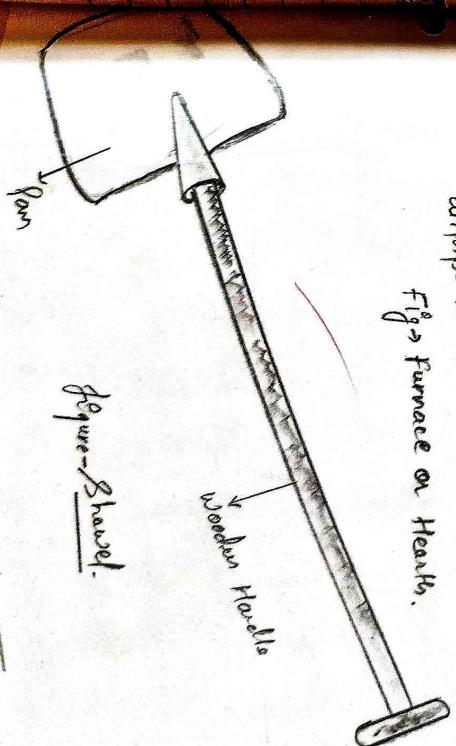
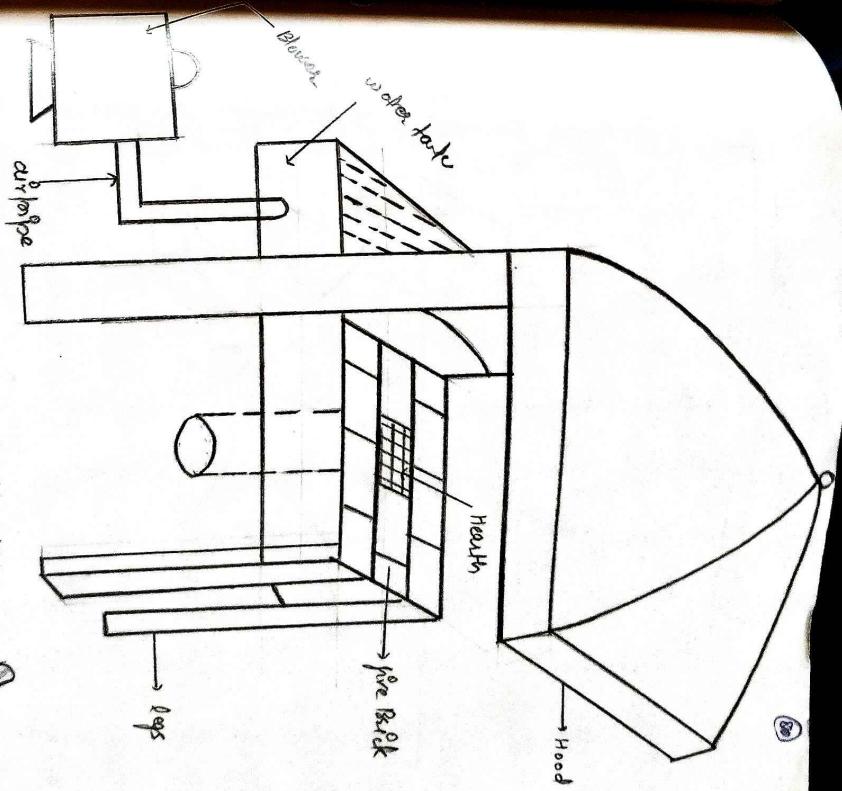


Fig. 1 Furnace on Heaths.





Poker

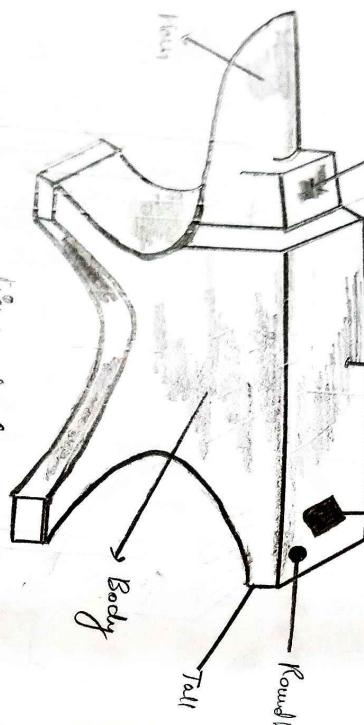
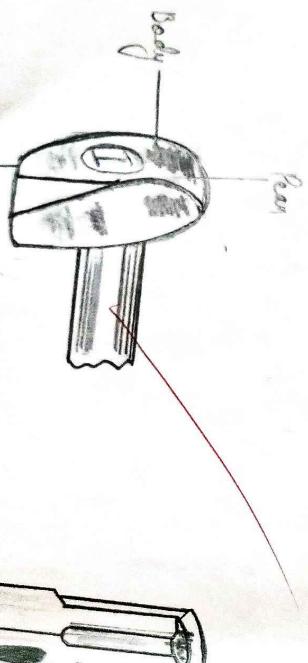
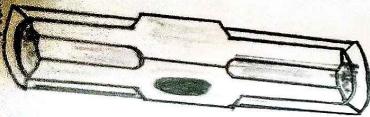


Figure April



(a) face
Hand Hammer

Spud Hammer



- Accessories for a Forging furnace -
- ④ Chimney: Chimney is fitted on the upper end of the hood. It is used for the purpose of easy escaping of exhaust gases and smoke.
 - ⑤ Water tank: A small iron tank is attached with the hearths of the furnace. It is used for dipping purposes.

Date 90
Page 90

fuel used in the forging shop -

- ⑥ Solid \Rightarrow (Coal, Coke, charcoal, limestone, flint, sand, etc.)
- ⑦ Liquid \Rightarrow (oils, benzene, turpentine, kerosene, etc.)
- ⑧ Gaseous \Rightarrow (Natural gas, producer gas)

(2) Anvil - A block on which forging work is done at the Anvil. It is made up of the cast iron and wrought iron. It is act as a supporting device for all forging operations since it is capable of withstanding very heavy blows.

Common type of Anvil used forging shop has the following parts:

- (a) Body
- (b) Horn
- (c) chipping block
- (d) face
- (e) handle hole
- (f) Tail
- (g) Sparrel.

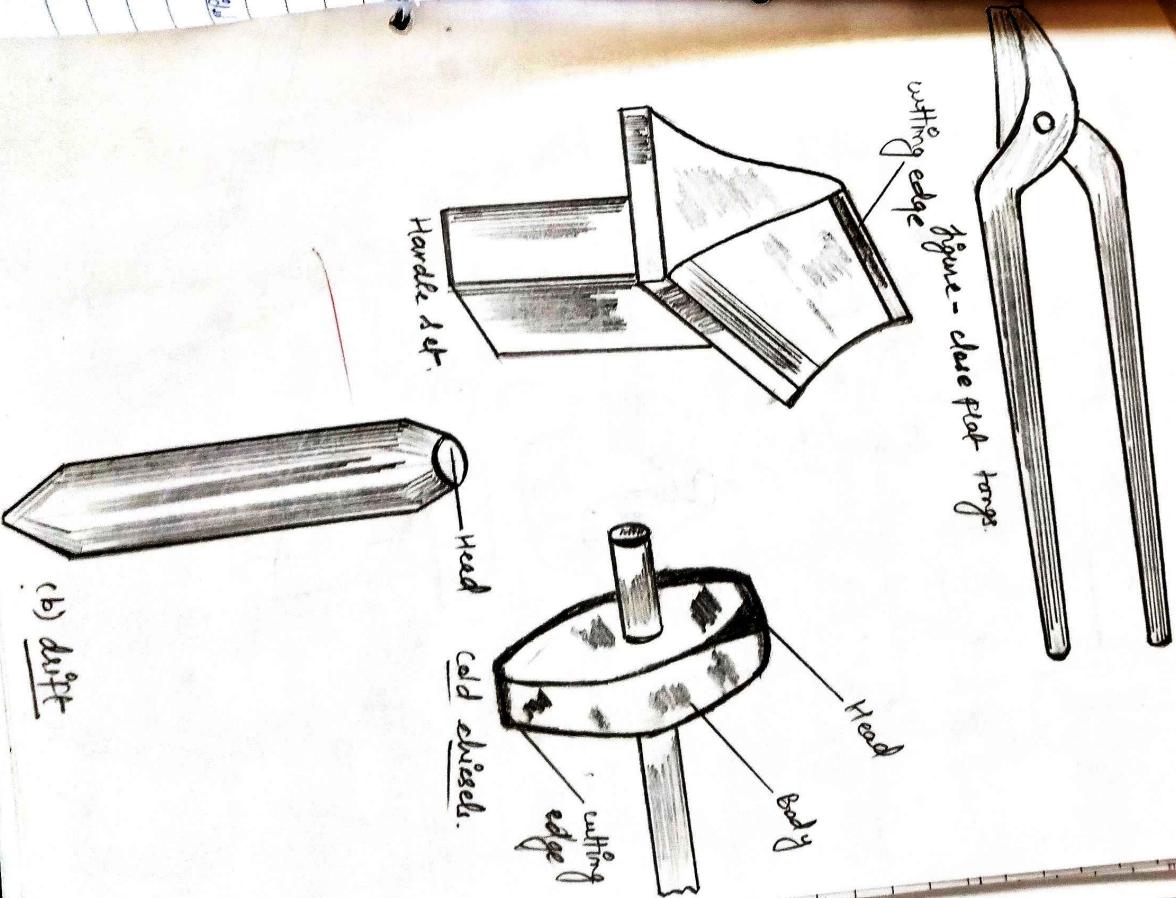
5. Hammers are used as striking tools. There are classified as under -

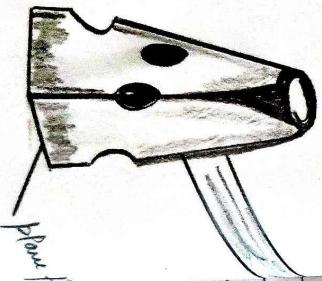
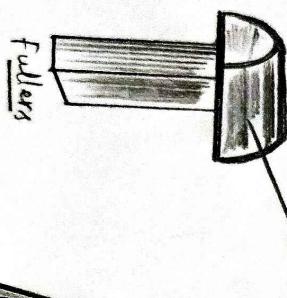
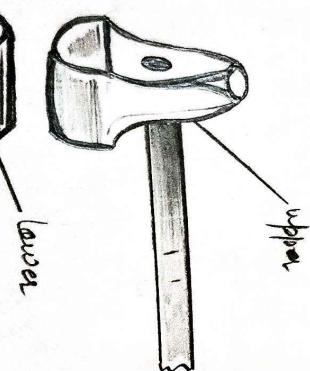
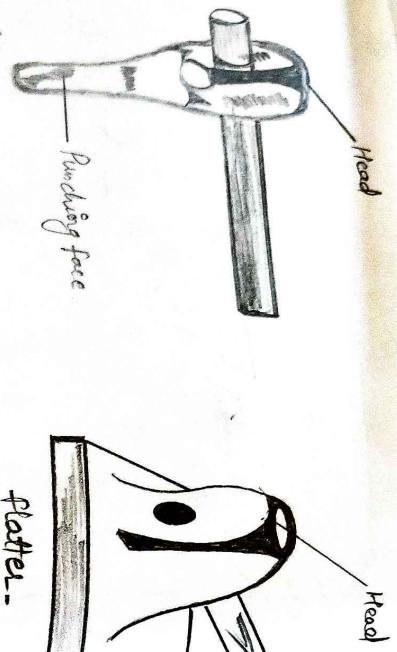
- (i) Hand Hammer
- (ii) Sledge Hammer
- (iii) Power Hammer.

Hand Hammer is light in weight - used by the Smith himself. Sledge hammer is heavy in weight and is used by the Smith's Helper. All the hammers are divided into four parts namely -

- (1) Head
- (2) Eye
- (3) Cheeks

Welding edge figure - clare flat type.





Sept Hammer

When the quantity of job to be produced is more, hand hammers are used. Commonly used hammers are spring hammers, pneumatic hammers, steam hammers and drop hammers.

→ Factors which influences the working environment

Q. Size and shape of the hammer.
Q. Size and weight of the hammer.
Q. Falling weight in tons weight.

⑧ Helpful or not. I am used for helping and running help
books are

(4) Tonga - Tongas are made upon four legs, have
Metals pieces, depending upon the shape of Tonga, have
classified in many ways. All types of Tongas have
the same construction except for Mouth. These are made
of two legs riveted from a suitable place. These are made
up of the red steel. Riveted based on the shape of the Mouth of

It is a
Ku Kong
for cutting metal pieces in
the form of
a square

(5) Chisels: Chisels are used to cut the metal in hot state
 Chisels are divided into two categories -
 (a) Hot chisels
 (b) Cold chisels

(6) Handie sets -

Hot climates by way of the metal
and cold climates to the metal
and

The main difference between these chisels is the cutting angle.

A handle set consists of the handle part

and

(a) Shank

(b) Body

(c) Cutting edge.

The shank is fitted in to the handle block in an angle.

(6) Punches and drifts -

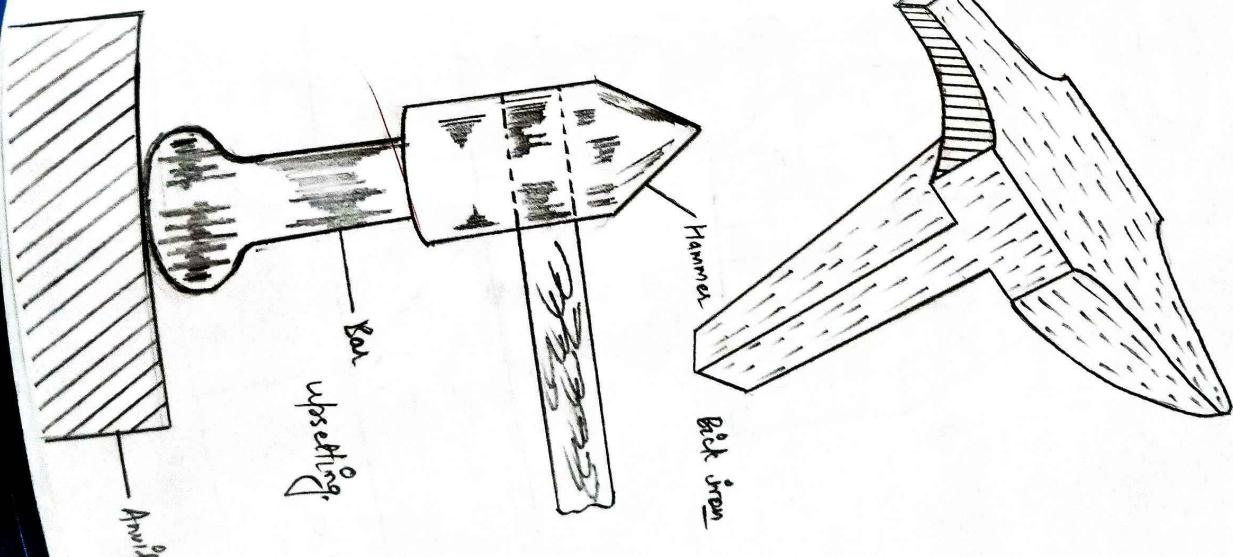
Punches are made up the high carbon steel and are used for making tough holes in hot metal or hot metal pieces. A drift is a large sized punch used to enlarge a hole.

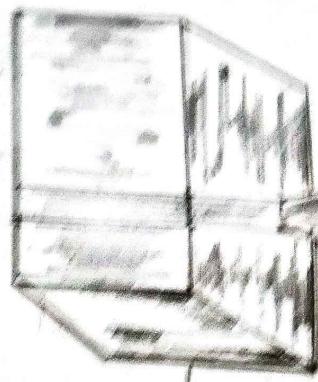
(7) Platters -

As indicated by the name, platters are used to flatten the work piece. It has a plane face tapered with straight shanks. It is held in a hammer vice.

(8) Fullers -

fuller are used for grooving and drawing. These are made in two pieces of lower and upper. Lower part is mounted on the anvil and the upper hand is held from upper handle. These are used for the hot working.



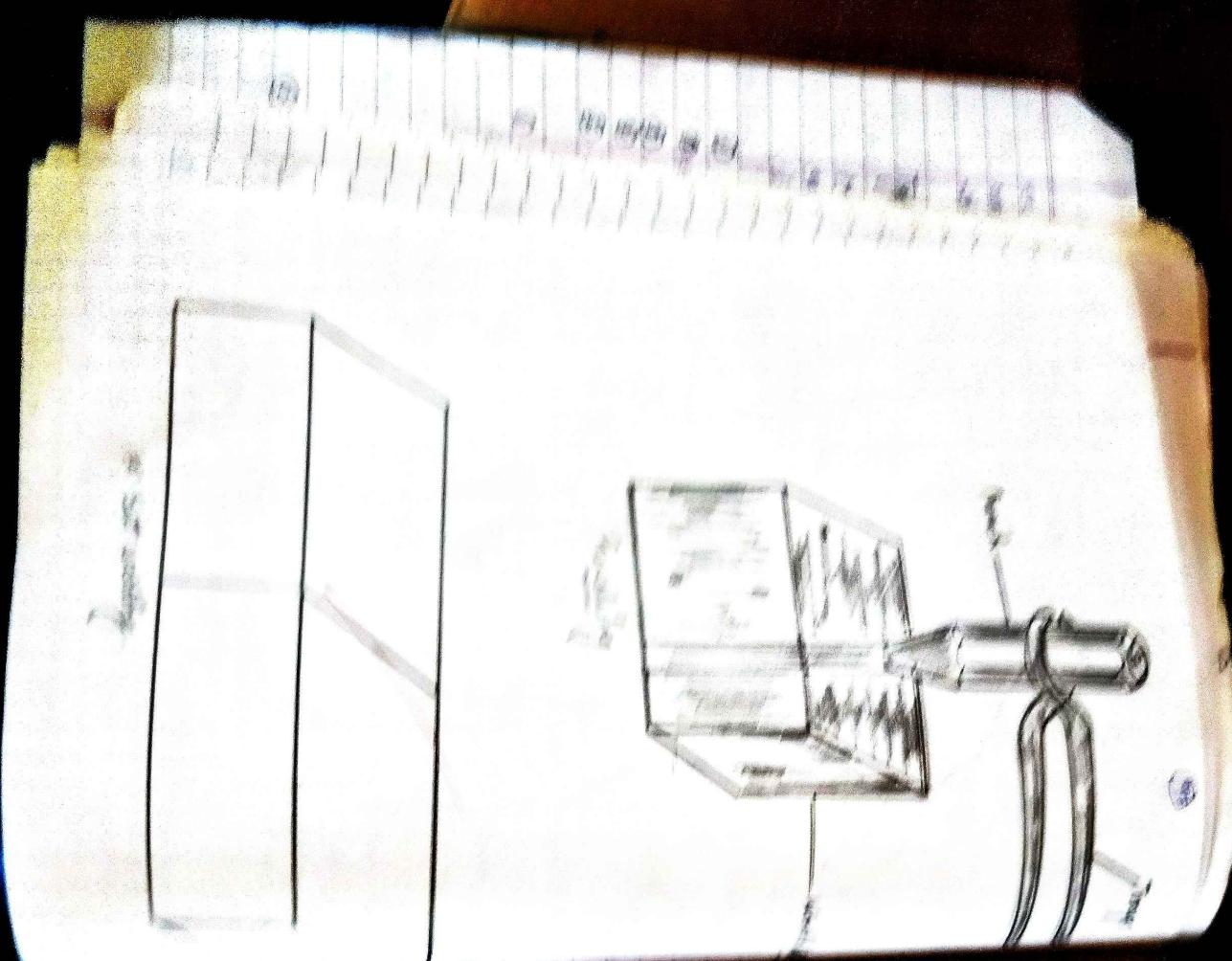


Aug 24, 1970. At the market back at
the 2nd St. 2nd St. This one used to be 20
L. 100. 400. 400. 400. 400.

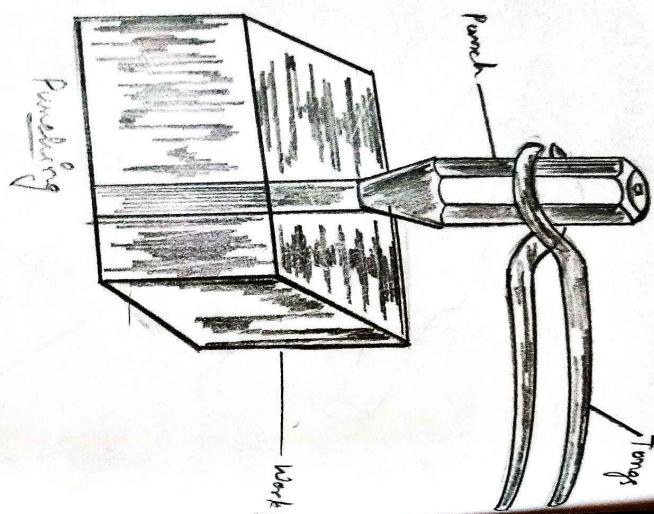
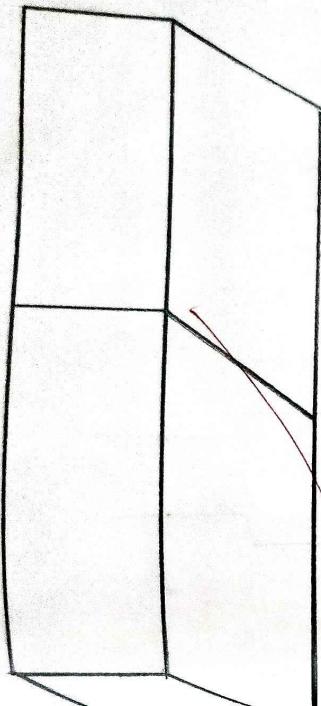
Aug 24, 1970. This one should give a few
more. 400. 400. 400. 400. 400.

Aug 24, 1970. This one should give a few
more. 400. 400. 400. 400. 400.





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(a) Butt welding.

42	Clamping vice	Clamping devices used in Smithy
(42)	leg vice	is only clamping device on wooden
wood	shop.	leg vice is mounted on a table or a
43	base. It consist of two jaws, a spring and a	couple
for work	piece are clamping on a	
	Hot work	
	Working	
(43)	Rock iron - It is also made of tool steel and it is	
	heat treated. The one portion is similar to the form of	
	horseshoe and a tapered tail on the other side. Due	
	to a taper, it is fitted in the anvil.	

Forging operations -

Following operations are used:

In forging shop. (6) fullering. common.

(1) Drawing (2) Bending
or
(3) Heating

upsetting
swaging
forging
force welding

(a) *Penitentiary*

(5) differing

(1) Drawing -

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(2) Upsetting.

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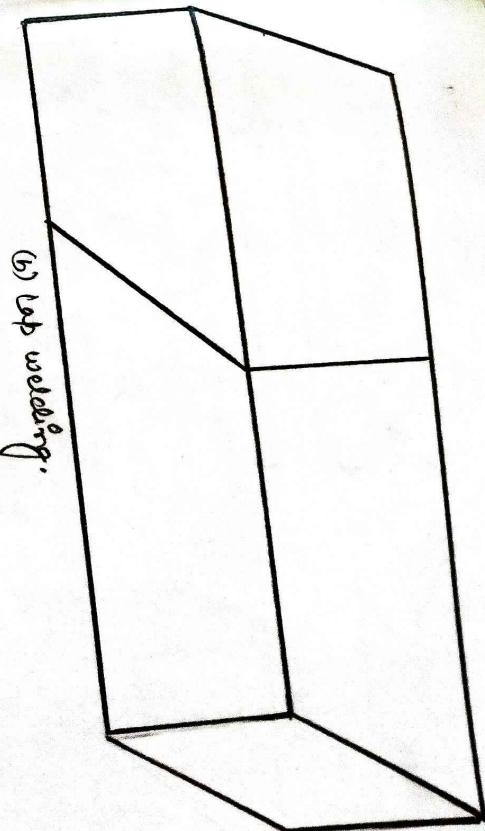
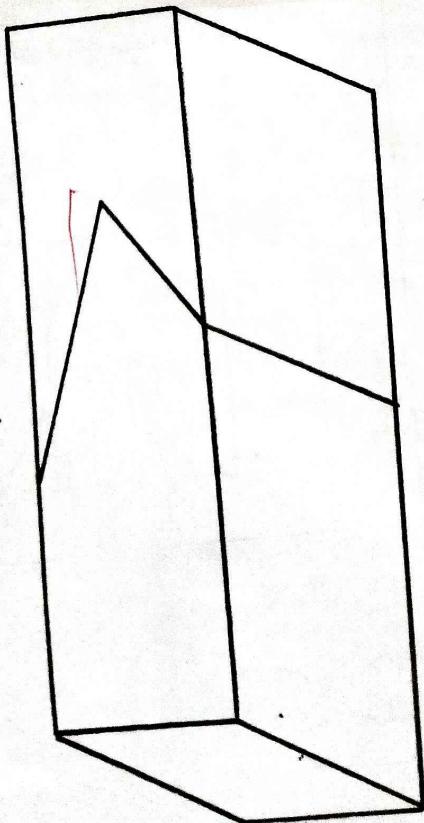
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(2) upsetting:
It is the process in which the diameter of hot wire is increased and length is reduced. It is used to place on the anvil on the vertical presser. It is done with a hand hammer. The hot wire is heated in the fire. Sometimes during the upsetting, bending

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(2) upsetting:
It is the process in which the diameter of Hot billets is increased and length is reduced. Hot metal is placed on the anvil. On the anvil the upsetting hammer is used. The hot metal is forced to spread by the long. Sometimes during the upsetting, bending

(c) V-Weeling -



on the job. In such case first job should be straightened and then upsetting should be continued.

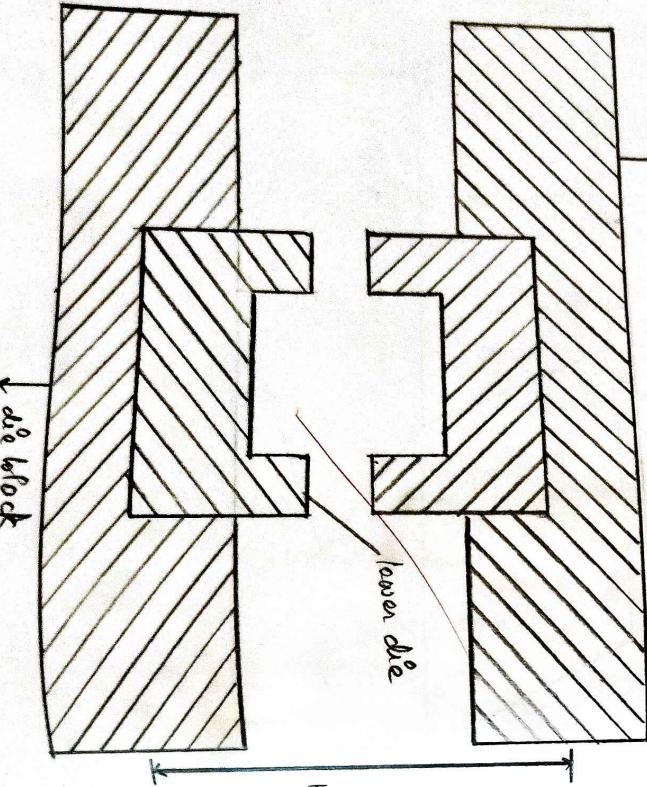
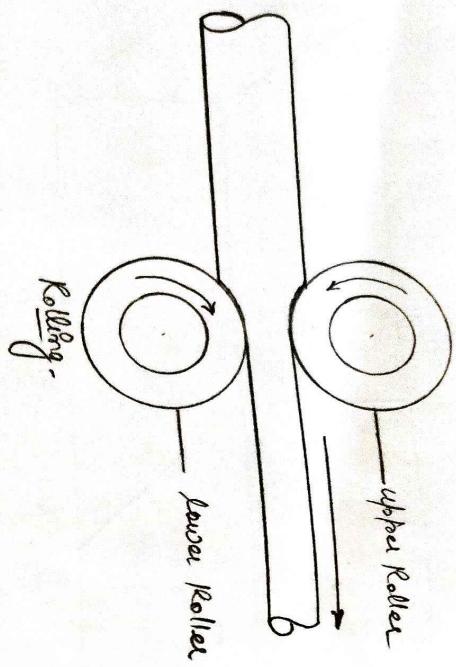


figure - drop forging.

Drifting - is the process in which a rough hole of punching is the hot work piece. The job is heated made from the hot work piece and then is placed up to the desired temperature and then is forced on the anvil. Punch is placed on the hot metal and with the help of sledge hammer, the punch is forced to move the metal up to half of the metal thickness.

Drifting - is the process of straightening and enlarge the hole. The process of straightening to drifting. If is a process of straightening to be called as drifting. but without using a die is called as drifting.

Swaging - is the process of straightening and enlarging the hole to form on finished off shapes. It is the process used to form on finished off shapes. Such as hexagonal and square etc. The work piece is held by the upper and lower part. Such as iron, steel, brass, copper, etc. The work piece is held by the help of a hammer, blow.

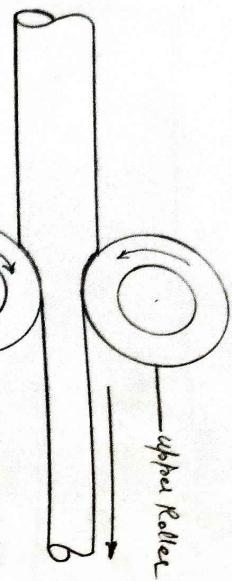
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on the job. In such case first the job should be straightened and then upsetting should be continued.



Upsetting -
 Rolling -

Upsetting -

Punching - is the process in which a rough hole is made from the hot work piece. The job is heated up to the desired temperature and then it is placed on the anvil. Punch is placed on the hot metal piece with the help of sledge hammer. The punch is forced into the metal up to half of the metal thickness.

Drapping -

It is a process of straightening and enlarge the hole. The process of straightening is called as drapping. To combine punching and drapping a die is called as drapping die.

Swaging - is the process used to form or make diff shapes such as cylindrical, hexagonal and square etc. The hot piece is held by the upper and lower part of the swage with the help of a hammer, blow care is given to the upper part of the swage.

Fullering - Fullering process is done on an enough lower part of the fuller bar is kept in the shade of the part of the fuller. Hot work piece placed in the groove of the anvil. Hot work piece placed in the groove of the

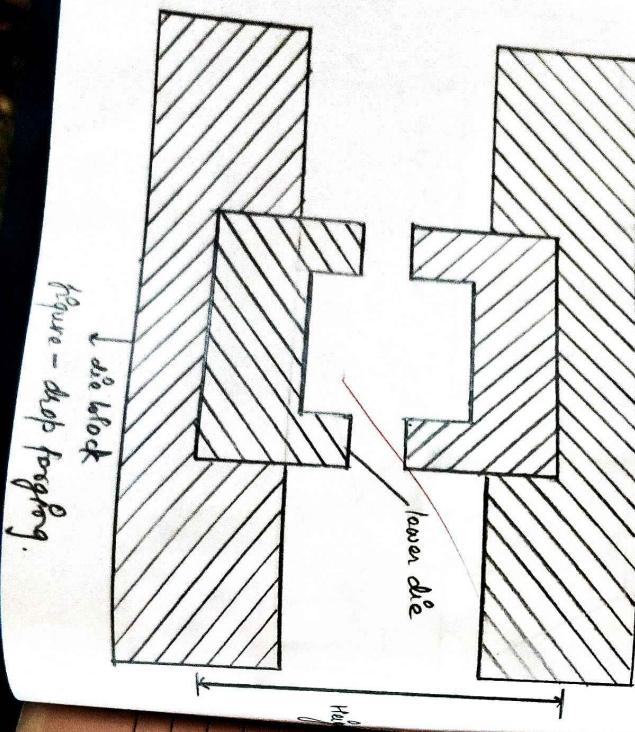


Figure - drop forging.

lower plier. upper plier is placed on the job and the hammering is done on the upper portion. Following is done for drawing & grooving.

Bending -

The process of giving the desired angle or curvature to the hot pieces is known as bending. The process is done on the edges of the anvil or on the clamping block. Circular shapes, U-shape holes, holes of any other shape can be performed using this operation.

Forge welding -

The process of joining two metal pieces by heating them to be welded are cleaned and heated in the furnace up to the welding temperature. The hot pieces are picked from the furnace with the help of tongs. Some fluxes are also added while welding process.

(2)

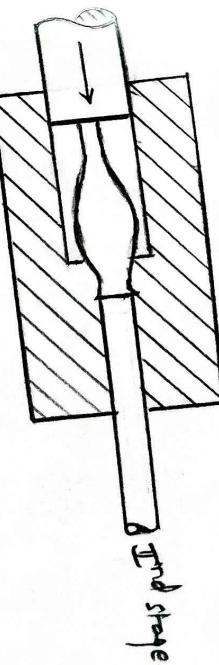
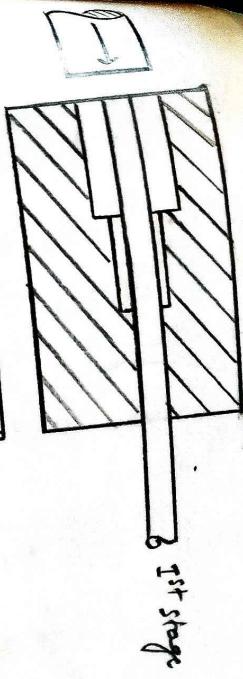
(a) Butt weld.

(b) Lap weld.

(c) U-weld.

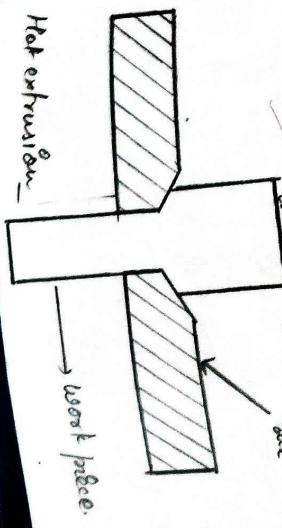
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3 final product

Mechanical forging -



Hot extrusion -

Cutting -

If it is done by hot and cold chisel. It is done before the finishing operation for removing the extra stock of material from the work piece. Cutting is done at the edge of the anvil or on a slapping block provided on the anvil.

Hot Working processes -

The processes which are done above the recrystallization temperature are known as Hot working processes.

Main Hot working processes are described as under -

(1) Rolling - Rolling is the process of reducing the sectional area of metal. The hot metal is passed through two rolls running in opposite directions at some suitable speed. The space b/w two rolls is kept in accordance with the desired thickness.

(2) Drop forging - Drop forging is a forging process which is done on a drop hammer, on drop hammer steel dies are used. The die is generally made in the two parts of the hammer and lower part is placed on the bed.

(a) Main factors to be considered in a drop forging process -

(i) falling weight

(ii) height of the falling weight.

- (3) **Press Forging** - In this case metal is heated up to the plating stage then metal is pressed through die slowly by the press. Presses that are used for this type work are mechanical presses and for heavier work hydraulic presses are used.
- (4) **Machine Forging** - In this process metal is held up to the plating stage then it is held below the heat source. Pressure is applied along the tang on the rod as a result a localised upsetting i.e. Threading on diameter of the rod takes place.
- (5) **Spinning** - spinning is the process in which the sheet metal is heated to forging temperature and then forming in to desired shape by rotating it on a lathe.
- (6) **Hot extrusion** - Hot extrusion is the process of forcing a hot metal piece through small openings. Desired shape can be achieved by using suitable dies.
- (7) **Hot drawing** - The process of producing cup shaped jets from sheet metal is known as hot drawing. The hot sheet metal is pressed by a punch to hot die to form desired shape. Soft materials are used for drawing. This process is illustrated in the figure.

Cold working process

The processes which are done on the metal by keeping the temperature below recrystallization temperature are known as the cold working process. The force required for these processes is high as compared to the hot working processes. Cold working processes are also applied for soft materials and vice versa will crack.

Precautions in the forging shop -

- ① The fire should be lightened in the heating unit carefully.
- ② There should be no leakage of fuel from pipes & pipes tanks.
- ③ All the exhausted gases and smoke should go to the chimney.
- ④ Never wear silly clothes in forging shop while working.
- ⑤ Never handle the hammers and hammers loose while working.

Experiment No. 5

Sheet Metal Shop-

Introduction -
Sheet Metal work is regarded as working of thin metallic sheets with hand tools and simple machines. It is necessary to know the construction and working of hand tools and machine used for the sheet working. It is very important to know that efficiently working in sheet metal one should have thorough knowledge of protective geometry i.e. development of surfaces and the properties of metals. Since the layout of the sheet for the sheet metal work depends upon above. Many important engineering articles made up of the sheet metal find their application in houses, agriculture machinery, decorative articles etc.

Types of Sheet Metal -

1. Non Ferrous Sheet
2. Steel (Ferrous) Sheets
3. Non-Ferrous Sheets

1. Coated Sheets
(Galvanized)

2. Uncoated Sheets
(Plain)

- Widely used steel sheets -
- (1) Mild Steel Sheet
 - (2) Galvanised Steel Sheets
 - (3) Coloured Iron (CI) Sheets.
 - (4) Tin Plate.

Tools used for Sheet Metal -

Various hand tools are used for sheet metal are described below -

- (1) Marking tools -
- (2) Hacking tools -
- (3) Hacking tools are used to mark the sheet according to required dimensions. Various marking tools are :

- (1) Steel rule - The rule could be steel foot rule, folding rule, or tape rule.
- (2) Steel square - It is used for making square corners. It is also used for marking and checking the right angles.

(3)

Hammer - It is steel wire of 200 mm length with one end

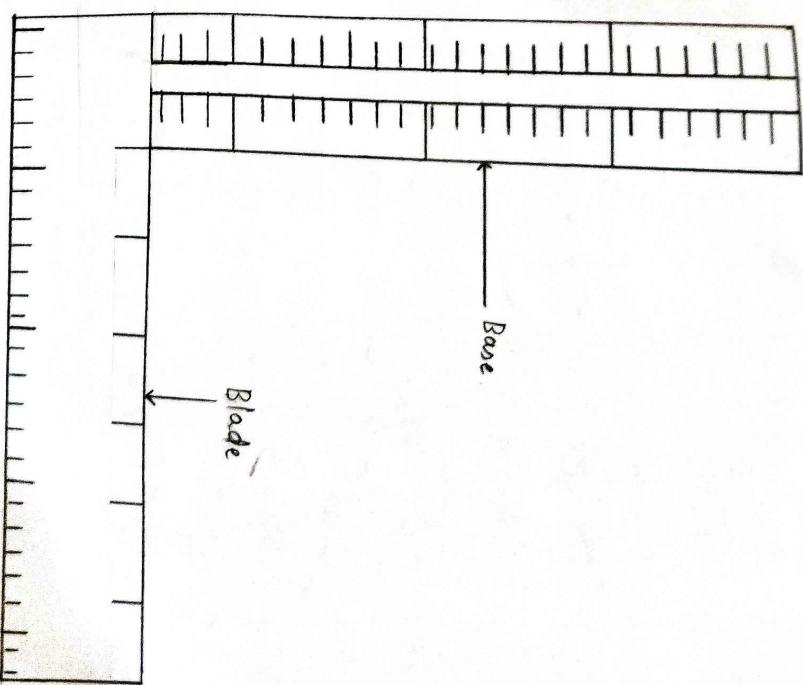
sharp and hardened to mark lines on metallic sheet

(4) Divider - It is used to scribe arcs and circles on the metallic sheet.

- (5) Trammel points - Used for drawing edges large circles of

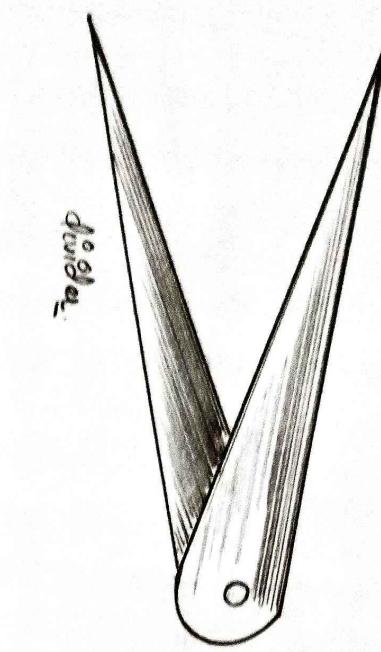


Steel Square.



Auxiliary

ans.



- (i) **Punches** - Used for the following punches of hard steel are used in sheet metal shop.
- (a) **Brick punch** - used for making indentations marks for location of the centre position for shoulders, having included angle of 30° .
 - (b) **Centre punch** - used for marking the location of holes or points and ground at 90° included Angle.

(B) **Cutting Tools**:-

Cutting tools used in the shop are -

- (1) **Straight Snips**:- for cutting along straight line. Straight snip is used where blades are straight. It is used to cut wires or leather.
- (2) **Bent Snips**:- blades are curved back from the cutting edge which allows the blade to slide over top blade.
- (3) **Hollow punch**:- when circular holes are to be cut in the sheet then hollow punch is used for this sheet.
- (4) **Dies**:- These are generally used in the sheet metal for cutting slots, rivets and bolts.

(c) Striking tools:

(a) Hammers: The hammers are used for riveting works, bending of sheets, smoothing of sheets, locking of joints etc. for these operations the following hammers are generally used.

(b) Ball Peen Hammer: It is a general purpose hammer. The face is slightly curved and the head is round.

(c) Square face Hammer: This hammer is called setting hammer and has a square flat face. It is used for flattening the seams.

(d) Raising Hammer: It is used to form flat surface of sheet in to curved surface. It is used with a raising block.

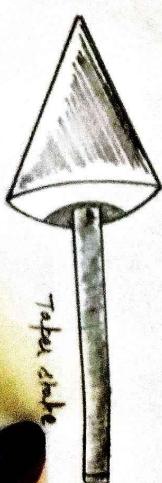
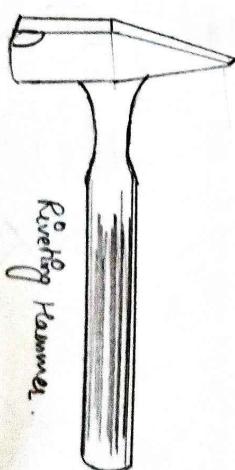
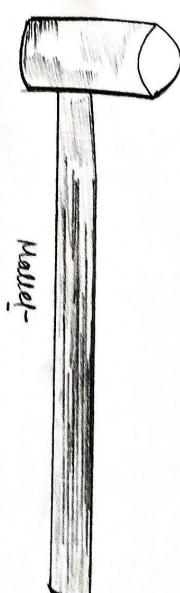
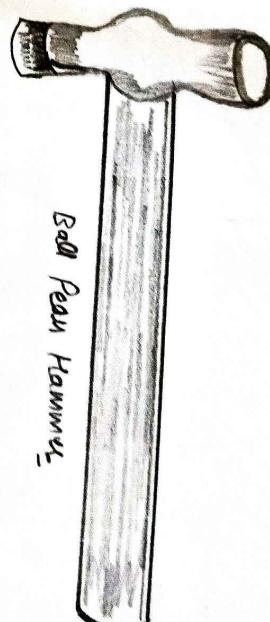
(e) Riveting Hammer: Face is square slightly curved and has bevelled edges.

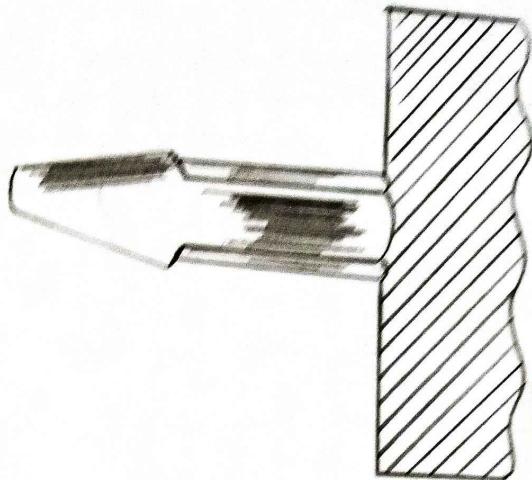
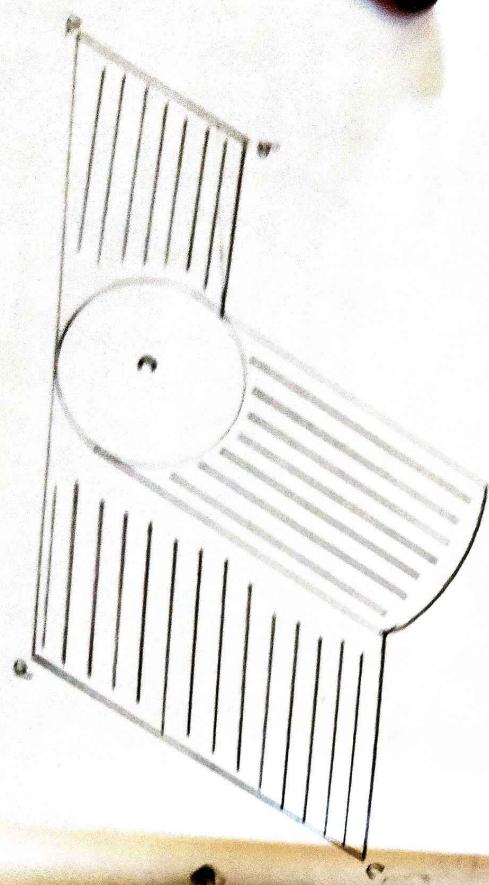
(f) Mallets: These are used whenever light force is required. It is used for smoothing of sheet.

Supporting Tools:

Stakes: Stakes are used to support sheet in bending. Some

Date 115
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Date: 11/11

Furnishing, mettling, branching etc. Can't be casted out.
Some commonly used stakes are:-

1) Hand stakes: It is a hand made a flat face, has straight edges one concave edge and other convex edge and is used for passing the lower side of straight joint.

2) Half Round stakes: It is used for passing round joint on inner side.

3) Taper stakes: It is used for rounding off tapering jobs such as curved jobs.

4) Dovetail stakes: Goves are made to support the triangle.

5) Nose stakes: These are two square stakes for holding the stakes at a nose for cutting out off operations.

Sheet Metal operations -

The main operations are -

- (i) Shearing and Notching
- (ii) Hand Bending and straightening
- (iii) Welding
- (iv) Lap joint
- (v) Hand forming
- (vi) Stake cutting
- (vii) Bending and straightening

① **Measuring and Marking** - The standard marked - sizes of No. sheets are quite large. But the required sheet sizes for making a component may be much smaller. So, a standard size sheet may have to be cut into several smaller pieces, each piece being represented for making one such component.

② **Laying out - laying out** means the operation of removing the development of the surface of the component due to sheet. sheet blank together with an added allowance for overlapping, bending, hammering etc. which when cut out of the blank and folded and joined will give the required component.

③ **Cutting and Shearing** - The word cutting normally used for the sheet metal is cut by means of a chisel and a hammer manually. The term shearing stands for cutting of sheet metal by two parallel cutting edges moving in opposite direction.

④ **Hand forming** - The term metal forming stands for shaping and/or bending of sheet metal in the three dimensions for order to give it the desirable shape and size of the final product. For this, the metal is often required to be stretched or shrunk in all directions or may need a combination of both.

⑤ **Nibbling or Nibbling** is a process of continuous cutting along a contour, which may be a straight line or an irregular boundary. The machines used in this operation are known as nibblers, which are portable-type shearing machines.

⑥ **Circle cutting** - It is a operation of cutting circular blanks or curved contours with the help of a circle cutting machines. It is also a common cutting operation.

⑦ **Punching and Blanking** - Punching is basically a hole punching operation, while blanking is an operation of cutting out a blank. In both the cases blank will be produced, but in the former case obtaining a blank is not the objective.

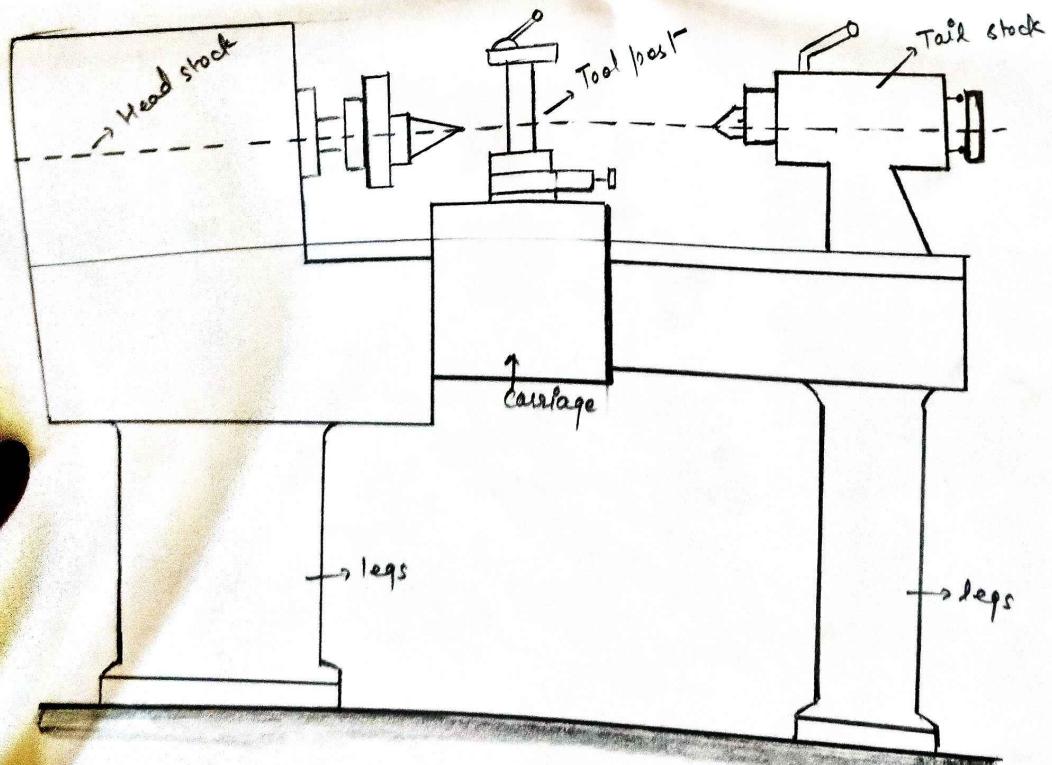
⑧ **Edge forming and winging** - The edges of the sheet metal produces and formed (and folded) to ensure safety of hands while handling these products and to provide sharpness to the product in order that they will not harm, when sharp during handling. It will not get buckled or compressed by simple hand or finger pressure during handling.

⑨ **Joint Making** - Several means are used for joining sheet metal parts together or securing them to other materials or non-metallic bodies. In case of very large size parts, specially when they are to be fastened to other metallic or large non-metallic bodies, screws, fastening can be used.

⑩ Bending - sheet metal is required to be bent at diff. L. to shape it into the required form. The bending operation involves stretching of metal on the outer surface and compression of an inner surface along a neutral line which remains unchanged in length.

⑪ Drawing - thin walled hollow shapes are produced in sheet metal through the drawing operations. The operation is carried out with the help of a die and a punch on suitable press. The drawn angle of the component is less than 90 degrees on draw press. It is called 'box drawing' or 'shallow drawing'.

Date : 12/1



Lathe:

A lathe is a powered Mechanical device for cutting the work & held and rotated against a suitable cutting tool for producing cylindrical forms in the Metal, wood or any other Machinable materials.

Principle of working -

The principle of Lathe Machine is that it holds the work between two strong supports called as centres. or in a chuck or face plate with jaws. The chuck or the centre is mounted on the main spindle of the machine. The cutting tool is rigidly supported in a tool post and it is fed against the rotating job. The job rotates in its axis and the tool is moved either parallel or to an inclined cut to its axis as such a cylindrical or tapered surface is produced.

Operations performed on the Lathe Machine -

- ① facing
- ② Rough turning
- ③ Shouldering
- ④ Radius Turning
- ⑤ Neckeling
- ⑥ Taper Guring
- ⑦ Thread cutting.
- ⑧ Forming
- ⑨ Chamfering
- ⑩ Lining
- ⑪ Drilling
- ⑫ Boring
- ⑬ Counter Boring
- ⑭ Counter Sinking

shaper -

shaper is a versatile machine which is primarily intended for producing flat surfaces. these surfaces may be horizontal or inclined. the machine requires the use of a profit tool held in a properly designed tool box mounted on a reciprocating ram.

shaper operations -

the different operations which can be performed on the shaper are briefly described

- Horizontal flat surface machining - this is achieved by moving table under the tool. automatic feed can be given on planed table if moved at the end of return stroke
- vertical surface machining - vertical feed is given to the tool by rotating the down feed screw by hand. it should be 0.05 mm at end of return stroke.
- Machining irregular surfaces - the vertical slide of the tool head is swivelled to the required angle in either direction. the down feed is given by rotating the down feed screw.
- Cutting slots and keyways - for cutting slots on keyways a square nose tool shaper to a parting tool is selected. external keyways are cut in a slot by first chipping a hole at the blind end of keyways.

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(c) Irregular Surfaces - shaper can produce a concave or concave surface or a combination of any of the above surfaces by a forming tool.

(f) Machining splines or cutting gears - by using the indexing mechanism on index table a gear or equally spaced of splines may be cut.

Milling Machine:

A machine tool which is used for producing flat or profiled surfaces, grooves or slots with the help of revolving multiple tools. cutter is known as milling machine. milling machine occupies a place opposite to lathe.

Principle -

Circular cutter revolves beneath which job is given feed in a straight line, to form a chip thickness. stress on cutting point of the milling cutter is not known as milling machine. milling machine occupies a place opposite to lathe. for rest of the revolution of tools is less and can cool off. it cuts only for a part of revolution.

Handwritten note:

SSC
9/8/18