NAME: ANUSHKA JAIN B.Tech CSE(AI-ML)

STD: 1st year DIV: A ROLL NO.: RA2211026030006 YOUVA

SUBJECT: Civil and Mechanical Practical file

INDEX

SR. NO.	EXPERIMENT	PAGE	DATE OF EXPERIMENT	DATE OF SUBMISSION	REMARKS
1	Sheet Metal (Introduction)	1-8	25/1/2023		
	☐ Exercise-1: To make a tray of given size from a sheet metal piece	8-11	25/1/2023		
	☐ Exercise-2: To make a funnel of a given size from a sheet metal piece	11-13	1/2/2023		
2	Machining (Turning & Facing)	14-19	8/2/2023		
3	Smithy	20-28	15/2/2023		
	☐ Experiment: To obtain a chisel using steel rod in smithy shop	29-30	15/2/2023		
4	Carpentry	31-37	01/03/2023		
	☐ Exercise-1: To make a cross-lapped joint using softwood & carpentry tools	38	01/03/2023		
	☐ Exercise-2: To make a duster using softwood & carpentry tools	39-40	15/03/2023		

SR. NO.	EXPERIMENT	PAGE	DATE OF EXPERIMENT	DATE OF SUBMISSION	REMARKS
5	Welding	41-45	22/03/2023		
	▪ Exercise-1: To join 2 pieces of metal plates placed on the same plane using arc-welding method (Butt Joint)	46-48	22/03/2023		
	▪ Exercise-2: To join 2 pieces of metal plates overlapping each other using welding method (lap Joint)	49-51	05/04/2023		
6	Foundry	52-57	12/04/2023		
	▪ Exercise-1: To prepare a mould of given pattern.	58	12/04/2023		
7	Fitting	59-68	19/04/2023		
	▪ Exercise-1: To make a step profile from the given work piece	68-69	19/04/2023		
			26/04/2023		
	▪ Exercise-2: To make threading & drilling in the work piece.	70-71			
8	Plumbing	72-74	26/4/2023		
	▪ Exercise-1: To thread the given pipe of kitchen & bathroom setup	74-75			

EXPT. NO.

NAME

M T W T F S S

Page No.: 1

Date: 25/1/2023

YOUVA

SHEET METAL

Introduction

- Sheet Metal Work is generally regarded as the working of metals from 16 gauge down to 30 gauge with hand tools and simple machines into various forms by cutting, forming into shape and joining. It has it's own significance as a useful trade in engineering works and also for our day-to-day requirements.

- The sheet metal shop is very important for every engineering concern. It deals with the working of metal sheets. It requires a thorough knowledge of the projective geometry, particularly the development of surfaces, because the laying out pattern and cutting of metal sheets to correct sizes and shapes entirely depends upon the knowledge of the workman.

- The various operations performed in a sheet metal shop are cutting, shearing, bending, etc.

- Common examples of sheet metal work are hoppers, boxes, cabinets, funnels, ducts, automobiles body and aircraft body. The sheet is cut into shape and folded

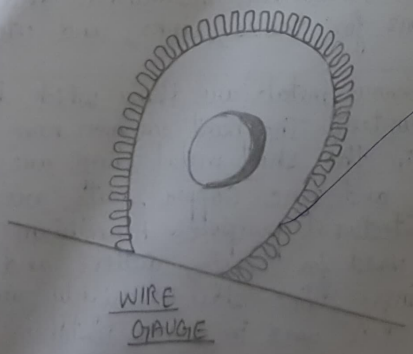
Teacher's Signature:

to form the finished articles.

★ Metals used in sheet metal work:
The two main groups of sheet metal are steel and non-ferrous, each group includes several types of metals for different uses.

- Steel is the most commonly used material in the sheet metal shop. Sheet steel may be either coated or uncoated. The most commonly used coated sheets are galvanized and tin plate. Galvanized sheet metal is soft steel sheets coated with zinc. Air conditioning duct, roof flashing, tanks, boxes are usually made from galvanized sheet because of it's low cost and good corrosion resistance. Stainless steel has high resistance to foreign or corrosive elements. For these reasons it is widely used in residential, institutional and restaurant kitchens for tables, sinks, and utensils.

- Non-ferrous metals are those which have no iron or steel content. The most common non-ferrous metals used in the sheet metal shop are copper, aluminium, lead and zinc. Copper sheets are used for architectural purpose. Aluminium & lead sheets are used for roofs, gutters and down spouts in buildings. Zinc sheet is highly resistant to corrosion and is used in some instances where galvanized



steel cannot provide adequate resistance.

★ Safety precautions in Sheet Metal Shop

1) Avoid touching the cut portion while cutting with snip.
2) Use snips only for metal that can't be cut by applied hard force.
3) Do not reach behind the shear blade to hold small pieces being cutoff. The tips of the fingers cannot be seen and can easily be placed under the blade.
4) Do not try to hold small pieces of metal while they are being cut. They are liable to tip up and tip your finger in to the blades.
5) Do not try to bend the sheet with hands.
6) Use shoes & leather gloves.

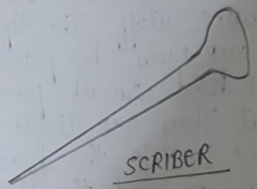
TOOLS

(A) Measuring Tools →

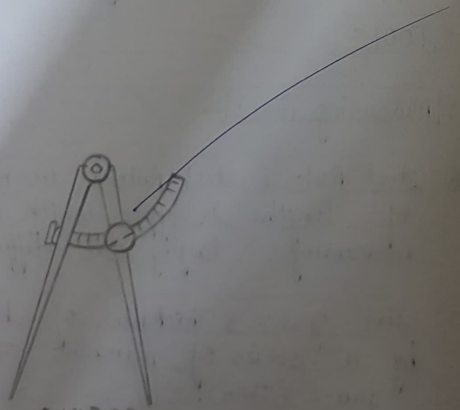
1) Steel Rules: steel Rulers are manufactured in variety of lengths & types which are designed for measuring & laying out different work.

2) Wire Gauge: Thickness of sheet metal is identified by a series of numbers called standard wire gauge (SWG).

Teacher's Signature:



SCRIBER



DIVIDER

Higher SWG number → lower the thickness

- General Rule → When gauge number is increased by 6, the thickness is decreased by approximately 1/2.

→ Wire gauge refers to the tool for measuring and determining the thickness of the sheet. It has gauge no. from 1-38.

(B) **Marking Tools** →

1) Scribers: There are 3 common types of scribers. All 3 perform the same function of marking lines on metals.

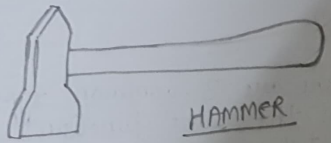
(a) Ring scribers: Made of one solid piece of steel approximately 8 inches long with a tapered point on one end & a ring on the other.

(b) Socket scribers: It has a steel blade approximately 5 inches long & is made with a replaceable wooden handle.

(c) Shank Type scribers: This is preferred for general purposes since the steel blade passes through the handle, reinforcing the top.

2) Dividers: Dividers are made with each straight leg tapered to a needle point. These wing-type dividers may be adjusted to any position by loosening the knurled screw, changing the distance between needle points and tightening the screw.

Teacher's Signature:



HAMMER

EXPT. NO. NAME

M T W T F S S

Page No. 5

Date: YOUVA

to retain the desired distance between tips. They are used to space off equal distances, to divide lines into equal parts & to scribe arcs and circles.

3) Hammers:

(a) Riveting Hammer: It has a square, slightly curved face with beveled edges to prevent the head of the hammer from marking the metal. The peen side is double tapered & has slightly rounded end.

(b) Setting Hammer: It has a square, flat face for flattening seams without damage to the metal. The single-tapered peen with a beveled end is used for peening operations.

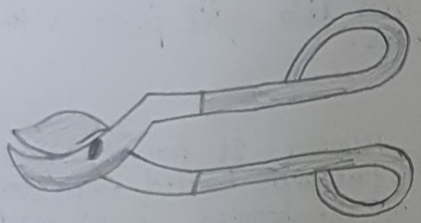
(c) Ball Peen Hammer: (General purpose hammer). It has a round, slightly curved face & round head.

(d) Raising Hammer: Used in raising circular disks & ornaments for cornice work & many other raising & bumping operations.

(e) Common Nail Hammer: Nails can be hammered or removed with this hammer.

(f) Mallet: Used where steel hammers would deface the work.

Teacher's Signature:



SNIP

EXPT. NO. NAME

Page No. 6 Date: M T W T F S S YOUVA

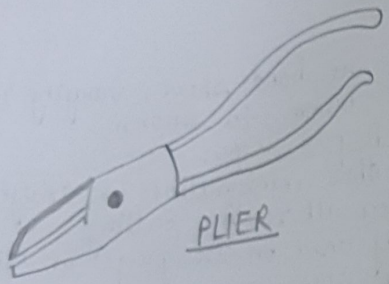
(c) Cutting Tools →

1) **Snips:** They are hand shear, varying in length from 200mm to 600mm.
   (a) General Purpose Snips:
   - maybe either combination or straight blade snips.
   - used for all routine cutting.
   - usually used on 26 gauge or lighter.
   (b) Circular Snips:
   - Have blades that curve sideways.
   - Designed for cutting inside circles or cutting metal close to an obstacle.

2) **Bench Shears:**
   - Designed to fasten onto the bench for heavy cutting.
   - Bottom handle is bent at right angle & is square in shape to fit into a square hole on a metal bench plate.
   - They are 2-3 feet long.
   - used for cutting sheet metal, 1/10 inch thick or more.

3) **Pliers:**
   (a) Flat Nose Plier:
   - Have flat jaws with small grooves.
   - Used for forming & holding work.

Teacher's Signature:



EXPT. NO. NAME

Page No. 7 YOUVA

Date

(b) Round Nose Pliers:
- Long jaws rounded on outside.
- Used for holding & forming various shapes & patterns.

(c) Slip Joint Combination Pliers:
- Adjustable Jaw
- General Purpose Tool.

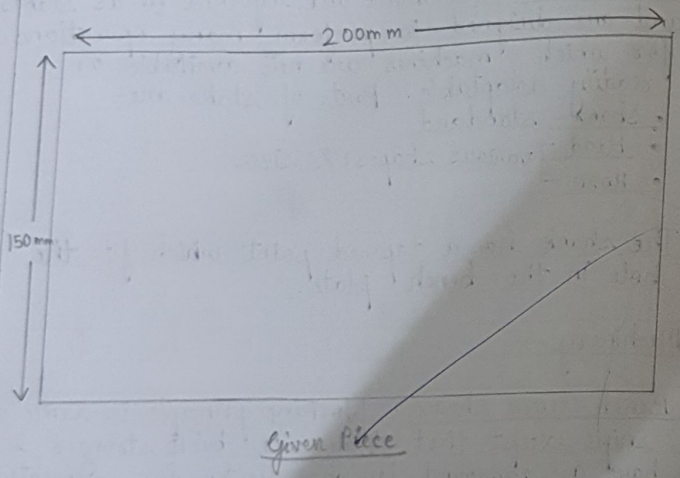
4) Bench Stakes: The anvils are referred to as stakes and are designed to perform many operations for which machines are not available or readily adaptable. Parts of stake are-
- Shank - standard
- Head] various shapes & sizes.
- Horn

The shank has a tapered point which fits the hole in the bench plate.

(D) Machinery →

1) Bench lever shear: Working principle is same as snips except that they are built stronger & have a compound leverage system for greater power. Blades are designed to cut curves & circles as well as straight lines.

Teacher's Signature



EXPT. NO. NAME Page No. 8 Date: YOUVA

2) Press Brake: Machine used for bending sheets. It bends the metal by pressing it into special dies.

25/1/2023

EXERCISE - 1

Aim: To make a tray of given size from a sheet metal piece.

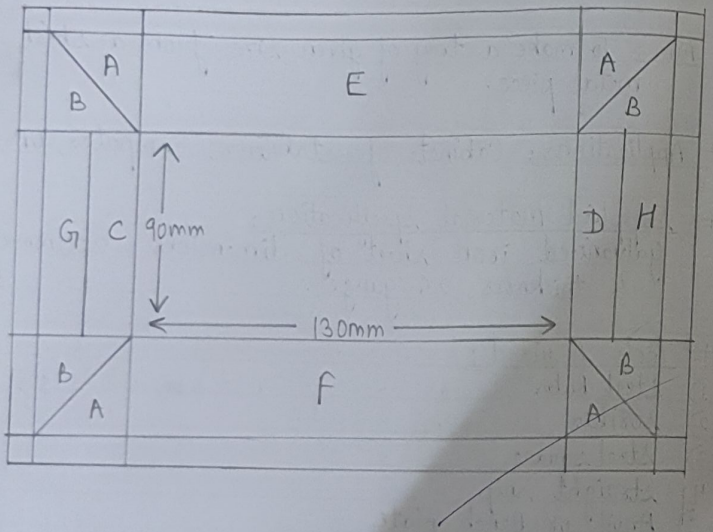
Applications: Cabinets of stabilizers, computer, UPS, etc

Supplied Material Specification:
galvanized iron sheet of dimensions 200mm x 150mm & thickness 26 gauge.

Tools Required:
1) Steel Rules
2) Scribers
3) Steel square
4) straight snip
5) Anvil or Bench plate
6) Stake
7) Mallet
8) Piece of wooden block

Sequence of Operations:
(I) checking
(II) Layout Marking
(III) Shearing
(IV) Folding
(V) Locking & Seaming.

Teacher's Signature:



EXPT. NO. | NAME | Page No. 9 | Date: | YOUVA

Working steps:

(I) Checking →

(i) Check whether the given sheet is having it's dimensions as 200mm × 150 mm. If the dimension is excess, trim off using hand shear.

(ii) Keep one corner of the sheet between body & tongue of steel square & check whether the sides exactly coincide with steel square.

(iii) Keep this corner as reference corner & these two sides as reference sides. This corner should be kept at left hand side bottom position.

(II) Layout Marking →

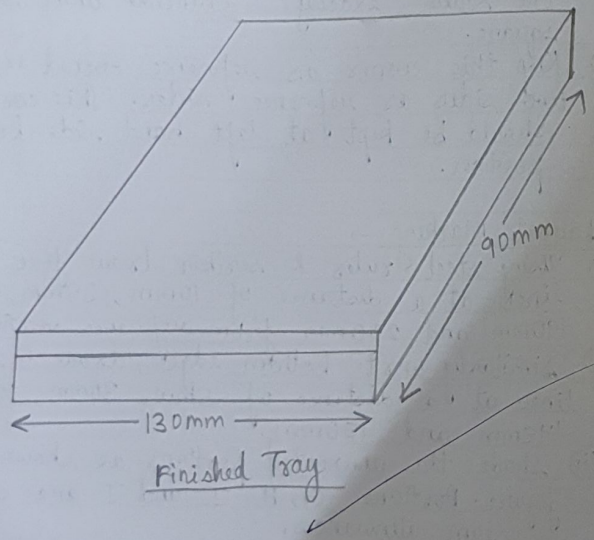
(i) Using steel ruler & scriber draw five vertical lines at a distance of 10mm, 35mm, 165 mm, 190mm and 200mm from reference vertical edge.

(ii) Similarly w.r.t. bottom edge, draw 5 horizontal lines at a distance of 5mm, 30mm, 120mm, 145mm and 150mm.

(iii) Shade the unwanted portions as shown in figure. Portions G, H, I and J are called as seam allowances.

P.T.O →

Teacher's Signature:



Finished Tray

EXPT. NO. | NAME | Page No.: 10 | Date: | YOUVA

(III) Shearing →

(i) To remove portion A, cut along the direction shown by arrows.

(ii) To remove portion B, cut along the direction shown. Use hand gloves to remove the cut portion.

(IV) Folding →

(i) Keep the pattern over square stake such that the inner line of hem portion I exactly coincides with the edge of stake.

(ii) Fold this portion 90° downwards with the help of mallet.

(iii) Remove the sheet, make further 90° fold over the portion I so that it form a hem along the edge. Similarly, fold the portion J also.

(iv) Place the sheet over the stake such that the line 1-2 coincides with the stake edge.

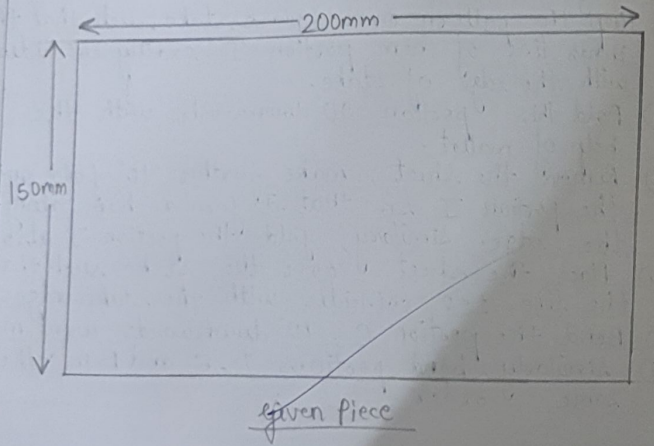
(v) Bend the portion C, 90° downwards using mallet

(vi) Similarly, bend portions D, E and F in the same order.

(V) Locking and Seaming →

(i) The incomplete tray is having four ~~corn~~ corners. Keep one corner in alignment with the corner of stake. Using mallet, fold the portion (triangular in shape) 90° towards the tray. Repeat this step for all other projections.

Teacher's Signature: 3/02/23



(ii) Fold the remaining portions G, and H 180° outwards using stake and mallet to lock the folds.

(iii) Check for the dimensions.

Result → Thus the required tray is made out of the given sheet metal piece.

11/2/2023

EXERCISE-2

Aim: To make a funnel of a given size from a sheet metal piece.

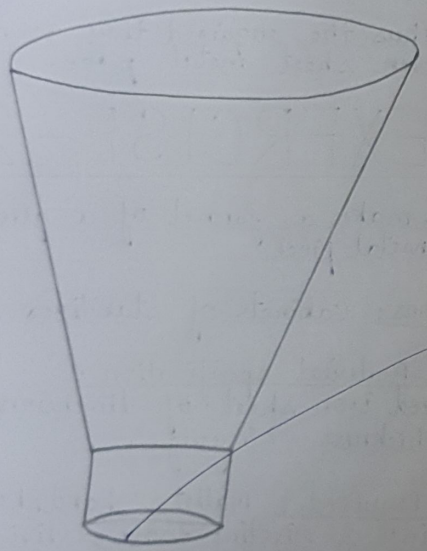
Applications: Cabinets of stabilizer, computer, UPS, etc.

Supplied Material Specification:
Galvanized iron sheet of dimensions 200mm x 150mm & thickness 26 gauge.

Tools Required: Mallet, hand shear, bench shear, grooving & riveting tools, divider, scriber, straight snip, nose plier, metal sheet.

Sequence of Operations: 1) Cone Making
2) Funnel Neck Making.

Teacher's Signature:



Funnel

EXPT. NO. | NAME | Page No. 12 | Date | YOUVA

Working steps →

1) Cone Making :

Step-1 :- Make a 90mm semicircle using divider. Cut around the circle with the snips in the centre of the tin snips. In the centre of the semicircle diameter, draw 25mm semicircle. Draw a straight line forming angle 150°.

Step-2 :- Overlap the edge of the metal to form a cone. The tapered end of the cone should have an operting approximately 5 inches in diameter.

Step-3 :- Return the metal to the overlapped position & clamp in place. Put on the helmet & gloves and wear long sleeves. Turn on the Mig welder at the mm power. Set Feeder speed to 3, & attach the ground clamp to the metal.

Step-4 :- Weld along the seams, not just front & back but also at the top of the clamped until it is closed.

P.T.O. →

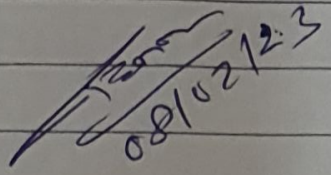
Teacher's Signature:

2) Making the Funnel Neck :

Draw a rectangle shape on the sheet of dimensions 50 x 30 mm. Fold it to 90° both end. Roll the ~~rect~~ rectangle.

Join the joint folded on 90°.

Result → The required cone with neck is made using given sheet.



Teacher's Signature:

EXPT. NO. NAME

Page No.: 14 YOUVA
Date: 8/2/2023

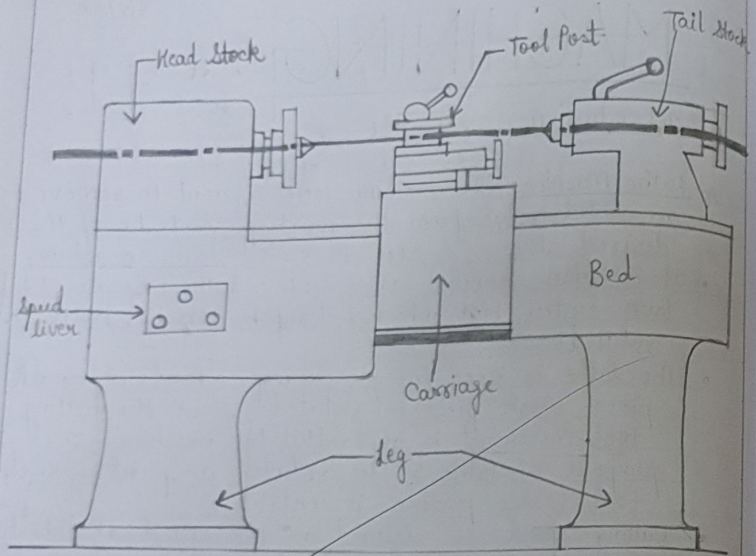
MACHINING

Introduction

★ **Lathe Machine:** The machine tool is used to remove unwanted metal from the work piece to be of the desired shape & size is called lathe machine.

- It is also known as "center lathe" because of two center b/w which the job can be held & rotated.
- The lathe is used for producing cylindrical work piece. Work piece is rotated while the cutting tool movement is controlled by machine. The purpose of lathe is to rotate a part against a tool whose position it controls.
- Cutting speed is defined as the speed at which the work moves with respect to the tool. Feed rate is defined as the distance the tool travels during one revolution of the part. Cutting speed & feed determines the surface finish, power requirement & material removal rate.
- The primary factor in choosing feed & speed is the material to be cut. However, one should also consider material of the tool, rigidity of the work piece, size & condition of lathe, & depth of cut.

Teacher's Signature:



Principle Components of a Central Lathe

EXPT. NO. NAME Page No. 15 YOUVA Date

Tools (← Parts of lathe →)

1) Head Stock: The headstock houses the main spindle, speed change mechanism, and change gears. The headstock is required to be made as robust as possible due to the cutting forces involved.

2) Bed: The bed is a robust base that connects to the headstock and permits the carriage & tailstock to be aligned parallel with the axis of the spindle. This is facilitated by hardened & ground ways which restrain the carriage & tailstock in a set track. The carriage travels by means of a rack and pinion system, leads screw of accurate pitch, or feed screw.

3) Feed and lead Screw: The feed screw is a long drivershaft that allows a series of gears to drive the carriage mechanisms. These gears are located in the apron of the carriage. Both feed & lead screw are driven by either the change gears or an intermediate gearbox known as a quick-change gearbox or Norton gearbox.

4) Carriage: In it's simplest form, the carriage holds the tool bit & moves it longitudinally (turning) or perpendicularly (facing) under the control of operator. The operator moves the carriage

Teacher's Signature:

manually via the hand wheel or automatically by engaging the feed screw with the carriage feed mechanism.

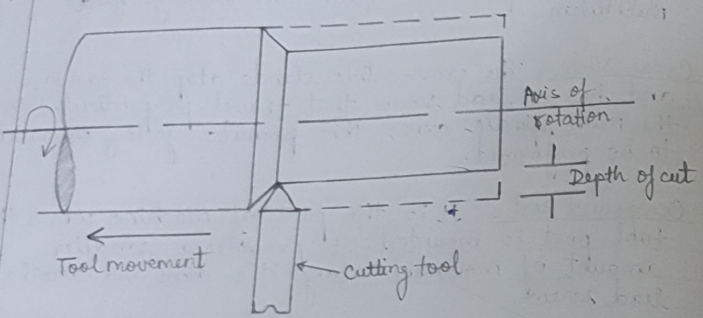
5) Cross Slide: The cross-slide stands atop the carriage and has a lead screw that travel perpendicular to the main spindle axis, this permits facing operations to be performed.

6) Compound Rest: It is the part of machine where the tool post is mounted. It provides a smaller amount of movement along it's axis via another lead screw.

7) Tool Post: The tool bit is mounted in the tool post which may be of the American lantern style, traditional 4-sided square styles, or in a quick change style.

8) Tail stock: It is a tool holder directly mounted on the spindle axis, opposite the headstock.

P.T.O.



TURNING

EXPT. NO. | NAME | Page No. 17 | Date: | YOUVA

Lathe Operations :-

⇨ TURNING : To reduce the diameter of a cylindrical work piece.
→ cutting tool moves in a linear fashion.
→ workpiece rotates.
→ work piece is made of mild steel.

⊙ Aim : To perform turning on a cylindrical work piece.

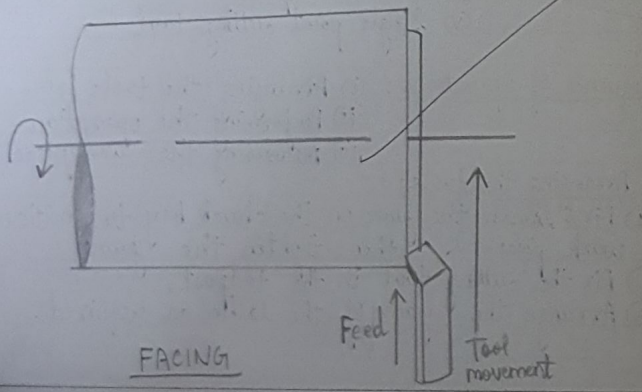
⊙ Supplied Material Specification : Work piece of 100mm length & 25mm diameter.

⊙ Tools Required : (i) Lathe
(ii) chuck key
(iii) chuck jaws
(iv) Vernier Calipers
(v) Single point cutting tool

⊙ Sequence of Operations : (i) Arranging the tools
(ii) Performing the operation
(iii) Measuring the workpiece.

(i) Arranging the tools :→
1) First loosen the jaws on the chuck key to position the work piece & then tighten the jaws.
2) Fix the cutting tool in the toolpost,
3) Arrange the gears of the lathe as required.

Teacher's Signature:



FACING

EXPT. NO. | NAME | Page No.: 18 | Date: | YOUVA

(ii) Performing the operation:→

1) Move the carriage to make the tool touch the end surface of workpiece.
2) The turning operation is done with cutting tool to reduce the diameter upto the required dimension.
3) Give a small push in longitudinal direction & then move the tool towards the axis of the workpiece using the cross slide to complete the work piece.

(iii) Measuring the workpiece:→

1) The work piece is removed from the chuck & the dimensions of the work piece are checked for requirements.

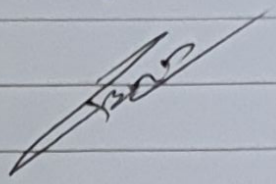
⊙ Result: Thus the required shape & size of the work is obtained by turning of the given material.

⇨ FACING: To reduce the length of cylindrical workpiece.

- Facing is the producing of a flat surface as the result of a tool's being fed across the end of the rotating work piece.
- Unless the work is held on a mandrel, if both ends of the work are to be faced, it must be turned end for end after the first end is completed & the facing operation repeated.

Teacher's Signature:

- The cutting speed should be determined from the largest diameter of the surface to be faced.
- Facing may be done either from the outside inward or from the center outward. In either case, the point of the tool must be set exactly at the height of the center of rotation.



Teacher's Signature:

EXPT NO. NAME

Page No. 20
Date 15/2/23
YOUVA

SMITHY

Introduction

Definition: Smithy is a process of heating the metal to it's plastic state & shaping it to the required form. Based on the metal being worked on, the trade gets different names like goldsmithy, silversmithy, Tinsmithy, etc. Black smithy is the oldest form of forging.

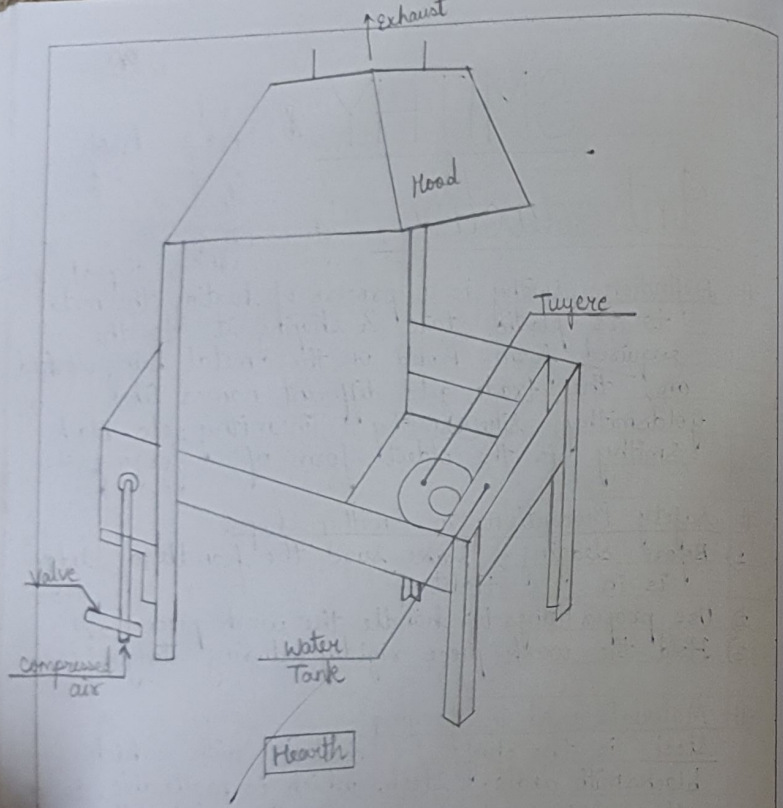
Safety Precautions in Smithy shop:

1) Before sledging, make sure the handle of sledge is in tight.
2) Use proper tongs to handle the work piece.
3) Hold the work piece rigidly during sledging.

Materials used in forging:

Steel is the chief material with which blacksmith deals. Steel, which is malleable, is an alloy of iron & carbon together with other elements.

Teacher's Signature:



EXPT. NO. NAME

Page No. 21 YOUVA

Date:

M T W T F S S

Tools

- **Hearth**

It is a furnace required to heat the metal to a malleable state. It is constructed of silica brick rather than brick to withstand high temperature. Hearth consists of tuyere for leading a forced air into the fire, blower for supplying air, & chimney. The fuel generally used in hearth is coke.

- **Measuring Tools**

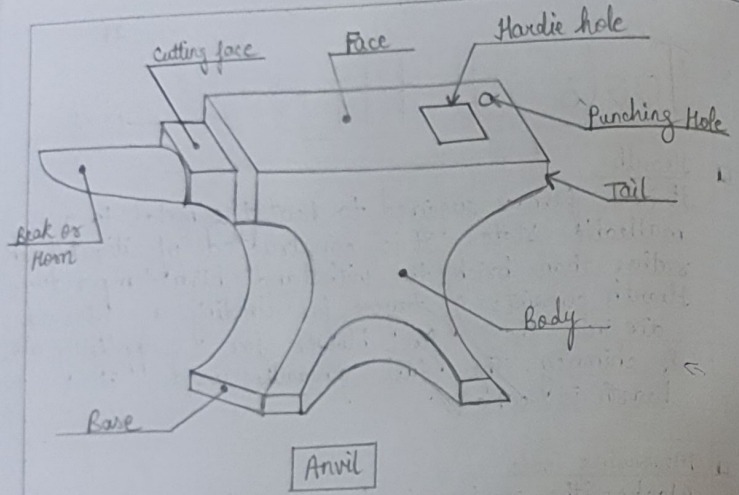
Blacksmiths employ simple measuring instruments for checking forgings in the process of work. Common calipers are employed for checking only one dimension of a forging. The blacksmith sets the caliper legs to the required dimension & while working, repeatedly checks the dimensions of the forging with the calipers set in this way.

- **Supporting Tools**

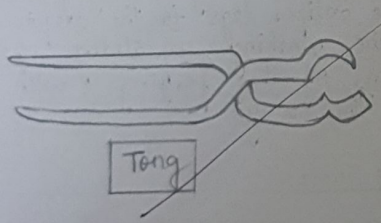
★ **Anvil**

The anvil is for supporting the work while it is being struck with the hammer, as well as providing means for other forging operations. Anvils have been made for many special

Teacher's Signature:



Anvil



Tong

uses ranging from the smallest jewellers anvils to the heaviest industrial anvils. Anvil is made of solid wrought iron or cast steel.

→ Modern anvils are made by a number of methods:→

1) Wrought iron bodies with heavy face plates welded on.
2) Cast iron or ductile iron bodies cast on to a steel face plate and
3) Solid steel castings.

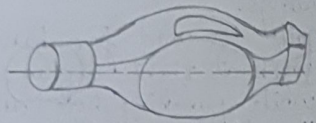
→ Horn of the anvil is used for bending, tail is used to bend work at right angles, punching hole is used while punching hole on work piece, whereas hardie hole is to secure devices like fuller or swages.

Holding Tools

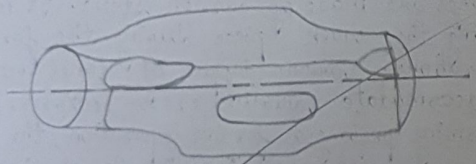
Tongs

The tongs are made of carbon steels. It is used for holding the work piece during the forging operations. Various types of tongs are available to accomodate various cross-sections. When performing prolonged forging operation, the blacksmith slips a ring over the handle of the tongs to keep them closed to tighten his work.

(a) Ball Peen Hammer



(b) Straight Peen Hammer



(c) Sledge Hammer

EXPT. NO. | NAME | Page No. 23 | Date: | YOUVA

M T W T F S S

Striking Tools

★ Hammers

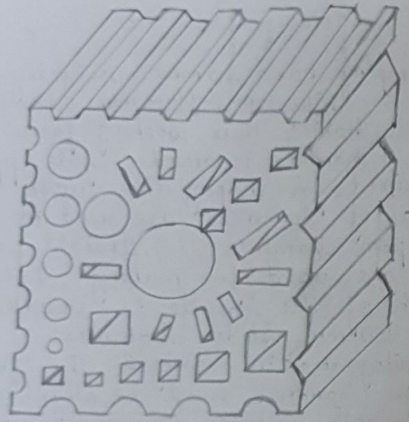
Blacksmith employ hand hammer weighing from 0.5 to 1.5 kilograms. Hammers are made of carbon steel having their working faces hardened & tempered. A hammer is used for applying forces required for shaping the work pieces. Various types of hammers are used in forging. The Ball peen hammer & straight peen hammers are used for making light forgings. The length of the handle is usually 350 to 450 mm. Sledge hammers vary from 2 to 10 kilograms in weight. The striking surface of a sledge hammer must be slightly convex & smooth. Sledge hammers handles are of 700 to 900mm long. Sledge hammers are used to give heavy blows over ingots.

Shaping Tools

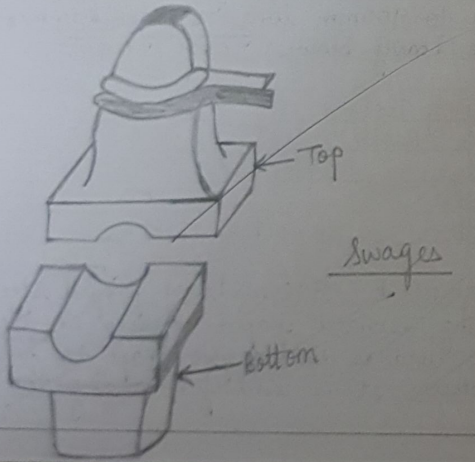
1) Swage Block
2) Swage
3) Fuller
4) Flatters or Smoothers

★ Swage Block: It is made of forged steel/cast steel having assorted shaped recesses on it's face. Holes are used as dies to give shape to hot work as per recesses. It is used for holding the bars while

Teacher's Signature:



Swage Block



Swages

EXPT. NO. | NAME | Page No. 24 | Date: | YOUVA

★ Swage block

It is made of forged steel/cast steel having assorted shaped recesses on it's faces. Holes are used as dies to give shape to hot work as per recesses. It is used for holding the bars while bending & knocking up heads, & for shaping into various shapes & sizes. The swage block is usually supported at a suitable height on a stand.

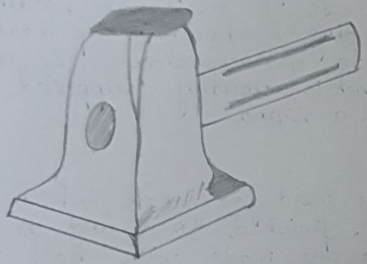
★ Swage

Swages are used for work which has to be reduced & finished to round or hexagonal form. They are made with half grooves of dimensions to suit the work being reduced. Swages are usually made in pairs, top & bottom swages. The top has a spring handle. The bottom one has a square shank which fits into the square hole of the anvil.

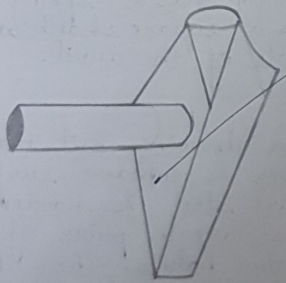
★ Fuller

Fullers are used for drawing out metal & also for finishing grooves & concave surfaces. Fuller is made of tool steel & hardened. Faces are polished. These are in pairs of two halves, namely top & bottom halves. The bottom part has a square shank which may be fitted into the square hole of the anvil. The top part of

Teacher's Signature:



Flatter



Chisel

EXPT. NO.

NAME

Page No. 25

Date:

YOUVA

the fuller carries a handle. Thus, a 12mm fuller will have a semi-circular edge 12mm wide. For shouldering, round nosed fullers may have their edges hollowed out.

☆ Flatters or Smoothers

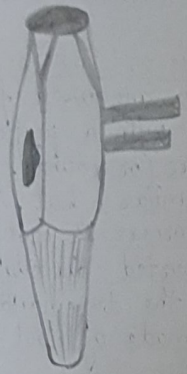
Flatters are used for finishing flat surfaces & are made with a perfectly flat face about 75mm square (or round). The set-hammer is a similar but smaller tool used for finishing in corners & confined spaces. As the work is supported directly on the anvil for flatting only the top handled tool is necessary. Flatters are made of tool steel.

Cutting Tools

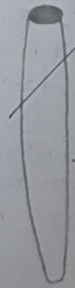
☆ Chisels: Chisels may be hot or cold depending upon whether the metal to be cut is cold or hot. Hot chisel is made of low carbon steel & cold chisel is made of tool steel. Chisels are used for cutting metals & for nicking prior to breaking. The cutting edges are hardened & tempered. For cold chisel, the cutting edge angle is about 60°. The cutting edge angle for hot chisel is about 30° & hardening is not necessary, since in any case the hot metal would re-soften it.

Teacher's Signature:

Gouges



Punch



Drift

★ Gouge

Gouge is made of tool steel. It is a type of chisel used for cutting in a curved form.

★ Punch

Punches are made of carbon steel having the working area hardened & tempered. A punch is to make a dot or a mark in the work piece. When punching a hole, it should be carried out from both sides.

★ Drift

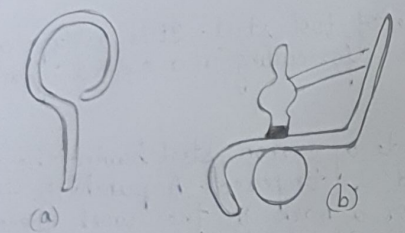
Drift is also made of tool steel, hardened & tempered. It is used for finishing & enlarging punched marks. It is a larger tapered punch.

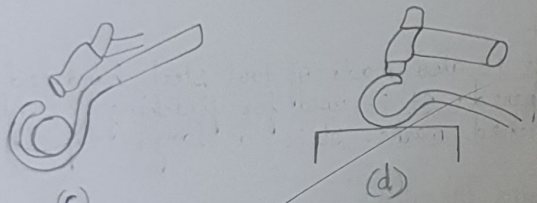
Forging Operations

★ Drawing

Drawing is the process of increasing the length of a bar at the expense of it's width or thickness or both. A good method of drawing down square or rectangular bars is to use the edge or break of the anvil, turning the bar through 90° if the thickness in both directions is to be reduced. When assisted by a striker, a pair of fullers may be used. When the preliminary drawing has been done in this way, the work may be finished off with the flatter. When round bars have to be drawn a

Teacher's Signature:





Types of Bending

considerable amount, they should first be brought down to a square drawn by the above method & then squared up again. The square is then taken to an octagen by taking off the corners & finally rounded & finished between swages.

★ Fullering

It is similar to drawing, but this operation is carried out with a set of two fullers. It results in an irregular shape, which should be smoothened by means of flatters.

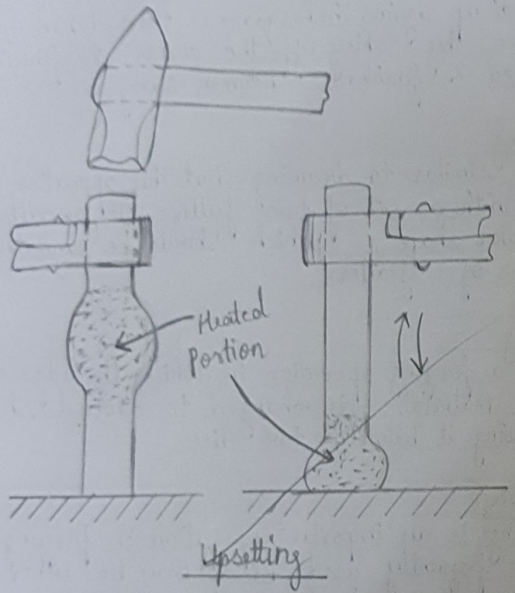
★ Edging

It is a forging operation in which the edge of the raw material is changed to desired shape by pressing it between two dies.

★ Bending

Bending is an important operation in forging & is one very frequently used. Bends may be either sharp-cornered angle bends or they may be composed of a more gradual curve. Angle bends may be made by hammering the metal over the edge of the anvil, over a block of metal held in the hardie hole or in a vise or vise jaw itself, while the metal is being gripped. When metal is bent, the layers of the metal on the inside are shortened & those on the outside are stretched. This causes a bulging of

Teacher's Signature:



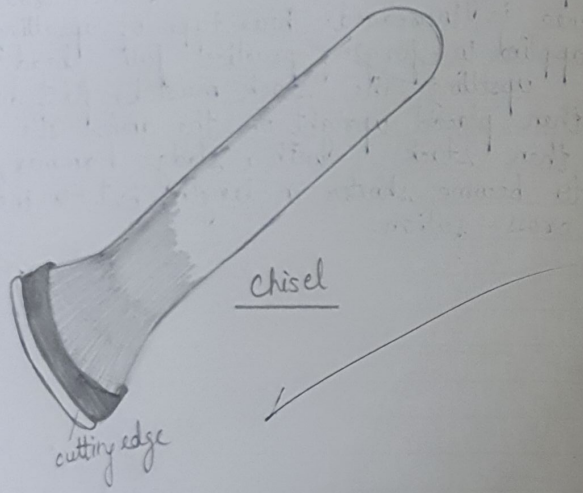
the sides at the inside. It is a forging operation to bend the workpiece as desired by using the front portion of the anvil suitably.

* Upsetting

Upsetting is a forging operation whereby the length of a piece of metal is reduced & it's cross-sectional area is increased. Three types of upsetting are applied in forging practice; full, head & central upsetting. The stock must be first heated & then placed upright on the anvil. It's top end is then struck with a sledge hammer, causing it to become shorter in length, but to increase in cross-section.

P.T.O.

Teacher's Signature:



EXPT. NO. | NAME | Page No.: 29 | Date: | YOUVA

Experiment – ?

Objective: To obtain a chisel using steel rod in smithy shop.

Tools Required: Tongs, Bench-vise, Sledge hammer, Anvil, Open Hearth, Furnace, Mild steel work piece.

Procedure:

1) First we take the mild steel cylindrical rod.
2) Then we use the saw to cut a piece of 150mm to get a desired piece to make the chisel using bench-vice for holding.
3) Now the cylindrical piece is heated to ~~hearth~~ furnace.
4) Now before reaching the melting point temperature we take out the furnace from fire.
5) After taking out the workpiece we put it on the anvil & hold firmly with tongs.
6) Before the metal starts to get stiff & cold we hit it using the sledge hammer to ~~provide~~ the layout of a chisel.
7) After proper hammering, the work piece is quenched in water.

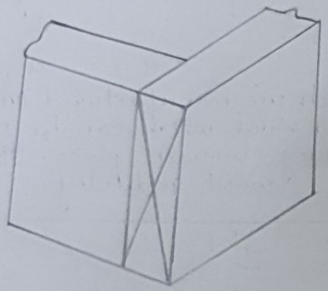
Teacher's Signature:

8) Now the chisel workpiece is dried & ~~fitted~~ filed properly to sharpen it's edges.
9) At last we obtain a chisel made out of mild steel.

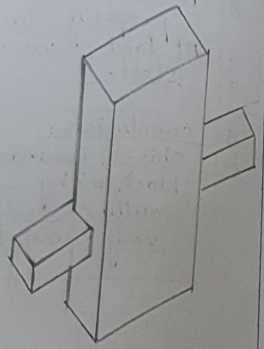
Conclusion:

chisel, ~~is made~~ which we manufactured in the blacksmithy shop, is a tool which can be used for cutting & designing wooden piece. It is very useful in wood industry.

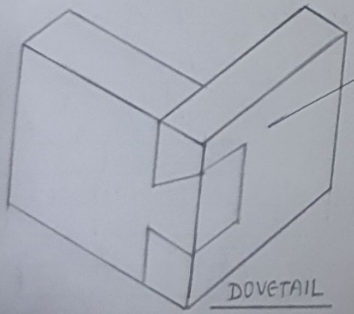
Teacher's Signature:



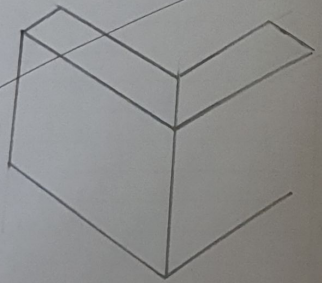
LAP



CROSS-LAPPED



DOVETAIL



MITER

EXPT. NO.

NAME

Page No.: 31

Date: 01/03/23

YOUVA

CARPENTRY

Introduction

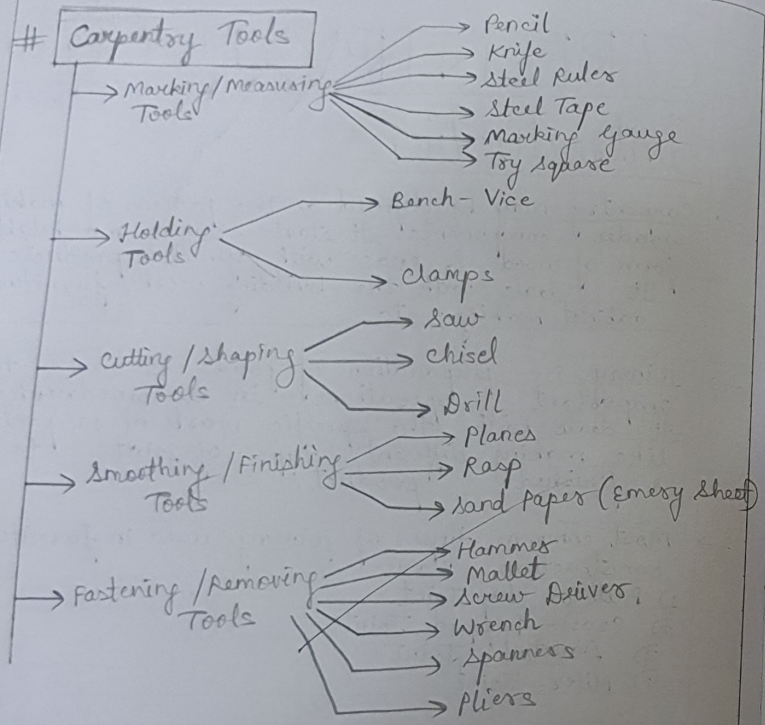
→ Carpentry may be defined as the process of making wooden components. It starts from a marketable form of wood & ends with finished products. It deals with the building work, furniture, cabinet making; etc.

→ Joinery i.e. preparation of joints is one of the important operations in all woodworks. It deals with the specific work of carpenter like making different types of joints to form a finished product.

→ Most common types of joinery used in furniture construction are-

1) Butt or Lap Joint
2) Cross-Lapped Joint
3) Dovetail Joint
4) Miter Joint

Teacher's Signature:



EXPT. NO. NAME

Page No.: 32 Date: YOUVA

Tools

(A) Marking and Measuring Tools

1) Pencil: Pencils aren't precise enough for most marking, but a package of cheap mechanical pencils will be handy to have around.

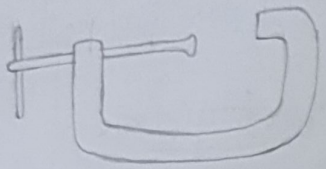
2) Knife: The best marking tool is a knife. The blades of the knife should be fine so that it can follow a straightedge.

3) Steel Rules: A good metal ruler with graduations in centimeter & millimeter on one edge & inch on the opposite edge. This is handy for measuring & as a straightedge.

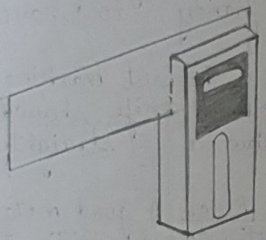
4) Steel Tape: The tape is a flexible steel ruler coiled in a compact steel casing. This is used to measure large dimensions in one stretch (upto 2 meters). Since the tape is flexible, measurements can be made on curved parts also.

5) Marking Gauge: Consists of a square bar of required length with graduations of a scale on one side of the square along the length of the bar.

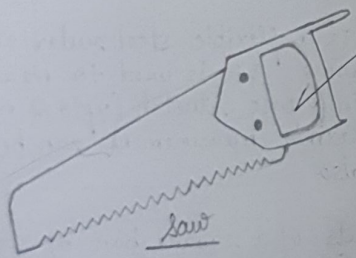
Teacher's Signature:



C clamp



Try square



Saw

EXPT. NO. NAME Page No. 33 Date: YOUVA

- Thumbscrew allows the slide to be moved along the ruler & locked in plane.
- Used to mark lines & set distances from the edge of a piece of wood.

6) Try Square: Used to mark perpendicular lines along the work piece with a pencil or scribing tool.
- Also used to check flatness of any surface or squareness of two adjacent sides.

⭐ Holding Tools

1) Carpentry Bench-Vise: Consists of one fixed jaw & one movable jaw.
- Distance b/w the jaws can be adjusted by a screw & nut arrangement.
- Used to hold long bars of wood for wood working.

2) Clamp: It has a C or G- shaped frame.
- Through one end of the frame, a lead screw & nut arrangement is provided. The other end acts as a stop.
- Used for clamping large wooden planks rigidly on a table.
- It can also be used for applying constant pressure on wooden pieces that are glued together for better adhesion.

Teacher's Signature:

⑧ Cutting & Shaping Tools

1) **Saws**: Most widely used wood-working tools.
- Consists of a toothed blade made of steel fitted to a ergonomically-designed wooden handle.
- The teeth are the cutting points.
- Saws are mainly specified by the pitch in number of teeth per inch (TPI) & the overall length of blade.

(a) **Cross Cut Saw**: Used for wood-working across the wood grain.
- 24" to 26" long with 8 to 11 tpi.

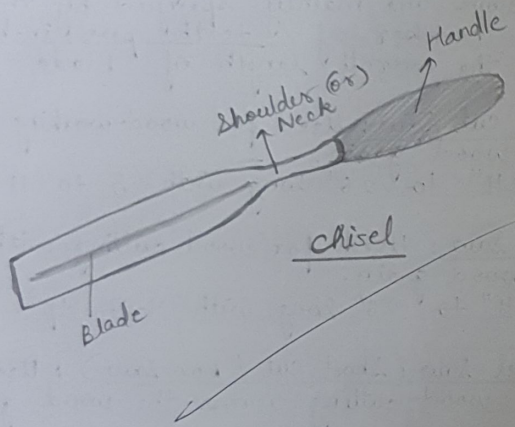
(b) **Rip Saw**: Used for wood-cutting with the wood grain.
- 24" to 26" long with 4-7 tpi.

(c) **Panel Saw (Short Cut / Box Saw)**: Used for wood-cutting across the wood grain.

(d) **Bow Saw**: Used for wood-cutting in any direction.

(e) **Coping Saw**: Used for fine wood-cutting, coping joints intricate cuts at extreme ends.

Teacher's Signature



EXPT. NO. | NAME

Page No. 35 | YOUVA

(f) Back saw: Used for fine wood-cutting, moulding and trimming.

(g) Dovetail Saw: Used for wood joint cutting.

(h) Keyhole Saw: Used for circle & curve cutting in wood.

(i) Compass Saw: longer, coarser blades ~~with~~ than keyhole saw.
- used for circle & curve cutting in wood.

2) Chisel: A metal tool with sharp-beveled edge.
- Used to cut or shape stone, wood or metal.

(a) Firmer chisel: Useful for large-scale carvings.

(b) Bevel-Edge chisel: These are slightly undercut, making them easy to push into corners.
- useful for finishing dovetail joints & also for chopping & shaping.

(c) Butt chisel: Shorter version of regular bevel-edge chisel.

(d) Mortise chisel: Used for chopping mortises (rectangular holes or slots).

Teacher's Signature:

(e) Paring chisel: Used for ~~cleaning~~ cleaning up the joint & to make it an accurate fit.
- used for paring down mortises that have been chopped or drilled, or other delicate work.

(f) Skew chisel: Used by carvers & turners.

3) Drill: It is meant for making holes.
- Small Holes → Bradawl or Hand Drill
- Large Holes → Brace and Bit

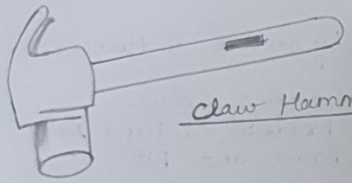
⑧ Smoothening & Finishing Tools

1) Planes: Most commonly used plane is a jack-plane, meant for general purpose work. Other types are-
(a) Trying Plane: for precision work
(b) Smoothing or Block Plane: Trimming end grains & small items.

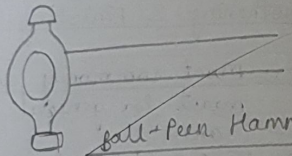
2) Rasp: Finishing Tool used to remove sharp edges & smoothen the surfaces.

3) Sandpaper: Small particles of abrasives are glued to a flexible thick sheet of paper or cloth. These are known as Sandpapers or Emery sheets.
- used for preparing the wooden surfaces as smooth as possible.

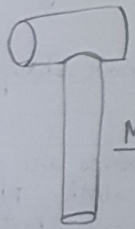
Teacher's Signature:



Claw Hammer



Ball-Peen Hammer



Mallet

EXPT. NO. | NAME | Page No.: 37 | Date: | YOUVA

M T W T F S S

(A) Fastening & Removing Tools

1) Hammer: Used for driving or removing nails & for flattening thin metallic sheets.

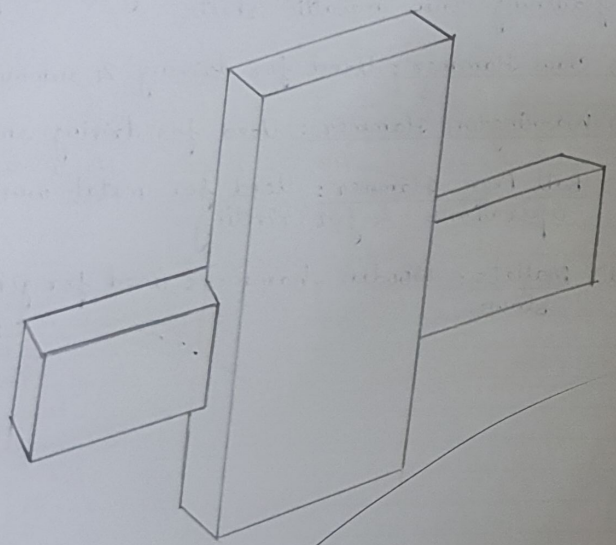
(a) Claw Hammer: Used for driving & removing nails.

(b) Warrington Hammer: Used for driving small nails.

(c) Ball Peen Hammer: Used for metal-working operations & for riveting.

(d) Mallets: Wooden hammers used for giving light blows.

Teacher's Signature:



CROSS- LAPPED JOINT

EXPT. NO. NAME

Page No. 38
Date: 01/03/23
YOUVA

Exercise - 1

Aim: To make a cross-lapped joint using softwood & carpentry tools.

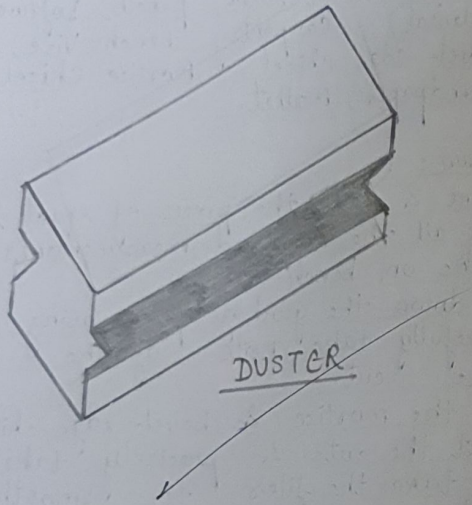
Tools Used: Steel ruler, pencil, softwood piece (material), Carpentry Bench-Vise, Panel saw, Bevel-edge chisel, Mortise chisel, filers, Sandpaper, Mallet.

Procedure:

(i) Measure & mark the pieces of equal size.
(ii) Mark all the required measurements & fix the blocks on bench-vice.
(iii) Cut down the garbage pieces using panel saw & carefully take note of the depth of the cut.
(iv) Use the mortise & bevel-edge chisel to take out the cuts & precisely take them out.
(v) Now take the filers to smoothen the hollow part.
(vi) After making cutouts from both the rectangular pieces, fix the two pieces tightly by connecting the hollow part of both the pieces using mallet & rub & smoothen it using the filer.

Conclusion: The final piece of cross-sign is obtained using two wooden pieces which are fixed without using any nail or glue.

Teacher's Signature:



EXPT. NO. | NAME | Page No.: 39 | Date: 15/3/23 | YOUVA

Exercise - 2

Aim: To make a duster using softwood & carpentry tools.

Tools Required: Steel Ruler, Pencil, Softwood Piece (material), carpentry Bench-Vice, Panel saw, Bevel-edge chisel, Mortise chisel, Filer, Sandpaper, Mallet, Triangular Filer.

Procedure:

(i) Take the required piece, smoothen the 3 sides using filer.

(ii) Now mark all the markings to make the required cuts using steel ruler & pencil.

(iii) Now fix the wooden piece on the bench-vise & make the cuts using panel saw.

(iv) Using the bevel-edge chisel, make the deep cuts to give it a finished look.

(v) Now using a mortise chisel, make a more precise cut of V-shape & throw out the garbage piece.

(vi) Then take the triangular filer to make the cut-out part V-shaped.

(vii) Now after perfect V-shape is obtained on both sides, make the face of curved edge.

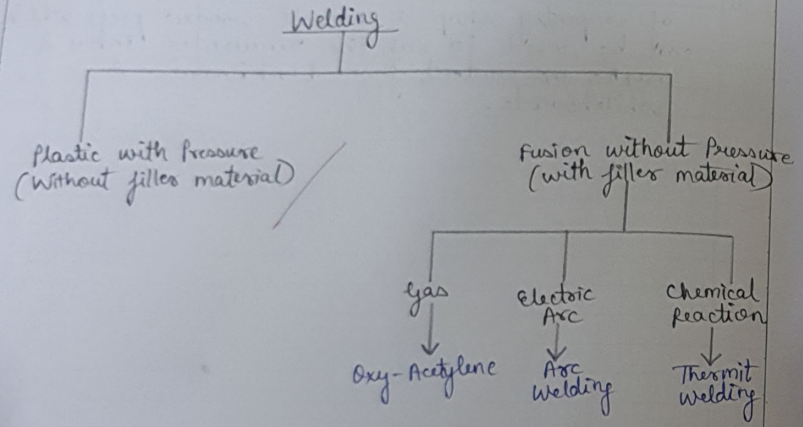
Teacher's Signature:

(viii) After getting the final piece, take a sandpaper & rub the 3 sides to get a final smoothened piece of duster.

Conclusion: Duster is manufactured using the tools of carpentry shop & a soft wooden piece which can be used to rub the unwanted inks & marks or content from blackboards & whiteboards.

22/03/23

Teacher's Signature:



EXPT. NO.

NAME

Page No.: 41
Date: 22/3/23
YOUVA

WELDING

Introduction

Welding is a process of joining similar metals by application of heat with or without application of pressure and addition of filler material. The result is a continuity of homogenous material, of the composition & characteristics of two parts which are being joined together. Welding is extensively used in the fabrication work in which metal plates, rolled steel sections, casting of ferrous materials are joined together. It is also used for repairing broken, worn-out or defective metal parts.

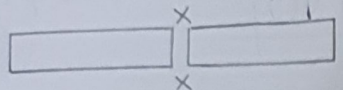
Types of Welding

→ Welding is classified under 2 broad headings:-

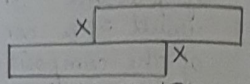
(1) Plastic Welding or Pressure Welding: The pieces of metal to be joined are heated to a plastic state & then forced together by external pressure. This procedure is used in forge welding & resistance welding.

(2) Fusion Welding or Non-Pressure Welding: The material at the joint is heated to a molten state & allowed to solidify. This includes gas welding, arc welding, etc.

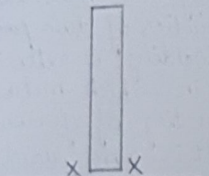
Teacher's Signature:



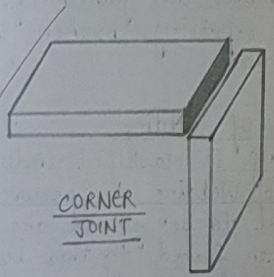
BUTT JOINT



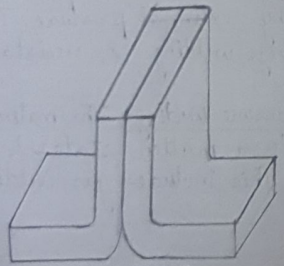
LAP JOINT



T-JOINT



CORNER JOINT



EDGE JOINT

Gas Welding

Gas welding is done by burning a combustible gas with air or oxygen in a concentrated flame of high temperature.

Arc Welding

Arc welding is the most extensively employed method of joining metal parts. Source of heat is electric arc. This is helpful in obtaining the desired penetration of base metal.

Types of Joints in Welding

1) Butt Joint: Join the ends or edges of 2 plates or surfaces located approximately in the same plane with each other.

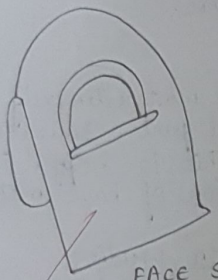
2) Lap Joint: Join 2 overlapping plates so that the edge of each plate is welded to the surface of the other.

3) Tee-Joint: Weld 2 surfaces whose surfaces are at right angles to each other.

4) Corner Joint: Join the edge of 2 sheets whose surfaces are at right angles.

5) Edge Joint: Join 2 parallel plates by means of a weld.

Teacher's Signature:



FACE SHIELD

EXPT. NO. | NAME | Page No.: 43 | Date: | YOUVA

Safety Precautions:

1) Protective clothing is most important for welding. Fire resistant gauntlet gloves should be worn for most welding operations.

2) Don't touch the electrode or fix the electrode with bare hand.

3) Don't touch the welded piece with hand.

4) Don't remove the used electrode from the electrode holder with bare hand.

5) Don't lean over the welding table.

6) Don't use water to extinguish an electric fire.

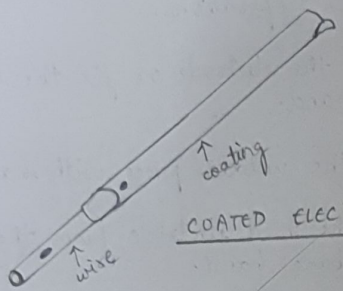
7) Don't stand over the electric cable.

8) Don't chip the welded piece without tongs & goggles.

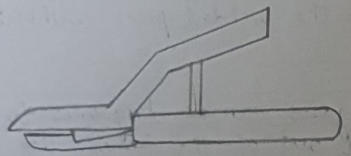
9) Fumes & gases can be dangerous to health. Keep your head out of the fumes. Use enough ventilation.

10) Don't touch live electrical parts.

Teacher's Signature:



COATED ELECTRODE



ELECTRODE HOLDER

EXPT. NO. | NAME | Page No.: 44 | Date: | YOUVA

M T W T F S S

Tools

1) AC Transformer / DC generator: Both DC and AC are used for electric arc welding, each having it's particular applications; in some cases either is suitable.

2) Electrodes (Filler Rods)

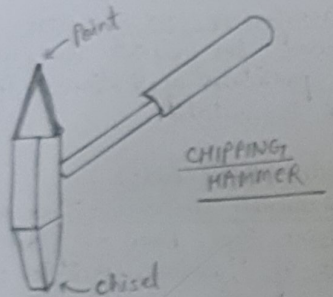
(i) Consumable Electrodes: They may be either coated or bare type. Bare or plain electrodes are made of various metals which don't have any coating of flux. They are exposed to oxygen (air) & hence, the molten metal is oxidised during welding. The molten pool contains oxidised metal also, which decreases the strength of the joint. They have limited application - minor repair.

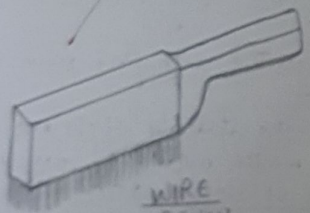
Electrodes coated with flux serve the following purposes -

(a) Facilitates the stability of the arc.
(b) Protects molten metal from oxygen & nitrogen.
(c) Formation of slag - protects the welded seam from oxidation & rapid cooling.

(ii) Non-Consumable electrodes: Made of carbon, tungsten, or graphite which don't get consumed during welding process.

Teacher's Signature:





3) Electrode Holder: Device used to secure electrode. They have grooves cut in the jaw which enables the electrodes to be held at various angles for ease in manipulation.

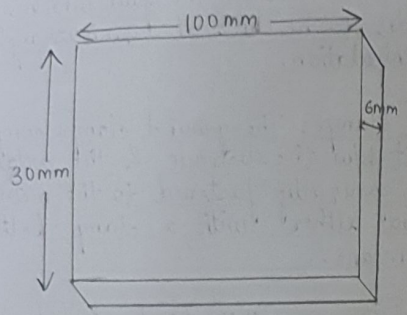
4) Ground Clamp: The ground clamp completes the circuit b/w the electrode & the welding machine. This is generally fastened to the metal being welded either with a clamp, bolt or some other means.

5) Chipping Hammer: It is chisel-shaped & is pointed at one end to aid the removal of slag.

6) Wire Brush: It removes small particulates of slag, is generally made of stiff steel wire embedded in wood.

7) Safety Accessories:
- Helmet-face shield
- Hand-held face shield
- Long gloves.

Teacher's Signature



GIVEN PIECE

EXPT. NO.

NAME

Page No. 46

Date:

YOUVA

Exercise - 1

Aim: To join 2 pieces of metal plates placed on the same plane using arc-welding method.

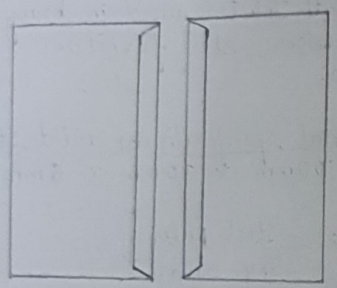
Application: Butt Joint is used in heavy constructions, automobile carriers, steel furniture & constructions.

Supplied Material specifications: Mild steel plate of dimensions 100mm x 30mm x 6mm, two pieces.

Tools Required:
- Steel Ruler
- Try Square
- Flat Filer
- Consumable electrode
- Tongs
- Chipping Hammer
- Wire Brush.

Sequence of Operations:
- Preparing
- Track Welding
- Final Welding
- Chipping & Cleaning.

Teacher's Signature:



PREPARED PIECE

EXPT. NO. | NAME | Page No.: 47 | Date: | YOUVA

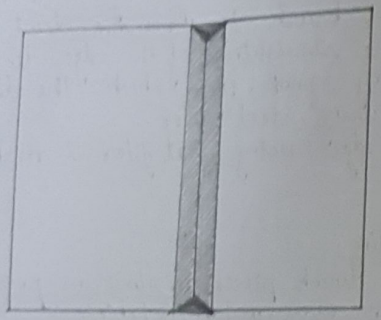
Working steps:

1) Preparing: (i) Clean the edges of the work pieces using wire brush to remove dust & rust.
(ii) Check the straightness of the edges to be joined using try square. Also check the dimension of sample using steel ruler.
(iii) File 3 edges using flat files & make them straight.

2) Track Welding:
(i) Place the work pieces as close as possible butting each other over welding table.
(ii) Check the welding machine, cables, electrode, & earth clamp for proper connections.
(iii) Select correct electrode & fix it to the electrode holder. Use gloves while fixing the electrode.
(iv) Switch on the welding machine. Adjust the current to 100A. Keep the shield closer to eye & move the electrode nearer to one end of the work piece pair.
(v) In the same way, enable another spot at the next end of the work piece pair. This is to keep the pieces in place during welding.

3) Final Welding:
(i) Move the electrode to first track & make a spark.
(ii) Gradually move the electrode towards the second track with shaking the & maintain the gap

Teacher's Signature:



FINAL WELDING

b/w electrode tip & work piece. This is known as first run.

(ii) For second run, start from first track & move towards second track with uniform oscillation motion. This keeps the metal molten a little larger & allows the gas to escape, bringing the gas to the surface.

4) Chipping & Cleaning:

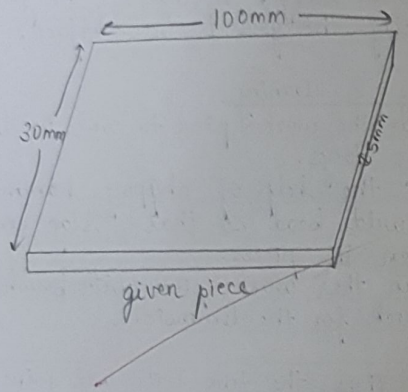
(i) Allow the work piece to cool or dip it in water using tongs.

(ii) With the help of chipping hammer, gently tap the weld bead so that slag coating is broken in pieces.

(iii) Clean the work piece with brush thoroughly.

(iv) Check for the dimension.

Result: Thus, the two flats are joined by butt joint using arc welding.



EXPT. NO. NAME

Page No.: 49 YOUVA
Date: 5/4/23

Exercise - 2

Aim: To join 2 edges of metal plates overlapping each other using welding method.

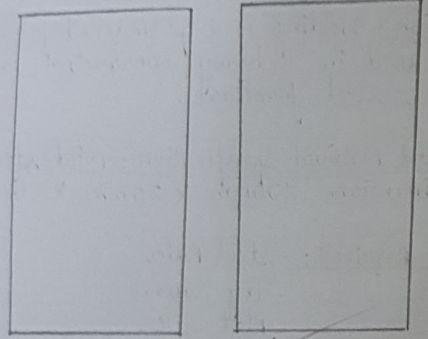
Application: Welding is a permanent joining. Lap Joint is used in heavy construction, automobile chasis, steel furniture.

Supplied Material specification: Mild steel flats of dimensions 100mm x 30mm x 6mm - two pieces.

Tools Required:
- Steel Ruler
- Try Square
- Flat file
- Welding Machine
- Consumable Electrode
- Tongs
- Chipping Hammer
- Wire Brush.

Sequence of Operations:
- Preparing
- Tack Welding
- Final Welding
- Chipping & cleaning

Teacher's Signature:



EXPT. NO. | NAME | Page No. 50 | Date: | YOUVA

Working steps:

1) Preparing →

(i) Clean the edges of the work pieces using wire brush to remove dust & rust

(ii) Check the dimensions using steel ruler & also check straightness of the edges to be joined using try square.

(iii) File these edges using flat file & make them straight & again check with try square.

2) Track Welding →

(i) Keep one work piece over welding table & place another piece over the first one so the filed edges make overlap of mm, with the help of tong hold the work pieces.

(ii) Check the welding machine, tables, electrode & earth clamp for proper connections.

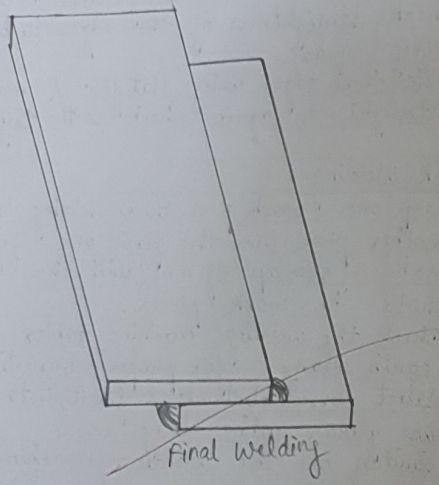
(iii) Select correct electrode & fix it into electrode holders, use gloves while doing so.

(iv) Switch on the welding machine. Adjust the current to 100A. Keep the shield closer to eyes & move the electrode nearer 1 end (A) of the work piece pair.

(v) In the same way, make another spot at the next end (B) of the work piece pair. This is to keep the piece in place during welding.

(vi) Turn the work piece upside down & make lap weld at required place.

Teacher's Signature:



EXPT. NO. | NAME | Page No.: 51 | Date: | YOUVA

3) Final Welding →

(i) Move the electrode to first track A & make a spark.

(ii) gradually move the electrode towards the 2nd track (B) without shaking the electrode. This is called first run.

(iii) For the 2nd run, start from A & move towards B with oscillation motion. This keeps the metal molten a little longer & allow the gas to escape, bringing the slag to the surface.

(iv) Turn the workpiece upside down & make final weld between C and D as explained above.

4) Chipping & Cleaning →

(i) Allow the work piece to cool or dip it in water using tongs.

(ii) With the help of chipping hammer, gently tap the weld bead so that the slag coating is broken to pieces.

(iii) Clean the work piece with wire brush technology.

(iv) check for dimensions.

Result: The given 2 parts are joined by lap joint using arc welding method.

12/04/23

Teacher's Signature:

EXPT. NO.

NAME

M T W T F S S

Page No.: 52

Date: 12/4/23

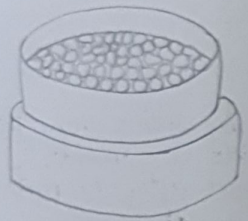
YOUVA

FOUNDRY

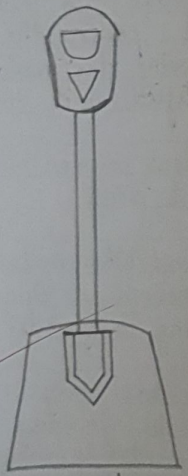
Introduction

- Metals are cast into shape by melting them into a liquid, pouring the metal into a mold, & removing the mold material after the metal has solidified as it cools.
- The most common metals produced are aluminium & cast iron.
- However, other metals such as bronze, brass, steel, magnesium & zinc are also used to produce casting in foundries.
- There are large number of tools & requirements used in foundry shop for carrying out different operations such as sand preparation, moulding, melting, pouring & casting.
- They can be broadly classified as hand tools, sand conditioning tools, flasks, power operated equipments, metal melting equipments & fettling and finishing equipments.

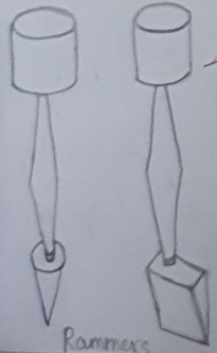
Teacher's Signature:



Hard Riddle



Shovel



Rammers

EXPT. NO. | NAME | Page No. 53 | Date: | YOUVA

Tools

① Hard Riddle: It consists of a screen of standard circular wire mesh equipped with circular wooden frame.
→ Used for cleaning the sand for removing foreign material such as nails, shot metal etc

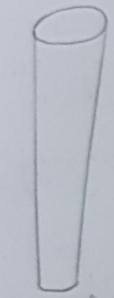
② Shovel: It consists of a steel pan fitted with a long wooden handle. It is used in mixing tempering & conditioning the foundry sand by hand. Also used for moving & transforming the moulding sand to the container & moulding box or flask.

③ Rammers: These are used for striking the moulding sand mass in the moulding box to pack or compact it uniformly all around the pattern. Common forms of rammers:→

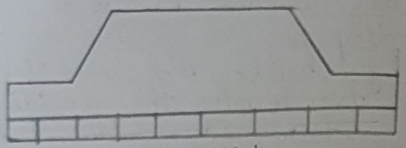
(a) Hand Rammer: made of wood / metal
- it is small & it's one end carries a wedge-type construction called peen.
- other end has a solid cylindrical shape known as butt.

(b) Peen Rammer: It has a wedge-shaped construction formed at the bottom of metallic rod.
- used in packing the moulding sand in pockets & corners.

Teacher's Signature:



Sprue Pin



Strike-off bar

Mallet

EXPT. NO. NAME

Page No.: 54 YOUVA

Date:

(c) Floor Rammer: It consists of a long steel bar carrying a peen at one end & a flat portion on the other.
- Heavier & larger.
- It's specific use is in floor moulding for ramming the sand for larger moulds.

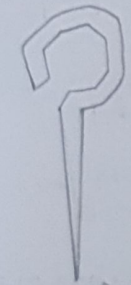
(d) Pneumatic Rammer: They save considerable time & labour and are used for making large moulds.

(4) Sprue Pin: Tapered rod of wood / iron placed or pushed in cope to join mold cavity while the molding sand in the cope is being rammered.
- Helps to make a passage for pouring molten metal in mold through gating system.

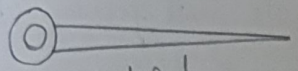
(5) Strike-off bar: It is a flat bar having straight edge & is made of wood or iron.
- used to strike off or remove the excess sand from the top of a molding box after completion of ramming, thereby, making it's surface plane & smooth.

(6) Mallet: It is similar to a wooden hammer & is generally used in carpentry or sheet metal shops.
- used for driving the draw spike into the pattern & then rapping it for seperation from the mould surfaces so that pattern can

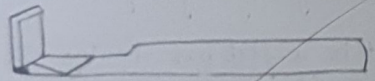
Teacher's Signature:



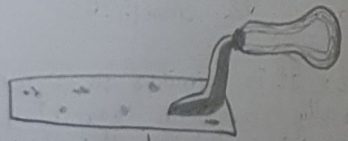
Draw Spike



Vent Rod



Lifter



Trowel

EXPT. NO. NAME

Page No.: 55 YOUVA

Date:

be easily withdrawn leaving the mould cavity without damaging the mold surfaces.

(7) Draw Spike: It is tapered steel rod having a loop or ring at it's one end & a sharp point at the other.
- used for driven into pattern which is embedded in the molding sand & raps the pattern to get seperated from the pattern & finally draws out it from the mold cavity.

(8) Vent Rod: It is a thin spiked steel rod or wire carrying a pointed edge at one end & a wooden handle or a bent loop at the other.

(9) Lifters:- Also known as cleaners or finishing tool.
- made of thin sections of steel of various length & width with one end bent at right angle.
- used for cleaning, repairing & finishing the bottom & sides of deep & narrow openings in mold cavity.

(10) Trowels: Utilized for finishing flat surfaces & joints & partings lines of the mold.
- consist of a metal blade of iron & are equipped with a wooden handle.

Teacher's Signature:

(11) Slicks: Also recognised as small double-ended mold finishing tool which are generally used for repairing & finishing the mold surfaces & thin edges after removal of pattern.

(12) Swab: Small hemp fibre brush used for moistening edges of sand mould, which are in contact with pattern surface before withdrawing the pattern. It is used for sweeping away the molding sand from the mold surface & pattern.

(13) Spirit level: It is used by molder to check whether the sand bed or molding box is horizontal or not.

(14) Gate Cutter: Small-shaped piece of sheet metal commonly used to cut runners & feeding gates for connecting sprue hole with mold cavity.

(15) Gaggers: pieces of wires or rods bent at one end or both which are used for reinforcing.

(16) Flasks: Also known as containers -

(i) Moulding Boxes: also known as moulding flasks. Boxes used in sand moulding are of two types:→

(a) Open moulding boxes → made with the hinge at one corner & a lock on the opposite corner.

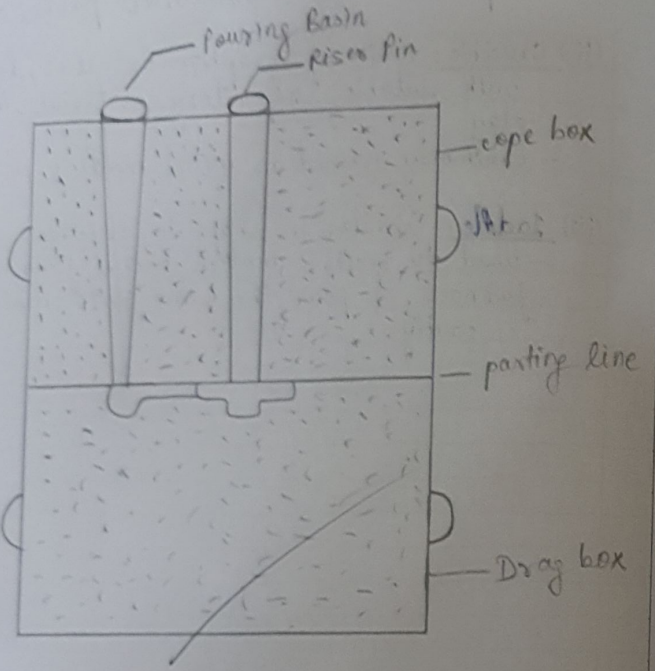
Teacher's Signature:

(b) Closed moulding boxes → The lower part is called drag, the upper part is called the cope & all intermediate parts, checks.

(ii) Crucible: made of graphite or steel shell lined with suitable refractory material like fire clay.
- commonly named as metal melting pots.

(iii) Ladle: similar in shape to crucible.
- used to receive molten metal from melting furnace & pour the same into mold cavity.

19/04/23



EXPT. NO.
NAME
Page No.: 58
Date:
YOUVA

Exercise - 1

Aim: To prepare a mould of given pattern.

Tools Required: Pattern, Sprue Pin, Riser pin, Sand molding box, Trowel, Strike-off bar.

Operation:

(1) The pattern is fixed inside the molding box.
(2) Sand poured inside the box until it completely fills, striker used to remove excess sand.
(3) Sand is poured inside the box with the help of trowel & then rammed with the rammer.
(4) Then using similar steps & sprue pin, another mould is created to fit the top of previous mold created.
(5) Second box helps to pour liquid metal into the pattern molding box easily & evenly.

Result: The given pattern mould is prepared.

19/04/23

Teacher's Signature:

EXPT. NO. NAME

Page No.: 59 YOUVA
Date: 19/4/23

FITTING

Introduction

→ Machine tools are capable of producing work at a faster rate, but, there are occasions when components are processed at the bench. Sometimes, it becomes necessary to replace or repair component which must be fit accurately with another component on reassembly. This involves a certain amount of hand fitting. The assembly of machine tools, jigs, gauges, etc., involves certain amount of bench work. The accuracy of work done depends upon the experience & skill of the fitter.

→ The term 'bench work' refers to the production of components by hand on the bench, whereas fitting deals with the assembly of mating parts, through removal of metal, to obtain the required fit.

→ Both the bench work & fitting requires the use of number of simple hand tools & considerable manual efforts. The operations in the above works consist of filing, chipping, scrapping, sawing, drilling & tapping.

Teacher's Signature:

Scope of fitting:→

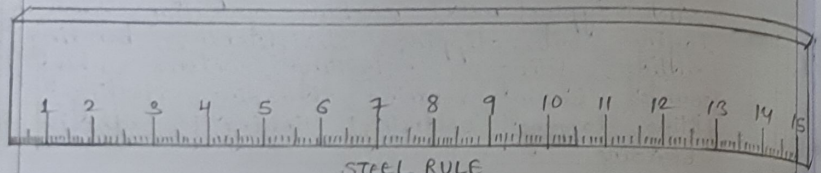
Today mechanical engineering cannot do anything without fitting operation. Any machine, mechanism of instrument requires the fitter for it's assembly & adjustment.

→ Fitting practice covers a great range of jobs including assembling, repairing, tool making & instrument setting. etc. Despite the various specialities, all fitters must be proficient in such typical metal working operations such as laying out, clipping, straightening, bending, cutting, filing, drilling, contour sinking, counter boring, reaming, threading, riveting, fitting, lapping, soldering, tinning & adhesive bonding.

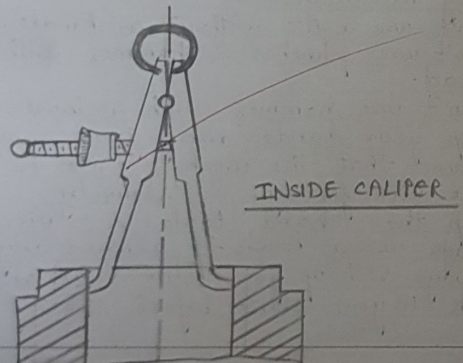
★ Safety Precautions:→

1) Don't use a file without a handle.
2) Don't use punches & hammer with mushroom head.
3) Don't use hammer with a loose head.
4) Keep your hands away from moving parts.
5) Ensure that the work piece is clamped in the vice firmly & securely.
6) Keep the hand tools & vice clean.
7) Always use a brush to remove any chips.
8) Always roll up your sleeves (or) wear short sleeves.
9) Tuck in your shirts before starting any operation.

Teacher's Signature:



STEEL RULE



INSIDE CALIPER

EXPT. NO. NAME

Page No. 61 YOUVA

Date:

10) Remove wristwatches, rings, bracelets, bangles, etc., since they can lead to injuries.

11) Always wear safety shoes.

Tools:→

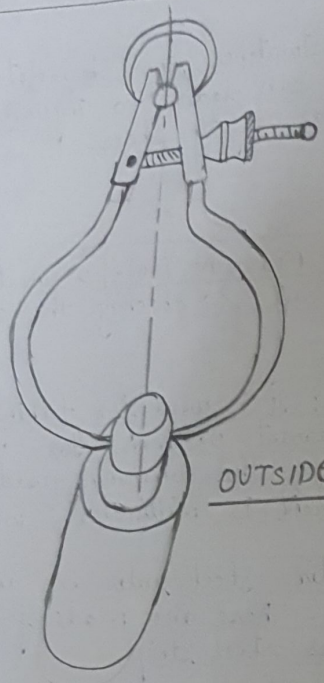
(A) Marking & Measuring Tools:→ used for setting or marking out & checking the work at various stages.

(1) Steel Rule: It is used for taking linear measurements to the nearest 0.5mm. For layout work in engineering the commonly used unit of measurement is millimeter, which is $\frac{1}{1000}$ part of a meter. Steel rules are available in different lengths. There are made from spring steel(or) stainless steel strip.

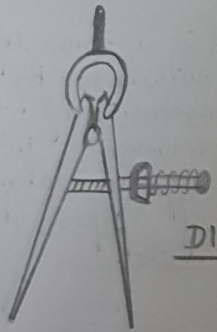
(2) Calipers:

- Inside caliper:→ It is a two-legged instrument with it's legs bent outwards. By adjusting the screw, the movement of the legs is controlled. It is used to measure internal diameters, width of slots, keyways, channels & other inner measurements of pipes, holes, bores, grooves, measuring gaps, etc.

Teacher's Signature:



OUTSIDE CALIPER



DIVIDER

EXPT. NO. NAME

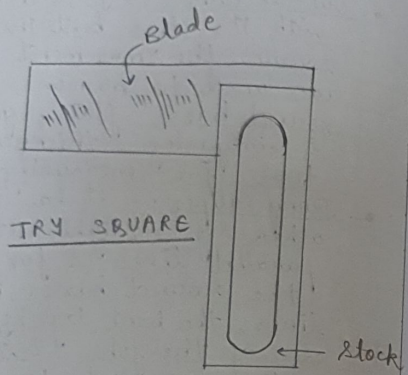
Page No.: 62 Date: YOUVA

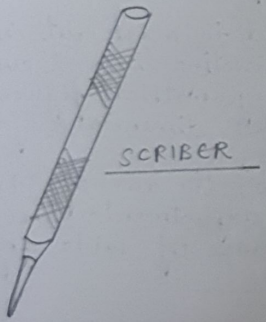
- Outside caliper :→ It is a two-~~way~~ legged instrument with it's legs bent inwards. By adjusting the screw, the movement of legs is controlled. They are used to measure outside dimensions of round bars, flats, grooves & steps for measuring & comparing thickness. This is a very ideal tool for measuring diameter.
- Jenny Caliper :→ It has one leg bent inside & the other leg straight. It is used for marking parallel lines & for finding out the center of the round bars. For marking the parallel lines, the bent leg is moved along the straight edge of the job & the caliper is moved, the line parallel to the edge is drawn with the straight leg. It is also named as Morphy caliper & Hermophrodite.

(3) Dividers: They are used to mark out circles, arcs, perpendicular lines, bisecting lines & curvilinear lines & for plotting geometrical figures. They are also used to transfer dimensions from steel rule to work pieces.

For longer sizes, the use of "trammel" is preferred as exact adjustments are difficult with dividers because of wide angle b/w the legs.

Teacher's Signature:





EXPT. NO. NAME

Page No.: 63 YOUVA

Date:

(4) Surface Plates: Jobs are mounted on the surface plates for marking & measuring precision jobs especially pre-machined jobs. The surface plate & marking plate have similar shapes. The difference lies in the accuracy of flat surface. The surface plates are more precise than marking plates.

(5) Surface Gauge: This is the main tool for 3-D layout. This is used along with the marking plate to scribe vertical, horizontal & parallel lines, locate the center of round bars, setting jobs on the table for machining, checking the height & position of work pieces setup on surface plates.

(6) Try Square: It is a fine precision tool having three right-angular edges. It is usually employed to check the flatness of a surface or squareness of adjacent edges. It is often used for marking parallel lines, setting jobs, etc.

(7) Scribers: They look like pencil of 3-4 mm diameter & 200 mm long. These scribers are used for marking lines on work surfaces with reference to edge of any tool template, steel rules or squares. One end of the scriber is pointed to

Teacher's Signature:

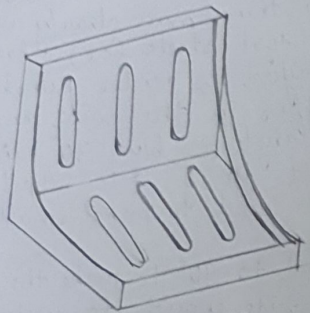
15° and the other is bent. They come in 3 main varieties such as single point, double point & removable point types.

(8) Punchers: These are sharply pointed tools used for marking indentation on the scribed lines in order to make them more clearly visible. They are made from tool steels (or) hardened steels. These are classified as center punch & dot punch. Both differ in the point angles. Dot punch point angle is b/w 30° and 60° but when ground to 30°, it is called as prick punch. It is used to make small punch marks on layout.

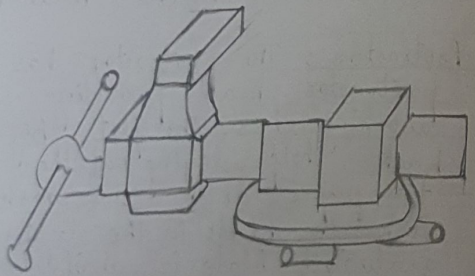
→ Center punch is ground to 90° to make the mouth of the punch mark wide enough to receive the drill point comfortably. They are used to widen the mark made by dot punch.

(9) Protractor: The protractor has a rectangular protractor head providing all four sides as working edges. The flat big surface on the back helps laying out the tool flat up on the paper or the work. The thumbnut locks the blade in the required position. The graduated blade is available to measure the depth of node, groove & cavity.

Teacher's Signature:



ANGLE PLATE



EXPT NO. | NAME | Page No.: 65 | Date: | YOUVA

(10) Vernier Height Gauge: This gauge is designed to scribe vertical distances from plane surfaces like the ordinary height gauge. It is intended for accurate layout work. It consists of a base to which a graduated vertical beam is rigidly secured, a slide with vernier & lock screw, a fine adjustment device, a scriber offset, & a scriber. The scriber is held with a holder on the jaw. The scriber can be sharpened several times & when worn out, can be replaced.

(B) [Holding Devices] →

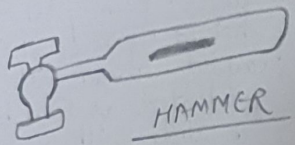
(1) Angle Plate: The angle plate has two plain surfaces at right angles to each other. They are used to hold parts on either the vertical or horizontal surfaces.

(2) Vices: These are the work-holding fixtures for clamping the work in the required position. Different types of vices are used such as leg vices, parallel bench vices & hand vices.

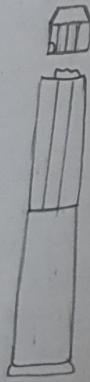
Leg Vice: - simple & very strong
- used for crude & heavy jobs that involve chipping, riveting, bending; etc.

Hand Vice: - used to grip small work pieces for drilling (or) filing when they are inconvenient to hold by hand.

Teacher's Signature:



HAMMER



CHISEL

EXPT. NO. NAME

Page No.: 66 Date: YOUVA

Parallel Bench Vice: used for clamping work in the required position.

(c) Striking Tools →

(1) Hammers: Hammers are made from structural & tool steels; the head is hardened & tempered.

Ball Peen Hammer – This is the most common type of hammer, which has a head with one end as ball-shaped & the other end flat, this flat end is the striking face. The ball portion is used to straighten, soften & expand metal into the desired shape.

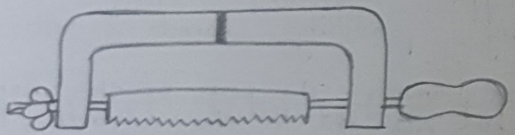
Cross Peen Hammer – These have blunt chisel-shaped ends on the head opposite to the face. This is used for chipping, riveting & sheet metal shapes for bending, providing channels & collars; swaging, etc.

Straight Peen Hammer – The peen of this hammer is flat but straight to the handle. This is used for bending channels, working on corners; etc.

(D) Cutting / Chipping Tools →

(1) Flat Chisel: The common form of chisel is flat or cold chisel. It is so called because it is used to wet cold metal. In this, the cutting edge is convex to avoid the damage to the corners while in use. This reduces the possibility of the corners breaking off. The cutting edge is ground

Teacher's Signature:



HACK SAW

EXPT. NO. NAME

Page No.: 67 Date: YOUVA

to an angle of 60° & the edge width varies from 20 - 30 mm. Only the edge is hardened. The head is left soft so that hammer faces are NOT damaged.

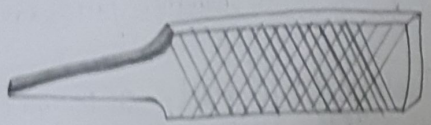
Cross-cut chisel / Cape chisel - It is used for cutting grooves in large surfaces previous to using the flat chisel, & is also used in cutting key ways in wheels & shafts. The cutting edge is slightly wider than supporting metal to provide clearance.

Half-Round chisel - It is used for cutting oil ways, grooves in bearings, bosses & pulleys, forming flutes, bringing drill holes in the correct position when set out inaccurately. They are also used for setting over pilot holes. The shank is reduced to a half round taper, which is beveled at the end to give a circular edge.

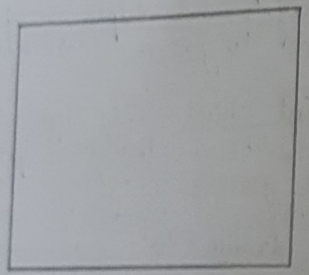
Diamond Point chisel - This type of chisel has cutting edge like a diamond point. It is used for cutting Vee-grooves, marking sharp corners, cleaning corners & squaring small holes. The chisel is drawn to a square section.

(2) Hack Saw: Hack sawing is a process of removing small chips of materials by series of small teeth. It is used for cutting thick metal sheets,

Teacher's Signature:



FILER



Given Piece

round bar of bar stock of round & other sections & also to cut slots, etc.

(c) Finishing Tools :→

(1) Filer: It is a basic tool for giving the work the necessary shape & size. They are used for working flat & curved surfaces, slots, grooves, holes of various types.

(2) Drill: Drilling is applied for holes of low grade accuracy & surface finish.

Exercise - 1

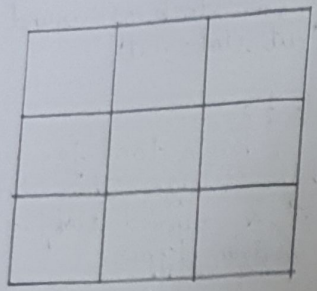
Aim: To make a step profile from the given work piece.

Supplied Material: Mild steel plate of dimensions 48mm × 48mm with thickness 6mm.

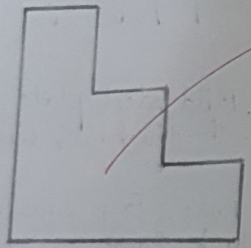
Tools Reqd: Steel Rule, Try Square, Calliper, Dot punch, Filer, Hack Saw.

Sequence Operations: Preparation, Marking, cutting, filing, finishing.

Teacher's Signature:



Marked Piece



FINAL PIECE

EXPT. NO. NAME

Page No.: 69 YOUVA

Date:

Working Steps:

(I) Preparing:- (i) check initial dimension
(ii) Fix the job on a vice & file
(iii) check for perpendicularity with a try squre.

(II) Marking:- (i) Measure the given dimension using jenny caliper.
(ii) Draw lines along dimensions of work piece.
(iii) Make dots along these lines using dot punch.

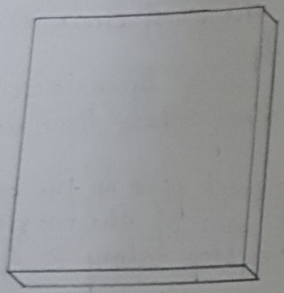
(III) Cutting:- (i) Fix the work piece on the bench-vice.
(ii) Cut with saw of the marked dimensions.
(iii) Repeat the step along 3 & 4.

(IV) Filing:- (i) Using flat rough file, remove the excess metal.
(ii) Remove the work piece from file & turn 90° & repeat the process.

(V) Finishing:- (i) Using a smooth flat file, produce smooth surface.
(ii) Finally check accuracy of the finished work piece.

Result: The required step form with proper dimensions is obtained on the work piece.

Teacher's Signature:



given Piece

EXPT. NO. NAME

Page No. 70 YOUVA

Date: 25/9/23

Exercise-2

Aim: To make threading & drilling in the workpiece

Tools Reqd: Bench Vice, Sensitive Drilling Machine, Taps, Filer

Sequence of Operations:

1) Preparation 2) Drilling 3) Threading 4) Finishing

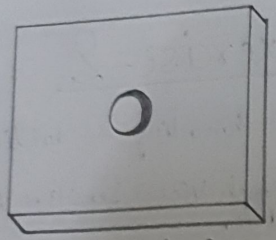
Procedure:

1) Preparation: (a) Carefully place the step profile with work piece on the drilling machine
(b) Keep a sprayer.

2) Drilling: (a) Turn on machine & drill.
(b) Spray water on the piece while drilling.
(c) Repeat above steps until the bottom of piece is reached.

3) Threading: (a) Firstly use taper tap carefully & rotate the bar 1/4 only.
(b) File the work piece & remove unwanted material.
(c) After that repeat the same process with intermediate & plug tap.

Teacher's Signature:



Finished Piece

EXPT. NO. | NAME | Page No.: 71 | Date: | YOUVA

4) Finishing: File the work piece & remove the unnecessary material.

Result: The required piece with taper & proper dimensions is obtained on the work piece.

Teacher's Signature:

EXPT. NO. NAME

M T W T F S S
Page No.: 72
Date: 26/4/23
YOUVA

PLUMBING

Introduction

→ Plumbing is a utility consisting of pipes & fixtures for the distribution of water or gas in a building & for the disposal of sewage.

→ It refers to installation of pipelines, water tanks & other pipe fittings to distribute water in a building. The plumbing water supply system comprises of pipes, valves, storage tanks, etc; and plumbing drainage system consist of wash basins, water closets, urinals, septic tanks; etc.

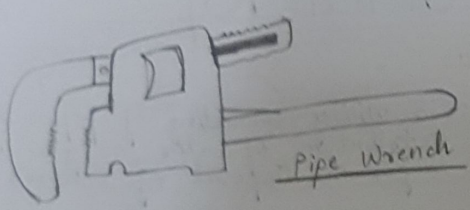
→ The plumbing industry is a basic & substantial part of every developed economy due to the need of clean water & proper collection & transport of wastes.

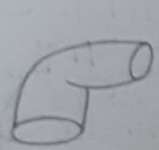
→ PVC (Poly Vinyl Chloride) pipe and GI (Galvanized Iron) pipes are commonly used in plumbing.

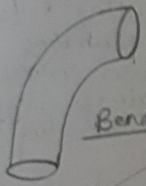
★ Safety Precautions:

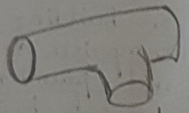
1) Wear shoes while working in the shop.
2) Use right tool for the job.
3) Keep cutting & measuring tools seperately.
4) Don't walk on wet floor.

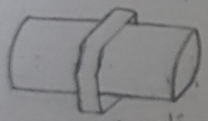
Teacher's Signature:











EXPT. NO. | NAME

Page No.: 73 | Date: | YOUVA

Tools :→

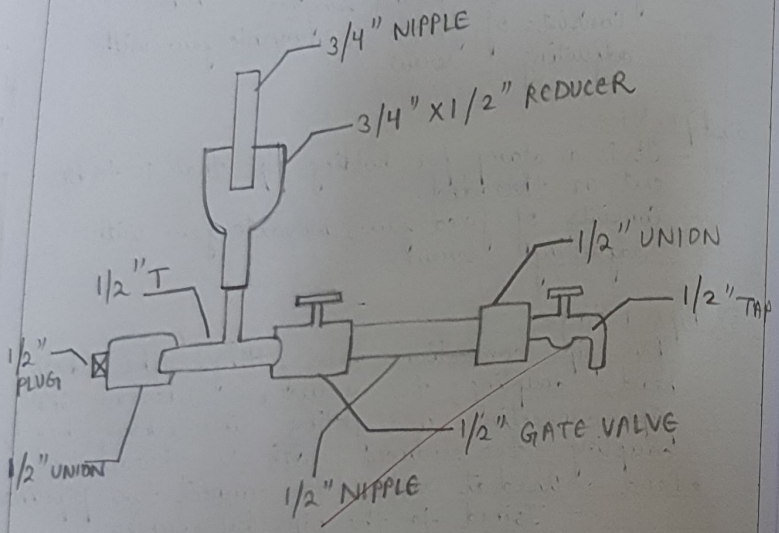
1) **Pipe Wrench:**
   - Used to hold & tight soft iron pipes & fittings with round surface.
   - Consists of fixed & movable jaw with adjusting screw.

2) **Pipe Vice:**
   - It is a clamp for holding pipe that is to be cut or threaded.
   - Consists of fixed jaw, movable jaw with adjusting screw.

3) **Pipe Fittings:**
   PVC pipe connections uses fittings like elbow, bend, coupling, tee reducer. whereas GI pipe connections use fitting like elbow bend, coupling, tee reducer with V-thread.

- **Bend →** - Used at corners to connect two pipelines.
  - Joined to the pipe by couplers.
  - Advantage- Water pressure is NOT dropped.
- **Elbow →** - Looks like elbow of human.
  - Used to connect two pipes at right angle.
  - Elbow's outside diameter is similar to coupler.

Teacher's Signature:



EXPT. NO. | NAME | Page No.: 74 | Date: | YOUVA

- Tee Joint → Used to connect branch line from main pipeline.
- Coupling → Used to join two pipes in a straight direction.

Exercise - 1

Aim: To thread the given pipe of kitchen & bathroom setup.

Tools Reqd: Pipes, bend, elbow, T-joint, wrench, GI pipe, pipe wrench, pipe vice, threading kit, hack saw.

Procedure:

(1) The given pipe is fixed into the pipe vice & then with the help of threading kit, threads are made on the pipe.

(2) Then the threaded part on the pipe is cut from the pipe using a hacksaw.

★ Bathroom setup:

1) First a tap is selected.
2) Then an elbow is attached on the tap.
3) The 3/4th pipe is selected & then given setup is arranged using bend & joint.

For bathroom fitting, GI pipes have used.

Teacher's Signature:

EXPT. NO. | NAME | Page No. 75 | Date: | M T W T F S S | YOUVA

★ Kitchen Setup:

1) According to the diagram, the pipes are arranged with the help of joint & unions, i.e. the joint, union, etc.
2) For kitchen fitting, PVC pipes are used.

Result: The given pipe is threaded & given setup is made.