MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
Accredited by NBA and NAAC with 'A' Grade & Recognized Under Section2(f) & 12(B)of the UGC act,1956

ENGINEERING WORKSHOP LAB MANUAL

B. Tech – I YEAR

Department of Mechanical Engineering

CONTENT

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PREFACE

This book entitled "**Engineering Workshop Lab**" is intended for the use of First B.Tech (all branches) students of **Marri Laxman Reddy Institute of Technology and Management**, Dundigal, Hyderabad. The main objective of the Engineering Workshop Lab Manual is to furnish the conceptual understanding of the basic principles of instruments involved in engineering applications, before the students carry out laboratory experiments. This book lays foundation of certain basic concepts and skills that can be repeatedly employed by the students in their future endeavors. The main aim of this book is to develop the habit of scientific reasoning and providing answers to all the doubts that arise during the course of conducting experiments. The book was written as per the new syllabus prescribed by the JNTUH University in a simple language. These experiments will help the students to expertise in the analysis and reporting the instruments quality for different applications. Hence we hope this book serve for better understanding by the student community with all details of experiments.

By,
N RAVITEJA,
Assistant Professor,
Department of Mechanical engineering

ACKNOWLEDGEMENT

I express my sincere thanks to **Mr.U. SUDHAKAR sir**, **Head of the Department of Mechanical Engineering**, Marri Laxman Reddy Institute of technology & Management, for his concern towards me and gave me opportunity to prepare Engineering Workshop laboratory manual.

I am deeply indebted and gratefully acknowledge the constant support and valuable patronage of **Dr. R. KOTAIH sir**, **Director**, Marri Laxman Reddy Institute of technology & Management. I am unboundedly grateful to him for timely corrections and scholarly guidance.

I express my hearty thanks to **Dr. K. VENKATESWARA REDDY sir**, **Principal**, Marri Laxman Reddy Institute of technology & Management, for giving me this wonderful opportunity for preparing the EWS laboratory manual.

At last, but not the least I would like to thanks the entire Department faculties those who had inspired and helped me to achieve my goal.

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GENERAL INSTRUCTIONS

- The objective of the laboratory is learning. The experiments are designed to illustrate phenomena in different areas of Workshop and to expose you to uses of instruments. Conduct the job with interest and an attitude of learning.
- You need to come well prepared for the job.
- Work quietly and carefully (the whole purpose of experimentation is to make reliable measurements!) and equally share the work with your partners.
- All presentations of job and diagram should be neatly and carefully done.
- Diagrams should be neatly drawn with pencil. Always display units.
- Come equipped with scales, pencils etc
- Do not fiddle idly with apparatus. Handle instruments with care. Report any breakage to the Instructor. Return all the equipment you have signed out for the purpose of your experiment.

SAFETY PRECAUTIONS

General Guidelines

a. Conduct yourself in a responsible manner at all times in the laboratory.

b. Be ***familiar with your lab experiment before you come to the lab***. Follow all written and verbal instructions carefully. If you do not understand a direction or part of a procedure, ask the lecturer/instructor/technician before proceeding.

c. No student may work in the laboratory alone. The lab instructor/lecturer grant exceptions on a case by case basis.

d. When first entering a laboratory, do not touch any equipment or other materials in the laboratory area until you are instructed to do so.

e. ***Do not eat, drink beverages or chew gum in the laboratory***. Do not use laboratory glassware as containers for food or beverages.

f. ***Smoking is strictly not allowed*** in any indoor area.

g. No music allowed in the laboratory. Radio (including walkman) and other entertainment devices are not permitted.

h. No cellular phone is allowed in this laboratory.

Clothing

1. ***Safety goggles and safety jacket must be worn*** whenever you work in lab.
2. ***Gloves should be worn whenever you use chemicals*** that cause skin irritations or need to handle hot equipment.
3. ***Mask should be worn every time you prepare the chemicals***.
4. ***Safety shoes and hard hat should be worn*** at all times while in the laboratory.
5. Contact lenses should not be worn in the laboratory unless you have permission from your instructor.
6. Dress properly during a laboratory activity.
7. Long hair, dangling jewellery and loose or baggy clothing are a hazard in the laboratory. Long hair must be tied back and dangling jewellery and loose or baggy clothing must be secured.
8. Sandal, open-toed shoes, high heels or shoes with holes in the sols will not be worn in the lab.
9. Shorts and skirts are not permitted.

INSTITUTION VISION AND MISSION

VISION

To establish as an ideal academic institution in the service of the nation, the world and the humanity by graduating talented engineers to be ethically strong, globally competent by conducting high quality research, developing breakthrough technologies, and disseminating and preserving technical knowledge.

OUR MISSION

To fulfill the promised vision through the following strategic characteristics and aspirations:

1. Contemporary and rigorous educational experiences that develop the engineers and managers.
2. An atmosphere that facilitates personal commitment to the educational success of students in an environment that values diversity and community.
3. Undergraduate programs that integrate global awareness, communication skills and team building.
4. Education and training that prepares students for interdisciplinary engineering research and advanced problem-solving abilities.

DEPARTMENT VISSION, MISSION, PROGRAMME EDUCATIONAL OBJECTIVES AND SPECIFIC OUTCOMES

Vision Statement:

"The H&S Department strives for immense success in the field of **education, research and development** by nurturing the budding minds of young engineers inventing sets of **new designs and new products** which may be **envisaged as the modalities** to bring about a **green future for humanity**"

Mission Statement:

i) Equipping the students with manifold technical knowledge to make them efficient and independent thinkers and designers in national and international arena.

ii) Encouraging students and faculties to be creative and to develop analytical abilities and efficiency in applying theories into practice, to develop and disseminate new knowledge.

iii) Pursuing collaborative work in research and development organizations, industrial enterprises, Research and academic institutions of national and international, to introduce new knowledge and

methods in engineering teaching and research in order to orient young minds towards industrial development.

Course Objectives:

1. To Study of different hand operated power tools, uses and their demonstration.
2. To gain a good basic working knowledge required for the production of various engineering products.
3. To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
4. To develop a right attitude, team working, precision and safety at work place.
5. It explains the construction, function, use and application of different working tools, equipment and machines.
6. To study commonly used carpentry joints.
7. To have practical exposure to various welding and joining processes.
8. Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

Programme Outcomes: At the end of the course, the student will be able to:

1. Study and practice on machine tools and their operations

2. Practice on manufacturing of components using workshop trades including pluming, fitting, carpentry, foundry, house wiring and welding.

3. Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.

4. Apply basic electrical engineering knowledge for house wiring practice.

INTRODUCTION

Workshop practice imparts basic knowledge of various tools and their uses in different sections of manufacturing such as Fitting, Tin Smithy, House Wiring, Carpentry etc. It is true that engineers are not going to become carpenters or blacksmiths or skilled workers on the shop floor, but by exposing themselves to all working trades, they get a bird eye view of the basic practical activities associated with all sections of manufacturing. It helps them, when they occupy managerial positions, in understanding the activities and practical difficulties, so that they can take appropriate decisions.

Even when large amount of mechanical equipment is available for producing or repairing parts, there are still some elements of work which have to be performed by manual methods. However, it must be borne in mind that all workshops and work areas are places of some risk. A healthy regard for rules and respect for all equipment being used reduces the risk of an accident considerably.

Finally, the engineers must also be familiar with the first aid practices. In case some minor injuries in the form of cuts, burns, fractures, fainting, electric shock etc occur in the shop floor, they should know how to give first aid to the victims.

1. CARPENTRY

INTRODUCTION:

Carpentry deals with the processing of wood to obtain desired shapes and sizes. The process dealing with the technique of making wooden pattern is called pattern making.

Wood obtained from tree is the chief product of forest. It has been universally acceptable as raw material for manufacturing wooden products or appliances. From the pre-historic times, wood has been utilized an important source of getting heat by firing it. It has been utilized as major construction material for making shelter for the basic need of human being. As the civilization advanced, it gained tremendous importance as special material for boatbuilding, for piling to support docks and railroad tracks. But in modern times, with the advance of wood chemistry, the uses of wood have recognized its importance in manufacturing cheap useful products used in day today life such as paper, furniture, textiles, plastics and hundreds of chemicals and extractives. The wooden products as plywood have superseded in some products in comparison metallic and ceramic materials. Compressed wood has also replaced some metals for gears and die casts. In war-time, in Europe, wood has been used as a source of wood gas for propelling automobiles. Similarly clothing has-been made from wood cotton and wood wool. The useful work on wood is being generally carried out in a most common shop known as carpentry shop. The work performed in carpentry shops comprises of cutting, shaping and fastening wood and other materials together to produce the products of woods. Therefore, carpentry shop deals with the timber, various types of tools and the art of joinery. In wood, there are two types of cells namely radiating outward from the center of wood cross-section and running parallel to the length of wood. Trees are generally classified into exogenous and endogenous types according to manner of growth.

CLASSIFICATION OF CARPENTRY TOOLS:

1. Marking and Measuring Tools
2. Cutting and planning tools
3. Drilling and boring tools
4. Striking tools
5. Holding tools

1. MARKING AND MEASURING TOOLS:

Steel rule, marking knife, Steel tape, marking gauge, Folding rule, Mortise gauge, Try square, Wing compass, Bevel square, Divider, Meter square, Trammel.

fig:Steel Rule

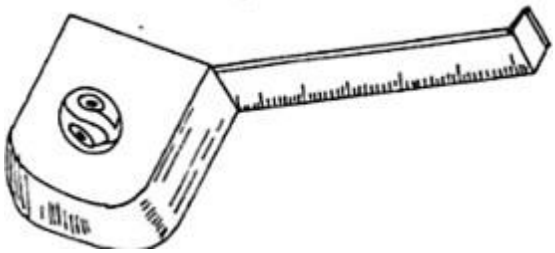

fig:Steel Tape

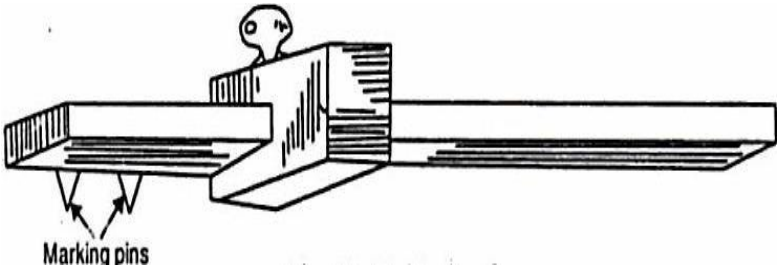

Fig: Mortise gauge

fig:Marking Knife

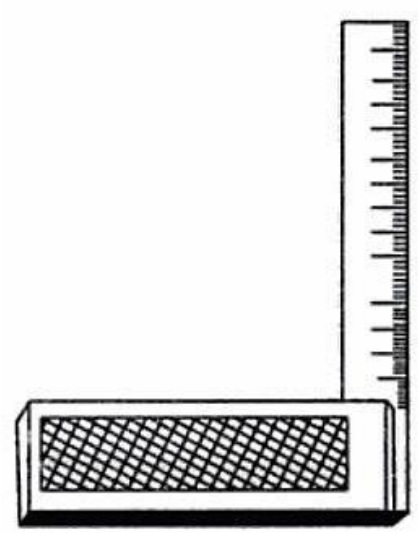

Fig:Try Square

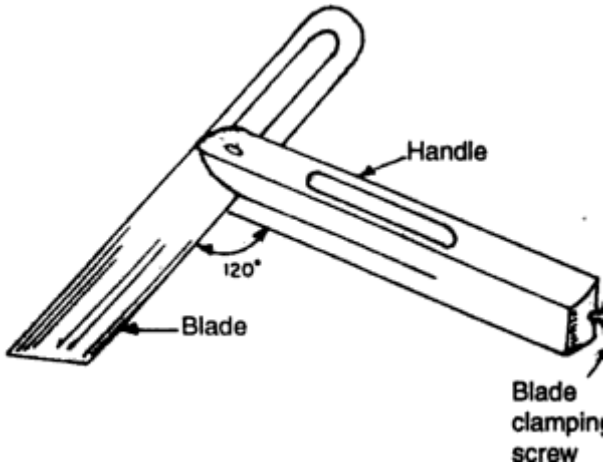

Fig.Bevel Square

2. CUTTING AND PLANNING TOOLS:

i) **SAWS:** Cross cut saw (Hand saw), Rip saw, Tenon saw.

ii) **CHISELS:** Firmer chisel, Dovetail chisel, Mortise chisel, outside chisel, inside chisel.

iii) **PLANNING TOOLS:** Wooden jack plane, metal jack plane, Smooth plane.

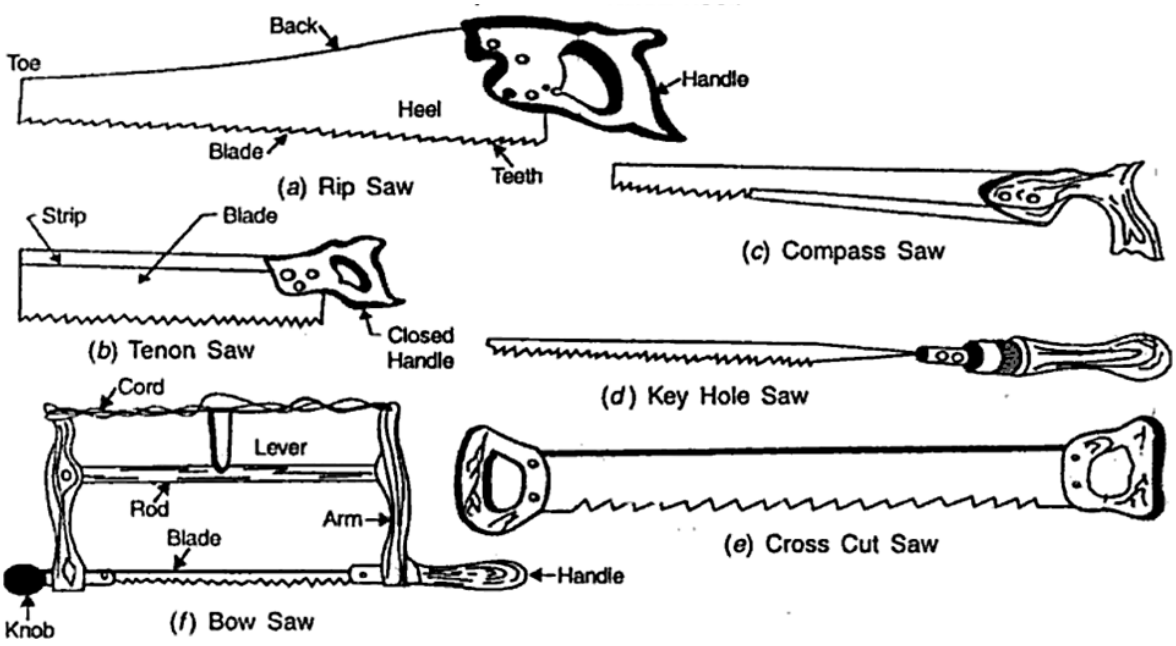

Fig:Saws

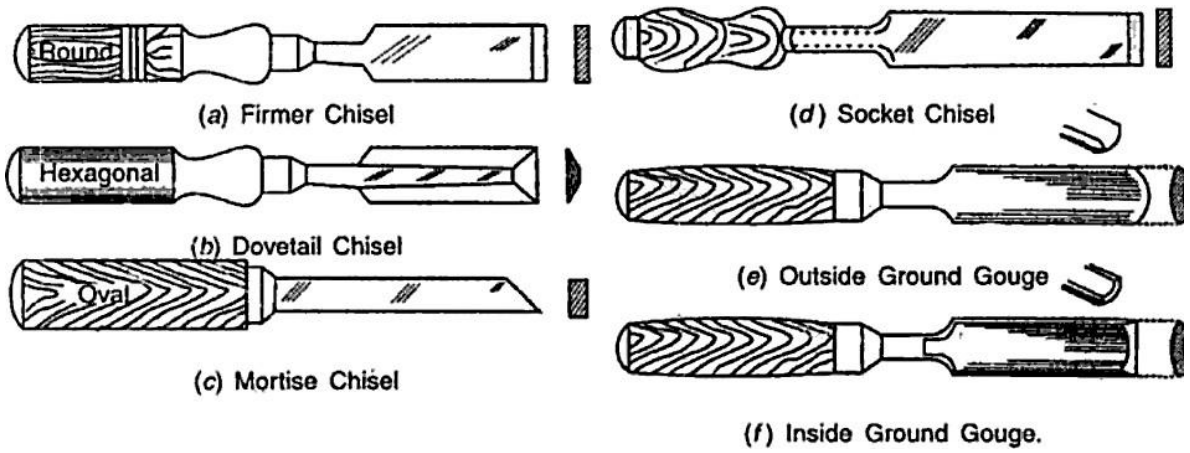

Fig:types of chisels

3. DRILLING AND BORING TOOLS:

Gimlet, Ratchet brace, Hand Drill, Auger

4. STRIKING TOOLS:

Wooden hammer, Claw hammer, Mallet, Straight peen hammer

5. HOLDING TOOLS:

Bench vice, Sash cramp, G-Cramp, C-Cramp

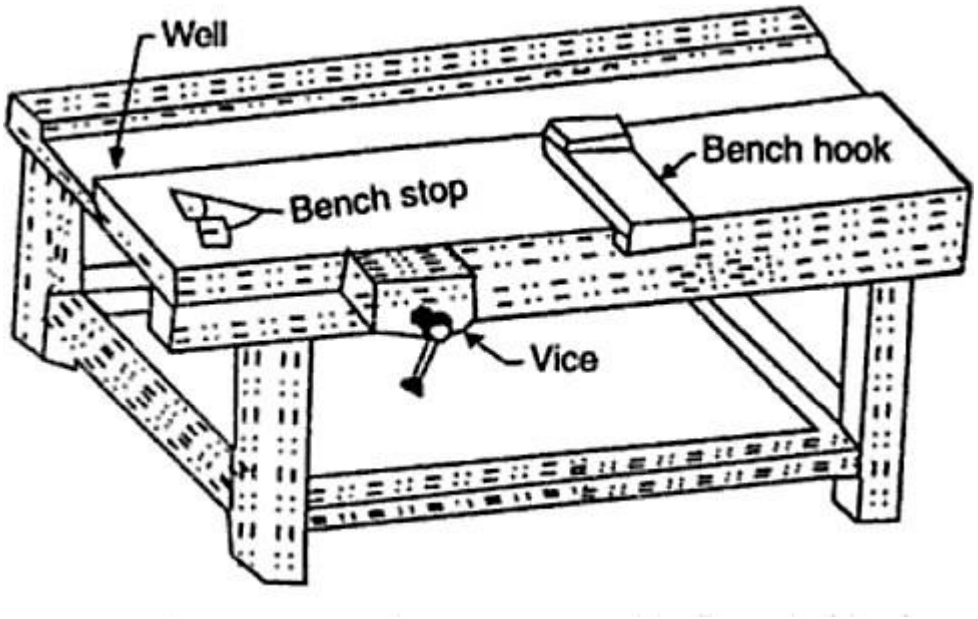

Fig.Work bench

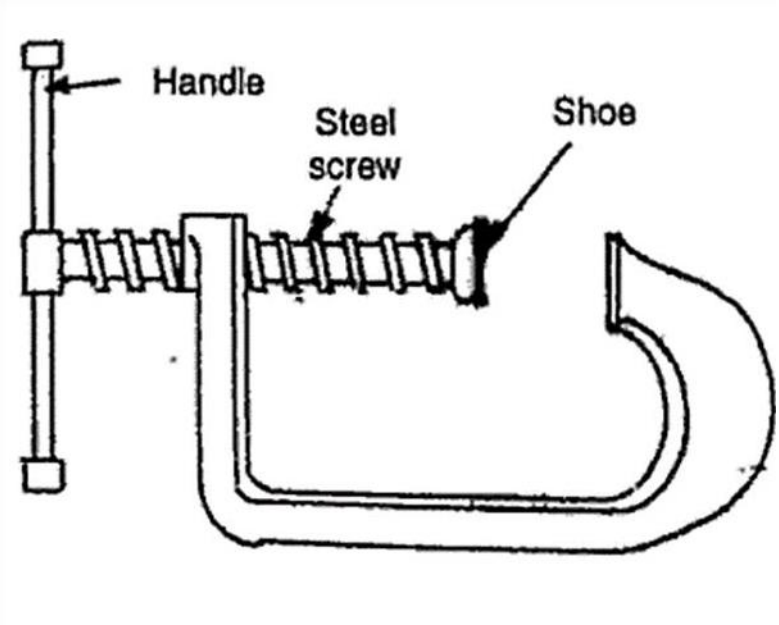

Fig.C-Clamp

6. MISCELLANEOUS TOOLS:

Screw driver, Wood rasp file, Pincer

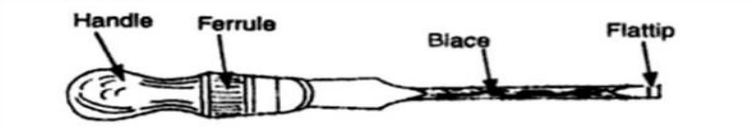

Fig:scew driver

fig:Wood rasp file

1. MARKING AND MEASURING TOOLS:

Marking is one of the most important features of wood work and success of completing job accurately depends on accuracy of marking and measuring.

STEEL RULE: Used for making and measuring linear dimensions. It is specified by its length.

STEEL TAPE: The steel tape is used for measuring longer dimensions. They are available in different sizes, ranging from 0.6 to 2.5 m. It is flexible can be coiled and presses in a case.

FOLDING RULE: Four-fold box wood rule is made of four pieces of each of 15 cm length. They are hinged in such a way that they can be folded. It is adapted to carpentry up to 60 cm length.

TRY SQUARE: The try square is used for testing flatness of surface marking parallel lines and also for marking and testing of right angles. It has a steel blade fitted at right angles in wooden or cast iron stock. It is available in various sizes ranging from 100 to 300 mm.

BEVEL SQUARE: It is used for marking and testing of any angle between 0 degrees to 180 degrees. It has a slotted blade and stock. The blade can be fixed at any position by means of a screw.

MARKING KNIFE: All dimensional lines marked with pencil are cut with marking knife. It has a chisel edge and sharp point at other end. It is made of steel and generally used with a try square.

MARKING GAUGE: The marking gauge is commonly used when absolute accuracy is required. It has a stem with a sharp pin at one end. It is used to cut line along the grains and parallel to an edge.The distance can be adjusted by sliding the stock (head) on a stem. This can be achieved by thumbscrew.

MORTISE GAUGE: It has two sharp pins, one is fixed to the stem and other to a brass slide, which can be secured at any position by a screw. It is used to cut two parallel lines in a single stroke. It is particularly adopted for marking in Mortise and Tenon joints.

Divider: It consists of two pointed legs, the points are hardened and tempered to prevent wear. It is used for transferring the sizes and scribing curves is circles on wooden surface.

TRAMMEL: It is used for drawing very large circles and arcs which are beyond the scope of a compass. It consists of a wooden beam on which the two pins are located and distance between them can be adjusted by means of thumb screws.

2. CUTTING AND PLANNING TOOLS:

Cutting tools are used for cutting timber to approximate size, cutting excess wood to obtain desired shape and accuracy. Planning tools are intended to make smooth and a accurate surface.

CROSS CUT SAW: It is used for cutting the wood across the grains. (Hand saw) Its teeth are pointed. The pitch of the teeth is about 2.5 to 3.0 mm and the blade length is about 600 mm. its teeth have less 'set' than the rip saw.

RIPSAW: It is used for cutting the wood along the grains. Its teeth have chisel edge the pitch of the teeth is about 5 to 8 mm and the length of the blade is about 700 mm. The process of cutting the wood along the grains is called ripping. Because of high flexibility of the blade and a smaller number of cutting points per cm. (i.e., high pitch) it is not suitable for cutting across the grains.

TENON SAW: Tenon saw or back saw is used for cutting small work. It is mostly adapted in joint work. It has a brass or steel back which strengthens the blade, but it restricts the depth of cut. Its fine theeth (6 to 8 teeth/cm) and stiff back permits the smooth, accurate cutting for marking joints. The saw is available in different length ranging from 250 to 400 mm.

3) PLANNING TOOLS:

Planning tools are for reducing to its final and for smoothing the surface.Wooden jack plane: It consists of a wooden body or stock in which blade or cutter is fastened at an angle of 450 to the sole. The plane iron (blade or cutter) and the cap iron (back iron) are assembled and assembly is inserted in the mouth of plane along with the wedge. The back iron supports the cutting edge and also breaks the shaving so that they curl away from the blade. The blade can be set for taking deeper or shallower cuts. The length of the jack plane is about 350 to 425 mm. the blade is made of high carbon steel and has a width of 50 to 75 mm. its cutting edge id tempered and ground to an angle of 25 to 300 and it is slightly curved (convex).

METAL JACK PLANE: Its body is made of gray cast iron, and is provided with a wooden handle at the back and a wooden knob at the front for holding with both the hands. A fine screw is used for adjusting the depth of cut i.e. the thickness of shaving removed, and a lever is used for lateral adjustment of the blade. It is very durable and gives better finish.

CHISELS: Chisels are used for cutting excess wood in shaping and joint making.

FIRMER CHISEL: The firmer chisel is capable of doing heavy work and is used for joining and shaping the wood, with or without mallet. The chisel blade is made of rectangular section with beveled edge, length of the blade is about 125 mm and the width of the edge varies from 3 to 50 mm.

Dovetail chisel: It is similar to firmer chisel but sides are beveled so that it can cut sharp corners. It is used for cutting sockets where the angles is less than a right-angle.

Mortise chisel: These chisels are robust, and can withstand heavy blows. It has a thick stock and narrow cutting edge. It is used for cutting mortises, and its width is ground to exact size of mortise to be cut.

4) STRIKING TOOLS:

Striking tools are used to drive in nails and to operate chisels.

Wooden Hammer: It is mostly used for bench work and light work. It is made of cast steel with tempered face and peen. The wooden handle fits in the eye and steel wedge is driven into from a rigid joint.

Claw hammer: It is a dual-purpose hammer. It has a hammer face which is used to drive in nails, and claw at other end for pulling out nails from the wood. It is designated by its weigh and it varies from 375 to 675 grams.

Mallet: It is used for operating the chisels and gauges. It is made of hard wood and is provided with handle. The striking faces are made flat, and may be round or rectangular in cross-section.

5) DRILLING TOOLS:

These tools are used for drilling and marking holes in wooden jobs.

Gimlet: It is hand operated tool used for making small holes for screw. It has a spiral flutes with screw like point.

Hand drill: It is used for drilling small holes. A straight shank drill is used with this tool. It is small, light in weight. The bit is clamped in the chuck at its end.

Auger: It is used for producing long deep holes. It is a steel bar with an eye at the top in which a handle is fitted. The bottom end s provided with a screw point.

6) WORK HOLDING TOOLS:

The vice and cramp are used to hold work while some operations are carried out.

CARPENTRY BENCH VICE: It is made of gray cast iron or steel, and it has two jaws one of which is fixed to the side of a bench and the other is movable. The faces of jaws are lined with hard wood to prevent damage of work surface. It is used for holding the work for planning sawing and chiseling on the bench.

G or C – CLAMP:

7) MISCELLANEOUS TOOLS:

SCREW DRIVER: These are used for driving the screws on wood or unscrewing them from wood. The size is specified by length of the blade.

PINCER: It is used for pulling out the nails and is more efficient the claw hammer.

WOODRASP FILE AND RASPS:

Files and Rasps are of used for maintaining other wood working tools and equipment. They are made of hardened tool steel which is tempered and they should never be dropped as they are very brittle to break. They are of various types depending upon their size, shape, cuts and degree of their coarseness.

DRILLING MACHINE:

In drilling machine the drill is rotated and fed along its axis of rotation in the stationary workpiece. Different parts of a drilling machine are discussed below:

(i) The head containing electric motor, V-pulleys and V-belt which transmit rotary motion to the drill spindle at a number of speeds.

(ii) Spindle is made up of alloy steel. It rotates as well as moves up and down in a sleeve. A pinion engages a rack fixed onto the sleeve to provide vertical up and down motion of the spindle and hence the drill so that the same can be fed into the work piece or withdrawn from it while drilling. Spindle speed or the drill speed is changed with the help of V-belt and V-step-pulleys. Larger drilling machines are having gear boxes for the said purpose.

(iii) Drill chuck is held at the end of the drill spindle and in turn it holds the drill bit.

(iv) Adjustable work piece table is supported on the column of the drilling machine. It can be moved both vertically and horizontally. Tables are generally having slots so that the vise or the work piece can be securely held on it.

(v) Base table is a heavy casting and it supports the drill press structure. The base supports the column, which in turn, supports the table, head etc.

(vi) Column is a vertical round or box section which rests on the base and supports the head and the table. The round column may have rack teeth cut on it so that the table can be raised or lowered depending upon the workpiece requirements. This machine consists of following parts

1. Base
2. Pillar
3. Main drive
4. Drill spindle
5. Feed handle
6. Work table

EX. NO: 1.1 HALF LAP JOINT DATE:

AIM: To prepare half lap joint as per dimensions.

MATERIAL REQUIRED:

wood 50 mm x 25 mm x 300 mm.

TOOLS REQUIRED:

1. Carpenters vice (6”)
2. Steel rule (12”)
3. Marking gauge (6”)
4. Metal jack plane (45 mm)
5. Firmer chisel (30 mm)
6. Mallet (1 kg)
7. Wood rasp file (100 mm)
8. Try square (9”)
9. Cross cut saw (300 mm)

SEQUENCEING OPERATIONS:

1. Initial measuring
2. Rough planning
3. Smooth planning
4. Marking
5. Cutting
6. Hammering
7. Chiseling
8. Filing
9. Final Finishing

WORKING PROCEDURE:

1. The given wood is checked for dimensions.
2. One side is planed with metal jackplane and checked for trueness by try square.
3. The four sides are also planned.
4. The excess material is cut by cross cut saw.
5. Now the portions for lapping are marked.
6. After sawing remove the waste material by firmer chisel.
7. It the material is still remained in 2 or 3 mm, and then removes by filing with wood rasp file.

SAFETY PRECAUTIONS:

1. Do not keep the tools at the edge of the workbench.
2. Do not keep the plane horizontal in idle mode.
3. Care must be taken while sawing operation.

RESULT:

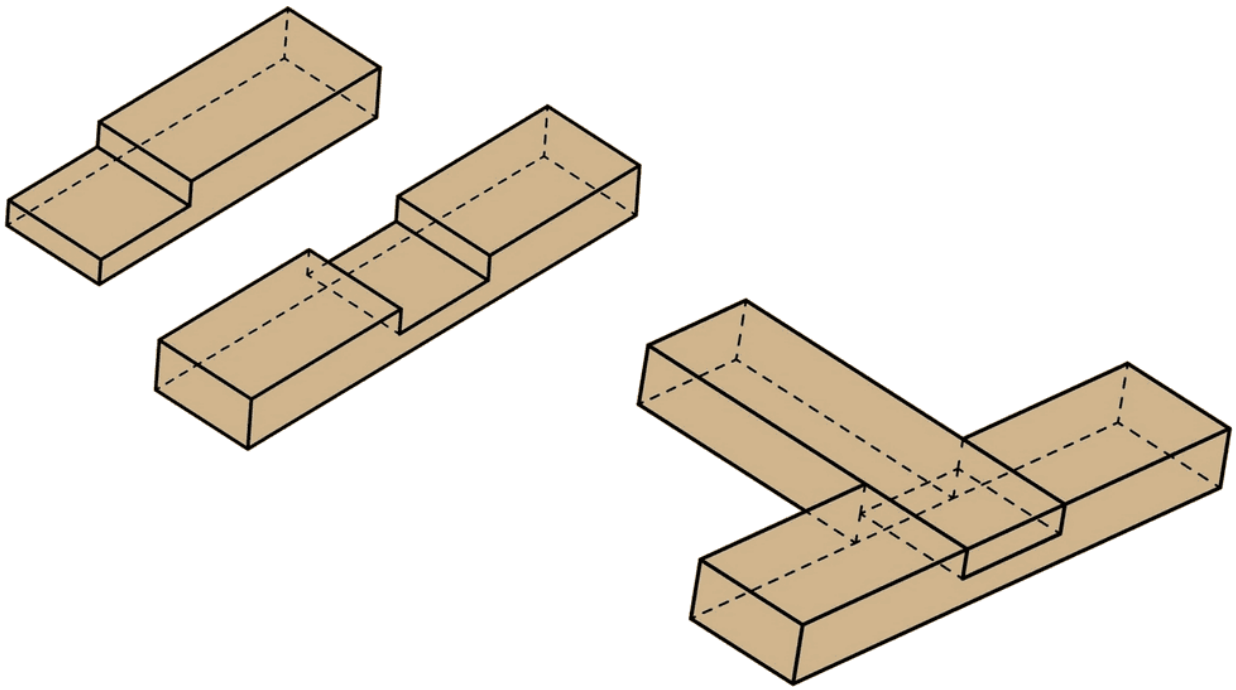

FIG: HALF LAP JOINT

VIVA QUESTIONS

1. What is the importance of workshop?
2. Name the common carpentry tools?
3. What is the use for firmer chisel?
4. What is the use of metal jack plane?
5. What is the use of Rasp file?
6. Name the carpentry process?
7. What are the uses of wood?
8. What is the use of the bench vice?
9. What are the striking tools?
10. Define Carpentry?
11. What is Timber?
12. Name the type of timbers and give examples?
13. What are the types of rules used for measuring?
14. What is the use of Try-square?
15. What are the types of gauges used in carpentry?
16. What is the use of calipers?
17. What is the need of spirit level?
18. What is the chisel Material and types used in carpentry?
19. What are the types of carpentry joints?
20. What is the need of Bench vice?

EX. NO: 1.2 DOVETAIL LAP JOINT DATE:

AIM: To prepare Dovetail lap joint as per dimensions.

MATERIAL REQUIRED:

Wood 50 mm x 50 mm x 300 mm.

TOOLS REQUIRED:

1. Carpenters vice
2. Steel rule
3. Marking gauge
4. Metal-jack plane
5. Firmer chisel
6. Mallet
7. Wood rasp file
8. Try square
9. Cross cut saw

SEQUENCEING OPERATIONS:

1. Initial measuring
2. Edge Preparation
3. Rough planning
4. Smooth planning
5. Marking
6. Cutting
7. Hammering
8. Chiseling
9. Filing
10. Final Finishing

WORKING PROCEDURE:

1. The given wood is checked for dimensions.
2. One side is planed with metal jackplane and checked for trueness by try square
3. The four sides are also planned.
4. The excess material is cut by cross cut saw.
5. Now the portions for lapping are marked.
6. After sawing remove the waste material by firmer chisel.
7. It the material is still remained in 2 or 3 mm, then remove by filing with woo rasp file.

SAFETY PRECAUTIONS:

1. Do not keep the tools at the edge of the workbench.
2. Do not keep the plane horizontal in idle mode.
3. Care must be taken while sawing operation.

RESULT:

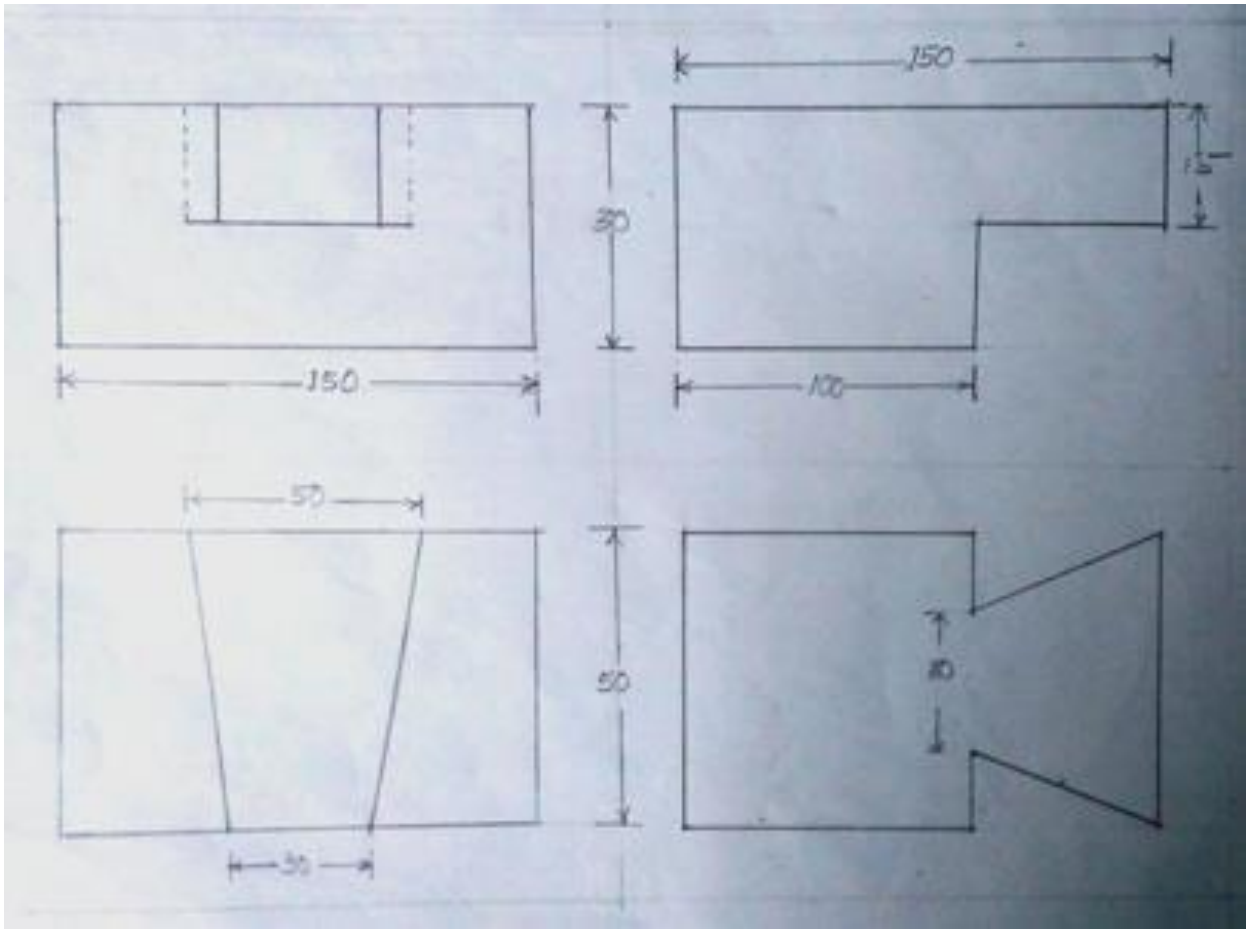

FIG: DOVETAIL LAP JOINT

VIVA QUESTIONS

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16. What is the use of calipers?
17. What is the need of spirit level?
18. What is the chisel Material and types used in carpentry?
19. What are the types of carpentry joints?
20. What is the need of Bench vice?

2.FITTING

INTRODUCTION:

Machine tools are capable of producing work a faster rate, but there are occasions when components are processed at the bench. The term bench work refers to the production of components by hand on the bench, whereas fitting deals with the assembly of matting parts, through removal of metal to obtain the required fit. Both the bench work and fitting operations consists of filling, chipping, sawing, drilling, tapping etc.

CLASSIFICATION OF TOOLS:

The tools commonly used in fitting may be classified as

1. Work holding tools
2. Cutting tools
3. Striking tools
4. Marking and checking tools

1.WORK HOLDING TOOLS:

Bench vice b)Hand vice c)Pipe vice d)Pin vice e)Tool makers vice f)Leg-vice g)C- clamp

BENCH VICE: The bench vice is a work-holding device. It has two jaws one of which is fixed to the bench and other slides with aid of square screw and a box nut arrangement. The outer end of screw carries a handle. The jaws are made with hardened steel and body is cast iron or cast steel. The working faces of jaws are serrated to give additional grip for holding. File is a cutting tool. A file is hardened steel is a hardened steel tool, having slant parallel rows of cutting edges or teeth on its surface on the faces. The one end of the file is shaped to fit into wooden handle. The hand file is parallel in width double cut teeth on the faces, single cut on the one edge and no teeth on the other edge, which is known as “safe edge”.

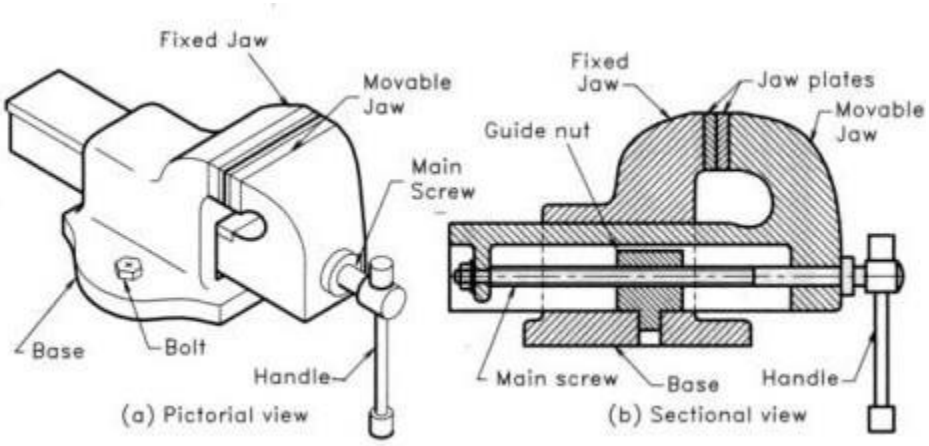


Fig:Bench Vice

TYPES OF FILES

Files are classified according to their shape, cutting teeth and pitch grades of teeth.

Hand file ---------- It is used for filing a surface, at a right angle to an already finished surface.

Flat file ---------- Used for general filing

Square file---------- Used for slots and key ways.

Triangular file ---------- Used for sharp corners

Half round file----- Used for filing concave surfaces and internal corners.

Round file-------- Used for deep hole filing

CUTTING TOOLS

HACK SAW:

1. Solid frame

2. Adjustable frame

The hack saw is used for cutting metal by hand. It consists of a frame. This holds a thin blade, firmly in position. Hack saw blades have a number of teeth ranging 5 to 15 per cm.. The teeth of Hack saw blade are staggered or bended alternatively are known as a set of teeth. These make slots wider than the blade thickness, preventing the blade from jamming. Hack saw blades are classified as

1. All hard files
2. Flexible type

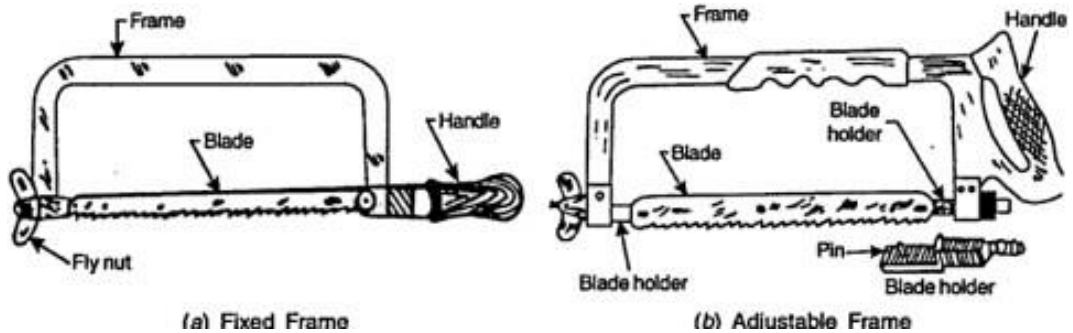


Fig:Hack Saw

DRILLS:

Drills are cutting tools used for making holes. These are usually made of high speed steel tools. Drills are two cutting edges and two helical grooves. The flute (grooves) admits coolants and allows the chips in The shank of twist drill may either straight or taper.

REAMER:
A reamer is used to finishing a drilled hole to accurate size and to produce a good surface finishing. It is made of HSS. They are two types of reamers.

1.Hand Reamer
2.Machine reamers

CHISELS:
Chisel are used for removing extra material from the surface and cutting the sheets.These tools are made up of from 0.9% to 1.0% carbon steel of octagonal or hexagonal. The cutting angle for the chisel for general purpose is about 60 degree. The recommended angles for cutting different materials at cold state.Alluminium-35 degrees Mild steel- 55 degrees Copper and brass- 40-50 degrees Cast iron 60 degrees cast steel 70 degrees.The chisels are specified by width of the cutting edge. The most common used chisels are.

1. Flat chisel
2. Half round Chisel
3. Side chisel
4. Diamond point chisel
5. Cross cut chisel

SCRAPPERS: Scrapers are used for producing finished surface. It removes the surface irregularities at selected spots on a surface hardened. The scrapers are made of tool steel. The cutting edge is but not usually tempered. The most commonly used scrapers are.

1. Flat scraper
2. Triangular scraper
3. Half round scraper.

STRIKING TOOLS:
Hand hammers are striking tools. They are made of medium carbon steel. The various types of hand hammers in common use are ball peen hammer, cross peen hammer, and straight peen hammer.

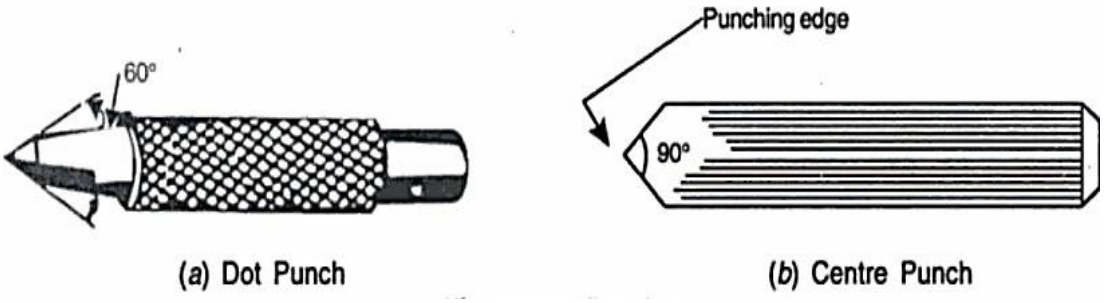
MARKING TOOLS: Marking is a process of layout of sizes on work piece. The following tools are used in marking out operations.

1. Scriber
2. Dividers
3. Jenny calipers
4. Scribing book
5. Angle plate
6. V-block
7. Punch
8. Try square
9. Surface plate.

SCRIBERS: A scriber is slender tool used to scribe or marking lines on metal work piece.

TAP AND TAP WRENCHES: A Tap is hardened steel tool. Used for cutting internal threads in a drilled hole. Hand taps are available in sets containing three taps. Taper tap, second tap and plug or bottom tap.

PUNCH:
Punch is made of tool steel. The various types of punches prick punch, center punch, number punch and letter punch.



(a) Dot Punch (b) Centre Punch

PRICK PUNCH: It is also called as dot punch. Used for marking small dots along the layout lines.

CENTER PUNCH: This is similar to dot punch, except that is point grounded to an angle 90°. It is used for mark the location of holes to be drilled

V-BLOCK:

v-blocks are made of cast iron or hardened steel. They are provided with grooves on the top and bottom, and rectangle slots on two sides for location of
clamps.

TRY SQUARE: It is used for checking the squareness of small works. The size of try square is specified by the length of the blade.

SURFACE PLATE: It is used for provide true surface support to the work during marking is made of cast iron, hardened steel or granite it is specified by length x width x height x grade.

DIVIDER: This is used for making circles, arcs, laying out perpendicular lines, bisecting lines etc

CLENNY CALIPER:

This is also called as odd leg or hermaphrodite caliper used for marking parallel lines from a finished edge and also for locating the center of round bars.

SCRIBING BLOCK: It is also known as universal scribing block. This used for scribing lines for layout work and checking parallel surfaces.

ANGLE PLANE: The angle plate is made of cast iron or hardened steel. They are provided with v-grooves on the top and bottom, and rectangle slots on two sides for location of clamps

VERNIER HEIGHT GUAGE: It is clamped with scriber it is used when it is required to take measurements from the surface on which the guage is standing. The accuracy and working principles of this guage are the same as those of the vernier caliper

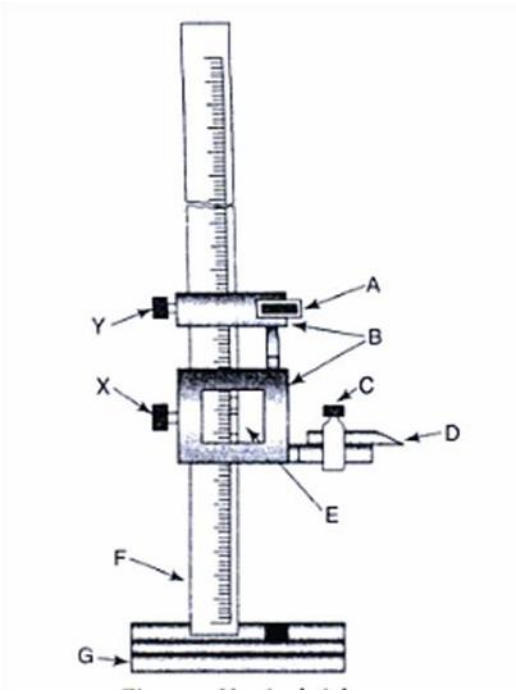


Fig: VERNIER HEIGHT GUAGE

OUTSIDE MICROMETER: It is used for measuring external dimensions accurately of 0.01mm

INSIDE MICROMETER: This is used to measure inside dimensions accuracy of 0.01 mm. It consists of measuring unit, a number of interchangeable extension rods, and a handle.

MEASURING AND CHECKING INSTRUMENT:

Measuring tools may be classified:

1 LINEAR MEASURING INSTRUMENTS

(a) Steel rule (b) caliper (c) depth gauge (d) vernier caliper

(e) Micro meter (f) gauge block (g) dial indicator or dial gauge

2 ANGULAR MEASURING INSTRUMENTS

(a) Bevel protractor (b) Combination set (c) Sine bar

3 SURFACE MEASURING INSTRUMENTS

(a)Spirit level (b) straight edge

STEEL RULE: It is a strip of steel with graduation on its edges

CALIPERS: Used for transferring the dimensions both external and internal. They are made either with firm joint or spring caliper.

OUTSIDE CALIPER: Used for measuring outside dimensions of cylindrical shapes.

INSIDE CALIPER: Used for measure the diameter of holes and width of key ways.

VERNIER CALIPER: They are used for measuring outside as well as inside dimensions accurately. It may be also used as depth guage. Least count = one main scale division – one vernier scale division

COMBINATION SET: It consist of a rule, square head, center head, and a protractor. This may be used for making mitres(45^o) for locating the centre on the end of the round bar.

GUAGES:
Gauges are inspection tools used in production work to control the size and shape of the components.

PEELER GUAGES: These are thin steel blades hardened and grounded to various sizes. These are used to check the clearance between the two mating parts. The blade thickness varies from 0.03 to 1.0mm and the length of the blade is about 100mm.

SCREW PITCH GUAGE: It is used to check the pitch of the screw. The pitch of the screw is directly on the gauge.

WIRE GUAGE: The wire gauge is used to check the diameter of wire from 0.1mm to 10mm

PLATE GUAGE: Plate gauge (standard wire gauge) is used to measure thickness. Each slot is represented by number (SWG NUMBER), as the number increases the thickness decreases. The most common gauge used in sheet metal has 21 slots with gauge numbers ranging from 4 to 24

RADIUS AND FILLET GUAGE: These are used to check the radii of curvature of convex and concave surfaces.

EX. NO:2.1 L-FIT DATE:

AIM: To prepare a L-fit.

MATERIAL REQUIRED: MS FLAT of 50 mm X 50 mm X 5 mm.

TOOLS REQUIRED:

1).150 mm Try square

2).250 gm Ball peen hammers

3) Dot punch

4) Centre punch

5) scriber

6) 15cm Steel rule

7) Odd leg Caliper

8) Vernier height Gauge

9) Chisel

12) 250mm Rough and Smooth square files

13) 6mm rough and Shank square files

14) 3mm Straight Shank Drill Bit.

15) Half round file

16) Divider.

PROCEDURE:

1. The given material is checked for (48X48X2) dimensions.
2. One edge of the given MS Flat is filed to straightness with rough and smooth files and check with try square for flatness.
3. An Adjacent edge is also filed such that it is a square to the first one and checked with try square. Wet chalk is applied on one side of the flat and dried for marking.
4. Marking is done in accordance with the dimensions using vernier height gauge

5. Using dot punch, dots are made along the marking lines.
6. The excess material is cut with hacksaw and then filed to correct size. Care taken to see that the marking dots are not crossed.
7. Finish the mating surfaces with rough file followed by smooth file.
8. Prepare the counterpart in similar way.
9. File the other surfaces also and remove burns and rust.

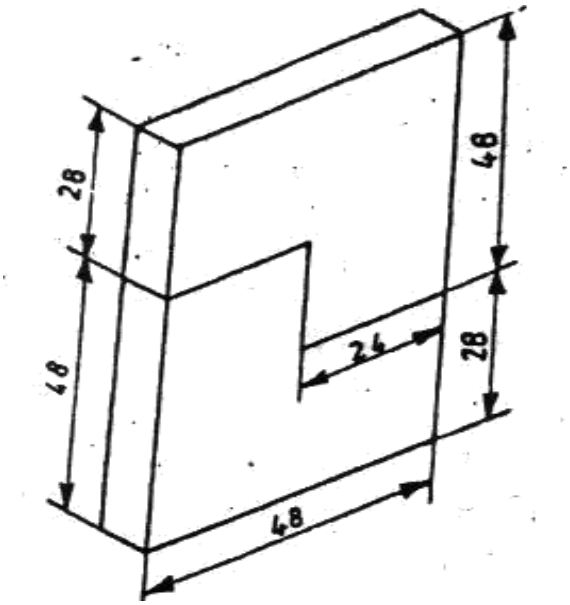
PRECAUTIONS:

Never remove chips with hand, use always a brush to remove chips.

Working tools should not be kept at the edge of the table.

While sawing, secure the work rigidly.

RESULTS:



VIVA QUESTIONS

1. What is meant by fitting?
2. What is the use of vice and give the various types of vice?
3. State the different types of hammers used in fitting work.
4. What is the use of V- block?
5. What are the materials used for files?
6. What are the methods of filing?
7. What is the composition of high speed steel?
8. What is meant by peening or swaging?
9. What are the different types of punches?
10. What is a wrench?
11. What is the material used for making hacksaw blades?
12. When should a blade with 32 teeth per inch be used?
13. What are the causes of breaking of hacksaw blades?
14. How to specify a vice?
15. What are the types of wrenches?
16. What is a torque wrench?
17. Name the material lout of which the vice is made.
18. Name the different types of drills used in fitting shop?
19. How can a tap drill step be determined?
20. What is the length of available steel rule?
21. What is the material used in making taps?
22. What is the use of tap?
23. Name the files which are classified based on longitudinal shape and cross section.

EX. NO:2.2 V- FITTING DATE:

AIM: To prepare a V- FITTING.

MATERIAL REQUIRED: MS FLAT of 80 mm X 40 mm X 5 mm.

Tools required:

1).150 mm Try square 2).250 gm Ball peen hammers 3) Dot punch

4) Centre punch 5) scriber 6) 15cm Steel rule 7) Odd leg Calliper

8) vernier height Gauge 9) Chisel 12)250mm Rough and Smooth square files

13) 6mm rough and Shank square files 14) 3mm Straight Shank Drill Bit.

15) Half round file 16) Divider.

PROCEDURE:

1. The given material is checked for (40X40X5) dimensions.

2. One edge of the given MS Flat is filed to straightness with rough and smooth files and check with try square for flatness.

3. An Adjacent edge is also filed such that it is a square to the first one and checked with try square.

4. Wet chalk is applied on one side of the flat and dried for marking.

5. Marking is done in accordance with the dimensions using vernier height gauge

6. Using dot punch, dots are made along the marking lines.

7. The excess material is cut with hacksaw and then filed to correct size. Care taken to see that the marking dots are not crossed.

8. Finish the mating surfaces with rough file followed by smooth file.

9. Prepare the counterpart in similar way.

10. File the other surfaces also and remove burns and rust.

Precautions:

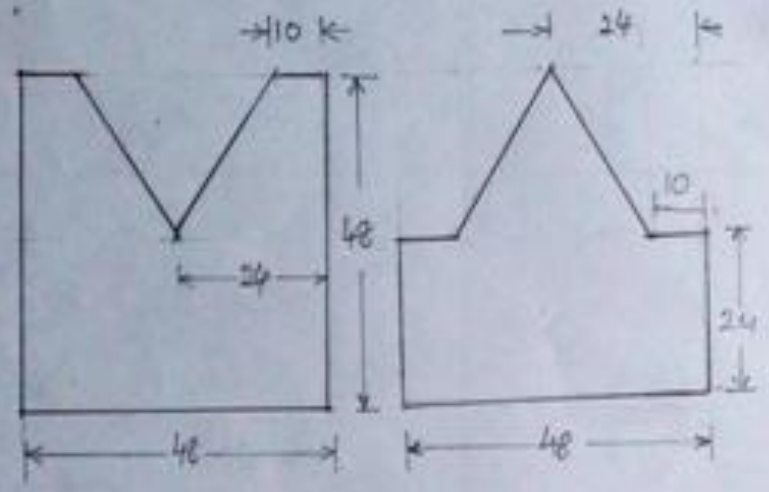
1. Never remove chips with hand, use always a brush to remove chips.

2. Working tools should not be kept at the edge of the table.

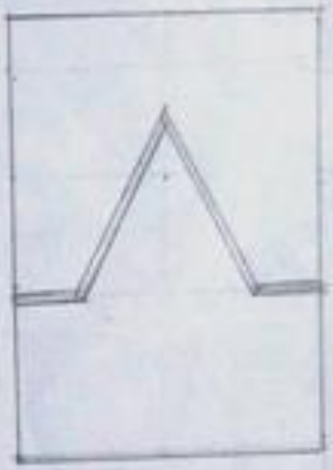
3. While sawing, secure the work rigidly.

RESULTS:

2. 'V' FITTING.



'V' FITTING



NOTE: ALL DIMENSIONS ARE IN mm

VIVA QUESTIONS

1. What is the mechanical meaning of fitting?
2. What is The Use of Try Square?
3. What Is The Name Of Vice Used In Fitting Shop?
4. Name the different files?
5. Which tools are used in fitting shop?
6. What is the use of center punch?
7. Write any five advantages of wood over the other materials?
8. What is bench vice made up of?
9. Should the hardness of work piece be same as that of the file?
10. what is a file?
11. What is meant by fitting?
12. What is the use of vice and give the various types of vice?
13. State the different types of hammers used in fitting work.
14. What is the use of V- block?
15. What are the materials used for files?
16. What are the methods of filing?
17. What is the composition of high speed steel?
18. What is meant by peening or swaging?
19. What are the different types of punches?
20. What is a wrench?
21. What is the material used for making hacksaw blades?

EX. NO:2.3 **HALF ROUND FITTING** **DATE:**

Aim: To make a half round fitting from the given two M.S pieces.

Material: Two MS FLAT of size 50x50x5mm

Tools required:

150mm try-square, 250gm ball-peen hammer, dot punch, scriber, chisel, 300mm hacksaw frame, 18TPI hacksaw blade, 250mm rough and smooth hand files, 6mm rough and smooth square files, Bench vice and steel rule.

Sequence of operations:

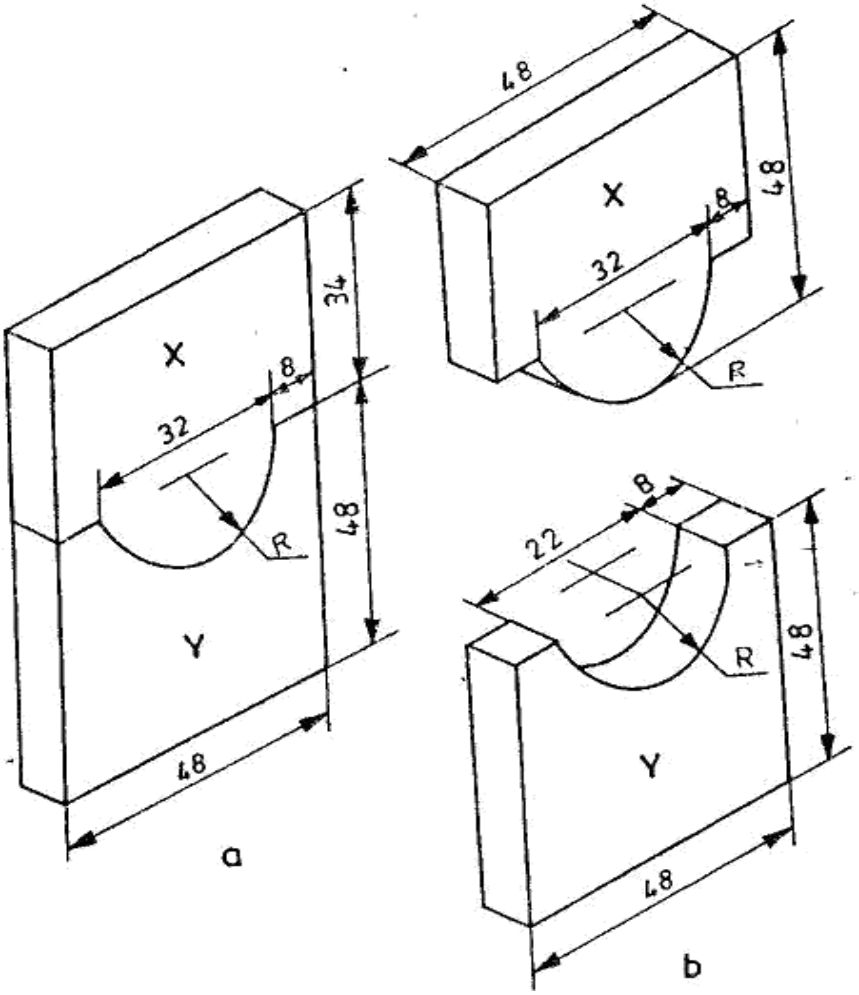
1. The burs in given materials are removed and the dimensions are checked for 50x50x5mm with steel rule.
2. The pieces are clamped one after the other and outer mating edges are filed and checked for their flatness, with the help of try-square.
3. The side edges of the two pieces are filed such that, they at right angles to each other and widths are exactly 48mm.
4. Wet chalk is applied on surfaces of the two pieces.
5. The given dimensions of the Stepped fitting are marked, by using jenny caliper, steel rule scriber, and the surface plate.
6. The portion to be removed is then marked.
7. Using dot punch, dots are punched along the above scribed lines.
8. Using the hacksaw, the unwanted portions are removed.
9. Now the potions are filed and burrs are removed by filing on the surfaces of fitted job.

Note: The centers of the half rounds are marked by a centre punch. However,after marking the centre of the half round in the piece Y, the edges of it is further filed, till half of the punch dot is left.

Precautions:

1. Never remove chips with hand use a wire brush.
2. Working tool should not be kept at the edge of table.
3. While sawing secure work rigidity.

Result:.



VIVA QUESTIONS

1. What is the mechanical meaning of fitting?
2. What is The Use of Try Square?
3. What Is The Name Of Vice Used In Fitting Shop?
4. Name the different files?
5. Which tools are used in fitting shop?
6. What is the use of center punch?
7. Write any five advantages of wood over the other materials?
8. What is bench vice made up of?
9. Should the hardness of work piece be same as that of the file?
10. what is a file?
11. What is meant by fitting?
12. What is the use of vice and give the various types of vice?
13. State the different types of hammers used in fitting work.
14. What is the use of V- block?
15. What are the materials used for files?
16. What are the methods of filing?
17. What is the composition of high speed steel?
18. What is meant by peening or swaging?
19. What are the different types of punches?
20. What is a wrench?
21. What is the material used for making hacksaw blades?

3.TIN SMITHY

INTRODUCTION:

The metal plank having less than 2 mm thickness is called sheet metal. Sheet metal work deals with the production of components in wide variety of shapes and sizes from sheet metal, with aid of tools or machines metals used in sheet metal work variety of metal shop. The characteristics and uses of some of the important metals used in sheet metal work are described below:

Galvanized iron: It is a sheet of soft steel, which is coated with zinc. Zinc resists corrosion and improves the appearance of metal. Galvanized iron is one of the least expensive metals and is used for making pans, buckets, ducts, gutters, tanks, boxes, etc.

Black iron: It is uncoated sheet of metal with bluish-black appearance. It corrodes rapidly and is not used extensively due to difficulties of soldering. The black iron sheets are used for the parts that are to be painted.

Tin plate: Tin plate is an iron or steel coated with pure tin. It has very bright silver appearance and is used for food containers, cans and pans.

Stainless steel: It is an alloy steel possessing corrosion resistance. General type stainless steel contains 18 percent chromium and 8 percent nickel. This steel is commonly known as 18-8 stainless steel. These are available in various sizes and thickness. It is widely used for food containers and dairy equipment.

Copper: It has reddish color and possesses good malleability, ductility and resistance to atmospheric corrosion.

Aluminium: Sheet aluminium is never pure aluminium and it is always allowed with small quantities of copper silicon, magnesium and iron.

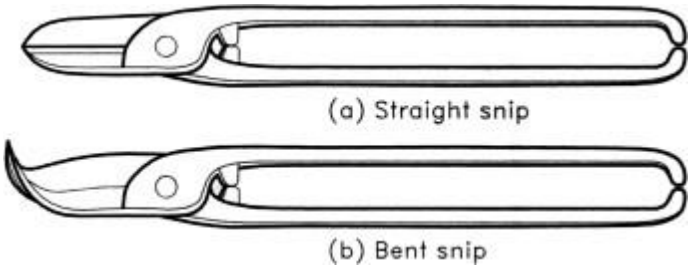
TOOLS AND EQUIPMENT:

Some of the tools used in fitting are also used in sheet metal work. Certain additional tools used by sheet metal worker are described below:

Snips: Hand shears or snips are used to cut sheet metal. Although there are many types, the sheet metal workers generally use straight snips and curved snips.

Straight snips: Straight snips have straight blades and are used for cutting along the straight lines and for trimming edges.

Curved snips: Curved snips has a curved blade and are used for cutting circles and irregular shapes.



Bench shears: Bench shear is used for cutting thicker sheets. It is the lower fixed blade firmly secured by bracket at the bottom. The movable blade is pivoted at the rear end; the hand operating lever is attached to the front end of movable blade in a link mechanism.

Stakes: Stakes are made of steel and forged in a variety of shapes and sizes. Its working face is machined and polished to facilitate various operations such as bending, seaming or forming. The following types of stakes are most generally used:

Double seaming: These stakes has two horns and it is used to make double seam for vessels.

Blow horn: These stakes has two horn tapering horns and it is used to form or seam funnels.

Break horn: These stakes has a square tapered horn on one side and a round tapered horn on opposite side. It is used for shaping round and square surfaces, bending edges and making corners.

Conductor stake: These stakes has two cylindrical horns having different diameters. It is used for forming pipes and cylindrical pieces.

Funnel stake: It is used for forming conical shapes and for making wire rings.

Hatchet stake: It has a horizontal sharp straight edge and can be used for making straight, sharp bends and for folding and bending edges.

Hand hammers and mallets: The sheet metal worker uses a wide variety of hammers and mallets for forming shapes by different operation. The most commonly used hammers are as follows:

Straight-peen hammer: It has a peen end similar to its bottom size round shape and its top side is straight point. Square, slightly curved face and its peen is tapered. It is used for riveting.

Cross-peen hammer: It has a square, flat face and it is tapered on one side. It is used for setting down the edges for making a double seam.

Mallet: Mallet is generally made of wood or plastic. It is used whenever slight blows are required. Wooden mallets do not damage the surface.

Wire Gauge: The thickness of sheet metal is preferred in numbers known as the standard wire gauge (SWG). The gaps in the circumference of the gauge are used to check the gauge number as shown below.

Sheet metal joints: Various types of joints are used in sheet metal work to suit the varying requirements. Some commonly used sheet metal joints and folded edges are shown below. These are self secured joints, formed by joining together two pieces of sheet metal and using the metal itself to form the joint.

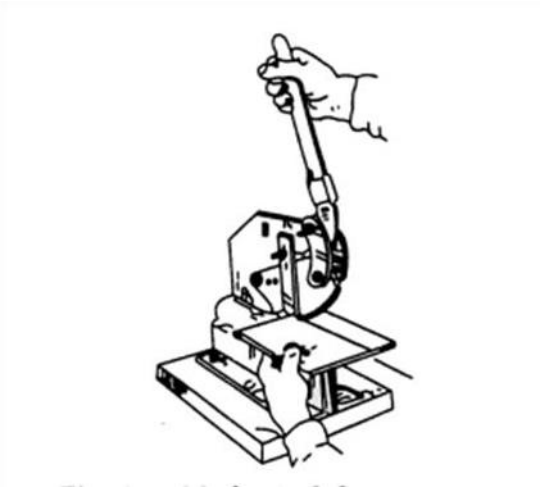
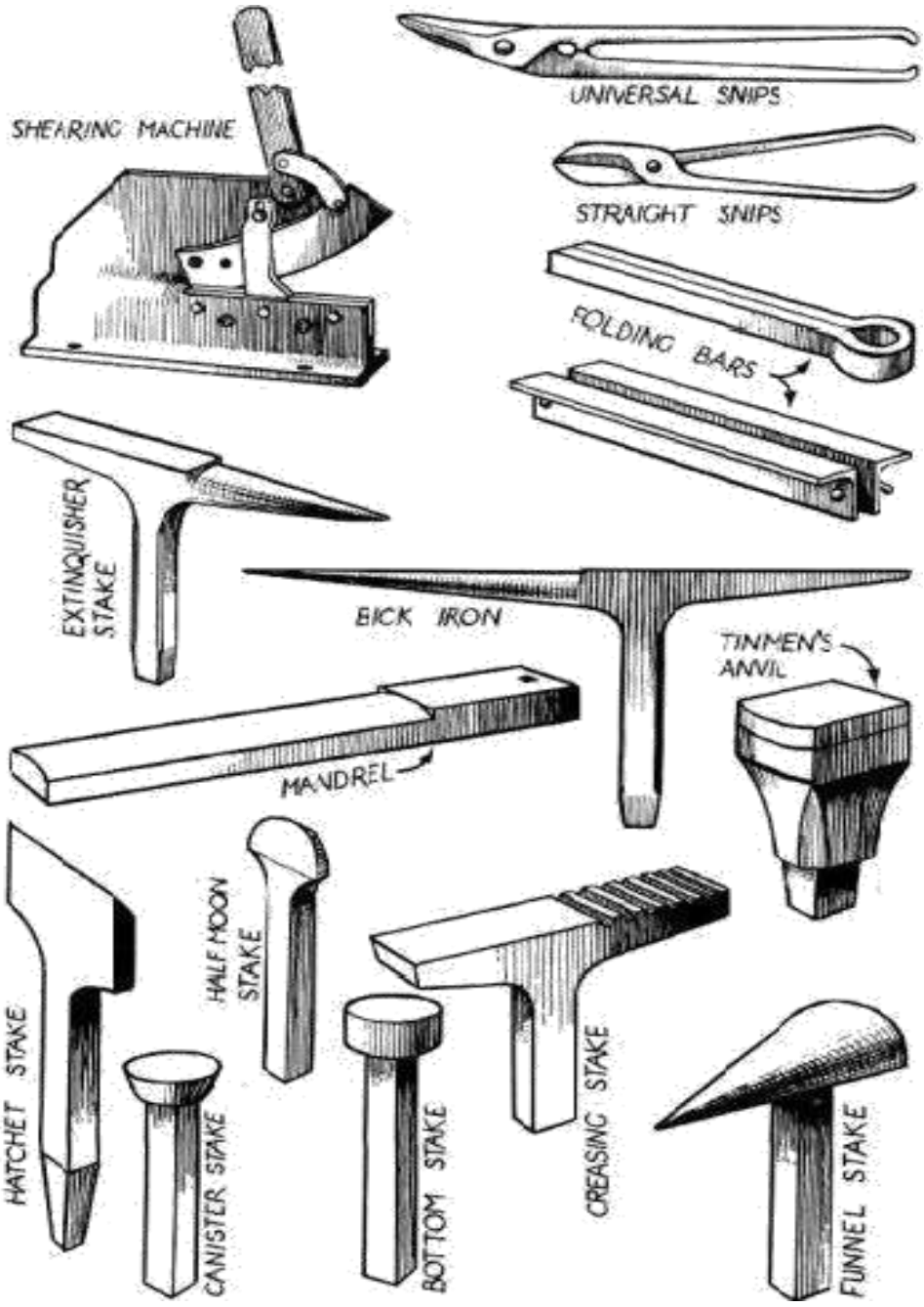


FIG: MECHANICAL SHEARING PRESS



TINSMITHY TOOLS

EX.NO:3.1 ROUND TIN DATE:

AIM: To prepare a ROUND TIN from the sheet metal as per given dimensions.

MATERIALS REQUIRED: Gl Sheet of size 110 mm X 70 mm.

TOOLS REQUIRED: 1. Scriber 2.Straight snip 3. Beak horn stake

4. Hatchet stake 5.Steel rule 12" 6.Mallet

PROCEDURE:

1. In order to obtain correct size and shape of the article, prepare a template.
2. The template is drawn directly on the sheet metal.
3. The sheet is cut with the help of snip and the notching operation is carried out to obtain the desired shape.
4. The sheet metal is bent along the marked lines by striking with a mallet on proper stake.
5. The edge of the sheet metal is folded to strengthen the edge and to eliminate the sharp edges.
6. Finally seaming operation is completed to obtain the rectangular tray.

EXPERIMENT DIAGRAM:

PRECAUTIONS:

1. Never carry tools in pockets.
2. Do not try to hold sheet with bare hands.
3. Remove scrap metal to avoid injuries.

RESULTS:

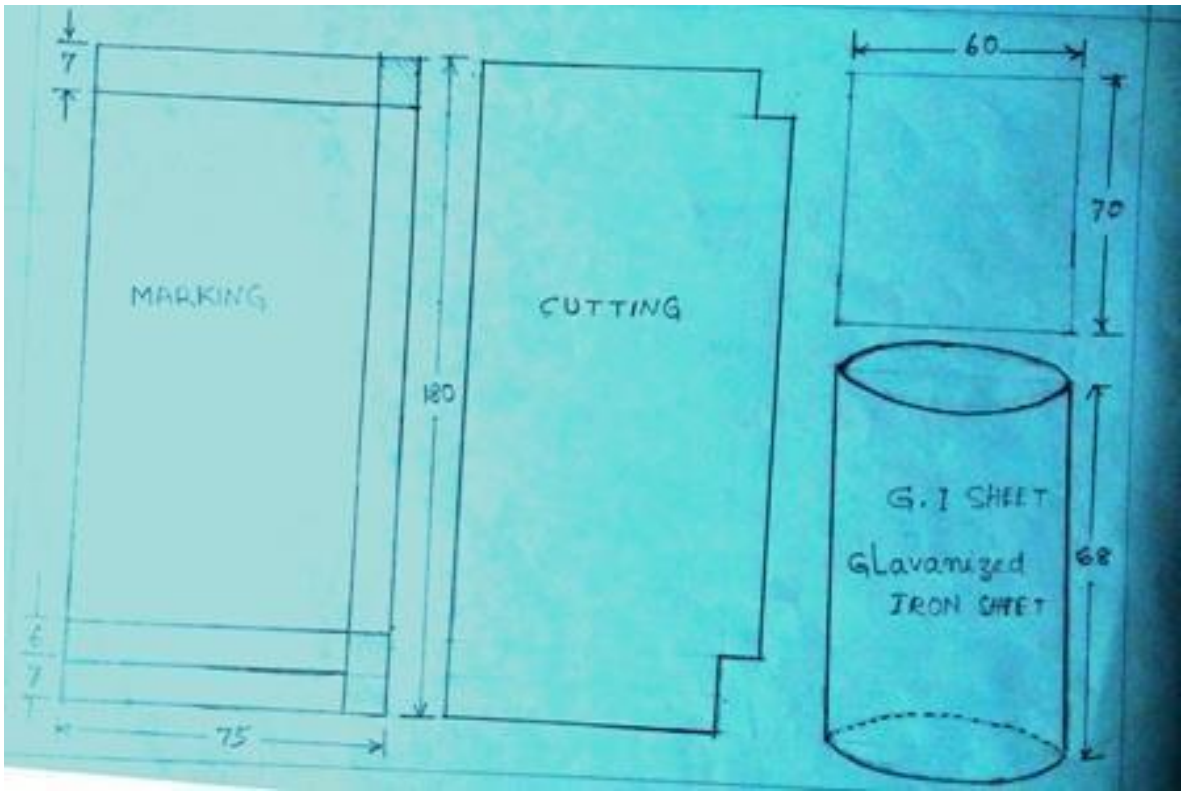


FIG:ROUND TIN

VIVA VOCE

1. Define sheet metal work?
2. What are the applications of sheet metal working?
3. What is the principle behind the sheet metal layout?
4. How do you identify the thickness of metal sheet?
5. What will be the result of the sheet thickness when increasing the gauge number?
6. What are the metals used in sheet metal work?
7. Name the striking tools used in sheet metal work?
8. Name the five tools and equipments which are used for cutting sheet metal?
9. What is a snip?
10. What are the types of snips?
11. Define punching operation?
12. Define nibbling operation in sheet metal work?
13. How will you design the diameter of rivet for sheet metal work?
14. Name the various sheet metal operations?
15. What is hem?
16. What are the functions of hem?
17. What is seam?
18. Double seam is ..... than single seam
19. What are the different types of seam?

EX.NO:3.2 REACTANGULAR TRAY DATE:

AIM: To prepare Rectangular Tray from the sheet metal as per given dimensions.

MATERIALS REQUIRED: Two Gl sheets

TOOLS REQUIRED: 1. Scriber 2. Straight snip 3. Curved snip

4. Beak horn stake 5. Hatchet stake 6. Steel rule 12”

7. Mallet 8. Soldering iron

EXPERIMENT DIAGRAM:

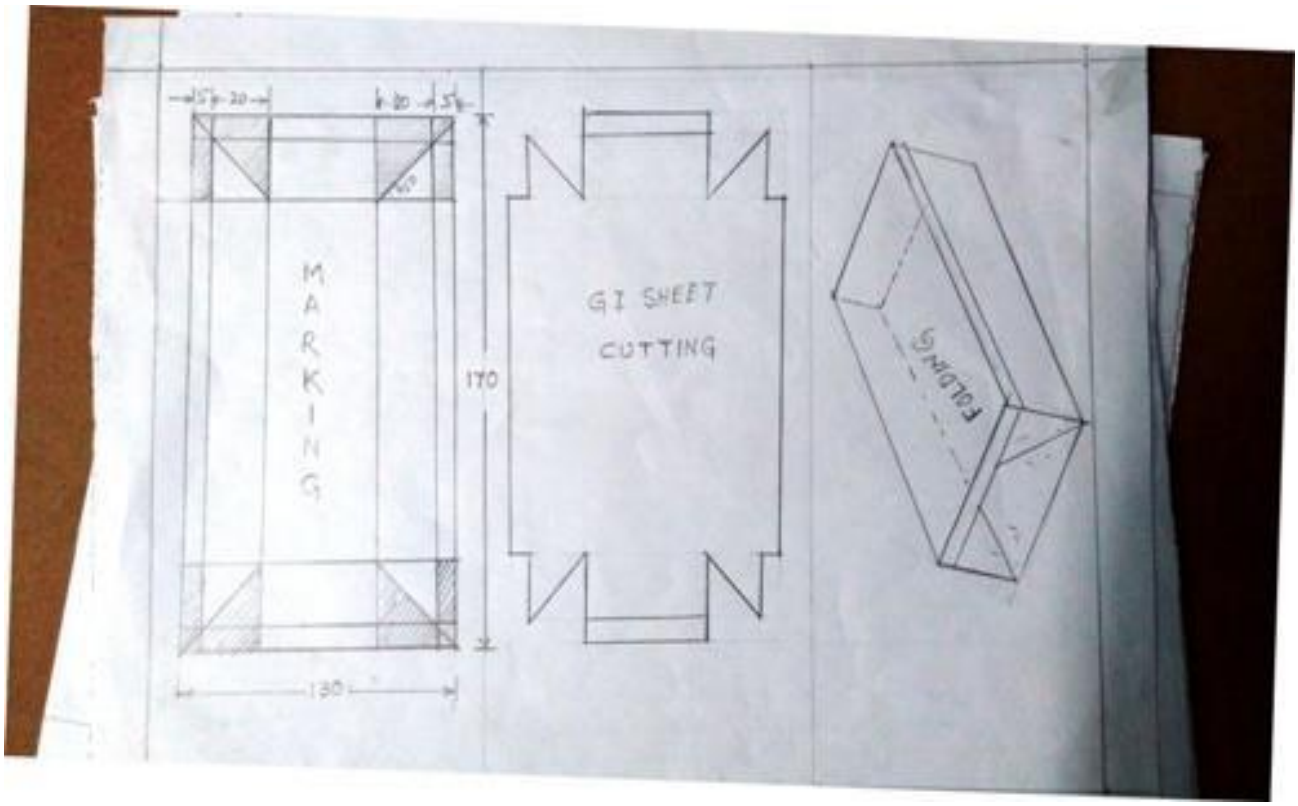
PROCEDURE:

1. The size of the given sheet is checked with steel rule.
2. Mark the measurement and make the development surface sketch diagram.
3. The layout of the tray is marked on given sheet.
4. The layout of the tray is cut by using the straight snips.
5. The sheet is bent to the required shape using stakes and mallet.
6. Now the bent edges are made to overlap each other and stuck with a mallet to get the required joint.
7. The joint is soldered.

PRECAUTIONS:

1. Never carry tools in pockets.
2. Do not try to hold sheet with bare hands.
3. Remove scrap metal to avoid injuries.

RESULTS:


MARKING
GI SHEET
CUTTING
FOLDING
170
130

VIVA QUESTIONS

1. Define sheet metal work?
2. What are the applications of sheet metal working?
3. What is the principle behind the sheet metal layout?
4. How do you identify the thickness of metal sheet?
5. What will be the result of the sheet thickness when increasing the gauge number?
6. What are the metals used in sheet metal work?
7. Name the striking tools used in sheet metal work?
8. Name the five tools and equipments which are used for cutting sheet metal?
9. What is a snip?
10. What are the types of snips?
11. Define punching operation?
12. Define nibbling operation in sheet metal work?
13. How will you design the diameter of rivet for sheet metal work?
14. Name the various sheet metal operations?
15. What is hem?
16. What are the functions of hem?
17. What is seam?
18. Double seam is.....than single seam
19. What are the different types of seam?

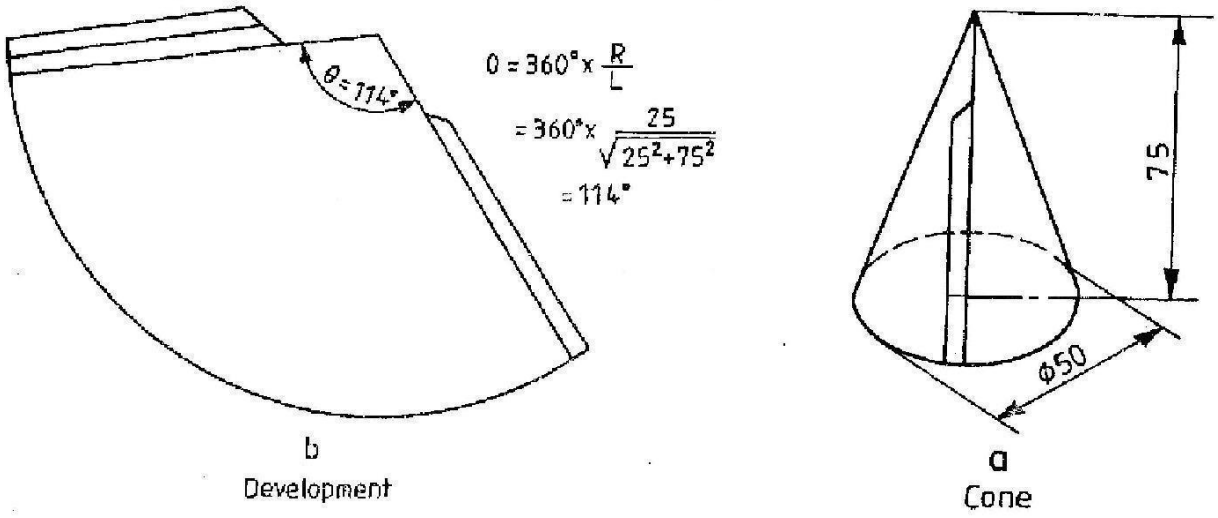
EX.NO:3.3 CONE DATE:

Aim: To make a cone as per the given dimensions.

Tools required: 300mm steel rule, try square, divider, scriber, straight snip, mallet, ball peen hammer and hatchet stake.

Sequence of operation:

1. The size of given sheet is checked with the steel rule.
2. The layout of the cone is drawn in the sheet and cut as shown in the development.
3. The allowance for folding and bending is added to the development.
4. The waste metal is cut away by using the straight and bent snips.
5. The development of the cone is folded by using the funnel stake, after forming the single hemmed joint.



Note: The angle subtended by the arc of the sector is calculated from the relation,

$$\theta \quad 360 \ \frac{\text{Radius of the base circle of the cone}}{\text{Slant Height}}$$

Precautions:

1. Do not try to hold the sheets with bare hands.
2. Be sure that the fingers are away from the shearing bend.
3. Markings should be done carefully.
4. Cutting should be done carefully to avoid cross cutting.

Result:

VIVA VOCE

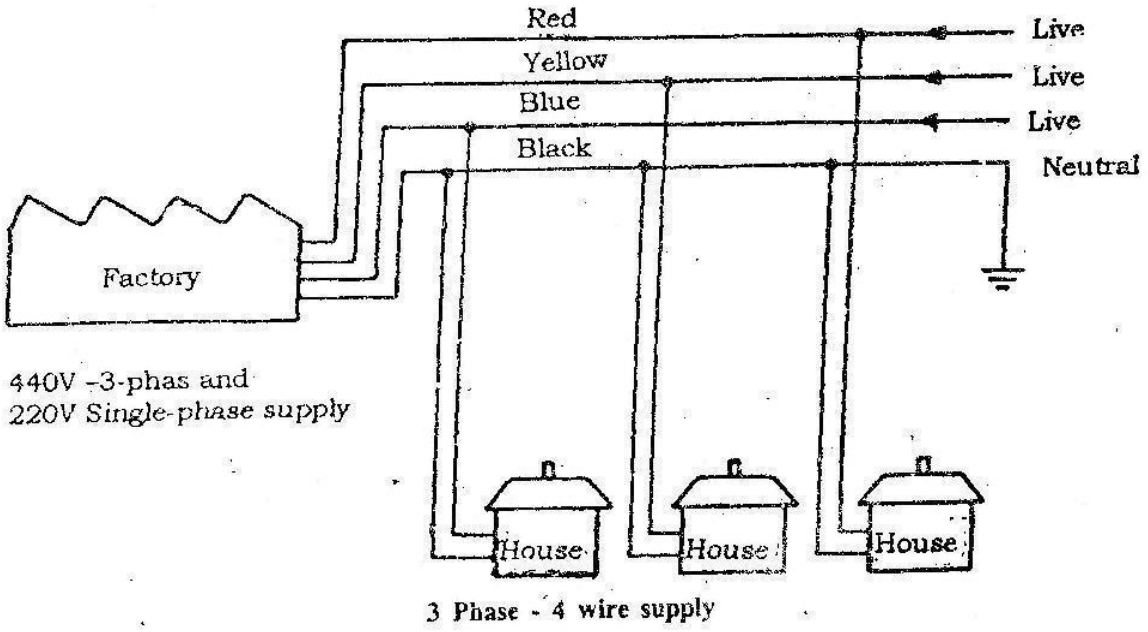
1. Define sheet metal work?
2. What are the applications of sheet metal working?
3. What is the principle behind the sheet metal layout?
4. How do you identify the thickness of metal sheet?
5. What will be the result of the sheet thickness when increasing the gauge number?
6. What are the metals used in sheet metal work?
7. Name the striking tools used in sheet metal work?
8. Name the five tools and equipments which are used for cutting sheet metal?
9. What is a snip?
10. What are the types of snips?
11. Define punching operation?
12. Define nibbling operation in sheet metal work?
13. How will you design the diameter of rivet for sheet metal work?
14. Name the various sheet metal operations?
15. What is hem?
16. What are the functions of hem?
17. What is seam?
18. Double seam is .....than single seam
19. What are the different types of seam?

4.HOUSE WIRING

INTRODUCTION:

Electrical wiring is defined as a system of electrical conductor, components and apparatus, for conveying electric power from the source to the point of use.

Electrical power is supplied to domestic installation through a phase and a neutral forming a single phase A.C. 230V, two wire system. For industrial establishment, power is supplied through 3-phase wire system to give 440v. The figure below shows the power tapping for domestic and industrial purpose. The neutral is earthed at the distribution sub-station of the supply.



3 Phase - 4 wire supply

ELEMENTS OF HOUSE WIRING:

1. Fuses and circuit breakers:
These are devices designed to provide protection to a circuit against excess current.

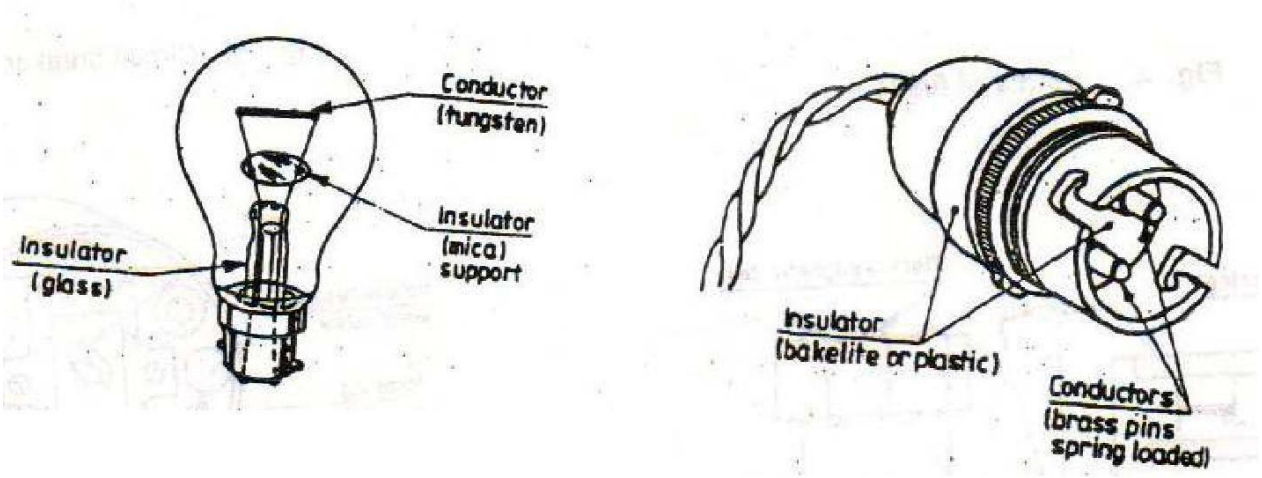
2.Electric Switch:
This is a device that makes and breaks or changes the course of electric circuit.

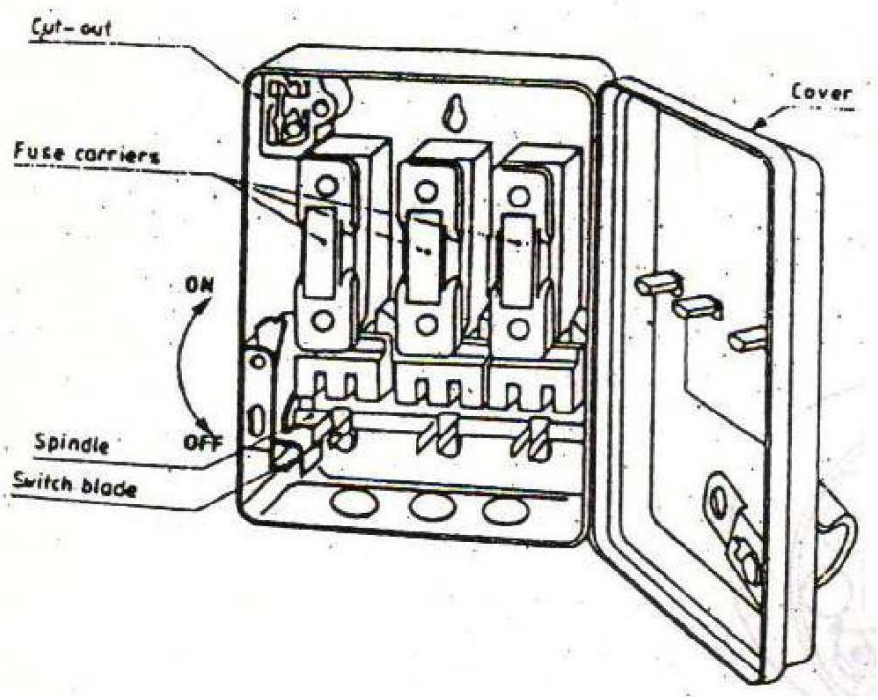
3. Plug:
It is a device carrying two or three metallic contacts in the form of pins, intended for engaging with corresponding socket contacts and arranged for attachment to appliances such as radio, T.V., Fan etc.

4.Socket out let:
It is a device carrying two or three contact designed for engagement with corresponding plug pins and arranged for connection to fixed wiring.

5.Lamp Holder:
Lamp Holder is designed to hold lamps and connect there in the circuit.

6. Main Switch:
This is a switch intended to connect or cut off the supply of the electricity to the whole of insulation. It contains one or more fuses.



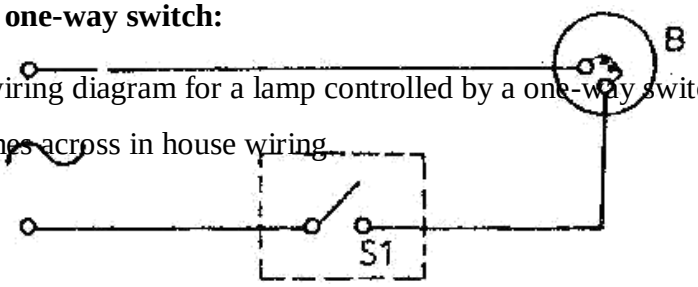


PARTS OF A LAMP AND LAMP HOLDER
MAIN SWITCH

COMMON HOUSE WIRING CONNECTIONS:

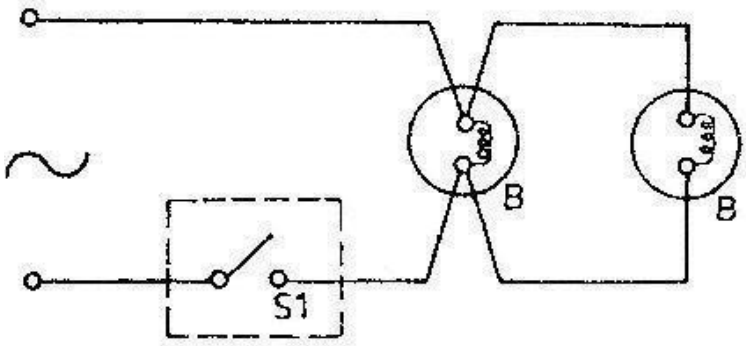
One lamp controlled by a one-way switch:

Figures show the wiring diagram for a lamp controlled by a one-way switch. This is the normal connection one comes across in house wiring.



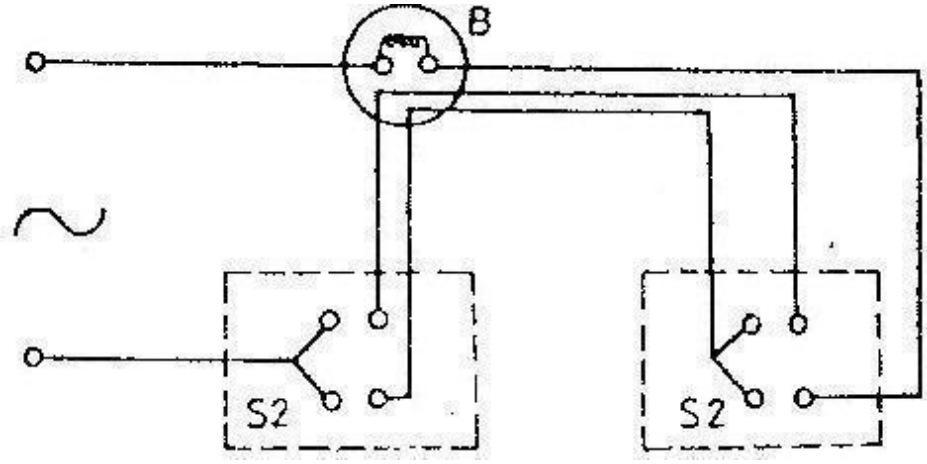
Two lamps connected in series or parallel by a one-way switch:

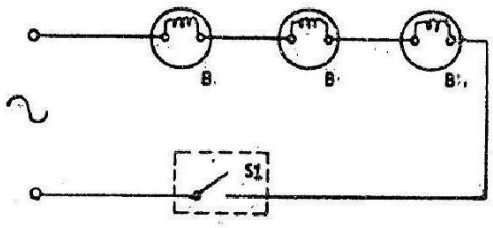
Two lamps may be connected by one-way switch in parallel for bright glow or in series for dull glow.



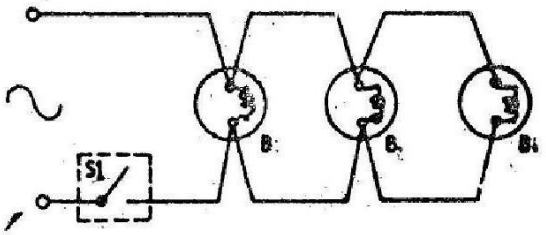
One lamp controlled by 2 two-way switches:

It is sometimes desirable to control a lamp from two different places. One may come across this situation with staircase, long corridors or hall containing two entrances etc.





Series circuit



Parallel circuit.

Combination Piler: It is made of steel and its size is given according to fix length. It has a cutter for cutting the wires.

Electrician knife: It is the tool used for removing the insulation from the wires. It has two folding blades, one for removing the insulation and the other for clearing the wires.

Test Lamp: A test holder with a lamp is called a test lamp. It is used for testing the supply.

Pocker: It is long sharp tool used for making pilot holes in wood before fixing and tightening of wood screws.

Rawl plug tool and bit: It has two parts namely the tool bit and tool holder. The tool bit is made of carbon steel and the tool holder is made of mild steel. It is used for making holes in brick and concrete walls or ceilings. Its size depends upon the number, as the number increases; the thickness of the bit as well as the plug also increases.

Ball peen Hammer: There are different types of hammers used for different purposes. The purpose of ball peen hammer is generally used in electrical trades. The size of hammer is usually indicated by its weight.

Electric soldering Iron: It is used for soldering wires to commutator segments and small joints with solder. It consists of pointed oval copper bit fixed to an iron rod which is heated by an electric element only.

EX. NO:4.1 TWO LAMPS CONNECTED IN SERIES BY ONE SWITCH.
DATE:

AIM: To prepare a wiring to control two lamps connected in series by one switch. (SERIES CONNECTION)

TOOLS REQUIRED:

1. Screw driver,
2. Connector,
3. Tester,
4. Lamp holders,
5. One way switch, wires,
6. Wire clips,
7. Bulbs,
8. Wire cutter,
9. Nose plier,
10. Cutting plier,
11. Ball peen hammer

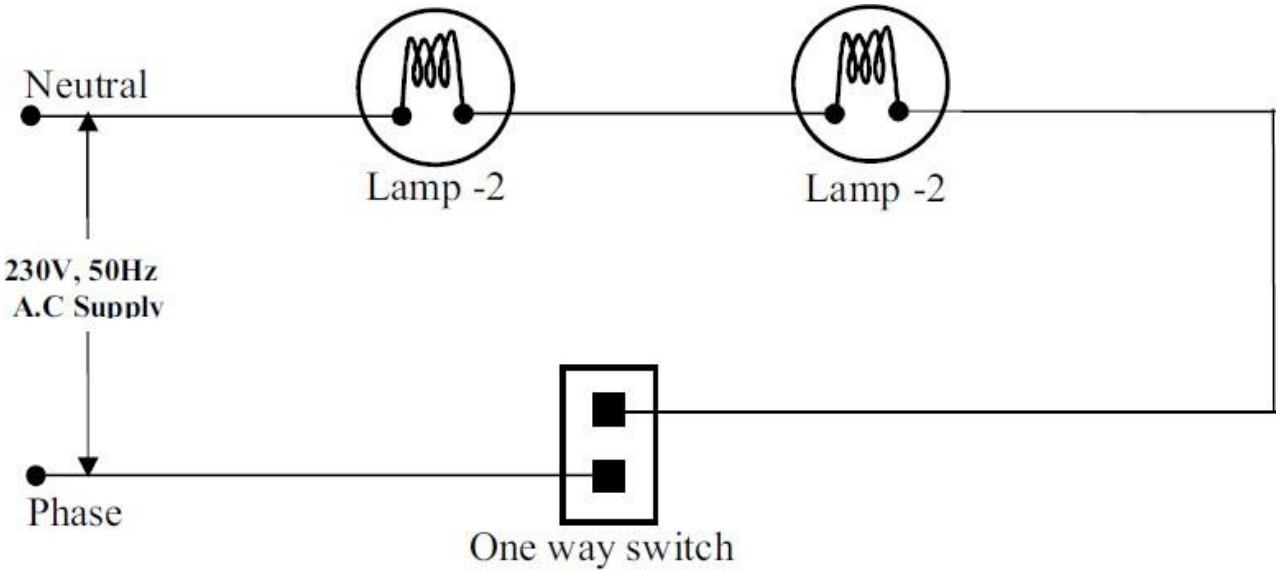
SEQUENCE OF OPERATIONS:

1. The outline of the wiring diagram is marked on the wooden wiring board.
2. Clips are nailed to the board, following the wire diagram.
3. Wires are stretched and clamped with the clips.
4. Wires are connected to the holder and the switch as shown in the above diagram, Which are then screwed on the board.
5. Bulbs are fitted to the holders.
6. The wiring connections are tested by giving power supply.

PRECAUTIONS:

1. Never remove a plug from an outlet by pulling the cord. Always pull by the plug.
2. Whenever there is power failure, put off the power supply to all equipment in order to prevent Spontaneous recovery.
3. Put on mains only ascertaining completion of correct wiring.

RESULT:


Neutral
Lamp -2
Lamp -2
230V, 50Hz
A.C Supply
Phase
One way switch

VIVA QUESTIONS

1. For domestic use, power is supplied through a……and a…….forming a single phase A.C, two wire system.

2. For industrial establishments, power is supplied through.....phase……wire system,

3. Electric switch……..and… ..... the electric circuit.

4. A plug engages with corresponding…..... contacts.

5. Main switch I only to cut-off the supply of electricity (T/F)

6. A lamp filament is made of……..

7. A multi-core conductor consists of several cores… .....from each other.

8. Wire sizes are specified by the diameters /length of the wire.

9. The wire specification 14/36 indicates…….stands of ..... SWG.

10. In series circuit, when one device breaks down; the remaining devices operate.(T/F)

11. In parallel circuit, if one device breaks down; the other devices continue to operate.(T/F)

12. Regulator is used for controlling the…..of a fan.

13. While using a table fan, always use two/three core flexible wire for connection.

14. Universal fans operate both on AC and DC

15. If the bulb on the handle of an automatic electric iron glows, it means that the iron is cool/hot.

16. The intensity of the glow of an indicator lamp is a measure of voltage/ current level.

EX. NO:4.2 TWO LAMPS CONNECTED IN PARALLEL BY ONE SWITCH

DATE:

AIM: To prepare a wiring to control two lamps connected in parallel by one switch. (PARALLEL CONNECTION)

TOOLS REQUIRED:

1. Screw driver
2. Connector
3. Tester
4. Lamp holders
5. One way switch
6. Wires
7. Wire clips
8. Nails
9. Bulbs
10. Wire cutter
11. Nose pliers
12. Cutting pliers
13. Ball peen hammer.

SEQUENCE OF OPERATIONS:

1. The outline of the wiring diagram is marked on the wooden wiring board.
2. Clips are nailed to the board, following the wiring diagram.
3. Wires are stretched and clamped with clips.
4. Wires are connected to the holder and the switch as shown in above diagram, which are then screwed on the board.
5. Bulbs are fitted to the holders.
6. The wiring connections are tested by giving power supply.

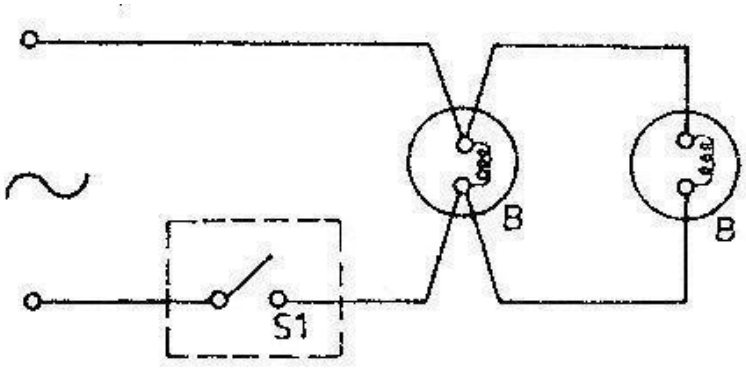
SAFETY PRECAUTIONS:

1. Never remove a plug from an outlet by pulling the cord. Always pull the plug.

2.Whenever there is power failure, put off power supply to all equipment in order to prevent spontaneous recovery.

3.Put on mains only after ascertaining completion of correct wiring.

RESULTS:



Viva questions

1. what is meaning of electrical wiring?
2. what is an electric conductor?
3. What are the tools are required in house wiring ?
4. What is difference between one way switch and two way switch ?
5. What is earthing?
6. Electric switch……..and the electric circuit.
7. A plug engages with corresponding .....contacts.
8. Main switch I only to cut-off the supply of electricity (T/F)
9. A lamp filament is made of……..
10. A multi-core conductor consists of several cores..... from each other.
11. Wire sizes are specified by the diameters /length of the wire.
12. The wire specification 14/36 indicates……. stands of .....SWG.
13. In series circuit, when one device breaks down; the remaining devices operate. (T/F)
14. How much household supply in India?
15. what are units of current, electromotive force, resistance and power?16.What is the relation among Volt, ohm and Amperes?

EX. NO:4.3 ONE LAMP CONTROLLED BY TWO 2-WAY SWITCHES

DATE:

AIM: To prepare a wiring to control one lamp controlled by two 2-way switch.

TOOLS REQUIRED:

1. Screw driver
2. Connector
3. Tester
4. Lamp holders
5. One way switch
6. Wires, wire clips
7. Nails
8. Pocker
9. Bulbs
10. Wire cutter
11. Nose plier
12. Cutting plier
13. Ball peen hammer

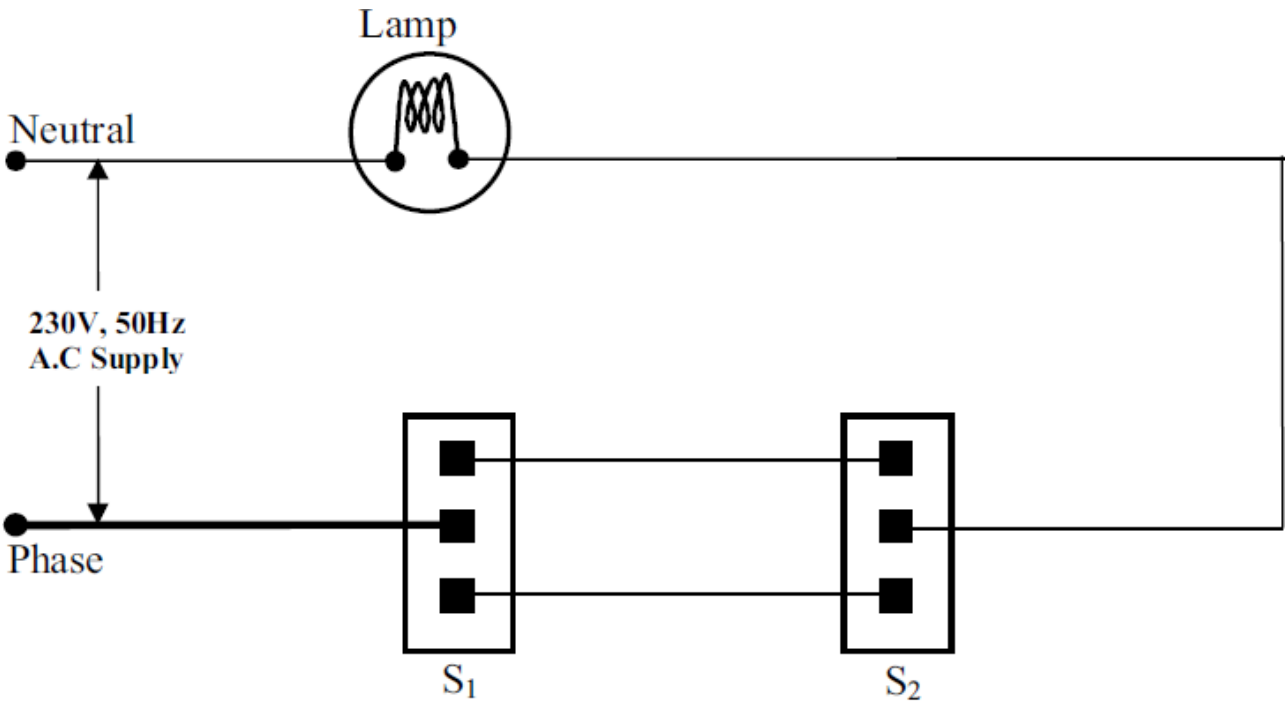
SEQUENCE OF OPERATIONS:

1. The outline of the wiring diagram is marked on the wooden wiring board.
2. Clips are nailed to the board, following the wiring diagram.
3. Wires are stretched and clamped with clips.
4. Wires are connected to the holder and the switch as shown in above diagram, which are then screwed on the board.
5. Bulbs are fitted to the holders.
6. The wiring connections are tested by giving power supply.

PRECAUTIONS:

1. Never remove a plug from an outlet by pulling the cord. Always pull the plug.
2. Whenever there is power failure, put off power supply to all equipment in order toprevent spontaneous recovery.
3. Put on mains only after ascertaining completion of correct wiring.

RESULTS:



Two way switches

Viva questions

1.what is meaning of electrical wiring?

2.what is an electric conductor?

3. What are the tools are required in house wiring ?

4. What is difference between one way switch and two way switch ?

5. What is earthing?

6.Electric switch…….and .....the electric circuit.

7.A plug engages with corresponding .....contacts.

8.Main switch I only to cut-off the supply of electricity (T/F)

9.A lamp filament is made of……..

10.A multi-core conductor consists of several cores..... from each other.

11. Wire sizes are specified by the diameters /length of the wire.

12. The wire specification 14/36 indicates…….stands of.....SWG.

13. In series circuit, when one device breaks down; the remaining devices operate.(T/F)

14. How much household supply in India?

15. what are units of current,electromotive force,resistance and power?

16.What is the relation among Volt,ohm and Amperes?

5. WELDING PROCESSES

Solid materials need to be joined together in order that they may be fabricated into useful shapes for various applications such as industrial, commercial, domestic, art ware and other uses. Depending on the material and the application, different joining processes are adopted such as, mechanical (bolts, rivets etc.), chemical (adhesive) or thermal (welding, brazing or soldering). Thermal processes are extensively used for joining of most common engineering materials, namely, metals. This exercise is designed to demonstrate specifically: gas welding, arc welding, resistance welding, brazing.

WELDING PROCESSES

Welding is a process in which two materials, usually metals, and is permanently joined together by coalescence, resulting from temperature, pressure, and metallurgical conditions. The particular combination of temperature and pressure can range from high temperature with no pressure to high pressure with any increase in temperature. Thus, welding can be achieved under a wide variety of conditions and numerous welding processes have been developed and are routinely used in manufacturing.

To obtain coalescence between two metals following requirements need to be met:-
(1) Perfectly smooth, flat or matching surfaces.
(2) Clean surfaces, free from oxides, absorbed gases, grease and other contaminants.
(3) Metals with no internal impurities.

These are difficult conditions to obtain. Surface roughness is overcome by pressure or by melting two surfaces so that fusion occurs. Contaminants are removed by mechanical or chemical cleaning prior to welding or by causing sufficient metal flow along the interface so that they are removed away from the weld zone friction welding is a solid state welding technique. In many processes the contaminants are removed by fluxing agents.

The production of quality welds requires
(1) A satisfactory heat and/or pressure source,
(2) A means of protecting or cleaning the metal, and
(3) Caution to avoid, or compensate for, harmful metallurgical effects.

ARC WELDING

In this process a joint is established by fusing the material near the region of joint by means of an electric arc struck between the material to be joined and an electrode. A high current low voltage electric power supply generates an arc of intense heat reaching a temperature of approximately 3800^{o}C. The electrode held externally may act as a filler rod or it is fed independently of the electrode. Due to higher levels of heat input, joints in thicker materials can be obtained by the arc welding process. It is extensively used in a variety of structural applications.

There are so many types of the basic arc welding process such as shielded metal arc welding (SMAW), gas metal arc welding (GMAW), gas tungsten arc welding (GTAW), submerged arc welding

RESISTANCE SPOT WELDING

The tips of two opposing solid cylindrical electrodes touch a lap joint of two sheet metals, and resistance heating produces a spot weld. In order to obtain a strong bond in the **weld nugget,** pressure is applied until the current is turned off. Accurate control and timing of the electric current and of the pressure are essential in resistance welding.

The strength of the bond depends on surface roughness and on the cleanness of the mating surface. Oil, paint, and thick oxide layers should, therefore, be removed before welding. The presence of uniform, thin layers of oxide and of other contaminants is not critical.

The weld nugget is generally 6 to 10 mm in diameter. The surface of the weld spot has a slightly discolored indentation. Currents range from 3000 A to 40000 A: the level depends on the materials being welded and on their thicknesses.

PROCESS CAPABILITIES:

Spot welding is the simplest and the most commonly used resistance-welding process. Welding may be performed by means of single or multiple pairs of electrodes, and the required pressure is supplied through mechanical or pneumatic means. **Rocker-arm type** spot-welding machines are normally used for smaller parts; **press type** machines are used for larger work pieces. The shape and surface condition of the electrode tip and the accessibility of the site are important factors in spot welding.

Spot welding is widely used for fabricating sheet metal parts. Examples range from the attaching of handles to stainless-steel cookware to the spot welding of mufflers.

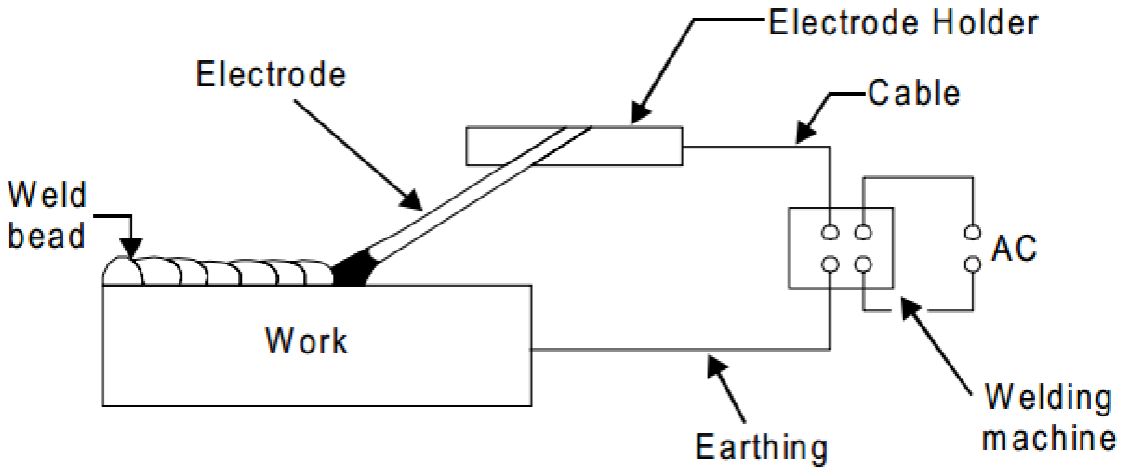


FIG.Process Of Arc Welding

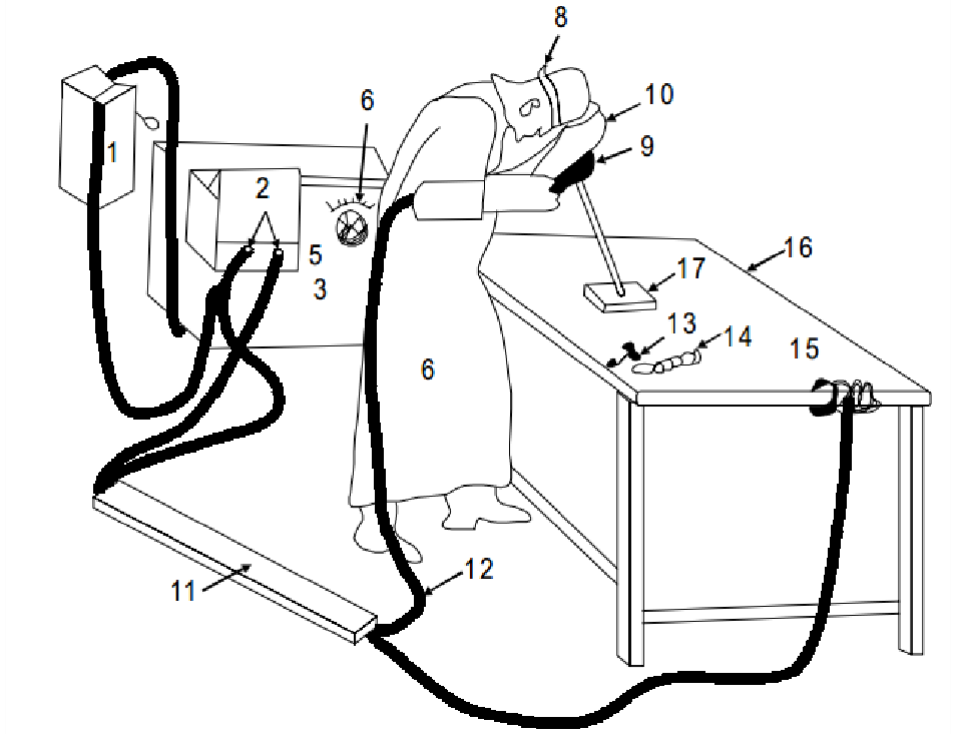


Fig:Basic elements of arc welding

1) Switch box.
2) Secondary terminals
3) Welding machine.
4) Current reading scale.
5) Current regulating hand wheel.
6) Leather apron.
7) Asbestos hand gloves.
8) Protective glasses strap
9) Electrode holder.
10) Hand shield
11) Channel for cable protection.
12) Welding cable.
13) Chipping hammer.
14) Wire brush.
15) Earth clamp.
16) Welding table (metallic).
17) Job.

EX.NO:5.1 BUTT JOINT WITH ARC WELDING

DATE:

Aim: - To prepare a butt joint with mild steel strip using Arc Welding

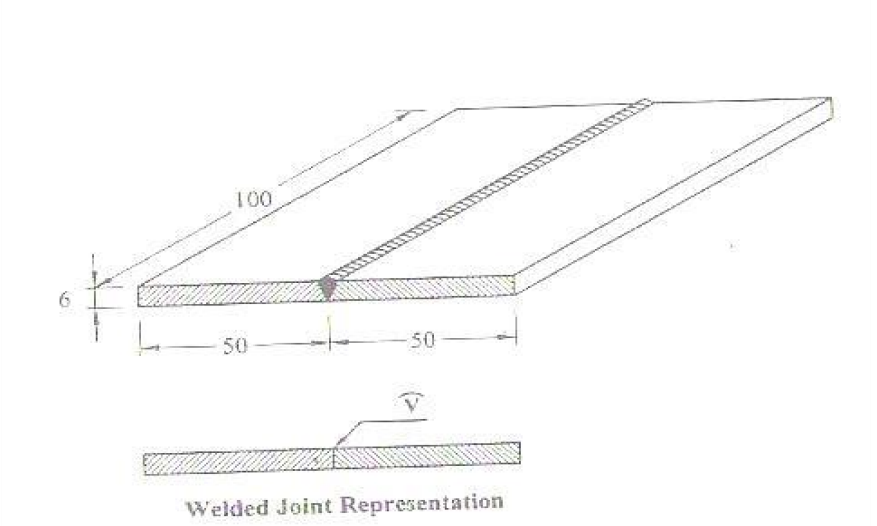
Equipment and materials: -

Welding unit, consumable mild steel Electrodes, mild steel flats. Wire brush, Tongs, Chipping hammer etc.

Procedure: -

1. Clean the mild steel flats to be joined by wire brush
2. Arrange the flat pieces properly providing the gap for full penetration for butt joint (gap ½ thicknesses of flats).
3. Practice striking of arc, speed and arc length control.
4. Set the welding current, voltage according to the type of metal to be joined.
5. Strike the arc and make tacks at the both ends to hold the metal pieces together during the welding process
6. Lay beads along the joint maintaining proper speed and arc length (Speed 100-150 mm/min).
7. Clean the welded zone and submit.

Result:



Welded Joint Representation

VIVA QUESTIONS

1. Which is the welding process you have carried out in workshop?
2. What is Welding?
3. Name the types of welding?
4. Name the welding tools used in workshop?
5. Which outer cover is on the welding rod?
6. Name some of the arc welded joints?
7. What is the difference between electrode and filler rod?
8. What is arc welding?
9. What distance should be maintained between the work and electrode?
10. What is the arc temperature?
11. What is the function of coating in coated electrodes in metal arc welding?
12. What is the output range of voltage and current on the metal arc welding?
13. What will happen if the arc length is reduced while welding?

EX.NO:5.2 BUTT JOINT WITH ARC WELDING

DATE:

Aim: To make a double lap joint, using the given mild steel pieces and by arcwelding

Material used: Two mild steel pieces of 100X40X6 mm

Tools and equipment used:

1. Arc welding machine,
2. Mild steel electrodes,
3. Electrode holder,
4. Ground clamp,
5. flat nose Tong,
6. Face shield,
7. Apron,
8. Hand gloves,
9. Metallic work Table,
10. Bench vice,
11. Rough flat file,
12. Try square,
13. Steel rule,
14. Wire brush,
15. Ball peenhammer,
16. Chipping hammer

Operations to be carried out:

1. Cleaning the work pieces
2. Tack welding
3. Full welding
4. Cooling
5. Chipping
6. Finishing

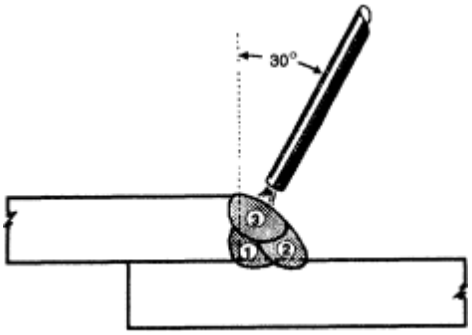


Fig:Lap Joint

Procedure

1. Take the two mild steel pieces of given dimensions and clean the surfaces thoroughly from rust, dust particles, oil and grease.
2. Remove the sharp corners and burrs by filing or grinding and prepare the work pieces.
3. The work pieces are positioned on the welding table, to form a lap joint with the required over lapping
4. The electrode is fitted in to the electrode holder and the welding current is set to a proper value.
5. The ground clamp is fastened to the welding table.
6. Wearing the apron, hand gloves, using the face shield and holding the over lapped pieces the arc is struck and the work pieces are tack-welded at the ends of both the sides
7. The alignment of the lap joint is checked and the tack-welded pieces are reset, if required.
8. Welding is then carried out throughout the length of the lap joint, on both the sides.
9. Remove the slag, spatters and clean the joint.

Precautions:

1. Use goggles, gloves in order to protect the human body.
2. Maintain the constant arc length.

Result:

VIVA QUESTIONS

1. Which is the welding process you have carried out in workshop?

2. What is Welding?

3. Name the types of welding?
4. Name the welding tools used in workshop?

5. Which outer cover is on the welding rod?

6. Name some of the arc welded joints?

7. What is the difference between electrode and filler rod?

8. What is arc welding?

9. What distance should be maintained between the work and electrode?

10. What is the arc temperature?

11. What is the function of coating in coated electrodes in metal arc welding?

12. What is the output range of voltage and current on the metal arc welding?

13. What will happen if the arc length is reduced while welding?

6. BLACKSMITHY

Black smithy or Forging is an oldest shaping process used for the producing small articles for which accuracy in size is not so important. The parts are shaped by heating them in an open fire or hearth by the blacksmith and shaping them through applying compressive forces using hammer.

Thus, forging is defined as the plastic deformation of metals at elevated temperatures into a predetermined size or shape using compressive forces exerted through some means of hand hammers, small power hammers, die, press or upsetting machine. It consists essentially of changing or altering the shape and section of metal by hammering at a temperature of about 980°C, at which the metal is entirely plastic and can be easily deformed or shaped under pressure. The shop in which the various forging operations are carried out is known as the smithy or smith's shop.

Hand forging process is also known as black-smithy work which is commonly employed for production of small articles using hammers on heated jobs. It is a manual controlled process even though some machinery such as power hammers can also be sometimes used. Black-smithy is, therefore, a process by which metal may be heated and shaped to its requirements by the use of blacksmith tools either by hand or power hammer.

Forging by machine involves the use of forging dies and is generally employed for mass-production of accurate articles. In drop forging, closed impression dies are used and there is drastic flow of metal in the dies due to repeated blow or impact which compels the plastic metal to conform to the shape of the dies.

APPLICATIONS OF FORGING:

Almost all metals and alloys can be forged. The low and medium carbon steels are readily hot forged without difficulty, but the high-carbon and alloy steels are more difficult to forge and require greater care. Forging is generally carried out on carbon alloy steels, wrought iron, copper-base alloys, aluminum alloys, and magnesium alloys. Stainless steels, nickel-based super alloys, and titanium are forged especially for aerospace uses.

FORGEABILITY:

The ease with which forging is done is called forgeability. The forgeability of a material can also be defined as the capacity of a material to undergo deformation under compression without rupture. Forgeability increases with temperature up to a point at which a second phase, e.g., from ferrite to austenite in steel, appears or if grain growth becomes excessive.

COMMON HAND FORGING TOOLS:

For carrying out forging operations manually, certain common hand forging tools are employed. These are also called blacksmith's tools, for a blacksmith is one who works on the forging of metals in their hot state. The main hand forging tools are as under.

Tongs: The tongs are generally used for holding work while doing a forging operation

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

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

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

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

Swage

Swage is used for forging work which has to be reduced or finished to round, square or hexagonal form. It is made with half grooves of dimensions to suit the work being reduced. It consists of two parts, the top part having a handle and the bottom part having a square shank which fits in the hardie hole on the anvil face.

Fuller

Fuller is used in forging shop for necking down a forgeable job. It is made in top and bottom tools as in the case of swages. Fuller is made in various shapes and sizes according to needs, the size denoting the width of the fuller edge

Punch

Punch is used in forging shop for making holes in metal part when it is at forging heat.

Chisels

Chisels are used for cutting metals and for nicking prior to breaking. They may be hot or cold depending on whether the metal to be cut is hot or cold. A hot chisel generally used in forging shop.

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

Hand hammers

There are two major kinds of hammers are used in hand forging:

a. The hand hammer used by the smith himself and
b. The sledge hammer used by the striker.

- Hand hammers may further be classified as
  (a) ball peen hammer, (b) straight peen hammer, and (c) cross peen hammer.

- Sledge hammers may further be classified as

(a) Double Face Hammer, (b) Straight Peen Hammer, And
(c) Cross Peen Hammer.

Hammer heads are made of cast steel and, their ends are hardened and tempered. The striking face is made slightly convex. The weight of a hand hammer varies from about 0.5 to 2 kg whereas the weight of a sledge hammer varies from 4 to 10 kg

Anvil

An anvil is a most commonly tool used in forging shop.It acts as a support for blacksmith's work during hammering. The body of the anvil is made of mild steel with a tool steel face welded on the body, but the beak or horn used for bending curves is not steel faced. The round hole in the anvil called pritchel hole is generally used for bending rods of small diameter, and as a die for hot punching operations. The square or hardie hole is used for holding square shanks of various fittings. Anvils in forging shop may vary up to about 100 to 150 kg and they should always stand with the top face about 0.75 mt. from the floor. This height may be attained by resting the anvil on a wooden or cast iron base in the forging shop.

Swage block

Swage block generally used in forging shop.It is mainly used for heading, bending, squaring, sizing, and forming operations on forging jobs. It is 0.25 mt. or even more wide. It may be used either flat or edgewise in its stand.

FORGING OPERATIONS:

The following are the basic operations that may be performed by hand forging:

1. Drawing-down:

Drawing is the process of stretching the stock while reducing its cross-section locally. Forging the tapered end of a cold is an example of drawing operation.

2. Upsetting:

It is a process of increasing the area of cross-section of a metal piece locally, with a corresponding reduction in length. In this, only the portion to be upset is heated to forging temperature and the work is then struck at the end with a hammer. Hammering is done by the smith (student) himself, if the job is small, or by his helper, in case of big jobs, when heavy blows are required with a sledge hammer.

3. Fullering:

Fullers are used for necking down a piece of work, the reduction often serving as the starting point for drawing. Fullers are made of high carbon steel in two parts, called the top and bottom fullers. The bottom tool fits in the hardie hole of the anvil. Fuller size denotes the width of the fuller edge.

4. Flattering:

Flatters are the tools that are made with a perfectly flat face of about 7.5 cm square. These are used for finishing flat surfaces. A flatter of small size is known as set-hammer and is used for finishing near corners and in confined spaces.

5. Swaging:

Swages like fullers are also made of high carbon steel and are made in two parts called the top and swages. These are used to reduce and finish to round, square or hexagonal forms. For this, the swages are made with half grooves of dimensions to suit the work.

6. Bending:

Bending of bars, flats, etc., is done to produce different types of bent shapes such as angles, ovals, circles etc. Sharp bends as well as round bends may be made on the anvil, by choosing the appropriate place on it for the purpose.

7. Twisting:

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

Larger pieces may be clamped in a leg vice and twisted with a pair of tongs or a monkey wrench. However, for uniform twist, it must be noted that the complete twisting operation must be performed in one heating.

8. Cutting (Hot and Cold Chisels):

Chisels are used to cut metals, either in hot or cold state. The cold chisel is similar to fitter's chisel, except that it is longer and has a handle. A hot chisel is used for cutting hot metal and its cutting edge is long and slender when compared to cold chisel. These chisels are made of tool steel, hardened and tempered.

9. Iron-Carbon Alloy:

If the carbon is less than 2% in the iron-carbon alloy, it is known as steel. Again, based on the carbon content, it is called mild steel, medium carbon steel and high carbon steel. The heat treatment to be given to these steels and their applications are shown in table below.

	Carbon %	**Hardening temp. 0C**	**Tempering temp. 0C**	**Applications.**
Mild Steel	0.1	800-840	250-300	Chains, rivets, soft wire, sheet
	0.25	800-840	250-300	Tube, rod, strip
	0.5	800-840	250-300	Girders
	0.6	800-840	250-300	Saws, hammers, smith's and general purpose tools
	0.75	760-800	250-300	Cold chisels, smith's tools shear blades, table cutlery
	0.9	760-800	250-300	Taps, dies, punches, hot shearing blades
Medium Carbon steel	1.0	760-800	250-300	Drills, reamers, cutters, blanking and slotting tools, large turning tool
	1.2	720-760	250-300	Small cutters, lathe and engraving tools, files drills
High Carbon	1.35	720-760	250-300	Extra hard, planning, turning and slotting tools, dies and mandrels
	1.5	720-760	250-300	Razor blades

NOTE: The forging produced either by hand forging or machine forging should be heat treated.

The following are the purposes of heat treatment:

i. To remove internal stresses set-up during forging and cooling.
ii. To normalize the internal structure of the metal.
iii. To improve machinability.
iv. To improve mechanical properties, strength and hardness.

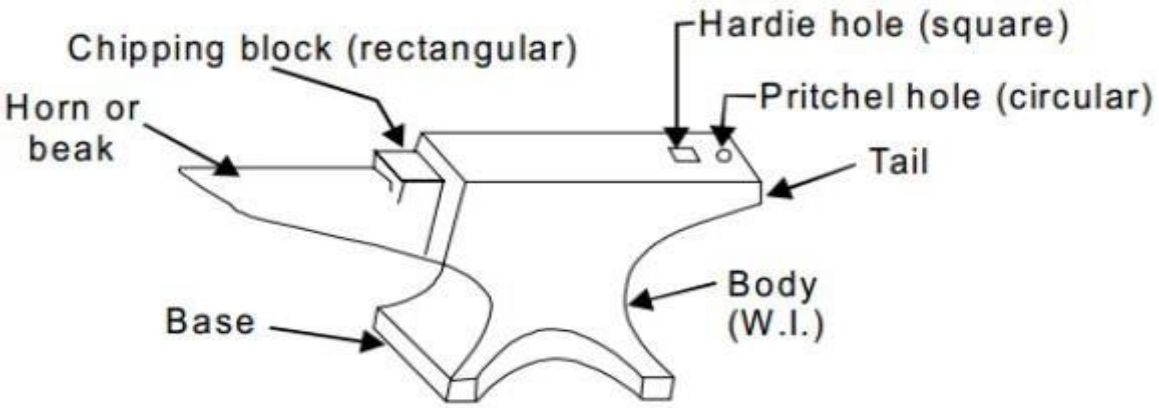


Fig:anvil

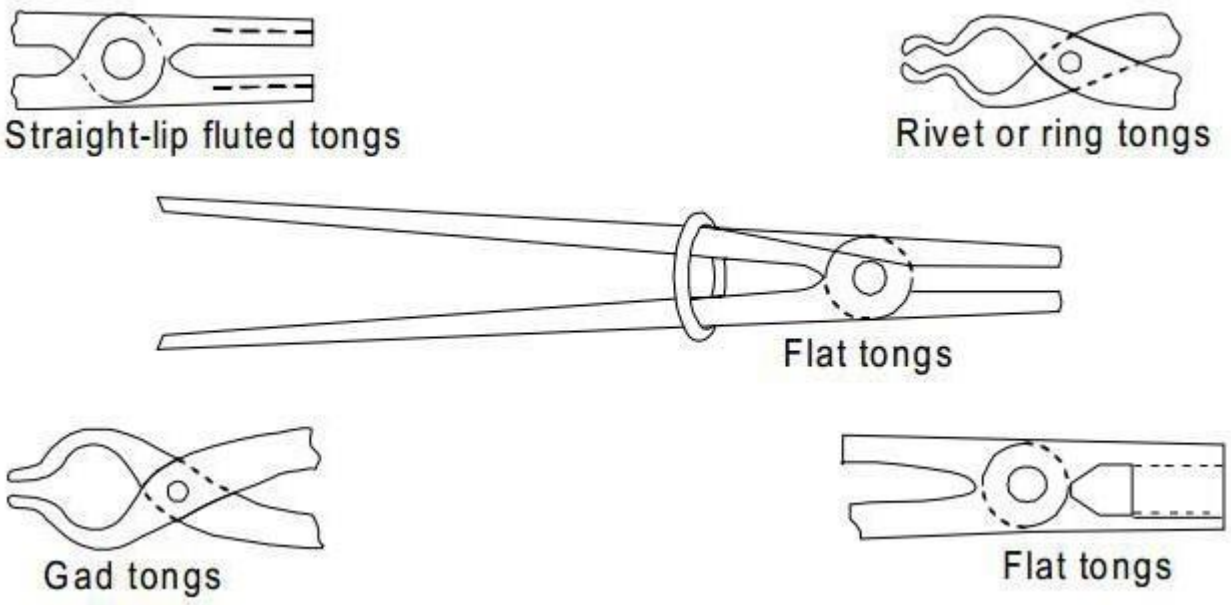


FIG:TYPES OF TONGS

EX.NO:6.1 J -SHAPE DATE:

Aim: To make a J-shape from a given round rod, by following hand forging operation

Tools required:
Smith's forge**,** Anvil**,** 500gm and I kg ball-peen hammers, Flatters, Swage block, Half round tongs, Pick-up tongs, Cold chisel.

SEQUENCE OF OPERATIONS:

1. One end of the bar is heated to red hot condition in the smith's forge for the required length.

2. Using the pick-up tongs; the rod is taken from the forge, and holding it with the half round tongs, the heated end is forged into a tapered pointed end.

3. The length of the rod requires for J shape is estimated and the excess portion is cut-off, using a cold chisel.

4. One half of the rod towards the pointed end is heated in the forge to red hot condition and then bent into circular shape as shown.

5. The other end of the rod is then heated and forged into a tapered pointed end.

6. The straight portion of the rod is finally heated and bent into circular shape as required.

7. Using the flatter, the J shape made as above, is kept on the anvil and flattened so that, the shape of the J is proper.

NOTE: In-between the above stage, the bar is heated in the smith's forge, to facilitate forging operations.

Precautions:

1. Hold the job carefully while heating and hammering

2. Job must be held parallel to the face of the anvil.

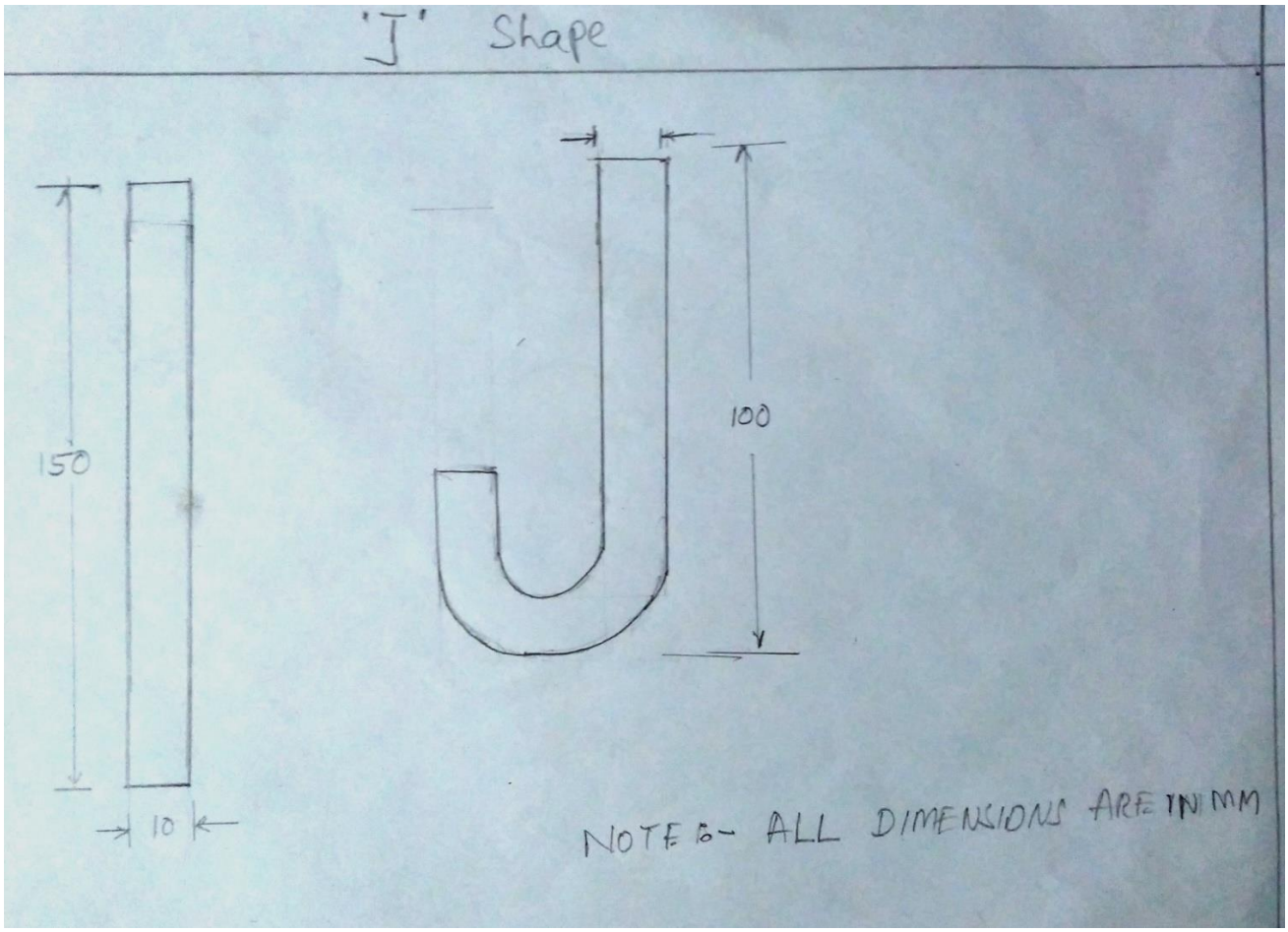
3. Wear steel-toed shoes.

4. Wear face shield when hammering the hot metal

5. Use correct size and type of tongs to fit the work.

Result:

'J' Shape



NOTE:- ALL DIMENSIONS ARE IN MM

VIVA QUESTIONS

Q.1 Name the types of furnace?

Q.2 Name the tools used in smithy shop?

Q.3 Why furnace is used in our workshop?

Q.4 Which type of furnace is used in our workshop?

Q.5 What is use of anvil & swage block?

EX.NO.6.2 S-HOOK DATE:

Aim: To make an S-hook from a given round rod, by following hand forging operation

Tools required:
Smith's forge**,** Anvil**,** 500gm and I kg ball-peen hammers, Flatters, Swage block, Half round tongs, Pick-up tongs, Cold chisel.

SEQUENCE OF OPERATIONS:

1. One end of the bar is heated to red hot condition in the smith's forge for the required length.

2. Using the pick-up tongs; the rod is taken from the forge, and holding it with the half round tongs, the heated end is forged into a tapered pointed end.

3. The length of the rod requires for S-hook is estimated and the excess portion is cut-off, using a cold chisel.

4. One half of the rod towards the pointed end is heated in the forge to red hot condition and then bent into circular shape as shown.

5. The other end of the rod is then heated and forged into a tapered pointed end.

6. The straight portion of the rod is finally heated and bent into circular shape as required.

7. Using the flatter, the S-hook made as above, is kept on the anvil and flattened so that, the shape of the hook is proper.

NOTE: In-between the above stage, the bar is heated in the smith's forge, to facilitate forging operations.

Precautions:

6. Hold the job carefully while heating and hammering

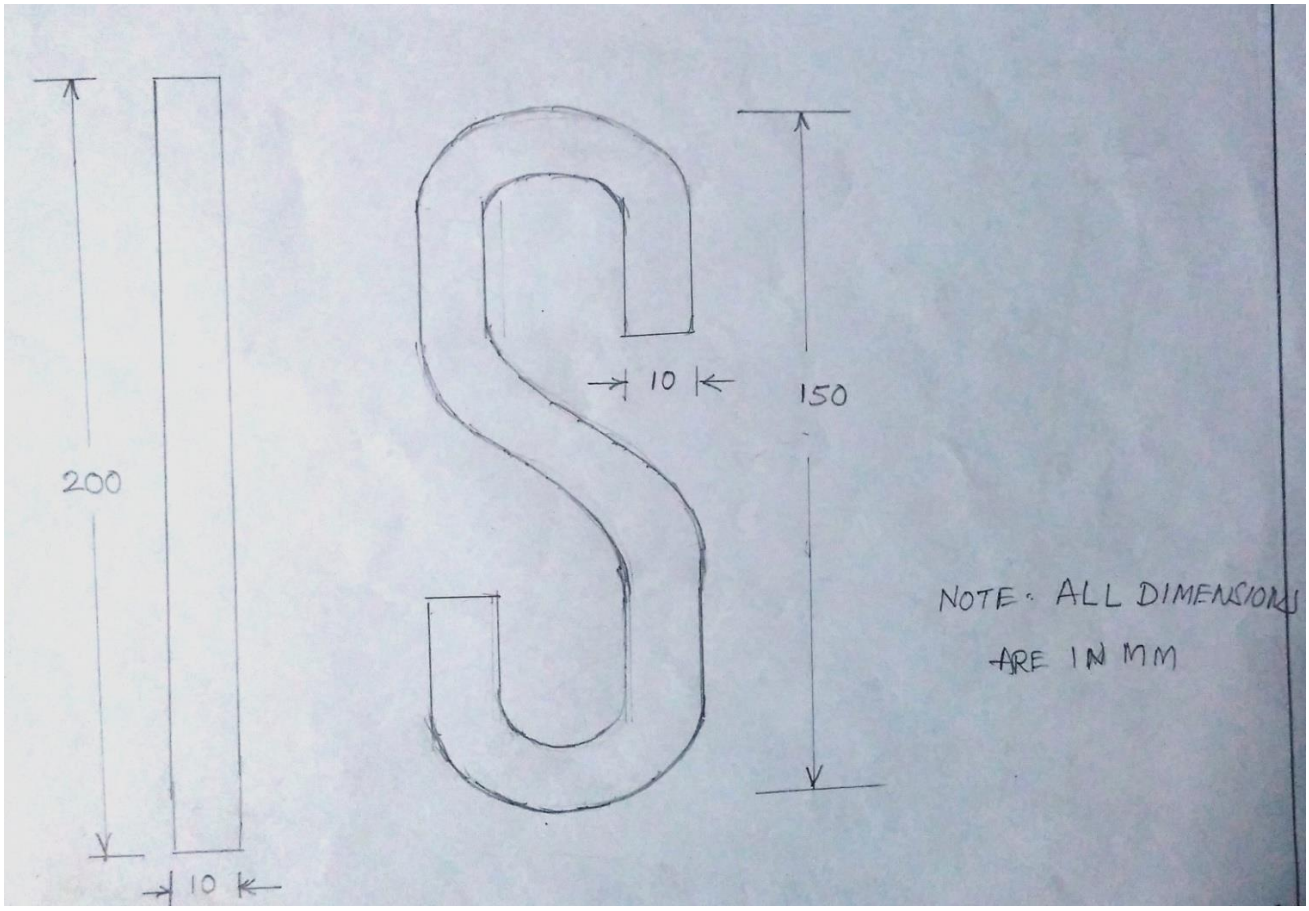
7. Job must be held parallel to the face of the anvil.

8. Wear steel-toed shoes.

9. Wear face shield when hammering the hot metal

10. Use correct size and type of tongs to fit the work.

Result:


200
10
10
150
NOTE: ALL DIMENSIONS
ARE IN MM

VIVA QUESTIONS

Q.1 Name the types of furnace?

Q.2 Name the tools used in smithy shop?

Q.3 Why furnace is used in our workshop?

Q.4 Which type of furnace is used in our workshop?

Q.5 What is use of anvil & swage block?

7. FOUNDRY

PATTERN:

A pattern is a model or the replica of the object (to be casted). It is embedded in molding sand and suitable ramming of molding sand around the pattern is made. The pattern is then withdrawn for generating cavity (known as mold) in molding sand.

COMMON PATTERN MATERIALS:

The common materials used for making patterns are wood, metal, plastic, plaster, wax or Mercury.

TYPES OF PATTERNS:

The types of the pattern and the description of each are given as under.

1. One piece or solid pattern
2. Two piece or split pattern
3. Cope and drag pattern
4. Three-piece or multi- piece pattern
5. Loose piece pattern
6. Match plate pattern
7. Follow board pattern
8. Gated pattern
9. Sweep pattern
10. Skeleton pattern
11. Segmental or part pattern

1. Single-Piece Or Solid Pattern:
Solid pattern is made of single piece without joints, partings lines or loose pieces. It is the simplest form of the pattern. Typical single piece pattern is shown in Fig. 10.1.

2. Two-piece or split pattern: When solid pattern is difficult for withdrawal from the mold cavity, then solid pattern is split in two parts. Split pattern is made in two pieces which are joined at the parting line by means of dowel pins. The splitting at the parting line is done to facilitate the withdrawal of the pattern. A typical example is shown in Fig.

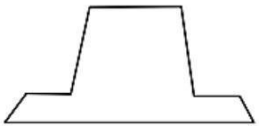
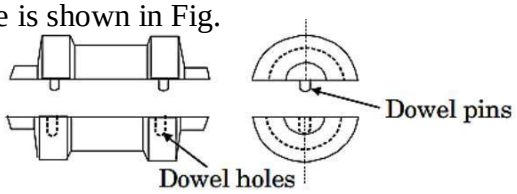


Fig. 10.1 Single piee pattern



MOLDING SAND

- The general sources of receiving molding sands are the beds of sea, rivers, lakes, granular elements of rocks, and deserts.
- Molding sands may be of two types namely natural or synthetic. Natural molding sands contain sufficient binder. Whereas synthetic molding sands are prepared artificially using basic sand molding constituents (silica sand in 88-92%, binder 6-12%, water or moisture content 3-6%) and other additives in proper proportion by weight with perfect mixing and mulling in suitable equipments.

BINDER

- In general, the binders can be either inorganic or organic substance. The inorganic group includes clay sodium silicate and port land cement etc. In foundry shop, the clay acts as binder which may be Kaolonite, Ball Clay, Fire Clay, Limonite, Fuller's earth and Bentonite. Binders included in the organic group are dextrin, molasses, cereal binders, linseed oil and resins like phenol formaldehyde, urea formaldehyde etc. Organic binders are mostly used for core making.

- Among all the above binders, the bentonite variety of clay is the most common. However, this clay alone cannot develop bonds among sand grins without the presence of moisture in molding sand and core sand.

ADDITIVES

Additives are the materials generally added to the molding and core sand mixture to develop some special property in the sand. Some common used additives for enhancing the properties of molding and core sands are discussed as under.

- **Coal dust:** Coal dust is added mainly for producing a reducing atmosphere during casting.
- **Corn flour:** It belongs to the starch family of carbohydrates and is used to increase the collapsibility of the molding and core sand
- **Dextrin:** Dextrin belongs to starch family of carbohydrates that behaves also in a manner similar to that of the corn flour. It increases dry strength of the molds.
- **Sea coal:** Sea coal is the fine powdered bituminous coal which positions its place among the pores of the silica sand grains in molding sand and core sand
- **Wood flour:** This is a fibrous material mixed with a granular material like sand; its relatively long thin fibers prevent the sand grains from making contact with one another.
- **Silica flour:** It is called as pulverized silica and it can be easily added up to 3% which increases the hot strength and finish on the surfaces of the molds and cores

KINDS OF MOULDING SAND

Molding sands can also be classified according to their use into number of varieties which are described below.

1. **Green sand:** Green sand is also known as tempered or natural sand which is a just prepared mixture of silica sand with 18 to 30 percent clay, having moisture content from 6 to 8%. The clay and water furnish the bond for green sand. It is fine, soft, light, and porous.
2. **Dry sand:** Green sand that has been dried or baked in suitable oven after the making mold and cores, is called dry sand. It possesses more strength, rigidity and thermal stability.
3. **Loam sand:** Loam is mixture of sand and clay with water to a thin plastic paste. Loam sand possesses high clay as much as 30-50% and 18% water.
4. **Facing sand:** Facing sand is just prepared and forms the face of the mould. It is directly next to the surface of the pattern and it comes into contact molten metal when the mould is poured. Initial coating around the pattern and hence for mold surface is given by this sand. This sand is subjected severest conditions and must possess, therefore, high strength refractoriness.
5. **Backing sand:** Backing sand or floor sand is used to back up the facing sand and is used to fill the whole volume of the molding flask.

6. **Parting sand:** Parting sand without binder and moisture is used to keep the green sand not to stick to the pattern and also to allow the sand on the parting surface the cope and drag to separate without clinging
7. **Core sand:** Core sand is used for making cores and it is sometimes also known as oil sand. This is highly rich silica sand mixed with oil binders such as core oil which composed of linseed oil, resin, light mineral oil and other bind materials.

PROPERTIES OF MOULDING SAND

The basic properties required in molding sand and core sand are described as under.

1. **Refractoriness:** Refractoriness is defined as the ability of molding sand to withstand high temperatures without breaking down or fusing thus facilitating to get sound casting. It is a highly important characteristic of molding sands. Refractoriness can only be increased to a limited extent
2. **Permeability:** It is also termed as porosity of the molding sand in order to allow the escape of any air, gases or moisture present or generated in the mould when the molten metal is poured into it. All these gaseous generated during pouring and solidification process must escape otherwise the casting becomes defective
3. **Cohesiveness:** It is property of molding sand by virtue which the sand grain particles interact and attract each other within the molding sand.
4. **Green strength:** The green sand after water has been mixed into it, must have sufficient strength and toughness to permit the making and handling of the mould. For this, the sand grains must be adhesive, i.e. thev must be capable of attaching themselves to another body
5. **Dry strength:** As soon as the molten metal is poured into the mould, the moisture in the sand layer adjacent to the hot metal gets evaporated and this dry sand layer must have sufficient strength to its shape in order to avoid erosion of mould wall during the flow of molten metal
6. **Flowability or plasticity:** It is the ability of the sand to get compacted and behave like a fluid. It will flow uniformly to all portions of pattern when rammed and distribute the ramming pressure evenly all around in all directions
7. **Adhesiveness:** It is property of molding sand to get stick or adhere with foreign material such sticking of molding sand with inner wall of molding box
8. **Collapsibility:** After the molten metal in the mould gets solidified, the sand mould must be collapsible so that free contraction of the metal occurs and this would naturally avoid the tearing or cracking of the contracting metal.

HAND TOOLS USED IN FOUNDRY SHOP

Hand riddle: It consists of a screen of standard circular wire mesh equipped with circular wooden frame. It is generally used for cleaning the sand for removing foreign material such as nails, shot metal, splinters of wood etc. from it. Even power operated riddles are available for riddling large volume of sand.

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

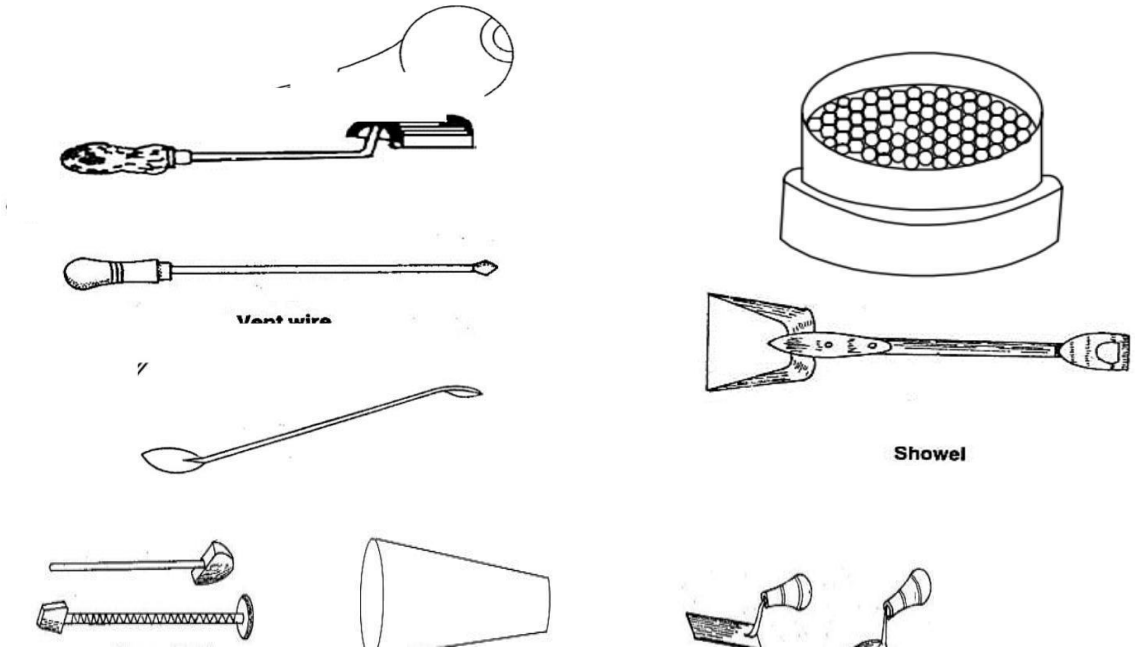


Fig. Rammers Fig. Sprue Pin

Rammers: Rammers are shown in Fig. These are required for striking the molding sand mass in the molding box to pack or compact it uniformly all around the pattern.

Sprue pin: It is a tapered rod of wood or iron which is placed or pushed in cope to join mold cavity while the molding sand in the cope is being rammed.

Trowels: These are used for finishing flat surfaces and comers inside a mould. Common shapes of trowels are shown as under. They are made of iron with a wooden handle.

Lifter: A lifter is a finishing tool used for repairing the mould and finishing the mould sand. Lifter is also
used for removing loose sand from mould**.**

Strike off bar: It is a flat bar, made of wood or iron to strike off the excess sand from the top of a box after ramming.

Its one edge made beveled and the surface perfectly smooth and plane.

Vent wire: It is a thin steel rod or wire carrying a pointed edge at one end and a wooden handle or a bent loop at the other. After ramming and striking off the excess sand it is used to make small holes, called vents, in the sand mould to allow the exit of gases and steam during casting.

Slicks: They are also recognized as small double ended mold finishing tool which are generally used for repairing and finishing the mold surfaces and their edges after withdrawal of the pattern

Swab: Swab is shown in Fig. It is a small hemp fiber brush used for moistening the edges of sand mould, which are in contact with the pattern surface before withdrawing the pattern. It is used for sweeping away the molding sand from the mold surface and pattern.

Gate cutter: Gate cutter is a small shaped piece of sheet metal commonly used to cut runners and feeding gates for connecting sprue hole with the mold cavity.

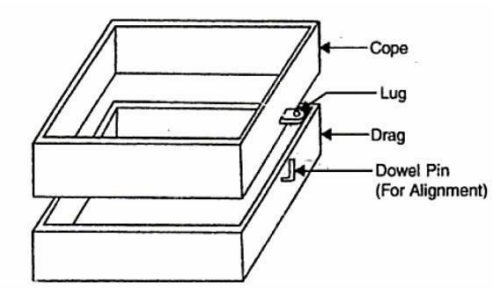
Bellows: Bellows gun is shown in Fig. It is hand operated leather made device equipped with compressed air jet to blow or pump air when operated. It is used to blow away the loose or unwanted sand from the surfaces of mold cavities.

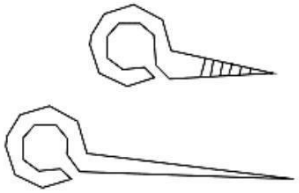
Draw spike: Draw spike is a tapered steel rod having a loop or ring at its one end and a sharp point at the other. It may have screw threads on the end to engage metal pattern for it withdrawal from the mold.

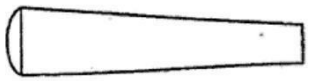
Sprue Pin: It is a tapered wooden pin, used to make a hole in the cope through which the molten metal is poured into the mould.

MOULDING BOX:

Moulding box is also called moulding flask. It is frame or box of wood or metal. It is made of two parts cope and drag as shown in figure.







EX.NO:7.1 MOULD FOR A SOLID DATE:

Aim: To prepare a sand mold, using the given single piece pattern.

Raw material required: Moulding sand, Parting sand, facing sand, baking sand, single piece solid pattern, bottom board, moulding boxes etc.

Tools Required:

1. Molding board
2. Drag and cope boxes
3. Molding sand
4. Parting sand
5. Rammer
6. Strike-off bar
7. Bellows
8. Riser and sprue pins
9. Gate cutter
10. Vent rod
11. Draw spike
12. Wire Brush

Sequence of operations:

1. Sand preparation
2. Placing the mould flask(drag) on the moulding board/ moulding platform
3. Placing the pattern at the centre of the moulding flask
4. Ramming the drag
5. Placing runner and riser
6. Ramming the cope
7. Removal of the pattern, runner, riser
8. Gate cutting

Procedure: Mould Making

1. First a bottom board is placed either on the molding platform or on the floor, making the surface even.
2. The drag molding flask is kept upside down on the bottom board along with the drag part of the pattern at the centre of the flask on the board.
3. Dry facing sand is sprinkled over the board and pattern to provide a non-sticky layer.
4. Freshly prepared molding sand of requisite quality is now poured into the drag and on the pattern to a thickness of 30 to 50 mm.
5. Rest of the drag flask is completely filled with the backup sand and uniformly rammed to compact the sand.

6. After the ramming is over, the excess sand in the flask is completely scraped using a flat bar to the level of the flask edges.
7. Now with a vent wire which is a wire of 1 to 2 mm diameter with a pointed end, vent holes are in the drag to the full depth of the flask as well as to the pattern to facilitate the removal of gases during casting solidification. This completes the preparation of the drag.
8. Now finished drag flask is rolled over to the bottom board exposing the pattern.
9. Using a slick, the edges of sand around the pattern is repaired
10. The cope flask on the top of the drag is located aligning again with the help of the pins of the drag box.
11. Sprue of the gating system for making the sprue passage is located at a small distance of about 50 mm from the pattern. The sprue base, runners and in-gates are also located as shown risers are also placed. Freshly prepared facing sand is poured around the pattern.
12. The moulding sand is then poured in the cope box. The sand is adequately rammed, excess sand is scraped and vent holes are made all over in the cope as in the drag.
13. The sprue and the riser are carefully withdrawn from the flask
14. Later the pouring basin is cut near the top of the sprue.
15. The cope is separated from the drag any loose sand on the cope and drag interface is blown off with the help of the bellows.
16. Now the cope and the drag pattern halves are withdrawn by using the draw spikes and rapping the pattern all around to slightly enlarge the mould cavity so that the walls are not spoiled by the withdrawing pattern.
17. The runners and gates are to be removed or to be cut in the mould carefully without spoiling the mould.
18. Any excess or loose sand is applied in the runners and mould cavity is blown away using the bellows.
19. Now the facing paste is applied all over the mould cavity and the runners which would give the finished casting a good surface finish.
20. A dry sand core is prepared using a core box. After suitable baking, it is placed in the mould cavity.
21. The cope is placed back on the drag taking care of the alignment of the two by means of the pins.
22. The mould is ready for pouring molten metal. The liquid metal is allowed to cool and become solid which is the casting desired.

Result:

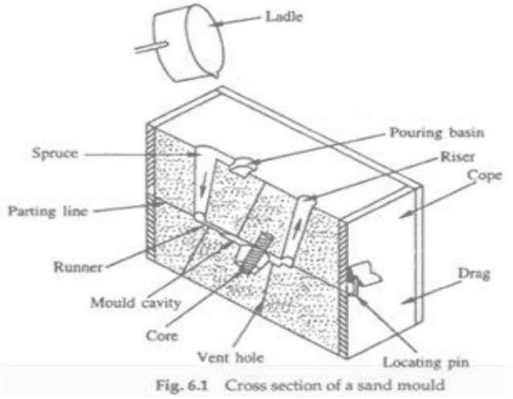
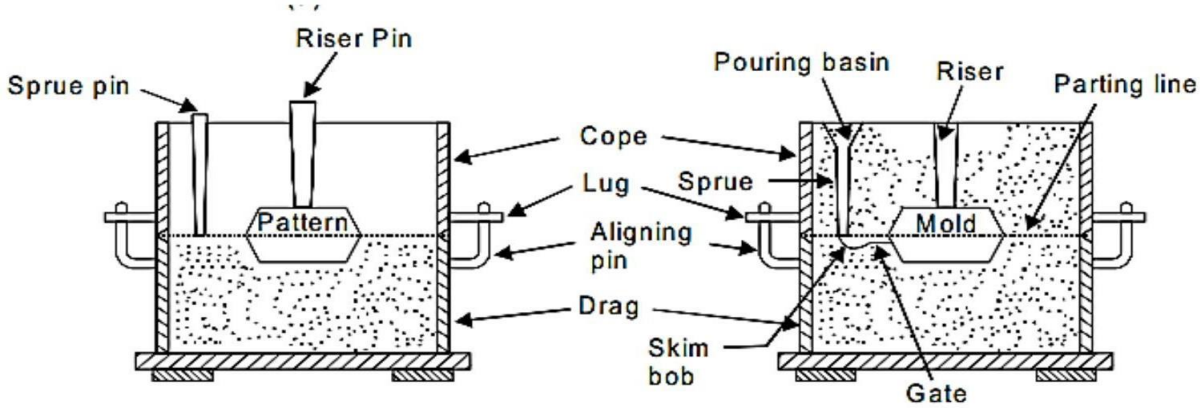


Fig. 6.1 Cross section of a sand mould



EX.NO:7.2 MOULD FOR A SPLIT PATTERN DATE:

Aim: To prepare a sand mold, using the given Split-piece pattern.

Raw Material required: Moulding sand, Parting sand, facing sand, baking sand, pattern, bottom board,

moulding boxes.

Tools Required:

1. Molding board
2. Drag and cope boxes
3. Molding sand
4. Parting sand
5. Rammer
6. Strike-off bar
7. Bellows
8. Riser and sprue pins
9. Gate cutter
10. Vent rod
11. Draw spike
12. Wire Brush

Sequence of operations:

1. Sand preparation
2. Placing the mould flask(drag) on the moulding board/ moulding platform
3. Placing the split pattern at the centre of the moulding flask
4. Ramming the drag
5. Placing the pattern at the centre of the moulding flask (Cope box)
6. Placing runner and riser
7. Ramming the cope
8. Removal of the pattern, runner, riser
9. Gate cutting

Procedure: Mould Making

1. First a bottom board is placed either on the molding platform or on the floor, making the surface even.
2. The drag molding flask is kept upside down on the bottom board along with the drag part of the pattern at the centre of the flask on the board.
3. Dry facing sand is sprinkled over the board and pattern to provide a non-sticky layer.

4. Freshly prepared molding sand of requisite quality is now poured into the drag and on the split-pattern to a thickness of 30 to 50 mm.
5. Rest of the drag flask is completely filled with the backup sand and uniformly rammed to compact the sand.
6. After the ramming is over, the excess sand in the flask is completely scraped using a flat bar to the level of the flask edges.
7. Now with a vent wire which is a wire of 1 to 2 mm diameter with a pointed end, vent holes are in the drag to the full depth of the flask as well as to the pattern to facilitate the removal of gases during casting solidification. This completes the preparation of the drag.
8. Now finished drag flask is rolled over to the bottom board exposing the pattern.
9. Using a slick, the edges of sand around the pattern is repaired and cope half of the pattern is placed over the drag pattern, aligning it with the help of dowel pins
10. The cope flask on the top of the drag is located aligning again with the help of the pins of the drag box.
11. Dry parting sand is sprinkled all over the drag surface and on the pattern
12. Sprue of the gating system for making the sprue passage is located at a small distance of about 50 mm from the pattern. The sprue base, runners and ingates are also located as shown risers are also placed. Freshly prepared facing sand is poured around the pattern.
13. The moulding sand is then poured in the cope box. The sand is adequately rammed, excess sand is scraped and vent holes are made all over in the cope as in the drag.
14. The sprue and the riser are carefully withdrawn from the flask
15. Later the pouring basin is cut near the top of the sprue.
16. The cope is separated from the drag any loose sand on the cope and drag interface is blown off with the help of the bellows.
17. Now the cope and the drag pattern halves are withdrawn by using the draw spikes and rapping the pattern all around to slightly enlarge the mould cavity so that the walls are not spoiled by the withdrawing pattern.
18. The runners and gates are to be removed or to be cut in the mould carefully without spoiling the mould.
19. Any excess or loose sand is applied in the runners and mould cavity is blown away using the bellows.
20. Now the facing paste is applied all over the mould cavity and the runners which would give the finished casting a good surface finish.

21. A dry sand core is prepared using a core box. After suitable baking, it is placed in the mould cavity.

22. The cope is placed back on the drag taking care of the alignment of the two by means of the pins.

23.The mould is ready for pouring molten metal. The liquid metal is allowed to cool and become solid which is the casting desired.

Result:

SPLIT PATTERN.

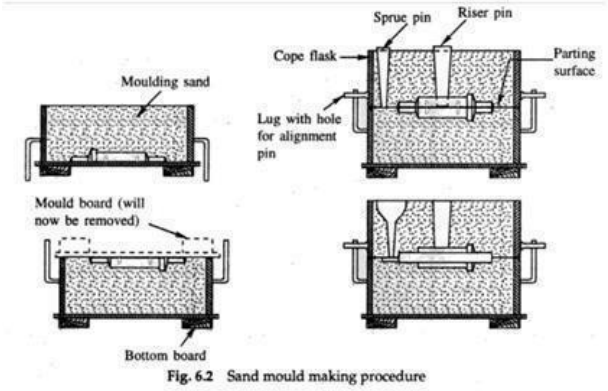
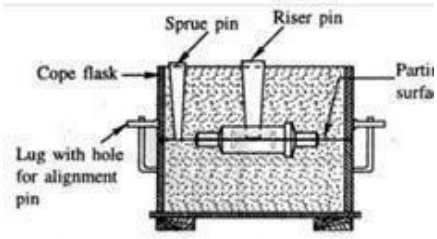
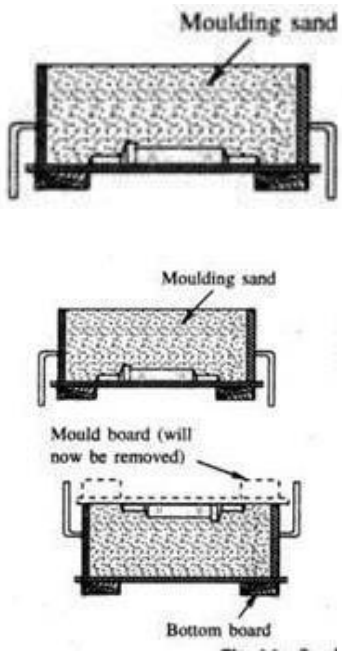


Fig. 6.2 Sand mould making procedure





Step :1 Place Drag part of the pattern on mould board and filled with mould sand

Step -2: Turn drag box upside down and Place cope box over drag box

Step -3: place cope part of the pattern ,riser, Sprue, runner in position and filled with mould sand.

Step-4: Finally the Mould cavity is produced by removing the pattern .

VIVA QUESTIONS

1. List the tools and equipment used in foundry.

2. List the Hand tools used in Foundry.

3. What is the function of Hand riddle?

4. What is a Rammer?

5. What is the use of Vent wire in foundry?

6. What is a Mallet?

7. What is a Swab?
8. What are Goggers?

9. What is the use of Bellow?

10. Mention the use of Trowels?

11. What are Slicks?

12. Which is the commonly used Slick?

13. List the containers used in foundry.

8.PLUMBING

Introduction

Plumbing refers to installation of pipelines, water tanks and other pipe fittings to distribute water in a building.

Best practices

1. Loose clothing should be avoided.

2. Wear shoes while working in the shop.

3. Tools should be placed in their respective places after proper cleaning.

4. Always use the right tool for the job.

5. Keep the cutting tools separate from the measuring tools.

6. Sharp edges of the cutting tools should be covered when they are not in use.

Plumbing Tools

Plumbing tools are many. The following tools are commonly used to install 25mm size pipelines. PVC (Poly Vinyl Chloride) pipes and GI (Galvanized Iron) pipes are commonly used in plumbing.

Pipe wrenchA pipe wrench is used to hold and rotate the pipes to tight them. It consists of a fixed jaw, a movable jaw with adjusting screw.

Pipe vice A pipe vice in used to hold the pipe during cutting, making threads at the ends of the pipe, fitting of couplings, etc. It also consists of a fixed jaw, a movable jaw and a screw with handle for adjustment.

Pipe Fittings

A PVC pipe connection uses fitting like elbow, bend, coupling, tee reducer, etc. Fitting like couplings, elbow, bend, union, nipple, tee reducer, plug, cap, flange, etc. with V-threads are commonly used in GI pipe connections.

Valves and Taps

A gate valve or globe valve is commonly used in the main pipeline to control/regulate the floe of water through it. Valves are usually made of cast iron or brass.

A domestic tap is commonly used to collect or tap water at desired points in the pipelines. Taps are made of brass, steel or plastic.

Flow Control Angle Valve

Flow control angle valve is used along with the applications to regulate the flow of water. The outlet of the valve and the control knob are at 90 degrees which is convenient to operate it.

Hacksaw

A hacksaw is used to cut pipes. It has a frame where the blade is tightened by means of a wing nut.

Screw Drivers

Screw drivers are used to tighten screws in the appliances. Screw drivers of various sizes are used.

Hammers

Ball peen hammer is commonly used in plumbing work where greater power is required in striking.

Measuring Tape

Measuring tape is used to measure the length of the pipe and also to mark the locations of the fittings, valves and appliances.

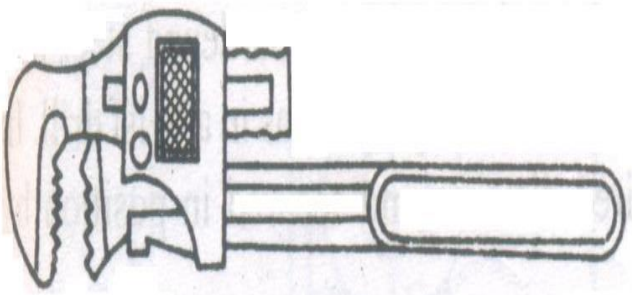


Fig: 1 pipe wrench

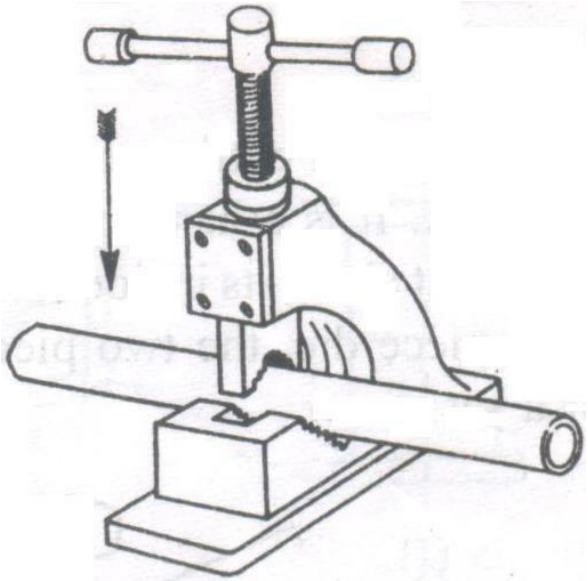


Fig: 2 pipe vice

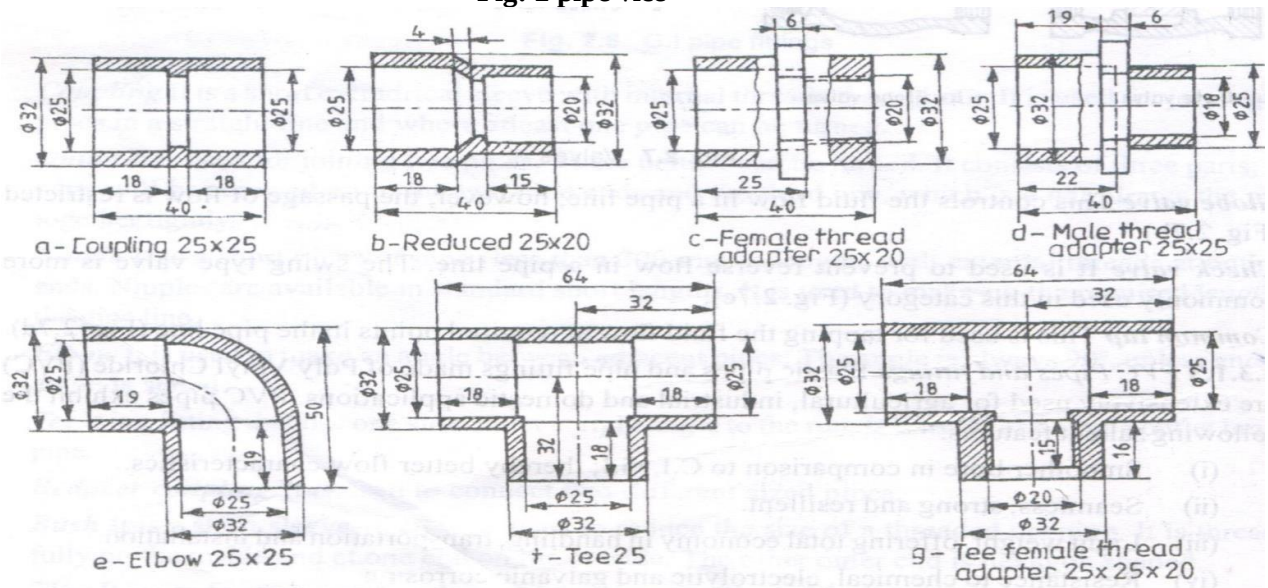


Fig: 3 PVC pipe fittings

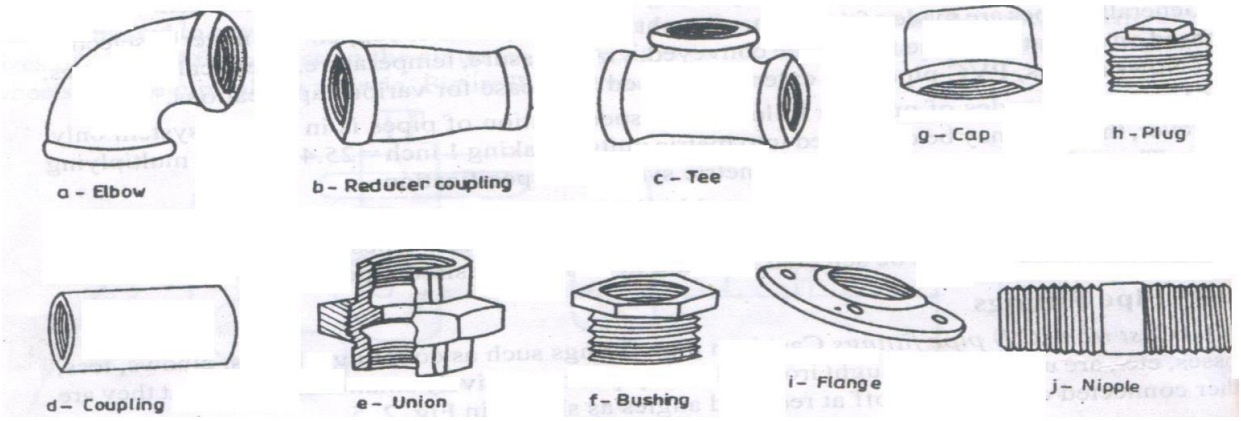


Fig : 4 GI Pipe fittings

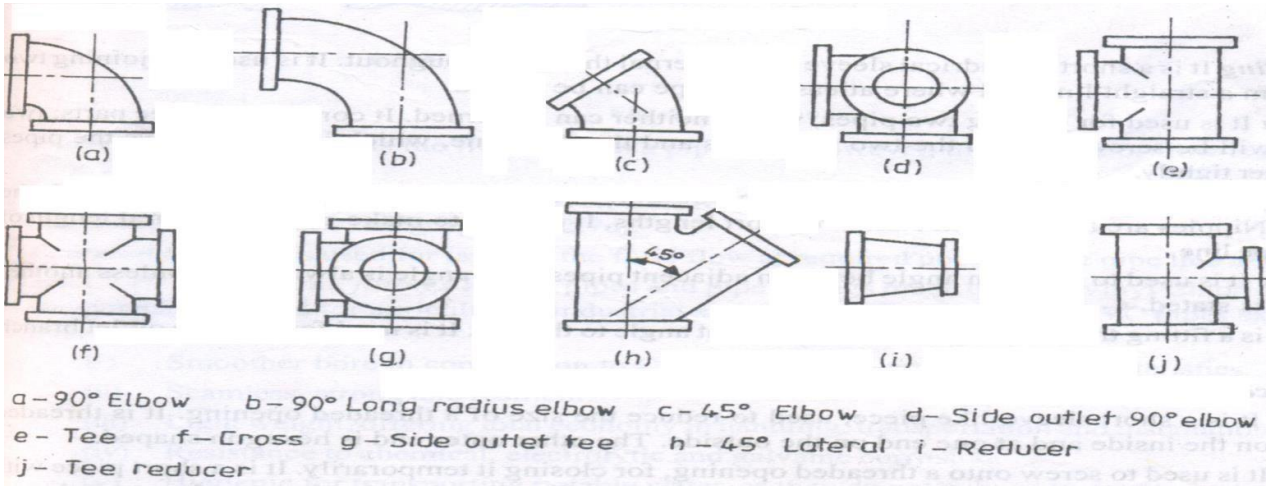


Fig: 5 CI Pipe fitting

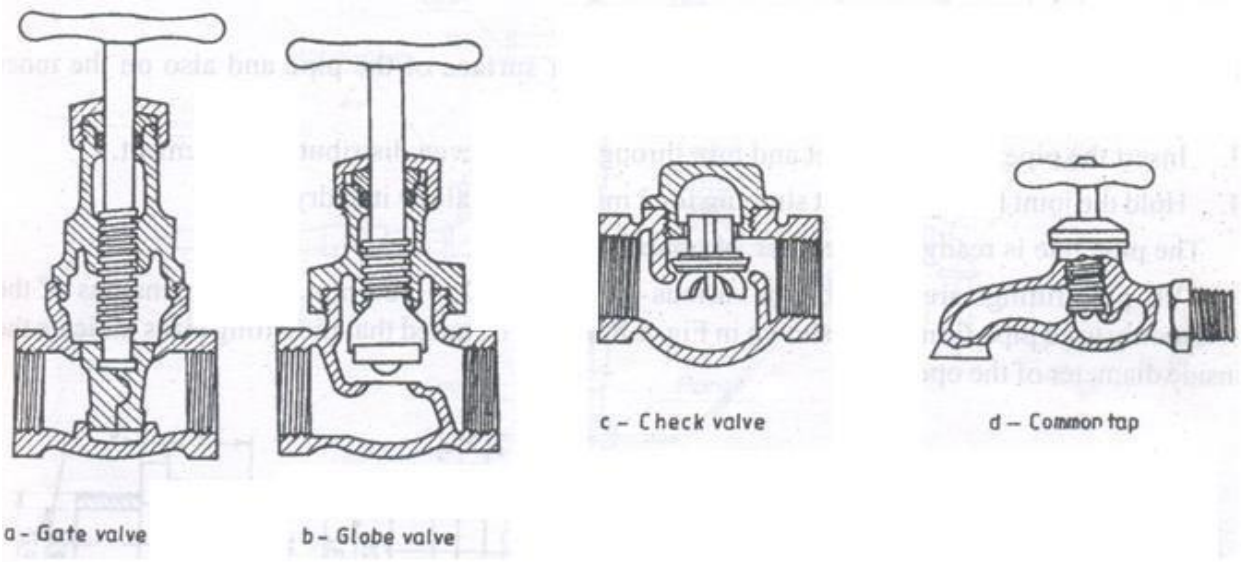


Fig: 5 valves and tap

9.MACHINE SHOP

INTRODUCTION

In a machine shop, metals are cut to shape on different machine tools. A lathe is used to cut and shape the metal by revolving the work against a cutting tool. The work is clamped either in a chuck,fitted on to the lathe spindle or in-between the centers. The cutting tool is fixed in a tool post, mountedon a movable carriage that is positioned on the lathe bed. The cutting tool can be fed on to the work,either lengthwise or cross-wise. While turning, the chuck rotates in counter-clockwise direction, whenviewed from the tail stock end.

principal parts of a Lathe

Figure.1 shows a center lathe, indicating the main parts. The name is due to the fact that work pieces are held by the centers.

Bed

It is an essential part of a lathe, which must be strong and rigid. It carries all parts of the machine and resists the cutting forces. The carriage and the tail stock move along the guide ways provided on the bed. It is usually made of cast iron.

Head stock

It contains either a cone pulley or gearings to provide the necessary range of speeds and feeds. It contains the main spindle, to which the work is held and rotated.

Tail stock

It is used to support the right hand end of a long work piece. It may be clamped in any position along the lathe bed. The tail stock spindle has an internal Morse taper to receive the dead center thatsupports the work. Drills, reamers, taps may also be fitted into the spindle, for performing operationssuch as drilling, reaming and tapping.

Carriage or Saddle

It is used to control the movement of the cutting tool. The carriage assembly consists of the longitudinal slide, cross slide and the compound slide and apron. The cross slide moves across the lengthof the bed and perpendicular to the axis of the spindle. This movement is used for facing and to providethe necessary depth of cut while turning. The apron, which is bolted to the saddle, is on the front of thelathe and contains the longitudinal and cross slide controls.

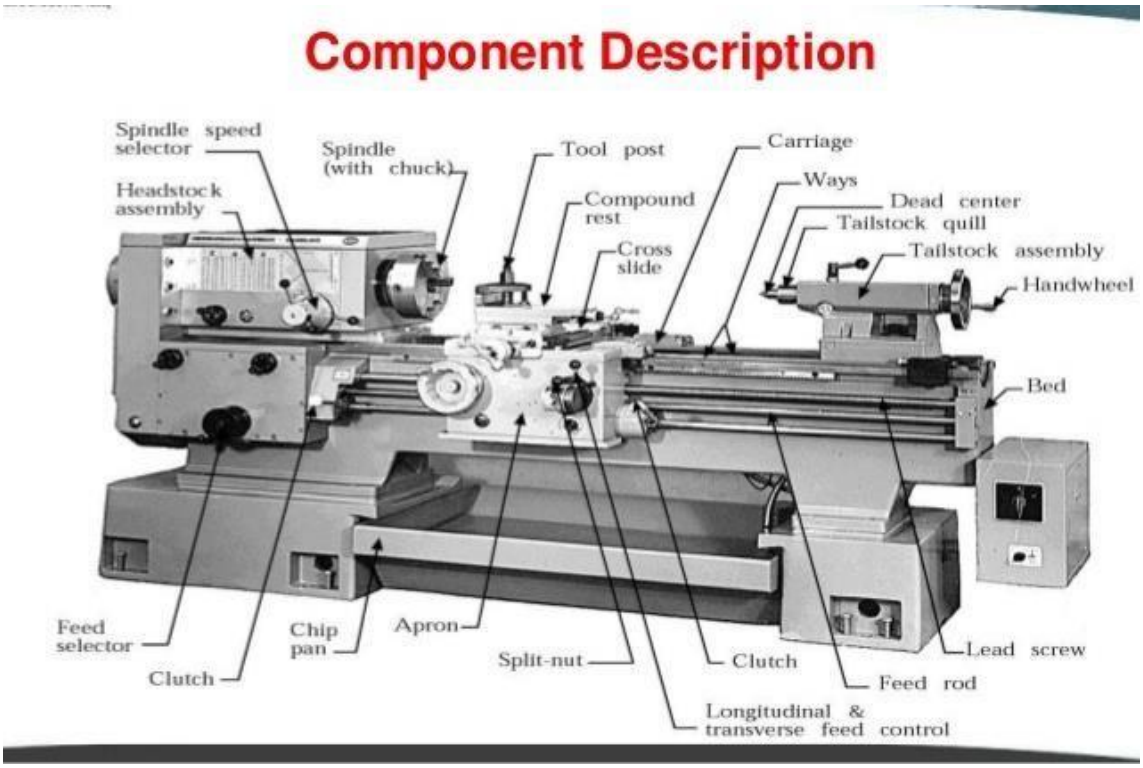


Fig :1 Parts of a center Lathe

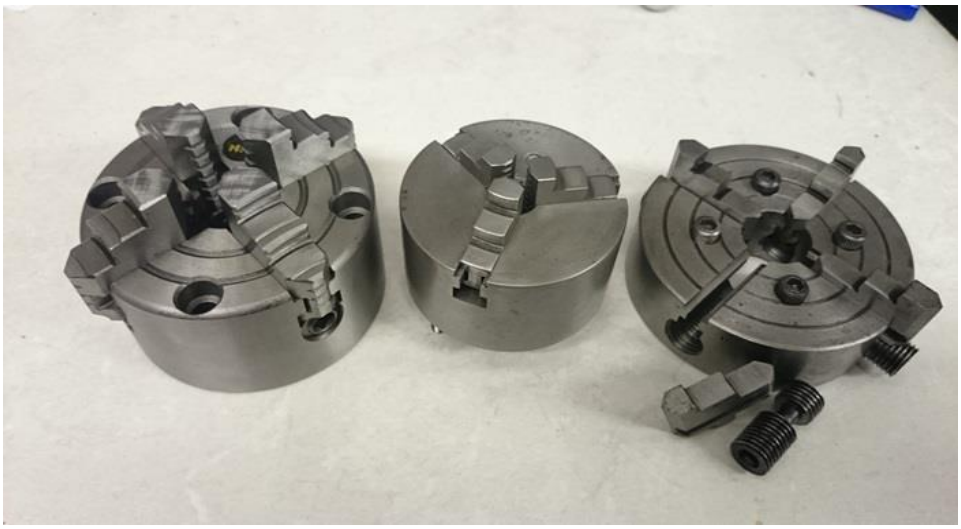


Fig :2 three jaw and four jaw chuck

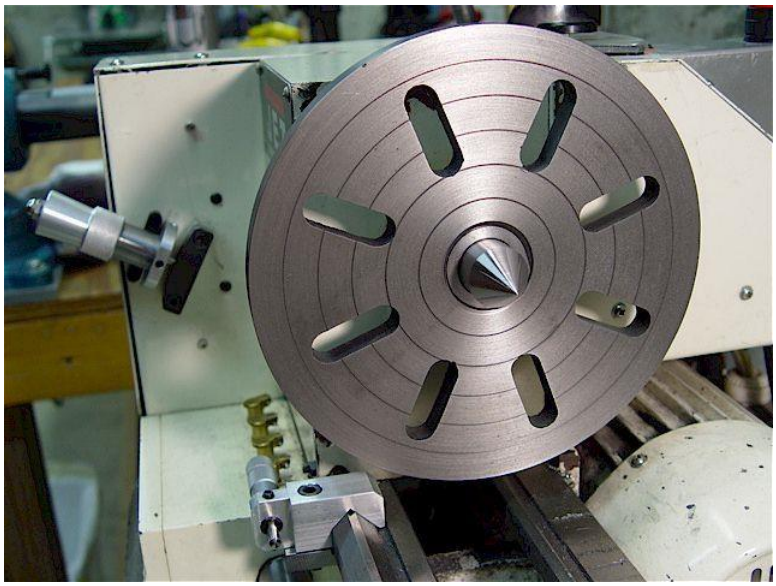


Fig:3 face plate

Fig :4 lathe dog and driving plate

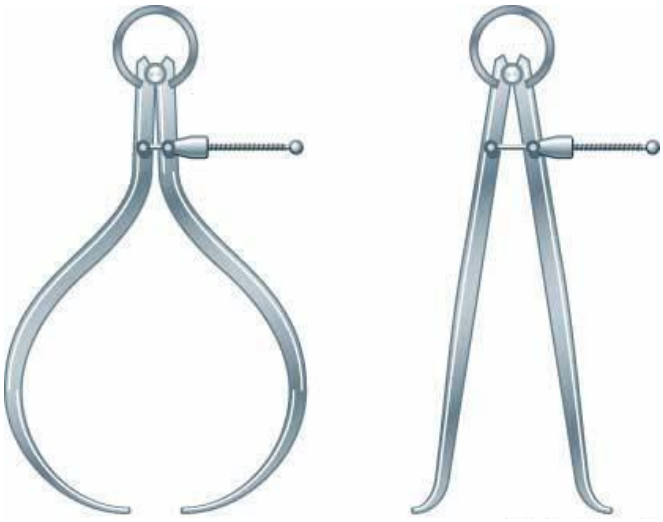


Fig: 5 calipers(outside and inside)

Compound Rest

It supports the tool post. By swiveling the compound rest on the cross slide, short tapers may be turned to any desired angles.

Tool Post

The tool post, holds the tool holder or the tool, which may be adjusted to any working position.

Lead Screw

It is a long threaded shaft, located in front of the carriage, running from the head-stock to the tail stock. It is geared to the spindle and controls the movement of the tool, either for automatic feeding or for cutting threads.

Centers

There are two centers known as dead center and live center. The dead center is positioned in the tail stock spindle and the live center, in the head-stock spindle. While turning between centers, thedead center does not revolve with the work while the live center revolves with the work.

WORK-HOLDING DEVICES

1. Three jaw chuck

It is a work holding device having three jaws (self-centering) which will close or open with respect to the chuck center or the spindle center, as shown in figure. It is used for holding regular objects like round bars, hexagonal rods, etc.

Face plate

It is a plate of large diameter, used for turning operations. Certain types of work that cannot be held in chucks are held on the face plate with the help of various accessories.

Lathe dogs and driving plate

These are used to drive a work piece that is held between centers. These are provided with an opening to receive and clamp the work piece and dog tail, the tail of the dog is carried by the pin provided in the driving plate for driving the work piece.

MEASURING INSTRUMENTS

1. Outside And Inside Calipers:

Firm joint or spring calipers are used for transfer of dimensions with the help of a steel rule.

2. Venire Calipers

Venire caliper is a versatile instrument with which both outside and inside measurements may be made accurately. These instruments may have provision for depth measurement also.

3. Micrometers

Outside and inside micrometers are used for measuring components where greater accuracy is required.

CUTTING PARAMETERS

1. Cutting speed

It is defined as the speed at which the material is removed and is specified in meters per minute. It depends upon the work piece material, feed, depth of cut, type of operation and so many other cutting conditions. It is calculated from the relation,

$$\text{Spindle speed (RPM)} = \text{cutting speed} \times 1000 / (\pi D)$$

Where D is the work piece diameter in mm.

2. Feed

It is the distance traversed by the tool along the bed, during one revolution of the work. Its value depends upon the depth of cut and surface finish of the work desired.

3. Depth of Cut

It is the movement of the tip of the cutting tool, from the surface of the work piece and perpendicular to the lathe axis. Its value depends upon the nature of operation like rough turning or finish turning.

TOOL MATERIALS

General purpose hand cutting tools are usually made from carbon steel or tool steel. The single point lathe cutting tools are made of high-speed steel (HSS). the main alloying elements in 18-4-1 HSS tools are 18 percent tungsten, 4 percent chromium and 1 percent vanadium.5 to 10 percent cobalt is also added to improve the heat resisting properties of the tool. Carbide tipped tools fixed in tool holders, are mostly used in production shops.

LATHE OPERATIONS

1. TURNING

Cylindrical shapes, both external and internal, are produced by turning operation. Turning is the process in which the material is removed by a traversing cutting tool, from the surface of a rotating workpiece. The operation used for machining internal surfaces is often called the boring operation in which a hole previously drilled is enlarged.For turning long work, first it should be faced and center drilled at one end and then supported by means of the tail-stock centre.

2.BORING

Boring is enlarging a hole and is used when correct size drill is not available. However, it should be noted that boring cannot make a hole.

3.FACING

Facing is a machining operation, performed to make the end surface of the work piece, flat and perpendicular to the axis of rotation. For this, the work piece may be held in a chuck and rotated about the lathe axis. A facing tool is fed perpendicular to the axis of the lathe. The tool is slightly inclined towards the end of the work piece.

4.TAPER TURNING

A taper is defined as the uniform change in the diameter of a work piece, measured along its length. It is expressed as a ratio of the difference in diameters to the length. It is also expressed in degrees of half the included (taper) angle.Taper turning refers to the production of a conical surface, on the work piece on a lathe.Short steep tapers may be cut on a lathe by swiveling the *compound rest* to the required angle. Here,the cutting tool is fed by means of the compound slide feed handle. The work piece is rotated in a chuckor face plate or between centers.

5.DRILLING

Holes that are axially located in cylindrical parts are produced by drilling operation, using a twist drill. For this, the work piece is rotated in a chuck or face plate. The tail stock spindle has a standard taper. The drill bit is fitted into the tail stock spindle directly or through drill chuck. The tail stock is then moved over the bed and clamped on it near the work. When the job rotates, the drill bit is fed into the work by turning the tail stock hand wheel.

6.KNURLING

It is the process of embossing a diamond shaped regular pattern on the surface of a work piece using a special knurling tool. This tool consists of a set of hardened steel rollers in a holder with the teeth cut on their surface in a definite pattern. The tool is held rigidly on the tool post and the rollers are pressed against the revolving work piece to squeeze the metal against the multiple cutting edges. The purpose of knurling is to provide an effective gripping surface on a work piece to prevent it from slipping when operated by hand.

7.CHAMFERING

It is the operation of beveling the extreme end of a work piece. Chamfer is provided for better look, to enable nut to pass freely on threaded work piece, to remove burrs and protect the end of the work piece from being damaged.

8.THREADING

Threading is nothing but cutting helical groove on a work piece. Threads may be cut either on the internal or external cylindrical surfaces. A specially shaped cutting tool, known as thread cutting tool, is used for this purpose. Thread cutting in a lathe is performed by traversing the cutting tool at a definite rate, in proportion to the rate at which the work revolves.

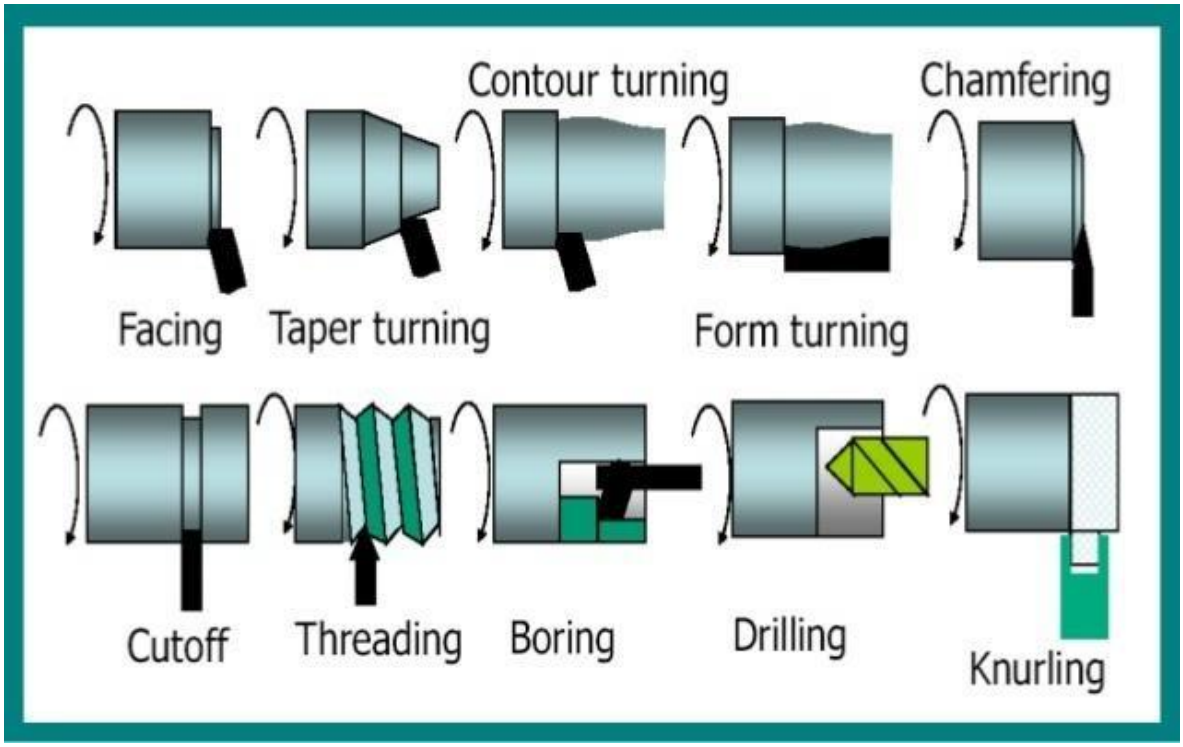


Fig: 6 operations on lathe

10.TRADES FOR DEMONSTRATION

METAL CUTTING

(WATER PLASMA)

Introduction:

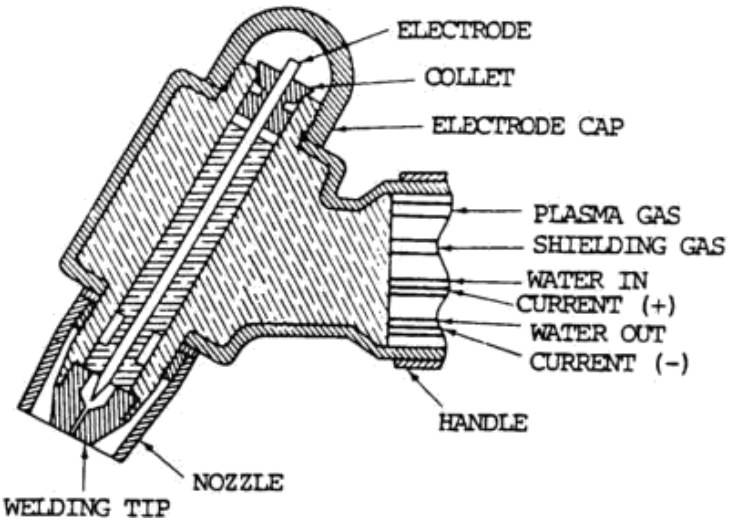
Plasma may be defined as the charged particle which are close together so that, each particle influences many charged particles, rather than interactive with nearby particles. Plasma is typically an ionized gas and it is considered to be distinct state of matter, because of its unique properties.

Water Plasma:

It is a multi-functional, portable and hand-held device. It is a technological breakthrough in the area of metal cutting, welding, soldering, tempering, spraying etc. as maximum efficiency is achieved when plasma technique is used. Usage of water plasma tool for welding in gas mode is similar to the regular gas welding process. The difference is that electric power and water are used instead of gas tanks to produce a high temperature jet flame.

Plasma cutting:

It is a process that is used to cut steel and other metals of different thicknesses (or sometimes other materials) using a plasma torch. In this process, an inert gas (in some units, compressed air) is blown at high speed out of a nozzle; at the same time an electrical arc is formed through that gas from the nozzle to the surface being cut, turning some of that gas to plasma. The plasma is sufficiently hot to melt the metal being cut and moves sufficiently fast to blow molten metal away from the cut. Plasma cutters use a number of methods to start the arc. In some units, the arc is created by putting the torch in contact with the work piece. Some cutters use a high voltage, high frequency circuit to start the arc. This method has a number of disadvantages, including risk of electrocution, difficulty of repair, spark gap maintenance, and the large amount of radio frequency emissions.



CROSS-SECTION OF A PLASMA TORCH HEAD

The Electrode: The primary function of the electrode is to provide power to the plasma arc. Electrode wear is detected by examining the insert and measuring pit depth. Excessive electrode wear reduces cut quality and can result in damage to the plasma torch. Premature electrode wear is most often caused by a few common culprits, the most common being mismatched torch parts. Other contributors may include incorrect gas flow settings, gas leaks, moisture build-up and impurities in the plasma gas.

The Nozzle: The nozzle limits the plasma arc to a specific diameter through a perfectly round hole in it's' tip. It constricts the plasma gas, increasing it's' velocity. The most common cause of nozzle damage is, once again, mismatched torch parts. The electrode and nozzle should be changed as a set to keep cut quality astatine it's very highest.

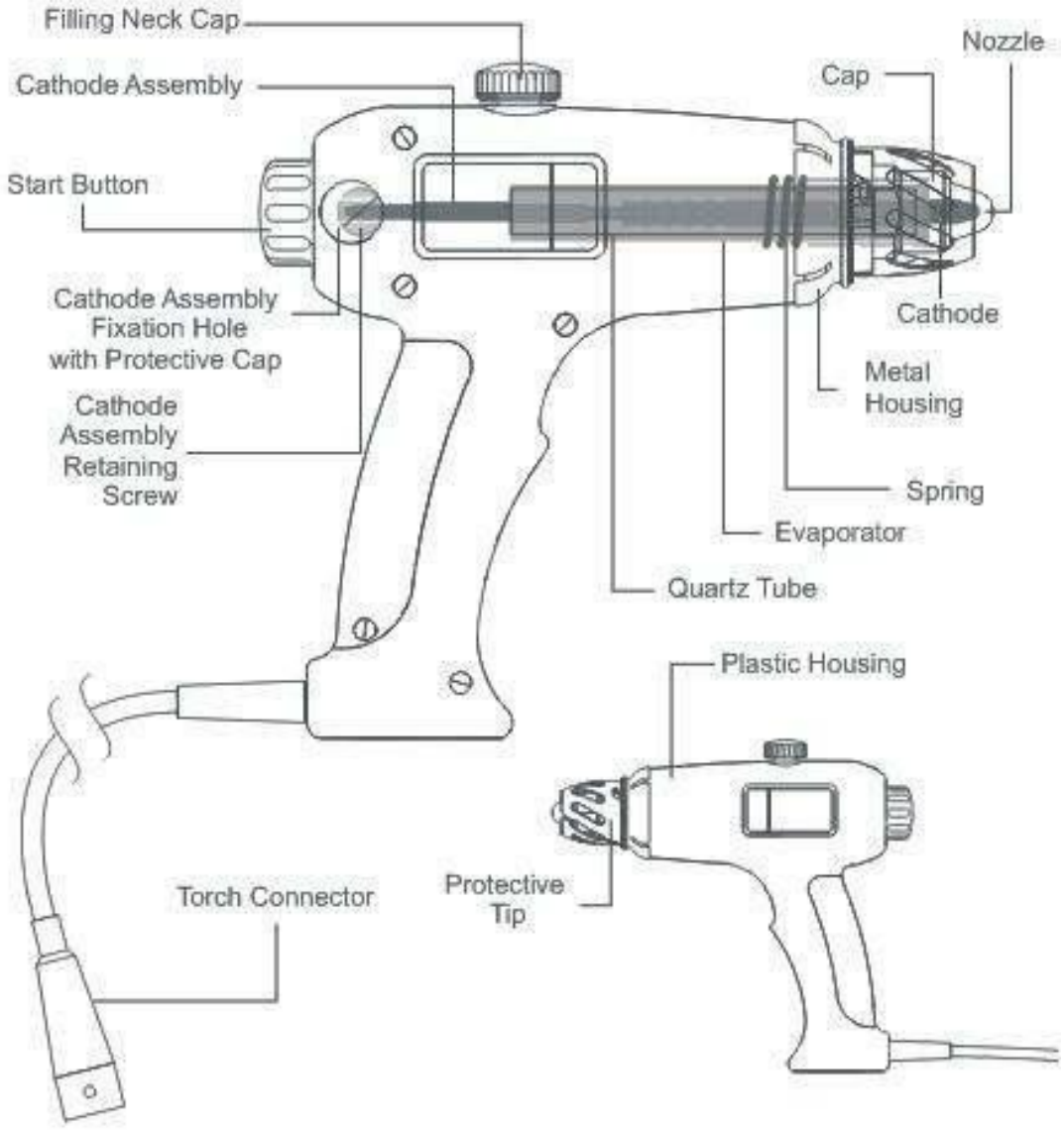
The Shield: The shield surrounds the consumable stack, protecting the parts from damage. It contains an identical, perfectly round hole as the Nozzle. The most common trouble associated with the shield is damage to the main orifice due to being plugged or clogged by dross or spatter.

The Swirl Ring: The swirl ring creates and controls the swirling action of the gas as it flows around the electrode and nozzle. When inspected and

cleaned regularly, the swirl rings will outlive many electrode and nozzle changes. A choked swirl ring will hamper gas flow, decrease cut quality and shorten electrode and nozzle life.

Principle of operation:

The torch is activated by pressing the knob already filled with working fluid. When the knob is pressed, movable cathode module slides forward and touches the nozzle anode; and completes the anode cathode short circuit. After releasing the knob, the cathode module moves back by means of the return spring and an electric arc between the cathode tip and nozzle-anode.

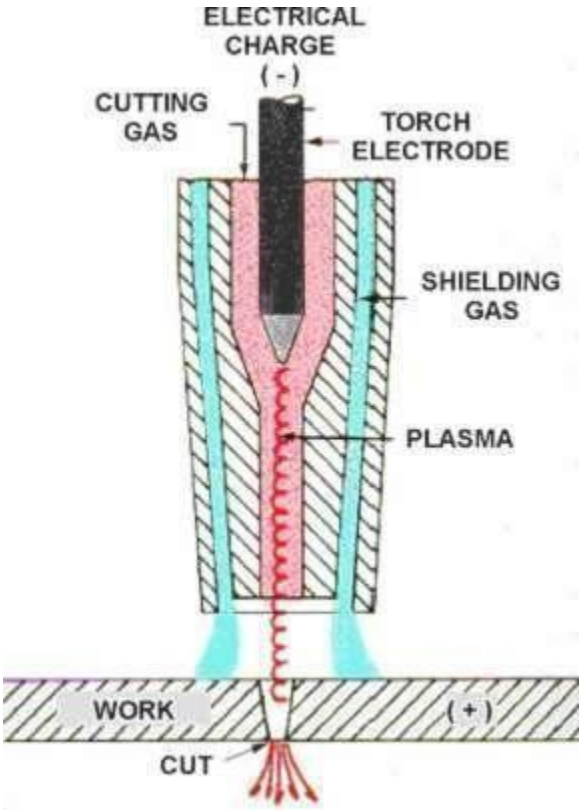


PLASMA TORCH

Working of Plasma Cutter:

Plasma cutters work by sending an electric arc through a gas that is passing through a constricted opening. The gas can be shop air, nitrogen, argon, oxygen etc. This elevates the temperature of the gas to the point that it enters a 4th state of matter. We all are familiar with the first three: i.e., solid, liquid, and gas. Scientists call this additional state plasma. As the metal being cut is part of the circuit, the electrical conductivity of the plasma causes the arc to transfer to the work.

The restricted opening (nozzle) causes the gas passing through it to squeeze by at a high speed, like air passing through a venturi in a carburetor. This high speed gas cuts through the molten metal. The gas is also directed around the perimeter of the cutting area to shield the cut.



PLASMA CUTTING

Advantages:

3. Plasma tool is cost effective, portable and less power consumption.
4. Does not require lightening as the flame produces effective illumination.
5. The device can be operated continuously.

11.POWER TOOLS

Introduction:

A power tool is a tool powered by an electric motor, an internal combustion engine, a steam engine, compressed air, direct burning of fuels and propellants, or even natural power sources like wind or moving water. Power tools are classified as either stationary or portable, where portable means handheld. They are used in industry, in construction, and around the house for driving, drilling, cutting, shaping, sanding, grinding, polishing, painting, and heating.

Stationary power tools for metalworking are usually called machine tools. The term machine tool is not usually applied to stationary power tools for woodworking, although such usage is occasionally heard, and in some cases, such as drill presses and bench grinders, exactly the same tool is used for both woodworking and metalworking. Stationary power tools are prized not only for their speed, but for their accuracy. A table saw not only cuts faster than a hand saw, but the cuts are smoother, straighter and more square than even the most skilled man can do with a hand saw. Lathes produce truly round objects that cannot be made in any other way.

Common power tools include the drill, various types of saws, the router, the electric sander, and the lathe. The term power tool is also used in a more general sense, meaning a technique for greatly simplifying a complex or difficult task. Some safety tips are mentioned below:

1. Never operate any power equipment unless you are completely familiar with its controls and features.
2. Inspect all portable power tools before using them. See that they are clean and in good condition.
3. Make sure there is plenty of light in the work area. Never work with power tools in dark areas where you cannot see clearly.

4. Before connecting a power tool to a power source, be sure the tool switch is in the “OFF” position.

Some examples of Portable Power Tools:

HAND DRILL

POWER CUTTER

BLOWER

CIRCULAR SAW

DISC GRINDER

ROTARY HAMMER

JIG SAW

MARBLE CUTTER

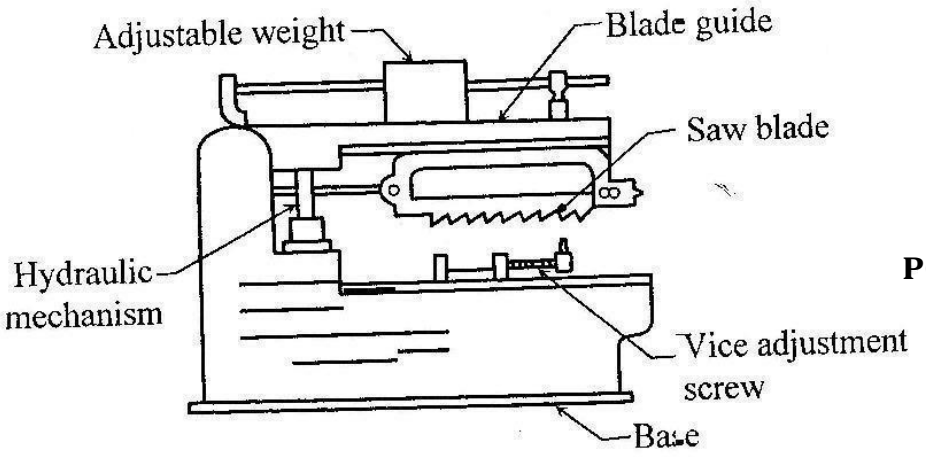
ORBIT SANDER

SAND POLISHER

SCREW DRIVER

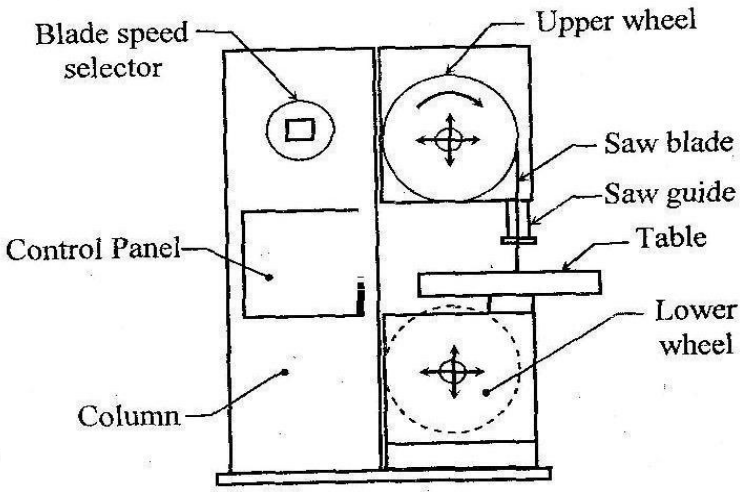
CHAIN SAW

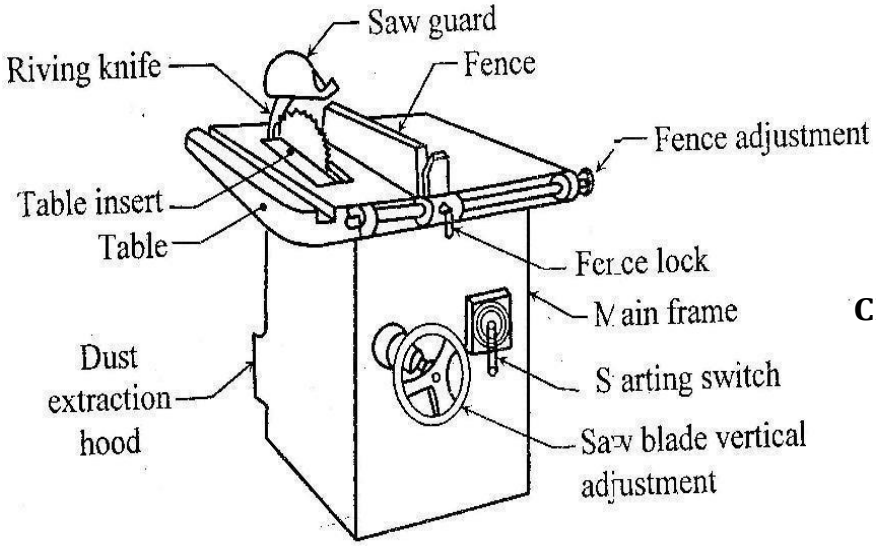
Some examples of Stationary Power Tools:



POWER HACK SAW

VERTICAL BAND SAW





CIRCULAR SAW