LAB MANUAL

WORKSHOP PRACTICE

DEPARTMENT OF TECHNICAL EDUCATION
KERALA

GOVERNMENT POLYTECHNIC COLLEGE
PERUMBAVOOR
Koovappady P.O, Perumbavoor, Ernakulam, 683544

SEMESTER I & II

REVISION 2015

DEPARTMENT OF MECHANICAL ENGINEERING

DEPARTMENT OF TECHNICAL EDUCATION
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Staff in Charge **SHIJATH.T.A**
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MOHAYUDHEEN KUTTY

CARPENTRY

Vision of the Institute

Excel as a centre of skill education moulding professionals who sincerely strive for the betterment of society.

Mission of the Institute

1. To impart state of the art knowledge and skill to the graduate and moulding them to be competent, committed and responsible for the wellbeing of society.
2. To apply technology in the traditional skills, thereby enhancing the living standard of the community.

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

Excel as a centre of skill education in mechanical engineering moulding professionals who strive for the betterment of society.

MISSION

To deliver professional competence by

1. Provide state of art knowledge, skill and transform the students into responsible professionals for the sustainable development of society
2. To have good infrastructure facilities so that students will gain hands on experience by using various equipment and software.

PROGRAMME EDUCATIONAL OBJECTIVES [PEOs]

PEO-1 To develop diploma holders with sound technical competency.

PEO-2 To impart quality consciousness, self learning attitude along with safety and environmental awareness.

PEO-3 To foster a passion for mechanical engineering to pursue higher studies and lifelong learning in their professional careers.

PEO-4 To inculcate diploma holders with good management practices, interpersonal skill and entrepreneurial discipline with strong adherence to ethics and values.

PROGRAMME OUTCOMES [PO's]

1. **Basic knowledge** An ability to apply knowledge of basic mathematics, science and engineering to solve the engineering problems.
2. **Discipline knowledge** An ability to apply knowledge in mechanical engineering to solve core and/or applied engineering problems.
3. **Experiments and practice** An ability to plan and perform experiments and practices and to use the results to solve engineering problems.
4. **Engineering Tools** Apply appropriate technologies and tools with an understanding of the limitations.
5. **The engineer and society** Demonstrate knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering practice.
6. **Environment and sustainability** Understand the impact of the engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
7. **Ethics** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice**.**
8. **Individual and team work** Function effectively as an individual, and as a member or leader in diverse/multidisciplinary teams.
9. **Communication** An ability to communicate effectively.
10. **Lifelong learning** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the context of technological changes.

SYLLABUS

COURSE TITLE	**WORKSHOP PRACTICE**
COURSE CODE	**2008**
COURSE CATEGORY	**F**
PERIODS/ WEEK	**3**
PERIODS/ SEMESTER (I & II)	**90**
CREDIT	**3**

TIME SCHEDULE

MODULE	TOPICS	PERIOD
1	Carpentry, Foundry & casting	27
2	Smithy, Forging & Fitting	27
3	Sheet metal	18
4	Welding	18
	Total	90

Course outcomes

STUDENT WILL BE ABLE TO

1. Perform various exercises on given drawing and specifications in Carpentry shop, Foundry & Casting shop.
2. Perform various exercises on given drawing and specifications in Smithy, Forging & Fitting shop.
3. Perform various exercises on given drawing and specifications in Sheet metal shop.
4. Perform various exercise on given drawing and specifications in Welding shop.

CONTENT DETAILS

MODULE I

Introduction, objectives, safety in the Carpentry shop, Foundry & Casting shop.

Familiarization of tools

Marking and measuring tools such as straight edge, meter square, try square, bevel square, combination Square, marking knife, marking gauge, mortise gauge, cutting gauge, wing compass, trammel, divider outside and inside calipers, spirit level and plumb bob.

Cutting tools such as Rip saw, Cross cut saw, panel saw, Tenon saw, bow saw, compass saw, key hole Saw, firmer chisel, bevel edge firmer chisel, paring chisel, mortise chisel, jack plane, wooden and metal trying Plane, smoothening plane, rebate plane, plough plane, router plate, spoke shave.

Boring tools such as Bradawl ratchet brace, wheel brace, shell bit, fostries bit, counter sunk bit.

Striking tools such as mallet etc

Holding devices such as Bench vice, bench stop, sash clamp, G Clamp.

Miscellaneous tools - Rasp cut file, scraper, glass paper, pincers, ratchet and cabinet type screw drivers.

Carpentry Practice - Marking, sawing, planing, chiseling, grooving, rebating exercises Preparation of carpentry joints.

Familiarization of Foundry tools

Hand tools, shovel, riddle, hammers, trowels, relic, lifters, strike off bar spruce, balloons, swab, gate Cutter, mallet, vent rod, draw spike, lifting plate, pouring weight, gaggers, clamps, core & chaplets. Moulding practice and casting preparation of moulding sand, prepare moulds of different types using different patterns (single, double & three piece patterns), ferrous and Non, ferrous metal casting using simple patterns.

MODULE II

Familiarization of Smithy tools

Hand tools - Anvil, swage block, hammers such as ball peen, straight peen, cross peen and sledge hammers. Tongs such as flat, hollow, cold and hot chisels, swages, fullers, flatters, set hammers, punch and drift.

Equipment - Open and closed hearth, furnaces, hand and power driven blowers, open and stock fire fuels such as charcoal, coal, oil and gas.

Smithy and Forging Practice - Ignite the furnace, Upsetting, bending, drawing, setting down, pinching, cutting and forge welding .

Familiarization of fitting tools

Hand tools & Marking tools - Scriber, compass, dividers, outside and inside caliper, jenny caliper, ordinary scribing block, universal scribing block, angle plate, V block, center punch, prick punch, try square, bevel square, surface plate, straight edge.

Cutting tools – Chisels - flat, crosscut, half round, diamond point chisels. Files - single cut and double cut files, rough, bastard, second cut, smooth Dead smooth files, flat, square, pillar, round, triangular, half round, knife edge, safe edge and needle files, Hack saw, solid and adjustable frames.

Striking tools - Ball peen, straight peen, cross peen and double face hammers

Holding devices - Bench vice, leg vice, pipe vice, hand vice, pin and tool makers vice

Fitting Practice - Cutting, filing, scribing and simple joints exercises

MODULE III

Familiarization of Sheet metal tools - scribers, dividers, trammel points, set square, punches, prick Punches, centre punches, hand groover, rivet, set, chisels hammers, riveting hammers, ball peen hammers, mallet, snip, shears, pliers, hand reamers (tongs) files, stakes. Measuring instruments in sheet metal folding rule, common rule, steel circumference rule, Vernier calipers, micrometer, calipers thickness gauges (SWG) sheet metal gauge.

Practice work - Sheet cutting, development, folding, bending and pipe bending, making right angle joints.

MODULE IV

Familiarization of welding tools and safety

Safety precautions, Study of various tools and equipment used in the welding shop for both arc welding and gas welding.

Practice work

1. DC arc welding.
2. AC arc welding.
3. Gas welding.
4. Edge preparation of welded joint such as V and double V.
5. Horizontal, flat and vertical joints.

General safety

1. Always wear safety glasses, or face shields designed for the type of the work
2. Wear safety shoes with thick soles.
3. Wear clothing suited for the job.
4. Don't wear rings, watches, bracelets or other jewellery that could get caught in moving machinery.
5. Don`t wear neck ties or loose turn clothing of any kind.
6. Wear shirts or uppers with sleeves cut off or rolled above the elbows.
7. Be sure you have sufficient light to see in work area.
8. Get first aid immediately for any injury.
9. Don't talk to others when they are operating a machine.
10. Keeping floor free from oil, grease or any other liquid.
11. Store materials in such a way that they cannot become tripping hazards.
12. Don't leave tools or work on the work table.
13. Keep tools always in Cupboards when not in use.
14. Place the scrap materials in the box provided.
15. Be sure that all machine's have effective and properly working guards.
16. Don't operate any machine unless authorized, to do so by the instructor.
17. Don't attempt to oil, clean, adjust or repair any machine while it is running.
18. Keep the floor clean of metal chips or curls and waste pieces, put them in boxes provided for such things.
19. Don`t operate machinery before getting instruction.
20. Ensure that all safety equipment remains accessible to the workshop personnel at all times.

PERSONAL SAFETY PRECAUTIONS

1. Wear tight clothes when rotating machines beware of hair, tie and clothing.
2. Never enters the workshop without shoes.
3. Do not use rings and watches while working.
4. Keep the workshop floor clean and tidy. The floor should be free from oil & greases.
5. Wear goggles whenever there is flying matters.
6. Do not run or play on the workshop floor
7. Do not operate any machine or tool without knowing its mechanism.
8. Never work on unguarded machines.
9. Do not talk to others or disturb them while they are operating the machine.
10. Keep your body behind the cutting edge of sharp edged cutting tools.
11. Use right tools for right job.
12. When you switch off a machine, do not leave before it has stopped running.
13. Store inflammable materials like kerosene, Turpentine etc. separately or keep away.
14. Never place sharp tools on the floor or at the edge of the work bench. Keep them in proper place marked for them.
15. Beware of electrical hazards such as wet floors, poor earth return connections, bar, wires etc.

CARPENTRY

INTRODUCTION

Carpentry and joinery are common terms used with any class of work in wood. Strictly speaking, carpentry deals with all works of carpentry such as roofs, floors, partitions etc. of a building while joinery deals with the making of doors, windows, cupboards, stairs and all the interior fitments for a building.

Timber is the basic material used for any class of wood working. The term timber is applied to the trees, which provide us with wood. Indian timbers most commonly used for various wood works are Teak, Babul, Deodar, Mahogany, and Rosewood etc.

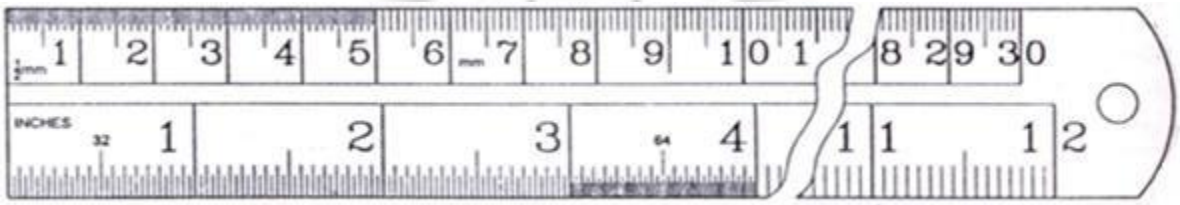
CARPENTRY TOOLS

In order to successfully work different forms to accurate shapes and dimensions, the wood workers must know the use of large number of tools. The tools which are manipulate by hand are,

1. MARKING AND MEASURING TOOLS.
2. CUTTING TOOLS.
3. PLANING TOOLS.
4. BORING TOOLS.
5. STRIKING TOOLS.
6. HOLDING AND MISCELLANEOUS TOOLS.

MARKING AND MEASURING TOOLS

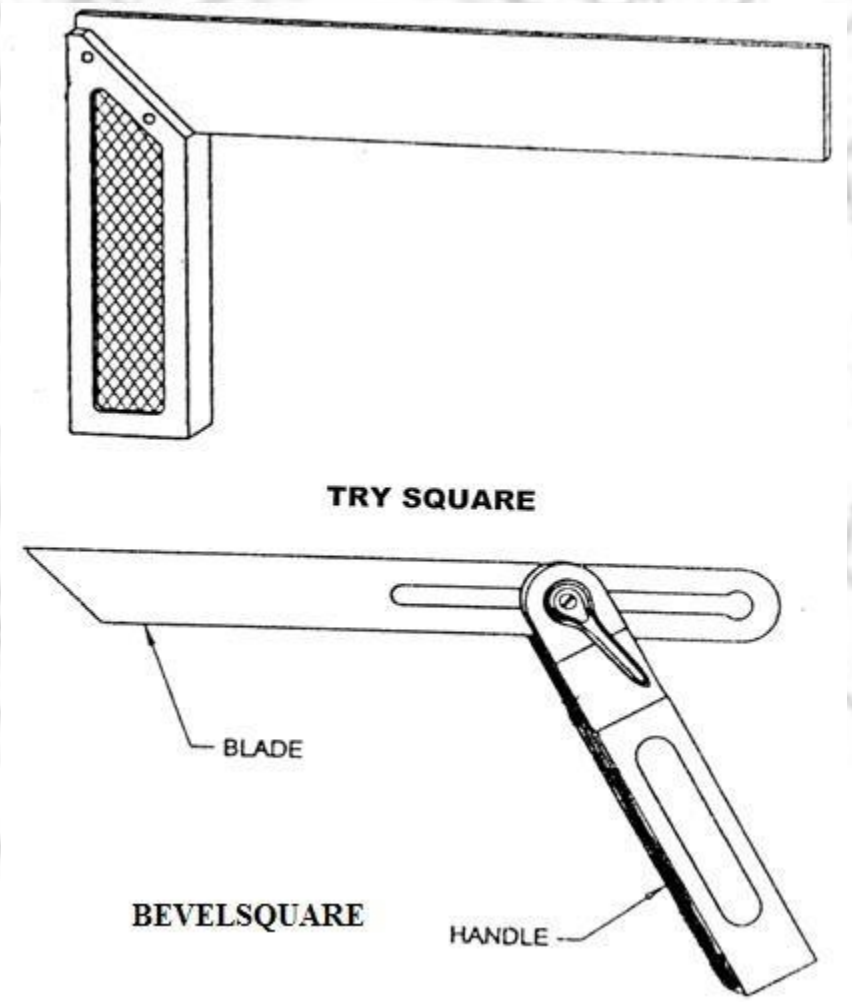
Steel rule



Steel rule is used for linear measurements. It consists of a strip of hardened steel having line graduations at interval of fractions of a standard unit of length. This is usually marked in both inches and centimeters. The least count is 1/64 of an inch or 0.5mm.

Try square

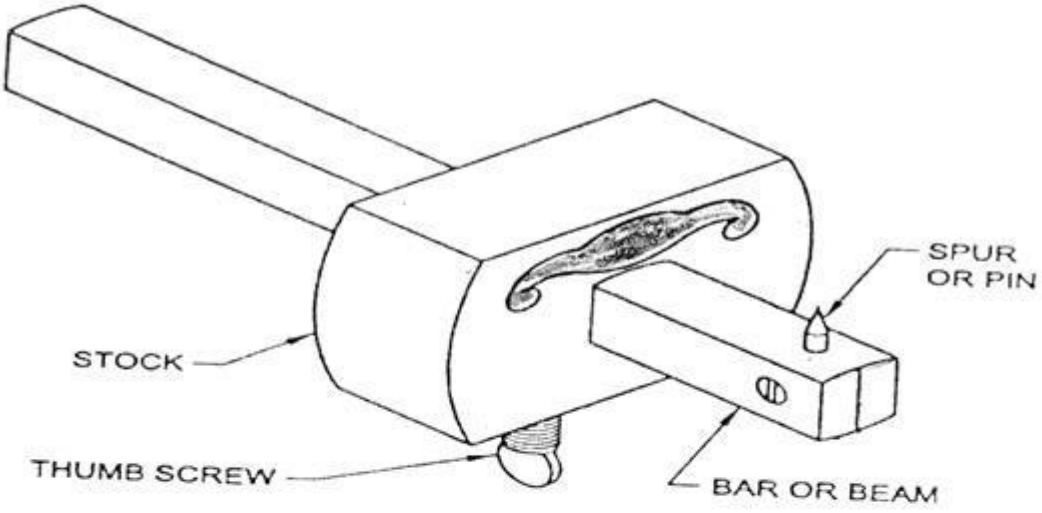
Try squares are used for making and testing of angle of 90^0. It consists of a steel blade riveted in to a metal stock. Sizes vary from l50 to 300 mm according to the blade.



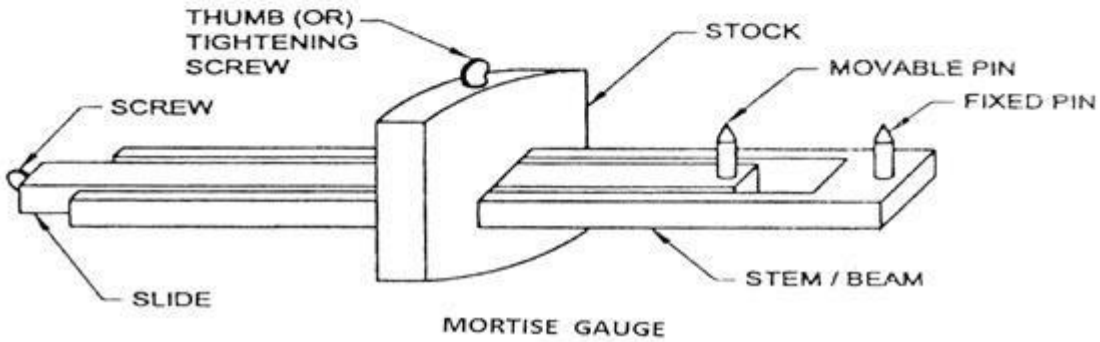
Gauges

Gauges are used to mark line parallel to the edge of a piece of wood. It consists of a small stem sliding on a stock. The stem carries one or more steel marking points. The stock is set to the desired distance from the steel points and fixed by thumb screw.

The gauge is held firmly against the edge of the wood and pushed along the sharp spur for marking the line.



MARKING GAUGE



MORTISE GAUGE

- **Marking Gauge**

The marking gauge has one marking point. It gives an accurate cut line parallel to a true edge usually with the grain.

- **Mortise Gauge**

  The mortise gauge has two marking points. One fixed near to the end of the stem and the other attached to a brass-sliding bar. These two teeth cut two parallel lines called mortise line.

Other Marking and measuring tools are Miter square, Bevel square, Marking Knife.

CUTTING TOOLS

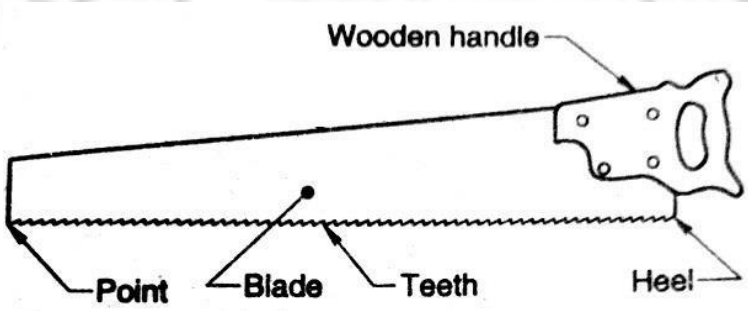
Cutting tools include saws, chisels and gouges.

Saws

The saw is the most widely used wood working tools. When cutting across the grain, a different action is required from the saw teeth than when ripping with the grain. Therefore, different types of saws are used as one type cannot do both jobs successfully. A saw is generally specified by the length of its blade, measured along the toothed edge and pitch of teeth, expressed in millimeters.

Cross cut saw

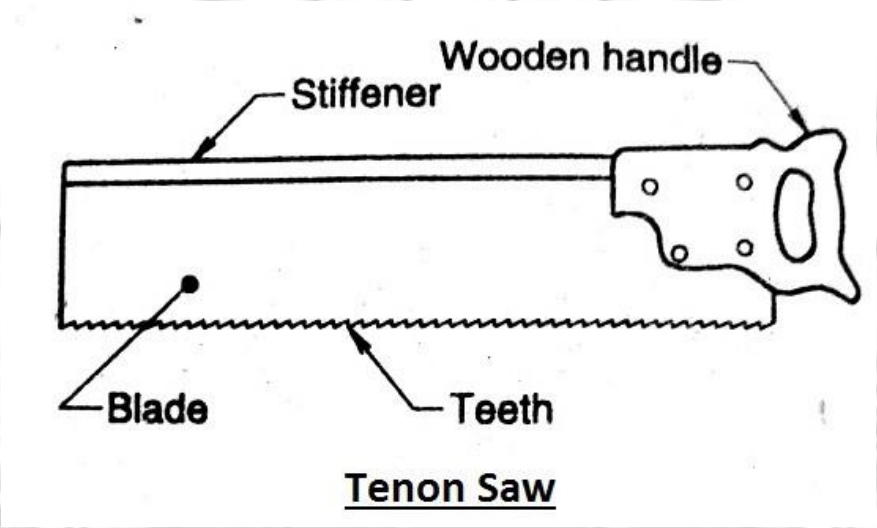
Cross cut saws or handsaws are used for cutting across the grain in thick wood. They are 600 to 650mm long with 8 to 10 teeth per 25mm. The action of the teeth is that of a series of Knives, which sever, the fibers and force out the waste wood in the form of saw dust.



Hand saw or Cross - Cut Saw

Tenon saw

This saw is mostly used for cross cutting when a fine and more accurate finish is required. The blade, being very thin, is reinforced with a rigid steel back. Tenon saw blade are from 250 to 400mm in length and generally have l3 teeth are shaped in the form of an equilateral triangle and sometimes termed peg teeth.



Tenon Saw

Other saws are Rip saw, Dovetail saw, Compass saw, Pad or Keyhole saw

Chisels - Chisels most commonly in use in carpentry include firmer chisels, either square or bevel edged, paring chisel and mortise chisel. They are usually specified by length and width of the blade

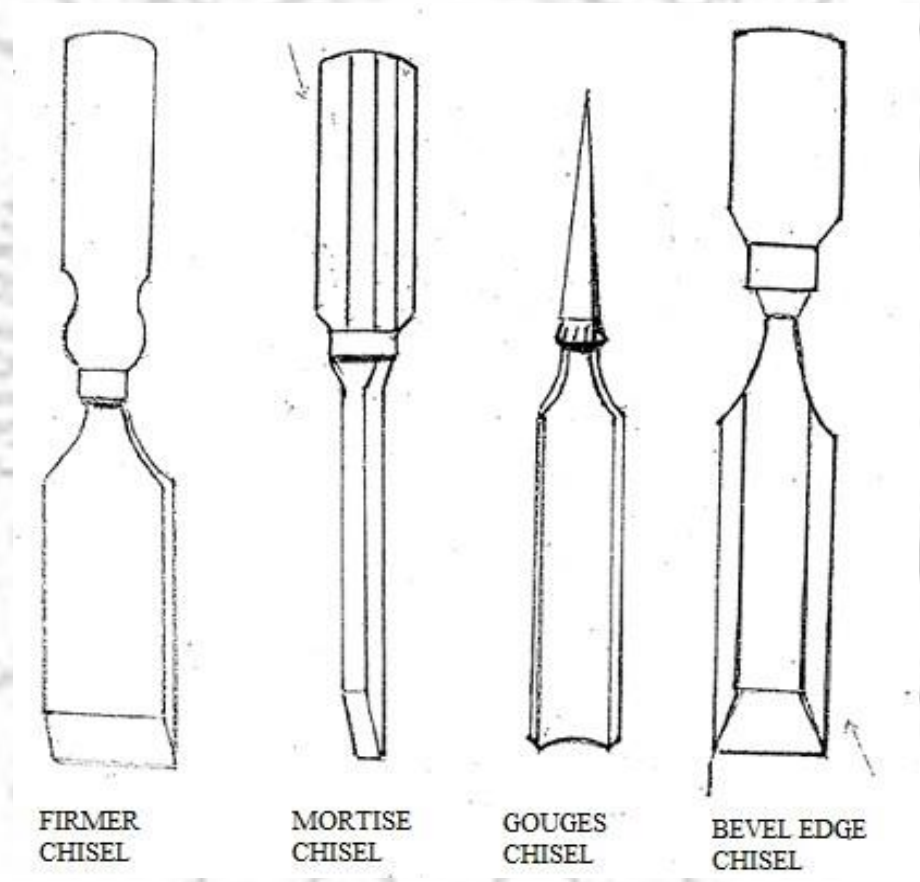
Firmer chisels -The firmer chisels are the most useful for general purpose and may be used by hand pressure of mallet. It has a flat blade about l25mm long. The width of the blade varies from 1.5 to 50mm.

Bevel edge firmer chisels -This chisel is used for more fine work. They are useful for getting into corners where the ordinary firmer chisels would be clumsy.

Paring chisels - Both firmer and bevel edge chisels are made of long thin blade are known as paring chisels. The length ranges from 225 to 500mm and width from 5 to 50 mm.

Mortise chisels - The mortise chisels are used for chopping out mortise. These chisels are designed to withstand heavy work. They are made of heavy blade with a collar to withstand the force of the mallet blows. Blades vary in width from 3 to l6 mm.

Gouges - Gouges are chisels with curved sections and may either inside or outside surface. Inside gouges are used in exactly the same way for inside curved edge, as



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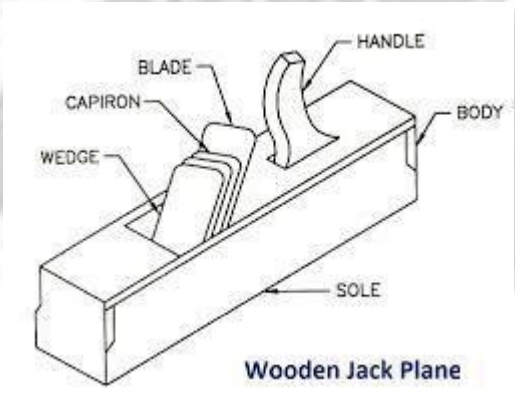
PLANING TOOLS

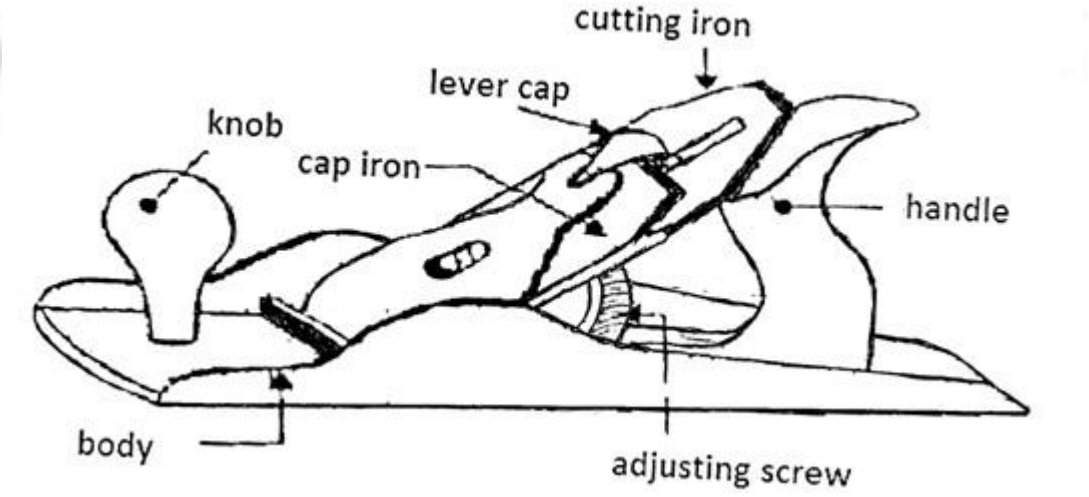
General planes are jack plane, trying plane and smoothing planes. Besides these, there are other planes which are used for special work.

Wooden jackplane

It consists of a block of wood into which the blade is fixed by a wooden wedge. The blade is set at an angle of 45º to the sole. Another blade is fixed over the cutting blades is called cap iron or back iron. This does not cut, but stiffness the blade near its cutting edge to prevent chattering and partially breaks the shaving as it is made. Some type of planes is obtainable from 350 to 425 mm in length and with blades 50 to 75mm wide.



Wooden Jack Plane



Metal Jack Plane

Metal jackplane - Metal jackplanes serve the same purpose as the wooden planes but facilitate a smoother operation and better finish. The body of a metal plane is made of gray iron casting, with the side and sole machined and ground to a bright finish. Thickness of the shaving removed by fine screw adjustment and a lever is used for adjusting the blade at right angle.

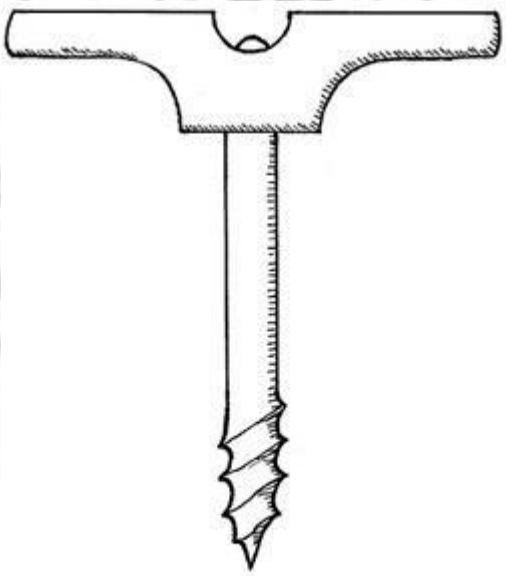
Other planes are Try plane, Smoothing plane, Rebate plane, Router plane, and Spoke shave plane.

BORING TOOLS

Boring tools are frequently necessary to make round holes in wood and they are selected according to the type and purpose of the hole.

Gimlet

The gimlet is a hand operate tools and is used to bore small holes such as for fixing a screw or large nail.

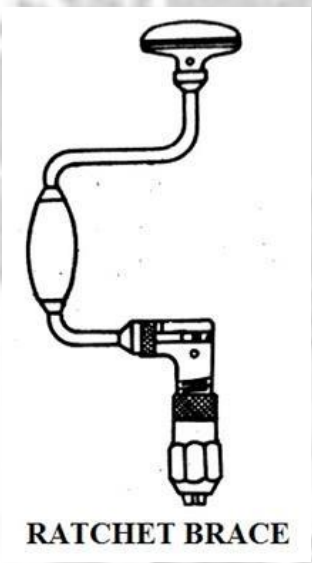


GIMLET

Ratchet brace

The brace is a tool used for holding and turning a bit for boring holes. It has three jaws, and is used for making holes in wood.

- For working in a confined situation.
- For when the cut is particularly heavy and it is desirable to pull the handle through a quarter turn only.



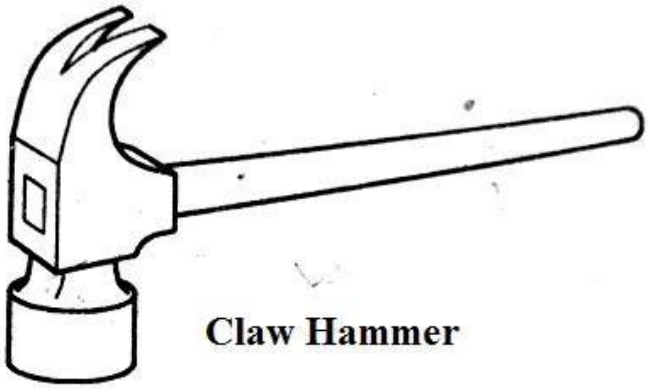
RATCHET BRACE

STIRIKING TOOLS

Striking tools include hammers and mallets.

Claw hammer

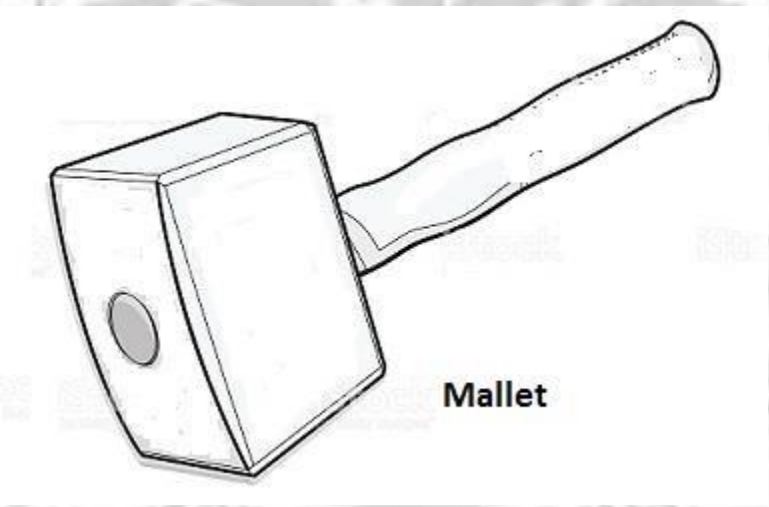
It is used for the purpose of hammer and a pair of pincers. The claw is used for pulling out nails.



Claw Hammer

Mallet

The mallet is a wooden headed hammer of round or rectangular cross section. The striking face is made flat to the work. A mallet is used to give light blows to the cutting tools having wooden handle such as chisels and gouges.



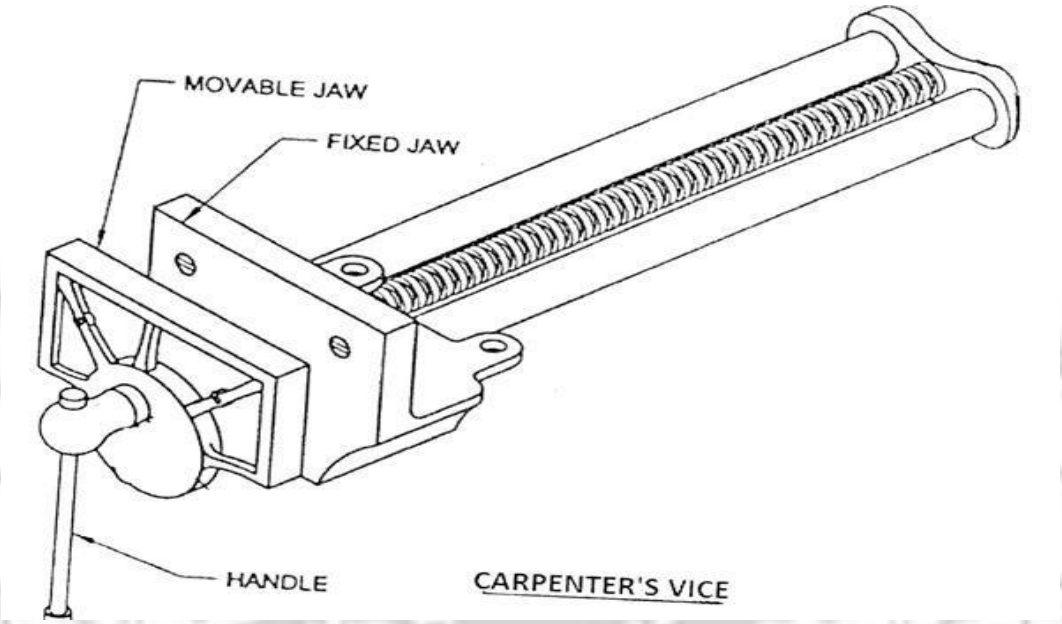
Mallet

HOLDING TOOLS AND MISCELLANEOUS TOOLS

Holding tools - Bench vice, Bench stop, Sash cramp, G clamp and screw driver etc.

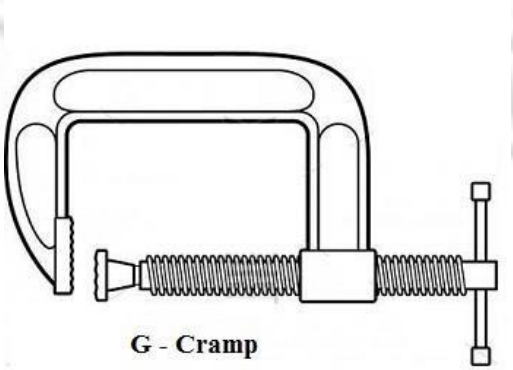
Carpenters Vice

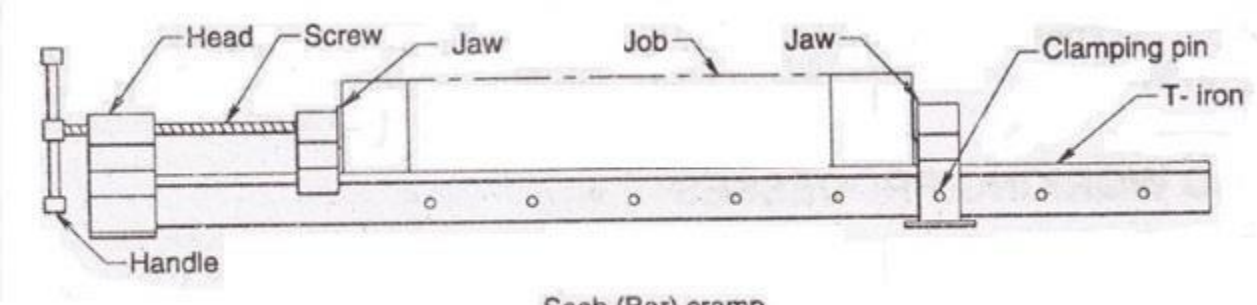
It's one jaw is fixed to the side of the work bench while the other is movable by means of a screw and handle.



G-Clamp

This clamp consists of a malleable iron frame in the 'C' shape and a screw to clamp the work piece on the table. Sash cramp is used to hold the large size work piece.





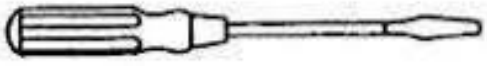
Sash (Bar) cramp

Miscellaneous tools - Pincers, Screw drivers, Rasp file and Oilstone.

Pincer - is mainly used for pulling nails and pins.

Pincer

Screw driver - Screw drivers are used for screwing or unscrewing screws used in wood work. These may be obtained in various sizes.



Screw Driver

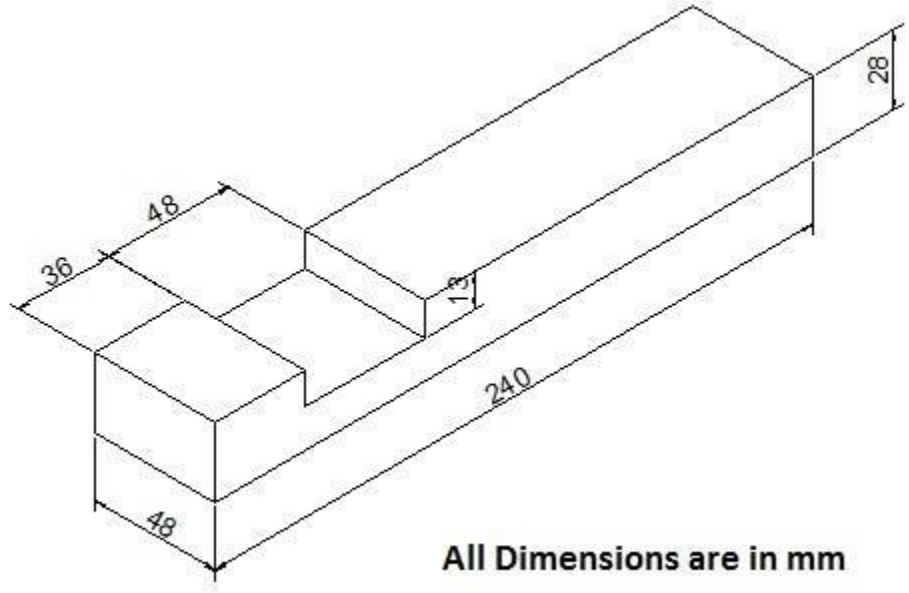
Rasp files - A rasp is coarse form of file used for coarsely shaping wood or other material. It consists of a generally tapered rectangular, round, or half round sectioned bar of case hardened steel.

Rasp file

Oil stone - Oil stones are used for final sharpening of chisels and gouges. This may be either natural or artificial stone made from carborundum (Aluminum oxide).

EX.NO 1

CUTTING, PLANING AND CHISELING PRACTICE



Ex.No. 1

Date

CUTTING, PLANING AND CHISELING PRACTICE

Aim

To practice cutting, planing and chiseling

Material Used

Wooden Piece of size 250 x 52 x 32 mm.

Operation to be carried out

Measuring marking, Planing & chiseling

Tools required

Steel rule, try square, marking guage, handsaw, metal jackplane, chisel.

Procedure, `

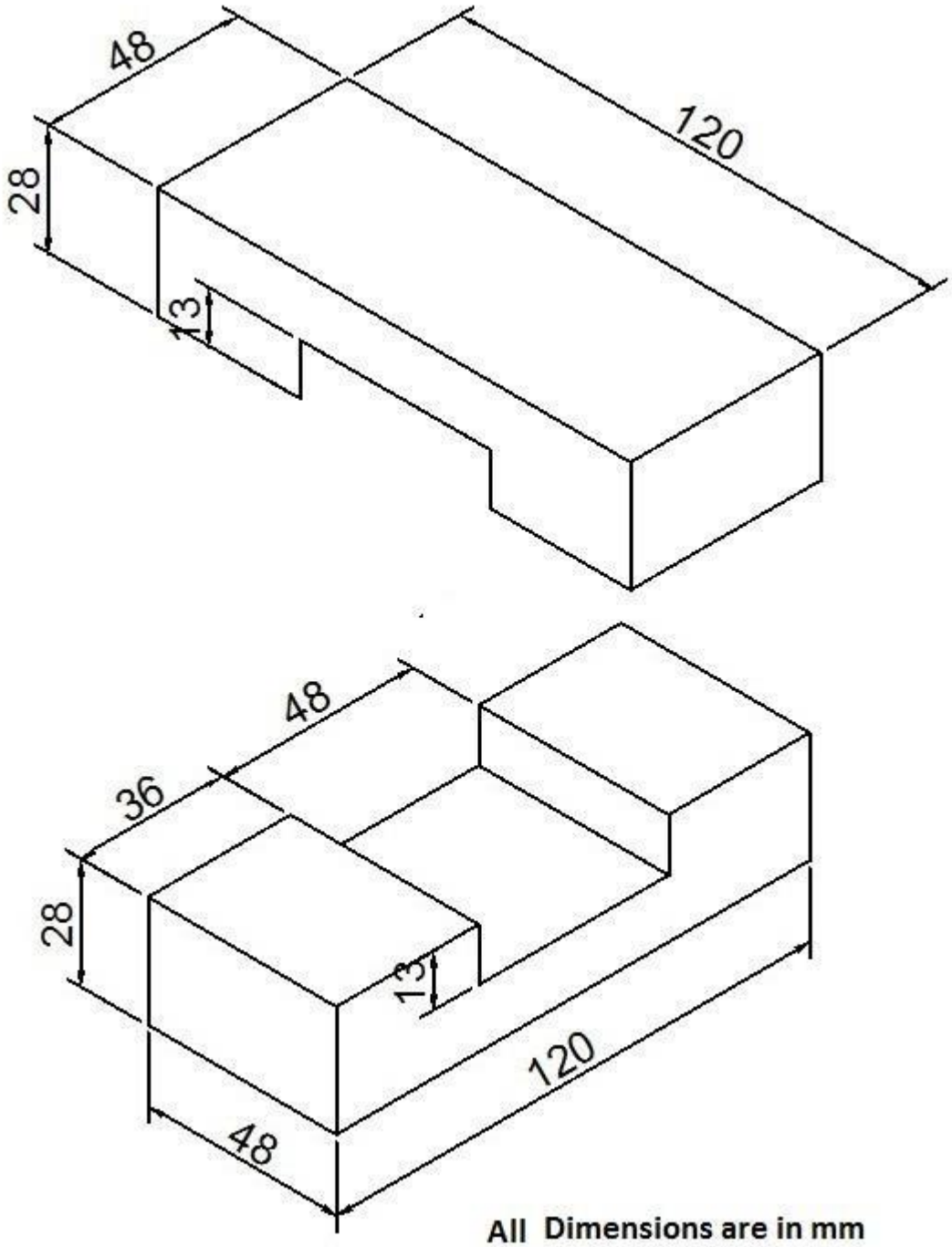
Cut a Wooden piece of size 250 x 52 x 32 mm by using handsaw. Then plane the face side of the piece and check the straightness in lengthwise, widthwise and diagonally by using steel rule. After this, plane the adjacent side to become straight and perpendicular to face side. Then mark the width and thickness using marking gauge. Plane the excess portion above the lines marked as per the dimensions of 240 x 48 x 28 mm. Then cut and remove the unwanted portion using tenon saw and chisel as per the figure.

Result

Completed cutting, planing and chiseling practice

EX. No. 2

CROSS HALVING JOINT



Ex.No.2

Date

CROSS HALVING JOINT

Aim

To practice cross halving joint.

Operations to be carried out

Measuring, marking, cutting, planing, chiseling, checking and finishing.

Tools required

Steel rule, try square, marking gauge, hand saw, metal jack plane chisel.

Materials required

Wooden piece of size 250 x 52 x 32 mm

Procedure

Cut a wooden piece of size 250 x 52 x 32 mm by using hand saw. Then plane the face side of the piece and check the straightness in lengthwise, widthwise and diagonally by using steel rule. After this, plane the adjacent side to become straight and perpendicular to face side. Then mark the width and thickness using marking gauge. Plane the excess portion above the lines marked as per the dimensions of 240 x 48 x 28 mm. Then cut and remove the unwanted portion using tenon saw and chisel as per the figure. Then cut the piece into two of length120 mm and mark as per the drawing. Then remove unwanted portion using tenon saw and chisel as per the dimensions. Join both pieces to complete the cross halving joint.

Result – Completed the Cross halved Joint

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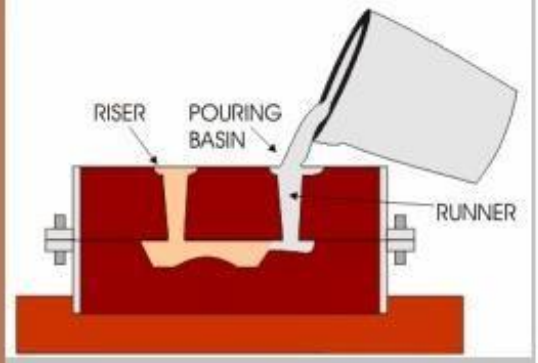
FOUNDRY & CASTING



FOUNDRY

INTRODUCTION

A foundry is a place where castings are produced. The casting is a process forming metallic products by melting the metal, pouring into a cavity known as the mould and allowing it solidify. When it is removed from the mould it will be of the same shape as the mould.

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 moulding sand.

COMMON PATTERN MATERIALS

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

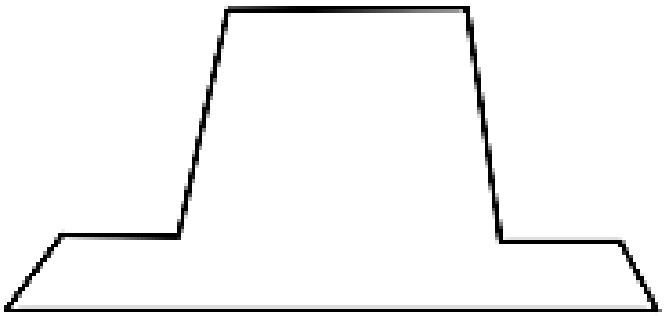
TYPES OF PATTERN

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

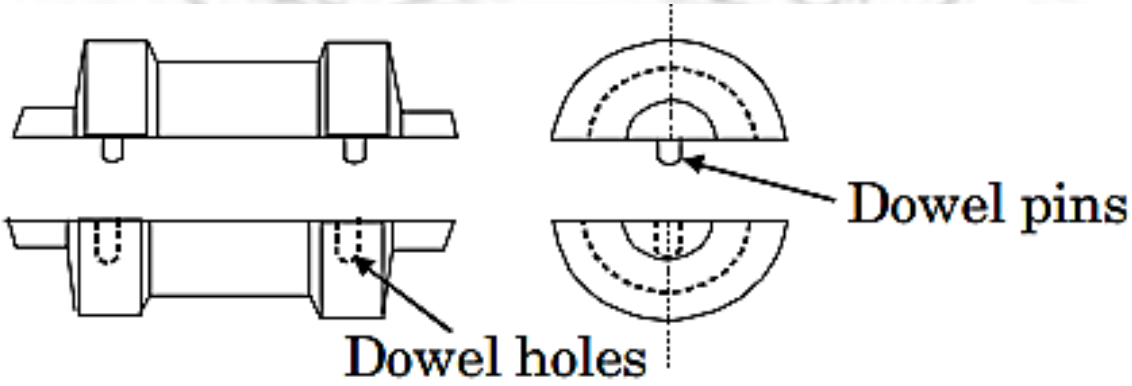
1. One piece or solid pattern 2. Two piece or split pattern

1. Single piece or solid pattern Solid pattern is made of single piece without joints, parting lines or loose pieces. It is the simplest form of the pattern.

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.



SINGLE PIECE PATTERN



TWO PIECE 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 equipment.

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. This is clean clay, free silica sand which serves the same purpose as parting dust.

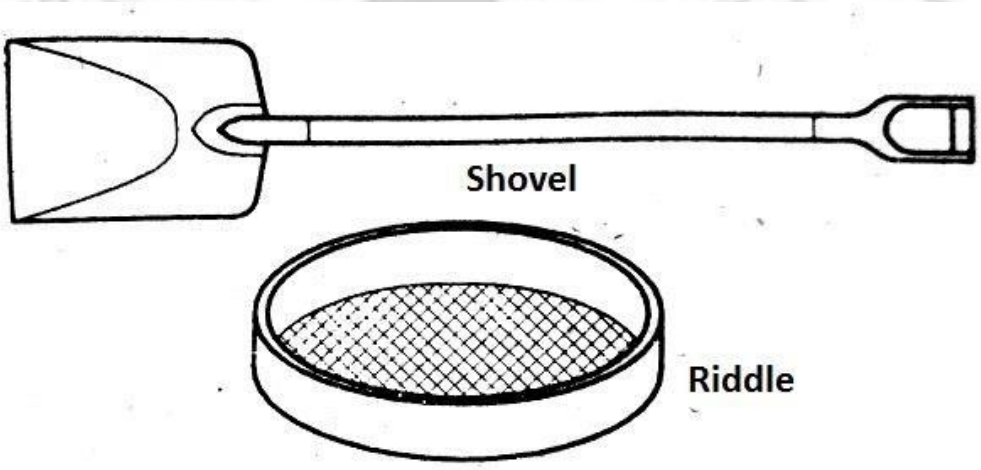
FOUNDRY HAND TOOLS

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.

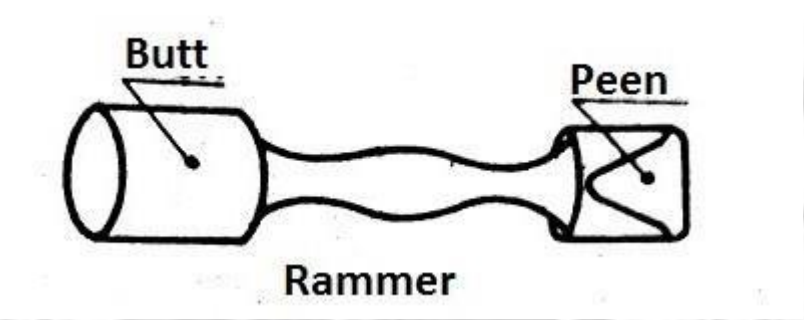
Shovel

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 transferring the molding sand to the molding box.



Rammers

It is used for packing or ramming the sand around the pattern. One of its ends called the peen end, is wedge shaped and is used for packing sand in spaces, pockets and corners. The other end is called butt end has a flat surface and is used for compacting the sand uniformly around the pattern.

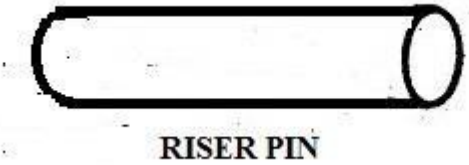


Sprue pin (Runner)

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

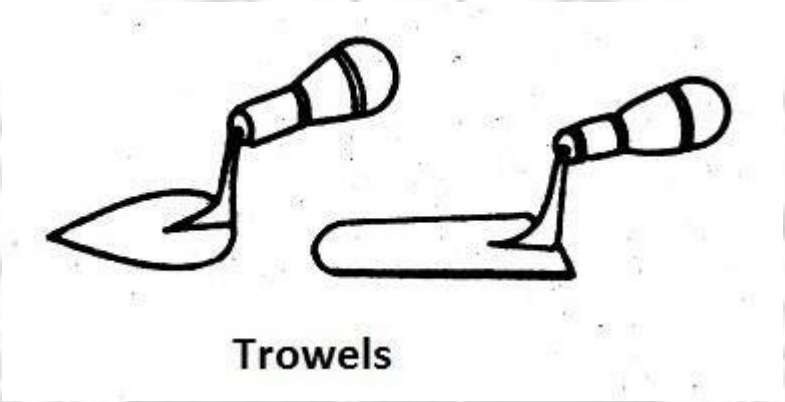
Riser Pin

It is a straight wooden pin used to make a hole in the cope over the mould cavity for the molten metal to rise in and feed the casting to compensate the shrinkage that may take place during solidification.



Trowels

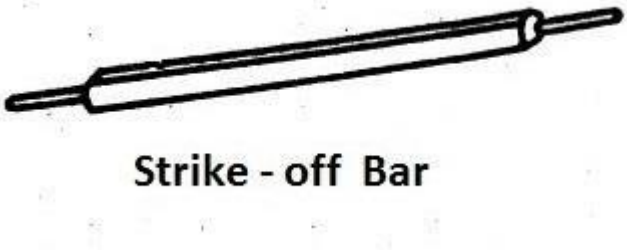
It consists of a metal blade with a wooden handle. The small trowels of various shapes are used for finishing and repairing mould cavities as well as for smoothing over the parting surface of the mould.



Trowels

Strike off bar

It is a flat bar made of wood or iron to strike off the excess sand from the top of moulding box after ramming and also to provide a level and a smooth surface. It's one edge made beveled and the surface perfectly smooth and plane.

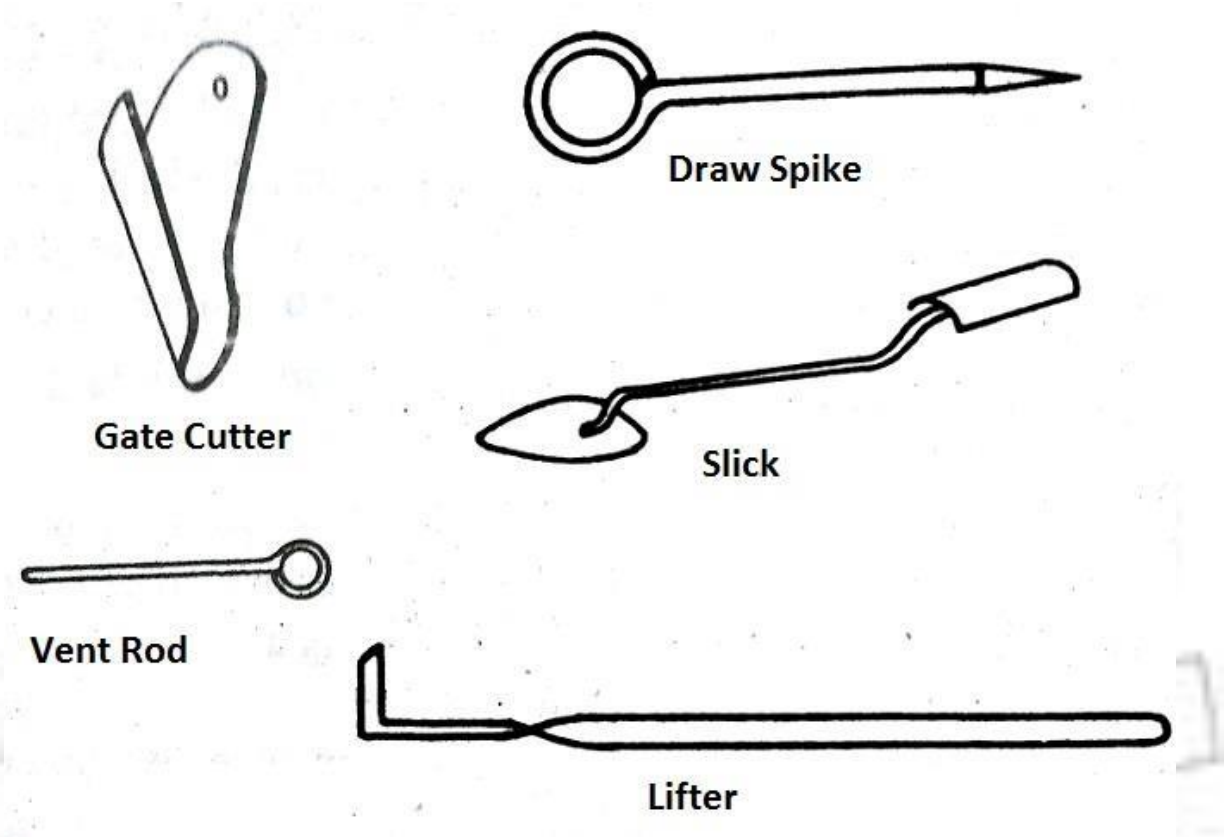


Strike - off Bar

SWAB

Swab

Swab 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

It is a 'U' shaped piece of thin sheet. It is used for cutting a shallow path in the mould, connecting sprue hole with the mold cavity to act as a passage for the hot metal.

Draw spike

A draw spike is a pointed steel rod with a loop at one end. It is driven into a wooden pattern to hold it when the sand is withdrawn.

Slicks

A slick is a double ended tool having a flat on one end and a spoon on the other. It is used for repairing and finishing the mold surfaces and their edges after withdrawal of the pattern.

Vent wire

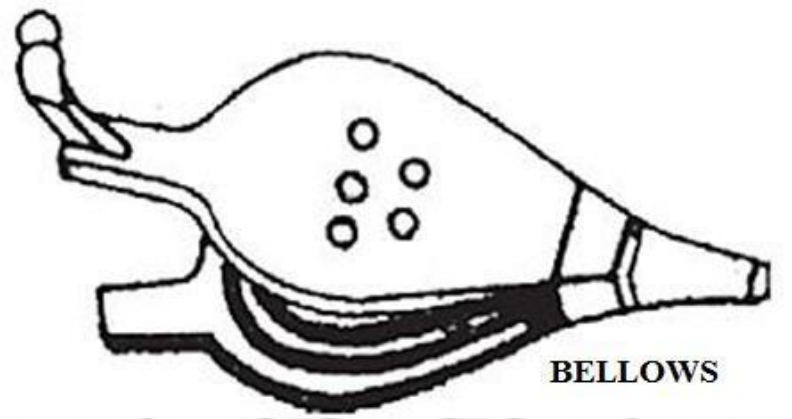
It is a thin steel rod or wire carrying a pointed edge at one end and a wooden handle or a bent loop at the other. After ramming and striking off the excess sand it is used to make small holes, called vents, in the sand mould to allow the exit of gases and steam during casting

Lifter

A lifter is made of thin sections of steel of various width and lengths with one end bent at right angles. It is used for smoothing and cleaning out depressions in the mould. Lifter is also used for removing loose sand from mould.

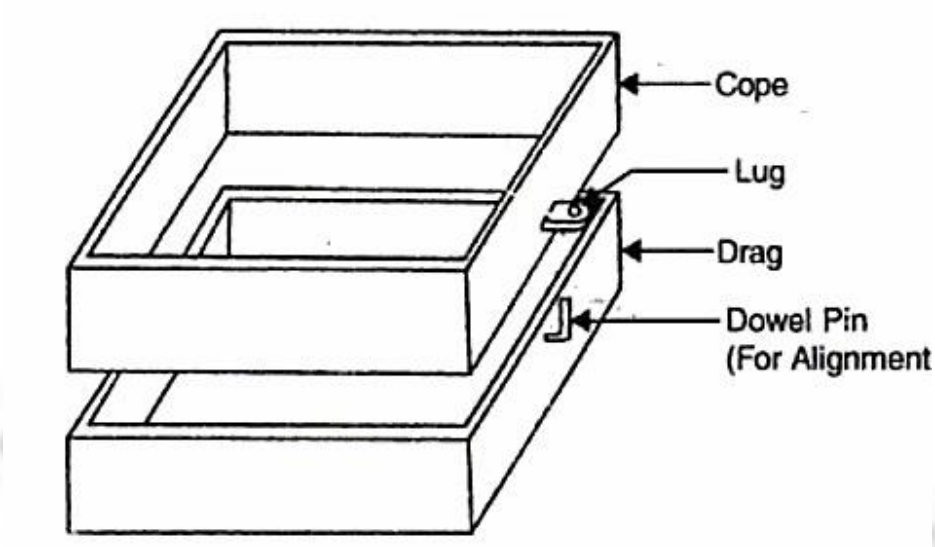
Bellows

Bellows gun is hand operated leather made device equipped with compressed air jet to blow or pump air when operated. It is used to blow loose particles of sand from the cavities and surface of the sand.



Moulding box

The sand moulds are prepared in a specially constructed boxes made of wood or metal called flasks, which are open at the top and bottom. They are made in two parts, held in alignment by dowel pins. The top part is called the cope and the lower part as drag.



MOULDING BOX

Ex.No. 1

MOULD OF CYLINDRICAL DISC (SOLID PATTERN)

Aim : To make a mould of cylindrical disc using given pattern.

Material required : Molding sand, parting sand, facing sand, clay, Water etc.

Tools required : Pattern, Moulding box, molding board, shovel, trowel, rammers, strike off bar, runner, riser, cleaners, smoothers, vent rod, draw spike etc.

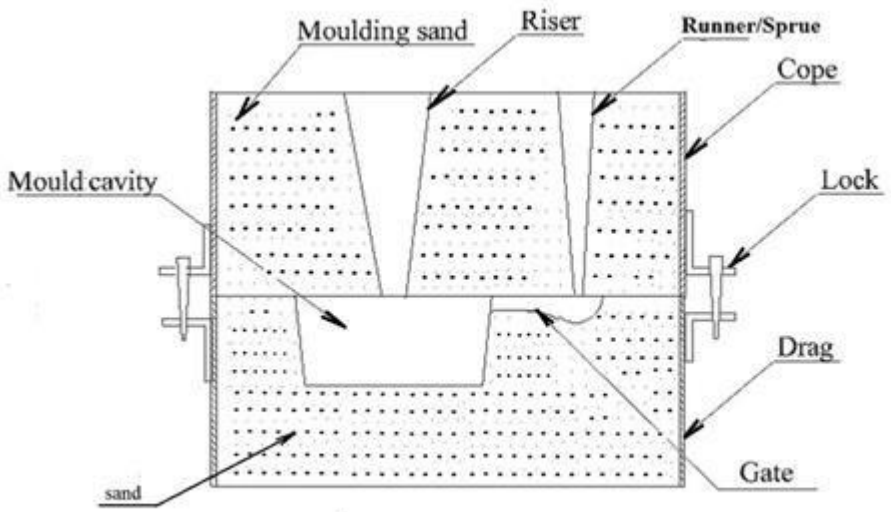
Operations to be carried out : Sand mixing, ramming, leveling, marking the gate and funnel cutting, finishing etc.,

Procedure:

Mix the molding sand with sufficient water on the work table. Select a molding box which can accommodate mould cavity, riser and gating system. Place the drag with parting surface down on the board and place the pattern. Sprinkle the facing sand carefully all-round the pattern so that the pattern and molding board does not stick with the molding sand. Fill the drag with loose molding sand. Ram the sand uniformly in the molding box around the pattern. Strike off excess material to bring it at the same level of flask. Sprinkle the parting sand over the top of the drag and roll over the drag. Sprinkle the parting sand all around the drag surface. Connect sprue and riser pins to form suitable sized cavities for pouring molten metal. Fill the cope with sand and ram. Strike off excess sand from the top of the cope. Remove sprue and riser pins. Vent the cope with vent rod. Sprinkle parting sand over the top of the cope surface. Roll over the cope on the bottom board. Rapp and withdraw each half of the pattern from cope and drag. Repair the mould if necessary. Cut the gate connecting to the sprue basin with the mould suitably. Bake the mould in case of dry sand mould; close the mould by

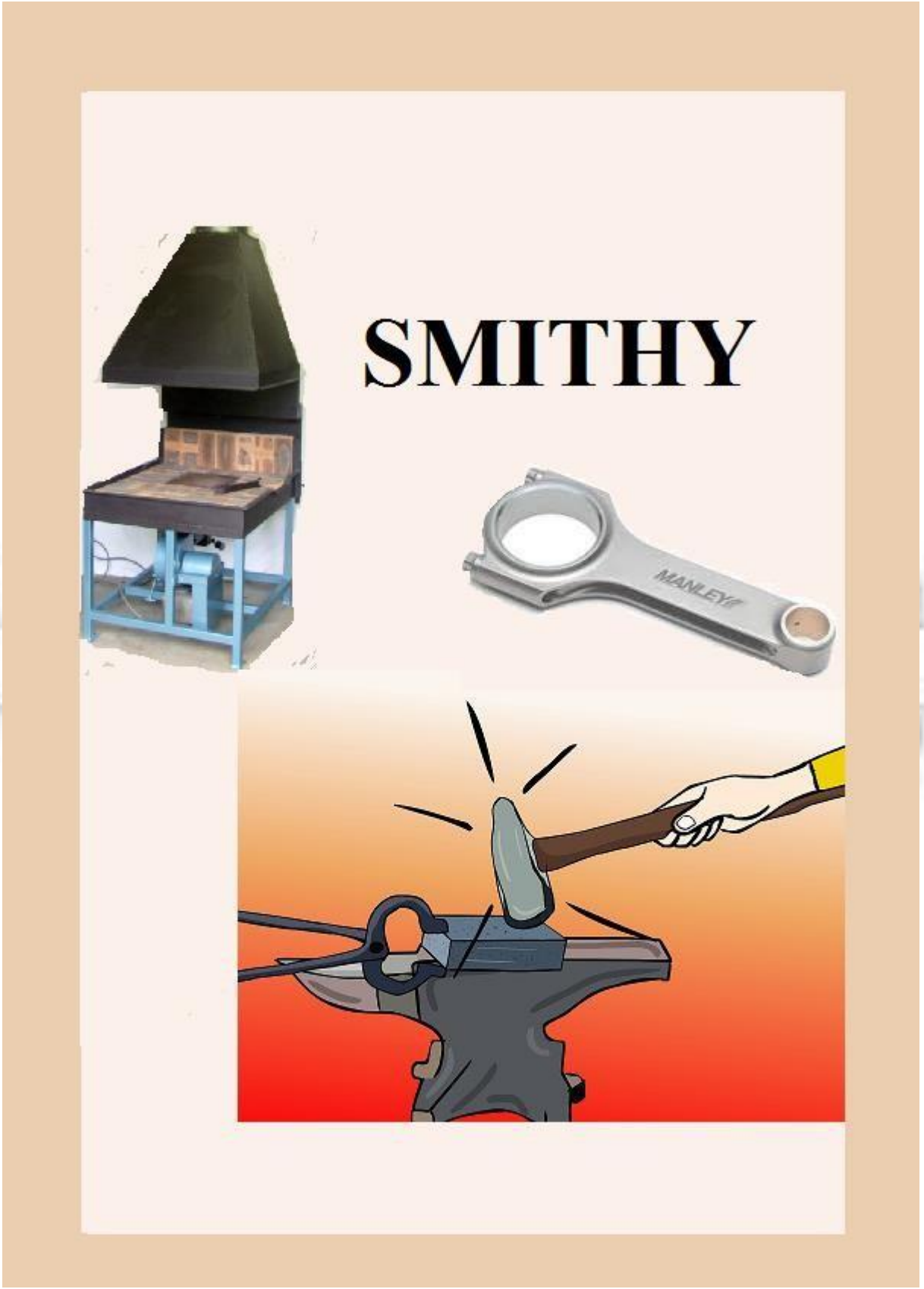
inverting cope over the drag. Clamp cope with the drag. The mould is ready for pouring.

Result : A mould for cylindrical disc is obtained.



Cylindrical disc mould cavity


GOVERNMENT POLYTECHNIC COLLEGE PERUMBAVOOR
SKILL EXCELLENCE SUSTAINABILITY


SMITHY
MANLEY

SAFETY PRECAUTION

1. Always avoid the use of damaged hammers.
2. Never try to strike a hardened surface with hardened tool.
3. No person should stand in line with the flying objects.
4. Always use the proper tongs tool to grip and lift objects according to the type of work.
5. The anvil should always be clean and free from moisture and grease while in use.
6. Always wear proper clothes such as apron, foot wears and goggles.
7. The handle of the hammer should always be tightly fitted in the head of the hammer.
8. Always put out the fire in the forge before leaving the Forging shop.
9. Always keep the working space clean and tidy.
10. Proper safety guards should be provided on all revolving parts,
11. Head of the chisel should be free from burrs and should never be allowed to spread.
12. During machine forging, always observe the safety rules prescribed for each machine.
13. One most have the thorough knowledge and working of the forging machine before going to operate it.

SMITHY

INTRODUCTION

Forging is defined as the controlled plastic deformation of material at elevated temperature under hammering and pressing it consists of altering the shape and section of a specimen (work piece) above recrystallization temperature. Forging process may be broadly classified in to two. In order to produce the desired shape or to improve the properties of any metal, shaping is done. Shaping process may be divided in two main groups as

(a) Cutting, and

(b) Non cutting.

Normally, the noncutting shaping operation is referred to as mechanical working process. One such process is called smithying or forging. Smithying is defined to handle relatively small jobs only such as those that can be heated in hearth or open fire, and the work is carried out by using of hand hammers or small power hammers.

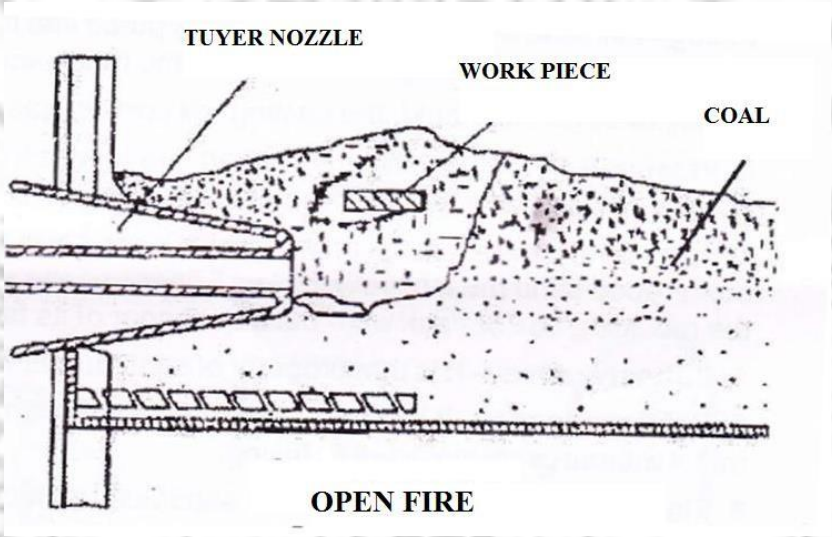
Forging refers to the production of those jobs which must be heated in a closed furnace. The part of job where forging is done is termed as a forge. The work is normally performed by means of heavy hammers, forging machines, presses etc.

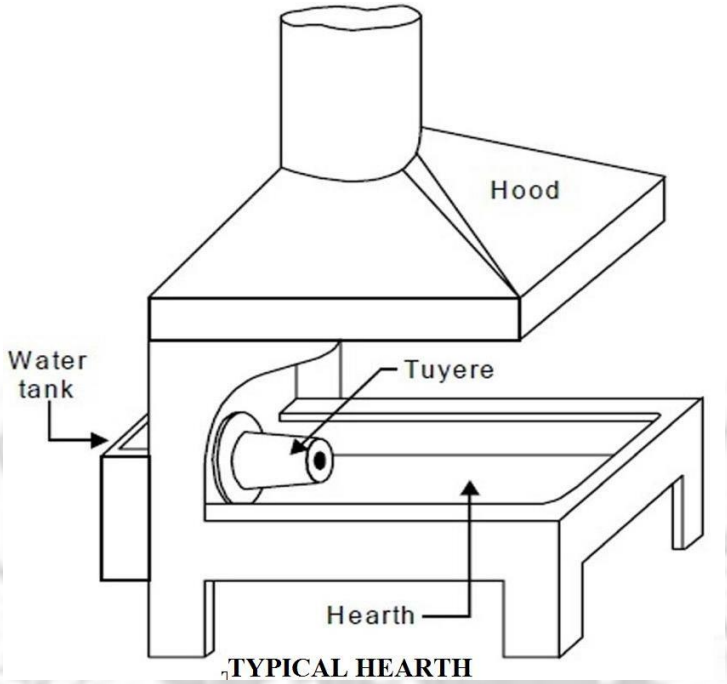
TOOLS AND EQUIPMENT USED IN FORGING

To perform the different typical operations in forging shop, a number of tools and equipment are used as per their requirements and according to the nature of work.

Smith's Forge or Hearth

It is used for heating purpose during the forging operation. The structure of hearth is made of cast iron or cast steel. It has four legged support, a hearth known as bottom, a chimney along with hood. A tuyere opening is also provided on the rear side of the structure to supply the air into the furnace. For quenching purpose, a water tank is also provided in front side of forge. Air under pressure is supplied to the furnace by the blower.

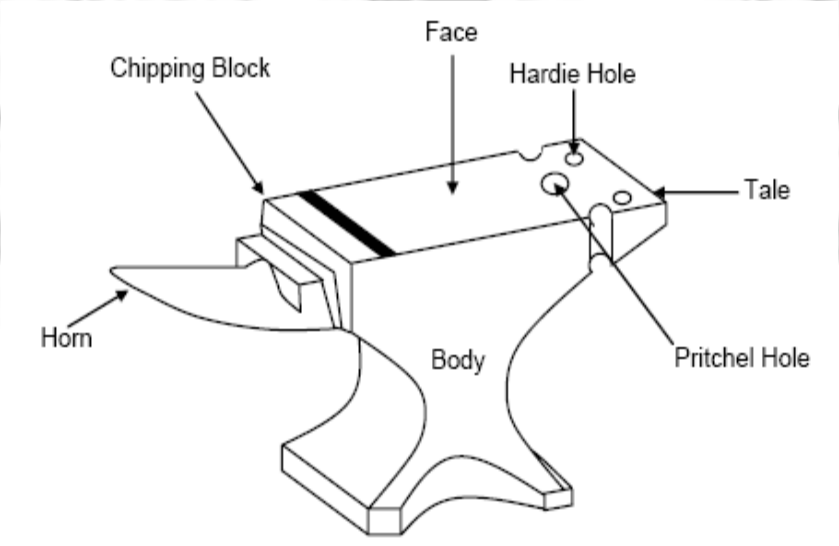




TYPICAL HEARTH

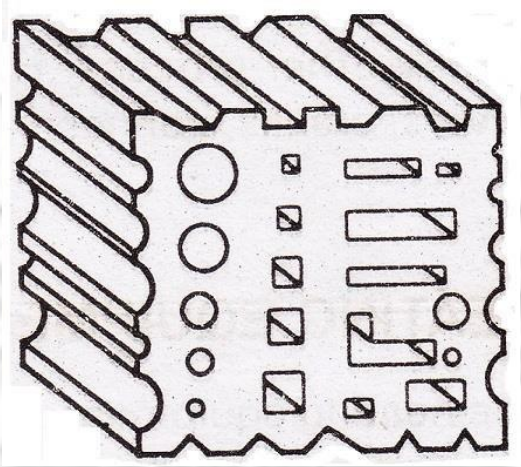
Anvil

The Anvil is used as a supporting device during hammering operation. The body of anvil is made of wrought iron or mild steel. The hardie hole is of square shape and is used for holding square shanks of swages fullers etc. while the Pritchel hole is of circular shape used for bending rods of small diameter and as a die for hot punching.



Swage Block

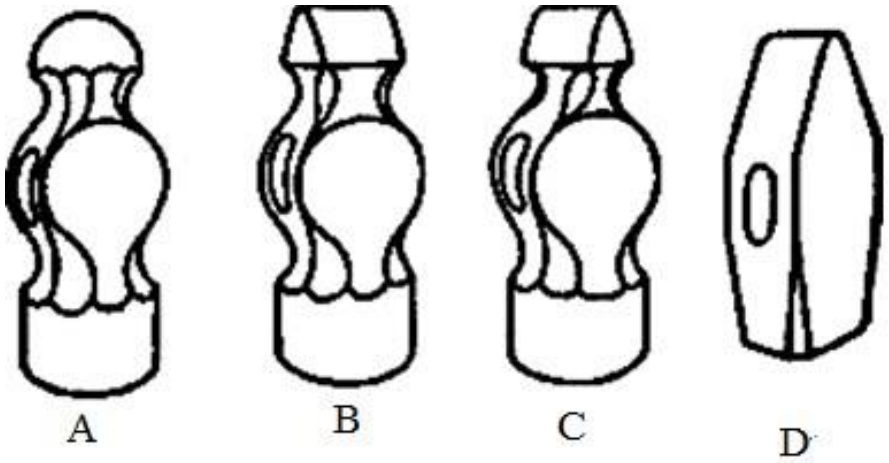
It is a block of cast steel consisting of a number of slots of different shapes and sizes along its four side faces.



Hammers

Hammers are the main striking tools made of forged steel, used in forging work. Generally, two types of hammer – hand hammer or smith's hammer and sledge hammers – are used in hand forging. Hand hammer is used by the worker himself while the sledge hammer is used by the striker. As per weight, hand hammer vary from about 0.5 to 2 kg while the weight of sledge hammer from 4 to 10 kg. Different types of Peen hammers

- Ball peen
- Cross peen
- Straight peen
- Sledge peen

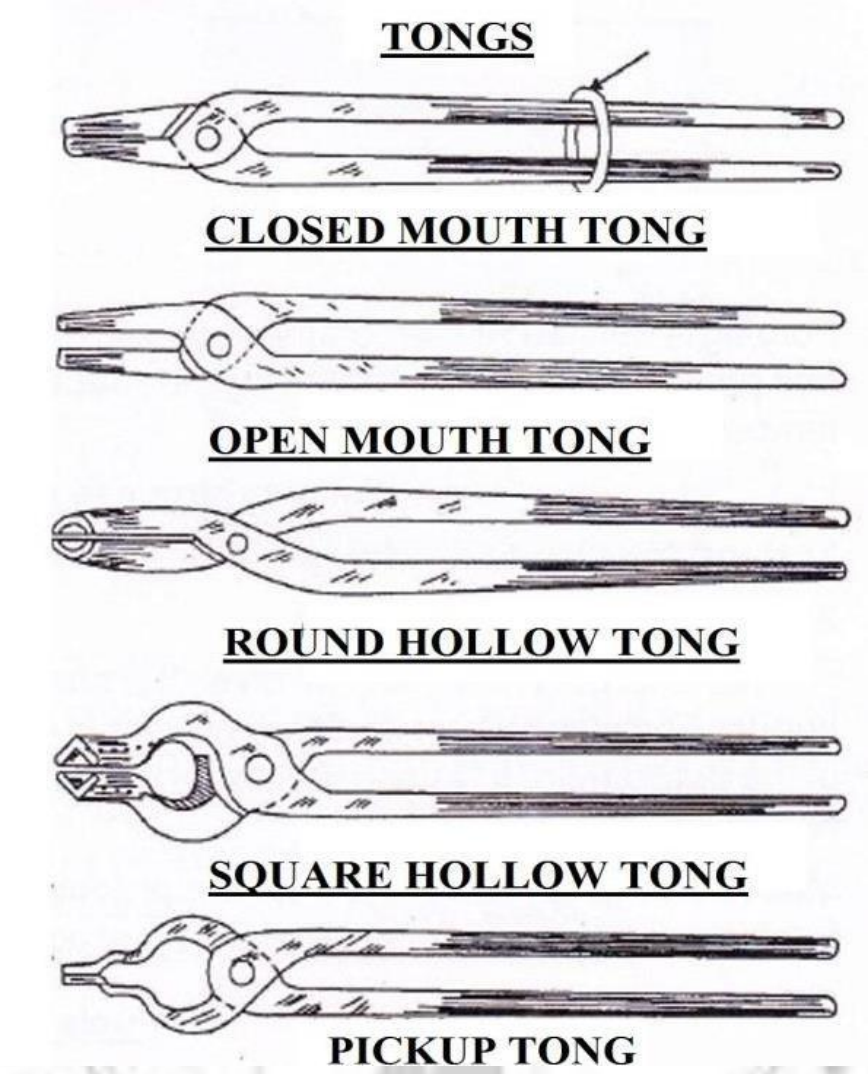


Types of Hammers

Ball Peen B. Straight Peen C. Cross Peen D. Smith's Hammer

Tongs

The work to be forged is generally held with various types of tong such as flat tong, round and square hollow tong, ring tong and GAD tong etc. Tongs are generally made of mild steel in two pieces, which are riveted together to form a hinge.

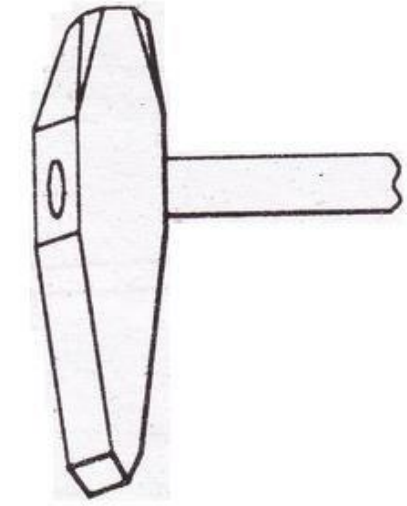


Types of Tongs

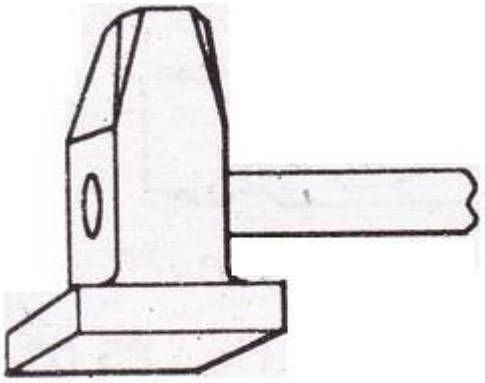
METAL SHAPING TOOLS

1. Fullers to make neck & drawing out a section.
2. Swage, to reduce & shape circular jobs.
3. Flatter, to level & finish flat surfaces.
4. Set hammer to level & finish corners of flat surfaces.
5. Chisel to cut metal in hot and cold stage.
6. Punch, to produce hole in hot stage.

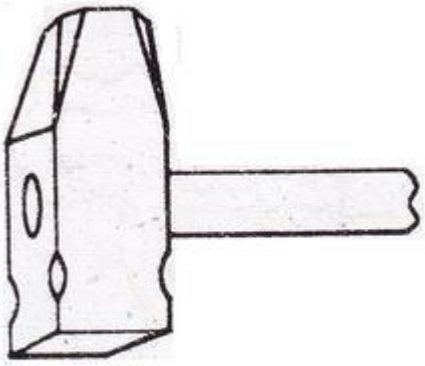
7. Drift, to expand the size of a hole after punching



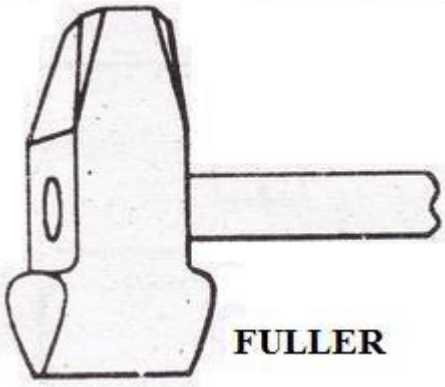
HOT CHISEL



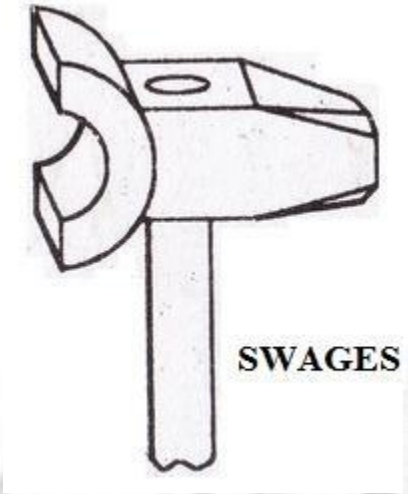
FLATTER



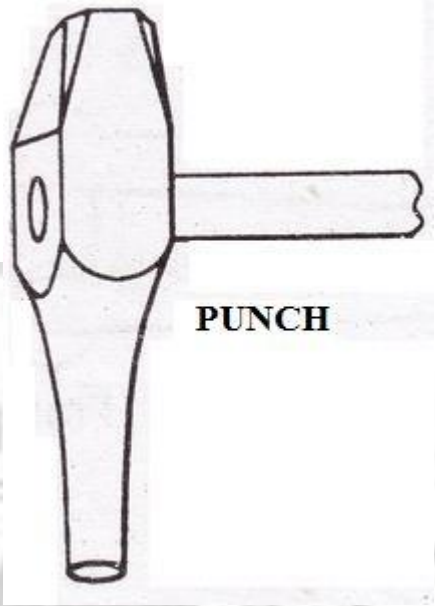
SET HAMMER



FULLER

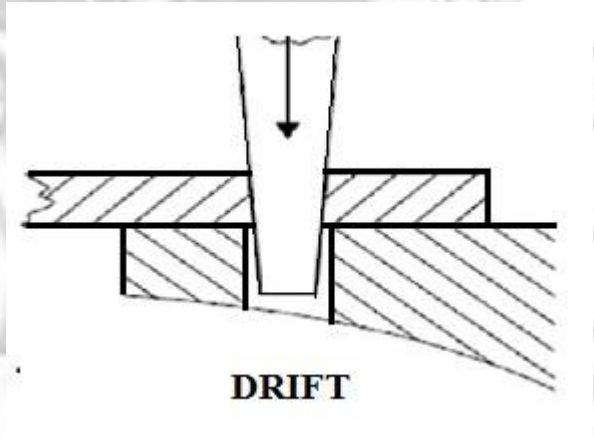


SWAGES



PUNCH

COLDCHISEL



DRIFT

HEATING OF METALS

For smithy, the temperature of steel is estimated by the colour of the heated zone. Dark red colour is obtained at about 700^0C and cherry red at 900^0 C. the colour red becomes orange at 1100^0C and white hot at 1300^0C. Heating of steel improves softness and reduce tensile strength resulting its plasticity and malleability. If the metal is over heated and kept for long time in a furnace, burning

due to oxidation may occur resulting cracks on surface or melting of the heat, affected zone. The Forging temperature for Mild Steel is in the range 750,1300^{0}C.

FORGING OPERATIONS

- Smith Forging Operations
- Upsetting or jumping up
- Forge Welding
- Drawing down or swaging
- Cutting
- Setting down
- Punching
- Bending
- Fullering

1) **Upsetting or jumping up** This is the process through which the cross section of metal stock is increasing with the corresponding reduction on its length. 2) Drawing down or swaging it is a forging operation during which the cross section of the metal is reduced and the length increased.

3) Setting down Setting down is the operation of reducing the thickness of the work piece in a small area.

4) Bending Bending is an operation by which the metal pieces may be bent to form various shapes without damage to its structure.

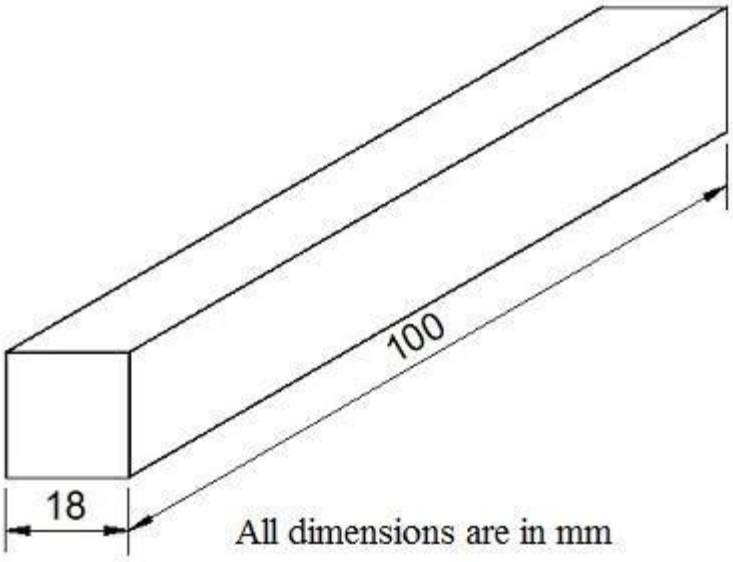
5) Forge Welding Welding in smithy is an important operation carried out in the smithy section. lt is the process of joining together two pieces of metal after they have been raised to correct welding temperature and then applying external pressure.

6) Cutting Cutting the metal in the hot or cold stage done by means of hot or **cold chisel.**

7) Punching and drifting it is the process of producing hole by using a hot punch over the pritchet hole of the anvil or over a cylindrical die.

8) Fullering it is actually same as drawing down and consists of reducing cross section of the work piece or lengthening a portion.

Ex no1.



CALCULATION

Diameter of the round rod = 20 mm

Length of the rod = 100 mm

Volume of the rod = $\pi r^2 h$

$= \pi 10^2 \times 100$

$= 31400\ mm^3$

Volume of the square rod = $a^2 h$

$$a^2 = \frac{V}{100}$$

$$a = \sqrt{\frac{v}{100}}$$

$$a = \sqrt{\frac{31400}{100}}$$

a = 17.22 mm

Ex No.1

Date

SQUARE BAR (HOT WORK)

AIM

To make a square bar from round M.S. rod.

OPERATION TO BE CARRIED OUT

Drawing, Flattening, squaring measuring, heating, hammering finishing.

LIST OF TOOLS

- Brass rule, Outside caliper, Chisel flat, Tongs, hollow flat, Sledge hammer
- Ball peen hammer, Flatter, rake, pocker, showel, Anvil, swage block.

MATERIALS REQUIRED

- Mild Steel rod Ø20 mm x 100 mm length, Coke and coal.

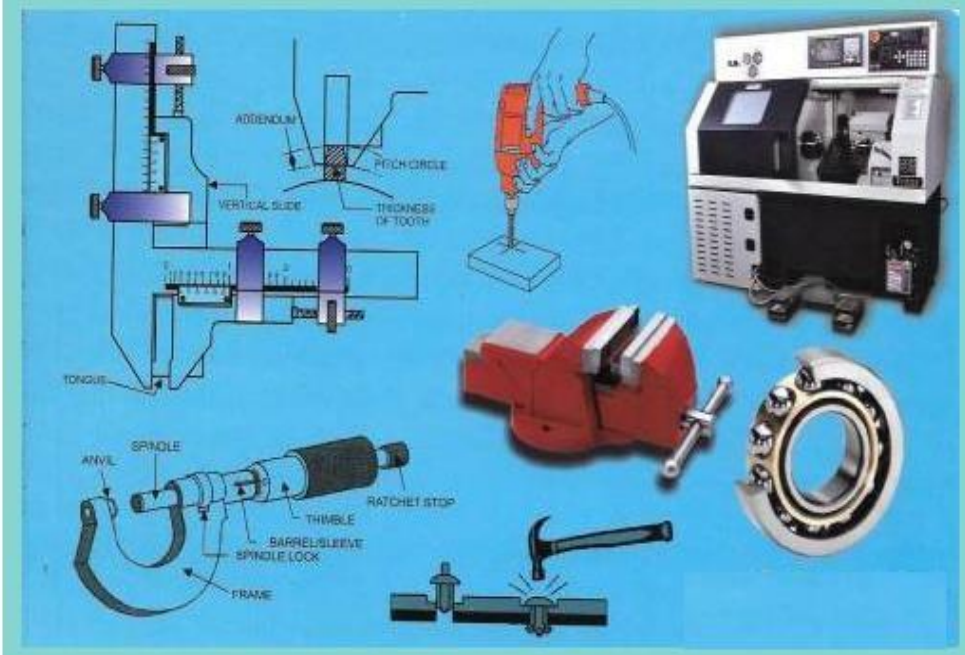
PROCEDURE

1. Cut the material to required dimension Ø20 mm x 100 mm length. Use sledge hammer and flat chisel.
2. Heat the metal to required temperature.
3. Draw out flat on the top side of the bar.
4. Turn 180^0 and form the second flat surface.
5. Again turn 90^0 and draw out the third flat surface.
6. Draw out the fourth flat surface.
7. Re-heat the bar till it turns into orange colour.
8. Check the squareness and dimensions.
9. Make correction if necessary.
10. Finish the square bar with flatter.

RESULT

Model of required dimensions is obtained.

FITTER


ADDENDUM
PITCH CIRCLE
VERTICAL SLIDE
THICKNESS OF TOOTH
TONGUE
ANVIL
SPINDLE
RATCHET STOP
THIMBLE
BARREL/SLEEVE
SPINDLE LOCK
FRAME

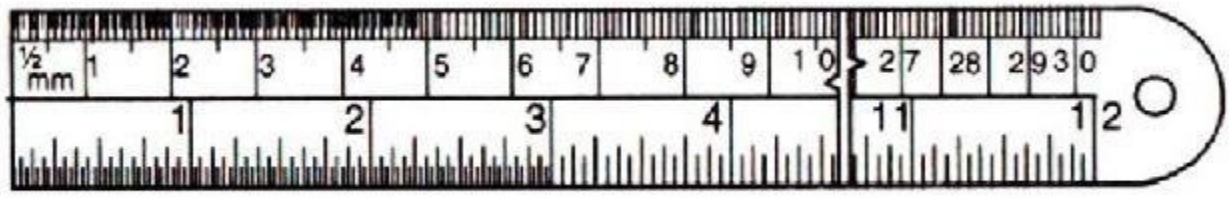
FITTING

Fitting consists of a hard work involved in fitting together components usually performed at a bench equipped with a vice and hand tools. The matting components have a close relation with each other, and when the function together is termed Fitting. We have to use hand tools, precision tools and various operations, as well as the details of the tool such as identification, material, parts, types, various uses, manipulation, specification, care and maintenance etc.

MEASURING AND MARKING INSTRUMENTS

1. Steel Rule

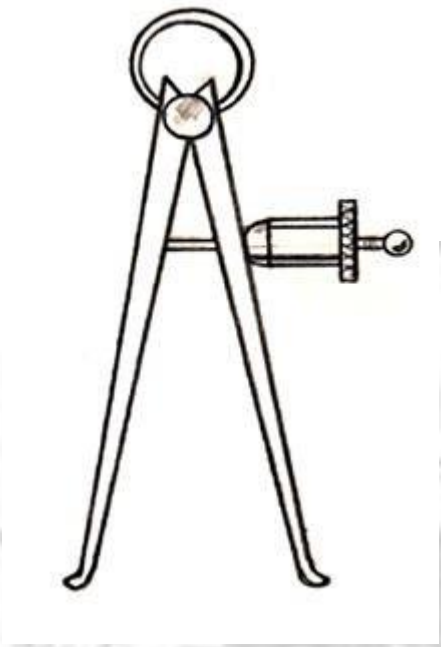
A steel rule is a direct reading measuring instrument used to read an accuracy of 0.5mm Available in various lengths, widths and thickness with several graduations. They are made from high carbon steel, spring steel, stainless steel and various alloy steel.



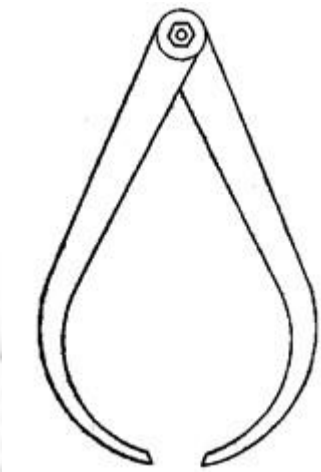
STEEL RULE

2. Caliper

It is a simple tool gauging legs. It is made of high carbon steel and the measuring points are hardened and tempered. Calipers are mainly classified into Spring type and firm joint caliper.



SPRING TYPE INSIDE CALIPER



FIRMJOINT OUTSIDE CALIPER

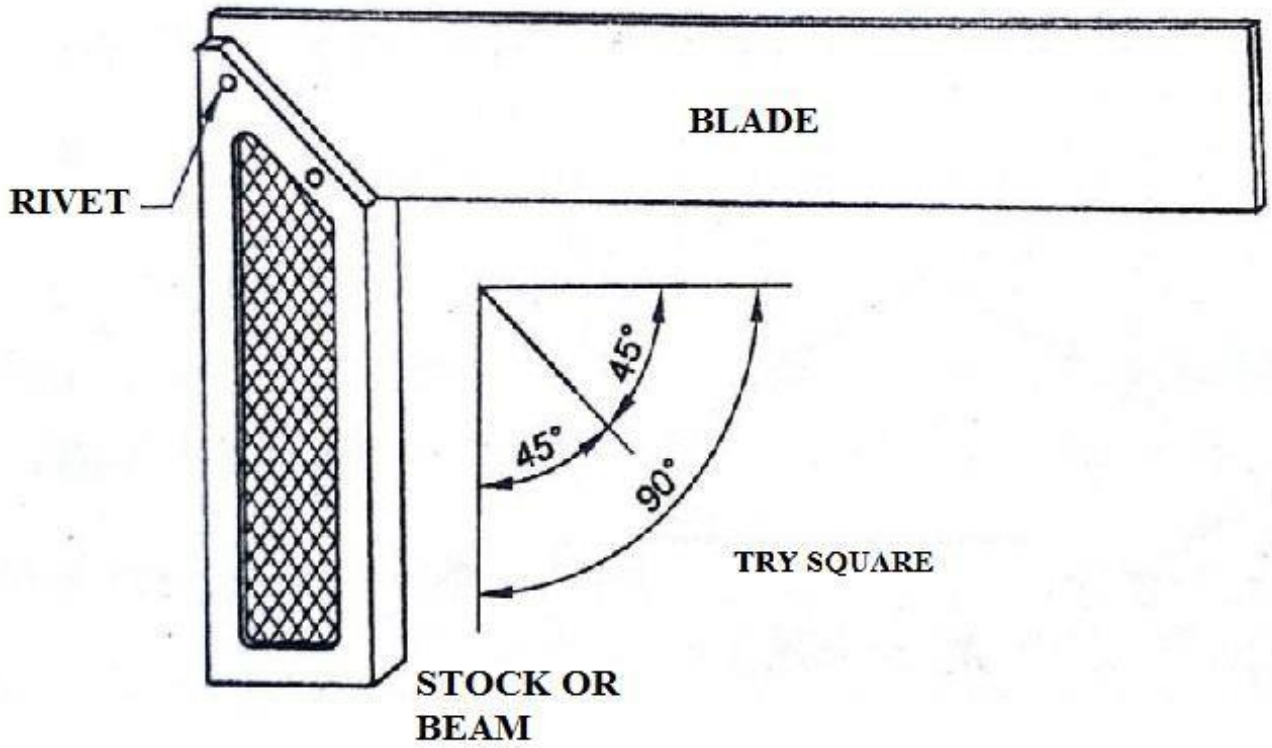
3. Types Outside Caliper,

They are used to measure the outer dimensions of the shafts, pulleys and square bars etc.

Inside Caliper They are used to measure the inner dimensions of holes, bores, slots etc.

Jenny Caliper They are used in layout work for locating and testing centre on cylindrical and other sections laying of distance from an edge and to scribe parallel lines.

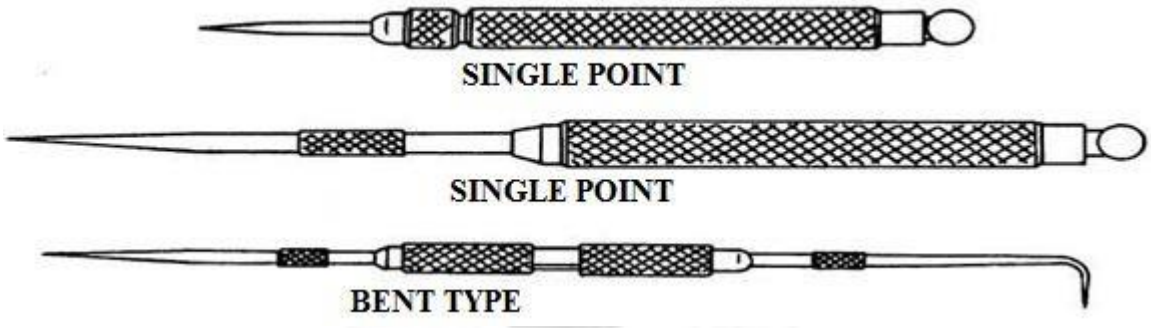
4. Try square it is a marking and checking instrument right anglers. It is made of two parts, the stock or beam made of cast iron and the blade made of high carbon steel. It is classified by its length of the blade; from the edge of the stock. It is used to check up the right angles and also for checking the flatness of the object.



5. Scriber A Scriber is a pointed tool used for marking lines on metals. Scribers are made from high carbon steel and the points are hardened and tempered.

Types

Straight Scriber, Bent type scriber, Offset scribes, Adjustable Scriber etc.

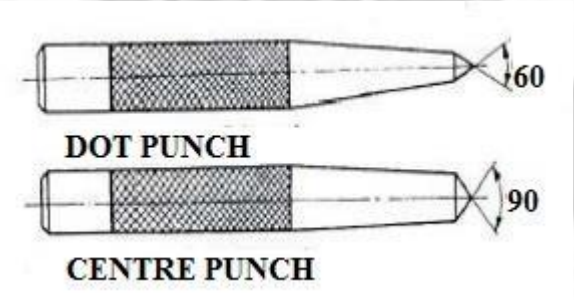


6. Divider This tool consists of two pointed legs having a joint at the top end. There are spring type and firm joint type dividers. It is made from high carbon steel and the points are hardened and tempered. It is used to scribe circles, arcs, parallel lines

and laying of distances. To divide straight or curved lines in to number of equal spaces, to find the centre of round bars, to transfer the dimension from a rule to job

7. Punches Punches are important tools used for marking outward, locating centre for holes. The punch marks are made along the marked out lines to make them Clear till the operation in over. Punches are made from carbon tool steel of length 90 to 150mm. The head is hardened and tempered. The point is ground to the proper angle according to the purpose of the punch.

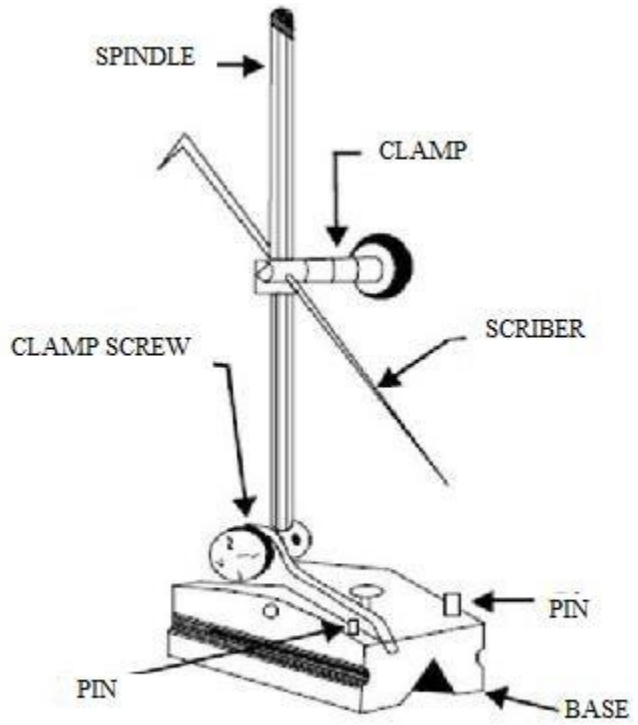
Dot punch is used to lightly indent along the layout lines, to locate center of holes and to provide a small center mark for divider point, etc. for this purpose, the punch is ground to a conical point having 60° included angle.



Center punch is similar to the dot punch, except that it is ground to a conical point having 90° included angle. It is used to mark the location of the holes to be drilled

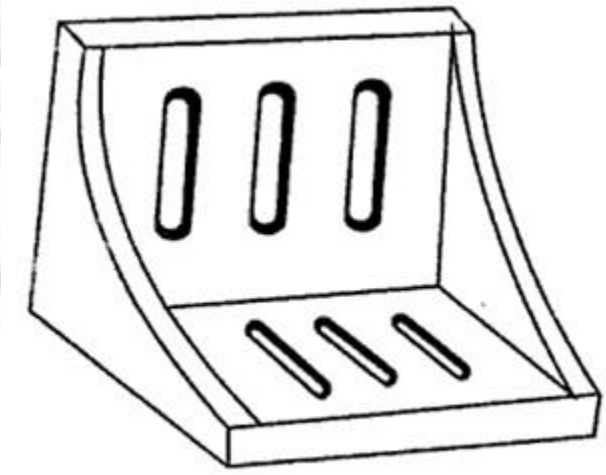
Prick punch Its point of angle is 30,40 degree, so that there points are sharp. It is also used to mark the location of the holes to be drilled.

8. Universal Surface Gauge It is often needed in connection with a surface plate, to scribe lines at a given vertical height from the base of the work or test the parallelism of the work. It consists of 6 parts. The major difference between the ordinary and universal scribing block are (1) a clamping nut which will adjust the movement of the spindle and (2) a fine adjusting Screw which helps the fine adjustment of the scriber point.



UNIVERSAL SURFACE GAUGE

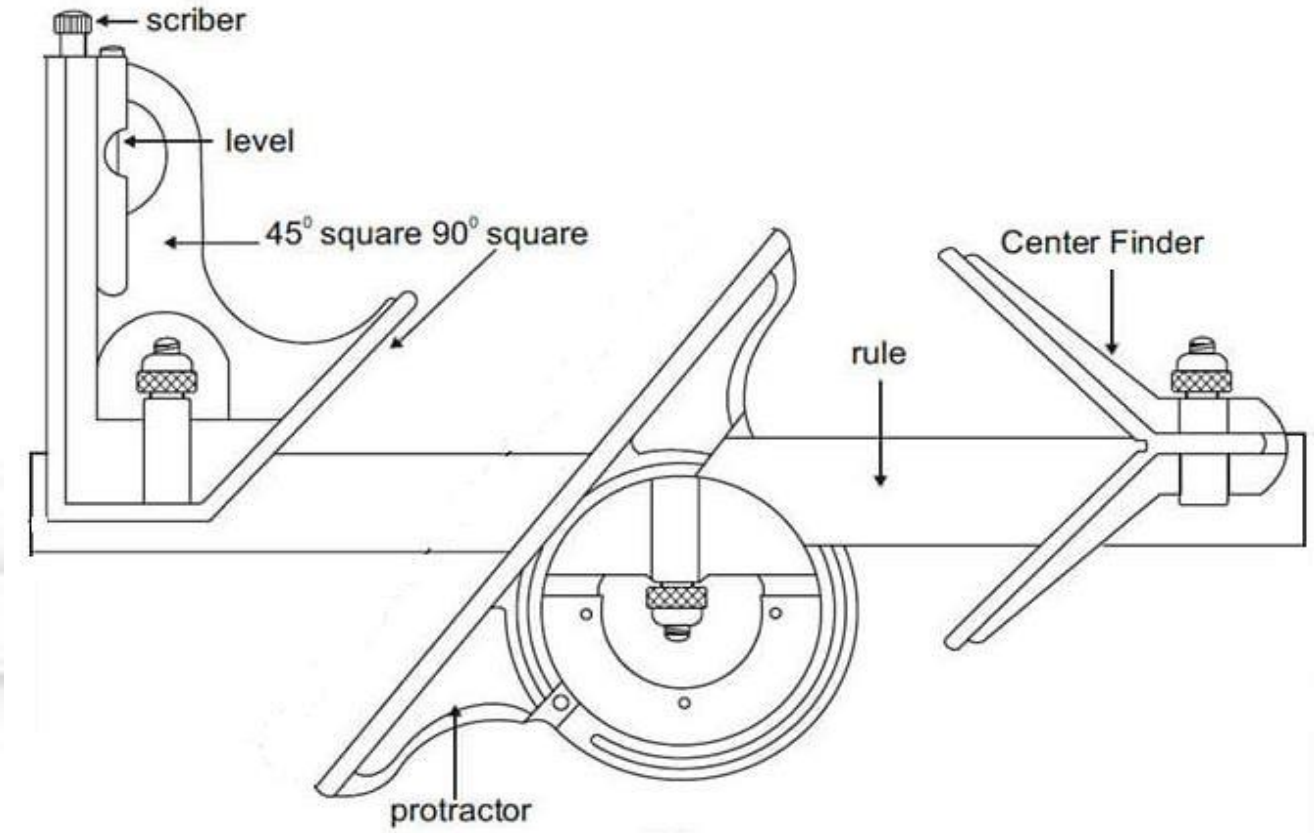
9. Angle Plate If the shape is such that it does not have a base, it has to be clamped to an angle plate. The faces of these plates are provided with slots to fasten the work in the plate by bolt and nut. Solid angular plates and adjustable angle plates are available.



ANGLE PLATE

10. COMBINATION SET

It is a precision checking instrument as well as a measuring instrument. It combines in one instrument a square head, a centre head and a Protractor head.



The three heads are used separately being held in at any desired position by nuts which engage in a slot machined on the whole length of the beam at its back. The beam which acts as a rule is marked in inches and centimeters for measuring length or height as and when required.

Square Head It has one edge square to the rule giving a right angle while the other edge from a meter. It is also provided with a spirit level both 90° and 45° can be tested by this head in conjunction with the rule.

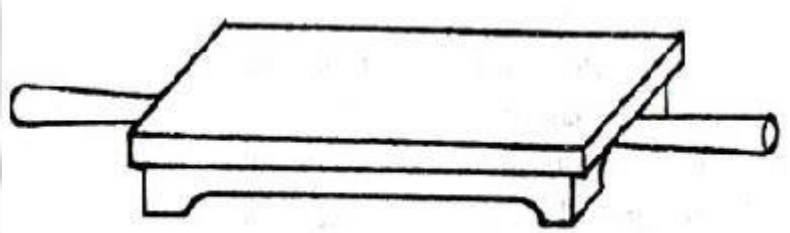
Centre Head With the rule fastened to it is called a centre head, It has two arms at right angles to one another and is so set as the rule that this angle is exactly

divided centre of a round bar or shafts. This is placed usually at the end opposite to the square head on the rule.

Protractor Head It is fitted at the centre of the rule is used to check, mark and measure angles from 00 to 180 degrees. It consists of a metal frame and graduated disc. The disc is graduated from 0 to 180 degrees in both directions. The adjustment is made by a screw; the head is provided with a spirit level to help in leveling the work or setting it as an angle.

11. SURFACE PLATE

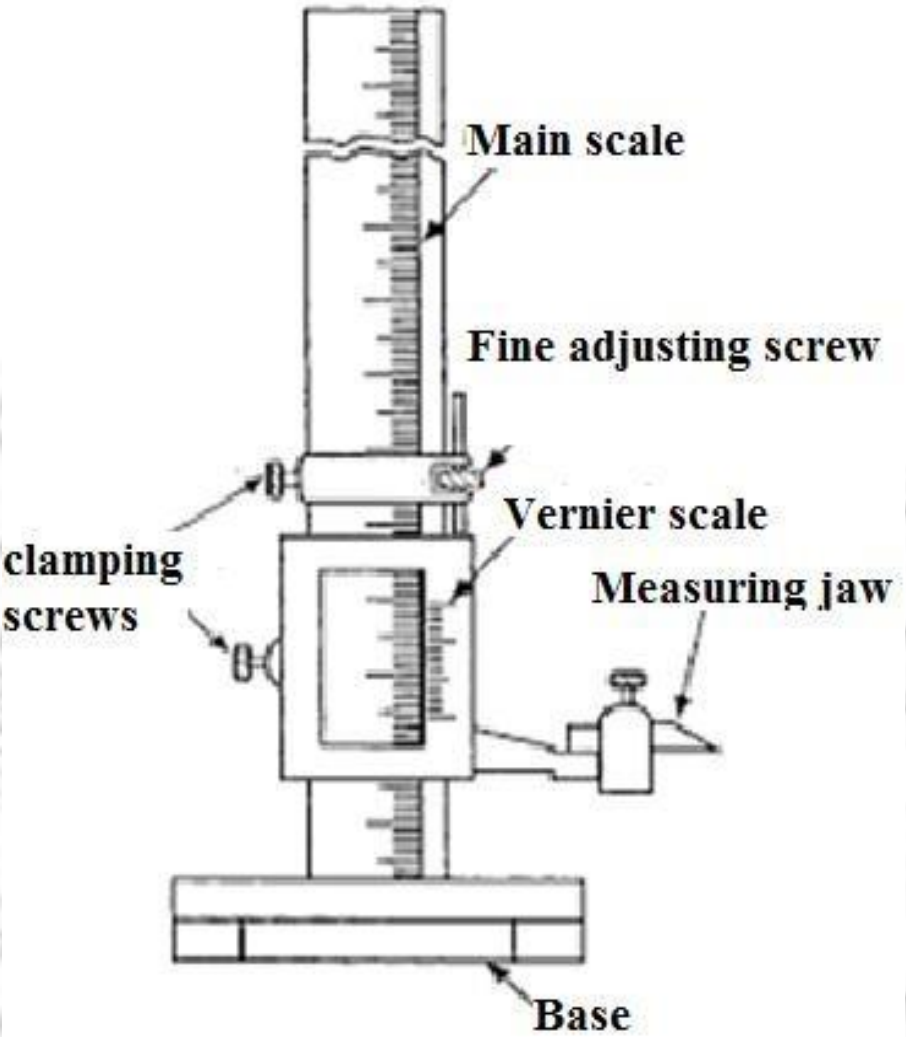
Surface plate is the basic tools used for marking. It is a plane table of fine grained cast iron. Even though surface plates are made in different sizes and shapes, the most common shapes are rectangular and square. The surface plate is specified in its sizes



SURFACE PLATE

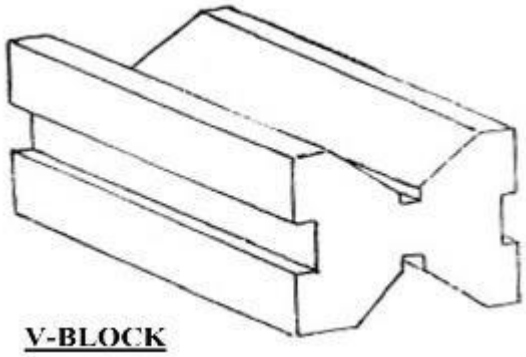
12. VERNIER HEIGHT GAUGE

The verneir Height gauge is used to measure the height of parts to an accuracy of 0.02mm (0.001 Inches). The vernier Height gauges are available for the following lower and upper limits of measurement 0,200, 20 to 250, 30 to 400, 40 to 500, 60 to 800 and 60 to 1000. For making out the scriber is set for the specified height and the lines are scribed by moving the scriber along the work piece.



13. V, BLOCK

This is a block of steel or cast iron, which provide with V-shape groove on its top or bottom or both surfaces. All its faces are truly machined. It is used to hold round bars during marking and drilling. The round bars clamped firmly on the V, block by a U clamp the slots cut at the 2 sides of the V block.



V-BLOCK

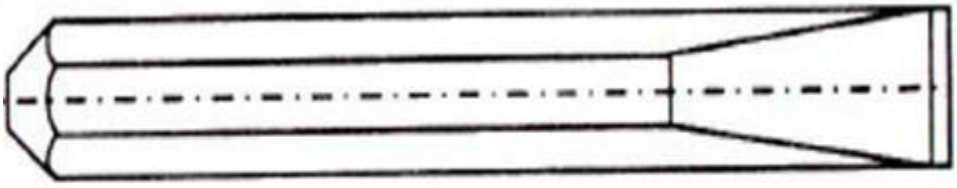
14. CUTTING TOOLS

CHISELS

Chisels are used for cutting and chipping away pieces of metal and are made of carbon steel usually of rectangular, hexagonal cross section. They are forged to shape roughly ground and then hardened and tempered. The edge is correct to the Cutting angle. Care being taken not to overheat the steel and draw the temper. The Cutting angles given to the chisel is determined mainly by the nature of the metal to be chip. It varies between 35 and 70 degree. It is generally specified by the length and width of the cutting edge.

Types

1. Flat chisel The flat chisel is the common of all the chisels used in engineering. It is the chisel which is used for most of the general chipping operation. It may be used for removing surplus metal from surface of jobs.



FLAT CHISEL

2. Cross cut chisel The cross cut chisel or cape chisel as it is sometimes called, is used cutting grooves in large surfaces. The cutting edge is slightly wider than the

supporting metal to provide clearance length of this chisel various from 100 to 400 mm width of the edge varies from about 4 to 12 mm.

Half round chisel A half round chisel is particularly useful for cutting oil ways, or grooves in bearing, pulleys, and bushes. They are also used for setting over pilot holes.

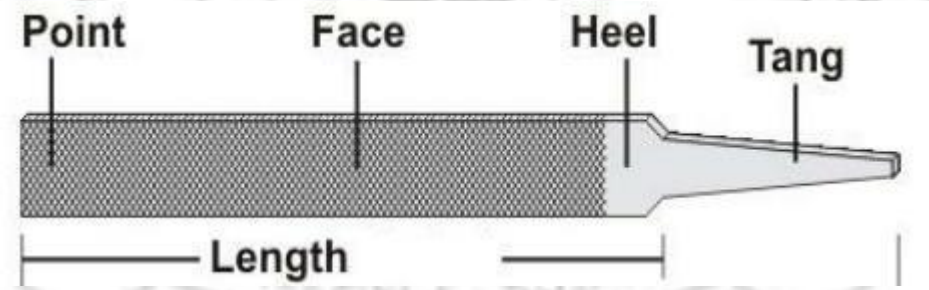
4. Diamond point chisel It is made square at the point and then beveled to make a cutting edge. It is used to make a cutting edge. it is used for cutting grooves and square Corners.

5. Side chisel It is ground and beveled on one side only. It is used for cutting sides were flat chisels cannot enter.

15. FILES

The most widely used hand tool in an engineering shop is the file. A file is a hardened piece of high grade steel with standing raw of teeth. The file consists of the

following parts tang, heel, face edge, and point. Files are classified according to four principal factors, sizes, shapes, grade and types of cut of teeth.

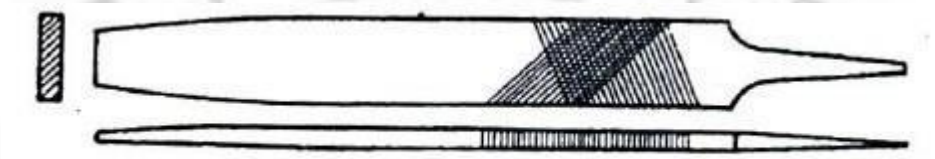


(1) Size The size of the file is it length. This is the distance from the point to the heel.

(2) Shape The swipe of file is its general outline and cross section. Commonly used shapes are as follows

a) Flat file This is tapered in width and thickness and one of the most commonly used file to general work. They are always double cut on faces and single cut on edges.

b) Hand file This is parallel in its width and tapered in thickness. It is used for finishing flat surfaces. It has one safe edge.



Flat file

c) Square file This square in cross section, double cut and tapered towards the point used for filing square corners, enlarging square or rectangular openings.

d) Round file They are round in cross section and usually tapered towards the point.

e) Half round file Its tapered, double cut, and its cross section is not a half circle but only about 1/3 of a circle. This file is used for round cuts and filing curved surfaces.

f) Triangular file It is triangular in shape and it is used for filing sharp corners and angles.

g) Knife edge file It is shaped like knife edge, tapered in width and thickness and double cut. They are used for filing narrow slots, notches and grooves.

h) Needle file It is made in sizes from 10 mm to 260mm of various shapes and cuts, are extremely delicate and are used for fine work.

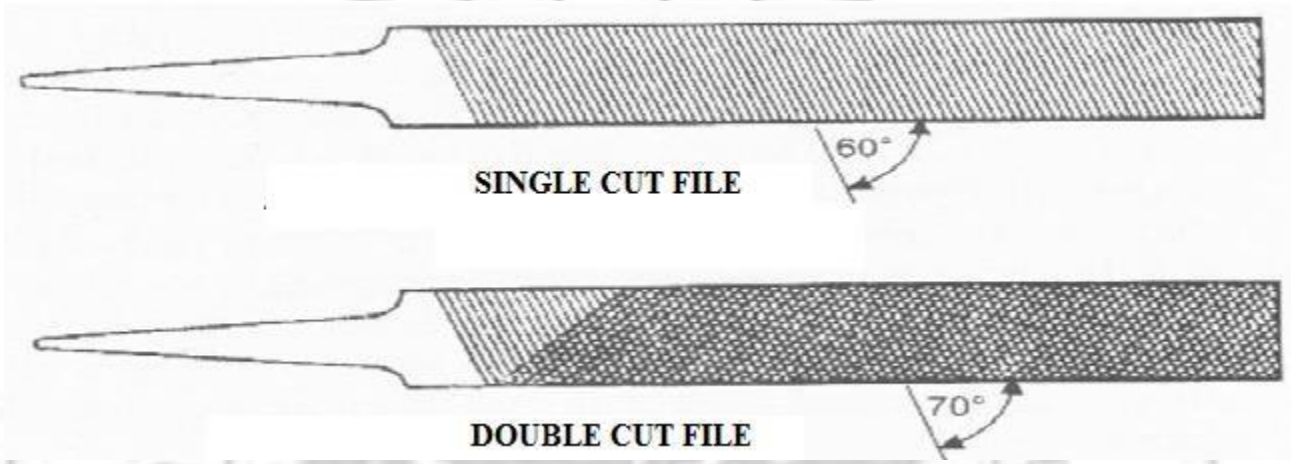
(3) Grade it is the coarseness is spacing between the rows of teeth, they are

Rough, Bastard, Second cut, smooth, dead smooth and super smooth.

(4) Cut Cut of files are classified into two groups

(a) Single cut and

(b) Double cut



On single cut files, the teeth are cut parallel across the file at an angle of about 60^0 to the centre of the file. Double cut file at an angle of teeth, the over, cut teeth being out at about 60^0, and the up cut at 75° to 80^{0}" to the centre lines.

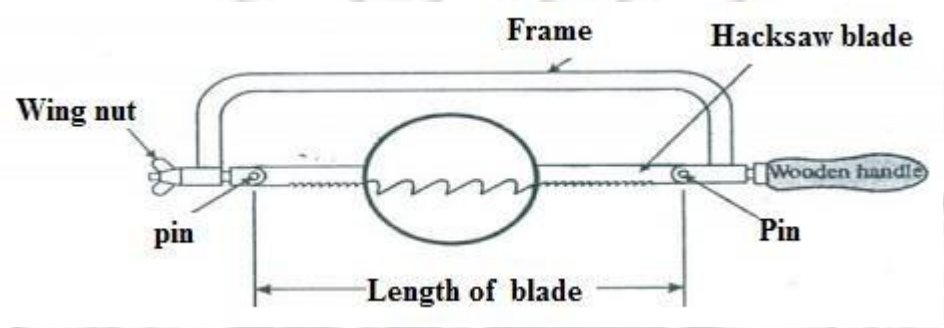
16. HACK SAW

The hacksaw is used for sawing metals. A hand hacksaw consists of a frame, handle, prongs, tightening screw and nut and blade. The frame is made to hold the blade tightly.

It is of two types `

The **solid frames**, in which the length cannot be changed, and the **adjustable frame,** which has a back that can be lengthened or shortened to hold blades of different length. Hack saw blades are made of either low alloy steel or a standard length 225,250 & 300mm. Push type blades those which cut in forward stroke only are generally used. Two types of hacksaw blades are available, all hard

and flexible. The all hard blade is hardened throughout and being more rigid. It is aid to an accurate sawing in hard metals. It requires skill to use, as it is easily broken. The flexible blade is hardened on the cutting edge only. They are suitable for general work for cutting,



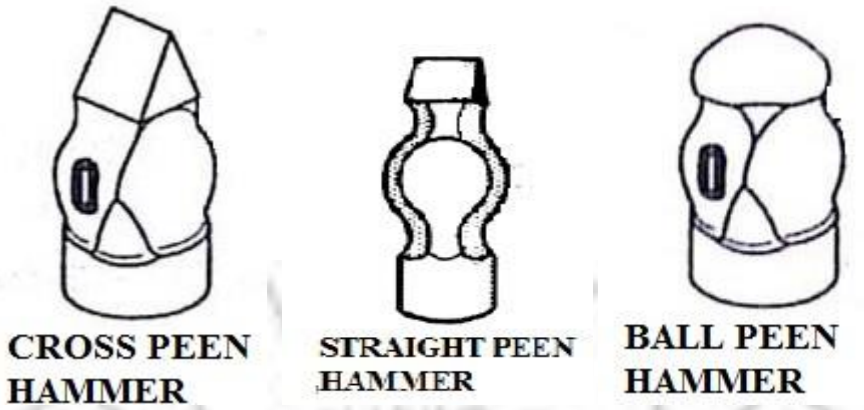
16. STRIKING TOOLS

Hammers are used to strike a job or a tool. They are made of forged steel of various sizes and shapes to suit various purposes. A hammer consists of 4 parts namely, peen, head, eye and face. The eye is made oval or elliptical in disc in shape and accommodates the handle.

Hammers are classified according to the shape and peen.

1. Ball peen hammer This is the most common hammer. The peen has a shape of a ball which is hardened and polished; size varies from 0.11 to 0.91 Kgs.

2. Cross peen hammer This is similar to ball peen hammer in shape and size except the peen which is across the shaft or eye.



3. Straight peen hammer This hammer has a peen straight with the shaft or parallel to the axis of the shaft.

4. Soft hammer When it is necessary to strike metal a blow with minimum damage to the surface as on hammer called mallet is used. They are made of hard rubber, copper, brass or commonly wood.

5. Double faced Both faces are similar in shape and are striking faces. It is used for heavier work and on flat surface in shops

17. WORK HOLDING DEVICES

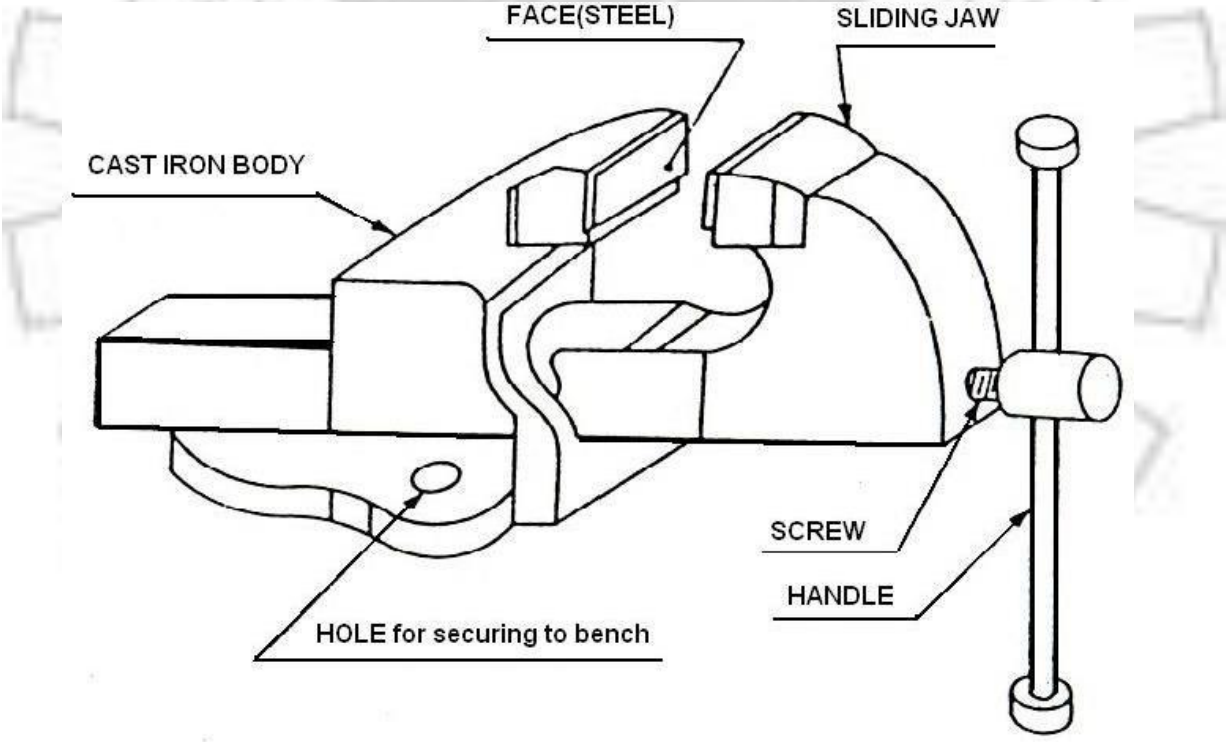
Vice Vice the most common tool for holding the work various types of vices are used for various purposes.

(a) Bench vice The most commonly used vice is engineers parallel jaw bench vice. It must be firmly fixed to a bench with nuts and bolts or screws. The vice essentially consists of a cast iron body, a fixed jaw, a movable jaw both made of cast steel, a handle, a square the ended screw and a nut all made of mild steel, separated cast steel plated jaw plates are fixed to the jaws by means of set screws and, they can be replaced when worn. The holding faces of Jaw plate, have teeth to hold the work firmly. The movement of the vice is caused by the movement of the screw through the nut fixed under the movable jaw. The size of the vice is known, by the width of its jaw.

(b) Leg vice The leg vice used by black smith is suitable for heavy hammering, chipping and cutting in fitters work.

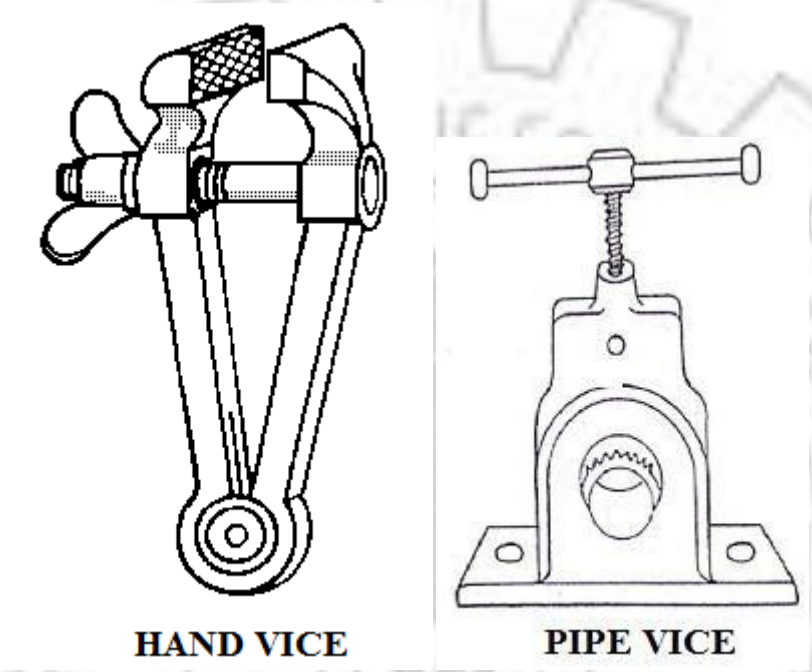
(c) Pipe Vice Pipe vice is used for holding round metals tubes, pipes, etc. In this case the screw is vertical and the movable jaw works vertically. It grips the work at 4 points on its surfaces.

(d) Hand vice The hand vice is used for gripping screws; rivets, keys, small drills and other similar objects which are too small to conveniently held, in the bench vice. It consists of two legs made of mild steel which holds the jaws at the top and hinged together at the bottom a flat spring held between the legs tends to keep the jaws open. The jaws can be open and close by a wing nut which moves through a screw that is fastened to one leg and passes through other



e) Pin Vice Pin vice is used for holding round materials of smaller diameter such as wire and pins during working. It also forms handles for small files. It consists of a handle and tapered nose covering a small collet chuck at its end. The chuck carries the jaws which are operated by turning the handle.

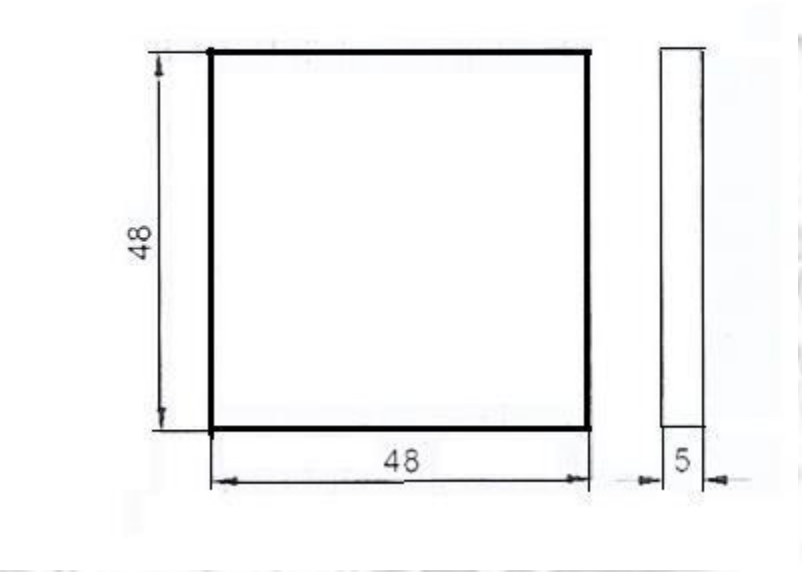
(f) Toolmakers Vice The toot maker's vice is useful for holding small work which, required filing or drilling. It is made of mild steel; it consists of a fixed jaw and a movable jaw, fixed with jaw plates. The movement is caused by the turn of screw through the nut, fixed under the movable jaw.



HAND VICE PIPE VICE

Ex.No.1

SQUARE MAKING



All dimensions are in mm

Ex. No. 1 SQUARE MAKING

Aim To make a square piece.

Materials required Mild steel flat piece of 50 X 50 X 6 mm `

Tools required flat file (bastard), flat file, smooth file, straight edge, steel rule, surface plate, V, BLOCK Vernier height gauge, punch, ball peen hammer, try square.

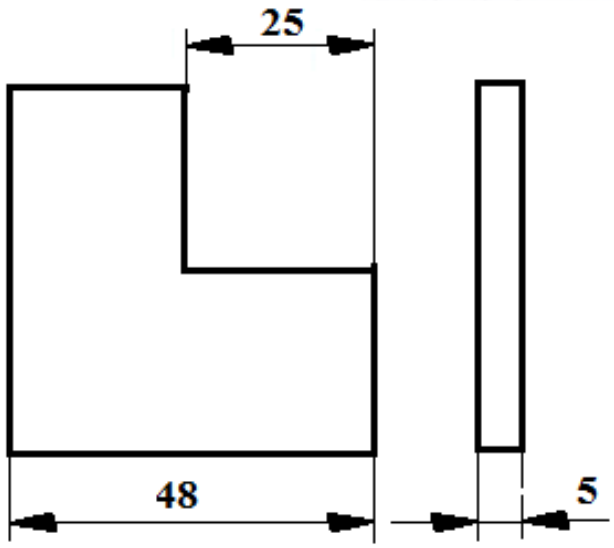
Operation to be carried out filing, checking, marking, punching, cutting and finishing.

Procedure

1. Hold the mild steel flat piece of 50 X 50 X 6mm between the jaws of the bench vice.
2. Start filing on first flat surface after removing the first with the tip of flat file.
3. Straight filing is continued till the surface is formed perfectly flat.
4. Checking the straightness by using straight edge.
5. Turn to the adjacent side which is narrow and make fit straight flat and 90° with flat surface prepared.
6. Then file the next adjacent side and make it flat and perpendicular to both flat surface and first narrow side which is already prepared.
7. For checking use try square.
8. Apply chalk on the finished flat surface and mark dimensions length wise and width wise.
9. Use surface plate V, block and vernier height gauge for marking.
10. Marked lines are punched by using dot punch and ball peen hammer.
11. File to correct dimensions in length and width and checked the dimensions using an outside caliper and steel rule.
12. Then file the second flat surface till correct flatness obtained.
13. Use flat files smooth for finishing, remove burns and give final touch.

Ex. No.2

L joint



All Dimensions are in mm

Ex no2

Date

L - JOINT

Aim To make a L - joint from mild steel flat.

Materials required mild steel flat piece of 50x50x6mm

Tools required flat file bastard, flat file smooth, safe edge file second cut, steel rule, straight edge, try square, surface plate, 'V' block, Vernier height gauge, dot punch, ball peen hammer, and hacksaw.

Operation to be carried out filing, checking, marking, punching, cutting and finishing

Procedure

1. Hold the mild steel flat piece of 50x50x6 mm between the jaws of the bench vice.
2. Remove the rest with the tip or edge of the flat file bar.
3. Prepared the first flat surface and four side with the flat file bastard, try square straight edge and steel rule.
4. Then apply a chock paste and mark the dimensions on the M.S flat piece with the help of V Block, surface plate, vernier height gauge.
5. Punch the required lines on the given M.S flat piece with help of dot punch and hall peen hammer
6. Separate the “A" piece and "B" piece from the permanent piece of with the help of hacksaw

Preparation of ”A." piece .

1. file the side "A" piece by using flat file bastard, safe edge file as per the dimensions

2, check the dimensions and perpendicularity of size with the help of try square and outside caliper.

Preparation of ’B’ Piece

1. file the sides of "B" piece by using flat file bastard and flat file smooth as per dimensions

2. check the dimensions and perpendicularity of size with the help of try square and outside caliper.

FITTING

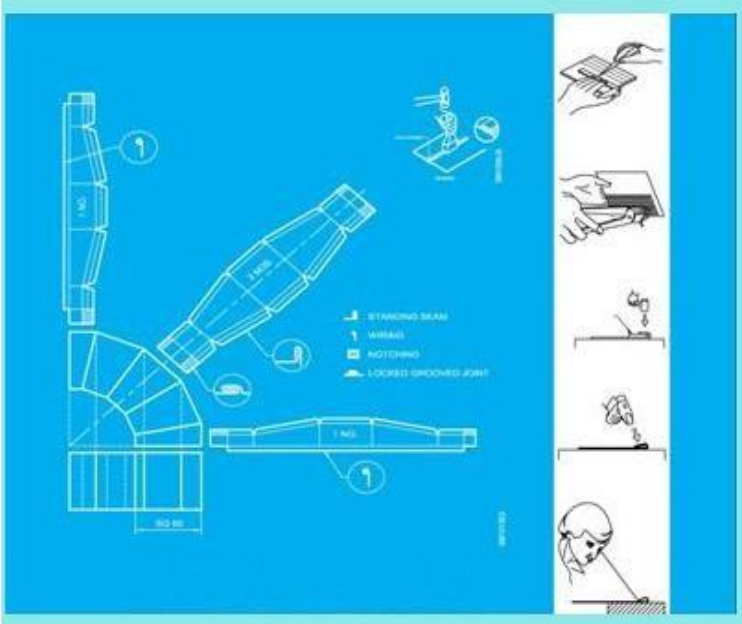
1, Fit the ”A’ piece with "B" piece in such way that there is no light passes through the fitted gap

2. Then file the second flat surface till correct thickness obtained

3. Finally remove the burns and give final touch with the help of flat file smooth

4. Finish the joint as shown in the figure.

SHEET METAL



SHEET METAL WORK

INTRODUCTION

Sheet metal work has its own significance in the engineering work. Many products, which fulfill the household needs, decoration work and various engineering articles, are produced from sheet metals. Common examples of sheet metal work are Hooper's, canisters, guards, covers, pipes, hoods, funnels, bends, boxes etc. Such articles are found less expensive, lighter in weight and in some cases sheet metal products replace the use of castings or forgings.

METALS USED IN SHEET METAL WORK

A metal plate of thickness less than 4 mm is considered as sheet. The size of the sheet is specified by its length, width and thickness in mm. In British system, the thickness of sheet is specified by a number called Standard Wire Gauge (SWG). The commonly used gauge numbers and the equivalent thickness in mm are given below

SWG (No.)	16	17	18	19	20	22	24	27	30
Thickness (mm)	1.62	1.42	1.22	1.02	0.91	0.71	0.56	0.42	0.37

The following metals are generally used in sheet metal work

Black Iron Sheet

It is the cheapest among ail. It has a bluish black appearance and is uncoated sheet. Being uncoated, it corrodes rapidly. It is prepared by rolling to the desired thickness, then annealed by pleasing in a furnace and then set aside to cool gradually. The use of this metal is limited to articles that are to be painted or enameled such as stovepipes, tanks, pans etc.

Galvanized Iron

It is soft steel coated with molten zinc. This coating resist rust, improves appearances, improves solidaribility, and improves water resistance. It is popularly

known as G.I. sheets. Articles such as pans, buckets, furnaces, cabinet etc. are made from GI sheets.

Stainless Steel

It is an alloy of steel with nickel, chromium and traces of other metals. It has good corrosive resistance. The cost of stainless steel is very high but tougher than GI sheets. It is used in kitchenware, food handling equipment, chemical plants etc.

Copper

It is a reddish colored metal and is extremely malleable and ductile. Copper sheets have good corrosion resistance as well as good appearances but costs are high as compared to GI and stainless steel. Because of high thermal conductivity, it is used for the radiator of automobiles, domestic heating appliances etc.

Aluminium

Aluminium cannot be used in its pure form, but is used in alloy form. Common additions are copper, silicon, manganese and iron. It has many qualities like high ratio of strength to weight, corrosion resistant qualities, and ease in fabrication and whitish in color. It is used in manufacturing of a number of products such as refrigerator trays, household appliances, lighting fixtures, window work, construction of airplanes and in many electrical and transportation industries.

Tin Plates

It is an iron sheet coated with the tin to protect it against rust. This metal has a very bright silvery appearance and is used principally in making food containers, cans and pans.

HAND TOOLS

For measuring, marking cutting and forming, various types of hand tools are used in sheet metal work. A list of them is given below

I. Measuring tools

II. Marking tools

III. Cutting tools

IV. Forming tools

V. Joining tools

MEASURING TOOLS

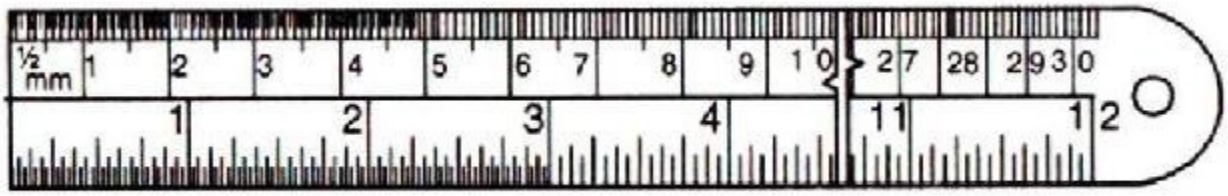
The following types of tools are commonly used in sheet metal shops to measure the dimensions of work pieces

1. Steel rule
2. Sheet Metal gauge

3. Try Square

Steel rule/ Brass rule

The steel rule consists of a hardened steel strip having line graduations etched or engraved in it. They are usually 150mm or 300mm long and is used to take linear measurements to an accuracy of 1mm or 0.5mm. The brass rule is similar to steel rule, but it is made of brass. Since the brass possess low coefficient of linear expansion, its dimensional accuracy will be more reliable in heated regions.

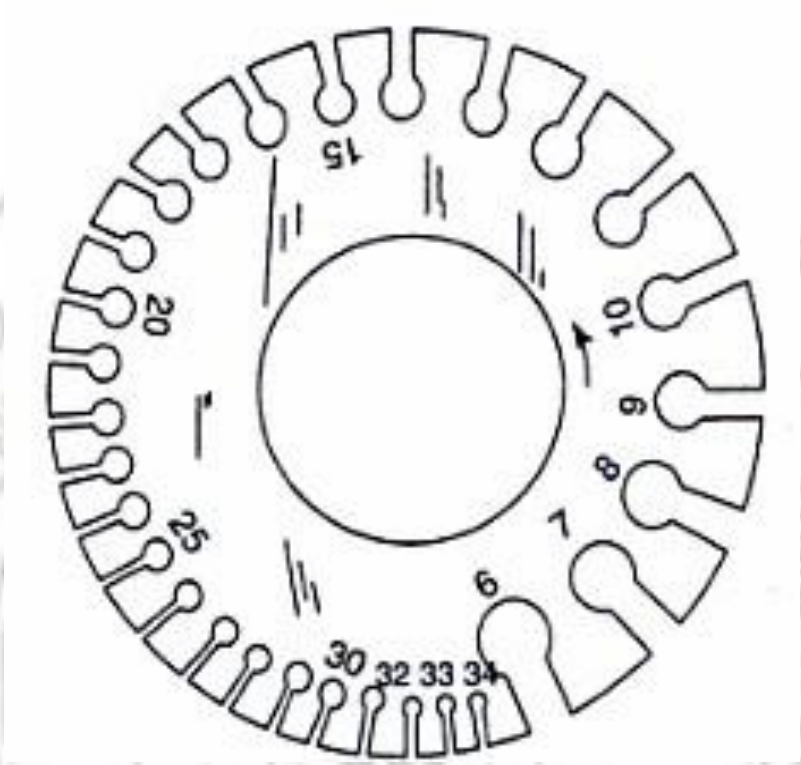


STEEL RULE

SHEET METAL GAUGE

It is a disc shaped piece of metal, having a number of slots on the outside edge as shown in figure. The slots are of various widths and each corresponds to a certain standard wire gauge (SWG) number. The gauge is placed over the edge of

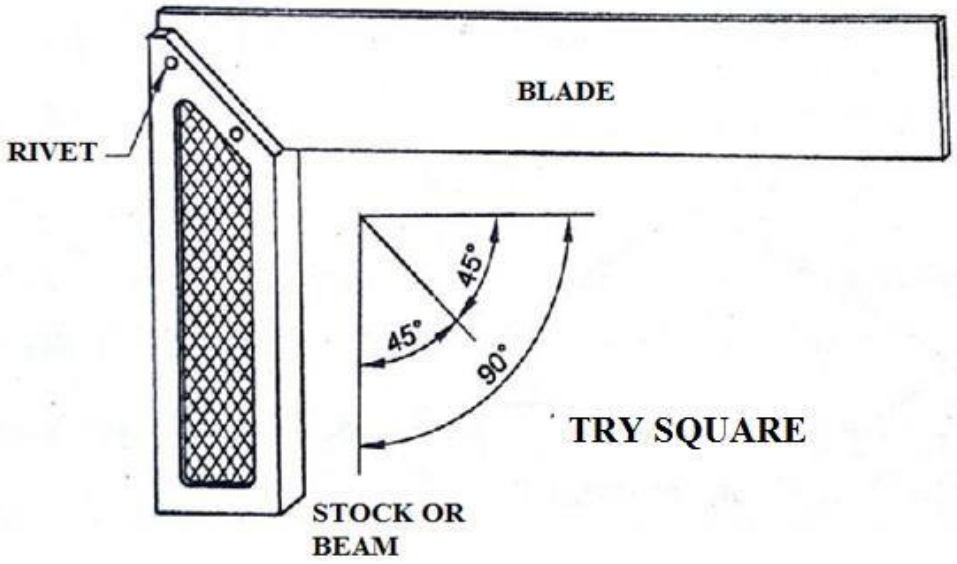
the sheet to be measured and a slot is found that will slip over the metal with a light fit pressure. Standard tables are referred to for conversion of SWG numbers to mm sizes

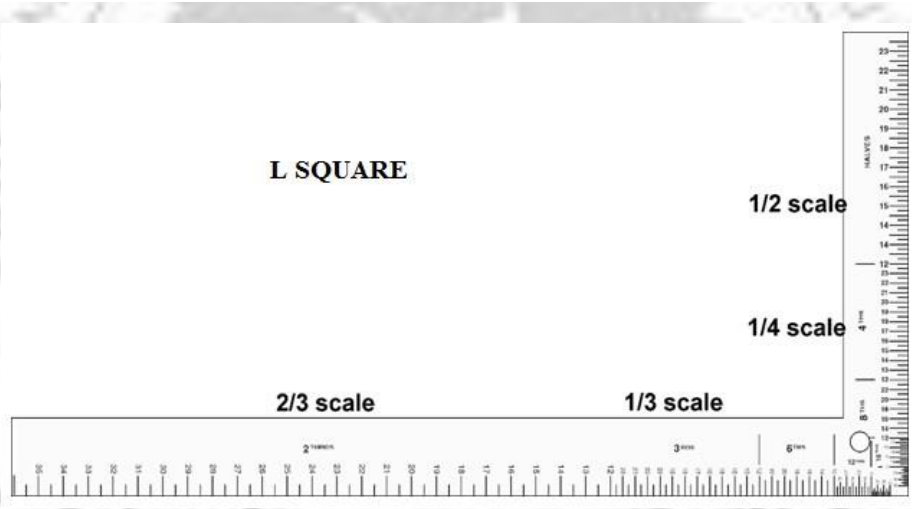


STANDARD WIRE GAUGE (SWG)

Try Square

It is used for checking squareness of two surfaces. It consists of a blade made up of steel, which is attached to a base at 90 degrees. The base is made up of cast iron or steel. It is also used to mark the right angles and measuring straightness of surfaces. Never use try square as a hammer.

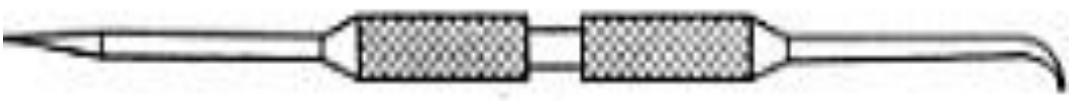




MARKING TOOLS

Scriber

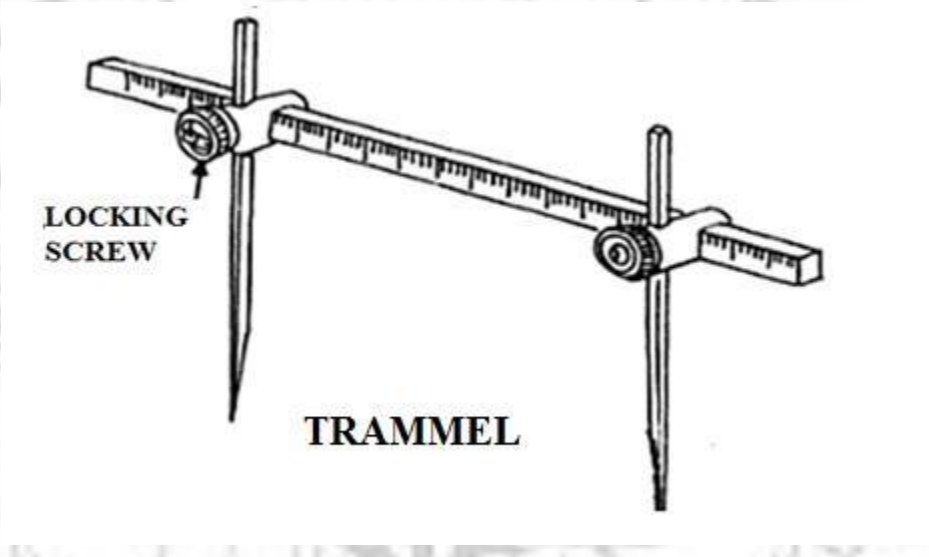
It is used to scribe or mark line on a metal surface for a variety of purposes. It is a metalworker's pencil.



SCRIBER

Trammel

These are used for drawing large circles and arcs that are beyond the limit of dividers. It has two straight, removable legs tapered to a needle point mounted on separate holders which slide on steel (or wooden) bar and held in position by thumb screws.



TRAMMEL

Punches

It is used in sheet metal work for marking on sheet, locating centers. Punches are percussion tools and are manufactured from tool steel. They are used on any scribed lines by indentations. Tips are tapered, hardened and tempered. The shanks are knurled for easier handling and gripping. The punch whose tip is tapered at an angle of 90º is known as centre punch used to mark centres to be drilled or to mark centre of an edge. A dot punch with tip tapered at 60º is used to punch a chain of dots on a scribed line.

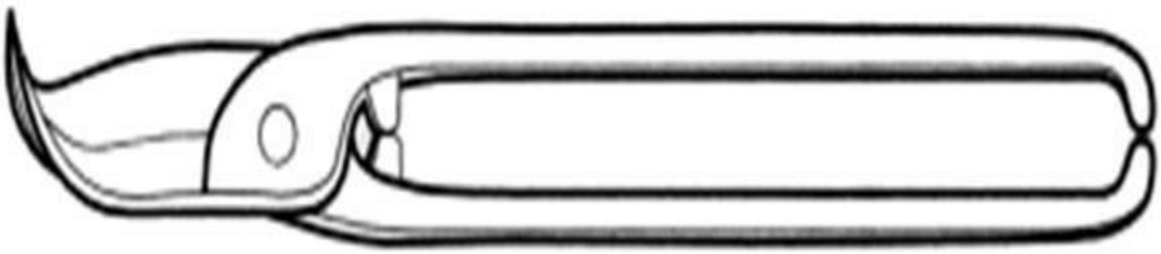
CENTRE PUNCH

DOT PUNCH

CUTTING TOOLS

To cut the sheet metal as per the pattern drawn and to make holes for rivets etc., the following types of tools are used. A snips is a hand shear used to cut thin sheets of gauge size number 20 or above. It works like ordinary scissors. There are several types and sizes of snips available to cut along straight lines or curved lines. A straight snips having straight blades to cut along straight lines snip having curved blades to cut along curved lines. These snips are used for cutting thin sheets. The heavier types are known as bench shear and block shear.

STRAIGHT SNIPS



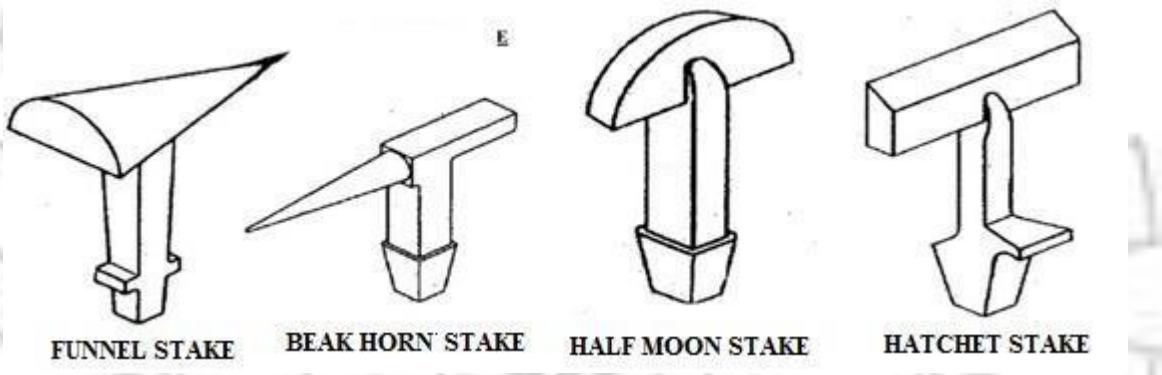
BENT SNIPS

FORMING TOOLS

Shaping of the sheet metal such as folding, bending, curling, etc., are done by using the following types of forming tools.

Stakes

Stakes are the sheet metal anvils used for bending, seaming and forming by using a hammer or mallet. They work as the supporting tool as well as the forming tools. They are made in different sizes and shapes depending upon the job requirement. Commonly used stakes are Round bottom stake, funnel stake, hatchet stake, half, moon stake, beak horn stake.

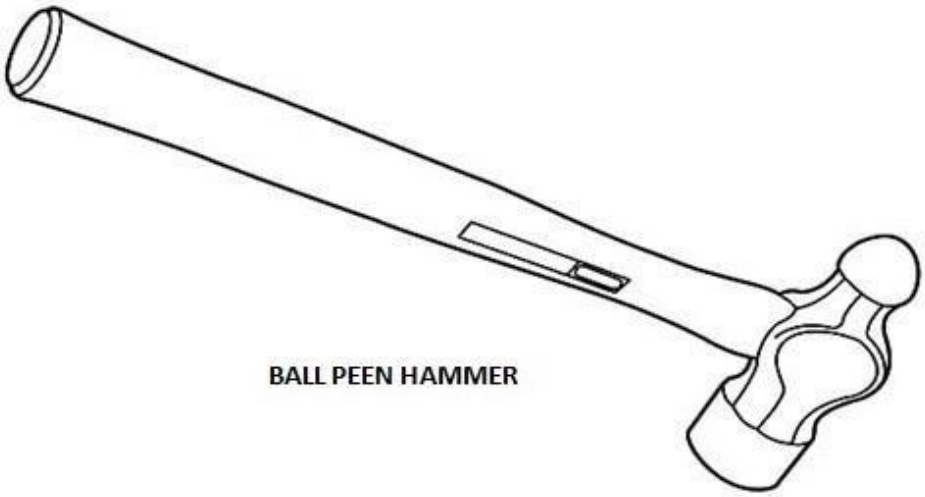


HAMMERS

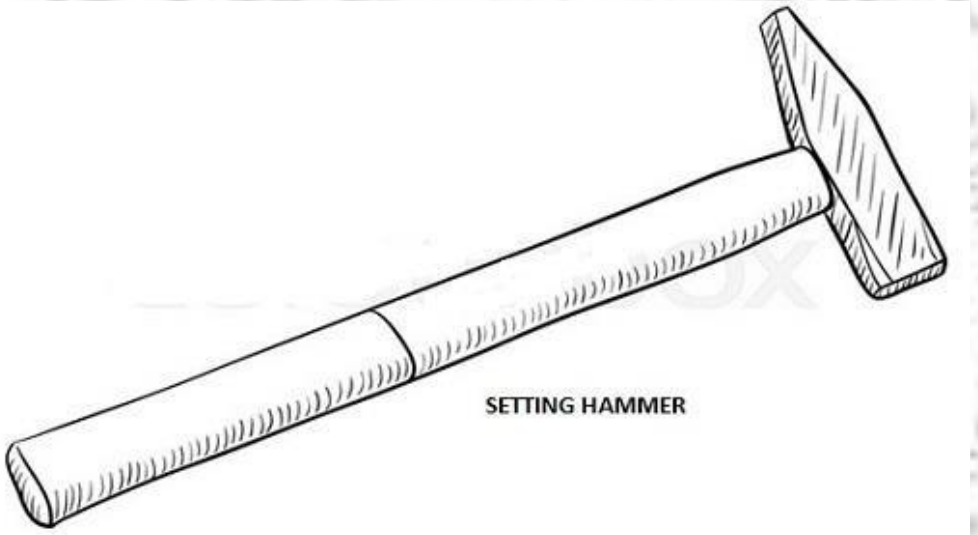
The sheet metal is shaped by hammering or striking with mallet, after keeping the work on suitable form of stake. The hammers used for sheet metal work are (a) Setting hammer, for setting down the edge while making double seam, (b) Raising hammer for forming curved or hollow shape from flat piece, and (c) Riveting hammer for riveting purpose. Mallets are soft hammers used to give soft blows which will not damage the sheet at the same time will shape them.

Ball peen hammer

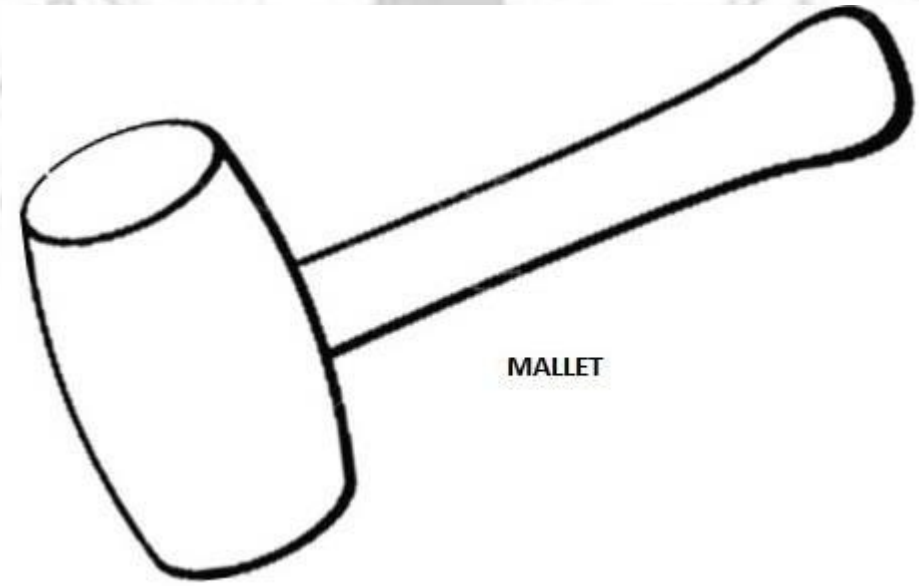
Hammer is a hand tool made of tool steel, largely used for striking on the metals. A hammer is named by its peen. The ball shaped peen hammer is known as ball peen hammer. The peen and face are hardened.



BALL PEEN HAMMER



SETTING HAMMER



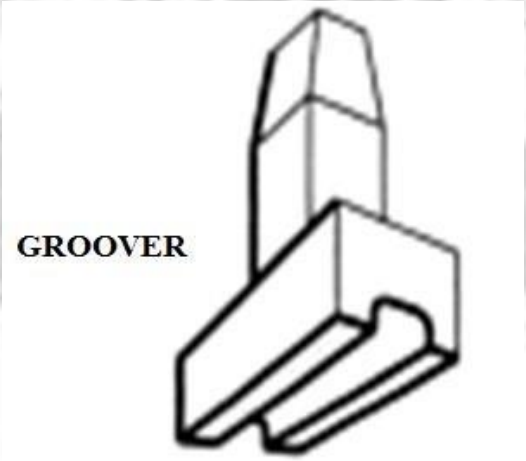
MALLET

JOINING TOOLS

The tools exclusively used for making and finishing joints are

Hand Groover

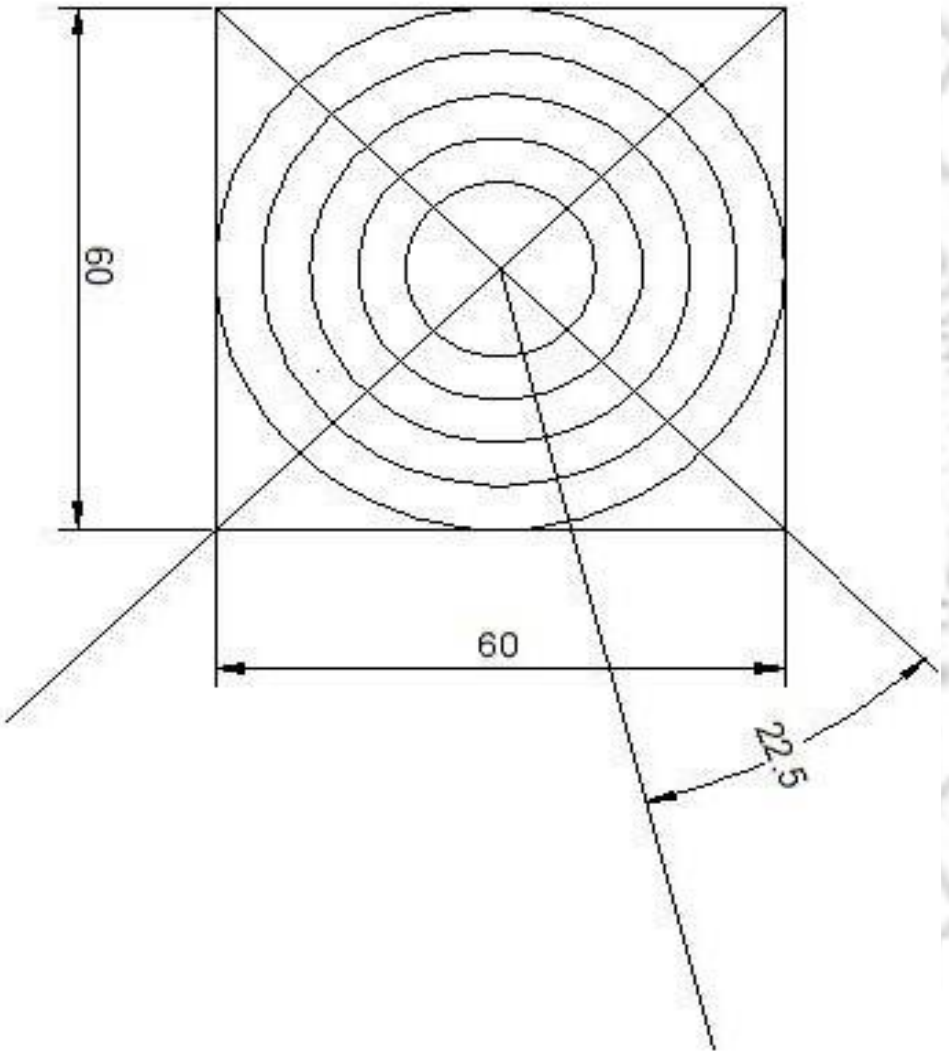
Hand groovers are used to flatten and shape joints made in sheet metal. The tool has a groove of required width and depth like a die. This groover is placed over the joint (double hem or lock seam) and hammered from the top of it, to shape the joint that of the groove.



Ex. No. 1

Date

CIRCLE CUTTING



All dimensions are in mm

Ex. No1
Date

CIRCLE CUTTING

AIM

To practice circle cutting with a given piece of sheet.

TOOLS REQUIRED

Bench vice, mallet, steel rule, scriber, try square, straight snips, bend snips, divider etc.

MATERIAL REQUIRED

A piece of 26SWG G I Sheet dimension 60 X 60 mm.

OPERATIONS TO BE CARRIED OUT

Marking, cutting, filing, leveling, finishing.

PROCEDURE

Prepare the sheet for the job. Mark dimensions …… the sheet and complete, the drawing as shown in figure. Cut the sheet through the curved lines and finish the work.

PRECAUTIONS

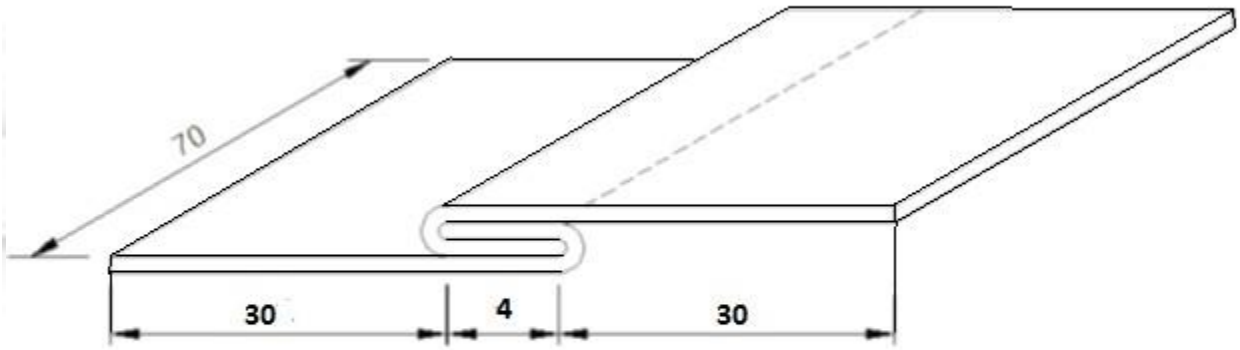
1. Care should be taken while cutting with snip.
2. Care should be taken while bending and jumping

RESULT

Complete the circle cutting practice in the given dimensions.

Ex.No2
Date

GROOVED JOINT



All dimensions are in mm

Ex.No2

Date

GROOVED JOINT

AIM

To make a Grooved joint with a given piece of sheet.

TOOLS REQUIRED

Bench Vice, Mallet, Steel Rule, Scriber, Try Square, Snips, file

MATERIALS REQUIRED

A piece of ……. SWG GI sheet dimensions…….

OPERATIONS TO BE CARRIED OUT

Marking, Cutting, Filing, Leveling, Bending, Finishing.

PROCEDURE

Take two piece of dimension…… Is made out by filing and leveling the given pieces. 4mm is marked both sheets and bend through that marking pieces hooked and joined with the help of mallet and a joint is made. The complete the work of Grooved Joint.

PRECAUTIONS

1. Care should be taken while cutting with snip.
2. Care should be taken while bending and jumping

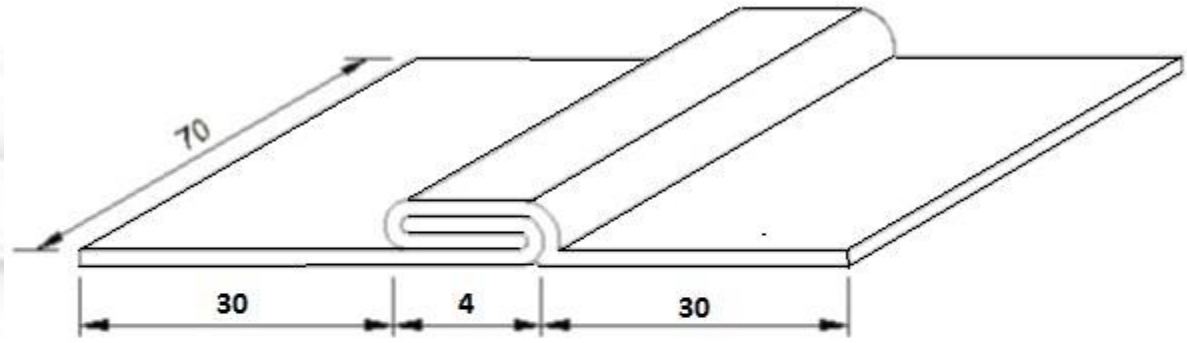
RESULT

Grooved Joints is formed.

Ex. No3

Date

LOCKED GROOVED JOINT



All dimensions are in mm

Ex. no3
Date

LOCKED GROOVED JOINT

AIM

To make a Locked Grooved joint with a given piece of sheet.

TOOLS REQUIRED

Bench Vice, Mallet, Steel Rule, Scriber, Try Square, Snips, file

MATERIALS REQUIRED

A piece of ……. SWG GI sheet dimensions…….

OPERATIONS TO BE CARRIED OUT

Marking, Cutting, Filing, Leveling, Bending, Finishing.

PROCEDURE

Take two pieces of dimension……. is made out by filing and leveling the given pieces. 4mm is marked both sheets and bend through that marking pieces hooked and joined with the help of mallet and a joint are made, then joint locked with groover. Thus complete the work of Locked Grooved Joint.

PRECAUTIONS

1. Care should be taken while cutting with snip.
2. Care should be taken while bending and jumping

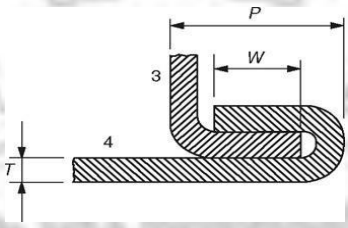
RESULT

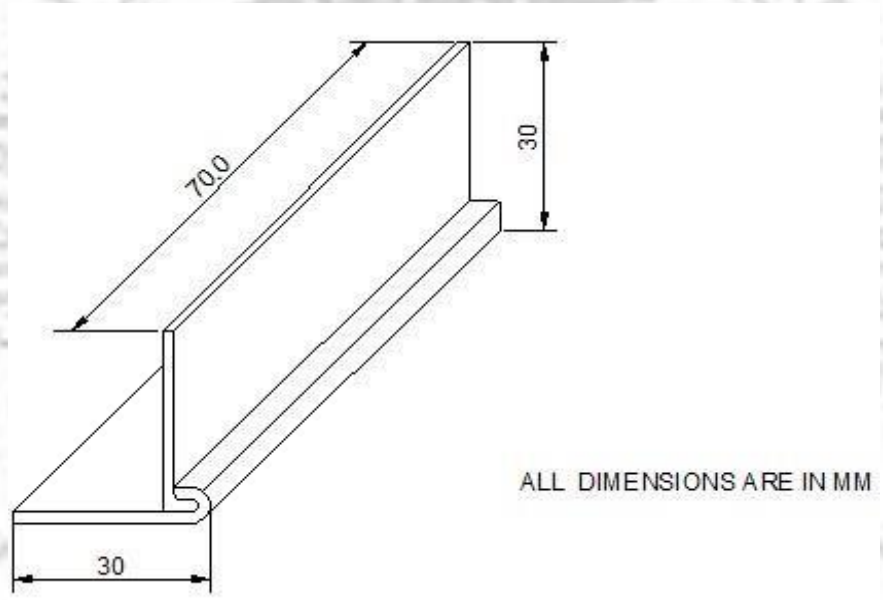
Locked Grooved Joints is formed.

Ex. No4

Date

PANNED DOWN JOINT





Ex.No4

Date

PANNED DOWN JOINT

AIM

To make a Panned Down joint with a given piece of sheet.

TOOLS Required

Bench Vice, Mallet, Steel Rule, Scriber, Try Square, Snips, file

MATERIALS Required

A piece of ……. SWG GI sheet dimensions…….

OPERATIONS to be carried out

Marking, Cutting, Filing, Leveling, Bending, Finishing.

PROCEDURE

Take two piece of dimension……. Is made out by filing and leveling the given pieces. 4mm is marked both sheets and bend through that marking pieces interlocked and joined with the help of mallet and a joint is made as 90 degrees. Thus complete the work of Panned Down Joint.

PRECAUTIONS

1. Care should be taken while cutting with snip.
2. Care should be taken while bending and jumping

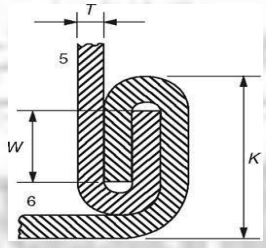
RESULT

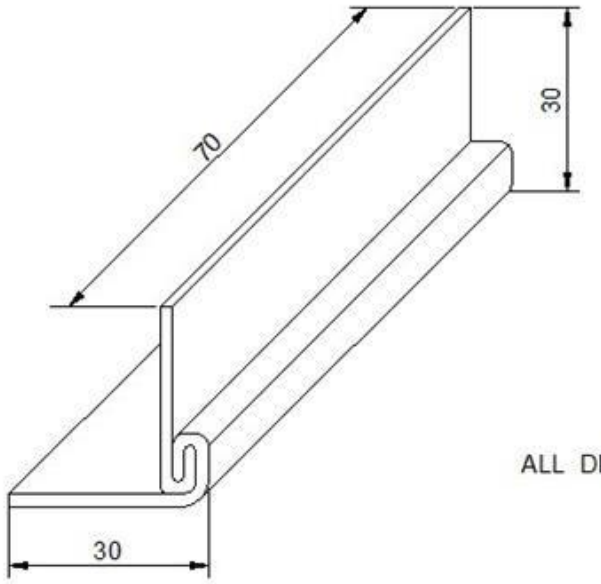
Panned down Joints is formed.

Ex. No5

Date

KNOCKED UP JOINT





ALL DIMENSIONS ARE IN MM

Ex.No5

Date

KNOCKED UP JOINT

Aim

To make a Knocked up joint with a given piece of sheet.

TOOLS REQUIRED

Bench Vice, Mallet, Steel Rule, Scriber, Try Square, Snips, file

MATERIALS REQUIRED

A piece of ……. SWG GI sheet dimensions…….

OPERATIONS TO BE CARRIED OUT

Marking, Cutting, Filing, Leveling, Bending, Finishing.

PROCEDURE

Take two piece of dimension……. Is made out by filing and leveling the given pieces. 4mm is marked both sheets and bend through that marking pieces interlocked and joined with the help of mallet and a joint with the suitable tools. Thus complete the work of Panned Down Joint. Then bend the jointed portion of the panned down joint towards parallel to the vertical side to get Knocked Up Joint and finished the joint.

PRECAUTIONS

1. Care should be taken while cutting with snip.
2. Care should be taken while bending and jumping

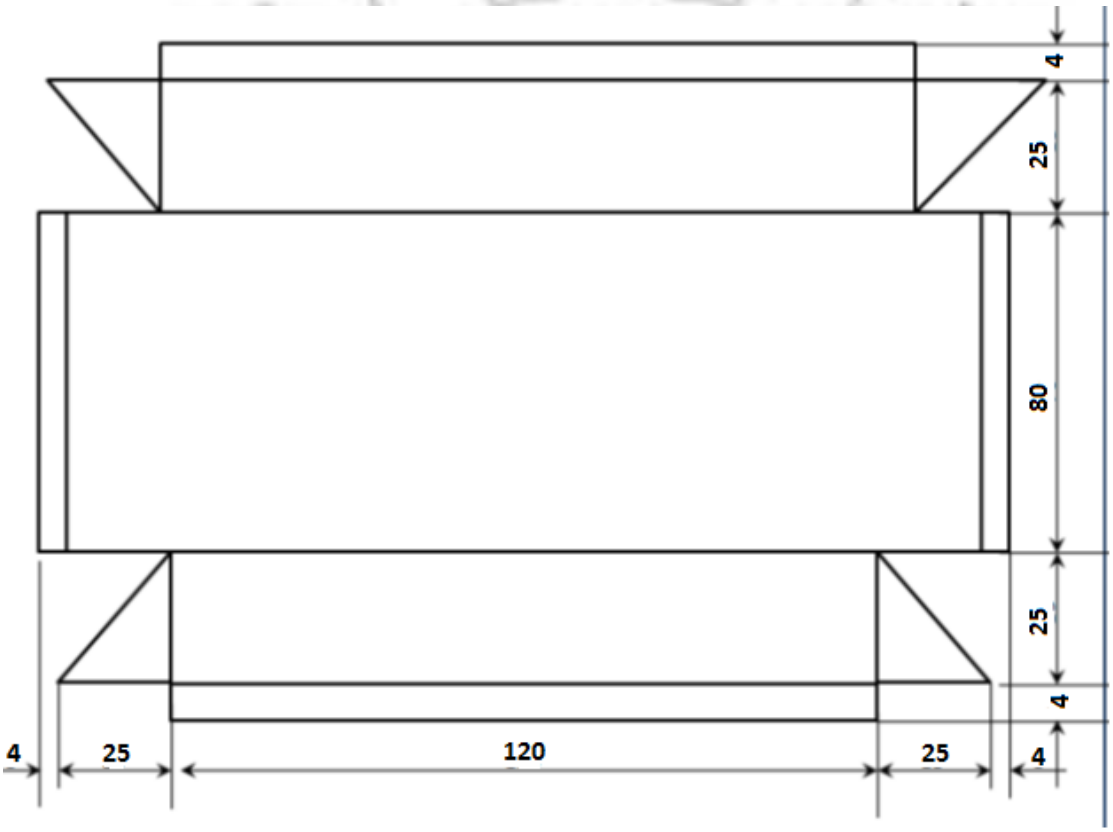
RESULT

Knocked Up Joints is formed.

Ex.No6

Date

RECTANGULAR TRAY



All Dimensions are in mm

Ex.No6

Date

RETANGULAR TRAY

AIM

To make a rectangular Tray as per required dimensions.

MATERIALS REQUIRED

Galvanized Iron sheet

TOOLS AND EQUIPMENT REQUIRED

Steel rule, Flat file, Scriber, Try square, Snips. Dot punch, Stakes, Mallet.

OPERATIONS TO BE CARRIED OUT

Planning, Marking, Cutting, Bending

PROCEDURE

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

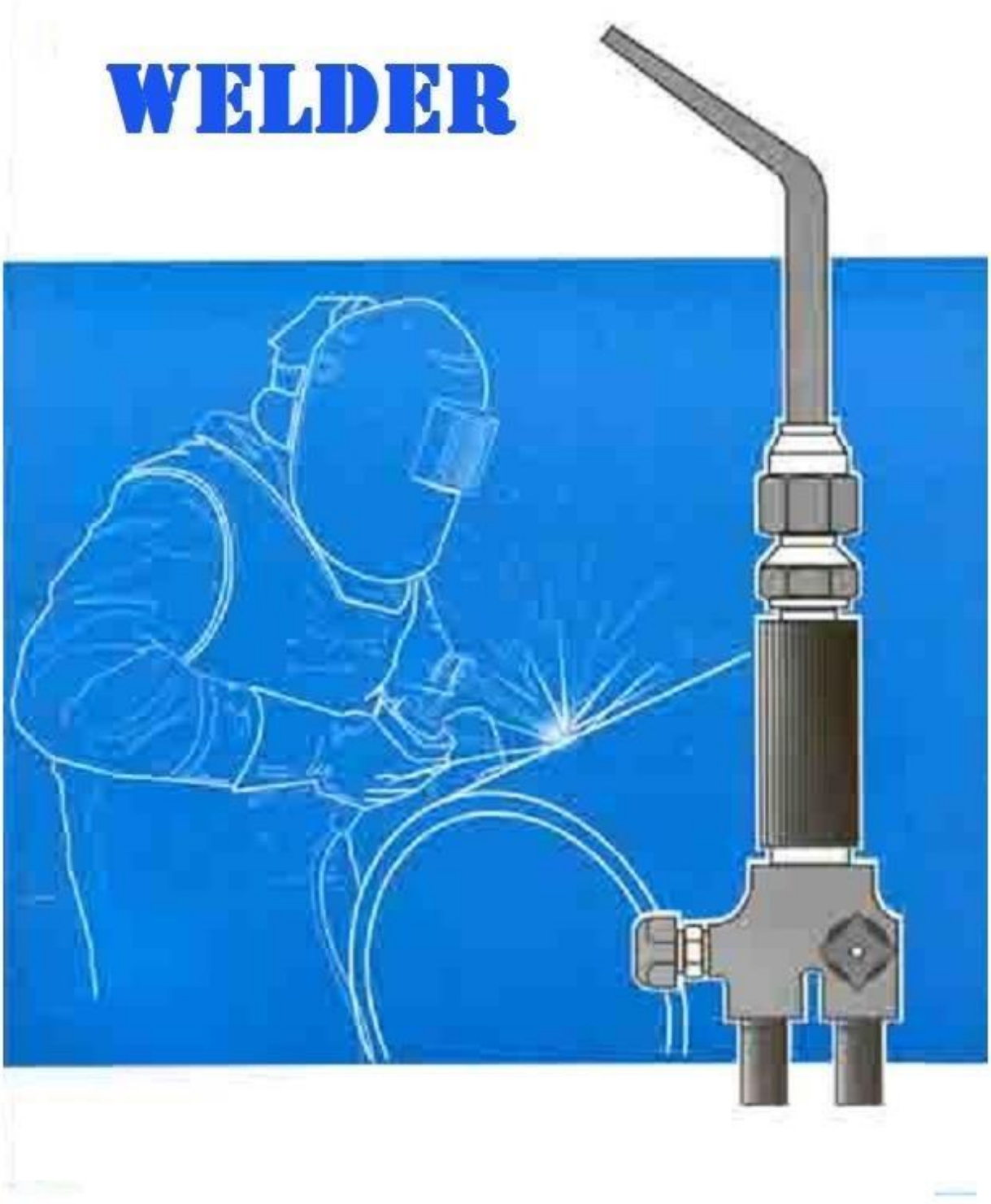
PRECAUTIONS

1. Care should be taken while cutting with snip.
2. Care should be taken while bending and jumping.

RESULT

The rectangular tray is done success fully made


GOVERNMENT POLYTECHNIC COLLEGE PERUMBAVOOR
SKILL EXCELLENCE SUSTAINABILITY


WELDER

SAFETY PRECAUTIONS

1. Always weld in a dry & properly ventilated area.
2. Avoid breathing the welding fumes.
3. Use proper gloves, helmet, shield & protective clothing.
4. Read and follow correct welding procedure.
5. Always wear proper dress and shoes in the work shop.
6. The working places should be kept clean and free from oil and grease,
7. The work bench and machine should be clean.
8. The tools and measuring instruments should be kept at their proper places.
9. Adequate ventilation and lighting shall be provided.
10. Wear safety goggles, face shield to protect eyes or face at the time of chipping, grinding and welding.
11. The machine should be operated by skilled Workman.

WELDING

INTRODUCTION

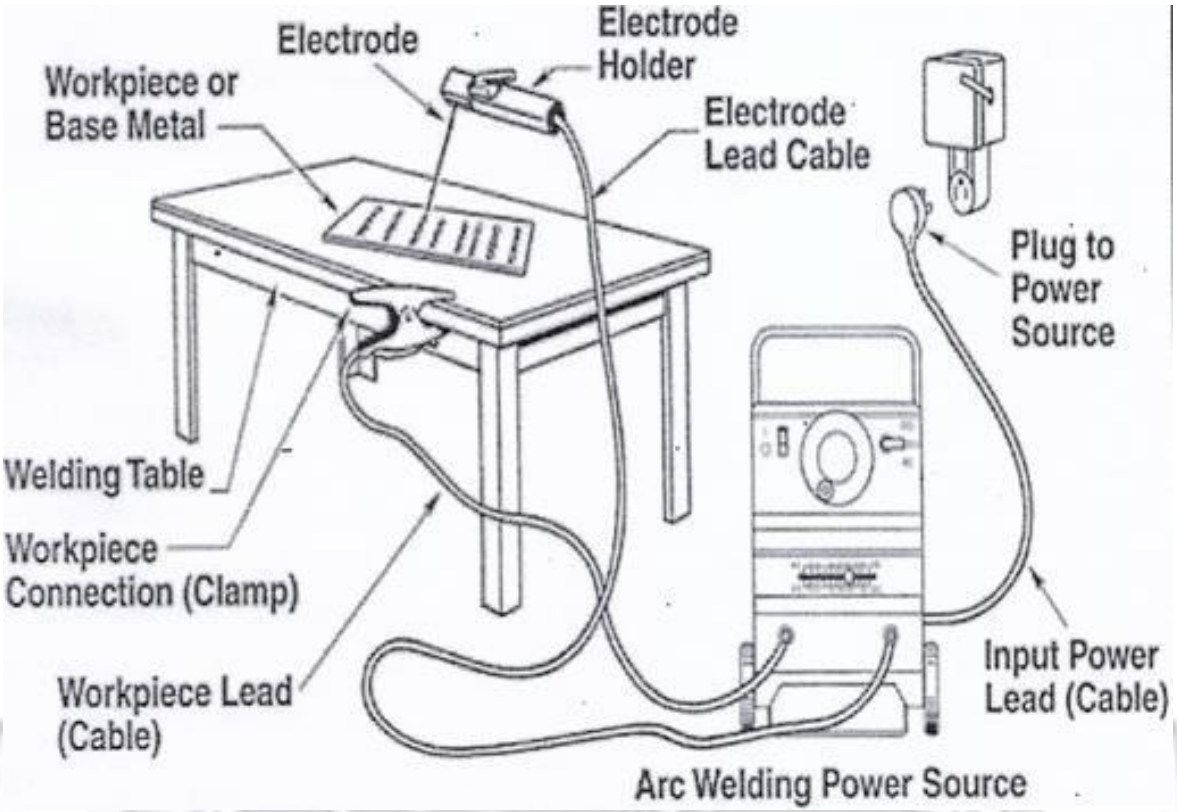
Welding is a process of joining similar or dissimilar metal pieces. Welding is a metal joining method in which the joining edges are heated and fused together to form a permanent bond. Riveting, assembling with bolt, seeming, soldering and brazing all result in temporary joints. Welding is the only method to join metals permanently. It is the strongest joint and any type of metals of any thickness can be joined. Welding process is employed in most of the modern fabrication work.

What is Welding?

Welding is a process by which metals are joined together by heating them to a suitable temperature with or without the application of pressure and with or without application of filler materials.

WELDING METHODS

WELDING METHODS			
Fusion welding			**Non fusion welding**
Without pressure welding		**With pressure welding**	**soldering**
Gas welding	**Arc welding**	**Forge welding**	**Brazing**
Oxy- Acetylene	**Carbon arc**	**Resistance welding**	**Bronze welding**
Oxy- coal gas welding	**TIG welding**	**Friction welding**	
Oxy- hydrogen welding	**MIG welding**		
Oxy- LPG gas welding	**Submerged**		



Arc welding is a type of welding that uses a welding power supply to create an electric arc between an electrode and the base metal to melt the metals at the welding point. They can use either direct (DC) or alternating (AC) current, and consumable or non consumable electrodes. The welding region is usually protected by some type of shielding gas, vapor, or slag. Arc welding processes may be manual, automatic.

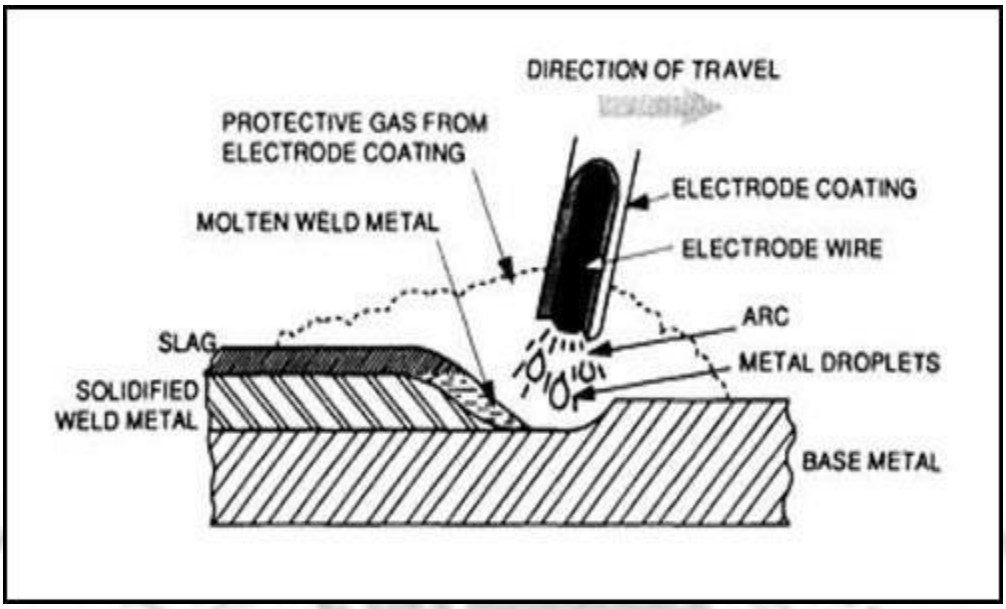
ARC WELDING MACHINES

Three types of welding machines are

a. Welding transformer.

b. Welding generator.

C. Welding Rectifiers

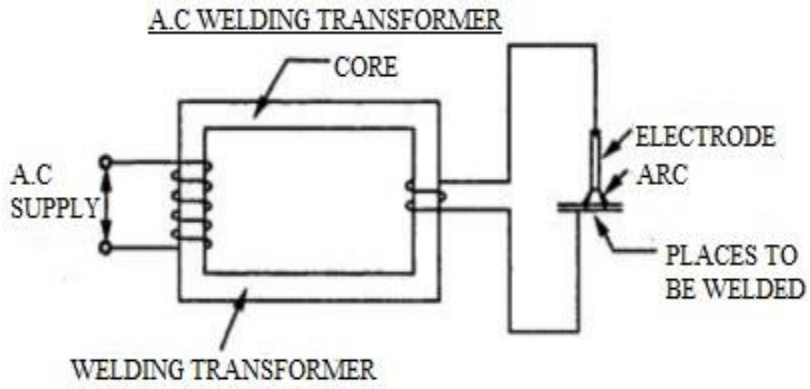


WELDING TRANSFORMER

Welding transformer is a transformer having thin primary winding with large number of turns. While the secondary is having more area of cross section and with less number of turns. This ensures very high current and less voltage in the secondary. Reduces the main supply voltage (220v or 440v) to welding supply open circuit voltage (OCV) between 40 and 100 volts, Increases the main supply low current to the required high output welding current.

One end of the secondary is connected to electrode holder and another end is connected to the pieces to be welded. Due to the contact resistance between the electrode and pieces to be welded, when a very high current flows, heat is produced. This heat is very large. Due to this heat, a tip of the electrode melts and fills the gap between the two pieces.

Winding used for the welding transformer is highly reactive or a separate reactor may be added in series with the secondary winding.



WELDING GENERATOR

It is used to generate D C for arc welding. It may be motor driven or engine driven. In the first type the generator is driven by an A C motor and main supply is essential to run the machine. In the second type the generator is driven' by a petrol or diesel engine. It can be used anywhere in field work away from electric lines.

WELDING RECTIFIERS

It is used to convert A C in to D C supply and does not have any rotating parts. Basically it is an A C welding transformer but the output of the transformer is converted with a rectifier to change the AC in to DC.

ELECTRODES FOR ARC WELDING

Arc welding electrodes are classified as

1. Non consumable electrode.
2. Consumable electrode

Non consumable electrodes may be of carbon, graphite or tungsten. Which do not consumes during welding operation. Consumable electrodes may be made of metals depending upon chemical composition of the metals to be welded.

CURRENT RANGE OF ELECTRODE

Electrode size (mm)	Current (Amps)
2.00	50, 75
2.50	60, 90
3.15	100, 140
4.00	140, 180
5.00	180, 230

WELDING POSITION

The welding positions are classified as follows.

1. Flat position (1G). The work piece has in a horizontal plane over a flat surface and the welding is done from the upper side of the joint.

2. Horizontal position (2G). The axis of the weld lines in a horizontal plane and its face in a vertical plane.

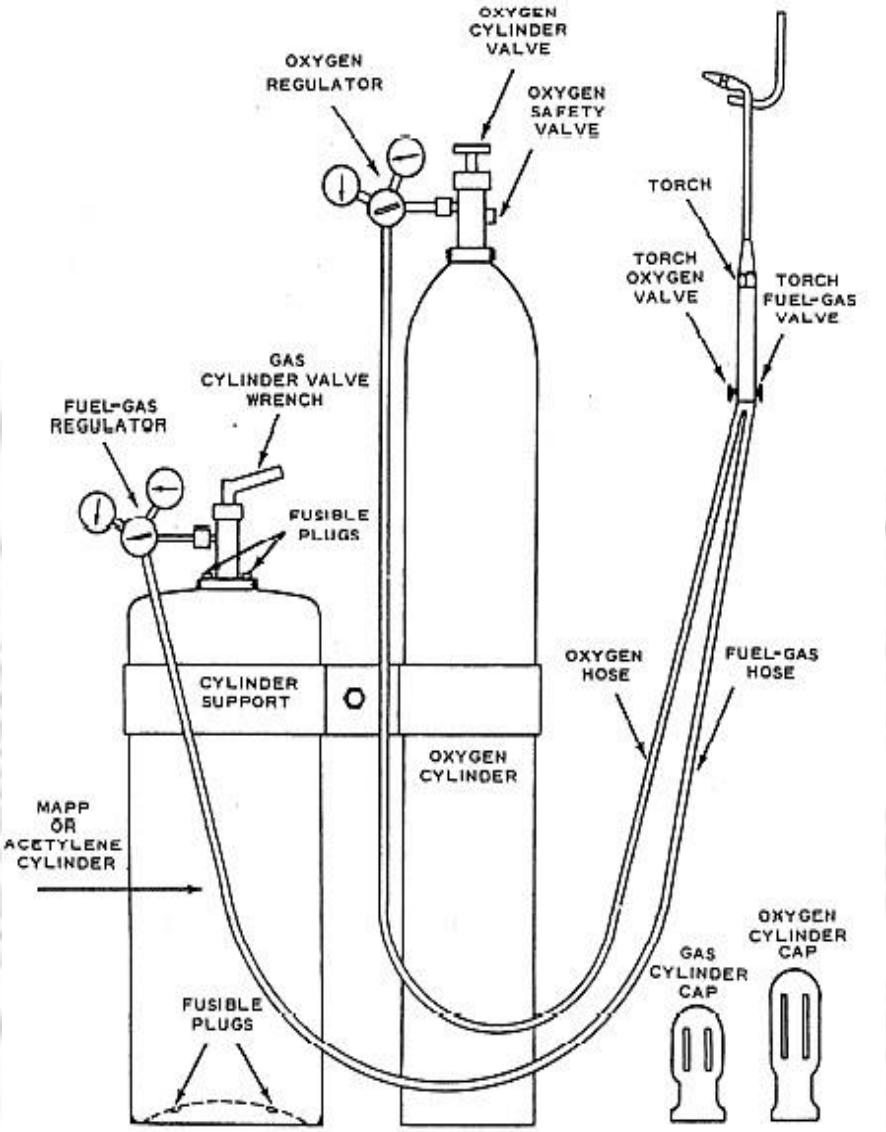
3. Vertical position (3G). In this position the axis of the weld remain either vertical or at an inclination of $<45^0$.

4. Overhead position (4G). In this position the welding is clone from the underside of the joint and work pieces remain over the head of welder.

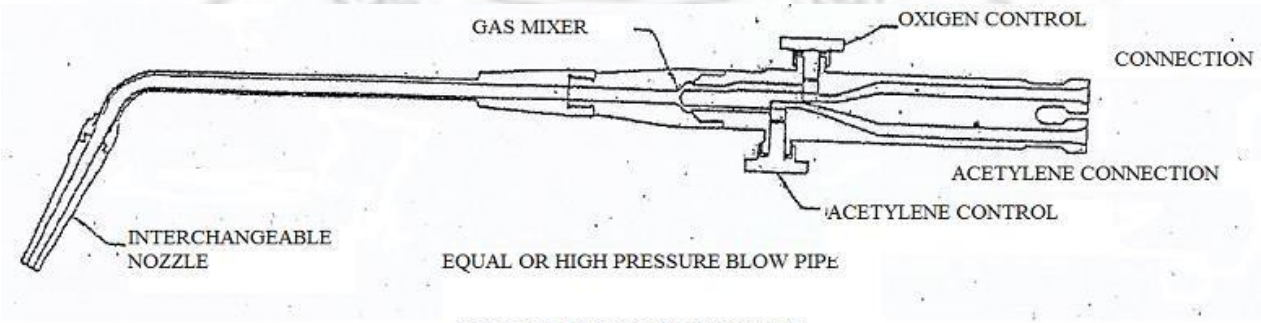
GAS WELDING

It is a fusion welding process in which metals are fused by a gas flame. A gas flame is obtained by the combustion of a fuel gas and oxygen. Different gas flame combinations commonly used for gas welding are

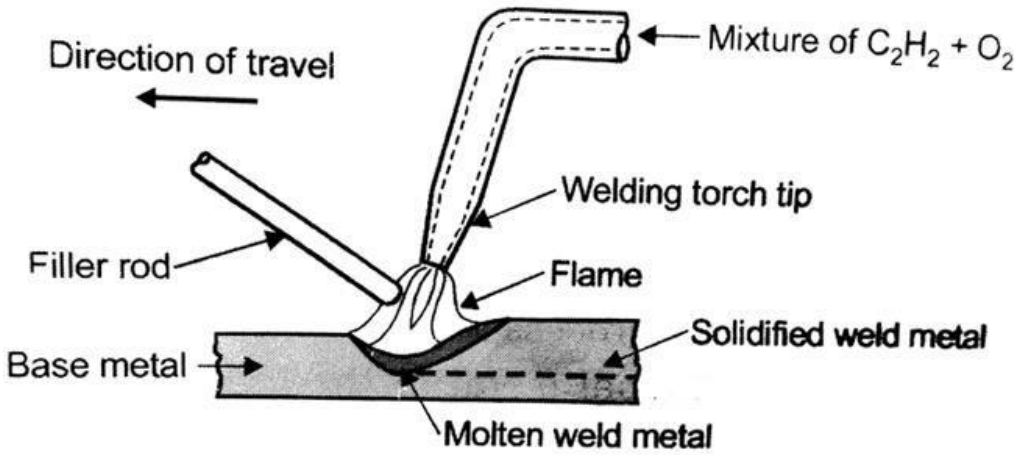
1. Oxy, Acetylene
2. Oxy, Hydrogen and
3. Oxy L.P.G. etc.



OXY-ACETYLENE GAS WELDING UNIT



GAS WELDING BLOW PIPE



OXY-ACETYLENE FLAME

There are three kinds of flames.

1. Neutral flame

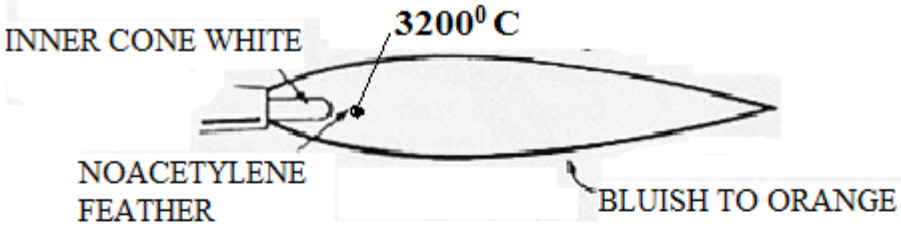
This type of flame is obtained by supplying equal volume of oxygen and acetylene. In this flame the inner tip is white and the outer envelope is bluish. This flame is used for welding non ferrous metal. The temperature of neutral flame is **3200^0 C**

2. Oxidizing flame.

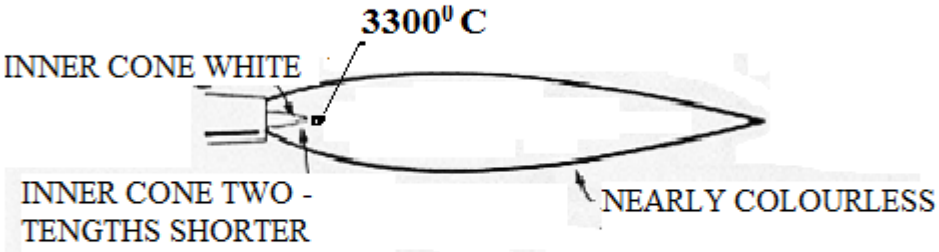
This type of flame is obtained by supplying excess of oxygen. it is similar to neutral flame but the inner cone is less luminous and shorter. it is used for welding brass and bronze. The temperature of Oxidizing flame is **3300^0 C**

3. Carburizing flame.

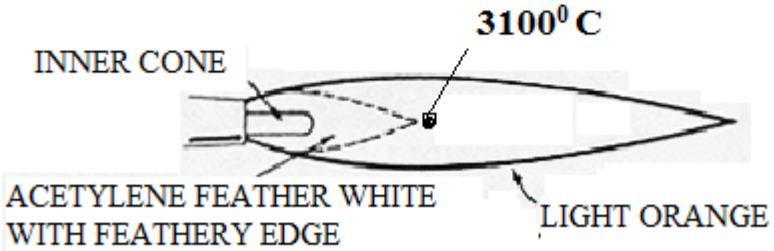
This type of flame is obtained by supplying an excess of acetylene. This flame has the following three zones. (a) inner cone (b) intermediate cone of whitish color (c) outer cone of bluish color. It is used a certain alloy steels and many of the non ferrous metals. The temperature of Carburizing flame is **3100^0 C**



NEUTRAL FLAME



OXIDIZING FLAME



CARBURIZING FLAME

OXY-ACETYLENE GAS WELDING FLAME

WHAT IS AN ALLOY?

lf two or more metals are chemically combined to form an alloy. eg. Iron, Chromium, Nickel and Carbon form an alloy called CHROMIUM NICKEL STEEL (Stainless Steel). Manganese Iron and Carbon form an alloy called MANGANESE STEEL.

Copper and Zinc form an alloy called BRASS.

MELTING POINT IN DEGREE CELCIUS

Mild Steel	1500 to 1530
Cast Iron	1150
Copper	1083
Aluminum	659
Brass & Bronze	850 – 950
Zinc	419
Tin	232
Lead	327
Nickel	1452
Soft solder	216

CHEMICAL COMPOSITION OF CARBON STEEL

Low carbon steel (M.S.)		Medium carbon steel		High carbon steel	
Carbon	.10to.25%	Carbon	0.3-6%	Carbon	0.7-1.4
Manganese	0.8%	Manganese	0.8%	Manganese	0.8%
Sulphur	0.05%	Sulphur	0.05%	Sulphur	0.05%
Phosphorus	0.05%	Phosphorus	0.05%	Phosphorus	0.05%
Silicon	0.25%	Silicon	0.25%	Silicon	0.25%

GAS WELDING FLUX

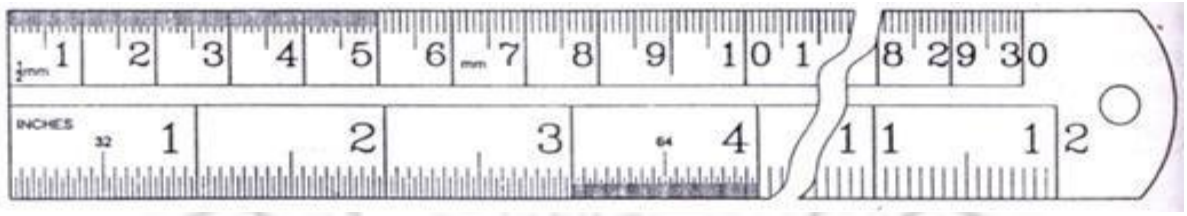
These are chemical compound used to prevent oxidation and other unwanted chemical reactions during welding. The common fluxes used are borax, sodium carbonate, sodium silicate for welding ferrous metals, mixture of sodium and potassium borates, chlorides for welding copper alloys.

TOOLS & EQUIPMENTS USED IN WELDING SHOP

STEEL RULE

Engineer's steel rules are used to measure the linear dimensions of work pieces. Steel rules are made of spring steel or stainless steel. These steel rules are

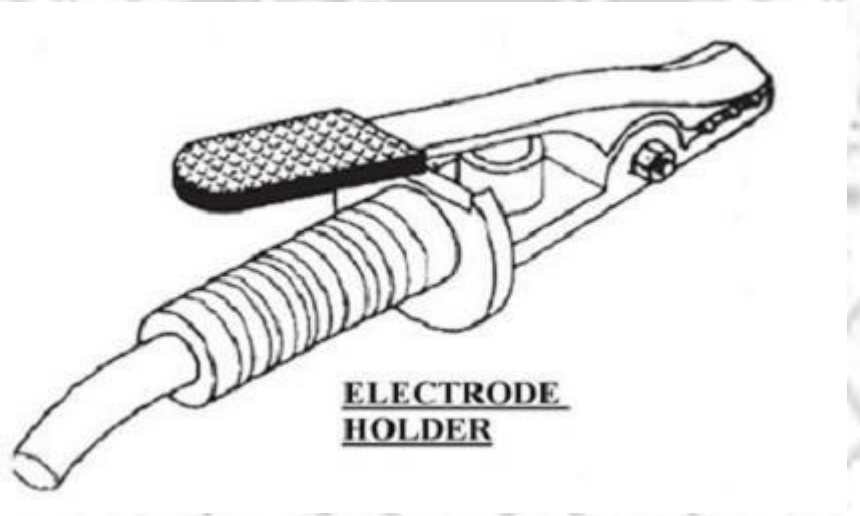
available in length of 150 mm, 300 mm and 600 mm. The reading accuracy of the steel rule is 0.5mm, in addition to mm marking, inch marking are also made on steel rules.



STEEL RULE

ELECTRODE HOLDER

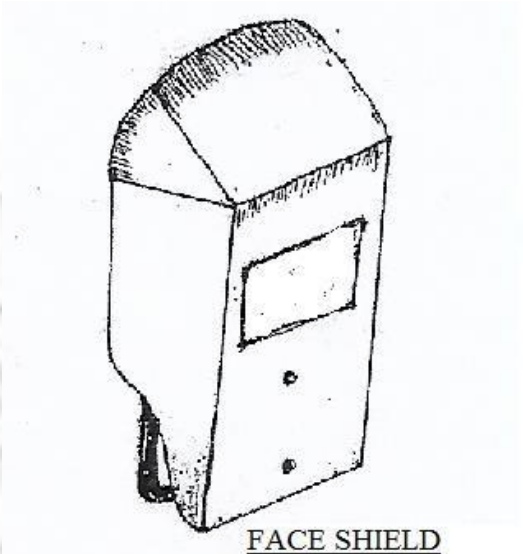
It is a clamping device used to grip and manipulate the electrode during arc welding. It is made of copper/copper alloy for better electrical conductivity partially or fully insulated holders are made in various sizes i.e. 200,300, 500 amps. The electrode holder is connected to the welding machine by a welding cable.



WELDING HAND SCREEN AND HELMET

These are used to protect the eyes and face of Welder from arc radiation and sparks during arc welding. Screens are made of non reflective, non flammable insulated, dull colored, light material with colored (filter) glasses fitted with plain

glasses on both sides to see the arc and molten pool while welding. Grades of colored glass is 10, 11 up to 100 to 300 amps.

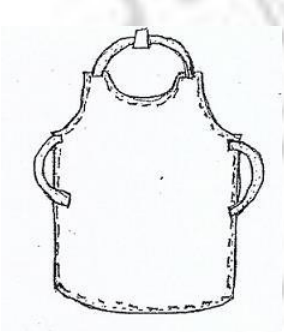


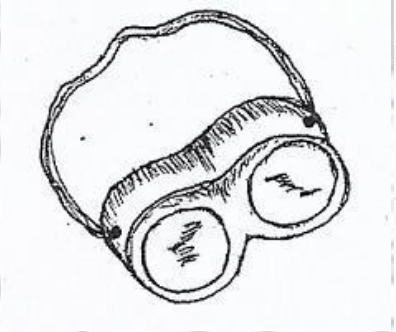
FACE SHIELD

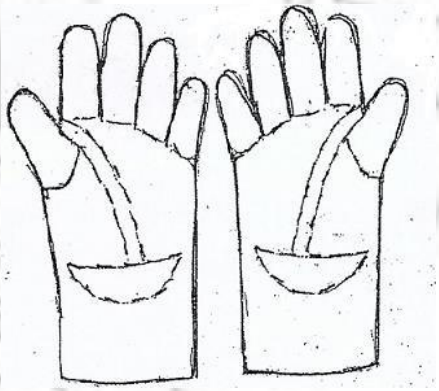
APRON `

The leather apron is used to protect the body neck and chest of the welder from the heat radiation and hot spatters from arc.

GLOVES







APRON GOGGLES HAND GLOVES

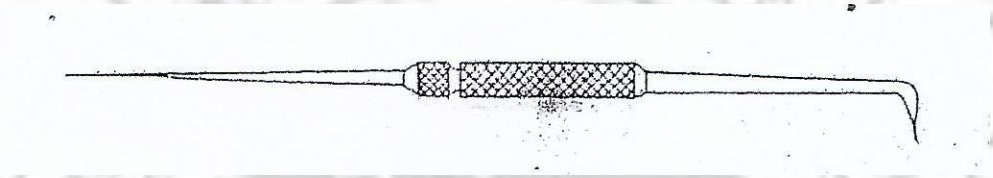
The leather gloves are used to protect the hands and arms from the heat radiation and hot spatters from the arc.

GOGGLES

Goggles are used to protect the eyes while chipping the slag or grinding the job. It is made of Bakelite frame fitted with clear glasses and an elastic band to hold it.

SCRIBER

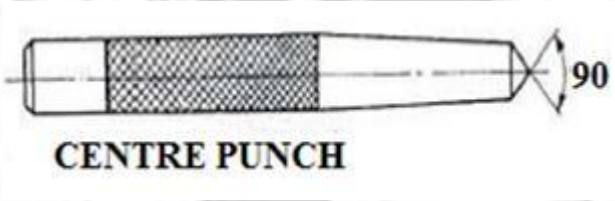
The scriber is a tool used for marking purpose. It is made of high carbon steel which is hardened. It is necessary to scribe lines to indicate the dimensions of work pieces.



SCRIBER

PUNCHES

There are three types of punches they are Centre Punch Prick Punch Dot punch.



CENTRE PUNCH

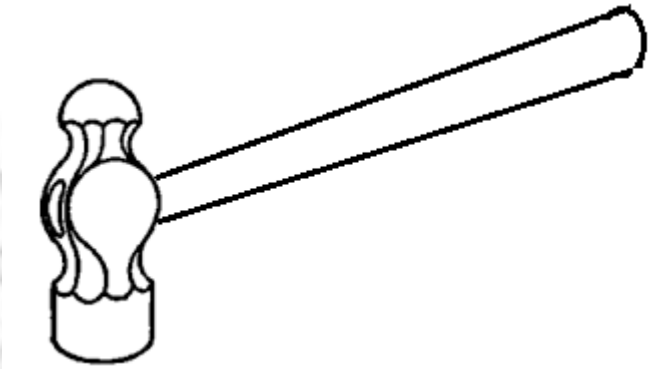
Centre punch: The angle of the point is 90º in a centre punch this punch is used for locating holes.

Prick punch: The angle of prick punch is 30º. This punch is used for marking light punch marks needed to position dividers and trammels.

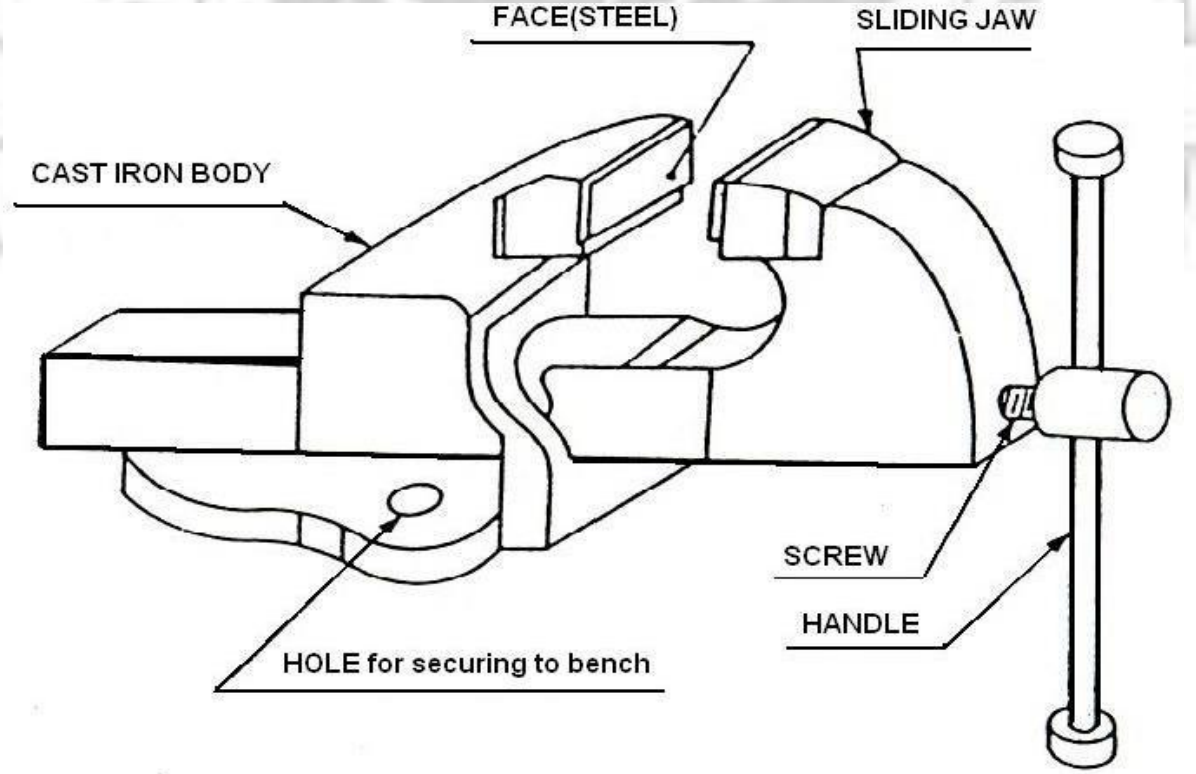
Dot Punch: The angles of dot punch are 60º. This punch is used for marking small dots on the scribed lines.

BALLPEEN HAMMER

The head is made of drop forged carbon steel. The face is the striking portion. The peen is used for shaping and forming work like riveting, peening and bending.



BALL PEEN HAMMER

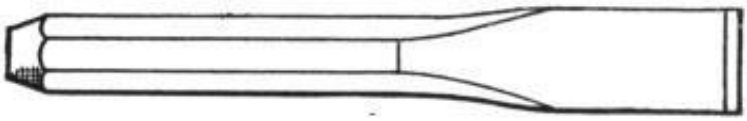


BENCH VICE

A bench vice is used for holding work pieces. A bench vice is made of cast iron or cast steel. It is used to hold Work while preparing the edges of sheets, plates and pipes by chiseling, hack sawing and filing.

FLAT CHISEL

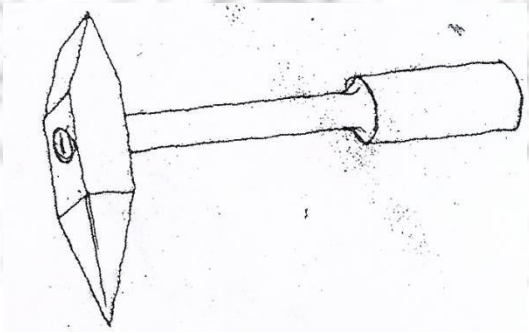
They are used to remove the taper or an uneven surface on the edge of the plate and make it flat and chip excess metal from weld joints and casting. Chisels are made from high carbon steel or chrome vanadium steel.



FLAT CHISEL

CHIPPlNG HAMMER

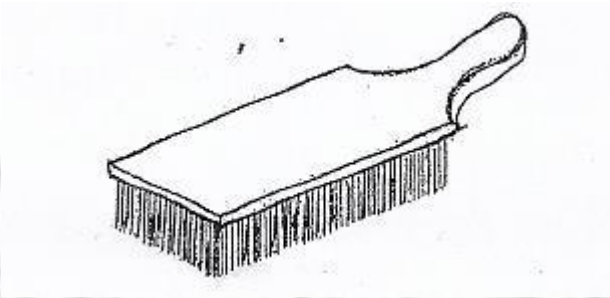
The chipping hammer is used to remove the slag on the weld bead. It is made of medium carbon steel with a mild steel handle. lt is provided with a chisel edge on one end and other end is pointed.



CHIPPING HAMMER

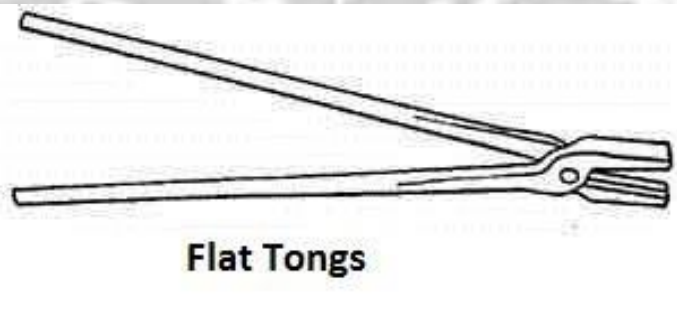
WIREBRUSH

Wire brush is used for removing rust, oxide and other dirt particles prior to welding. Cleaning the weld deposits after chipping the slag. It is made of Carbon steel wires fitted in three to five rows on a wooden piece with handle.



TONGS

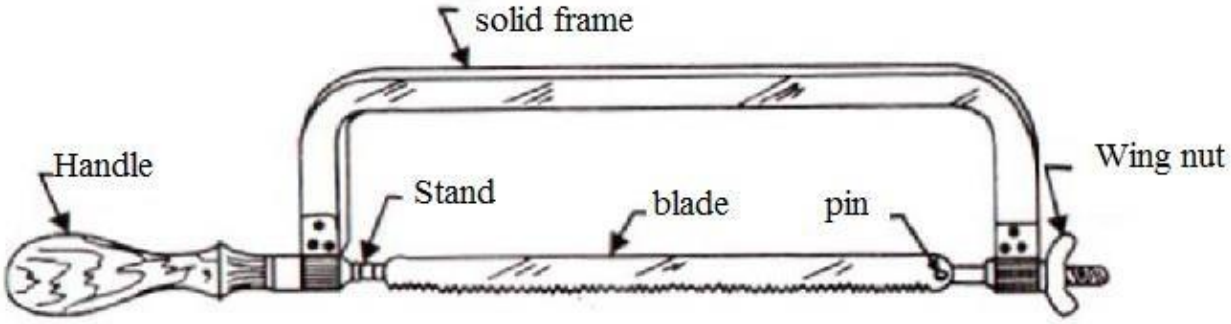
Tongs used to hold hot work pieces and to hold the job in position.



Flat Tongs

HACKSAW

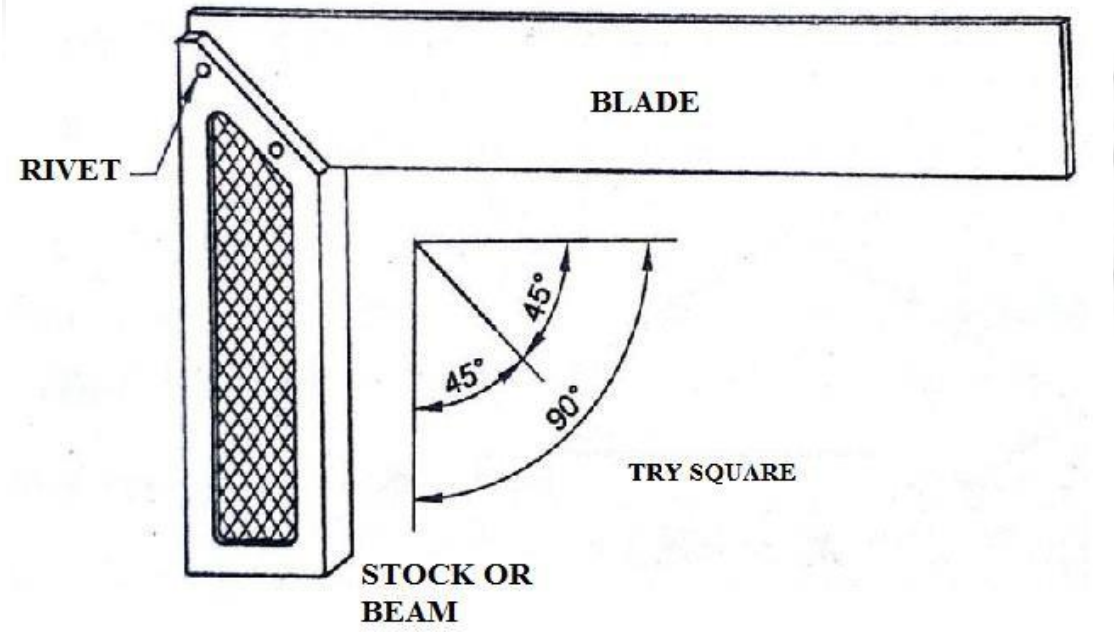
The hand hacksaw is used along with a blade to cut metals of different sections. The blade is made of either low alloy steel or high speed steel and is available in standard lengths of 250mm and 300 mm. The distance between adjacent teeth is known as the pitch of the blade. Classification pitch coarse 1.8mm medium 1.4mm & 1.0mm, fine 0.8mm.



SOLID OR FIXED FRAME

TRY SQUARE

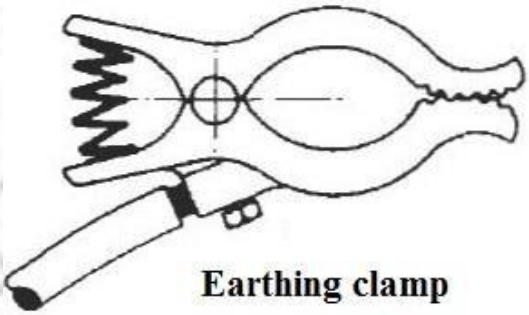
Try square is used to check the squares and the flatness of surfaces very accurately. The edge of work pieces mark line at $90^0$to the edge of work pieces, set work pieces at right angles etc. This blade is fixed to the stock at 90^0. Try squares are made of hardened steel. Try squares are specified according to the length of the blade ie. 100mm, 150mm, 200mm,



TRY SQUARE

EARTH CLAMP

It is used to connect the earth cable from welding machine firmly to job or welding table. It is also made of copper/ copper alloys. Sizes of earth clamp are 200, 300, 500 amps.

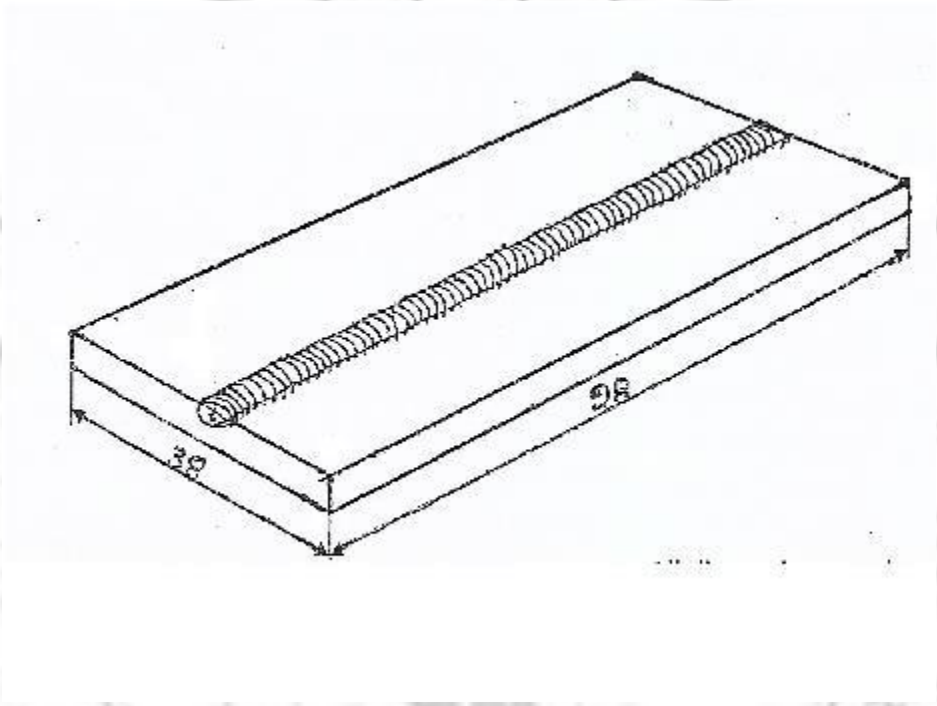


Earthing clamp

Ex.No.1

Date

STRAIGHT LINE WELDING IN DOWN HAND POSITION BY ARC



All dimensions are in mm

Ex.No.1

Date

STRAIGHT LINE WELDING IN DOWN HAND POSITION BY ARC.

Aim.

Straight line welding in down hand position by arc.

Tools & Equipments required,

Steel rule, Scriber, Try square, Flat file, Dot punch, Ball peen hammer, Tongs Chipping hammer, Hack, saw, Wire brush, Gloves, Electrode holder, Bench vice, Welding transformer.

Materials required,

Mild Steel Flat (M.S.) 102 x40 x 6 mm, M.S. Electrode Ø 3.15 mm.

Operations to be carried out,

Marking, Punching, Cutting, Filing, Welding, Chipping, Cleaning, Finishing.

procedure

1. Mark and cut work piece as per the required dimension.
2. Make the edges of the work piece in right angle using Flat file and Try square.
3. Make a straight line through the centre of work piece using scriber.
4. Clean the surface to be welded with the wire brush.
5. Switch ON the welding machine and adjust the welding current 120,130 Amps.
6. Weld through the straight line in down hand position.
7. After cooling remove the slag and spatters from weld bead.
8. Submit the model for inspection

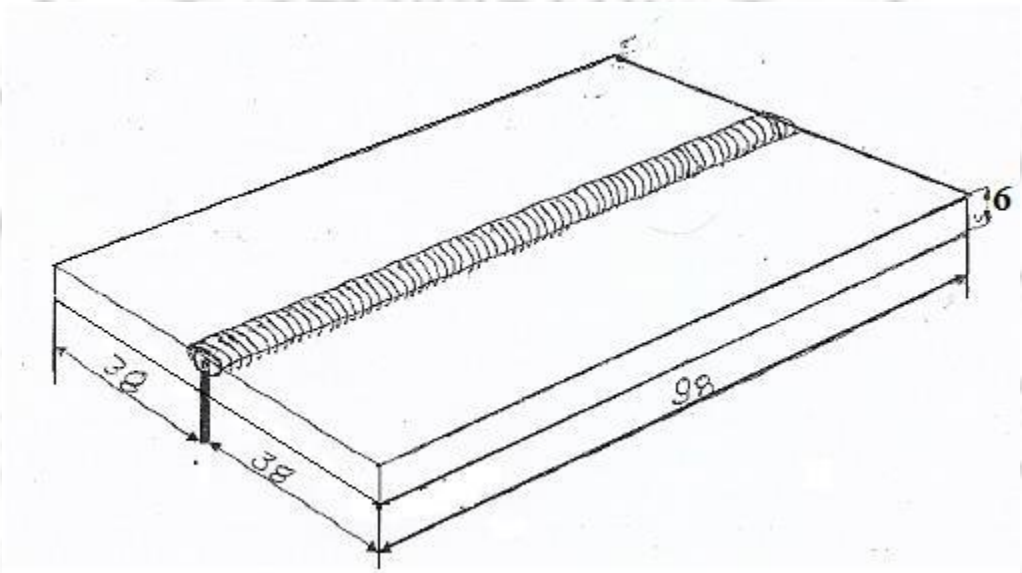
Result

The required straight line welded model is obtained.

Ex.No.2

Date

SQUARE BUTT JOINT



All dimensions are in mm

Ex. No.2

Date

SQUARE BUTT JOINT WELDING IN DOWN HAND POSITION BY ARC

Aim:

Square butt joined welding in down hand position by arc.

Tools & Equipment's required:

Steel rule, Scriber, Try square, Flat file, Dot punch, Ball peen hammer, Tongs, Chipping hammer, hacksaw, Wire brush, Gloves, Electrode holder, Bench vice, Welding transformer

Materials required:

Mild Steel Flat (M.S.) 102 x 40 x 6 mm, 2 Nos, M.S. Electrode Ø 3.15 mm;

Operations to be carried out:

Marking, Punching, Cutting, filing, Welding, Chipping, Cleaning, Finishing.

Procedure:

1. Mark and cut work piece as per the required dimension
2. Make the edges of the work piece in right angle using Flat file and Try square
3. Switch On the welding machine and adjust the welding current 120,130 Amps.
4. Set the work pieces and tack weld each other at the end of the two pieces.
5. Weld through the joint from one end to other end.
6. Remove the slag and spatters from the work piece using chipping hammer and wire brush.
7. Submit the model for inspection

Result: The required square butt welded joint is obtained.

GOVERNMENT POLYTECHNIC COLLEGE

PERUMBAVOOR

Koovappady P.O, Perumbavoor, Ernakulam, 683544