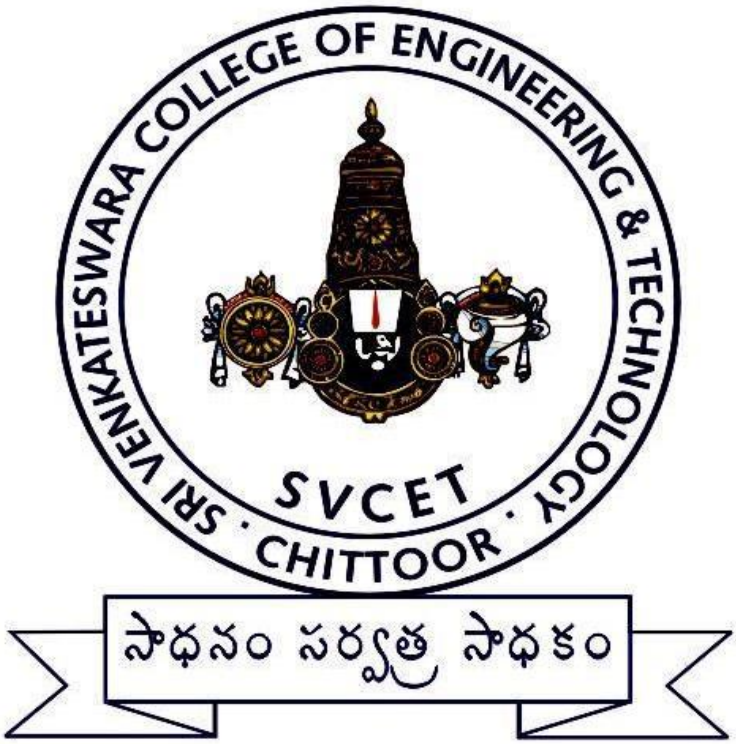
20AME02- ENGINEERING PRACTICE LAB MANUAL



DEPARTMENT OF MECHANICAL ENGINEERING

SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

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20AME02- ENGINEERING PRACTICE LAB MANUAL

DEPARTMENT OF MECHANICAL ENGINEERING

Subject code : 20AME02

Name of subject : ENGINEERING PRACTICE LAB

Name : ……

Reg. No : ……..

Branch : ……..

Year& Semester: ……..

SRI VENKATESWARA COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
R.V.S. NAGAR, CHITTOOR-517 127, ANDHRA PRADESH
DEPARTMENT OF MECHANICAL ENGEERING

Vision of Mechanical Engineering

Providing excellent technical education in Mechanical Engineering with the help of state of art infrastructure and carvethe youth to suit the global needs.

Mission of Mechanical Engineering

Provide excellent Teaching-Learning process using state of art facilities to help a holistic growth in the disciplines of Thermal, Design, Manufacturing, Management and Quality areas with an emphasis on practical applications. Stimulate innovative thinkingleading to higher learning.

SRI VENKATESWARA COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
R.V.S. NAGAR, CHITTOOR-517 127, ANDHRA PRADESH
DEPARTMENT OF MECHANICAL ENGINEERING

Programme Educational Objectives (PEO's) of UG:

PEO1	Pursue higher education in the varied fields of mechanical engineering and management.
PEO2	Secure a career placement in core and allied areas
PEO3	Develop skills to undertake entrepreneurship and lifelong learning

PROGRAMME SPECIFIC OUTCOMES (PSOs) of UG

PSO1	Apply the knowledge of manufacturing, thermal and industrial engineering to formulate, analyze and provide solutions to the problems related to mechanical systems
PSO2	Apply the design concepts and modern engineering software tools to model mechanical systems in various fields such as machine elements, thermal, manufacturing, industrial and inter-disciplinary fields.

SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY

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DEPARTMENT OF MECHANICAL ENGINEERING

DO'S

- Wear uniform, shoes & safety glasses
- Please follow instructions precisely as instructed by your supervisor.
- If any part of the equipment fails while being used, report it immediately to your supervisor.
- Students should come with thorough preparation for the experiment to be conducted.
- Students will not be permitted to attend the laboratory unless they bring the practical recordfully completed in all respects pertaining to the experiment conducted in the previous class.
- All the calculations should be made in the observation book. Specimen calculations for oneset of readings have to be shown in the practical record.
- Wherever graphs are to be drawn, A-4 size graphs only should be used and the same shouldbe firmly attached to the practical record.
- Practical record should be neatly maintained.
- Students should obtain the signature of the staff-in-charge in the observation book aftercompleting each experiment.
- Theory regarding each experiment should be written in the practical record before procedurein your own words.

DONT'S

- Do not touch hot work piece
- Do not start the experiment unless your setup is verified & approved by your supervisor.
- Do not leave the experiments unattended while in progress.
- Do not crowd around the equipment's & run inside the laboratory.
- Don't wear rings, watches, bracelets or other jewellery
- Don't wear neck ties or loose turn clothing of any kind.
- Do not eat or drink inside labs.
- Do not wander around the lab and distract other students
- Do not use any machine that smokes, sparks, or appears defective

SRI VENKATESWARA COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

I B. Tech I Semester (Common to EEE, CSE, IT, CSE(DS) & CSE(AI&ML))

I B. Tech II Semester (Common to CE, ME & ECE)

20AME02 **Engineering Practice lab**

L	T	P	C
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Course Outcomes:

After completion of this course, the student will be able to

1. Perform a different prototype model in the carpentry trade such as Mortise and Tenon joint, and Table stand using wood turning lathe.
2. Prepare models such as Dove tail joint and Half Round joint using Fitting tools and Rectangular tray, and funnel prototypes in the trade of Tin smithy.
3. Perform various basic House Wiring techniques such Staircase wiring (i.e. control of one lamp by two switches fixed at two different places), and wiring for tube light (Fluorescent Lamp)/ Focus light.
4. Fabricate different models in a foundry shop such as single- and two-pieces patterns and prototypes in the trade of Welding such as T-Joint and H-Joint.

TRADES FOR EXERCISES:

a. Carpentry Shop.

1. Prepare a Mortise and tenon joint from a given 300 x 40 x 25mm soft wood stock.
2. Prepare a Table stand (desired shape) by using wood turning Lathe from a given 300 x 40 x 25 mm soft wood stock.

b. Fitting Shop

1. Prepare a Dovetail joint from a given100 x 50 x 5mm M.S. stock.
2. Prepare a Half Round joint from a given 100 x 50 x 5mm M.S. stock.

c. Sheet Metal Shop

1. Prepare a Funnel from given G. I. sheet.
2. Prepare a Rectangular Tray from given G. I. sheet.

d. House-Wiring

1. Stair case wiring (i.e. control of one lamp by two switches fixed at two different places).

2. Prepare a wiring for tube light (''Fluorescent Lamp '')/ Focus light
3. Prepare a mould for a single piece pattern (Connecting rod)
4. Prepare a mould for a Double piece pattern (Stepped Pulley)

e. Welding

1. Prepare a T-Joint from given M. S Flat pates using Arc Welding.
2. Prepare a H-Joint from given M.S Flat pates using Arc Welding.

2. TRADES FOR DEMONSTRATION:

a) Plumbing
b) Machine Shop
c) Metal Cutting

Apart from the above the shop rooms should display charts, layouts, figures, circuits, hand tools, hand machines, models of jobs, materials with names such as different woods, wood faults, Plastics, steels, meters, gauges, equipment, CD or DVD displays, first aid, shop safety etc. (though they may not be used for the exercises but they give valuable information to the student). In the class work or in the examination knowledge of all shop practices may be stressed upon rather than skill acquired in making the job.

Reference Books

1 Work shop Manual/P. Kannaiah/ K. L. Narayana/ SciTech Publishers.
2 Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian,4/eVika0073
3 Dictionary of Mechanical Engineering, GHF Nayler, Jai co Publishing House.
4 Engineering Work shop by Vishnu Universal Learning.
5 Engineering Work shop by GRIE institute.

S. NO	TRADES FOR EXERCISE	NO.OF. HRS REQUIRED	CUMML. HRS
A	**CARPENTRY SHOP**		
	1. Prepare a Mortise and Tenon Joint	3	3
	2. Prepare table stand by wood turning lathe	3	6
B	**FITTING SHOP**		
	3. Prepare a Dove tail joint	3	9
	4. Prepare a Half-Round joint	3	12
C	**SHEET METAL SHOP**		
	5. Prepare a funnel	3	15
	6. Prepare a rectangular tray	3	18
D	**HOUSE-WIRING**		
	7. Stair casing wiring	3	21
	8. Wiring for tube light (Fluorescent Lamp)	3	24
E	**FOUNDRY**		
	9. Prepare a Mould for single piece pattern (Connecting rod)	3	27
	10. Prepare a mould for a Double piece pattern (Stepped pulley)	3	30
F	**WELDING**		
	11. Prepare a T-Joint by Arc Welding	3	33
	12. Prepare A H-Joint Arc Welding	3	36
G.	**TRADES FOR DEMONSTRATION**		
	Plumbing, Machine Shop, Metal Cutting	6	42

Lab In-charge

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S. No.	Date	Name of the Experiment	Signature of the Faculty
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CARPENTARY

INTRODUCTION:

Wood work or carpentry deals with making joints for a variety of applications like door frames, cabinet making furniture, packing etc.,

Timber:

Timber is a name obtained from well grown plants or trees. The timber must cut in such a way that the grains run parallel to the length. The common defects in timber are knots, wet rot, dry rot etc.,

Market sizes of timber:

Timber is sold in market in various standard shapes and sizes. They are:-

Log:

The trunk of a tree, which is free from branches.

Balk:

The log sawn to have roughly square cross section.

Post:

A timber piece, round or square in cross section with more than 275 mm in width, 50 to 150 mm in thickness and 2.5 to 6.5 mts. length.

Board:

A sawn timber piece, below 175 mm in width and 30 mm to 50 mm in thickness.

Reapers:

Sawn timber pieces of assorted and nonstandard sizes, which don't conform to the above shapes.

WORK HOLDING TOOLS:

Carpentry vice:

It is a work holding device. When handle vice is turned in a clockwise direction, the sliding jar forces the work against the fixed sawn. The greater the force applied to the handle, the tighter to the work held.

Bar clamp:

It is a rectangular (or) square block with V-groove on one or both sides opposite to each other. It holds cylindrical work pieces.

C-Clamp:

This is used to hold work against an angle plate or V-block.

MARKING AND MEASURING TOOLS:

Try square:

It is used for marking and testing the squareness of planed surfaces. It consists of a steel blade, fitted in a cast iron stock. It is also used for flatness. The size of a try square used for varies from 150 mm to 300 mm, according to the length of the blade. It is less accurate when compared to the try square used in fitting shop.

Marking gauge:

It is a tool used to mark lines parallel to the edges of wooden pieces. It consists of a square wooden stem with a riding wooden stock on it. A marking pin, made of steel is fitted on the stem. A mortise gauge consists of two pins. In these it is possible to adjust the distance between the pins, to draw two parallel lines on the stock.

Compass and dividers:

This is used for marking circles, arcs, laying out perpendicular lines on the planed surface of the wood.

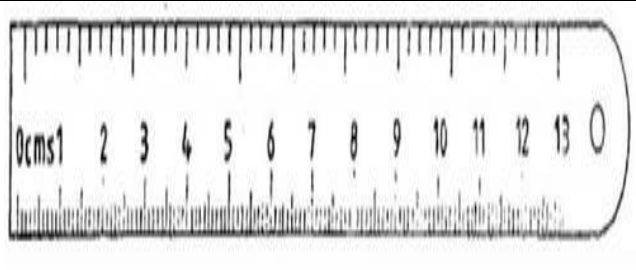


Fig.1 Steel rule

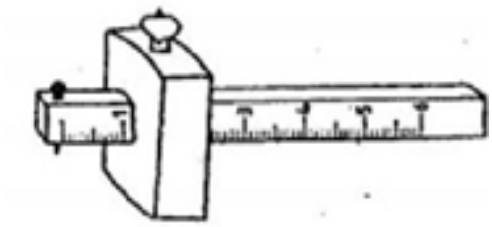


Fig.2 Marking Gauge

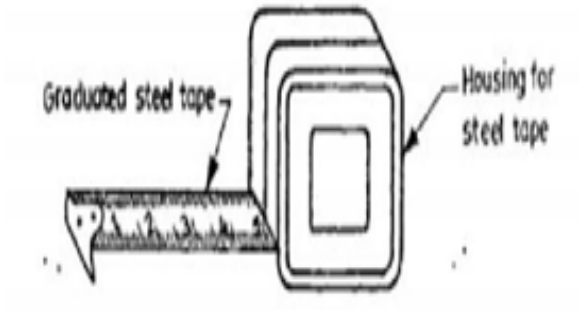


Fig.3 Steel Tape

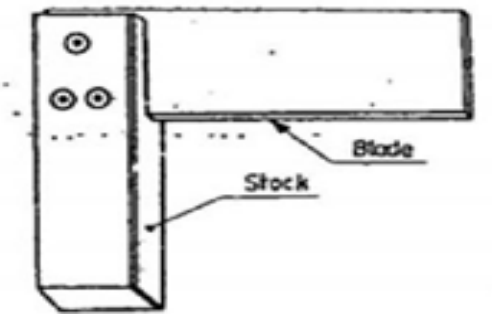


Fig.4 Try Square

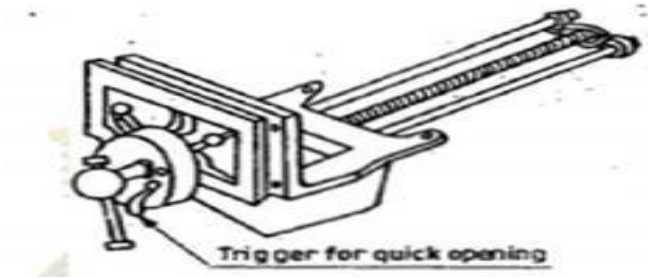


Fig.5 Carpentry Vice

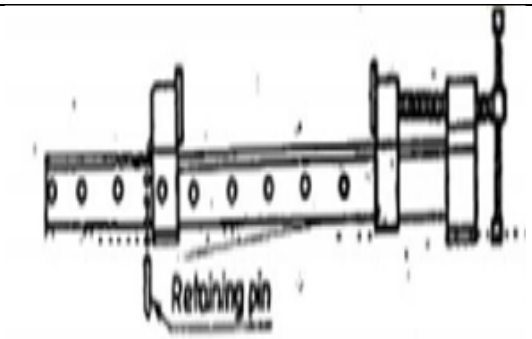


Fig.6 Bar Clamp

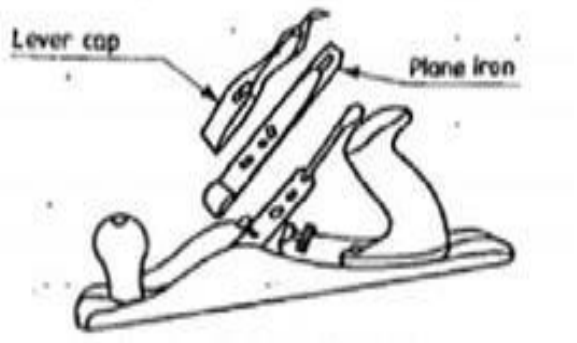


Fig.7 Metal Jack Plane

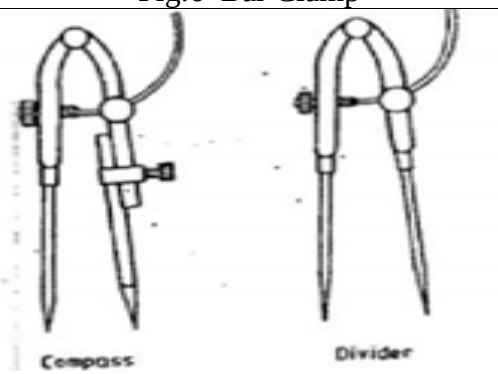


Fig.8 Compass & Divider

Fig.9 Cross cut saw

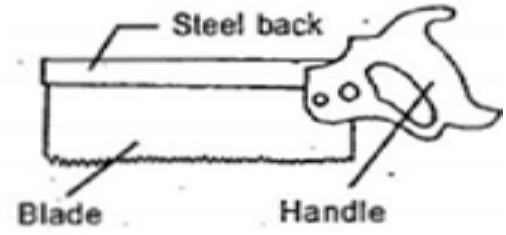


Fig.10 Tenon saw

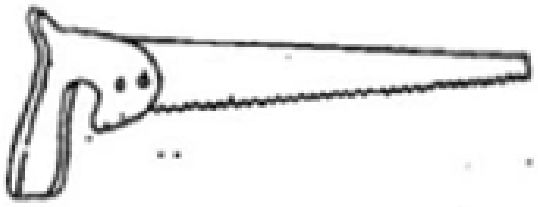


Fig.11 Compass saw

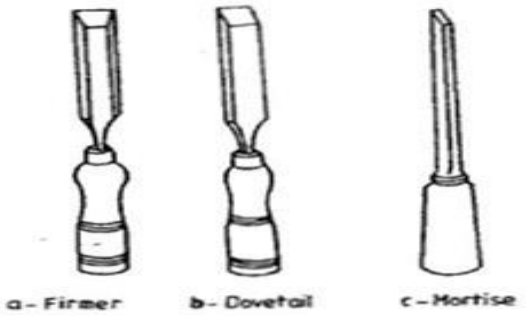


Fig.12 Chisels

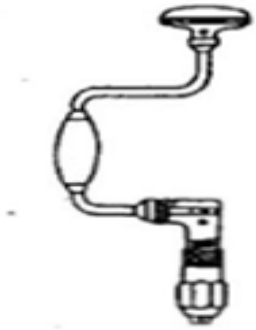


Fig.13 Carpenter Brace

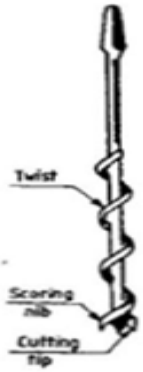


Fig.14 Auger bit

Fig.15 Gimlet

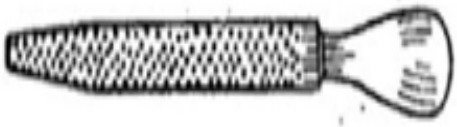


Fig.16 Wood rasp file

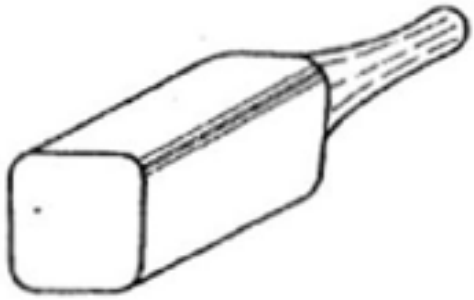


Fig.17 Wooden mallet

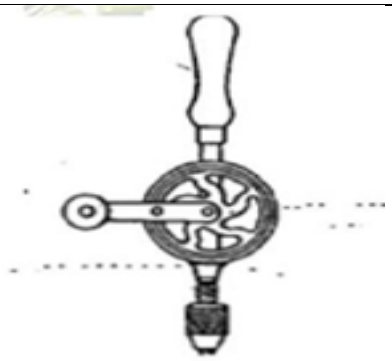


Fig.18 Hand drill

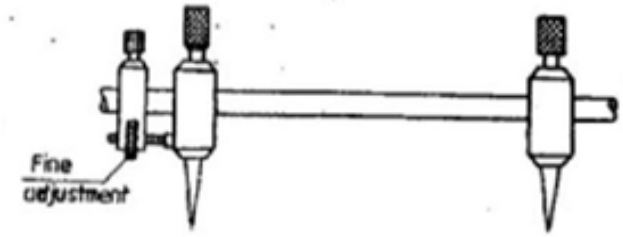


Fig.19 Trammel

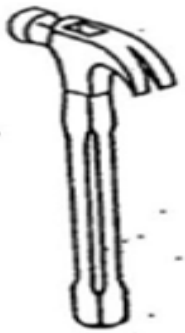


Fig.20 Claw hammer

CUTTING TOOLS:

Hack saw:

It is used to cross cut the grains of the stock. The teeth are so set that the saw kerfs will be wider than the blade thickness. Hard blades are used to cut hard metals. Flexible blades are having the teeth of hardened and rest of the blade is soft and flexible.

Chisels:

These are used for removing surplus wood. Chisels are annealed, hardened and tempered to produce a tough shank and a hard cutting edge.

Rip saw:

It is used for cutting the stock along the grains. The cutting edge of this saw makes a sleeper angle about 60o whereas that saw makes an angle of 45o with the surface of the stock.

Tenon saw:

It is used for cutting tenon's and in fine cabinet works. The blade of this saw is very thin and so it is used stiffed with back strip. Hence, this is sometimes called back saw. The teeth shapes similar to cross cut saw.

DRILLING AND BORING TOOLS:

Auger bit:

It is the most common tool used for boring holes with hard pressure.

Gimlet:

This is a hand tool used for boring holes with hand pressure.

Hand drill:

Carpenters brace is used to make relatively large size holes, whereas hand drill is used for drilling small holes. A straight shank drill is used with these tools. It is small light in weight and may be conveniently used than the brace. The drill is clamped in the chuck.

MISCELLANEOUS TOOLS:

Ball peen hammer:

It has a flat face, which is used for general work and a ball end is used for riveting.

Mallet:

It is used to drive the chisel, when considerable force is to be applied, steel hammer should not be used for these purpose, as it may damage the chisel handle. Further, for better to apply a series of light taps with the mallet rather than a heavy single blow.

Claw hammer:

It is a striking flat at one end and the claw at the others. The face issued to drive nails into wood and for other striking purpose and the claw for extracting nails out of wood.

Pinches:

It is made of steel with a hinged and is used for pulling out small nails from wood.

Wood rasp file:

It is a finishing tool used to make the wood smooth, remove sharp edge finishing fillets and other interior surfaces. Sharp cutting teeth are provided on its surface for the purpose. This file is exclusively used in wood work.

CARPENTRY SECTION

MORTISE AND TENON JOINT

EXPERIMENT NO: **DATE:**

AIM: To make a Mortise and Tenon joint from given wooden work piece.

TOOLS REQUIRED:

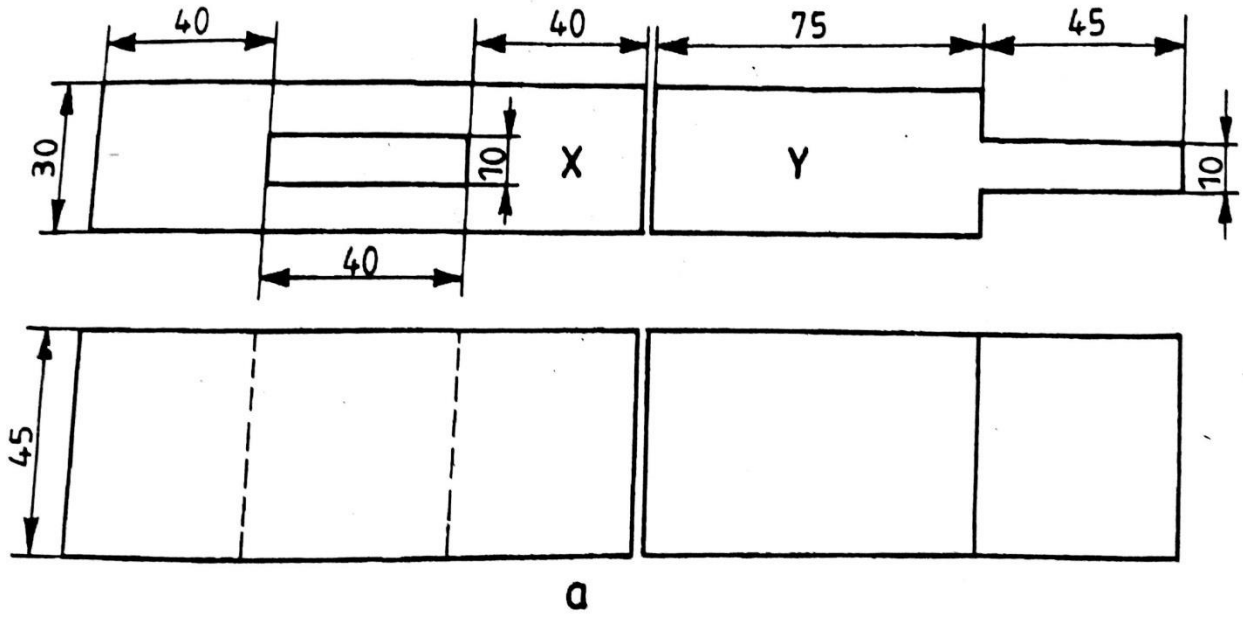
1. Carpenter's vice
2. Steel Rule
3. Try square
4. Jack plane
5. Scriber
6. Cross cut saw
7. Tenon saw
8. Marking gauge
9. 6 mm Mortise chisel
10. 25 mm Firmer chisel
11. Wooden Mallet
12. Wood rasp file and smooth file.

MATERIAL REQUIRED: Soft Wood stock of size 250 x 50 x 35 mm.

SEQUENCE OF OPERATION:

1. Measuring and Marking
2. Planning
3. Check for squareness
4. Removal of extra material
5. Sawing
6. Chiseling
7. Finishing

SKETCHES:



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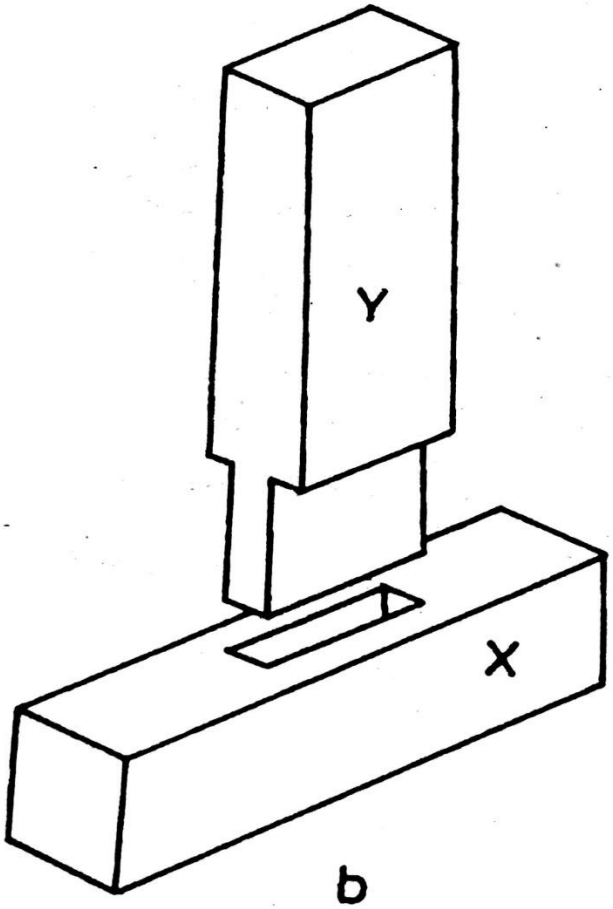


b

Fig. Mortise and tenon joint

PROCEDURE:

1. First check the dimensions given work piece.
2. The reaper is firmly clamped in the carpenter's vice and one of its faces are planned and checked for straightness.
3. The adjacent face is then planed and the faces are checked for squareness with a try square.
4. Marking gauge is set and lines drawn at 30 and 45 mm to mark the thickness and width of the model respectively.
5. The excess material is first chiseled with firmer chisel and then planned to correct size.
6. The mating dimensions of the parts X and Y are then marked using steel rule and marking gauge.
7. Using the crosscut saw, the portions to be removed in part Y (tenon) is cut , followed by chiseling.
8. The material to be removed in part X (mortise) is carried out by using the mortise and firmer chisels.
9. The parts A and B are separated by cross cutting with tenon saw.
10. The ends of both the parts are chiseled to the exact lengths.
11. Finish chiseling is done where ever needed so that, the parts can be fitted to a obtain a near tight joint.

SAFETY PRECAUTIONS:

1. Loose cloths are to be avoided.
2. Tools to be placed at their proper place.
3. Hands should not be placed in front of sharp edged tools.
4. Use only sharp tools.
5. Care should be taken, when thumb is used as a guide in cross cutting and ripping.
6. Handle while chiseling, sawing and planning with care.

RESULT:

The mortise and tenon joint is thus made by following the above sequence of operations.

Date: **Signature of the staff**

TABLE STAND BY WOOD TURNING LATHE

EXPERIMENT NO: **DATE:**

AIM: To be able to handle the wood working lathe.
To be able to turn wood for getting desired shapes.

TOOLS REQUIRED:

1. Steel Rule
2. Jack plane
3. Outside caliper
4. Wood turning lathe
5. Flat chisel with sharp cutting edge
6. Smooth file.

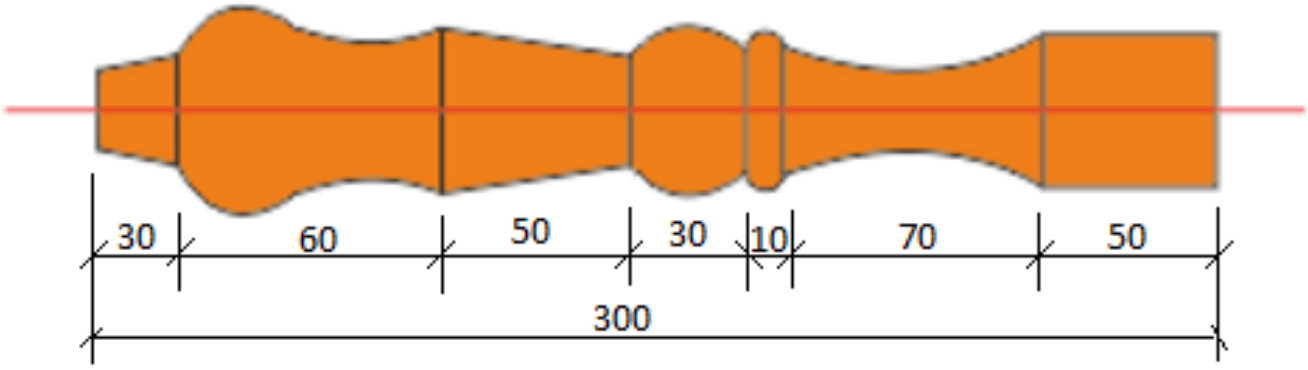
MATERIAL REQUIRED: Soft Wood stock of size 300 x 40 x 25 mm.

SEQUENCE OF OPERATION:

1. Measuring and Marking
2. Planning
3. Fix the job in wood turning lathe.
4. Removal of extra material
5. Finishing

PROCEDURE:

1. Take the soft wood stock of 300x45x25 mm by measuring the dimension.
2. Fix the job in the vice and planning the four corners of the work piece by using Jack plane.
3. Mark the dimensions on work piece by using steel rule and gauge.
4. Mark the centers of the job on either side.
5. Mounting the job between head stock and tail stock centers of the wood turning lathe.
6. Fix the tool in the tool post and positioning it to appropriate height.
7. Start the lathe to make the work piece to revolve at desired speed.
8. Feeding the tool against the rotating work piece to remove the excess material and to convert round shape.
9. Using outside calipers check the diameter of the work piece.
10. Using parting off tool reduce the diameter on either ends of the work piece.
11. Remove the rolling pin between the centers and cutoff the excess material on either sides.



SAFETY PRECAUTIONS:

1. Do not distract your attention while working on lathe.
2. before switching on the lathe, ensure that the job is held rigidly.
3. Don't wear loose clothes when working on lathe.
4. beware of your hands while working and applying tool on the job.

RESULT: The Table stand by using wood turning lathe is thus made by following the above sequence of operations.

Date: **Signature of the staff**

FITTING

INTRODUCTION:

Machine tools are capable of producing work at a faster rate, but there are occasions when components are processed at a bench. Sometimes it becomes necessary to replace or repair a component that must fit accurately with one another or reassemble. This involves a certain amount of hand fitting. The assembly machine tools, jigs, gauges etc., involves certain amount of bench work.

FITTING TOOLS: Holding tools:-

- Bench vice
- V-block with clamp
- C-clamp

Bench vice:

It is a work holding device, when vice handle is turned in a clockwise direction the sliding jaw forces the work against the fixed jaw, the greater the force applied to the handle, the tighter is the work held.

V-block with clamp:

It is a rectangular (or) square block with v-groove on one or both sides, opposite to each other. It holds cylindrical work pieces.

C-clamp:-

This is used to hold work against an angle plate or v-block.

MARKING AND MEASURING TOOLS:

1. Surface plate
2. Try square
3. Angle plate
4. Scriber
5. Universal scribing block
6. Odd leg caliper
7. Divider
8. Calipers
9. Dot punch
10. Vernier caliper

Surface plate:

It is used for testing flatness of work piece, for marking out small works.

Combination cutting pliers:

This is made of tool steel and is used for cutting as well as for ripping work.

Taps and die holders:

Tap and wrenches are used for cutting internal threads in a drilled hole.

Dies and die holders:

They are used for making external threads. Dies are made either solid (or) split type.

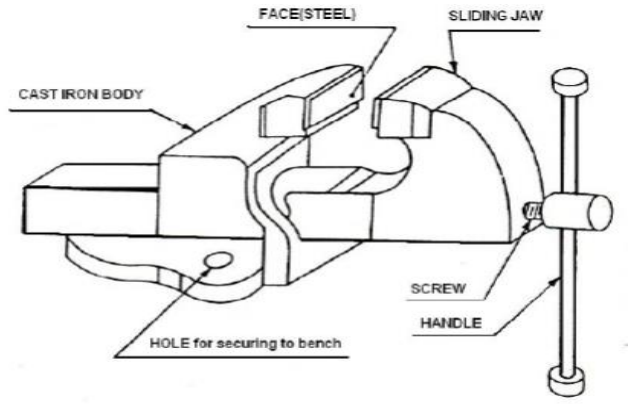


Fig: 1 Bench wise

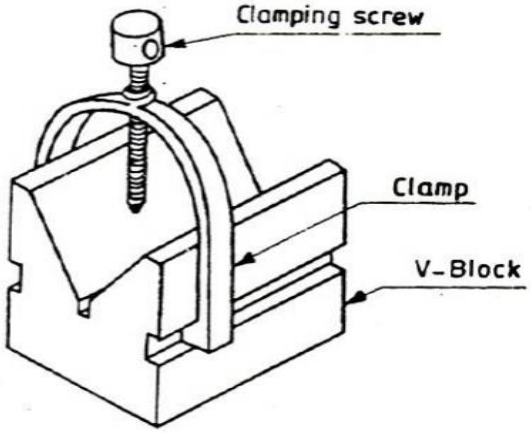


Fig: 2 V- Block

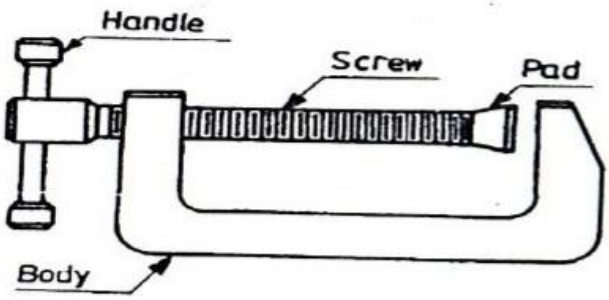


Fig: 3 C – Clamp

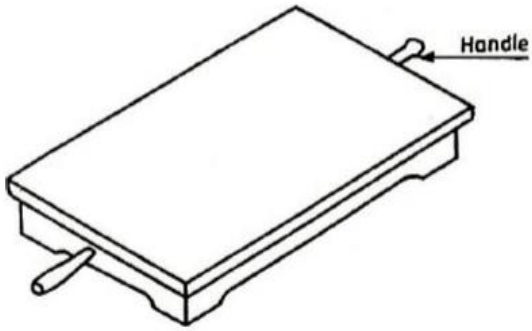


Fig: 4 Surface plate

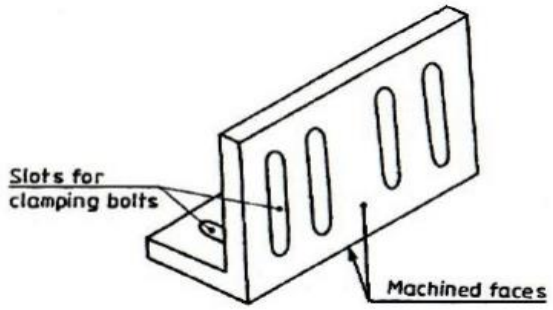


Fig: 5 Angle plate

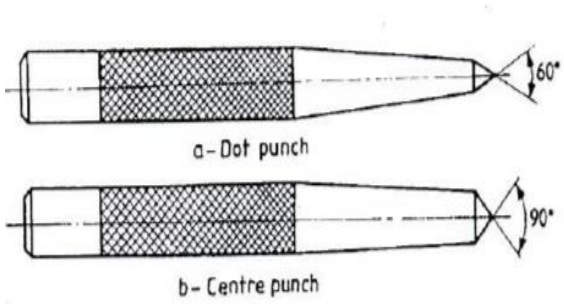


Fig: 6 punches

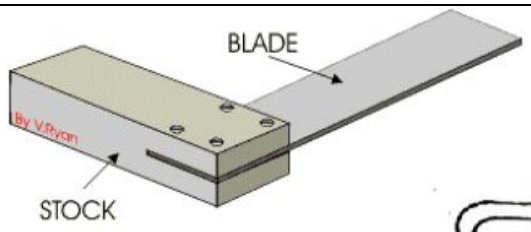


Fig: 6 try square

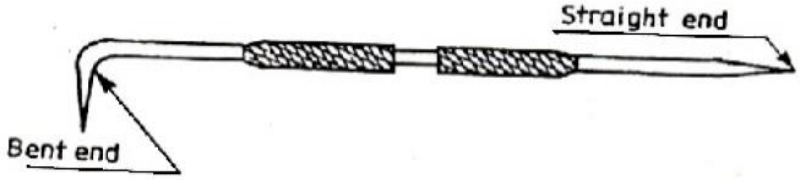


Fig: 7 scriber

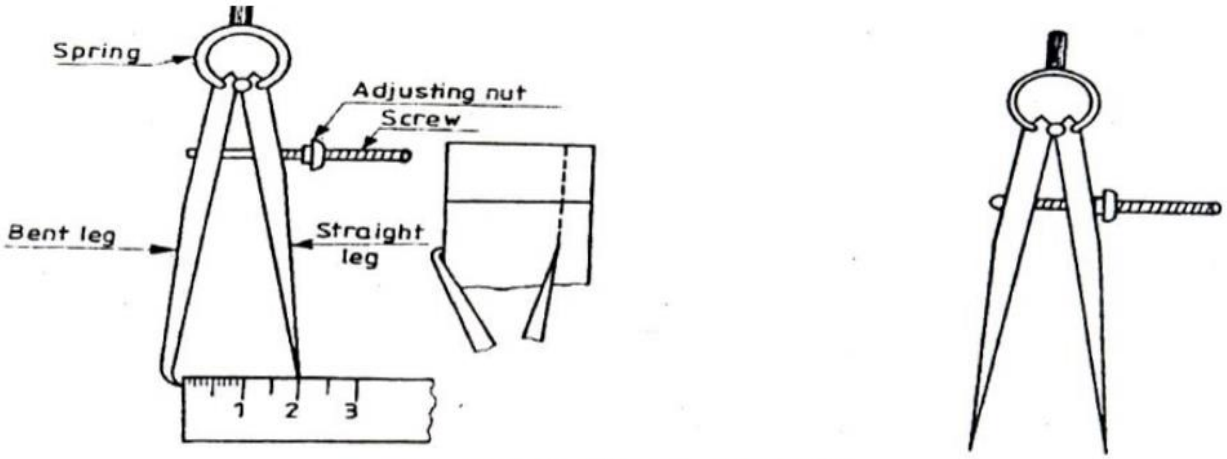


Fig: 8 odd leg clamp and divider

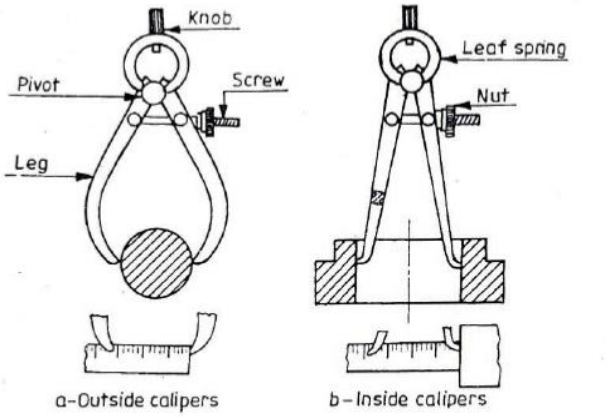


Fig: 9 calipers

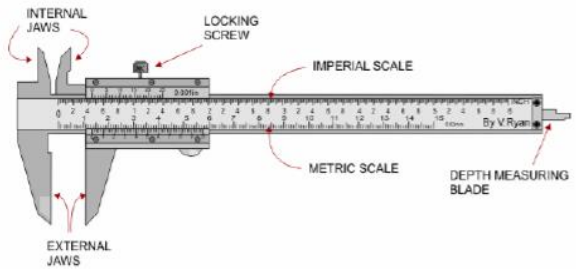
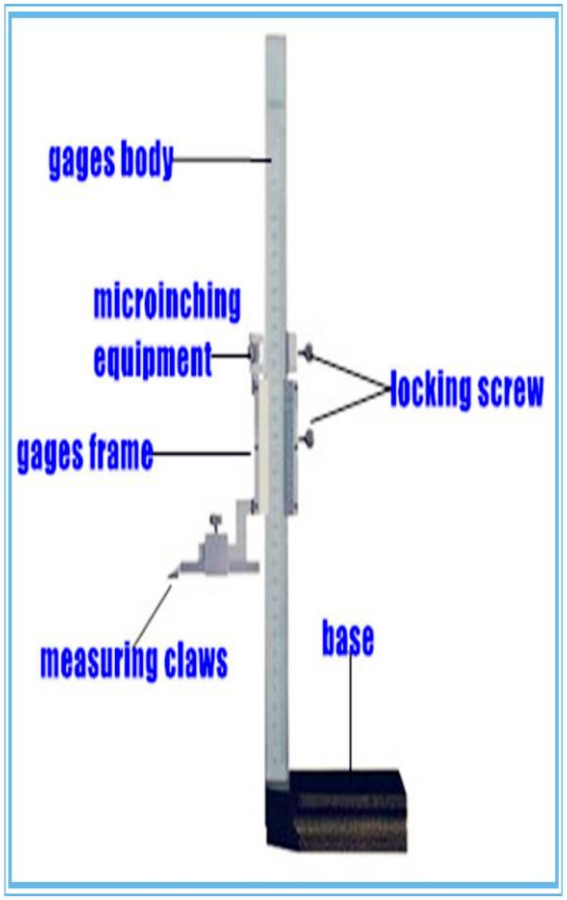


Fig: 10 Vernier caliper



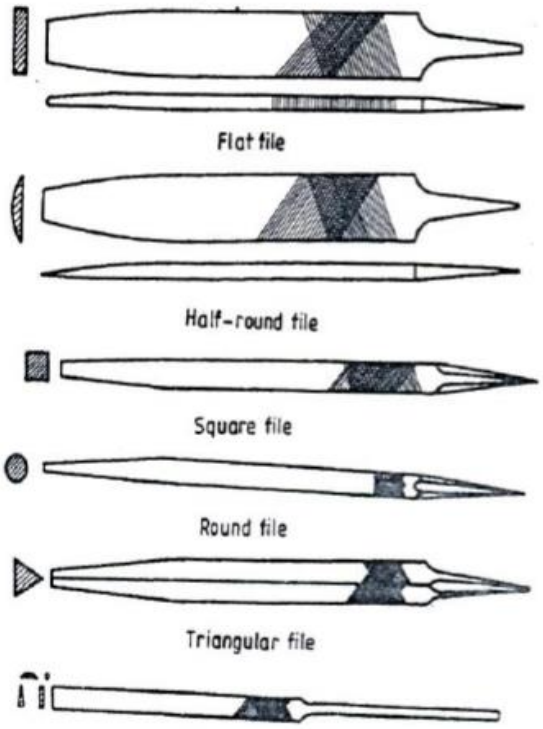


Fig: 12 Types of files

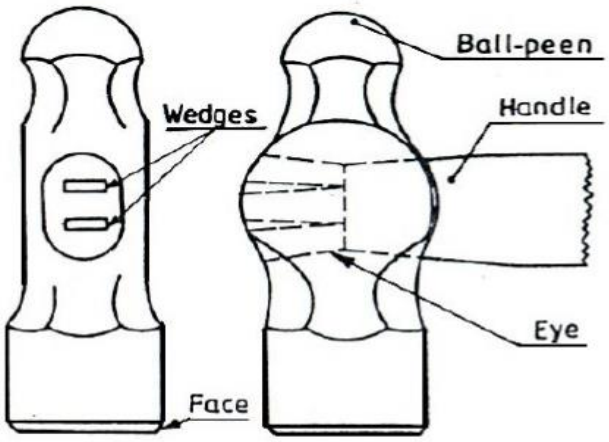


Fig: 13 ball peen hammer

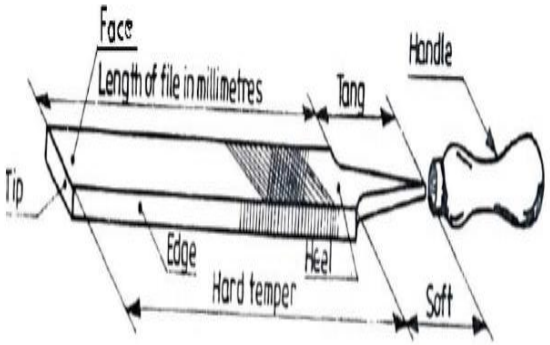


Fig: 11 Parts of hand file

TYPES OF FILES:

Hand file:

It is a rectangular in section tapered in thickness but parallel in width.

Flat file:

Rectangular in section and tapered for 1/3rd length in width and thickness.

Square file:

Square in section and tapered for 1/3rd length on all sides.

Half round file:

It has one flat face, connecting by a curved (surface) face & tapered for 1/3rd length.

Round file:

Circular in cross section and tapered for 1/3rd length, it has double cut teeth.

MISCELLANEOUS TOOLS:

Ball peen hammer:

It has a flat face, which is used for general work and a ball end is used for riveting.

Screw driver:

It is designed to turn the screws. The blade is made of steel and is available in different lengths and diameters.

Spanners:

It is a tool for turning nuts and bolts. It is usually made of forged steel.

FITTING OPERATIONS:

Chipping:

Removing metal with a chisel is called chipping and is normally used where machining is not possible.

Fitting:

1. Pinning of files:

   Soft metals cause this; the pins are removed with a file card.

2. Checking flatness and squareness:

   To check flatness across thickness of plate.

MARKING AND MEASURING:

Measurements are taken either from a center line, for visibility of the non-ferrous metals and oxide coated steels are used.

FITTING SECTION

DOVETAIL FITTING

EXPERIMENT NO: **DATE:**

AIM: To make a dovetail fitting from the given two M.S. Pieces.

TOOLS REQUIRED:

1. Bench vice
2. Steel rule
3. Try square
4. Ball peen hammer
5. Scriber
6. Hack saw with blade
7. Dot punch and Centre punch
8. Surface plate
9. Venire height gauge
10. Rough and smooth flat files
11. Flat chisel and triangular file

MATERIAL REQUIRED: Mild steel (M.S) plate of size 48 x 34 mm –2 Nos.

SEQUENCE OF OPERATIONS:

1. Filing
2. Checking flatness and squareness
3. Marking and measuring
4. Punching
5. Sawing
6. Chipping
7. Finishing

PROCEDURE:

1. The burrs in the pieces are removed and the dimensions are checked with a steel rule.
2. The pieces are clamped one after the other and the outer mating edges are filed by using rough and smooth files.
3. The flatness, straightness and squareness i.e. right angle between adjacent sides are checked with help of Try-square.
4. Chalk is then applied on the surfaces of the two pieces.
5. The given dimensions of the T-fitting are marked with help of Vernier height gauge carefully.
6. Using the dot punch, dots are punched along the above scribed lines.
7. Using the hack saw, the unwanted portions are removed.

8. Using the flat chisel, the unwanted material in the piece Y is removed.
9. The cut edges are filed by the half round file.
10. The corners of the stepped surfaces are filed by using a square or triangular file to get the sharp corners.
11. The pieces (X and Y) are fitted together and the mating is checked for the correctness of the fit. Any defects noticed , are rectified by filing with a smooth file.

NOTE: Care is taken to see that the marking dots are not crossed, which is indicated by the half of the punch dots left on the pieces.

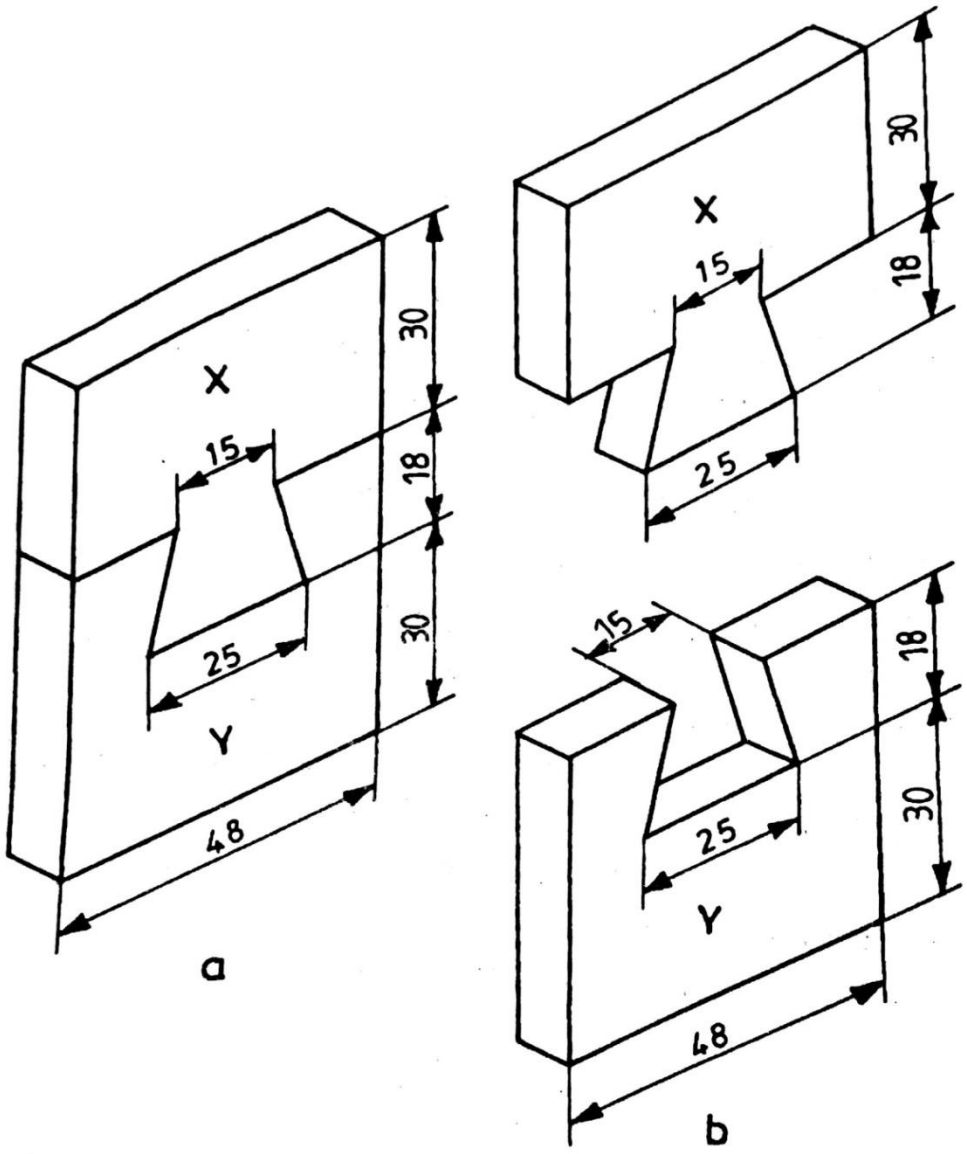


Fig. Dovetail fitting

SAFETY PRECAUTIONS:

1. Care is taken to see that the marking dots are not crossed, which is indicated by the half of the punch dots left on the pieces.
2. Apply pressure in forward direction during hack sawing.
3. Don't rub steel rule on the job.
4. Fix blade in hack saw frame with correct tension.
5. During hack sawing the coolant like water or lubricating oil is to be used.
6. Use precision instruments like Vernier calipers and Vernier height gauge carefully.
7. Files are to be cleaned properly after using.

Result: The required dovetail fitting is thus obtained, by following the stages, as described above.

Date: **Signature of the staff**

HALF ROUND FITTING

EXPERIMENT NO: **DATE:**

AIM: To make a half round fitting from the given two M.S. Pieces.

TOOLS REQUIRED:

1. Bench vice
2. Steel rule
3. Try square
4. Ball peen hammer
5. Spring divider
6. Hack saw with blade
7. Dot punch and Centre punch
8. Surface plate
9. Venire height gauge
10. Rough and smooth flat files
11. Flat chisel and triangular file

MATERIAL REQUIRED: Mild steel (M.S) plate of size 48 x 34 mm –2 Nos.

SEQUENCE OF OPERATIONS:

1. Filing
2. Checking flatness and squareness
3. Marking and measuring
4. Punching
5. Sawing
6. Chipping
7. Finishing

PROCEDURE:

1. The burrs in the pieces are removed and the dimensions are checked with a steel rule.
2. The outer mating edges are filed, by rigidly fixing in the bench vice. The flatness of the edge is also checked by the try-square.
3. The edges of the two pieces are filled such that, they are at right angles to the edges 1,1 and the widths are exactly 48 mm each.
4. Chalk is then applied on the surfaces of the two pieces.
5. The given half rounds (semi-circles) are marked on the two pieces , by using the Jenny caliper and spring divider.

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

6. Using the dot punch, dots are punched along the above scribed lines.
7. Using the hack saw, the unwanted portions are removed to the extent possible..
8. The cut edges are filed by using square and the half round files.
9. The pieces (X and Y) are fitted together and the mating is checked for the correctness of the fit. Any defects noticed , are rectified by filing with a smooth file.

NOTE: Care is taken to see that the marking dots are not crossed, which is indicated by the half of the punch dots left on the pieces.

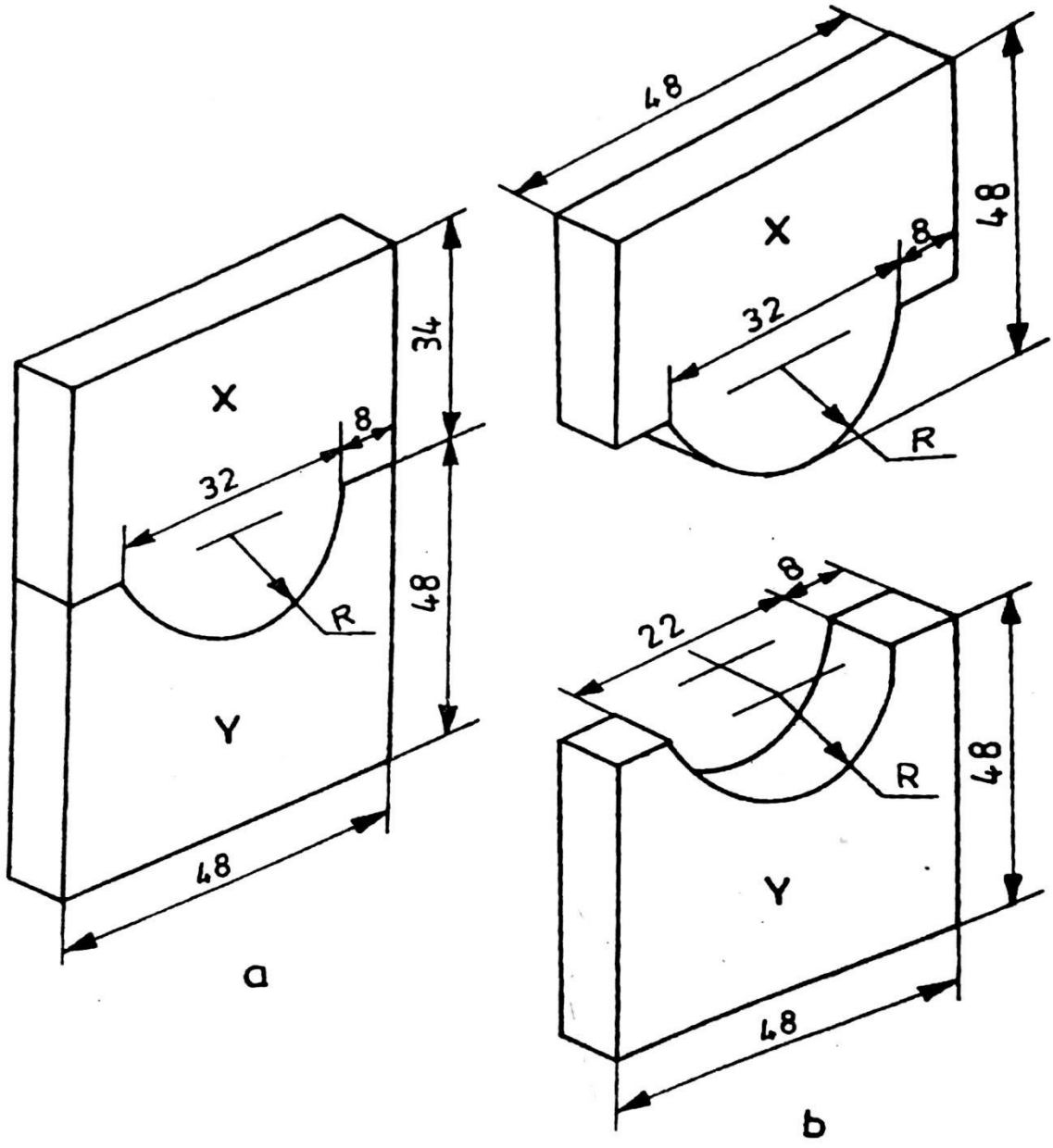


Fig. Half round fitting

SAFETY PRECAUTIONS:

1. Care is taken to see that the marking dots are not crossed, which is indicated by the half of the punch dots left on the pieces.
2. Apply pressure in forward direction during hack sawing.
3. Don't rub steel rule on the job.
4. Fix blade in hack saw frame with correct tension.
5. During hack sawing the coolant like water or lubricating oil is to be used.
6. Use precision instruments like Vernier calipers and Vernier height gauge carefully.
7. Files are to be cleaned properly after using.

RESULT: The required half round fitting is thus obtained, by following the stages, as described above.

Date: **Signature of the staff**

TIN SMITHY

INTRODUCTION:

Many engineering and house hold articles such as boxes, cans, funnels, ducts etc., are made from a flat sheet of metals. These process being known as tin smithy. For this, the development of the article is first drawn on the sheet metal then cut and folded to form the required shape of the article. The edge of the articles are then secured through welding, brazing, soldering, riveting etc.

Sheet metal materials:

A variety of metals used in a sheet metal shop such as black iron, aluminum and stainless steel. A sheet of soft steel which is coated with molten zinc is known as galvanized iron. The zinc coat forms a coating that resists rust, improves the appearance of the metal and permits it to be solderized with greater care.

HAND TOOLS:

The common hand tools used in sheet metals work are steel rule, usually of 60 cm length, Vise gauge, dot punch, scriber, trammels, ball peen hammer, and straight peen hammer, cross peen hammer, mallets, snips and soldering iron.

Trammels:

Sheet metals layouts require marking of arcs and circles. This may be done by using the trammels. The length of the beam decides the maximum size of the arc that can be scribed.

Wire gauge:

The thickness of the sheet metal is referred in numbers known as standard wire gauge (SWG). The gaps in the circumstance of the gauge are used to check the gauge number.

Bench shears:

Sheet metal may be cut by shearing action. In this the force is applied through a compound lever, making it possible to cut sheet metal up to 4mm thick. The chopping hole can shear a mild steel rod up to 10mm diameter.

Snips:

Snips are hand shears, varying in length from 200mm to 600mm. 200mm to 250mm being the commonly used. The straight lines are curved snips or bent snips are for trimming along inside curves.

Hammers:

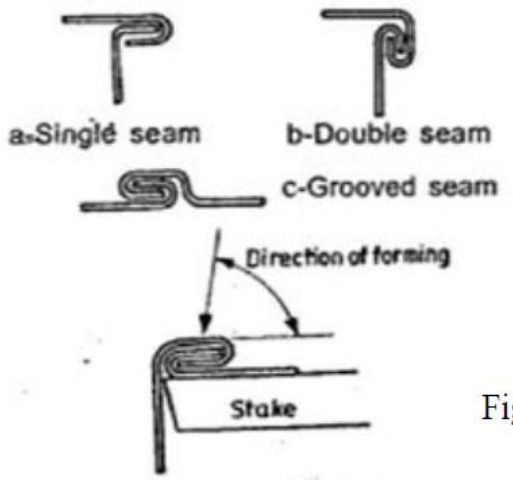
Ball peen hammer has a cylindrical slightly curved face and a ball head straight peen and similar to the cross peen, but it is positioned paralleled to the handle which can be used conveniently for certain operations of folding.

Stakes:

Stakes are nothing but anvils, which are used as supporting tools and to form seam, bend, rivet sheet metal objects.

Snips:

Snips are hand shears, varying in length from 200mm to 600mm. 200mm to 250mm being the commonly used. The straight lines are curved snips or bent snips are for trimming along inside curves.



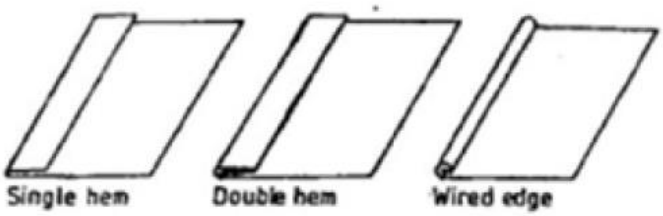


Fig: 1 Sheet metal joints

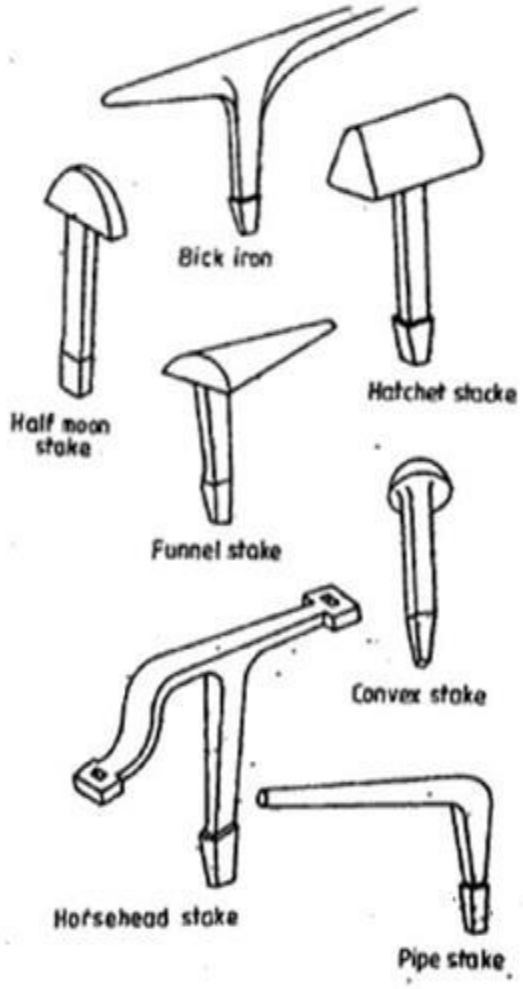


Fig: Stakes

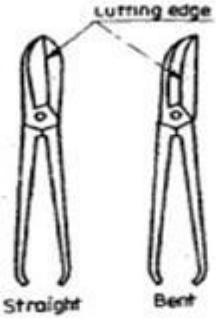


Fig. 10.4 Snips

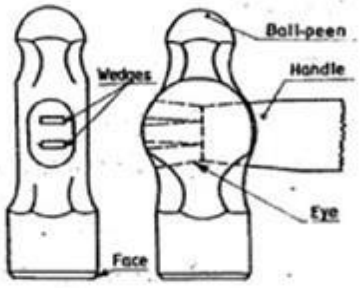


Fig. 8.34 Ball-peen hammer

Table 10.1

SWG No	Thickness, mm
10	3.20
12	2.60
14	2.30
16	1.60
20	1.00
22	0.70
24	0.65
26	0.45
30	0.30

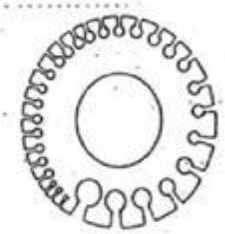


Fig. 10.2 Standard wire gauge

Hammers:

Ball peen hammer has a cylindrical slightly curved face and a ball head straight peen and similar to the cross peen, but it is positioned paralleled to the handle which can be used conveniently for certain operations of folding.

Stakes:

Stakes are nothing but anvils, which are used as supporting tools and to form seam, bend, rivet sheet metal objects.

Trammels :

Sheet metals layouts require marking of arcs and circles. This may be done by using the trammels. The length of the beam decides the maximum size of the arc that can be scribed.

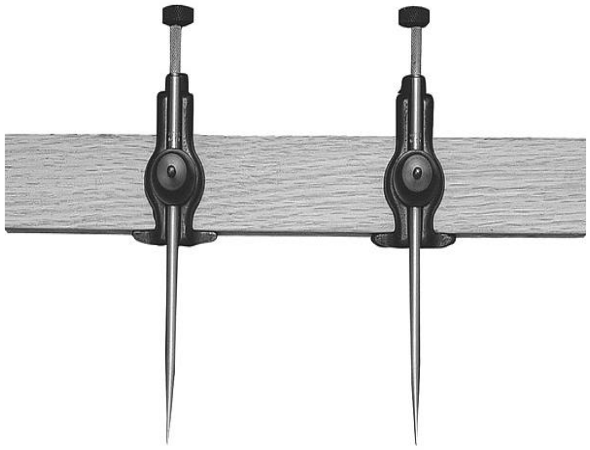


Fig: Trammel

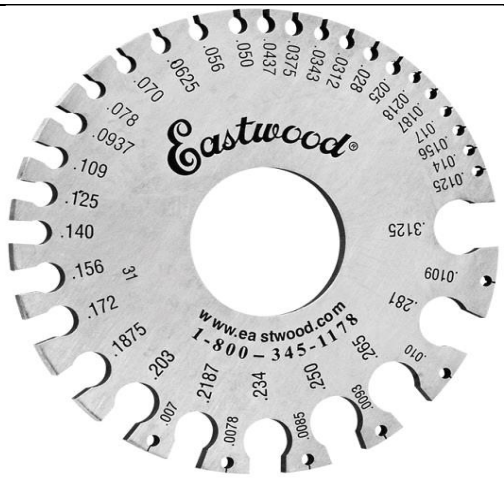


Fig: SWG (Standard wire gauge)

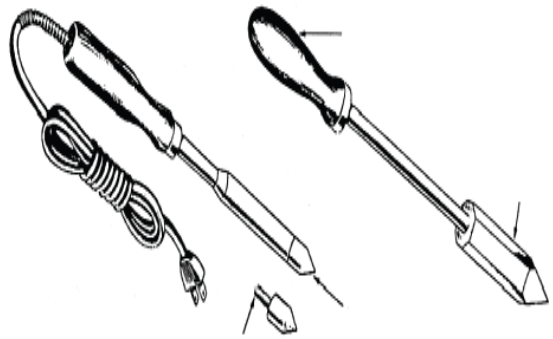


Fig: Soldering Equipment

Fig: Sheet metal screws

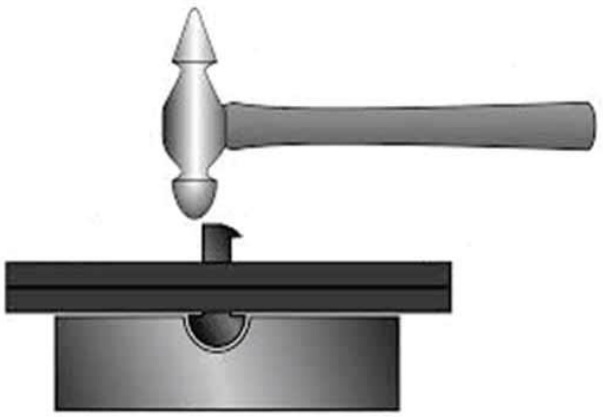


Fig: Rivet set

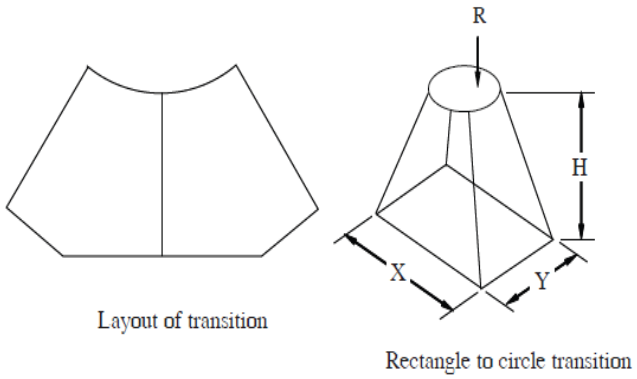


Fig: Sheet metal layout

SHEET METAL JOINTS:

Various types of joints are used in sheet metal work to suit the varying requirement. These are self-secured joints, formed by joining together two pieces of sheets metal and using the metal itself to form the joints. These joints are to be used on sheets of less than 1.6mm thickness.

Riveting:

Rivets are used to fasten two of more sheets of metal together. It is the common practice to use the rivets of the same material as that of the sheets having fastened.

Sheet metal screws:

These are used in sheet metal work to join and install duct work for ventilation air conditioning etc. These screws are also known as self-tapping screws since they cut their own threads.

Soldering:

Soldering is one method of joining two pieces of metal with an alloy that melts at a lower temperature than the metals to be joined for a good job. The metals to be joined must be free from dirt, grease and oxide. Solder is made of tin and lead in equal proportions. It comes either in the form of wire and bar.

Soldering iron:

Soldering requires a source of heating. A common method of transmitting heat of the metal surfaces is by using a soldering iron.

TINSMITHY SECTION

PREPARATION OF A FUNNEL

EXPERIMENT NO: **DATE:**

AIM: To be able to prepare a funnel from given G.I Sheet.

TOOLS REQUIRED:

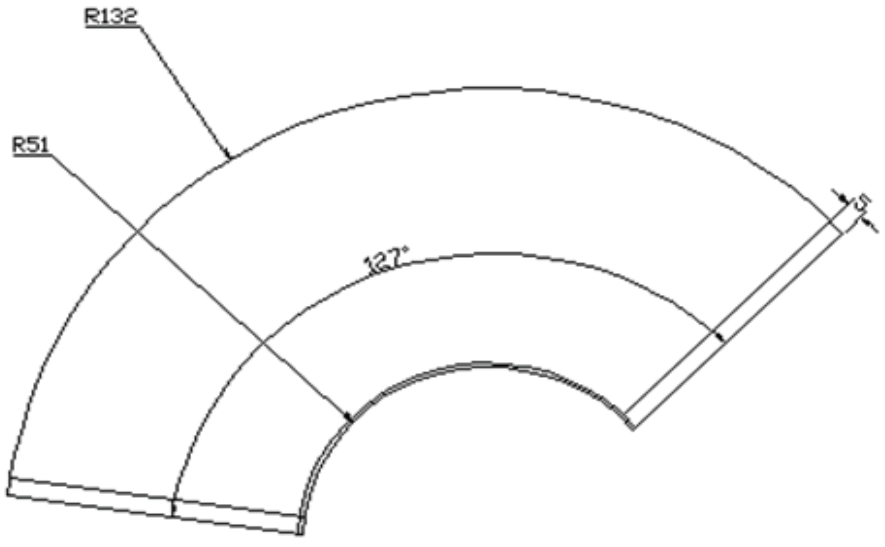
1. Steel Rule
2. Scriber
3. Compass with pencil
4. Divider
5. Straight snip
6. Bent Snip
7. Mallet
8. Stakes

MATERIAL REQUIRED: G.I Sheet of size 300 x 100 mm (for upper part)
G.I Sheet of size 75 x 45 mm (for bottom part)

SEQUENCE OF OPERATIONS:

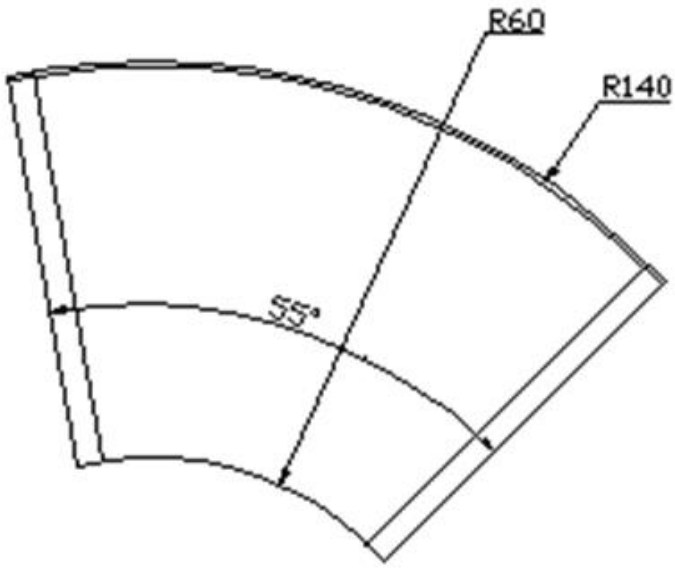
1. Cleaning
2. Surface leveling
3. Marking
4. Cutting
5. Folding

PROCEDURE: For Upper conical Part:



1. Draw the development of the upper conical part.
2. Mark the dimensions of metal removed on the sheet by using scriber or Pencil.
3. Cutting the sheet in required shape from the stock along the marked lines using straight snip and bent snip.
4. Hem the upper side of the sheet.
5. Flanging out the bottom of the sheet.
6. Folding the edges of the joining sides.
7. Forming the flat sheet into the conical shape by using appropriate stake and apply pressure by using mallet.
8. Prepare single hem on the longitudinal sides in opposite direction by applying the pressure using mallet.
9. Inter lock the bent edges and apply pressure with mallet to make required joints.

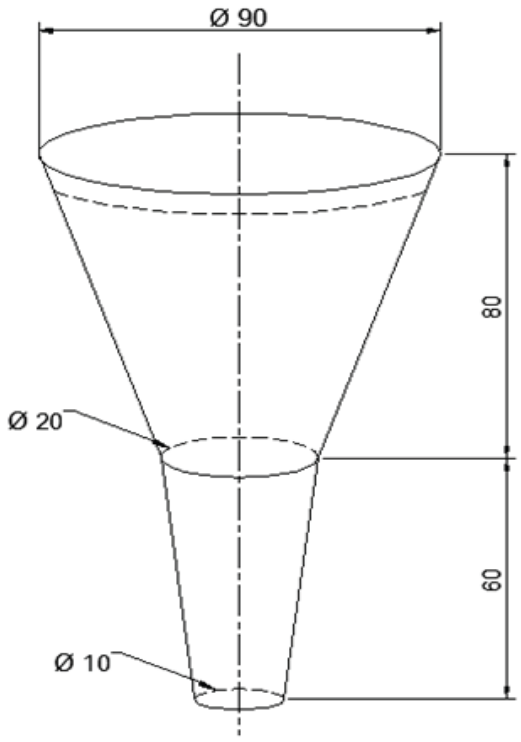
For bottom conical part :



1. Draw the development of the bottom conical part.
2. Marking the dimensions of metal removed on the sheet by using scriber (or) pencil & steel rule.
3. Cutting the sheet in required shape from the stock along the marked lines using a straight snip.
4. Hem the bottom side of the sheet.
5. Flanging the upper side of the sheet.
6. Folding the edges of the joining sides.
7. Forming the flat sheet in to the conical shape by using appropriate stake and applying pressure by using mallet.
8. Prepare single hem on the longitudinal sides in opposite direction by applying the pressure using mallet.
9. Inter lock the bent edges and apply pressure with mallet to make required joints.

ASSEMBLING :

Seeming the top conical part and bottom conical part to obtain the required funnel.



SAFETY PRECAUTIONS :

1. Always hold the snip in one hand and the nearest metal in the other hand.
2. Do not hold the sheet and bend the sheet with bare hands.
3. Do not keep tools on the edge of the work table.
4. Remove sharp projections on the sheet immediately on notching.

RESULT :

Date: **Signature of the staff**

PREPARATION OF RECTANGULAR OPEN TYPE TRAY

EXPERIMENT NO: **DATE:**

AIM : To be able to prepare a rectangular open tray.

TOOLS REQUIRED :

1. Steel rule
2. Scriber
3. Pencil
4. Straight snip
5. Mallet
6. Stakes

MATERIALS REQUIRED : G.I sheet of size 170 × 150 mm

SEQUENCE OF OPERATION:

1. Cleaning
2. Surface leveling
3. Marking
4. Cutting
5. Folding

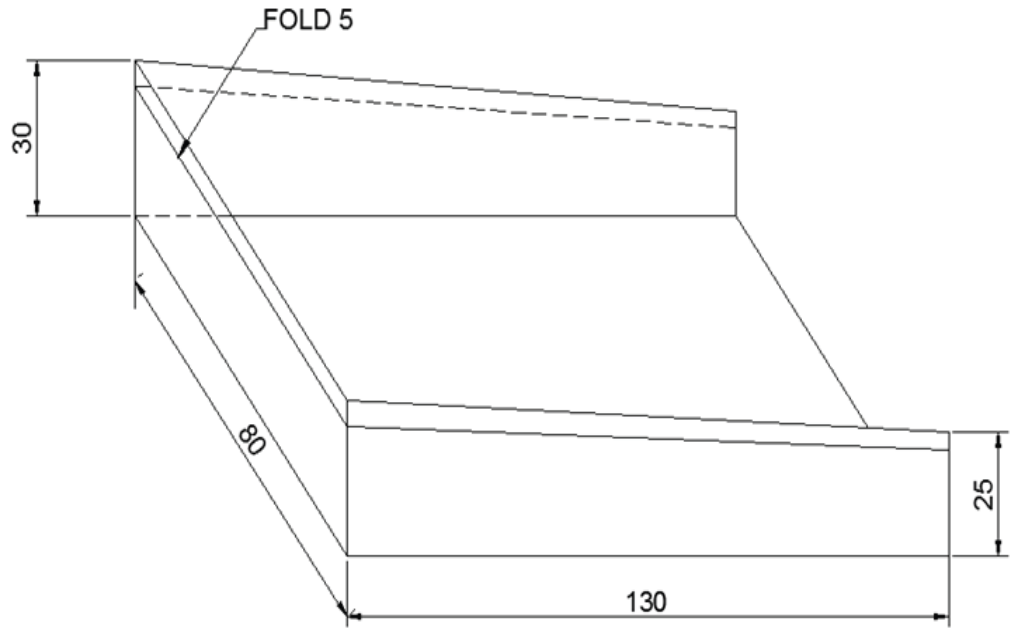


Fig: Rectangular OpenTray

PROCEDURE :

1. Draw the development of the object to be made.

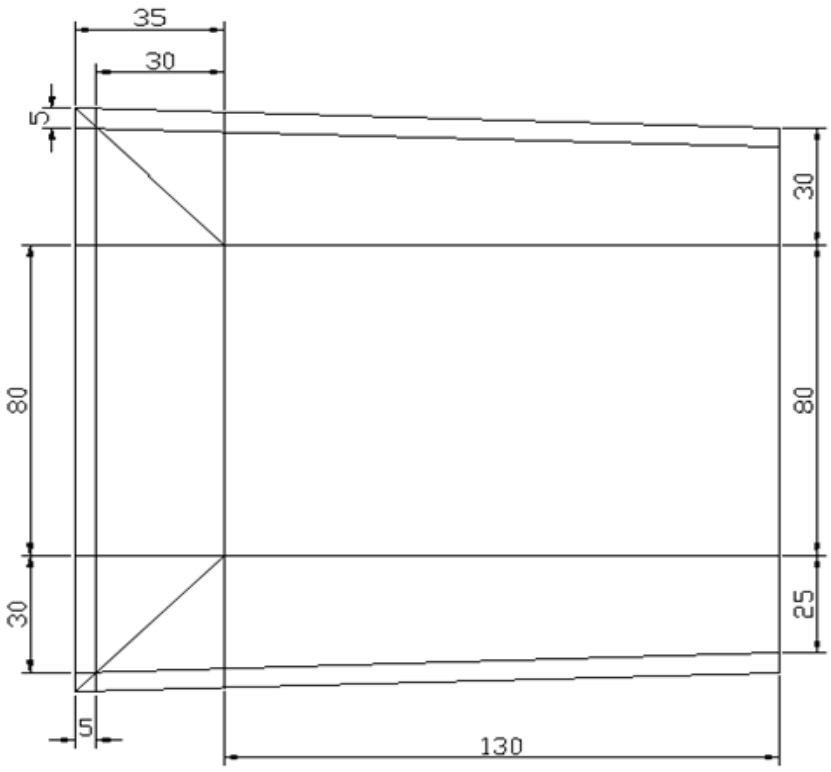


Fig: Development of Rectangular Open Tray

2. Marking the dimensions of metal removed on the sheet by using scriber (or) pencil & steel rule.
3. Cutting the sheet in required shape from the stock along the marked lines using a straight snip.
4. Marking the lines on the sheet, for marking bends for forming.
5. Strengthen the sides of sheet by making the single hem using hatchet stake.
6. Forming the flat sheet in to the desired shape on the stake and applying pressure by using mallet.
7. Seaming the corners of the tray by inserting the laps of the adjacent sides with single hem.

SAFETY PRECAUTIONS :

1. Do not hold the sheet and bend the sheet with bare hands.
2. Do not keep tools on the edge of the work table.
3. Care is to be taken in avoiding the wastage of material.

RESULT:

Date: **Signature of the staff**

HOUSE WIRING

INTRODUCTION:

Power is supplied to domestic installations through a phase and a neutral, forming a single phase. A.C 230V, 2- wire system for industrial establishments. Power is supplied through three phase four wire system to give 440V. Fig. Shows the power tapping for domestic and industrial purposes. The neutral is earthed at the distribution sub-station of the supply.

When supplied to domestic utilizes power is fed to a kilowatt meter and then to a distribution panel. The panel distributes power along several circuits' breakers. The panel also serves as a main switch.

Electrical wiring is defined as a system of electrical conductors, components and apparatus for conveying electrical power from the source to the point of use. The wiring system must be designed to provide a constant voltage to the load.

ELEMENTS OF HOUSE WIRING:

Fuses & circuit Breakers:

These are the devices to provide protection to a circuit against excess current. Open link fuses are not in safe in operations, even though they are cheaper and reliable. It consists of a thin strip of metal (or) wire.

Electric switch:

This is a device that makes and breaks or changes the course of electric circuit. It consists of 2 or more contacts mounted on an insulating structure and arranged such that they may be moved in to and out of contact with each other by a suitable operating mechanism.

Plug:

It is a device carrying 2 or 3 contact, designed for engagement with corresponding plugs pins and arranged for connection to fixed wiring and arranged for attachment to appliances such as radio, T.V, table, fan etc.,

Socket outlet:

It is a device carrying 2 or 3 contacts, designed for engagement with corresponding plug pins and arranged for connection to fixing wiring.

Lamp holder:

These are designed to hold lamps & connect them in the circuit. Both bay one cap and screw lamp holders are available up to 200 watts lamps.

Ceiling rose:

A ceiling rose consists of a circular base & cover made of Bakelite. The base has 2 or 3 terminal plates. One end of the plate is connected to supply wire connected to pendent lamp, ceiling fan, exhaust fan, etc.

Wiring method:

A circuit is path along which the electric current flows from negative side of power source to positive side.

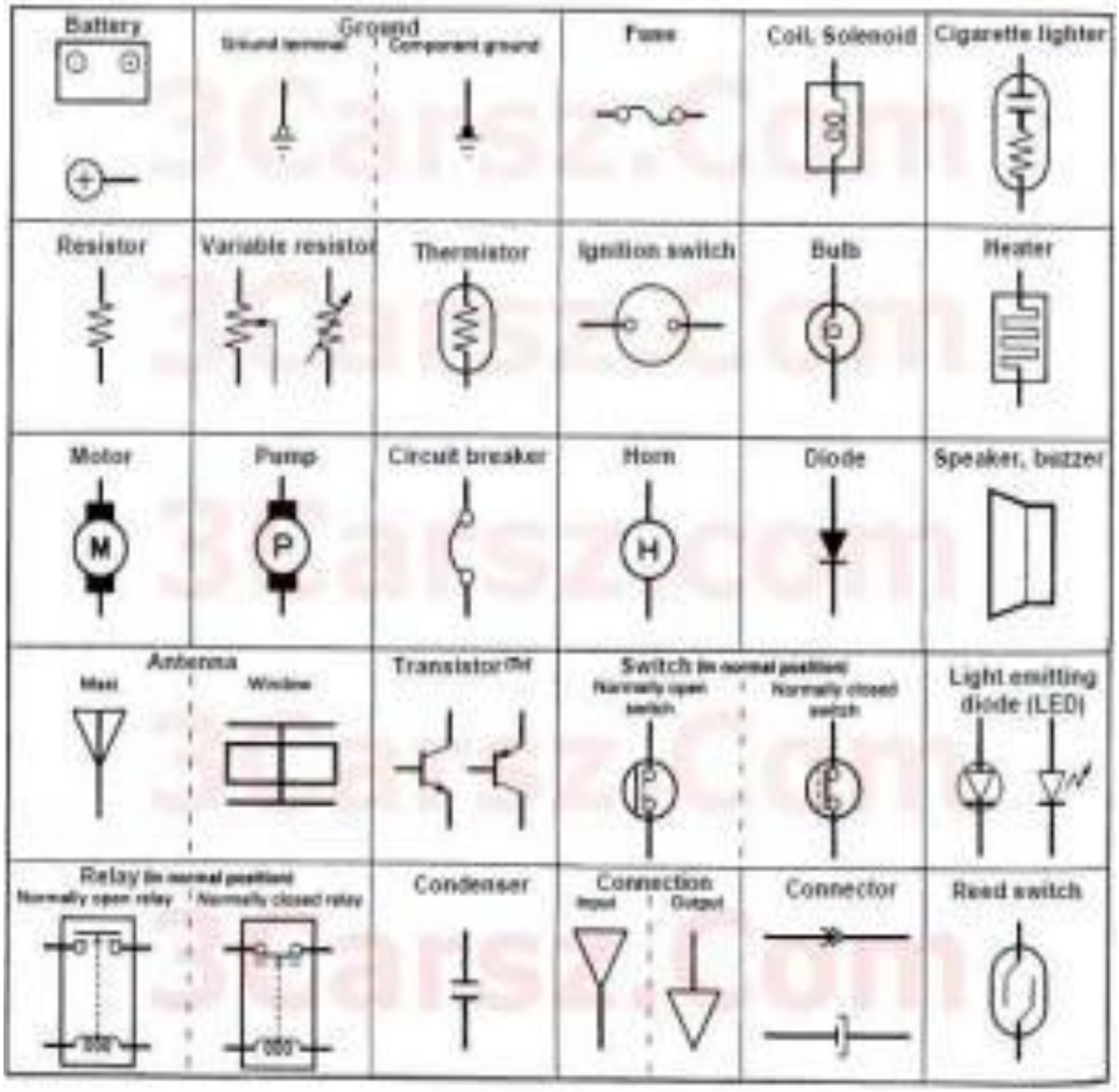


Fig: Various Symbols for electrical appliances

Main switch:

This is a switch intended to connect or cut-off the supply of electrical to the whole of an installation. It is generally of metal clad type. The metal clad gives greater strength and safety. The main switch contains one or more fuses, single phase, and A.C. circuits.

Incandescent light:

Incandescent means 'glowing at white heat'. A lamp actually works like heating elements that it gives off light by becoming white hot, the amount of power it consume is stamped on the bulb. Higher the wattage, brighter the light. The bulbs have filaments made of tungsten.

Interior wiring:

Wires & wire sizes:

A wire is defined as a bare or insulated conductor consisting of one (or) several strands. An insulating wire consists of a conductor with insulating material made of Vulcanized Indian Rubber (VIR) (or) Poly Vinyl Chloride (PVC). The wire may consist

of 1 or several twisted strands. A multi sore conductor consists of several cores insulated from one another and enclosed in a common seating. Wire sizes are specified by the diameter of the wire, using a standard wire gauge (SWG), which also gives an idea of the current carrying capacity. The specification consists of the both the number of strands and the diameter of the each wire in it.

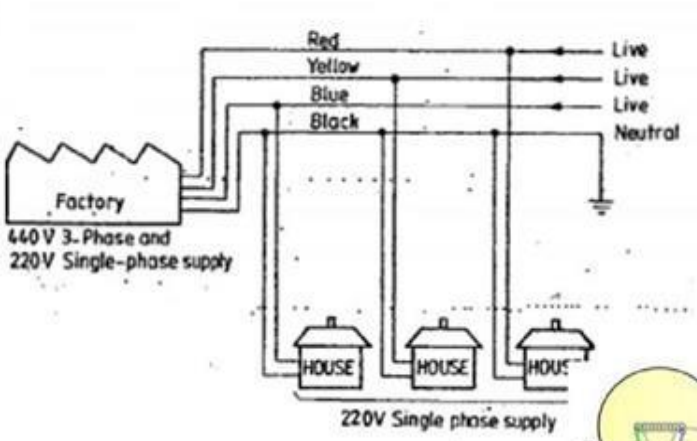
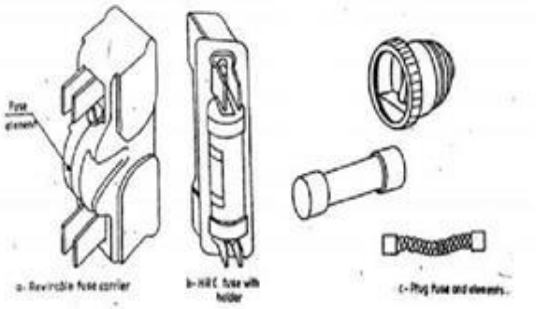


Fig. 3.1 3 phase-4 wire supply



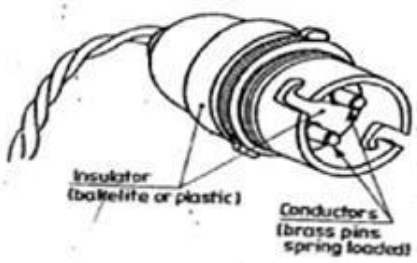
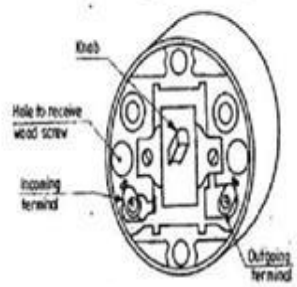


Fig. 3.6 Pendant lamp holder



One-way switch

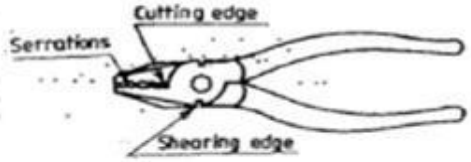


Fig. 8.22 Combination plier

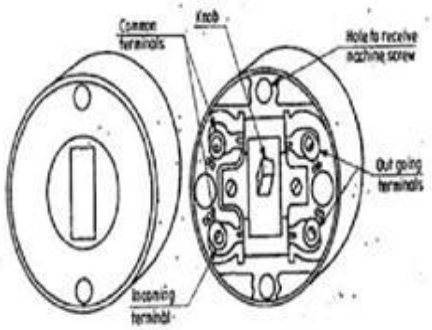


Fig. 3.4 Electric switches

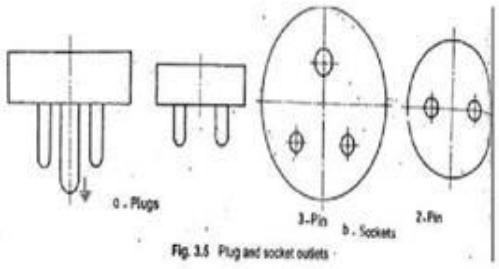


Fig. 3.5 Plug and socket outlets

NOTE: Parts of bulb
1) Glass bulb 2) Low-pressure inert gas 3) Tungsten-filament 4) Contact wire (out of stem) 5) Contact wire (into stem) 6) Support wires7) Stem Glass mount 8) Contact wire (out of stem) 9) Cap (Steeve) 10) Insulation 11) Electrical contact.

Fig. 8.23 Nose plier

HOUSE WIRING SECTION

ONE LAMP CONTROLLED BY TWO TWO-WAY SWITCHES (STAIR CASE CONNECTION)

EXPERIMENT NO: **DATE:**

AIM: To give connections to one lamp controlled by two two-way switches.

TOOLS REQUIRED:

1. Screw driver
2. Cutting pliers
3. Ball peen hammer
4. Insulation remover
5. Tester
6.

MATERIAL REQUIRED:

1. Wooden wiring board
2. Silk wire
3. Electrical bulb-1 No.
4. Two way switches -2 Nos.
5. Wooden round block- 1 No
6. Batten lamp holder - 1 No
7. Wire clips
8. Nails
9. Screws

SEQUENCE OF OPERATION:

1. Fitting the wires
2. Connection of the bulb holder
3. Connection of switches
4. Circuit-connection
5. Power from mains
6. Operating the lamp

PROCEDURE:

1. Five phase wire pieces are taken and insulation is removed at the ends by wire stripper.
2. The first phase wire is connected by seconds phase wire.
3. The middle point of switchesS2 is connected to one point of bulb holder “B2”.
4. By using another phase wire the remaining point o f the bulbholder“B1”.
5. At the same point of bulb“B1” a phase wire connected to the upper point of switch“S1”.

6. Two neutral wire pieces are taken and connected to the remaining point of bulbholder“B1”.
7. One of it is connected to the main supply.
8. After checking the proper circuit connects the power supply is given to switches.
9. Now the bulbs are ready to show bright and dim.

SKETCH:

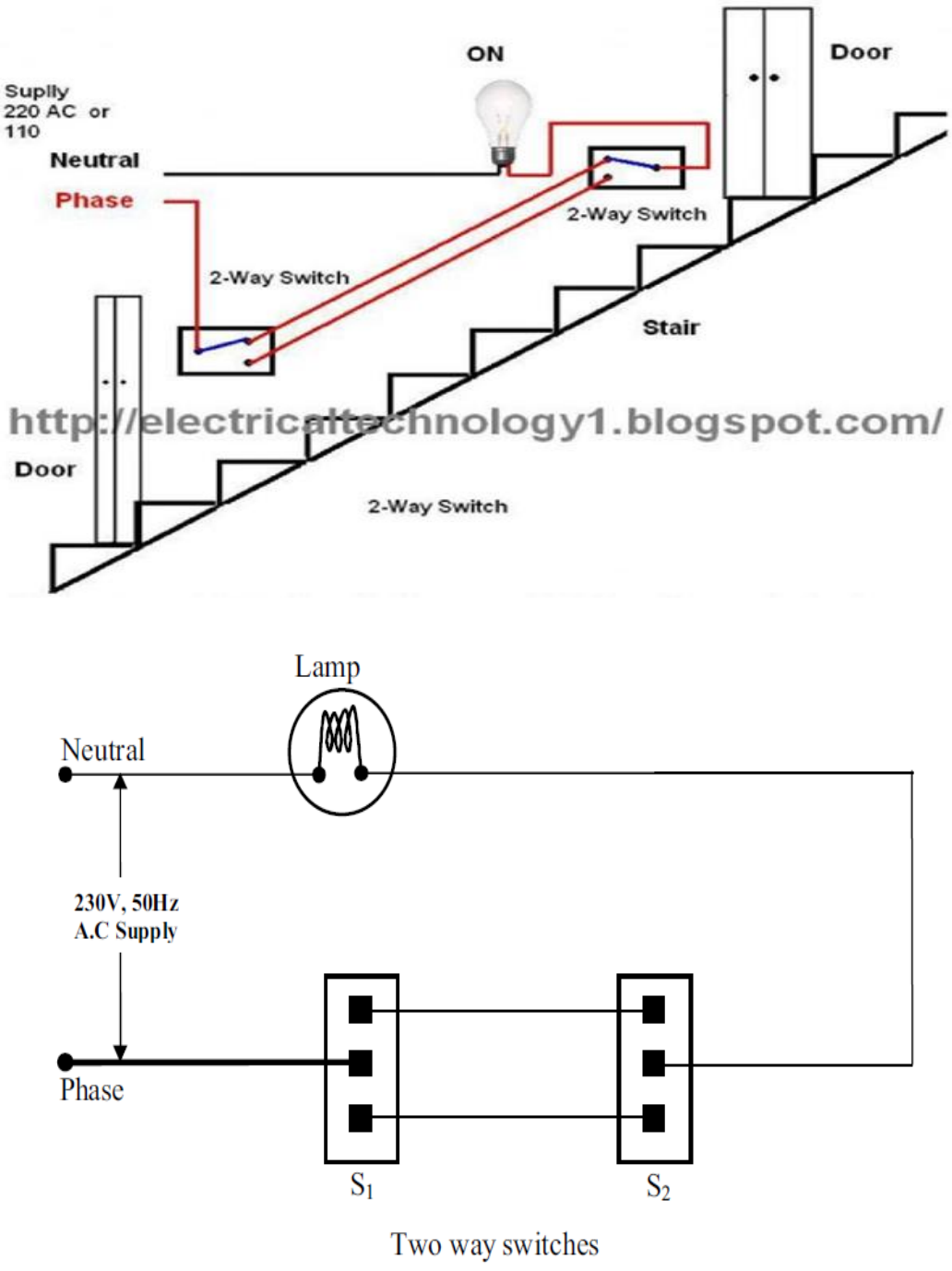


Fig: Circuit Diagram for One lamp controlled by 2 two – way switches

SAFETY PRECAUTIONS:

1. Electricity has no respect for ignorance. Do not apply voltage or turn-on any device until it has been properly checked.
2. Care should be taken from electrical shocks.
3. Don’t touch the connection points.
4. Avoid loose connection.
5. Don’t work at damped areas and with wet clothing.
6. Handle the lamp carefully.

RESULT:

Connections are given to one lamp controlled by two two-way switches and tested.

S. No	S1	S2	L1	L2
1	UP	DOWN	BRIGHT	OFF
2	UP	UP	BRIGHT	BRIGHT
3	DOWN	UP	OFF	OFF
4	DOWN	DOWN	DIM	DIM

Date: **Signature of the staff**

WIRING FOR TUBE LIGHT (FLUORESENT LAMP)

EXPERIMENT NO: **DATE:**

AIM: To give a wiring for the tube light "Fluorescent Lamp".

MATERIALS REQUIRED:

1. 1/18''PVC wire of sufficient length 5-no
2. One-wayswitch-1
3. Starter-1
4. Choke-1
5. Fluorescent lamp
6. Holders with frame

TOOLS AND EQUIPMENT USED:

1. 6'' cutting pliers
2. 6''screwdrivers
3. ball-peen hammer
4. Hacksaw
5. Wire stripper
6. 12mm hand drilling machine
7. Tester

SEQUENCE OF OPERATION:

1. Fitting the wires
2. Connection of the fluorescent lamp
3. Connection to choke
4. Connection of switches
5. Circuit-connection
6. Power from mains
7. Operating the lamp

PROCEDURE:

1. 6''PVC wire pieces are taken and insulation is removed at the ends by using wire stripper.
2. A phase wire is connected to one point on the switch.
3. The other point of the switch is connected to Choke.
4. The other point of the Choke is connected to one point of the starter and the other point of l amp holder-1.
5. The other point of the lamp holder-1 is connected to one point of the Starter.
6. A neutral wire pieces taken and connected to one point of the lampholder-2.
7. The other point of the lamp holder-2 is connected to Remaining point of the Starter.

8. After checking proper circuit connections the power supply is given. Now the lamp is ready to glow.

SKETCH:

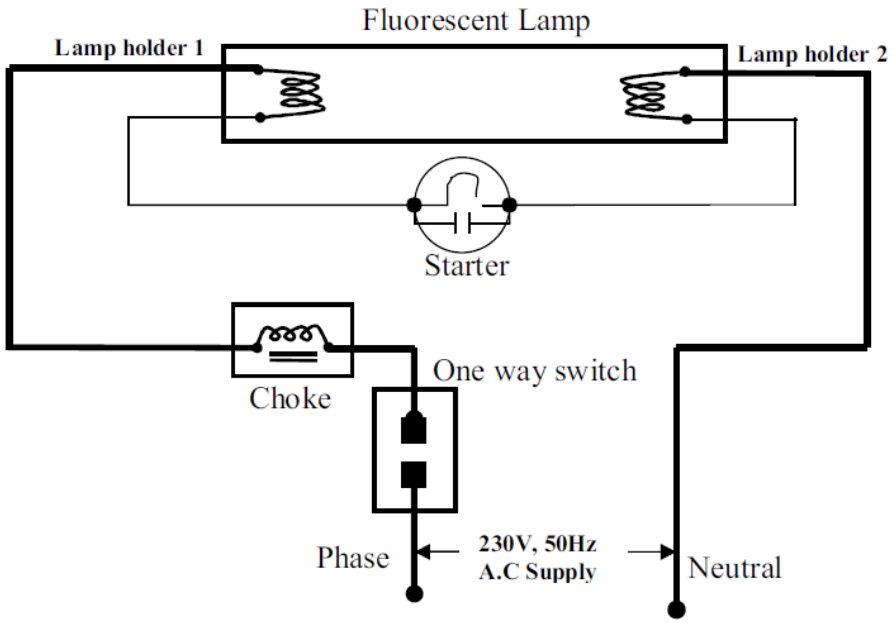


Fig: Circuit diagram for Fluorescent Lamp wiring

SAFETY PRECAUTIONS:

1. All wire connections to the switches and bulb holders should be tight.
2. Always red wire should be used for phase and black for neutral.
3. Switch should be connected in phase only.
4. The switches must be in off position before giving power supply

RESULT: Operating the fluorescent lamp is done.

Date: **Signature of the staff**

FOUNDRY

INTRODUCTION:

Foundry practice deals with the process of making casting in moulds, formed in either sand or other material. This is found to be the cheapest method of metal shaping. The process involves the operations of pattern making, sand preparation, molding, melting of metals, pouring in moulds, cooling, shake out, fettling, heat treatment, finishing, and inspection.

Mould is a cavity in a molding core, formed by a pattern. It is similar in shape and size that of the actual casting plus some allowance for shrinkage, machining etc., molding is the process of making molds.

Moulds are classified as:

- Temporary moulds
- Permanent moulds

Temporary mould are made of sand and other binding materials and may be produced either through hand molding (or) machine molding.

Permanent moulds are made of ferrous materials and alloys i.e., cast iron, steel etc.,

Molding Sand:

Sand is the principle material used in foundry. The principle ingredients of molding sands are 1) Silicon sand 2) Clay 3) Sand.

Clay imparts the necessary bonding strength to the molding sand, moisture when added to correct preparation provides the bonding action to the clay sand can withstand high temperature and doesn't react with molten metal.

Natural molding sand is either available in river beds are dug from pits. It possesses and appreciable amount of clay and are used as received with the addition of water. Synthetic sands are prepared by adding clay. Water and other materials to silica sand so that the desirable strength and banding properties are achieved.

Most of molding is done with green sand i.e.; sand containing 6 to 8%, moisture and 10% clay content to give it sufficient bond. Green sand moulds are used for pouring the molten metal – immediately after preparing the moulds. Green sand moulds are cheaper and take less time to prepare. These are used for small and medium size casting. Parting sand, which is clay tree, fence grained silica sand, is used to keep the green sand from sticking to the pattern and also to prevent the cope and drug from cleaning. Core sand is used for making cores. This is silica missed with core oil and other oddities.

Pattern:

A pattern is the replica of the desired coasting, which when packed in a suitable materials produces a cavity called mould. This cavity when filled with molten metal's, produces their desired coasting of the solidification.

Types of pattern:

Wood are metal patterns are used in foundry practice, single piece, split loose piece and cored patterns are some of the common types.

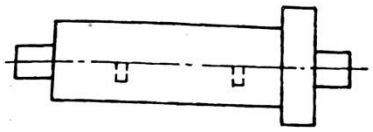


Fig. Split pattern

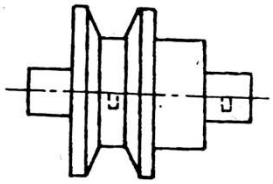


Fig. Split pattern

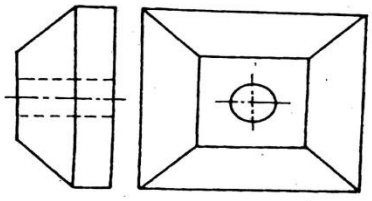


Fig. Single piece pattern

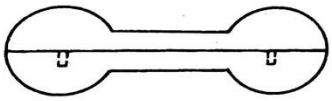


Fig. Split pattern

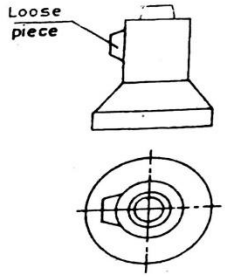


Fig. Loose piece pattern

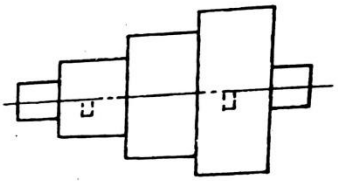


Fig. Split pattern

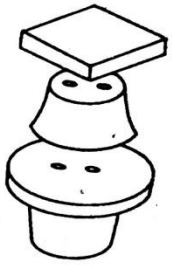


Fig. Multi-piece pattern

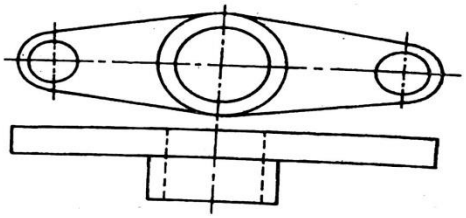


Fig. Single piece pattern

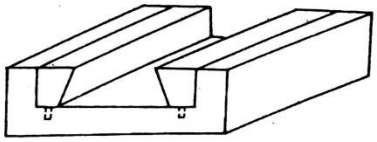


Fig. Loose piece pattern

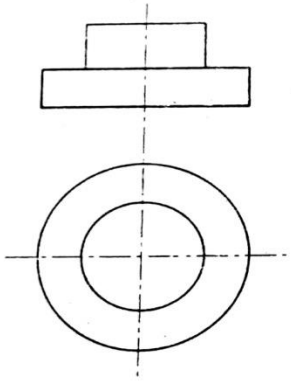


Fig. Solid flange

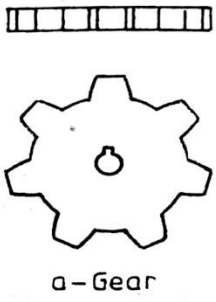


Fig. Gear

Tools and equipment

The tools are equipment needed for molding are

Molding board:

It is wooden board with smooth surfaces. It supports the flasks and the pattern, while the mould is being made.

Molding Flask:

It is a base, made of wood or metal, open at both ends. The sand is rammed in after placing the pattern to produce a mould it is made of 2 parts; cope is the top half of the flask, having guides for the aligning paints to enter. Drag is the bottom half of the flask having aligning pins.

Shovel:

It is used for mixing and tempering molding sand and for transferring the sand in to the flask. It is made of steel blade with a wooden handle.

Rammer:

It is used for pocking 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 in the early stages of ramming. The other end called the But – end has a surface and is used for computing the sand towards the end of molding.

Strike of edge / strike of bar:

It is a piece of metal or wood with straight edge. It is used remove the excess sand from the mould after ramming to provide a level surface.

Spruce pin:

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

Riser pin:

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

Trowel:

It is used to smoothen the surface of the mould. It may also be used for reproducing the damaged portion of the mould. A trowel is made in many different styles and sizes each one recallable for a particular hole.

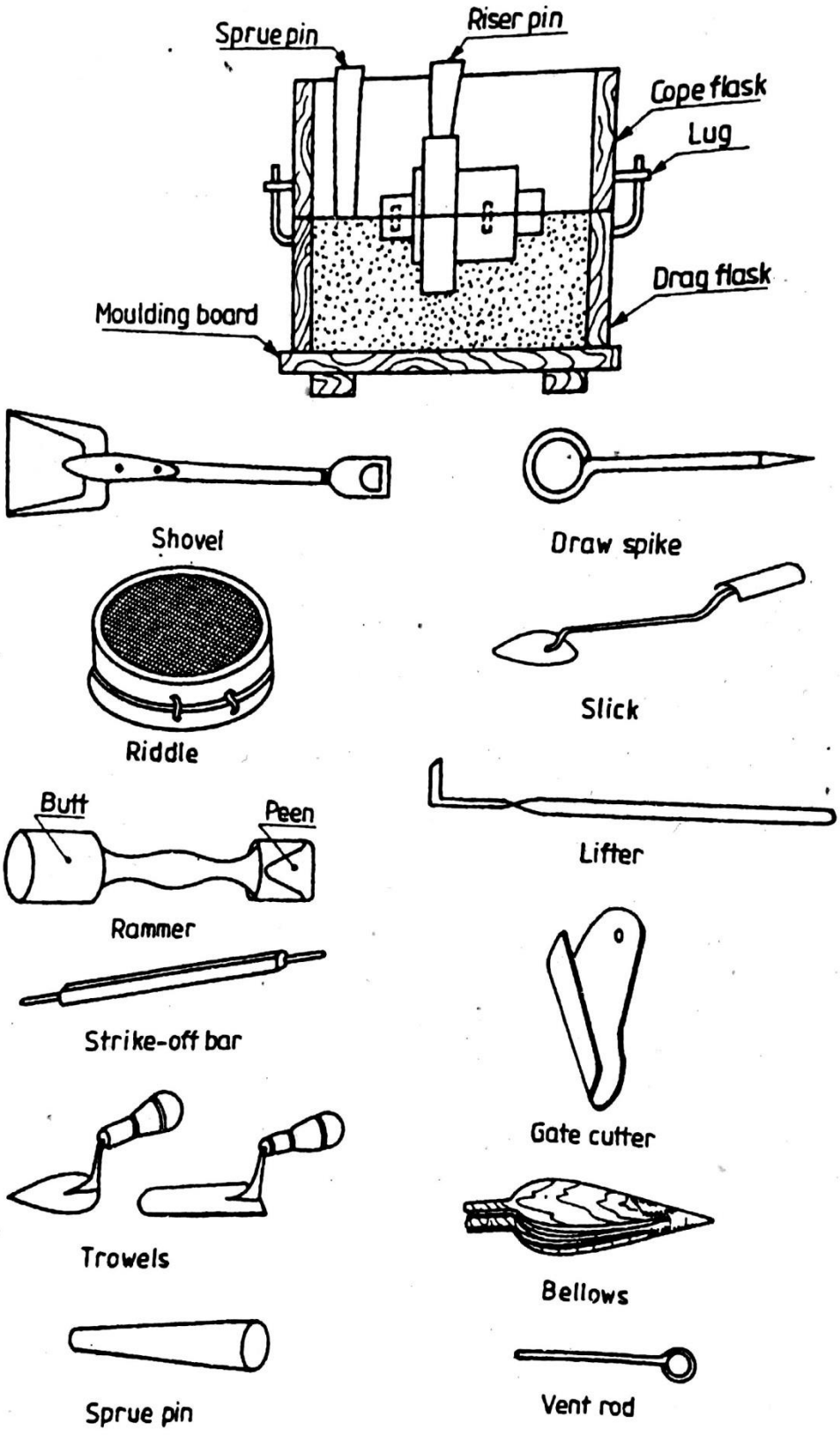


Fig. 7.3 Moulder's tools and equipment

FOUNDRY SECTION

CONNECTING ROD

EXPERIMENT NO: **DATE:**

AIM: To prepare the sand mould casting of a connecting rod.

MATERIAL REQUIRED:

1. Molding sand
2. Facing sand
3. Parting sand
4. Metal or wax.

TOOLS REQUIRED:

1. Molding boxes (cope and drag)
2. Pattern
3. Molding Board
4. Trowels
5. Shovels
6. Rammer
7. Strike off bar
8. Vent rod
9. Draw spike
10. Gate cutter
11. Lifter
12. Slick
13. Runner
14. Riser

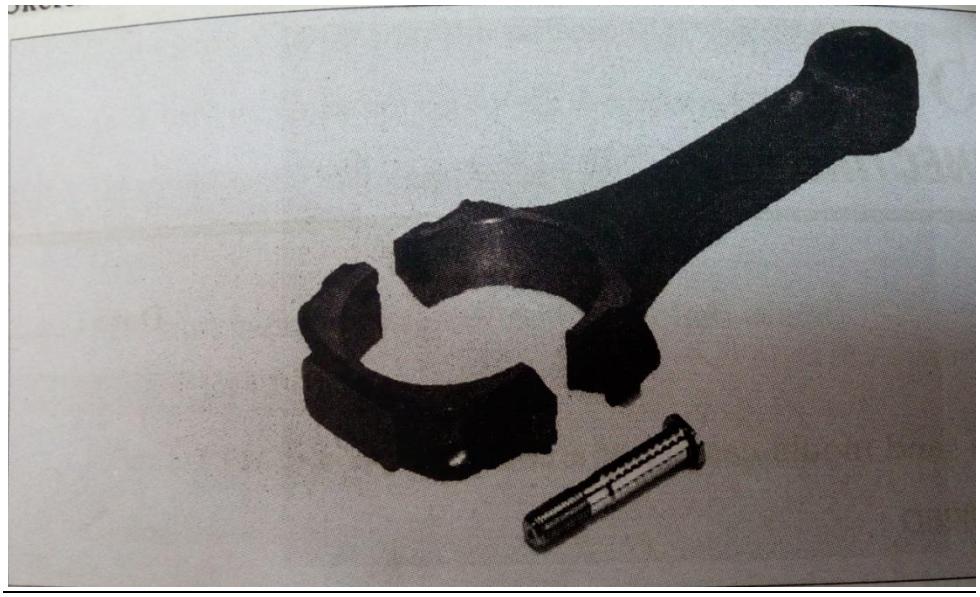


Fig: Connecting Rod

PROCEDURE:

1. Clean the surface of pattern and molding board.
2. Prepare the molding sand mix.
3. Place the drag box on the molding box and place the pattern inside the box in middle like flat face on the molding board.
4. Sprinkle facing sand and fill the molding sand ram properly.
5. Scrap the excess sand by strike-off bar, otherwise molding sand not filling completely after ramming knurl the surface of sand and fill the sand and ram it.
6. Turn the drag box upside down and finish the surface and also sprinkle the parting sand on the surface.
7. Place the cope box over the drag box.
8. Mark the lines on at each face indicate the numbers of avoiding mismatch.
9. Clamp the cope and drag box by clamping bolts or pins.
10. Keep the runner and riser in correct position.
11. Fill the cope box with molding sand and ram the sand properly.
12. Remove the excess sand and finish the surface.
13. Remove the runner and riser pins properly and cut the sprue.
14. Remove the cope box on drag box and place upside down on molding board.
15. Remove the pattern b draw spikes and cut the gates at required places.
16. Remove the sand and unwanted particles from the mould cavity by using lifter and bellows.
17. Place the molded cope box over the drag box in correct position without mismatch.
18. Take the molten metal or wax in crucible from the furnace and pour it into the cavity through runner passage in the cope box.
19. Check the filling status in riser passage and keep some time for solidification.
20. After solidification cut the runner , riser and gates. Take the required shape of the casting.

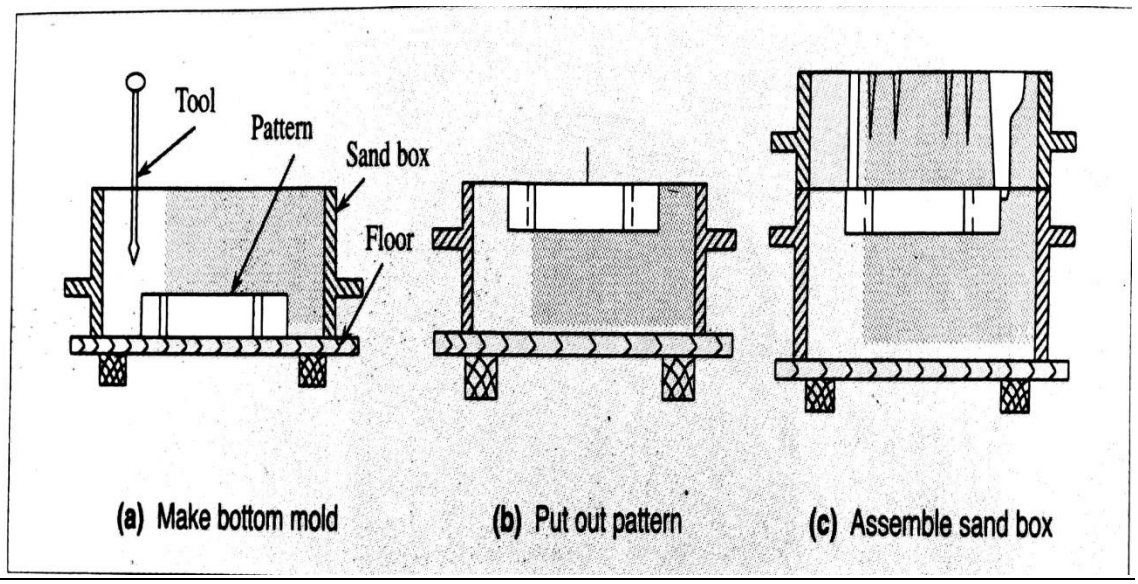


Fig: Mold cavity Process for Connecting rod

SAFETY PRECAUTIONS:

1. Do not get the sand too wet. Water is an enemy of molten metal's.
2. Provide adequate ventilation to remove smoke and fumes.
3. Never stand near or look over the mold during the pouring because of the molten metal might be too hot.
4. Do not shake out a casting too hastily, which may result in second and third degree burns.

RESULT: A sand mold cavity is prepared by using Connecting rod.

Date: **Signature of the staff**

STEPPED PULLEY

EXPERIMENT NO: **DATE:**

AIM: To prepare the sand mould casting of a Stepped pulley.

MATERIAL REQUIRED:

1. Molding sand
2. Facing sand
3. Parting sand
4. Metal or wax.

TOOLS REQUIRED:

1. Molding boxes (cope and drag)
2. Pattern
3. Molding Board
4. Trowels
5. Shovels
6. Rammer
7. Strike off bar
8. Vent rod
9. Draw spike
10. Gate cutter
11. Lifter
12. Slick
13. Runner
14. Riser

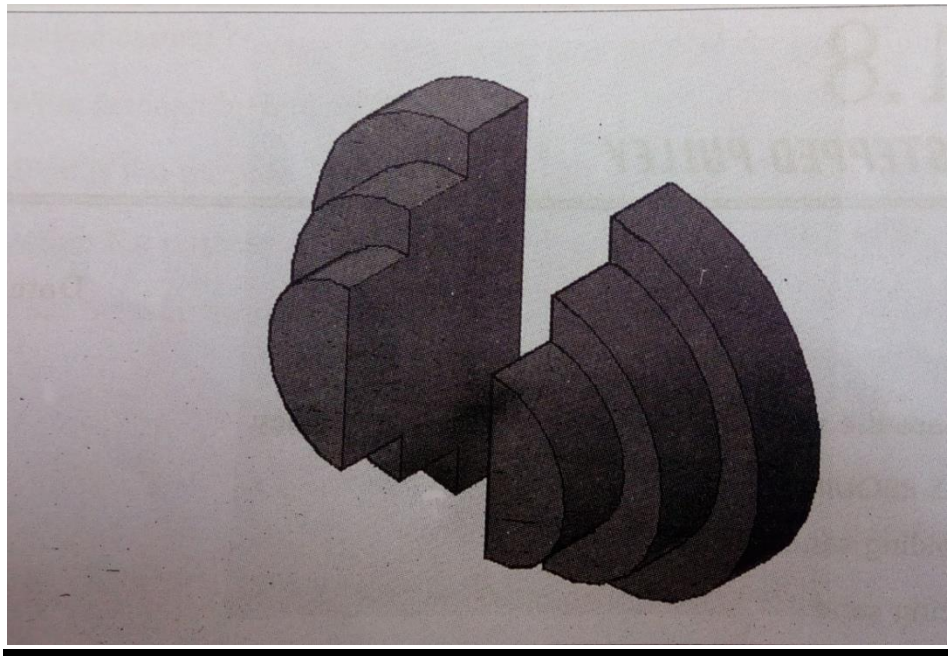


Fig: Stepped pulley

PROCEDURE:

1. Clean the surface of pattern and molding board.
2. Prepare the molding sand mix.
3. Place the drag box on the molding box and place the pattern inside the box in middle like flat face on the molding board.
4. Sprinkle facing sand and fill the molding sand ram properly.
5. Scrap the excess sand by strike-off bar, otherwise molding sand not filling completely after ramming knurl the surface of sand and fill the sand and ram it.
6. Turn the drag box upside down and finish the surface and also sprinkle the parting sand on the surface.
7. Place the cope box over the drag box.
8. Mark the lines on at each face indicate the numbers of avoiding mismatch.
9. Clamp the cope and drag box by clamping bolts or pins.
10. Keep the runner and riser in correct position.
11. Fill the cope box with molding sand and ram the sand properly.
12. Remove the excess sand and finish the surface.
13. Remove the runner and riser pins properly and cut the sprue.
14. Remove the cope box on drag box and place upside down on molding board.
15. Remove the pattern b draw spikes and cut the gates at required places.
16. Remove the sand and unwanted particles from the mould cavity by using lifter and bellows.
17. Place the molded cope box over the drag box in correct position without mismatch.
18. Take the molten metal or wax in crucible from the furnace and pour it into the cavity through runner passage in the cope box.
19. Check the filling status in riser passage and keep some time for solidification.
20. After solidification cut the runner , riser and gates. Take the required shape of the casting.

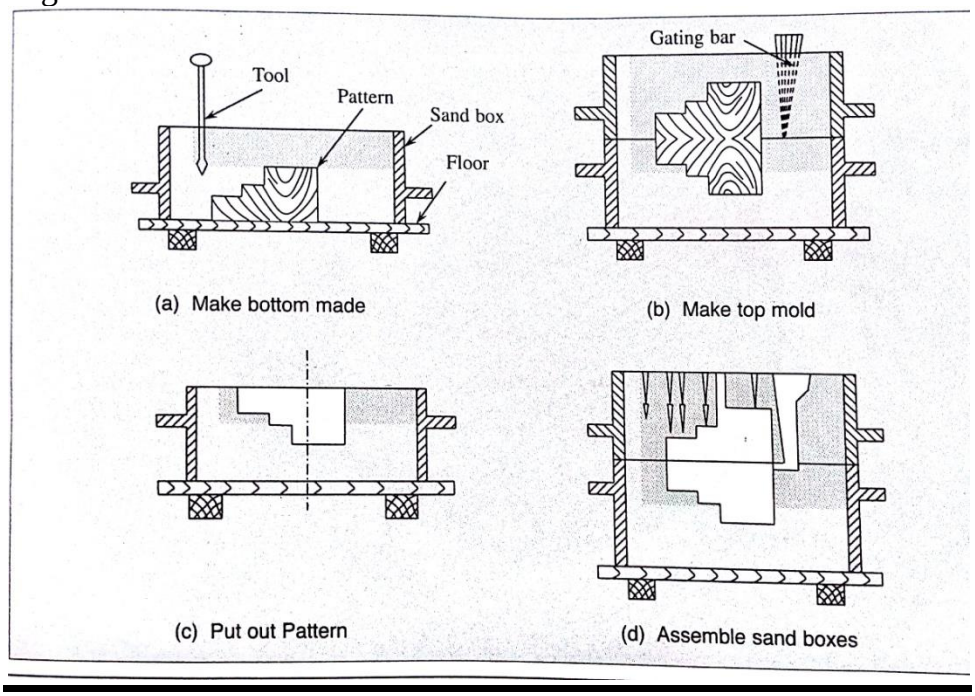


Fig: Mold cavity process for stepped pulley

SAFETY PRECAUTIONS:

1. Do not get the sand too wet. Water is an enemy of molten metal's.
2. Provide adequate ventilation to remove smoke and fumes.
3. Never stand near or look over the mold during the pouring because of the molten metal might be too hot.
4. Do not shake out a casting too hastily, which may result in second and third degree burns.

RESULT: A sand mold cavity is prepared by using Stepped pulley.

Date: **Signature of the staff**

WELDING

INTRODUCTION

Welding is the process of joining similar metals by the application of heat, with or without application of pressure or filler metal, in such a way that the joint is equivalent in composition and characteristics of the metals joined. In the beginning, welding was mainly used for repairing all kinds of worn or damaged parts. Now, it is extensively used in manufacturing industry, construction industry(construction of ships, tanks, locomotives and automobiles) and maintenance work, replacing riveting and bolting, to a greater extent.

The various welding processes are:

1. Electric arc welding,
2. Gas welding
3. Thermal welding
4. Electrical Resistance welding and
5. Friction welding

However, only electric arc welding process is discussed in the subject point of view.

Electric arc welding

Arc welding is the welding process, in which heat is generated by an electric arc struck between an electrode and the work piece. Electric arc is luminous electrical discharge between two electrodes through ionized gas.

Any arc welding method is based on an electric circuit consisting of the following parts:

a. Power supply (AC or DC);
b. Welding electrode;
c. Work piece;
d. Welding leads (electric cables) connecting the electrode and work piece to the power supply.

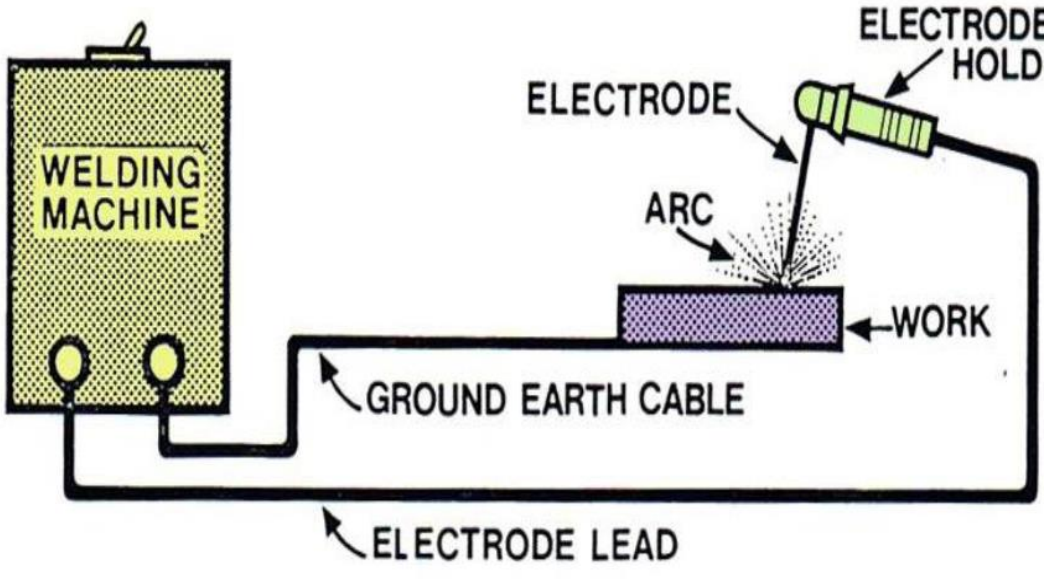


Fig:1 Arc welding set up

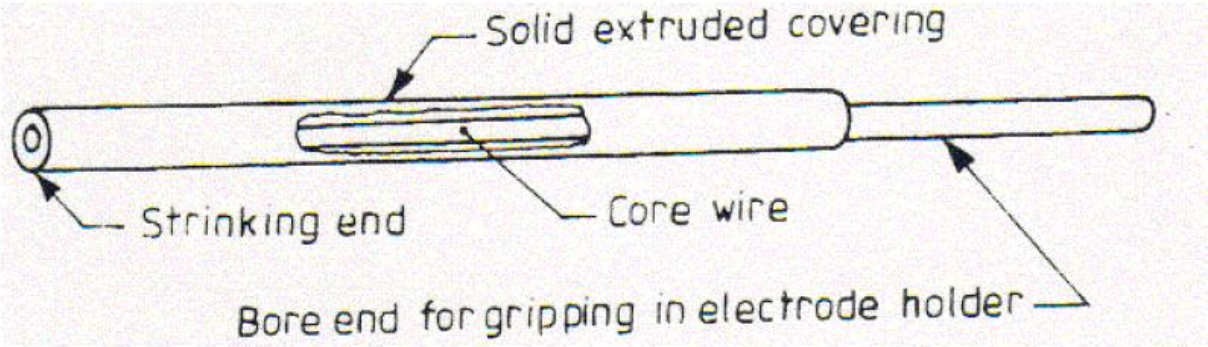


Fig :2 parts of an electrode

Electric arc between the electrode and work piece closes the electric circuit. The arc temperature may reach 10000°F (5500°C), which is sufficient for fusion the work piece edges and joining them. When a long joint is required the arc is moved along the joint line. The front edge of the weld pool melts the welded surfaces when the rear edge of the weld pool solidifies forming the joint.

Transformers, motor generators and rectifiers' sets are used as arc welding machines. These machines supply high electric currents at low voltage and an electrode is used to produce the necessary arc. The electrode serves as the filler rod and the arc melts the surface so that, the metals to be joined are actually fixed together.

Sizes of welding machines are rated according to their approximate amperage capacity at 60% duty cycle, such as 150,200,250,300,400,500 and 600 amperes. This amperage is the rated current output at the working terminal.

Transformers:

The transformers type of welding machine produces A.C current and is considered to be the least expensive. It takes power directly from power supply line and transforms it to the voltage required for welding. Transformers are available in single phase and three phases in the market.

Motor generators:

These are D.C generators sets, in which electric motor and alternator are mounted on the same shaft to produce D.C power as pert the requirement for welding. These are designed to produce D.C current in either straight or reversed polarity. The polarity selected for welding depends upon the kind of electrode used and the material to be welded.

Rectifiers:

These are essentially transformers, containing an electrical device which changes A.C into D.C by virtue of which the operator can use both types of power (A.C or D.C, but only one at a time).In addition to the welding machine, certain accessories are needed for carrying out the welding work.

Welding cables:

Two welding cables are required, one from machine to the electrode holder and the other, from the machine to the ground clamp. Flexible cables are usually preferred because of the case of using and coiling the cables. Cables are specified by their current carrying capacity, say 300 A, 400 A, etc.

Electrodes:

Filler rods are used in arc welding are called electrodes. These are made of metallic wire called core wire, having approximately the same composition as the metal to be welded. These are coated uniformly with a protective coating called flux. While fluxing an electrode; about 20mm of length is left at one end for holding it with the electrode holder. It helps in transmitting full current from electrode holder to the front end of the electrode coating. Flux acts as an insulator of electricity. In general, electrodes are classified into five main groups; mild steel, carbon steel, special alloy steel, cast iron and non-ferrous. The greatest range of arc welding is done with electrodes in the mild steel group. Various constituents like titanium oxide, potassium oxide, cellulose, iron or manganese, Ferro silicates, carbonates, gums, clays, asbestos, etc., are used as coatings on electrodes. While welding, the coating or flux vaporizes and provides a gaseous shield to prevent atmospheric attack. The size of electrode is measured and designated by the diameter of the core wire in SWG and length, apart from the brand and code names; indicating the purpose for which there are most suitable.

Electrodes may be classified on the basis of thickness of the coated flux. As

1. Dust coated or light coated
2. Semi or medium coated and
3. Heavily coated or shielded

Electrodes are also classified on the basis of materials, as

1. Metallic and
2. Non-metallic or carbon

Metallic arc electrodes are further sub-divided into

1. Ferrous metal arc electrode (mild steel, low/medium/high carbon steel, cast iron, stainless steel, etc)
2. Non-ferrous metal arc electrodes (copper, brass, bronze, aluminum, etc). In case of non-metallic arc electrodes, mainly carbon and graphite are used to make the electrodes.

Fig : Electrode holder

Fig : Ground Clamp

Fig : Wire brush

Fig : Chipping hammer

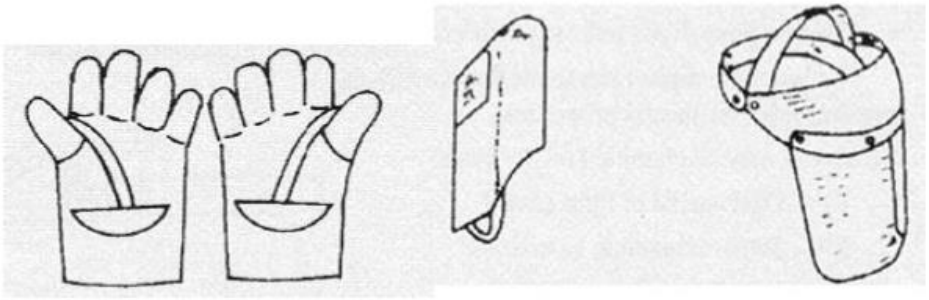


Fig : Hand gloves

Fig : Face shield

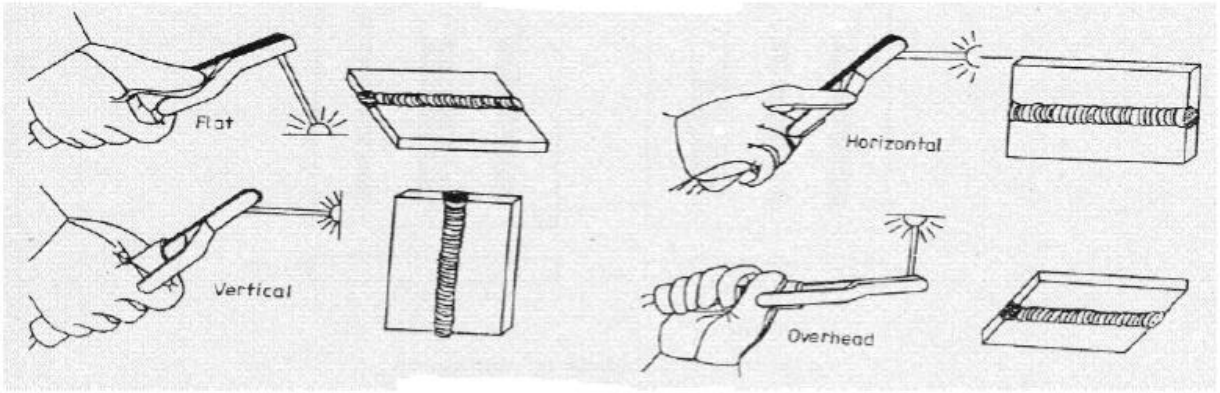


Fig : Weld positions

WELDING TOOLS

Electrode holder:

The electrode holder is connected to the end of the welding cable and holds the electrode. It should be light, strong and easy to handle and should not become hot while in operation. Figure shows one type of electrode holder. The jaws of the holder are insulated, offering protection from electric shock.

Ground clamp:

It is connected to the end of the ground cable and is clamped to the work or welding table to complete the electric circuit. It should be strong and durable and give a low resistance connection.

Wire brush and chipping hammer:

A wire brush is used for cleaning and preparing the work for welding. A chipping hammer is used for removing slag formation on welds. One end of the head is sharpened like a cold chisel and the other, to a blunt, round point. It is generally made of tool steel. Molten metal dispersed around the welding heads, in the form of small drops, is known as spatter. When a flux coated electrode is used in welding process, then a layer of flux material is formed over the welding bead which contains the impurities of weld material. This layer is known as slag. Removing the spatter and slag formed on and around the welding beads on the metal surface is known as chipping.

Welding table and cabin:

It is made of steel plate and pipes. It is used for positioning the parts to be welded properly. Welding cabin is made-up by any suitable thermal resistance material, which

can isolate the surrounding by the heat and light emitted during the welding process. A suitable draught should also be provided for exhausting the gas produced during welding.

Face shield:

A face shield is used to protect the eyes and face from the rays of the arc and from spatter or flying particles of hot metal. It is available either in hand or helmet type. The hand type is convenient to use wherever the work can be done with one hand. The helmet type though not comfortable to wear, leaves both hands free for the work. Shields are made of light weight non-reflecting fiber and fitted with dark glasses to filter out the Harmful rays of the arc. In some designs, a cover glass is fitted in front of the dark lens to protect it from spatter.

Hand gloves:

These are used to protect the hands from electric shocks and hot spatters.

WELDING POSITIONS

Depending upon the location of the welding joints, appropriate position of the electrode and hand movement is selected. The figure shows different welding positions.

Flat position welding

In this position, the welding is performed from the upper side of the joint, and the face of the weld is approximately horizontal. Flat welding is the preferred term; however, the same position is sometimes called down hand.

Horizontal position welding

In this position, welding is performed on the upper side of an approximately horizontal surface and against an approximately vertical surface.

Vertical position welding

In this position, the axis of the weld is approximately vertical as shown in figure.

Overhead position welding

In this welding position, the welding is performed from the underside of a joint

PREPARATION OF WORK: Before welding, the work pieces must be thoroughly cleaned of rust, scale and other foreign material. The piece for metal generally welded without beveling the edges, however, thick work piece should be beveled or feed out to ensure adequate penetration and fusion of all parts of the weld. But, in either case, the parts to be welded must be separated slightly to allow better penetration of the weld. Before commencing the welding process, the following must be considered

a. Ensure that the welding cables are connected to proper power source.
b. Set the electrode, as per the thickness of the plate to be welded.
c. Set the welding current, as per the size of the electrode to be used.

WELDING SECTION

Tee-JOINT

EXPERIMENT NO: **DATE:**

AIM: To make a Tee-Joint, using the given Mild steel pieces and by arc welding.

MATERIAL USED: Two Mild steel pieces of 100X40X6 mm

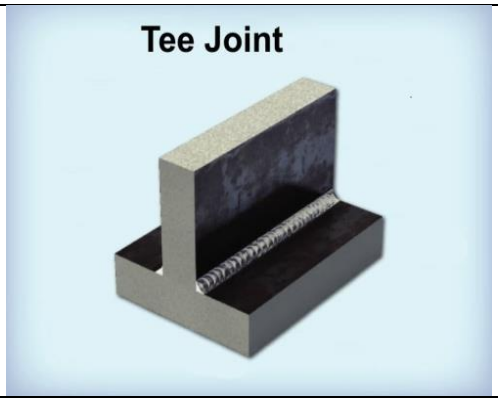
.

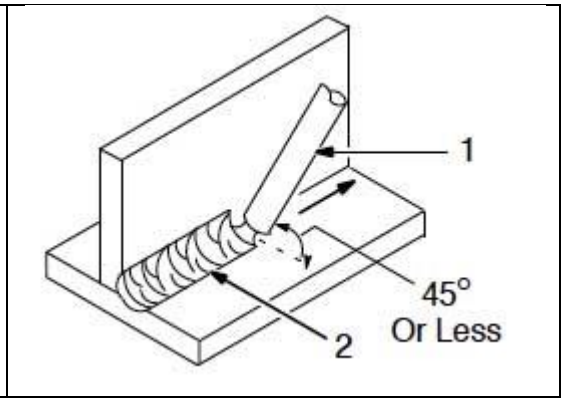
TOOLS AND EQUIPMENT:

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

SEQUENCE OF OPERATION:

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





PROCEDURE:

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

PRECAUTIONS:

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

RESULT The Tee-joint is thus made, using the tools and equipment as mentioned above.

Date: **Signature of the staff**

H-JOINT

EXPERIMENT NO: **DATE:**

AIM: To make a H-Joint, using the given Mild steel pieces and by arc welding.

MATERIAL USED: Three Mild steel pieces of 100X40X6 mm

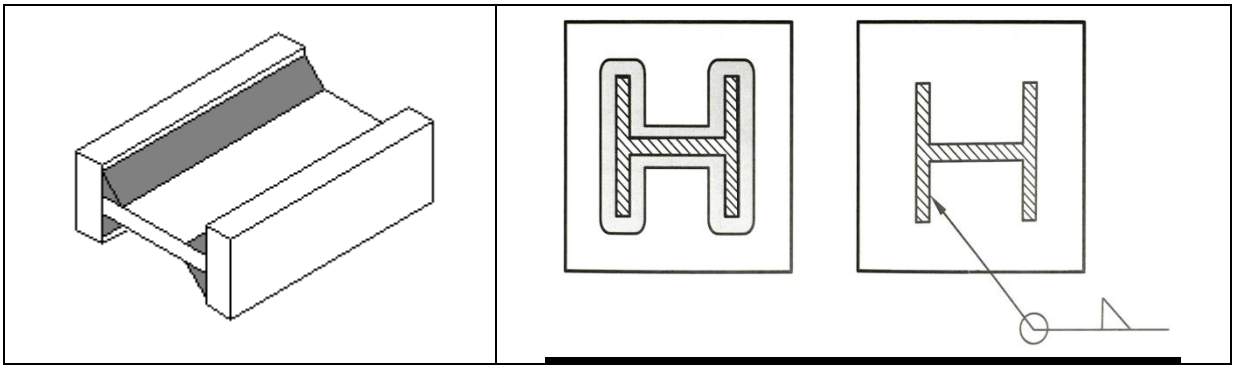
.

TOOLS AND EQUIPMENT:

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

SEQUENCE OF OPERATION:

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



PROCEDURE:

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

PRECAUTIONS:

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

RESULT The H-joint is thus made, using the tools and equipment as mentioned above.

Date: **Signature of the staff**

PLUMBING

Plumbing is a skilled trade of working with pipes or tubes and plumbing fixtures. The process is mainly used for the supply of drinking water and the drainage of waste water, sometimes mixed with waste floating materials in a living or working place. A plumber is someone who installs or repairs piping systems, plumbing fixtures and equipment such as valves, washbasins, water heaters, water closests, etc. Thus it usually refers to a system of pipes and fixtures installed in a building for the distribution of water and the removal of waterborne wastes.

The latin word plumbum, means metal lead pipe, is the origin for developing the term plumbing. Plumbing process was originated during the ancient civilizations such as the greek, Roman, Persian, Indian and Chinese civilizations as they developed public baths and needed to provide potable water, and drainage of wastes carried by water.

PIPES AND THEIR JOINTS:

Pipes are manufactured by using different types of materials like steel, cast iron, galvanized iron, brass, copper, aluminum, lead, plastic, concrete, asbestos, etc. They are usually classified according to the material. They are also grouped as cast, welded, seamless, extruded, etc. For conveying large quantity of water, cast iron, steel or concrete pipes having large diameter are usually used. Galvanized iron pipes (GI pipes) are popular for medium and low pressure water supply lines.

Plastic pipes are preferred for household uses at low pressure. Pipes are generally specified by their inner diameter (Nominal diameter specified in inches). Hence, the pipe fitting size is also based on this dimension. But for plastic pipes, this rule is not strictly followed because threading is not usually required for them. For engineering uses, along with the nominal diameter, the pipe thickness is also specified as light, medium or heavy.

TYPES OF PIPE JOINTS:

According to the pipe material, size and application, different methods are used to join pipes. The most common types of pipe joints are:

1. Screwed pipe joint – For GI Pipes
2. Welded pipe joint – for steel, copper, aluminum and lead pipes
3. Flanged pipe joint – for cast iron and steel pipes
4. Soldered pipe joint – for brass and copper tubes
5. Glued or cemented pipe joint – for PVC pipes

Pipes made of iron (GI Pipes) and brass of small and medium diameters (10 mm to 100 mm) are usually joined by screwing the pipe specials with internal or external threads. Welding is used to make permanent joint of medium and large diameter steel pipes. Flanged pipe joints are common in medium and large diameter pipes of cast iron and steel, along with rubber/CAF (Compressed asbestos fibre) gaskets. The flanged are screwed to the pipe for smaller diameter but made integral for large diameters. Pipes of copper and brass are usually joined by soldering.

PVC (poly Vinyl Chloride) pipe is the most popular choice in plastic group. It is rigid and uses thread and solvent weld (glue) connections. It also can be heat fused. PVC pipes are available in various pressure ratings for water supply, and is a very choice for

landscape irrigation. The reasons for the popularity are the economy, no corrosion and easiness to work. CPVC is a different type of plastic, which has an extra chlorine atom in the compound, can be used for the hot water supply, and in industry.

To join plastic pipes, gluing or cementing method is used. Solvent cement is the gluing material and it partially melts the surface of the plastic pipe to make the joint. As the glue evaporates within two minutes, a strong joint is obtained.

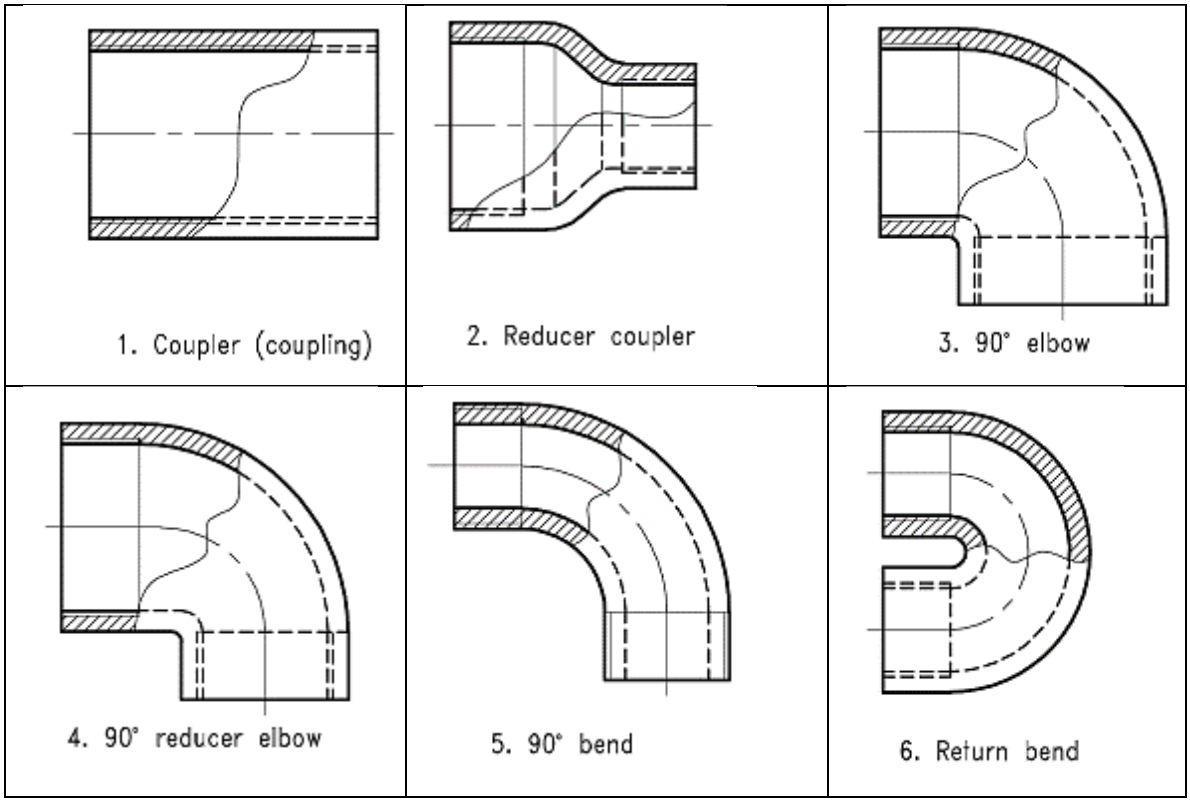
Screwed pipe fittings, (pipe specials) are removable or temporary pipe connections which permit necessary dismantling or reassembly for the purpose of installation, maintenance, cleaning, repair, etc. The functions of pipe fittings can be broadly classified as:

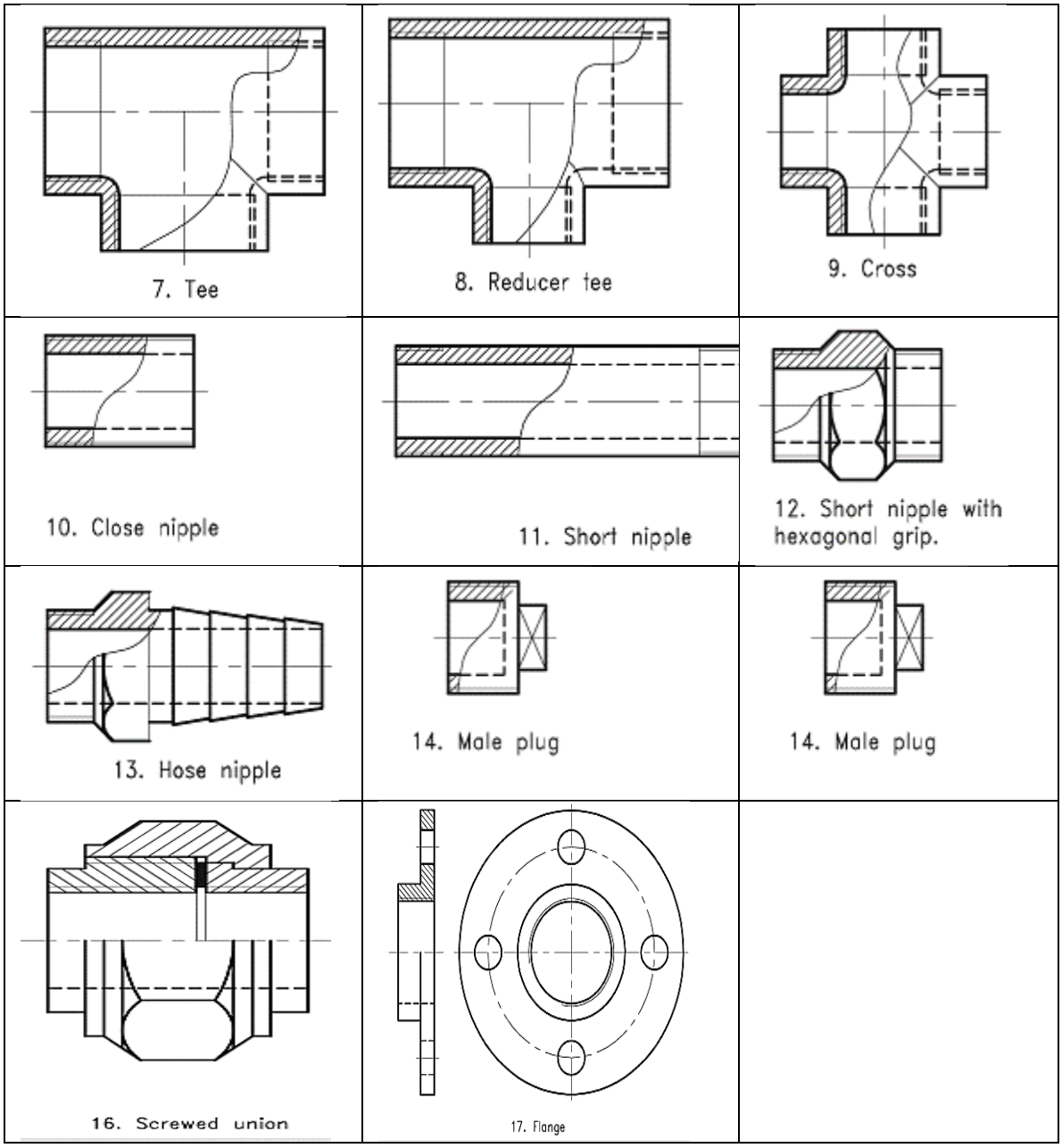
1. To join two or more pipe lines together
2. To effect change in diameter or direction
3. To close the end of a pipe line

The most common types of screwed pipe fittings used in galvanized iron (GI) pipe lines and plastic (PVC) pipe lines are shown in Figure 1 (I to 17). A brief description of these fittings is given below

1. **Coupler (coupling):** Two pipe lines of equal diameter and in axial alignment can be joined by a coupler (coupling). It is a short sleeve with internal thread.
2. **Reducer coupler (Reducer coupling):** This is a coupler to join two pipe lines of different diameters in axial alignment.
3. **90^0 Elbow:** This is a pipe special used or effecting abrupt change in direction through 90°. Internal threads are provided on both ends. An elbow brings twice the head loss than a bend.
4. **90^0 Reducer elbow:** This is an elbow with outlet diameter less than that of inlet diameter It is used to join two pipe lines having different diameters and meeting at right angle.
5. **Bend:** This is a pipe special used to effect gradual change in direction (usually 90°).The two ends of the bend are externally threaded.
6. **Return hand:** This bend is used to return the direction of pipe line through 180°.The ends are internally threaded for fitting the pipe lines.
7. **Tee:** This pipe special is used to make a branch connection of same diameter to the main pipe line at right angle. A Tee is internally threaded and it connects three ends of pipes.
8. **Reducer Tee:** This is a pipe special similar to Tee used to take a branch connection of reduced diameter from the main pipe line.
9. **Cross:** This pipe special is used to take two branch connections at right angles to the main pipe line. The threads are provided internally,
10. **Close nipple:** A nipple is a short straight piece of pipe with external thread on both ends. A close nipple is the shortest one of this category with external thread for the full length. They are used to join two internally threaded pipe specials and valves.
11. **Short nipple**: A short nipple has the same shape and function of a close nipple, but it has a short unthreaded portion at the middle of its length for gripping.

12. **Short nipple with hexagonal grip:** This nipple has an additional hexagonal nut shape at the middle portion for easy screwing with spanner. It is similar to an ordinary short nipple, except that difference.
13. **Hose nipple:** A hose nipple is used to connect a hose (flexible pipe-usually plastic or rubber) to a pipe line. One end of the hose-nipple has a stepped taper to fit the hose, while other end has thread. A hexagonal nut shape is given to the middle portion for gripping with a spanner.
14. **Male plug:** A male plug is used to close an internally threaded end of a pipe line or pipe special. It has external thread and a grip of square shape at the end.
15. **Female plug (cap):** A female plug is used to close and externally thread end of a pipe or pipe special. It has internal thread and a grip of square shape at the end.
16. **Screwed union:** II consists of three pieces as shown in the drawing. The two end pieces have internal threads at their ends which are connected to the pipe ends. The central hexagonal (or octagonal) piece (union nut) has internal thread at one end and a collar at the other end. After the end pieces are screwed on to the pipes, the central piece (union nut) is tightened to draw the end pieces together to get a water tight joint.
17. **Flange:** This is a disc type pipe special having threaded hole at the centre for screwing to the externally threaded end of a pipe line. It will have holes around the central hole at equal angular spacing (3, 4, 6f or 8 Nos.) for joining to another similar flange or flat surface using bolt or stud. Example for the use of various pipe fittings in pipe line is given in Figure.





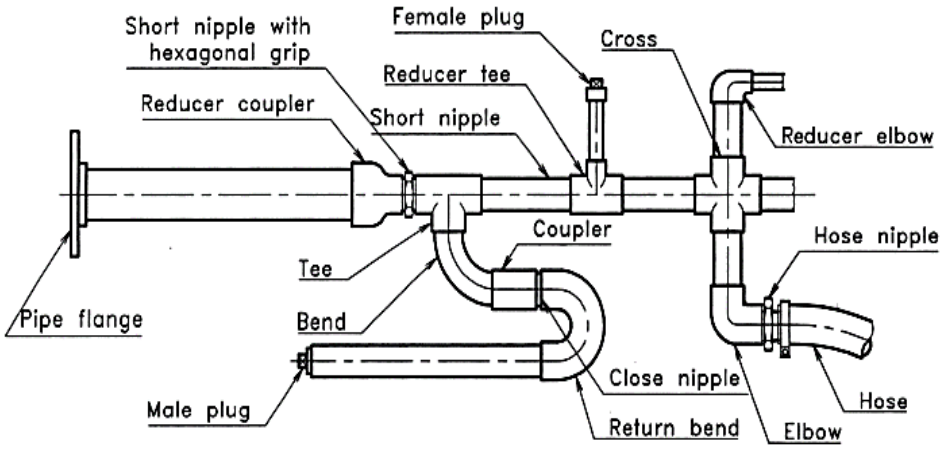


Fig: Various pipe joints and its Application

VALVES AND METERS :

Valves are used in piping systems to control or stop the flow of liquid or gas. The most common types of valves used in low pressure water pipe line are:

1. Water tap
2. Water cock
3. Globe valve
4. Gate valve
5. Ball valve
6. Non-return valve
7. Foot valve

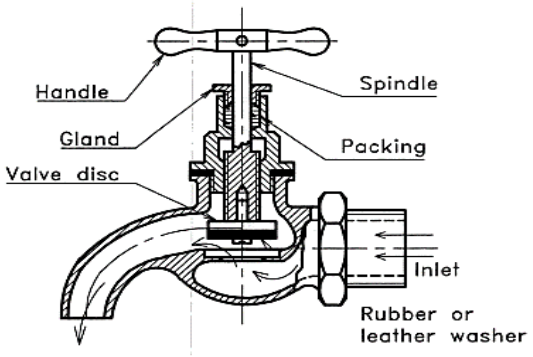


Fig: Water Tap

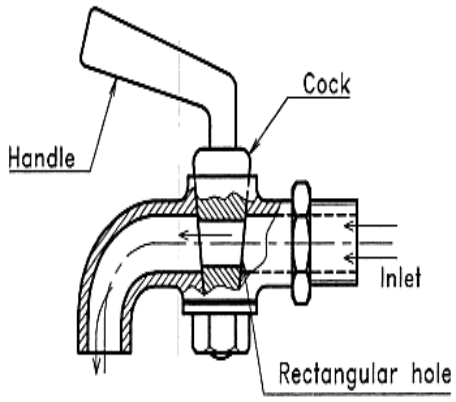


Fig: Water Cock

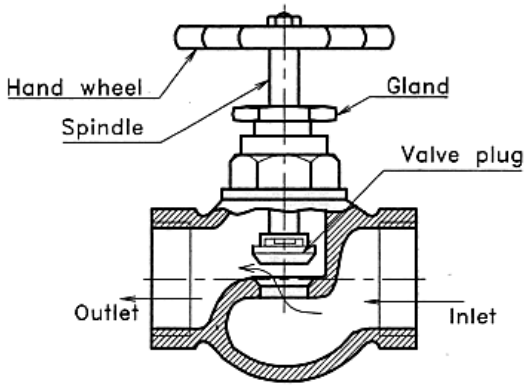


Fig: Gate Valve

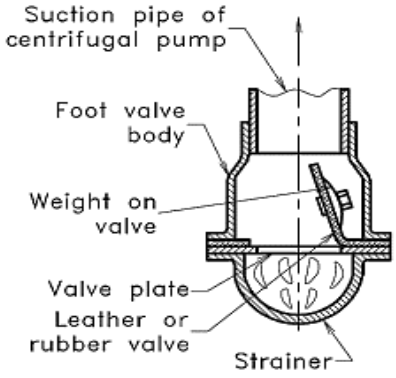


Fig: Foot valve

Water tap:

To collect water from low pressure pipe line, water tap (screw-down valve) is commonly used. Figure gives the cross section of the tap. Its leather or rubber faced valve disc is lifted or lowered by rotating the spindle. Brass or gun-metal is the material used for the valve body and the size is specified by the pipe to which it is fitted, usually ranging from 10 mm to 25 mm.

Water cock :

This is the simplest and smallest form of a valve in which a conical plug called cock is inserted into a conical hole having a matching taper. A rectangular hole is provided at the centre across the conical potion so that, in one position it permits flow of water as shown in Figure. A half turn of the handle will bring the solid portion of the cock to the water ways preventing the flow. Cocks are used for low rate of water flow' or for tapping pressure line to a manometer etc.

Globe valve:

Globe valves are used as control valves in fluid (gas and liquid) pipe lines. Figure shows the simplest and smallest type of globe valve used in water pipe lines. Basically, the valve is a variable opening flow device. The design of a globe valve also creates a slight retardation to the flow because the fluid is forced to make a double turn and passes through the opening at 90° to the axis of the pipe. The valve plug is raised or lowered to stop or regulate the flow through a circular opening. A globe valve can be identified by the spherical body and the arrow mark for the direction of flow. These valves are used in water pipe lines from 12 mm to 100 mm or even larger diameter for the flow control purpose.

Gate valve:

A gate valve is on-off type valve. It allows a straight-line movement of fluid and offer very little resistance to the flow in fully opened position. The central disc moves completely out of the passage and leaves a full opening. Figure shows a simple type of gate valve partially opened in position. These valves are very widely used in water pipe lines of diameter ranging from 12 mm to higher values. A gate valve can be identified by its slim body. It is to be noted that there will be no arrow mark or the body of valve because it can be used in both ways

Foot valve:

Foot valve is a kind of non-return valve used in centrifugal pumps. It is fitted at the bottom most end of the suction pipe (Foot) to stop flow in the downward direction for priming purpose. The strainer restricts the entry of floating materials to the pipe line. Figure gives the details of the foot valve. The material used may be cast iron, brass, or PVC.

MACHINE SHOP

INTRODUCTION

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

principal parts of a Lathe

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

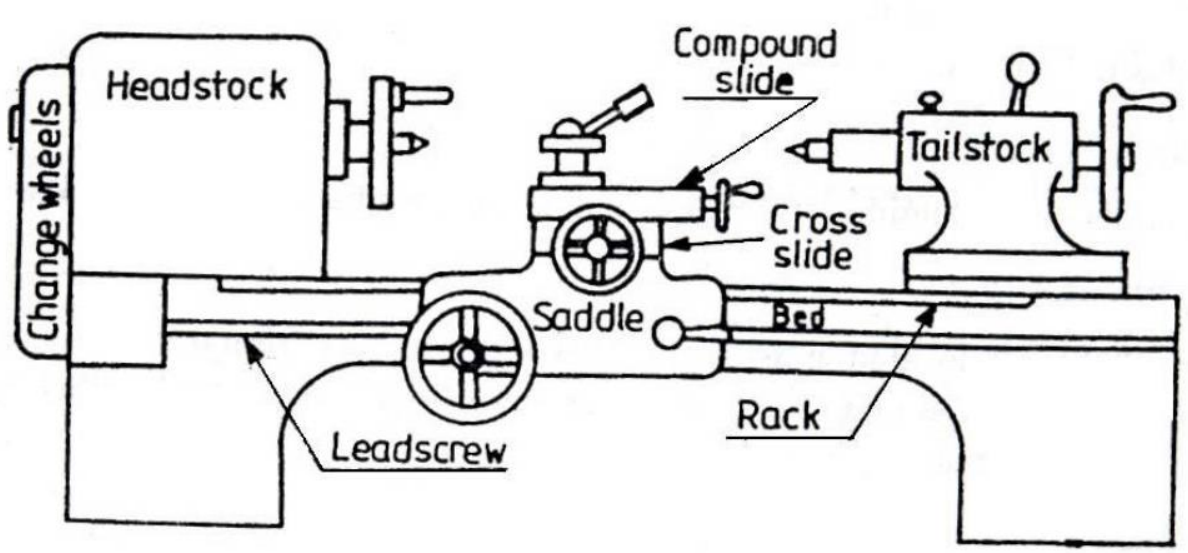


Fig : Parts of a center Lathe

Bed

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

Head stock

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

Tail stock

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

Carriage or Saddle

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

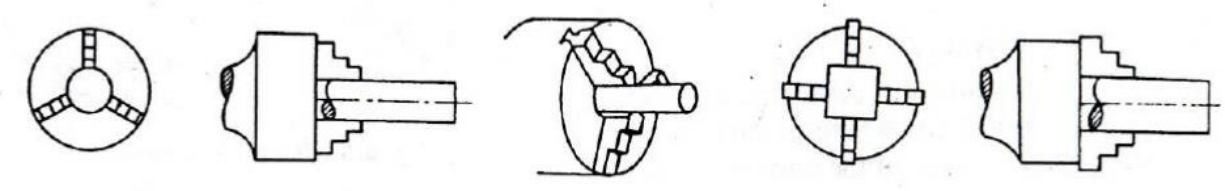


Fig : three jaw and four jaw chuck

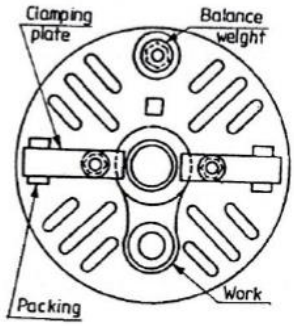


Fig:face plate

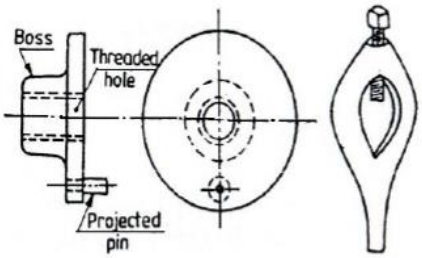


Fig :lathe dog and driving plate

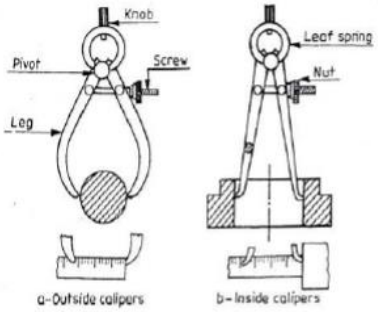


Fig: calipers

Compound Rest

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

Tool Post

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

Lead Screw

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

Centers

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

WORK-HOLDING DEVICES

Three jaw chuck

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

Face plate

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

Lathe dogs and driving plate

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

MEASURING INSTRUMENTS

1. Outside and inside Calipers

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

2. Venire Calipers

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

3. Micrometers

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

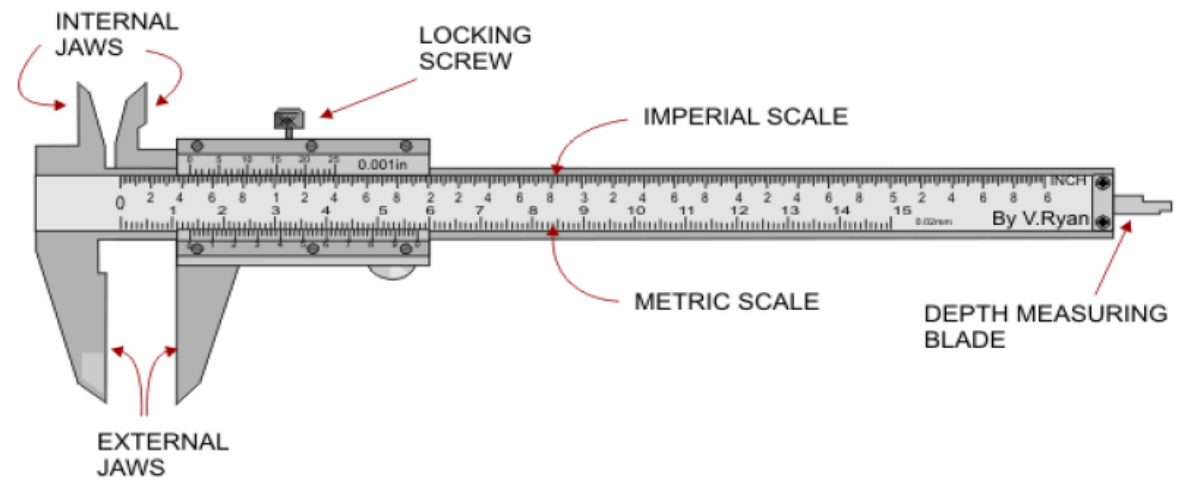


Fig: varnier caliper

CUTTING PARAMETERS

1. Cutting speed

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

Spindle speed (RPM) = cutting speed x 1000 / (πD)

Where D is the work piece diameter in mm.

2. Feed

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

3. Depth of Cut

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

TOOL MATERIALS

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

LATHE OPERATIONS

1. Turning

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

2.Boring

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

3.Facing

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

4.Taper Turning

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

5.Drilling

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

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

7.Chamfering

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

8.Threading

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

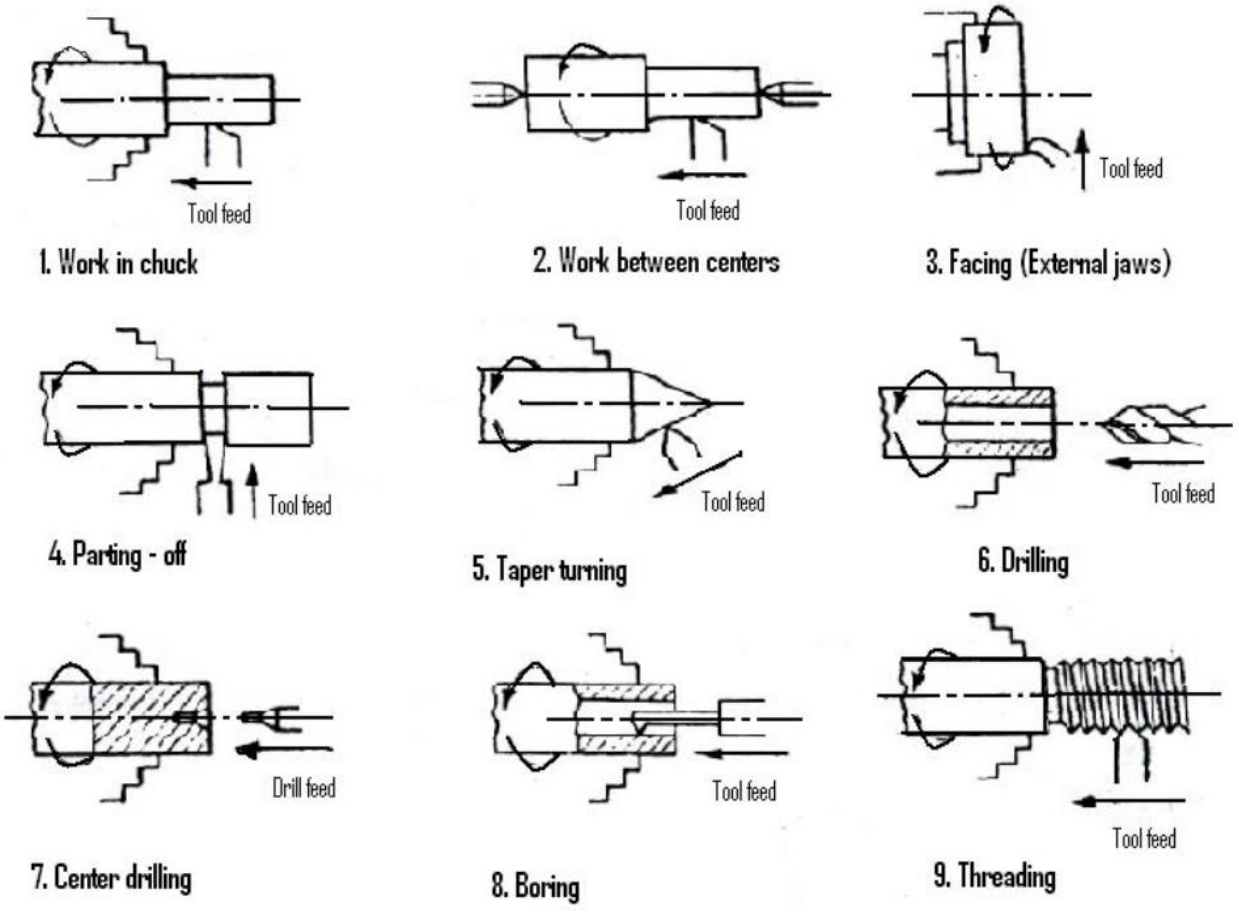


Fig: operations on lathe

Metal cutting (water plasma)

INTRODUCTION

Plasma may be defined as charged particles which are close together so that, each particle influences many charged particles, rather than just interacting with the nearby particles. Plasma is typically an ionized gas and it is considered to be distinct state of matter, because of its unique properties. It is a fourth state of matter. The term "ionized" refers to the presence of one or more free electrons, which are not bound to an atom or molecule. The free electric charges make the plasma electrically conductive so that it responds strongly to electro – magnetic fields. Plasma is formed by heating and ionizing a gas, stripping electrons away from atoms; there by enabling the +ve and –ve charges to move freely. The ionized gas containing balanced charges of ions and electrons is called plasma.

For plasma to exist, ionization is necessary. Plasma density refers to the electron density that is the number of free electrons per unit volume. The degree of ionization of plasma is the proportion of atoms which have lost electrons and is controlled mostly by the temperature. Even a partially ionized gas in which as little as 1%of the partials are ionized, can have characteristic of plasma. Plasma temperature is commonly measured in kelvin or electron volts and is a measure of thermal kinetic energy per particle. Plasma is sometimes referred to as being hot if it is nearly fully ionized or cold if only a small fraction of the gas molecules are ionized.

Water plasma

Palma in a water vapor can be made at different temperatures, depending upon the pressure of the water vapor. In water plasma, the free electrons, water vapor and +ve ions like OH+, O+ , and H+ are present. To ionize water, the electrons should have energy of 12 electron volts. If it is to be achieved thermally; the water has to be heated to a temperature of 120000 k. so it is difficult to make water plasma purely thermally. By applying a voltage across the space in water vapor, we can initiate water plasma at a pressure of 1 torr of water vapour.

The new technical devices for heat energy as well as energy containing gases from water will be the future industrial power installations. The use of water as a source of energy will solve many environmental problems in the planet.

Applications of water plasma:

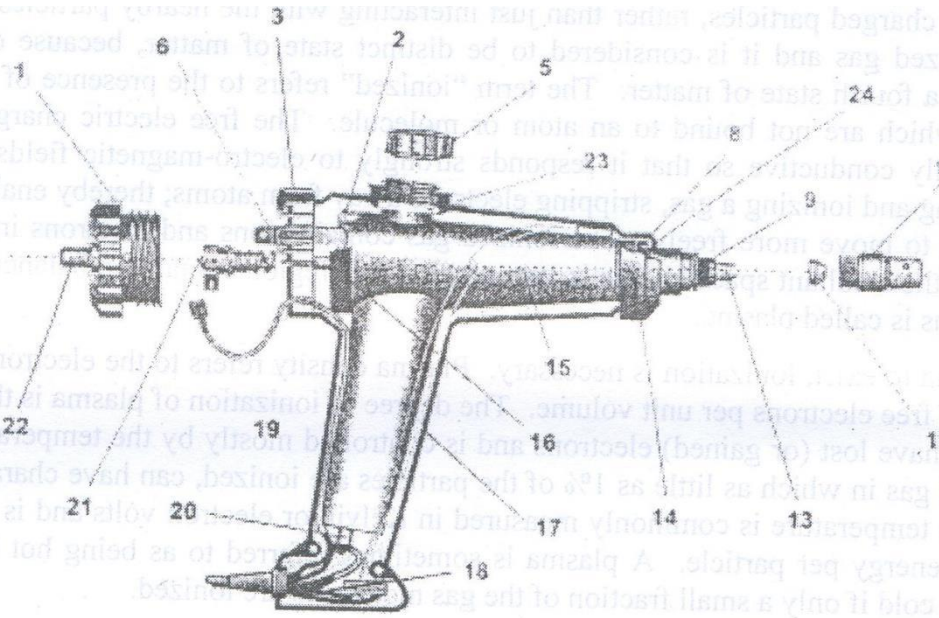
Water plasma is a multi – functional, portable, and hand – held device. It is a technological breakthrough in the area of metal cutting, welding, soldering, tempering, spraying, etc., as maximum efficiency is achieved when plasma technique is used.

Usage of water plasma tool for welding in gas mode is similar to the regular gas welding process. The difference is that electric power and water are used instead of gas tanks to procedure a high temperature jet flame. Filler rod and fluxes used for water plasma welding are the same with used for conventional welding. For carrying out welding in plasma arc model, it is necessary to take into account, an increased level of heat flow, capable of heating the metal up to its whole depth. The high production rate and quality of plasma jet precision cutting, supersedes

such as gas oxygen cutting and it is a more sophisticated method of welding when used for welding. Water plasma can also use for heating of 0.5 to 10 mm thick metal.

Construction of plasma torch:

A plasma torch with the main parts indicated and which is in the form of a handgun. It is connected to the power supply unit via the power cable. The power unit is connected to the conventional electric system (220v, AC, 50Hz) through a grounded power outlet. Majority of the main parts of the plasma torch are located inside the plasma body 17 which is in two halves, fitted together. The metal tank 15 is filled with liquid absorbing material. Sliding cathode assembly 21 connected to the negative terminal of power source through the contact plate 19, consists of cathode holder with replaceable cathode, 13, screwed into its front part. Nozzle anode 11, connected to the metal tank15 by means of spout 10, is powered by positive voltage from power supply (terminal 20). Nozzle and 11 and cathode 13 form a discharge chamber, where the stream of working fluid heats up to the plasma generation temperature due to the energy of electric arc.

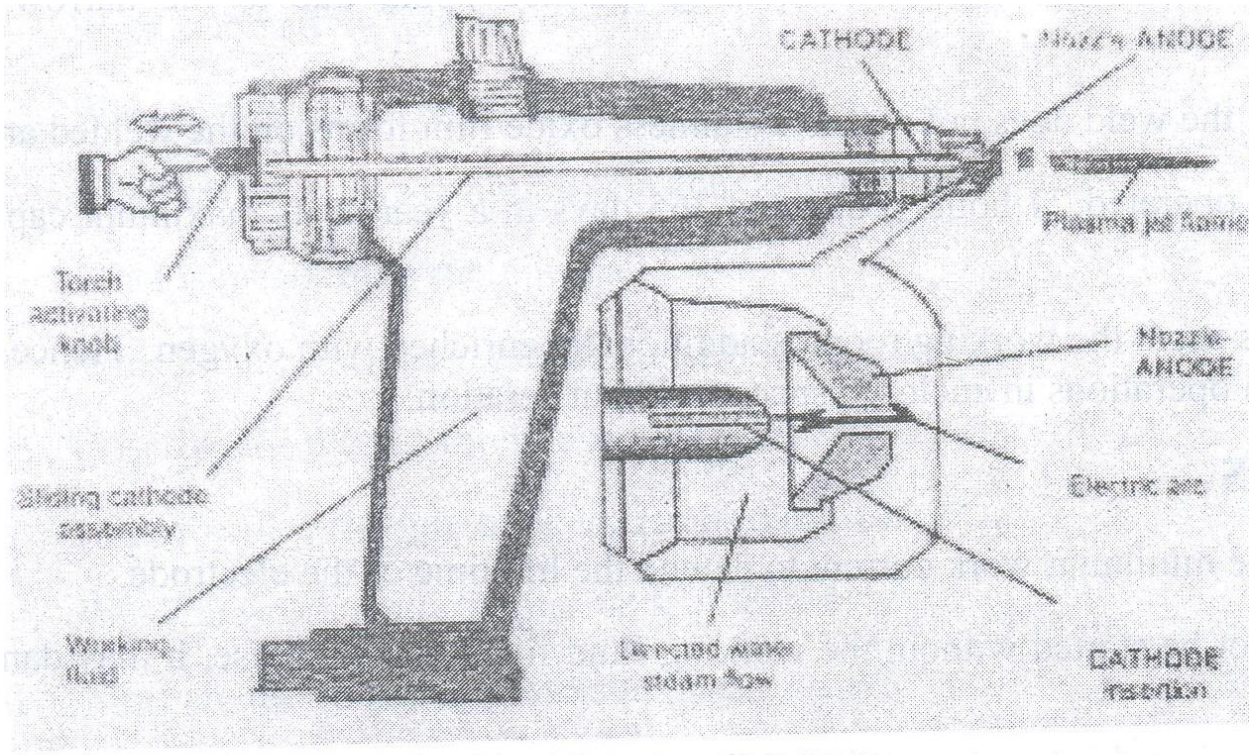


Plasma torch

1. Cathode adjusting cap
2. Sealing bush
3. Ring
5. Filling plug
6. Adjusting cap limiting device
8. Overheat sensor
9. Evaporator
10. Spout
11. Nozzle-ANODE
13. CATHODE
14. Torch body tightening nut
15. Metal tank
16. Tank gasket
17. Plastic body
18. Connecting cable
19. MINUS power supply terminal
20. PLUS power supply terminal
21. Cathode module
22. Torch activating knob
23. Packing ring
24. Thermocontractable ring

Principle of operation of plasma tool:

The principle of plasma tool operation. Brief pressing of the torch activating knob activates the torch already filled with working fluid. When the knob is pressed, movable cathode module slides forward and touches the nozzle anode; and completes the anode cathode short circuit. After releasing the knob, the cathode module moves back by means of the return spring and an electric arc occurs between the cathode tip and nozzle – anode.



Plasma tool operation

The thermal energy of electric arc heats the water and it evaporates. The resulting pressure force the stream to run to the operating of the nozzle – anode. While passing through the electric arc area, the stream "terms" the arc from the internal surface of the nozzle "pulls" it out and connects to the outer side of the outer edge of the nozzle – anode. The steam surrounds the arc inside the fine bored nozzle, opening and centers it; thus not allowing the arc to close onto the side walls of the opening.

While passing through the electric arc, part of the stream turns into the fourth state of matter – plasma with the temperature up to 80000c, by means of while cutting, welding, soldering, and heat treatment of non – consumable material is performed. Water plasma device is also highly efficient for pipe line heating and central heating systems, power supply systems, assembly, plumbing, repairs of refrigerators, air conditioners, and ventilation system. The device is indispensable for operations performed in water trenches, underground tunnel engineering operations, assembly of all kinds of underground utility systems, for the use on board of the ships and is also widely used in the nuclear industry. Water may be used as a working fluid for cutting and 40%water – alcohol solution for welding, soldering, and brazing.

The device operates with a 220v socket connector and does not require a high voltage connection. The device can be carried to the worksite in a small big with a total weight of only 6 kg.

Advantages of plasma tool :

1. Cost effective
2. Can be carried to the work site in small bag.
3. Less power consumption
4. Does not require lighting as the firm produces effective illumination.
5. No thermal strains in the material that is being operated upon, due to the narrow heat penetration area.
6. In case of welding, the weld does not rust as a stainless oxide film forms on the welded area.
7. The device can be operated 24 hours a day and 365 days in a year at maximum capacity rate.
8. When this device is used the working room is additionally enriched with oxygen. Hence it is possible to perform operations in enclosed space without a ration

Precautions :

1. It is advisable to use minimum work current to extend the life time the electrode
2. Torch should not be started without working fluid filled. Otherwise it may damage the electrodes.
3. It is advisable to usage the operating mode when the flame became greenish.
4. While working out doors with temperature below zero, fill the torch just before the use, to avoid water freezing inside the torch

Safety rules :

1. Fire protects the work area by providing the sand, higher extinguishers, bucket of water or internal fire hydrants.
2. Ensure that the local exhaust ventilation is operational.
3. Avoid contact of molten metal and torch flame with non-fair proof martial and power supply unit.
4. Wear glass welder’s marks for plasma arc mode to prevent eye injury.
5. Do not use the appliance without grounded power out let.
6. Do not weld, cut shoulder or braze freshly painted parts until the paint dries out completely.
7. Do not activate the plasma torch near inflammable material and liquid.
8. Do not wear cloth with spot of oil, grease, gasoline or any other combustible liquid.
9. Disconnect power supply unit from the power out let before disassembling the torch.
10. Never pore working fluid into the torch with voltage applied.
11. Do not immerse the torch into the water when output voltage is applied.
12. Never bring the torch close to your face.

POWER TOOLS

INTRODUCTION:

Power tool is a powered by an electric motor, a compressed air motor, or a gasoline engine. Power tools are classified as either stationary or portable, where portable means handheld. They are used in industry, in construction, and around the house for cutting, shaping, drilling, sanding, painting, grinding, and polishing.

Stationary power tools for metalworking are usually called Machine tools. The lathe is the oldest power tool, being known to the ancient Egyptians. Early industrial revolution-era factories had batteries of power tools driven by belts from overhead shafts. The prime power source was a water wheel or a steam engine.

Stationary power tools are prized not only for their speed, but for their accuracy. A table saw not only cuts faster than a hand saw, but the cuts are smoother, straighter and more square than even the most skilled man can co with a handsaw. Lathes produce truly round objects that cannot be made in any other way.

An electric motor is the universal choice to power stationary tools. Portable electric tools may be either corded or battery-powered. Common power tools include the drill, various types of saws, the router, the electric sander, and the lathe. The term power tool is also used in a more general sense, meaning a technique for greatly simplifying a complex or difficult task.

1. POWER HACKSAW:

A power hacksaw is a type of hacksaw that is powered either by its own electric motor (also known as electric hacksaw) or connected to a stationary engine. Most power hacksaw are stationary machines but some portable models do exist. Stationary models usually have a mechanism to lift up the saw blade on the return stroke and some have a coolant pump to prevent the saw blade from overheating.

While stationary electric hacksaw are reasonably uncommon they are still produced but saws powered by a stationary engines have gone out of fashion. The reason for using one is that they provide a cleaner cut than an angle grinder or other types of saw.

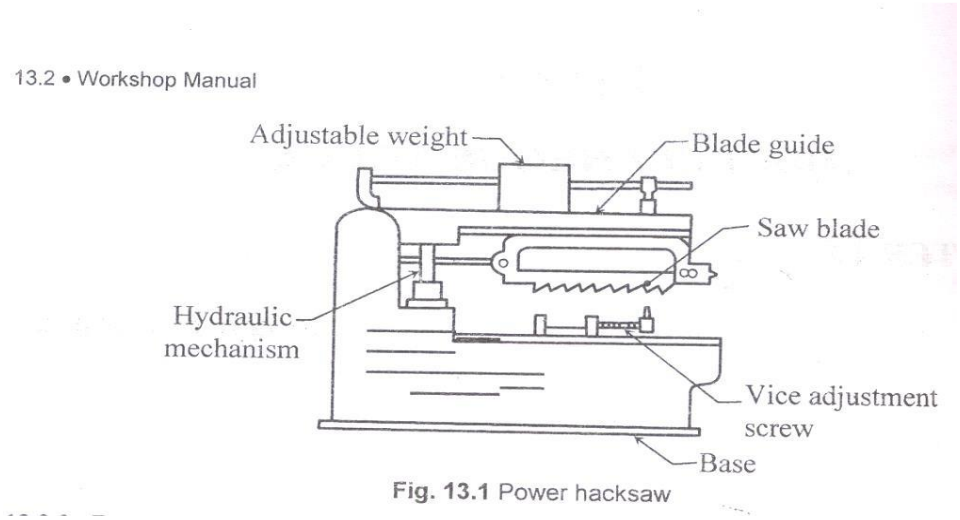


Fig. Power hack saw

Hand-Held circular saws:

The term circular saw is most commonly used to refer to a hand-held electric circular saw designed for cutting wood, which may be used less optimally for cutting other materials with the exchange of specific blades. Circular saws can be either left or right handed, depending on the side of the blade where the motor sits and which hand the operator uses when holding a saw.

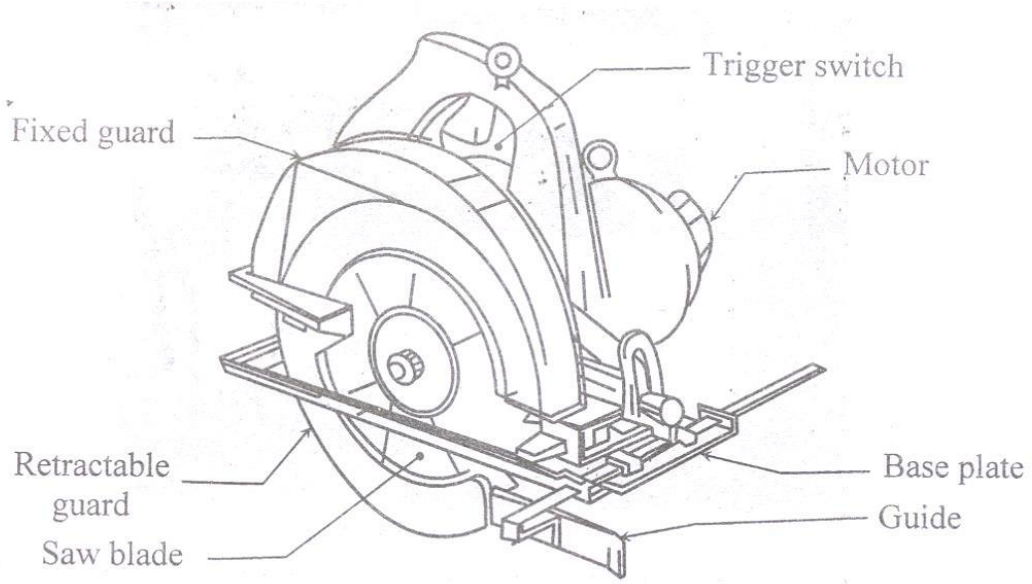


Fig. 13.5 Circular saw (Portable)

Fig. Circular saw (Portable)

DRILL:

A drill is a tool with a rotating drill bit used for drilling holes in various materials. Drills are commonly used in woodworking, metalworking. Special designed drills are also used in medical and other applications such as in space missions. The drill bit is gripped by a chuck at one end of the drill and rotated while pressed against the target material. The tip of the drill bit does the work of cutting into the target material, either slicing off thin shavings (twist drills or auger bits), grinding of small particles (oil drilling), or crushing and removing pieces of the work piece (masonry drill).

BENCH GRINDER:

A bench grinder or pedestal grinder is a machine used to drive an abrasive wheel (or wheels). Depending on the grade of the grinding wheel it may be used for sharpening cutting tools such as lathe tools or drill bits. Alternatively it may be used to roughly shape metal prior to welding or fitting. A wire brush wheel or buffing wheel can be interchanged with the grinding wheels in order to clean or polish work-pieces.