Certificate

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Roll No. : BTECH/10038/23 Exam No. :

Institution Birla Institute of Technology, Mesra

This is certified to be the bonafide work of the student in the Workshop Practice *Laboratory during the academic year 20 / 20 .*

No of practicals certified _____ *out of* _____ *in the subject of* _____

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Teacher In-charge

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Examiner's signature

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Principal

Date : ..... *Institution Rubber Stamp*

(N. B : The candidate is expected to retain his/her journal till he/she passes in the subject)

INDEX

Sr. No.	Experiment	Page	Date of Experiment	Date of Submission	Remarks
1.	Carpentry Shop [Carpentry Tools & Instruments]	1	08/09/2023	29/09/2023	
	I. To study the various tools, instruments & equipments used in carpentry Practices.	1-7			
	II. To learn the carpentry work by making a wooden Job using different tools	8-10	15/09/2023	29/09/2023	
2.	Foundry Shop,				
	I. (a) To get acquainted with various tools & equipments used in making green sand mould.	11-16	29/09/2023	27/10/2023	
	(b) To prepare green sand mould from given one piece pattern.				
	II To get acquinted with melting & pouring of metal in a mould	17-20	06/10/2023	27/10/2023	

INDEX

Sr. No.	Experiment	Page	Date of Experiment	Date of Submission	Remarks
3.	Welding shop				
	Exp-I Manual metal arc welding To join two pieces of metal by arc welding process.	21-25	27/10/23	10/11/23	(8) 10/11/23
	Exp-II Gas welding Practice To study gas welding process different types of flames, filler metal & flux etc	26-30	03/11/23	10/11/23	(8) 10/11/23
4.	Fitting shop				
Exp-I	Fitting tools & measuring instruments. To study various tools used & operations performed in fitting.	31-41	10/11/23	17/11/23	(10) 24/11/23
Exp-II	Fitting & Assembly Practices To make a job clamping plate as per given drawing by fitting operations & to check for its assembly with a given component	42-44	10/11/23	17/11/23	(10) 24/11/23
5.	Machine shop	45-53	17/11/23	24/11/23	(9) 24/11/23
Exp-I	center lathe machine To study control parts machine & to machine a given job on shaper as per drawing				
Exp-II	shaper machine To study shaper machine & to machine a given job on shaper as per drawing	54-61	17/11/23	24/11/23	(9) 24/11/23

Experiment-I: Carpentry Tools & Instruments
(Assignment - 1)

Objective of experiment :- To study various tools, instruments & equipments used in carpentry practices.

Job Assignment :- To make sketches of different tools & instruments used in carpentry Practices.

Theory: [Introduction to carpentry shop]

The term carpentry is used with wood working. Wood works such as making wooden partition, roofing, flooring, etc. are carpentry works. To understand this basic knowledge of all the materials & tools used in carpentry is necessary. The term joinery is used with making of doors, windows, wooden frames. Teak, Mahogany, Sal, Mango, Deodar, Padak, etc are the commonly used woods in carpentry works.

Carpentry tools & Instruments :-

1. **Iron-Jack Planner :-**

It consists of body of iron casting & handle made of wood. The iron cutter is fixed. Blade or iron cutter is inclined at 45° to the scale. It helps a smoother operation & produces a better finish than a wood Jack Planner.

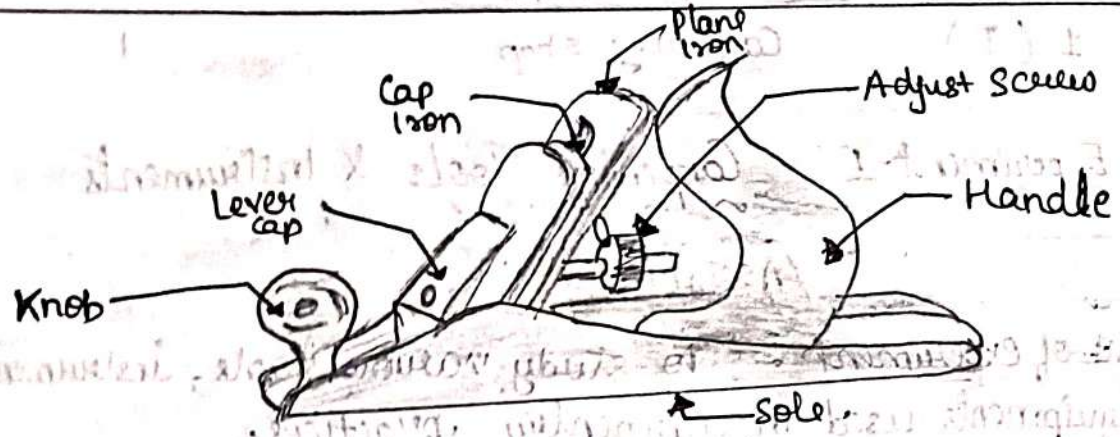

Fig. Iron-Jack Planer

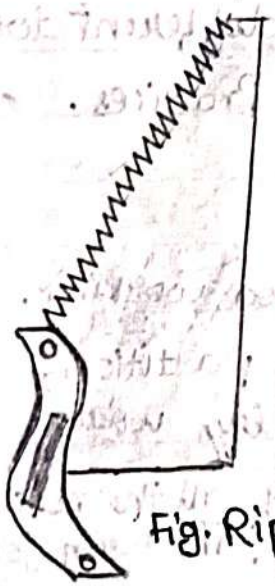

Fig. Rip Saw

Fig. Tenon Saw

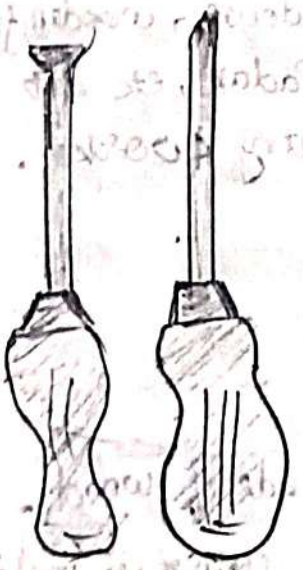

Fig. Screw Driver

Fig. Rasp File

Fig. Flat Bastard File.

use pencil for labelling.

2. **Rip Saw**:- It is used for cutting wood. The blade of rip saw is either straight or skew-backed. The blade is fitted in a wooden handle. Rip saw is about 700 mm long & contains 3 to 5 teeth per 25 mm length. The correct angle for rip sawing is 60 degrees.

3. **Tenon saw**:- It is used for fine and accurate work. It consists of a very fine blade, which is reinforced with a rigid steel back. Its length varies from 350 mm to 450 mm with 10 to 12 teeth pe 25 mm.

4. **Screw Driver**:- It is used for screwing/unscrewing in the wood. It consists of a metal rod with a flat or cross-shaped end that fits into the top of the screw.

5. **Rasp file**:- It is a tool used for shaping wood, iron or other material. It consists of a point, then long steel bar, then the tang. The tang is joined to handle usually made of plastic or wood. The bar has sharp teeth.

6. **Flat Bastard file**:- It is wood working material. It has a series of sharp, parallel teeth & has narrow pointed tang.

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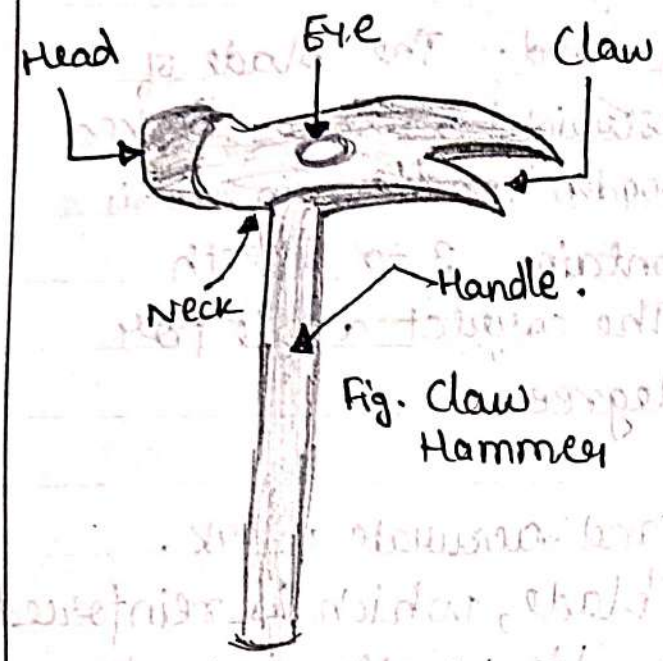

Fig. Claw Hammer

Fig. Ball Peen Hammer.

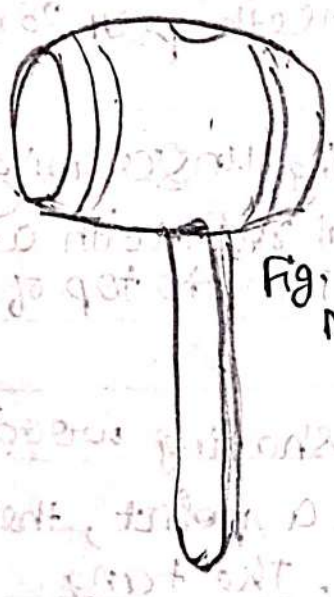

Fig. Wooden Mallet

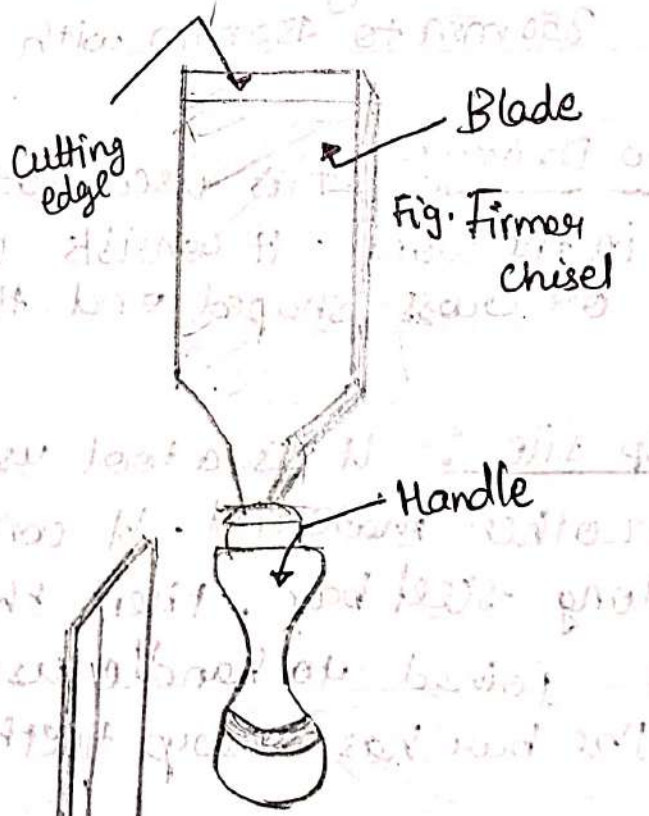

Fig. Firmer chisel

Fig. Dovetail Chisel

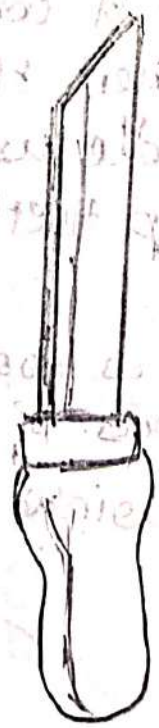

Fig. Mortise chisel

7. **Claw Hammer** :- It is a tool primarily used for pounding nails into or extending some other object. It is also used for driving out nails. This serves both the purpose of a hammer & a pair of pincers.

8. **Ball · Peen Hammer** :- It is also known as machinist hammer. It is used in metal working & is distinguished from other hammers by having a hemispherical head.

9. **Wooden Mallet** :- It is a striking tool which is made up of wood and is frequently used to give light blows to tools having wooden handle like chisel.

10. **Firmer chisel** :- It is used by hand pressure or with a mallet for cutting square recesses in wooden pieces. It has a flat blade of 5 to 25 mm width & 125 mm length. The end of the blade is bevelled to form a cutting edge.

11. **Dovetail Chisel** :- It has a back to ensure finishing of sharp corners like dovetail joints etc. It is used to create & clean out dovetails.

12. **Mortise chisel** :-

It is used for heavy & deep cuts. Its thickness is 6-15 mm and is stronger than other chisels.

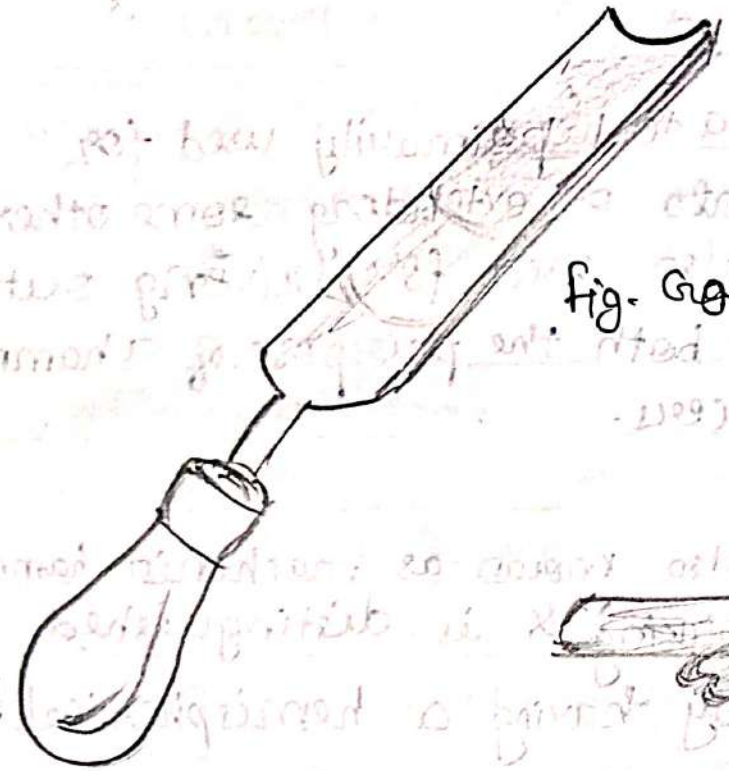

Fig. Gauge chisel.

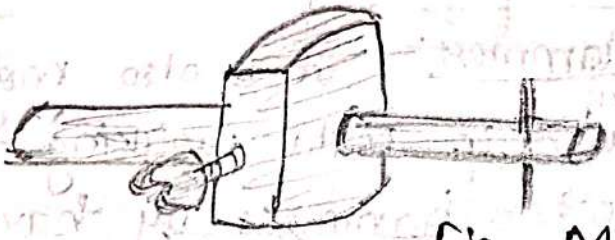

Fig. Marking Gauge.

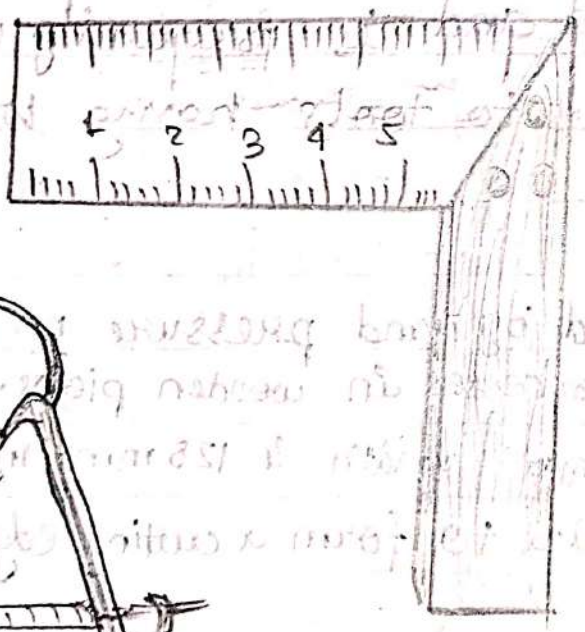

Fig. Try Square

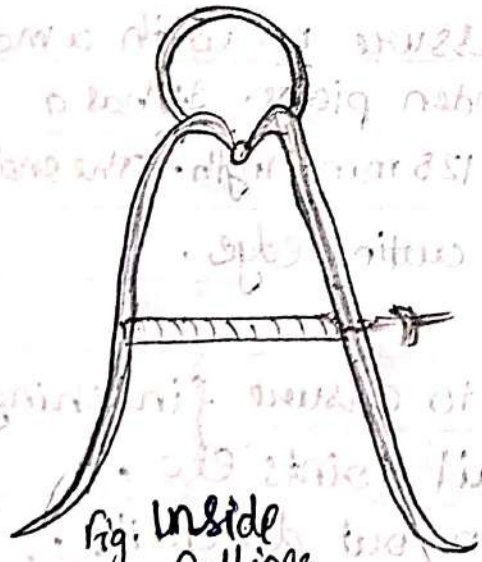

Fig. Inside Calliper

Fig. Outside Calliper

13. **Gouge chisel** :- It has a hollow curved blade provided for finishing curved surfaces (Carving)

14. **Marking Gauge** :- It consists of a long wooden bar of square cross section with slightly curved side faces on which a piece of wood moves. Long wooden bar is provided with a marking pin face of the sliding piece remains in contact with job being marked.

15. **Try Square** :- It consists of steel blade fitted in a wooden or metallic stack at right angle. the steel blade is graduated in mm or inches. It is used for measuring the flatness of surface and making perpendicular surface.

16. **Inside Calliper** :- It is a device used to measure the distance between two opposite open object. It is used to measure the internal size (diameter) of an object.

17. **Outside Calliper** :- It is used to measure the external size (diameter) of an object. They are made up of high carbon steel. They have high degree of accuracy and are used in measuring large dimensions.

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Fig. Divider

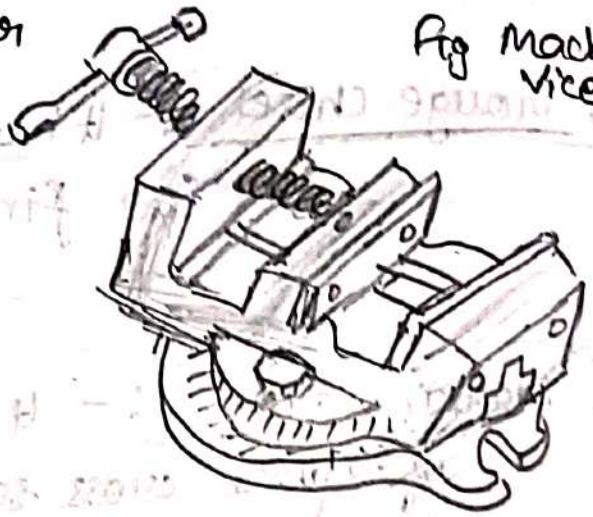

Fig Machine vice.

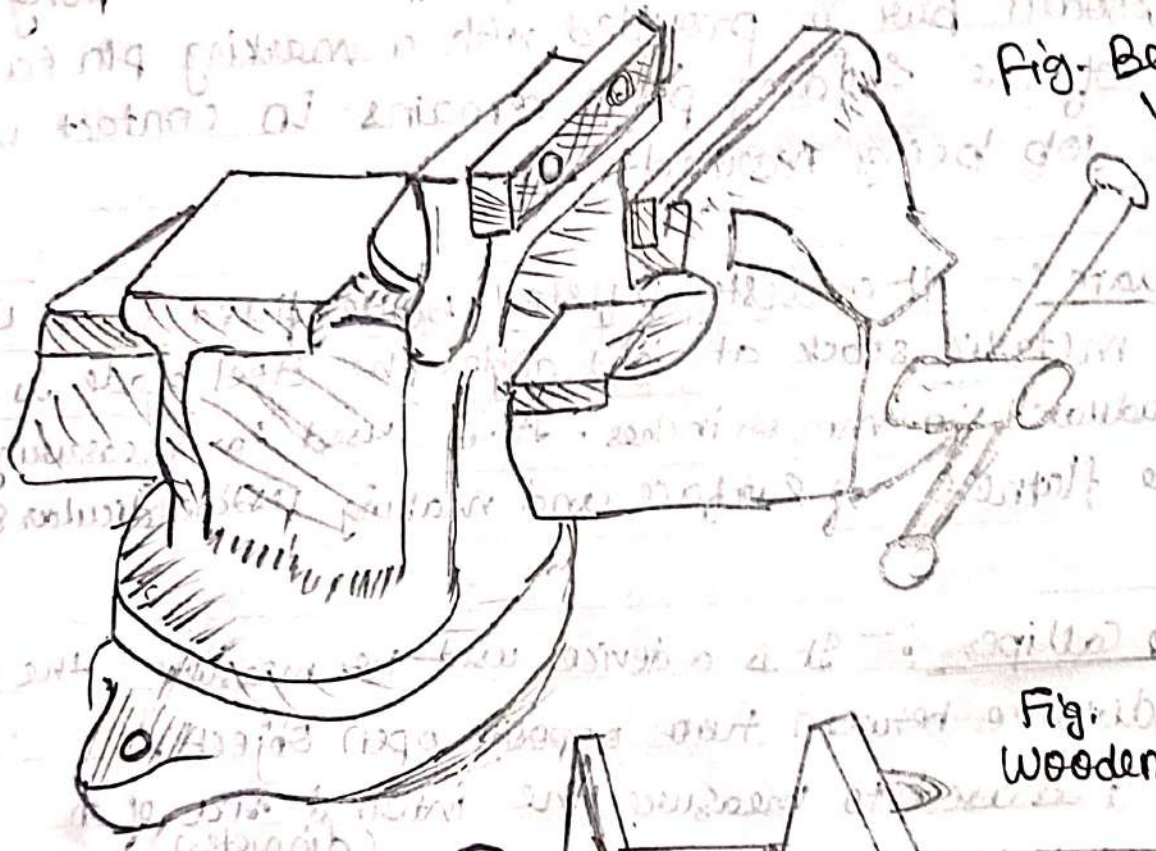

Fig. Bench vice

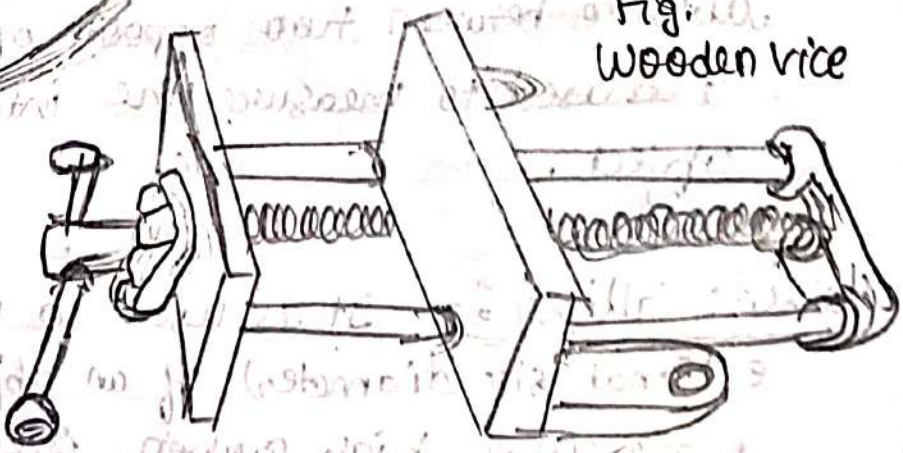

Fig. Wooden vice

18. **Divider :-** A diameter calliper is generally used as divider. It is used for making circles. It's ends are sharp so that one of the legs can be fixed & other can be moved.

19. **Bench Vice :-** A bench vice is made of cast iron/steel & it is used to hold or clamp work for filing, sawing, threading & other hand operations. The size of the vice is stated by the width of the jaws

20. **Machine Vice :-** It is a mechanical device designed to hold workpieces still during machining operations. It has hardened steel jaws

21. **Wooden vice :-** Wood working vices are attached to wooden bench. There jaws are made of wood or metal. They are used to hold workpiece.

(Next Page)

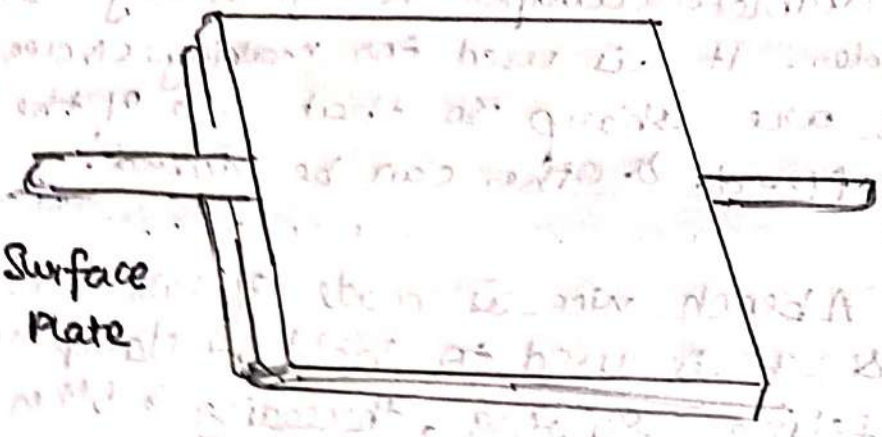

fig. Surface Plate

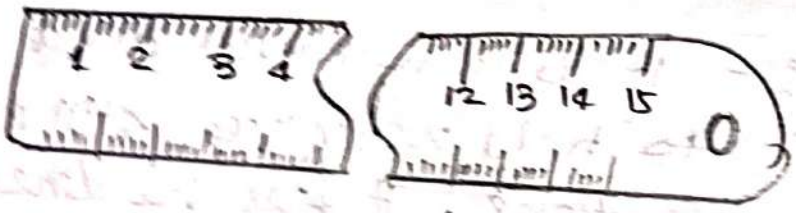

Fig. Steel Rule

22. Surface Plate :- It is a solid flat plate used as horizontal reference plane for precision inspection marking & tool setup. It is often used as the baseline for all the measurements to the work piece.

23. Steel Rule :- It is used for making measurements or dimensions on the wood & the marking gauge. It is made of steel . It is graduated on both sides in millimeters, centimeters & inches. It is available in 150mm (6 inches) & 300 mm (12 inches) length.

Qs Questions & Answers

1. What is the difference between Mallet & hammer?

Ans => Mallets have wooden or steel handles that may be long or short. They have wide head which is made up of wood & are used to drive pins, wooden screws or flatten metal surface while hammers have their head made up of metal & are used to drive nails, screws etc.

Date .....

Expt. No. .....

2. Describe the function of Try Square?

Ans → Try Square is used for measuring & marking process. It consists of steel blade fitted in a wooden or metallic stick at right angle to it. The steel blade being graduated in mm or inches. It is used to make/measure plane surface & to measure adjacent surface perpendicular.

3. Differentiate b.ttween chisel & Gauge..

Ans → Chisel is a tool used for generally Chiselling or cutting wood while gauge is used for cutting & making curved surfaces.

4. What is difference between rip saw & tenon saw?

Ans → A rip saw is a tool used for cutting smaller or medium sized work. While a tenon saw is used to cut joints sizes & fine work. A tenon saw has more number of teeth per unit length as Compared to a rip saw.

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Do not scale the Drawing | All Dimensions in mm

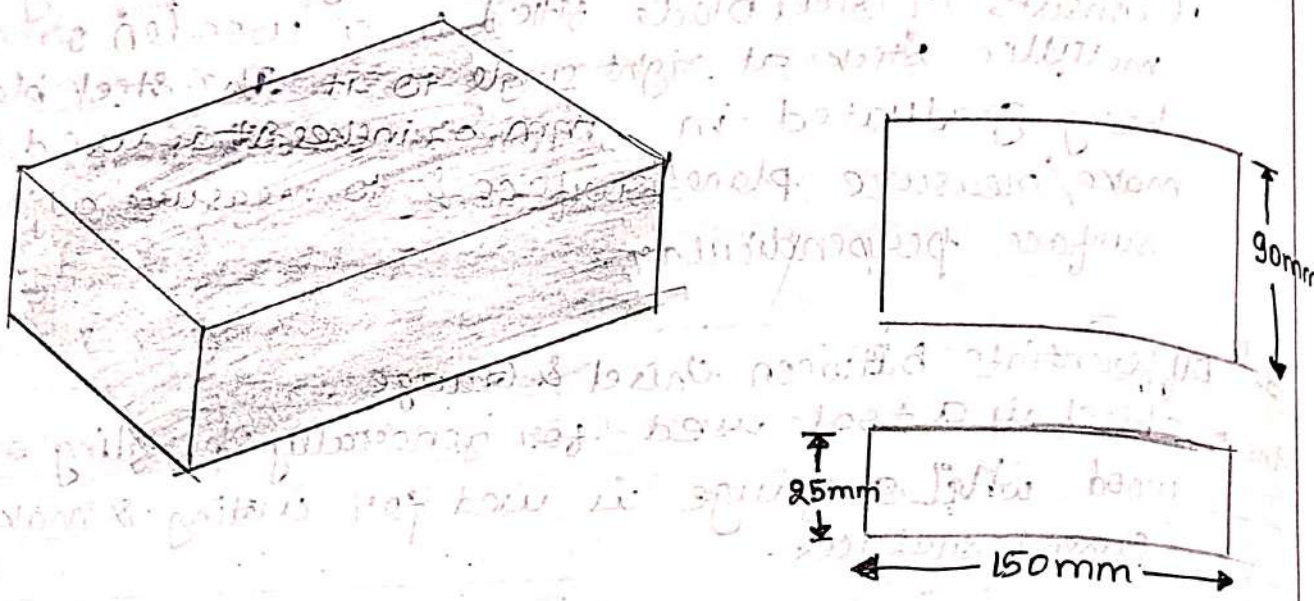


Fig. Wooden Job.

Experiment - II Carpentry Practices.

Objective of Experiment :- To learn the carpentry work by making a wooden Job using different tools.

Job Assignment :- To make Job as per given drawing.
The dimension of block being follows:-

1. Length is 150 mm.
2. Breadth is 90 mm.
3. Height is 25 mm.

Tools and Instruments :-

1. Iron Jack Planer
2. Try Square
3. Marking Gauge
4. Rip Saw.
5. Steel Ruler
6. Rasp file
7. Flat Bastard file
8. Wooden Vice.
9. Wooden workpiece
10. Pencil etc.

Teacher's Signature : _____

Date .....

Expt. No. ..... Page No. 9

Process Sheet :-

Sl. No.	Description	Tools & Equipments
1.	Make all sides of wood plain	→ Iron Jack Planer, wooden vice.
2.	Make one side of block as 90°	→ Try square, Flat Bastard File, wooden vice
3.	Make dimensions of length as 150 mm.	Marking Gauge, Pencil, Steel Rules.
4.	Now cut Fine piece of wood on the marking made.	Rip saw, wooden vice
5.	Mark dimension of breadth (90cm) & height (25cm) & cut it.	Marking Gauge, Rip saw, wooden vice.
6.	Finish the product by filing the wooden Job.	Flat Bastard file.

Teacher's Signature : .....

Date .....

Expt. No. .....

Precautions :-

1. Use seasonal wood.
2. Secure the wood tightly in wooden vice.
3. Set workpiece high above on wooden vice such that iron-jack planer's blade never touch vice.
4. Keep the tools in proper position when not in use.

Questions & Answers

1. What are the factors which govern the selection of timber for particular use?

Ans → The factors which govern the selection of timber for particular use are :-

i) Density
ii) Durability
iii) Thermite Resistance
iv) Wood Type
v) Trade names & Cost.

2. What do you mean by grain & texture as applied to wood?

Ans → The terms grain & texture are used in various ways to describe physical properties of appearance rather than properties of strength of wood.

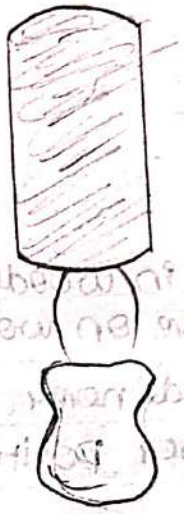
3. What do you understand by seasoning of wood?

Ans → Seasoning is the process of removing moisture content from the wood to minimize structural problems when used in construction or to give less smoke when used as fire wood.

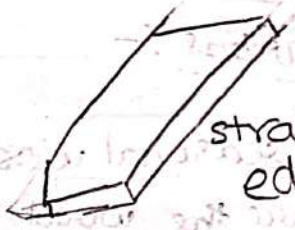
29/7/22

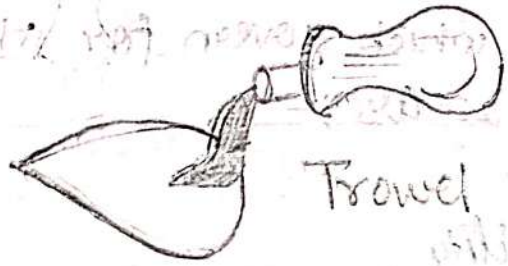
Teacher's Signature : _____

Showel



Rammer





Trowel

Experiment-1: Green sand Moulding.

Objective of Experiment:

1. To get acquainted with various tools & equipments used in making green sand mould.
2. To practice green sand mould making with single piece pattern.

Job assignment: To prepare green sand mould from given one piece pattern.

Tools & Instruments: Mention various tools & measuring instruments used in making the assigned job.

1. **Shovel:** A shovel is used for deracking & moving sand from sand pile to moulding box.

2. **Rammer:** A rammer is a wooden tool used for packing the sand into the mould.

3. **Straight Edge:** It is a metal box used to remove the surplus sand from the mould after the ramming is complete.

4. **Trowel:** They are used for making joints & finishing flat surface of mould.

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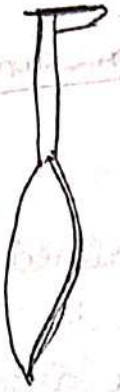
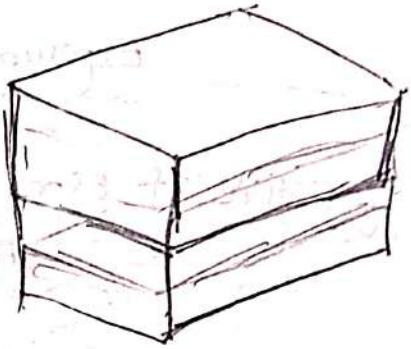
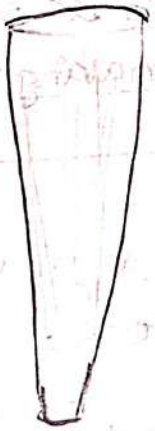
Flat end cleaner



Knife end cleaner



Moulding Box



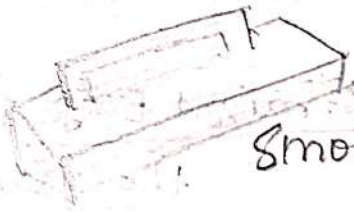
Sprue Rod

Riser Rod

Swab

Draw Spike

Vent wire



Smoother

Date .....

Expt. No. .....

5. Flat & Knife cleaners : They are used for packing section of mould & removing loose sand from the packet of mould.

6. Moulding Box : It is used for making moulds consisting of two parts, one is known as cope & other is known as drag.

7. Sprue Rod : It is a wooden metal rod used to make an opening in the mould through which metal is poured.

8. Riser Rod : It is a wooden or metal rod used to make the riser vent in the mould.

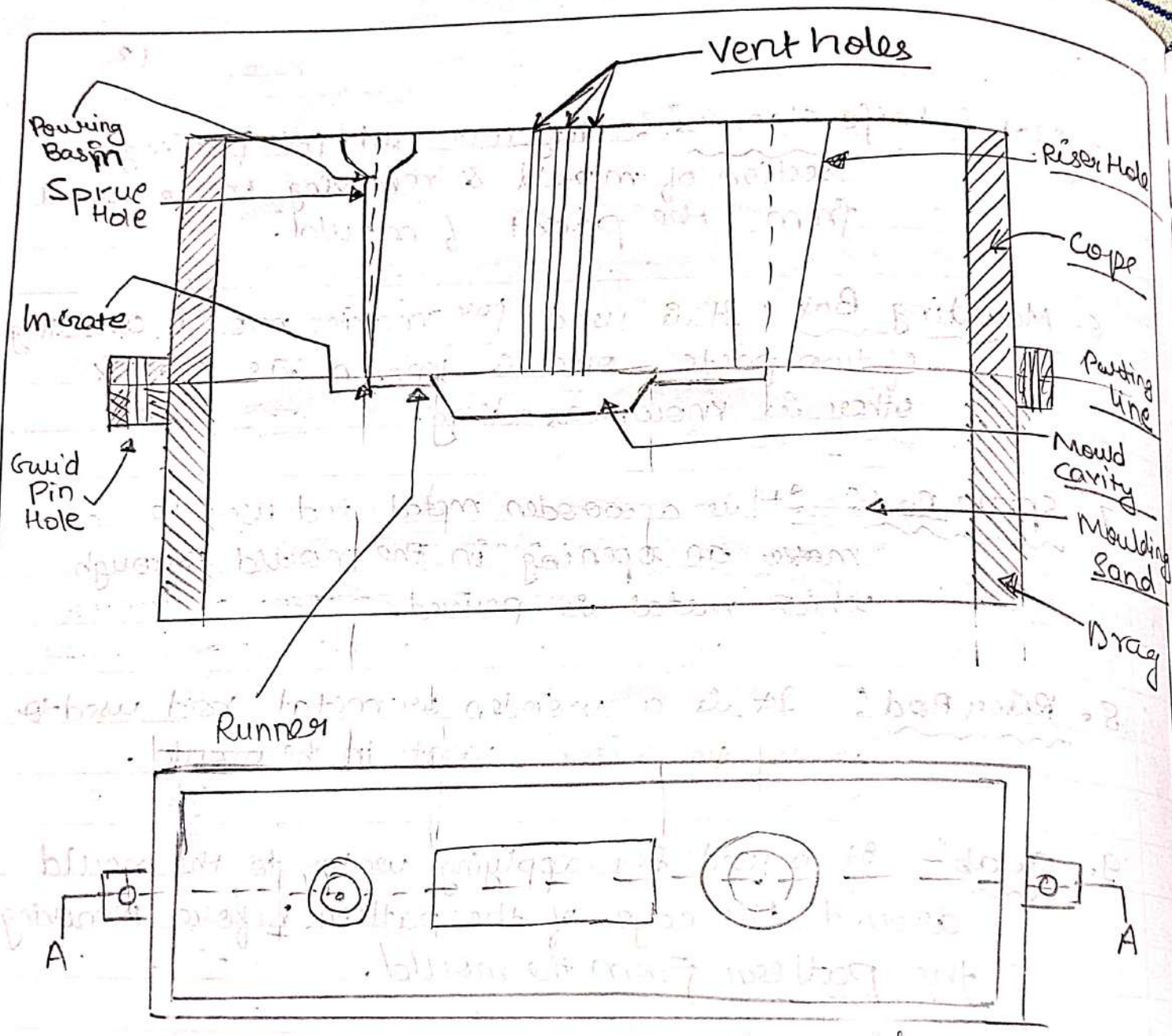
9. Swab - It is used for applying water to the mould around the edge of the pattern before removing the pattern from the mould.

10. Draw spike or Screw : It is a sharpened piece driven into the pattern for withdrawing the pattern from the mould.

11. Vent wire : It is a wire-rod used for making openings called vents in the mould to allow escape gas & steam.

12. Smoother : It is a wooden piece which is used to shape the surface & repair flat & round surfaces. It is used as finishing tools.

Teacher's Signature : _____



Green sand Mould
For single Piece Pattern

single
Piece Pattern

Date .....

Expt. No. .....

Process Sheet:

S.No	Description	Tools & Instrument
1.	Place the pattern with bigger surface downwards on the moulding board	Moulding board & pattern.
2.	Place the drag half of the box on the moulding board with pins pointing downward	Drag.
3.	Draw the partition sand over the pattern & the moulding board.	Dusting tool.
4.	Fill the drag with green sand & ram using pin end of rammer. Now fill the sand to height above the drag and ram using butt end of rammer	Shovel, Rammer
5.	Strike off the extra sand from the top of the drag and then smoothen the top surface property.	Straight edge.
6.	Now finish the sand surface & place the second moulding board.	Trowel

Teacher's Signature : .....

Date .....

Expt. No. ..... Page No. 14

S.No	Description	Tools & Instrument
7.	Now turnover the drag & put the cope box & sprinkle the parting sand b/w them.	Parting sand
8.	Insert sprue rod & riser rod at a distance of nearly one inch from pattern & mark in sand.	Sprue Rod & riser rod
9.	Now start filling the cope with green sand using shovel & rammer	Shovel, Rammer
10.	Strike of extra sand & finish the top surface	Straight edge, Smoother, Trowel.
11.	Make vent holes in the sand	vent wire.
12.	Remove the sprue & riser rod by wetting the sand & rotating gently	Swab.
13.	Now make the pouring basin and finish it	knife end cleaner flat end cleaner
14.	Lift off the cope half & set it on edge to one side. Wet the sand edge around the pattern	Swab
15.	Remove the pattern after inserting draw spike into the back of pattern & rapping lightly from all sides	draw spike
16.	Repair the mould if needed.	

Teacher's Signature : .....

Date .....

Expt. No. .....

Sl No.	Description	Tools & Instruments
17.	Make in Gate from the riser and sprue hole to pattern cavity	Knife & flat end cleaners
18.	Close the mould by replacing the cope on drag. The mould is ready.	

Precautions:

1) Ram the sand properly into drag & cope.
2) Sprue rod & riser rod must be located properly.
3) Pattern mould should be withdrawn straight.
4) Moulding sand must be tempered properly before using.

Question & Answers

1. What is cope & drag?

Ans-> Cope is the portion of mould that holds sprue and riser cavity and vent holes. While Drag contains the pattern cavity & in gates.

2. What are the ingredients of moulding sand

Ans-> Main ingredients are

Silica sand 80-90%

Clay 2-10%

Moistures 2-8%.

Additives like corn flour, coal dust, sea coal etc.

Teacher's Signature : _____

Date .....

Expt. No. .....

Page No. 16

3. How is the pattern withdrawn from mould?

Ans -> First the sand surrounding pattern is wet using swab and then Draw spike is made into pattern & is tightly striked in all the directions. Then the draw spike is slowly moved outwards.

4. What is mulling?

Ans -> After mixing sand with water. Bentonite is added to it & is stamped with feet until it becomes flat. This is mixed with shovel & is known as mulling.

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Experiment - II: Aluminium Casting

Objective Of Experiment :- To get acquinted with melting & pouring of metal in a mould.

Job assignment :- To make a mould from given two piece of handle and make aluminium casting.

Tools & Instrument :- Shovel, Rammer, straight edge, Trowel, flat end & knife end cleaner moulding box, sprue rod, riser rod, swab draw spike, vent wire.

Process-sheet :-

S.No.	Description	Tools & Equipments
1.	Place one part of two piece-pattern with the parting surface downward on the moulding board.	Moulding board two-piece pattern
2.	Place the drag half of box on the moulding board.	Drag.
3.	Draw the parting sand over the pattern & the moulding sand	Drawing tool
4.	Fill the sand in the drag with constant ramming using pin end and then using butt end.	-Shovel, Rammer

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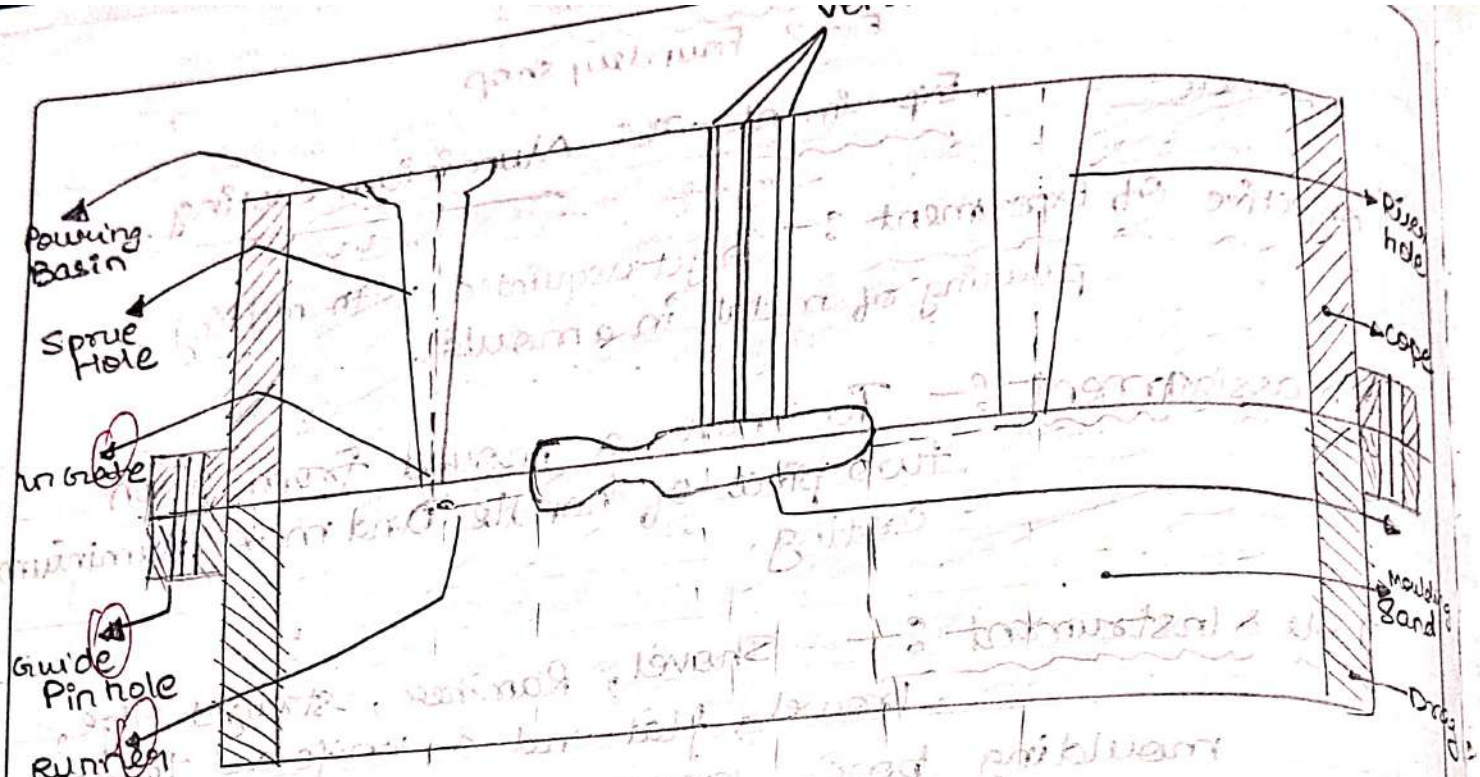
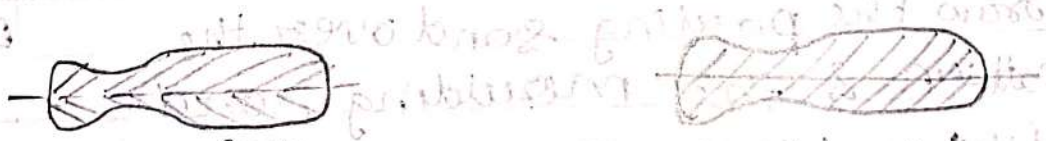


Green sand mould for two piece Pattern



Two piece Pattern

Aluminium Cast

Date .....

Expt. No. ..... Page No. 15

Sl. No.	Description	Tools & Equipments
5.	Strike off the excess sand from top of the drag & level the sand to the top of the box.	Straight edge
6.	Now finish the top surface of the Drag.	Smoother, Trowel
7.	Now place the second part of two-piece pattern & put riser rod & sprue rod at a distance of one inch from pattern	Riser and Sprue rod
8.	Now put the second box over the first perfectly aligning it with drag & put same parting sand.	Drawing Tool
9.	Fill the cope with sand with constant ramming using pin end	Shovel Rammer
10.	Now fill cope a little more over the level ram with butt end.	Rammer
11.	Remove the excess sand from the top of cope.	Straight Edge
12.	Make pouring basin after removing sprue & riser rod and make vent holes.	Knife end cleaner, vent wire.
13.	Remove the pattern using vent wire	vent wire

Teacher's Signature : .....

Date .....

Expt. No. .....

Sl.No	Description	Tools & Equipment
14.	Make in gates & cover them up with graphite powder	graphite powder
15.	Heat the required amount of Aluminium (Al)	Laddle furnace Gloves
16.	Pour the hot metal into the sprue hole & & after cooling removed the aluminium casting	Hammer

Precautions :-

1) Always wear gloves, goggles & leggings while melting metal.
2) Mould must have weight or clamps on it before metal is poured.
3) Do not place your face over the sprue or riser.

Questions & Answer :

1) What is Casting?

Ans → Casting are made from patterns which are exact copy of the article to be produced. The pattern are pressed into sand and removed leaves impression called mould Into the sand impression or mould molten metal in poured & allowed to solidify. It forms a reproduction of the pattern known as casting.

Teacher's Signature : .....

2. What are the defects of casting?

Ans → Some of the defects are: blow holes, shrinkage, cold cracks, run outs, fins, internal air packets, metal remaltation etc.

3. What is the role of vent hole & how it is given?

Ans → Vent holes are the opening made out with the help of vent wire to allow gases & steam escape from mould.

4. What is laddle?

Ans → They are used to receive molten metal from the metal furnace and pour the same in the mould.

5. Which types of metals can be melted in pit furnace?

Ans → Non-ferrous metals can be melted in pit furnace.

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2/1/23 (2)

Experiment - I Manual metal arc welding

Objective of Experiment: To join two pieces of metal by arc welding process.

Introduction: Welding is defined as a material joining process used in making welds. A weld is a localised coalescence of metals or non-metals produced either by applying heat, pressure and/or use of filler metal

Manual metal arc is one of the efficient methods of welding process using an electrode arc to create heat to melt & join metals. A power supply creates an electric arc between a consumable & non-consumable electrode & basic base material using either DC or AC.

Theory :-

An arc is generated between two conductors of electric current, cathode & anode to establish the flow of current, when separated by a small distance, an arc is sustained through ionized gas column called plasma. It is used in planes, automobiles etc

Job-Assignment :- To make following joints by arc welding

- Lap Joint
- Butt joint double-Vee
- T-joint
- L-joint
- Butt joint single-Vee

Teacher's Signature : .....

Fig. Hand Gloves

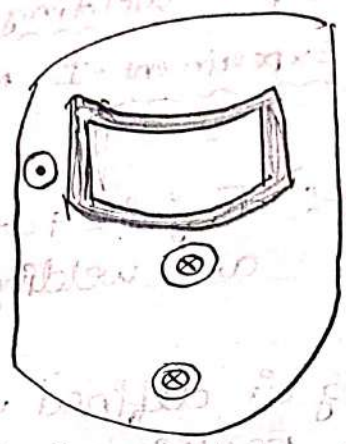

Fig. Hand Shield

Fig. Wire Brush

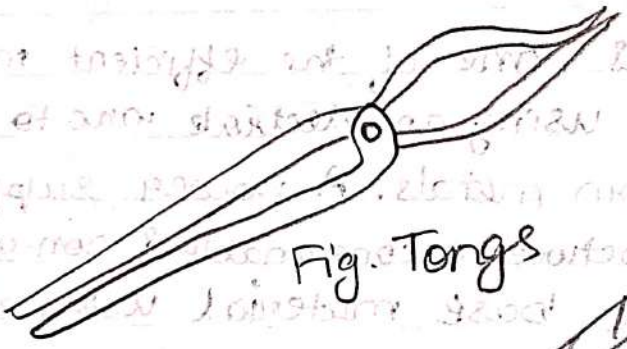

Fig. Tongs

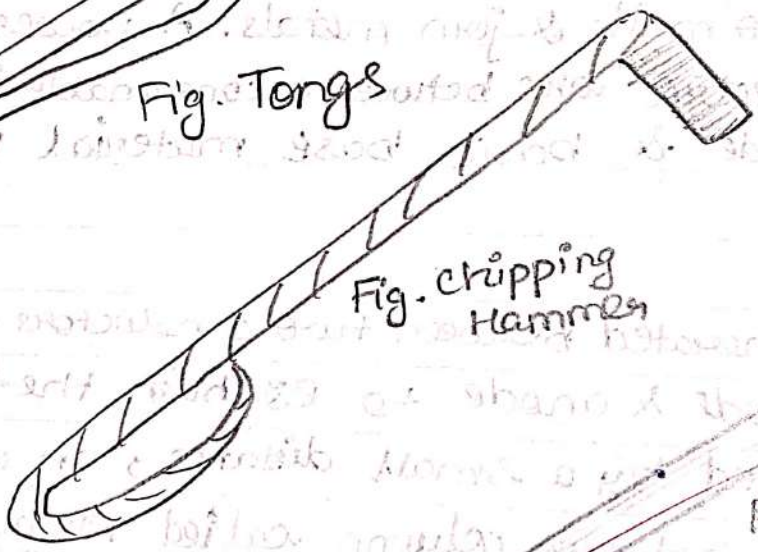

Fig. Chipping Hammer

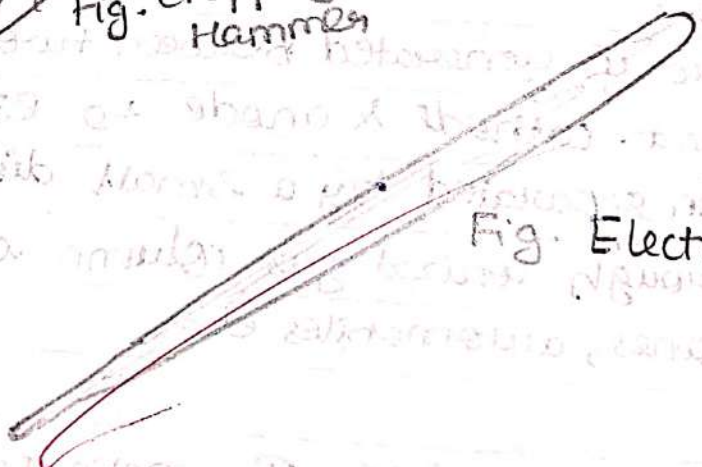

Fig. Electrode

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Tools & Instruments :-

1. **Wire Brush :-** It is used for cleaning the material before welding and removing impurities (like slag) after welding.

2. **Chipping Hammer :-** It is used for removing the slag which covers the weld.

3. **Gloves :-** It is used to protect hands of the operator.

4. **Tongs :-** They are used to hold the heated metal

5. **Hand Shield :-** It is used to protect the face & eyes in arc welding process

6. **AC or DC Machine :-** Depending upon application AC or DC machines are used.

Observation Table :-

①	Types of Joint :	Double vee Butt-Joint
②	Metal of composition :	Mild steel
③	Metal of thickness :	4mm
④	Diameter of electrode :	3.15mm
⑤	length of electrode :	450mm
⑥	Applied current :	101 Amp (AC)
⑦	Types of Transformer :	AC
⑧	Open circuit voltage :	80V

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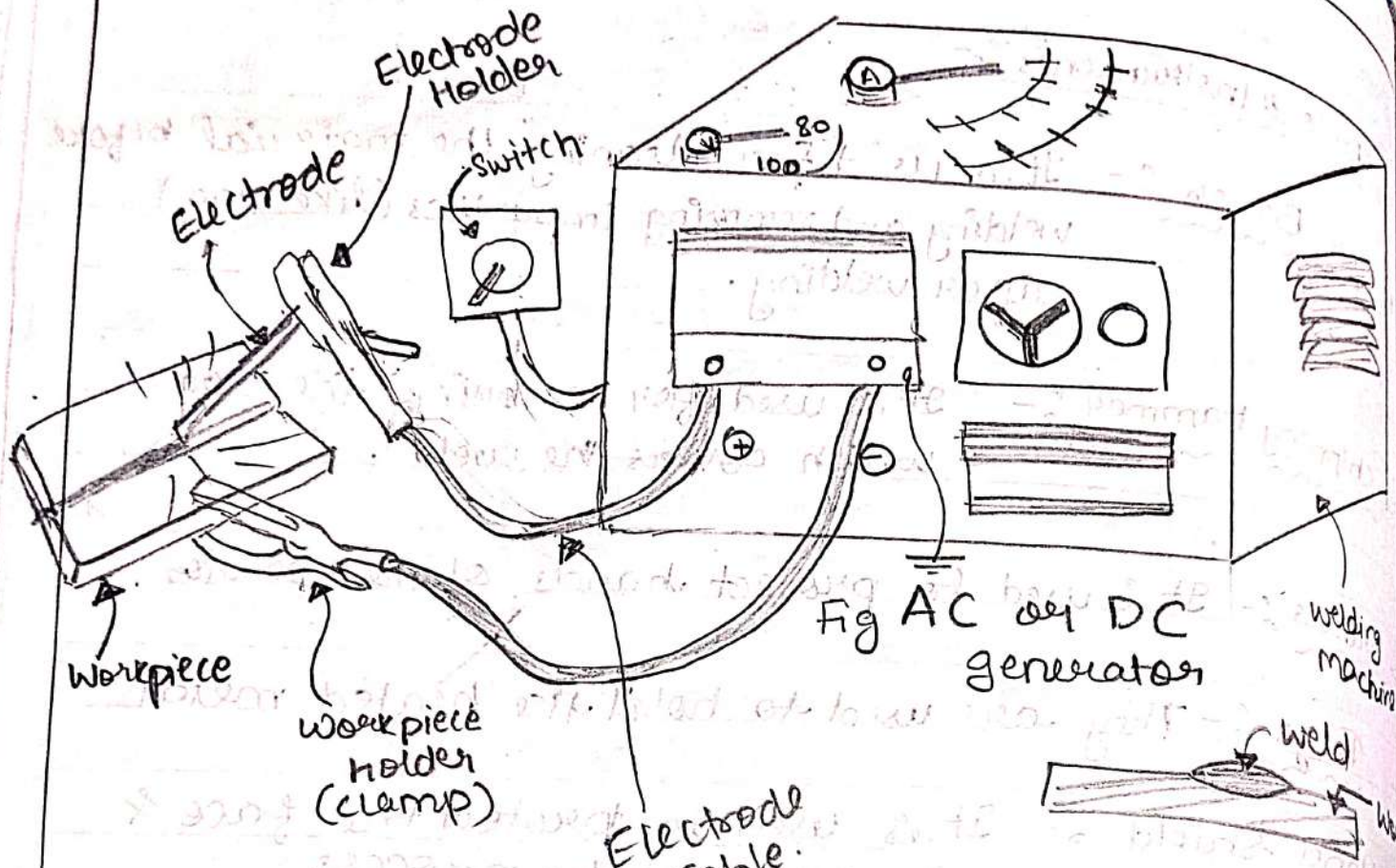


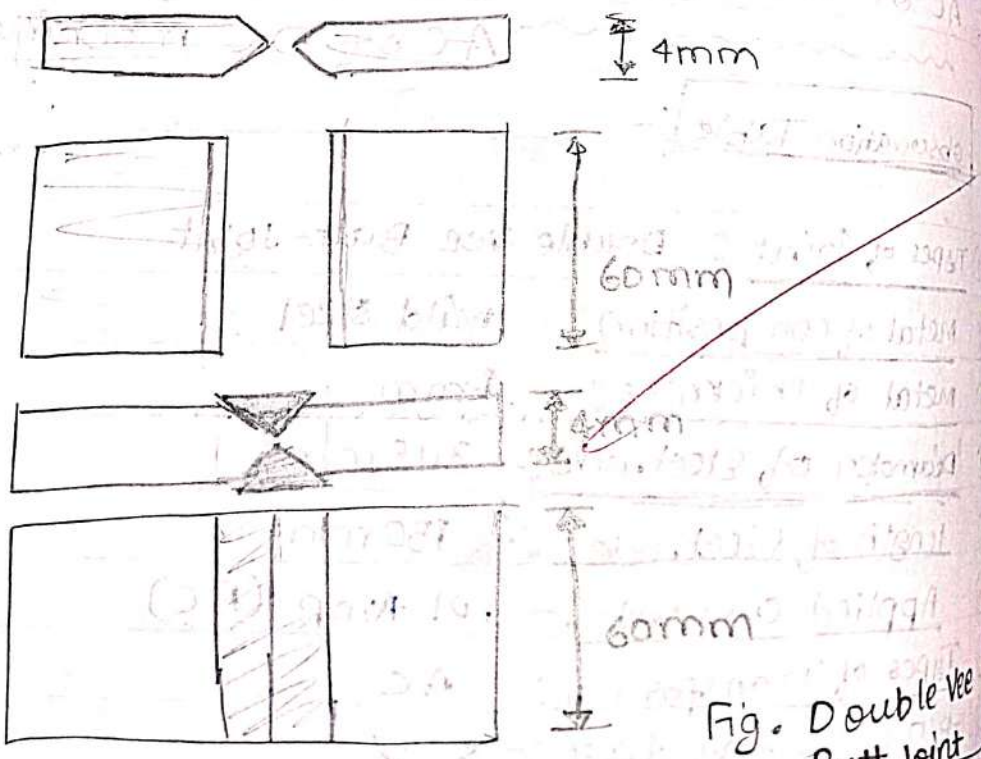


Fig. Double vee Butt joint

Date .....

Expt. No. .....

Process Sheet

S.No.	Description	Tools & Equipment
1.	Place two flat pieces of mild steel of required dimensions (work piece)	Chisel, hammer, scale.
2.	Set the machine for welding operation	welding set, electrode holder
3.	Select correct electrode size & hold it in the holder	Electrode holder.
4.	Clear the welding area	Wire brush
5.	Make angle of 45° by creating a V-shape structure, one edge of metal, place them together	Electric grinding machine welding table.
6.	Make tacks at both ends of points	Tong, earth, clamp, gloves, helmet, electrode holder
7.	work piece are kept in the required position & root welding is performed on the work piece at the both sides of joint one by one.	Tong, gloves, helmet, electrode holder
8.	Allow joints to cool & inspect the weld reweld if necessary. Finally scale formed is chipped with hammer.	chipping Hammer Anvil.

Teacher's Signature : _____

Fig. Butt joint

fig. Lap joint

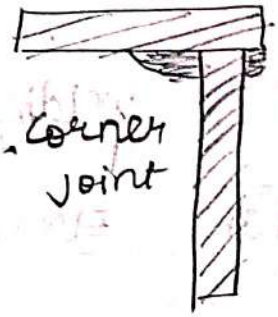


Fig. Corner joint

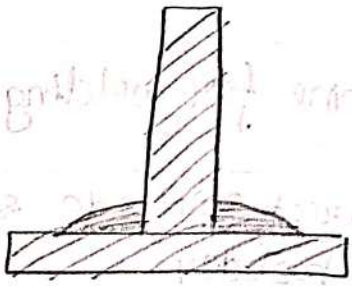


Fig. Tee-joint

Fig. Edge joint

Table:-

Different size of electrodes for MMAW	
Size of electrodes	current Range (Amps)
2.5 x 350 mm	80-100 AC/DC
3.15 x 450 mm	90-120 AC/DC
4 x 450 mm	140-170 AC/DC
5 x 450 mm	180-220 AC/DC

Date .....

Expt. No. .....

Precautions:-

1. Working area & floor should be kept clean & dry.
2. Before starting welding ensures that welding equipment is adequately earthed.
3. To prevent arc rays from reaching his/her body one should not look at an electric arc with naked eye.
4. The proper electrode according to welding to be used.
5. To prevent welder head from radiation, spatter & hot slag a helmet or hand shield must be worn.
6. The welding should be done in adequated ventilation area.
7. No inflammable material should be present in the welding shop.
8. Set voltage, current etc properly.

Questions:-

1. Describe with the help of suitable sketches the various types of welded joints?

Ans → There are five types of welded joints.

i. Butt joint
ii. Lap joint
iii. Corner joint
iv. Tee-joint
v. Edge joint

Butt joints have good tensile strength when fitted & welded properly Edge joint can be on inside of workpiece & corner point is typically the outside of work space.

Lap joints are very common for joining plates or sheet metal such as when you're adding flooring to a vehicle or patching a hole.

Teacher's Signature : .....

Date .....

Expt. No. .....

Page No. 25.....

2. What do you understand by welding position ?

Ans → It refers to the position of welding which may be flat, vertical, inclined, horizontal and overhead welds.

3. Describe How arcs are initially generated ?

Ans → An arc is generated between two conductors of electric current, cathode & anode when they are touched to establish the flow of current & then separated by a small distance an arc sustained electric discharge through ionized gas column called plasma.

4. Why edge preparation is done before making joints by welding ?

Ans → In edge preparation joint is inclined 45° before welding so that welding process is done throughout the inner core to increase the strength of the weld.

Teacher's Signature :

Types of Flame

oxidising Flame

Temp. (°C) [3400°C]

Neutral Flame

[3200°C]

Reducing Flame

[3000°C]

Experiment-II Gas welding Practice.

Aim :- 1. To study gas welding process, different types of flames, filler metal and flux etc.

Introduction :- Gas welding is the process of joining the metallic parts by application of heat. Heat is provided by various gas combinations, common mixture of gases are oxygen & acetylene, oxygen & propane oxygen & butane, oxygen & hydrogen and Oxygen & Natural gas. It is a fusion welding process.

Theory :- There are three types of flames induced in a oxy-acetylene welding process.

1. **Neutral flame :-**
In this, oxygen & acetylene amounts are nearly equal induce neutral flame. Temperature obtained is about 3200°C in inner core. It is double layered [inner core, outer envelope]. This flame is round shape & has blue colour. It is used for mild steel, stainless steel, aluminium, great coat iron, etc.

2. **Oxidising flame :-**
In this, oxygen is in excess to acetylene. Temperature of about 3400° C is obtained. It is also double layered (inner core ; outer envelope) In this inner core is sharp & wide. This flame is sound producing. It is used for metal cutting, cast iron, zinc base metal etc.

Teacher's Signature

Fig. Wire Brush

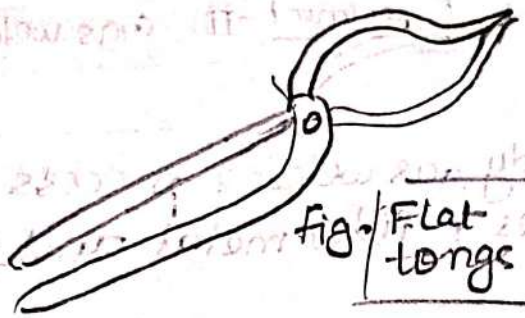


Fig. Flat-tongs

Fig. Welding Rod

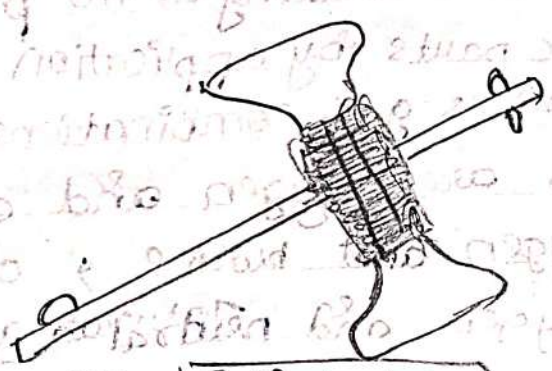


Fig. Cylinder key

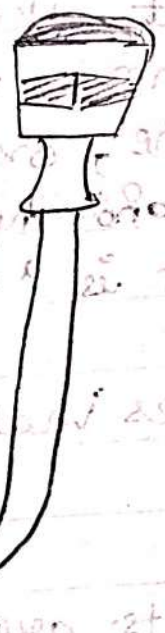
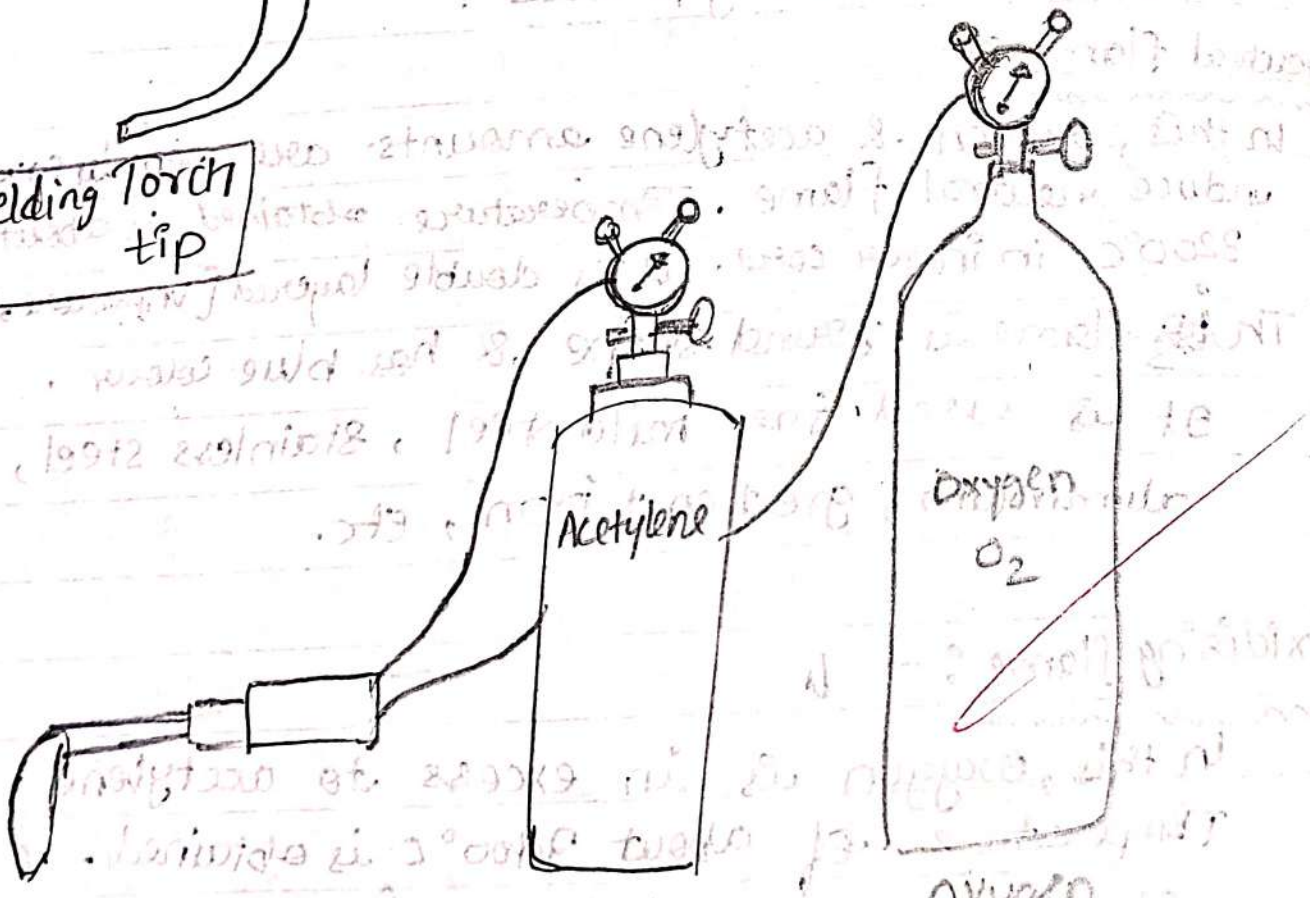


Fig. Welding Torch tip



Acetylene cylinder

Oxygen cylinder

Fig. Welding set

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3. Reducing flame :- (carbonising flame)
In this flame acetylene is in excess to oxygen.
Temperature obtained is about 3000°C.
This flame is triple layered [inner core (3000°C), intermediate (2100°C), outer envelope (1200°C)]
Inner core is long & yellow in colour.
It is used in silver welding, tin welding, lead welding etc.

Job Assignment :-
a) To sketch gas welding set and equipments used
b) To sketch different type of flames produced
c) To make different joints like lap joint.
d) To cut specimen of given dimension by gas cutting.

Tools & Instruments :-
1. Wire brush : It is used for cleaning the material before welding and removing impurities after welding.
2. Tongs : It is used to hold heated material.
3. Welding rod : It is a wire which is melted into its weld metal, therefore the composition and properties of the welding rod should match with base metal very closely.
4. Cylinder key : It is used to open cylinders.

Teacher's Signature : _____

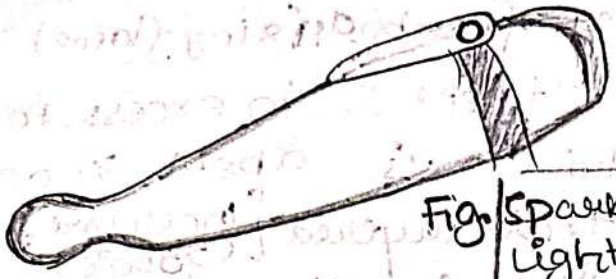

Fig. Spark Lighter

Fig. Welding Goggles

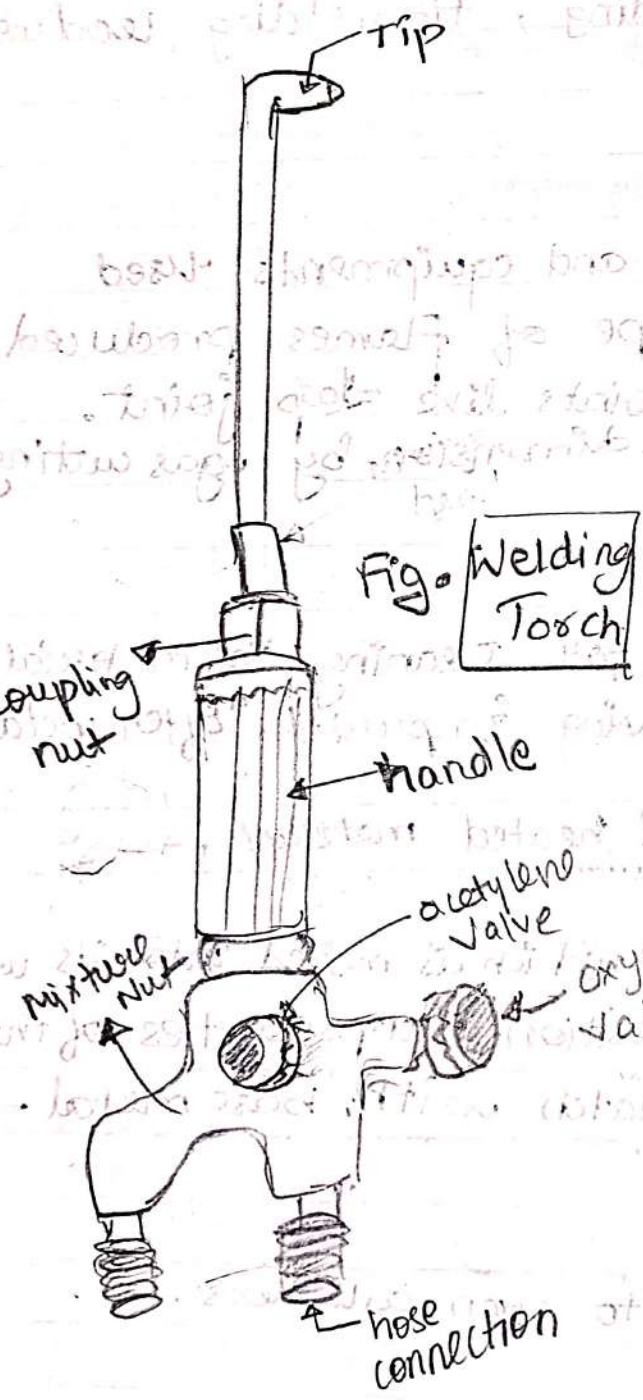

Fig. Welding Torch

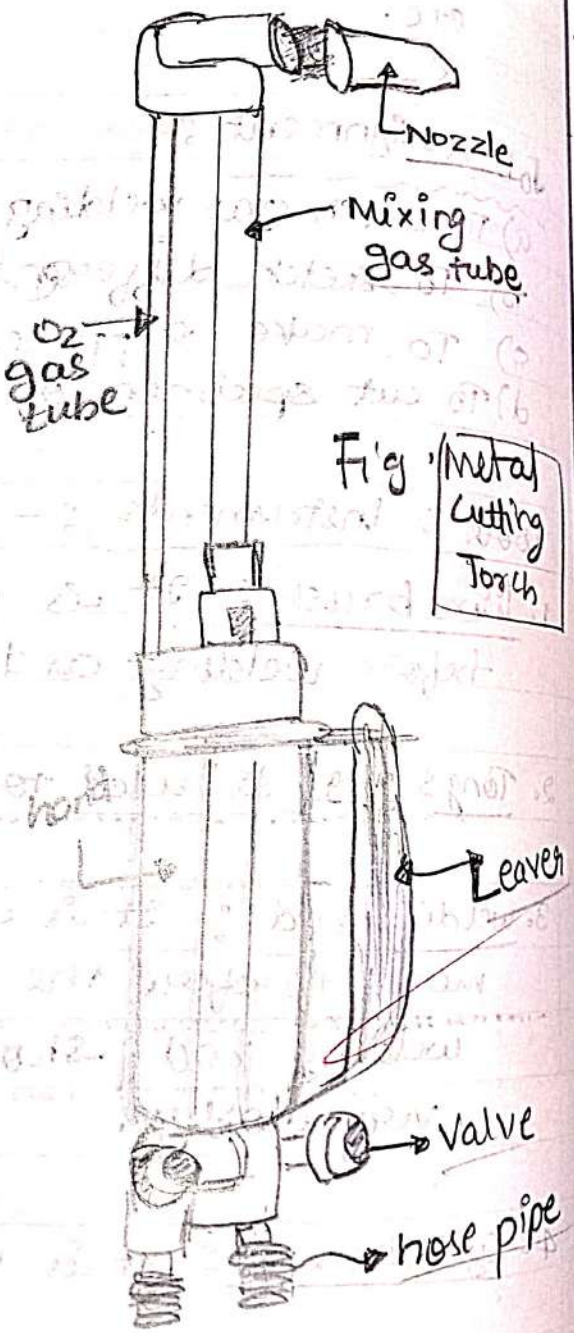

Fig. Metal Cutting Torch

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Expt. No. .....

5. Spark lighter : It is used for lightning the torch.

6. Welding Torch : It is a device used for mixing acetylene and oxygen and controling the flow of the gas.

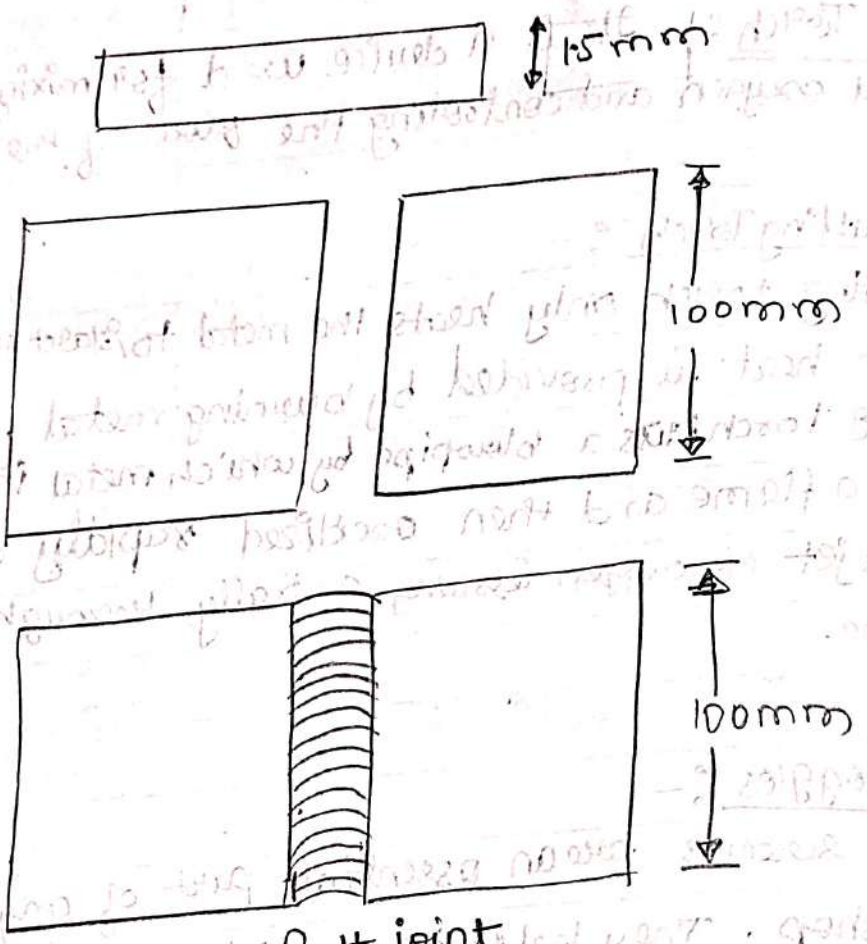
7. Metal cutting Torch :-
The cutting torch only heats the metal to start the process further heat is provided by burning metal.
cutting torch was a blowpipe by which metal is preheated with a flame and then oxidized rapidly and removed by a jet of oxygen issuing centrally through the preheating flame.

8. welding Goggles :-
welding screens are an essential part of any welding workshop. They help to protect welder from sparks & keep the area clean.

Process sheet

Sl.No.	Description	Tools
1.	Procure two pieces of mild steel & make flat edges	Flat vice, scale machine grinder
2.	Clean the welding area	wire brush
3.	place the pieces on the welding table turn on gas knobs and light the torch.	welding Table, gas lighter, welding torch, gas cylinder
4.	Turn on the oxygen knob so that a neutral flame can be obtained for welding.	welding torch, gas cylinder

Teacher's Signature : .....



Butt joint

Observation Table

welding material :- Mild steel

Thickness of material :- 2mm

Torch tip size :- 0.5mm

welding technique :- rightward

Flame type :- neutral

Date .....

Expt. No. ..... Page No. 29

Sl No	Descriptions	Tools
5.	Hold the welding torch in one hand and welding rod in other.	welding torch, welding rod
6.	Heat the job at the corners & make the tack weld on both sides.	welding rod, torch, goggles.
7.	Start the job from one end & complete it on other end.	welding rod, welding torch.
8.	Inspect the weld, reweld if necessary.	wire brush, hammer

Precautions:-

1. Before welding equipment is used, it is very important to make sure that it is properly assembled.
2. Check up gas pressure as per tip size.
3. Select proper tip size and probable welding rod.
4. Close the torch valves when welding is not in progress.
5. Clean the material before welding
6. Material must be heated before welding.

Q. & A.

Q1. Describe the use of types of gases in gas welding.

Ans ▶ The common mixture of gases used in gas welding are oxygen and acetylene, oxygen and hydrogen, oxygen and natural gas.

Teacher's Signature : .....

Fig. Leftward welding

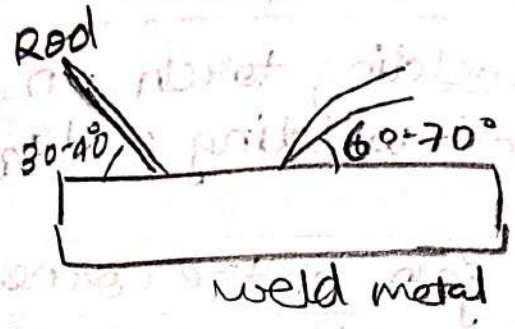
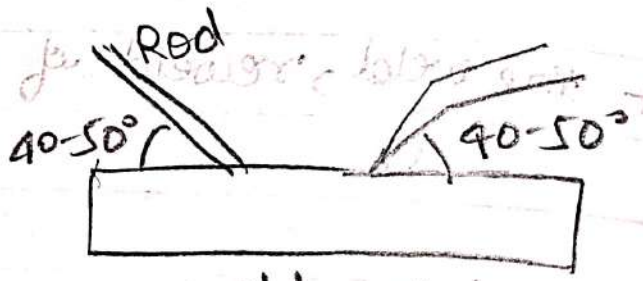


Fig. Rightward welding



Date .....

Expt. No. .....

Page No. 30

Q.2. what is right hand and left hand welding in gas welding.

Ans → In leftward welding, the rod precedes the nozzle tip in the direction in which weld is being made and tip is also pointed in same direction.
In rightward welding, the nozzle tip precedes the rod in the direction of travel and is pointed back at the motion puddle and complete weld.

Q.3. what is the colour code for different gas cylinder?

Ans → The oxygen containing cylinder is black or blue in colour, whereas the fuel gas containing cylinder is maroon or red in colour.

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Teacher's Signature : 10/11/23

Experiment-I

Fitting Tools and Measuring Instruments

Objective : To study various tools used and operations performed in fitting (like marking, chipping, hack sawing, filing, drilling etc.).

Job Assignment :- To make sketches of tools & instruments commonly used in fitting shop.

Theory :-

(Introduction)

Fitting is the process of finishing the job using different hand tools to obtain the desire surface finish & accuracy.

Tools & Instruments :-

1. **Holding Tools** : Bench vice, leg vice, hand vice, pipe vice, pin vice
2. **Marking Tools & Measuring Tools** : Surface plate, scribers, try square, callipers, dividers, punch (a) Prick & (b) centre punch, angle plate, steel rule,
3. **Cutting Tools** : Hack saw, chisels, files, scrapers, Taps, Tap wrench, Dies & Die holders
4. **Striking Tools** : Ball peen Hammer, Cross-Peen Hammer, Straight Peen Hammer,
5. **Miscellaneous Tools** : Screw Driver, Spanner.

Teacher's Signature : .....

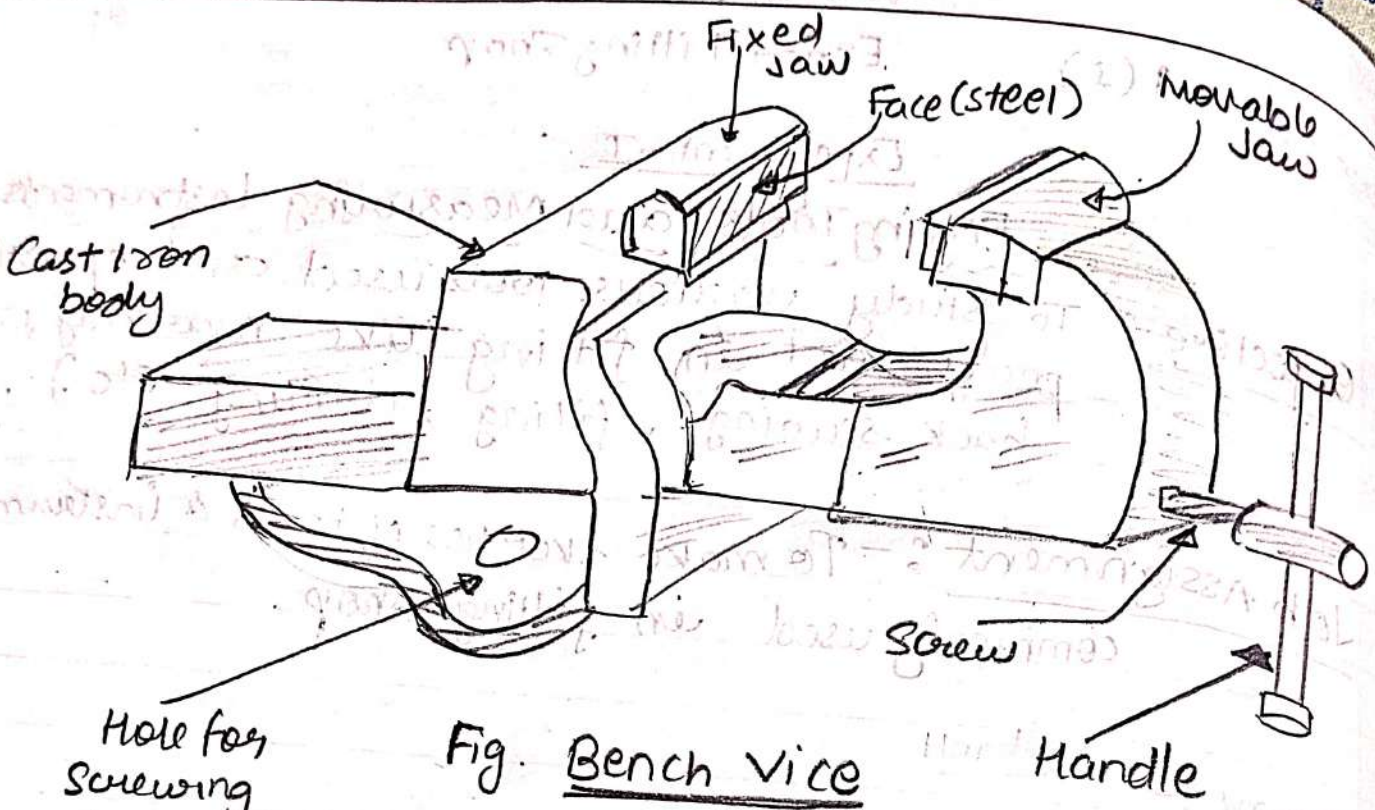

Fig. Bench Vice

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(1) Holding Tools :-

(a) Bench vice : It is the most commonly used holding device, called Engineer's parallel Jaw bench vice or fitter's Vice. It essentially consists of a cast iron body, a fixed jaw & a movable jaw of cast steel, a handle, a square threaded screw & nut made of mild steel. The size of the vice is designated by the width of jaw which is from 80 to 140 mm & its maximum opening is from 95 to 180 mm.

(b) Leg Vice : It is secured firmly at bench top. Its leg is attached to the leg of the bench and its end goes into the hole made at the floor. It is used for hammering, chipping & cutting in the fitting shop

(c) Hand vice : It is used for gripping small object. It consists of two steel legs hinged together at the bottom two steel jaws at the top of vice. The vice is used for gripping the small object such as key, rivets screws, etc. which are too small to be gripped in a bench vice.

(d) Pipe Vice : It is used for holding the round section, pipes, tubes etc. It has got a vertical movable screw which moves up & down while tightening & loosening.

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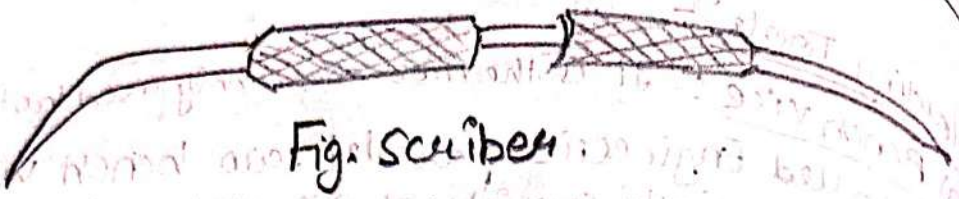

Fig. Scriber

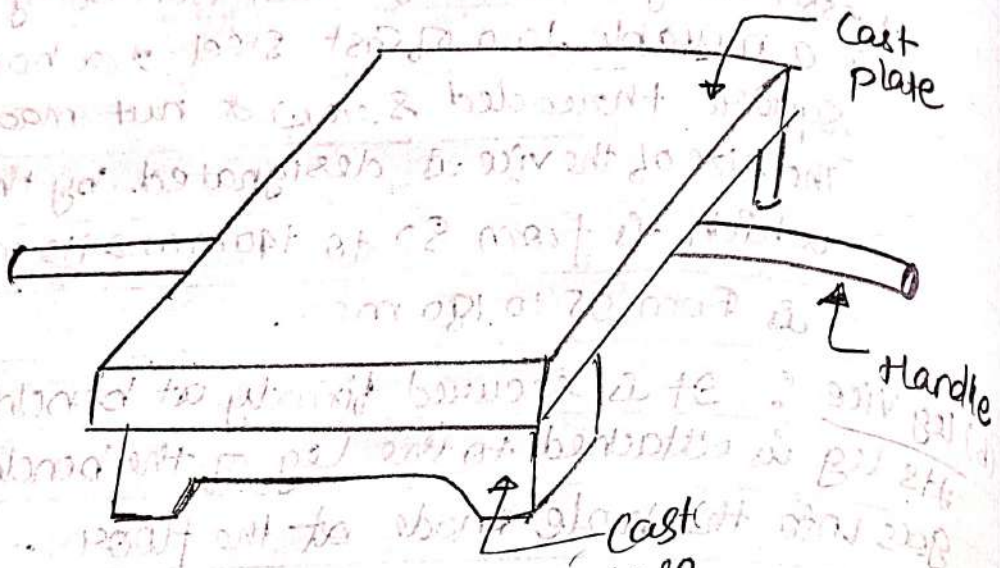

Fig. Surface Plate

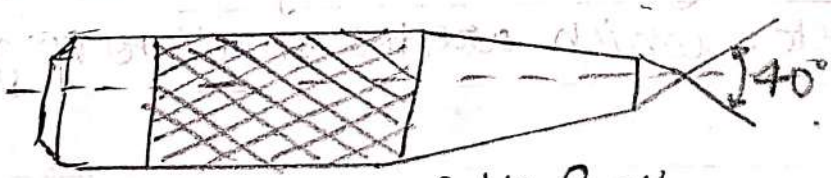

Fig. Brick Punch

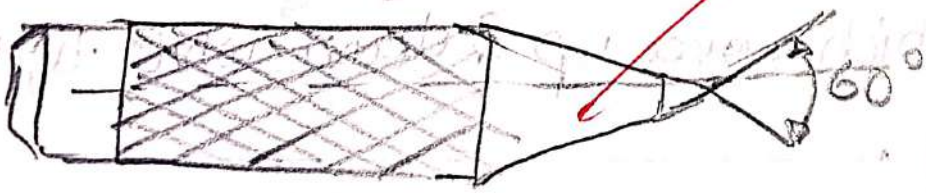

Fig. Centre Punch

② Marking Tools & Measuring Tools :-

(a) Scribers : Scribers are pieces of hardened & tempered high carbon steel. It has two pointed ends. It is a slender steel tool, used to scribe or mark lines on metal work pieces. The bent end is used for marking lines where the straight end can't reach.

b) Surface Plate : The surface plates are made of grey cast iron. It is used for testing the flatness of job itself & is also used for marking out the job. This is used for small pieces of job while marking-out table is used for larger jobs. In marking process it is used as a base for V-block & angle plate etc.

(C) Punch : A punch is used in a bench work for marking out work, locating centers, etc in a more permanent manner than that of scriber. Usually two types of punches are used in fitting shop :-

(i) Prick Punch :- It consists of a tapered portion sharply pointed having the angle of 40°. It is used for marking small marks on the line.

(ii) centre Punch :- It is used for making the prick punch hole larger. Usually, the centres for drilling are marked using centre punch. Its angle at the tip is usually 60 degree.

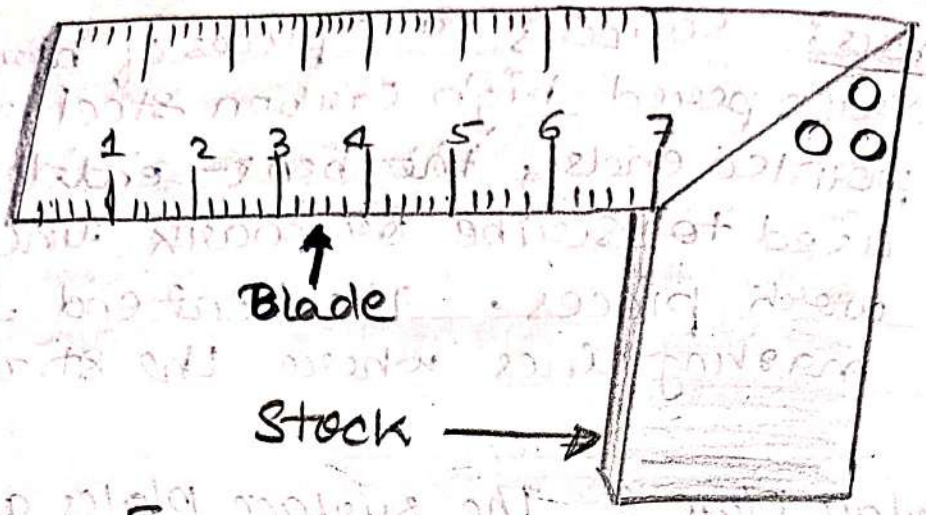

Fig. Try Square

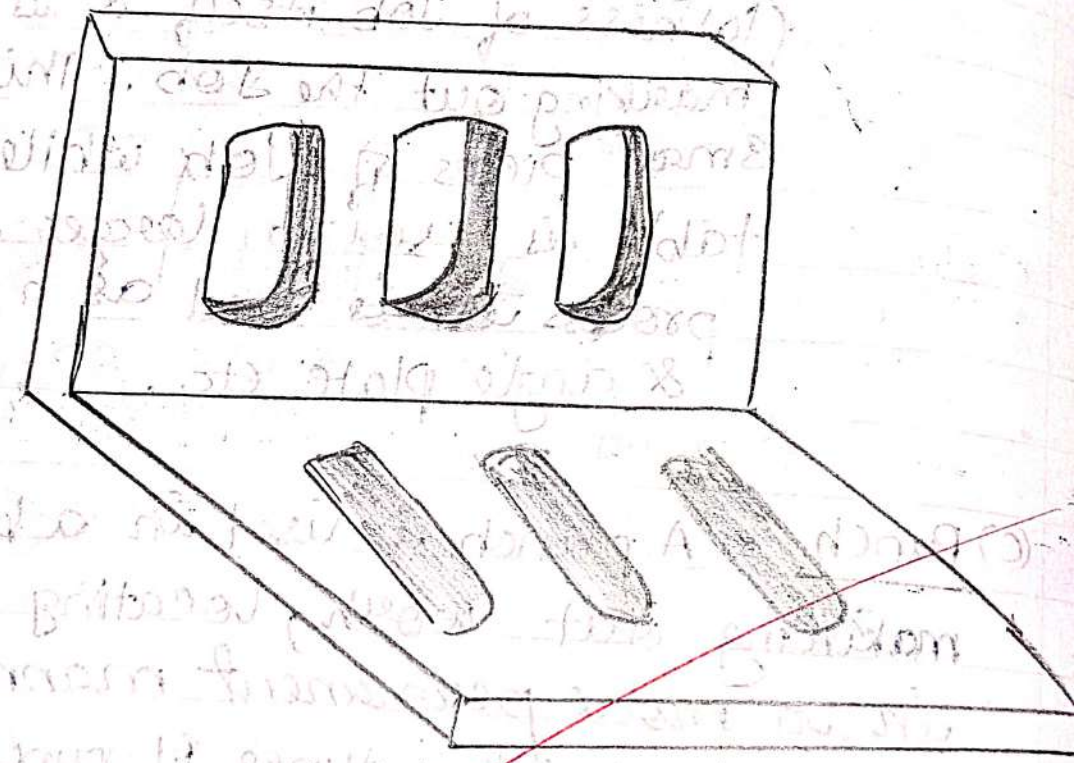

Fig. Angle Plate

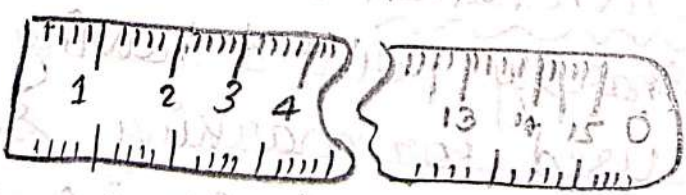

Fig- Steel Rule.

(d) V-block : It is steel block having a V-shaped groove. It is used for marking or working on round end objects, so that the objects can't move side-wise & also does not rotate easily.

(e) Try Square : It is measuring & marking tool for 90° angle. In practice, it is used for checking the squareness of many types of small works when extreme accuracy is not required. The blade of the try square is made of hardened steel & the stock of cast iron or steel. The size of the Try square is specified by the length of the blade.

(f) Angle Plate : It has two mutually perpendicular surface & several holes on the surface. It is used for marking the jobs when they are placed in vertical position. The angle plate is placed over the surface plate & the job to be marked is placed in vertical position on the angle plate and is held firmly in this position using clamps & bolts.

(g) Steel Rule : It consists of a hardened steel strip. having line graduation etched or ingraved in it they are usually 150 mm or 300mm long & is used to take line measurement to accuracy of 1mm or 0.5mm. This is marked in inches or milli-meters. The edges of steel rule should be protected from rough handling.

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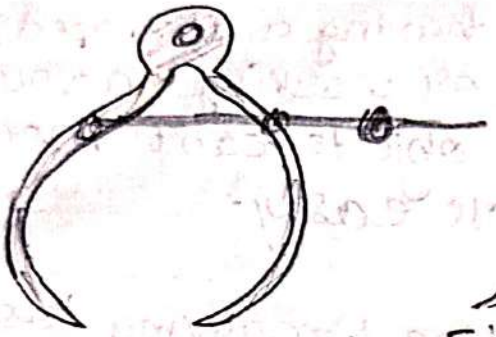

Fig. Outside Caliper

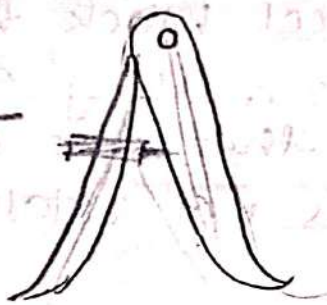

Fig. Inside Caliper

Fig. Divider

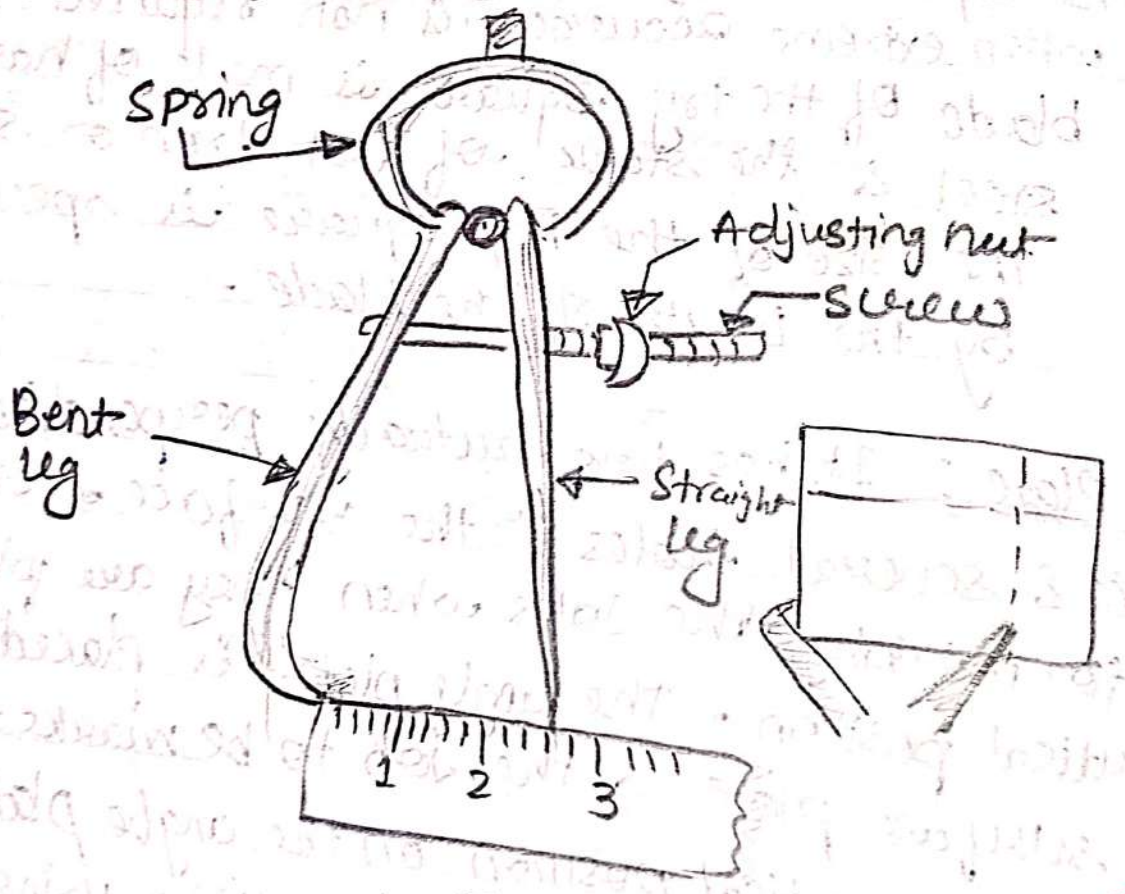

Fig. Jenny Caliper

(h) Calipers : Calipers are the device used for measuring & transferring the inside or outside dimensions of components.

Types of calipers used : (i) Outside calipers (measures outer diameter)
(ii) Inside calipers (measures inner diameter)
(iii) Jenny caliper.

Jenny Caliper (Hermaphrodite or odd-leg caliper)
This is used for marking parallel lines from a finished edge & also for locating the centre of round bars. It has one leg pointed like a divider & other leg bent like a caliper. It is specified by the length of the leg up to the hinge point.

(i) Dividers : It is basically similar to calipers except that its legs are kept straight & pointed at the measuring edge. This is used for marking circles arcs laying out perpendicular lines, by setting lines. It is made of case-hardened mild steel or hardened and tempered low carbon steel. Its size is specified by the length of the leg.

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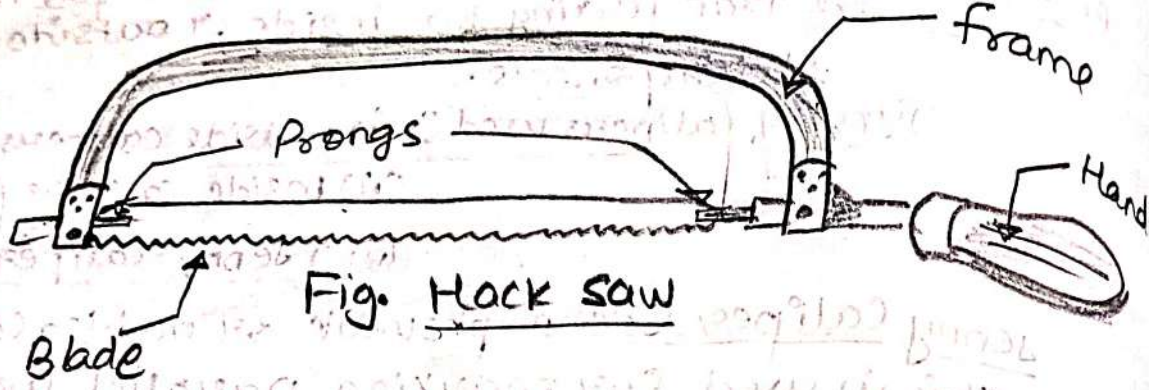
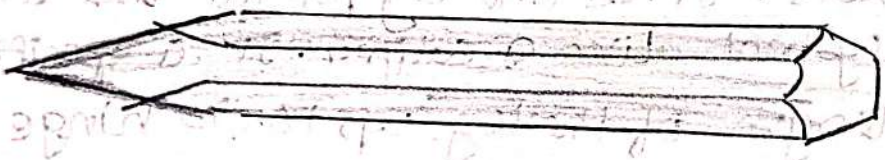


Fig. Hack saw



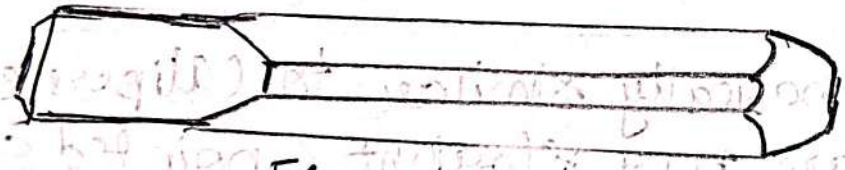


Fig. Flat chisel

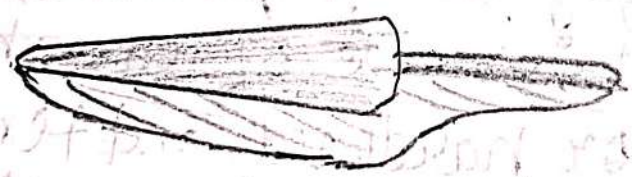


Fig. Triangular scraper

Fig. Half Round scrapper

③ Cutting Tools :-

(a) Hack Saw :- The Hack saw is used for cutting metal by hand. It consists of a frame which holds a thin blade, firmly in position. Hacksaw blade is specified by number of teeth for centimeter. Hacksaw blades have a number of teeth ranging from 5 to 15 per cm. The teeth of blades are staggered, these make slots wider than the blade thickness, preventing the blade from Jamming. Blades are made of high carbon steel or alloy steel.

(b) Chisels :- Chisels are made of carbon steel. They are used for chipping operations ie. used for removing surplus metal or for cutting thin sheets. Chisels are annealed, hardened & tempered to produce a tough shank & hard cutting edge. Annealing relieves the stresses in a metal. The cutting angle of Chisel for general purpose is about 60°.

(c) Scrapers :- They are used for scraping which is also a finishing tool of fitting shop. They contain very hard cutting edge & are made of forged steel. The cutting edge is hardened & tempered to make it able to scrap the material and to make the surface of the job plane.

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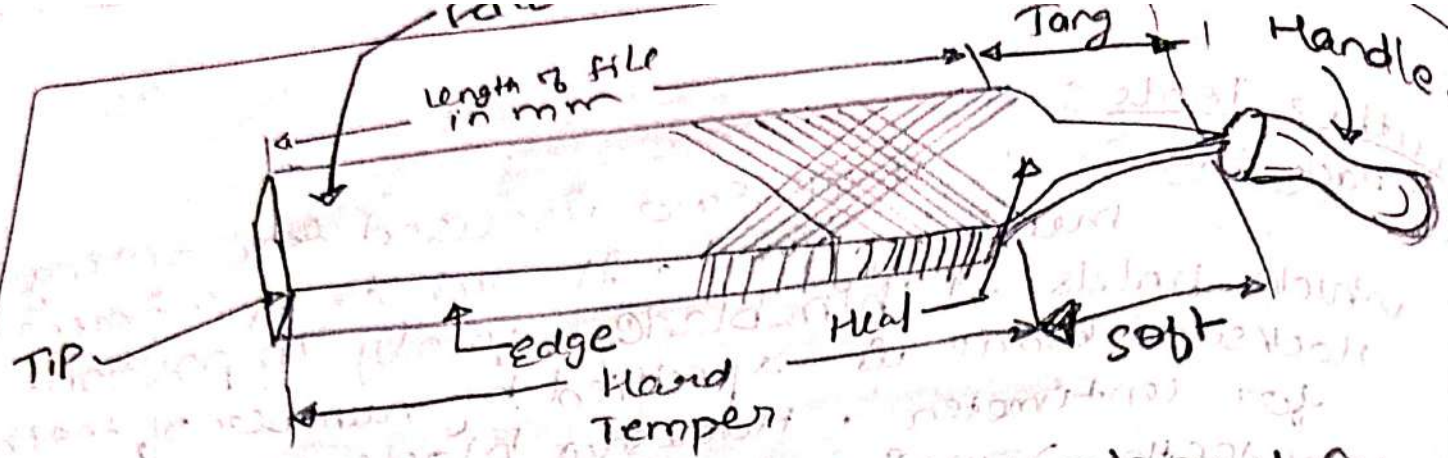
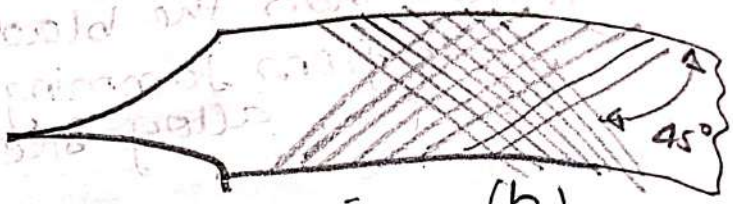


Fig. Parts of a hand file.

(a)

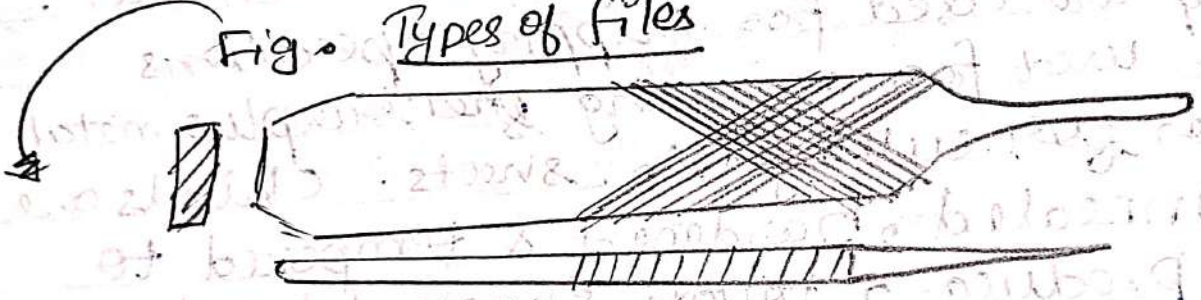
Fig Single cut file



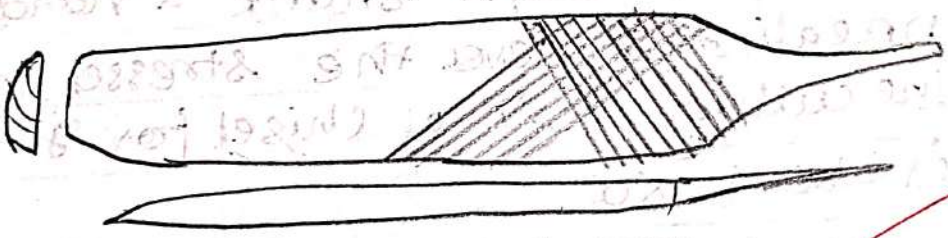
(b)

Fig: Double cut fi

Fig. Types of files

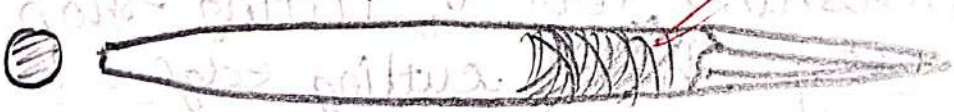


Flat Bast file

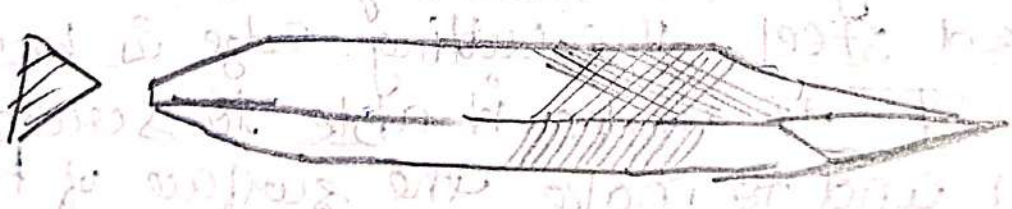


Half Round File

Square file



Round File



Triangular file

Knife file

Round second cut file

(d) files :- Filing is one of the methods of removing small amounts of material from the surface of a metal part. A file is hardened steel tool having small parallel rows of cutting edges or teeth on its surfaces. On the faces, the teeth are usually diagonal to the edge. One end of the file is shaped to fit into a wooden handle. The handle file is parallel in width & tapering slightly in thickness, towards the tip. It is provided with double cut teeth. On the faces, single cut on one edge & no teeth on other edge which is known as a safe edge.

Files are classified according to their shape, cutting teeth & pitch or grade of the teeth.

(e) Taps & Tap Wrenches :-

A tap is a hardened steel tool, used for cutting internal thread in a drill hole. Hand taps are usually supplied in sets of three in each diameter and thread size. Each set consists of a tapper tap, intermediate tap & plug or bottoming tap. Taps are made of high carbon steel or high speed steel (fig. in next Page).

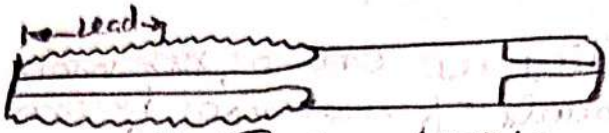


Fig. Taper or First

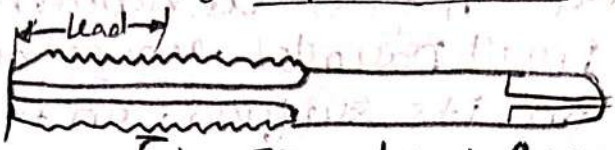


Fig. Second or Intermediate

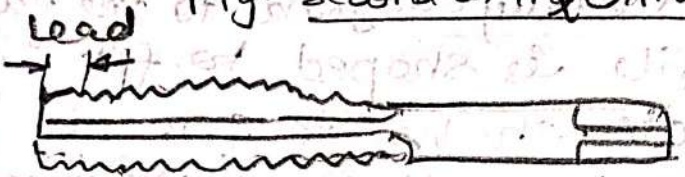


Fig. Bottoming or Plug

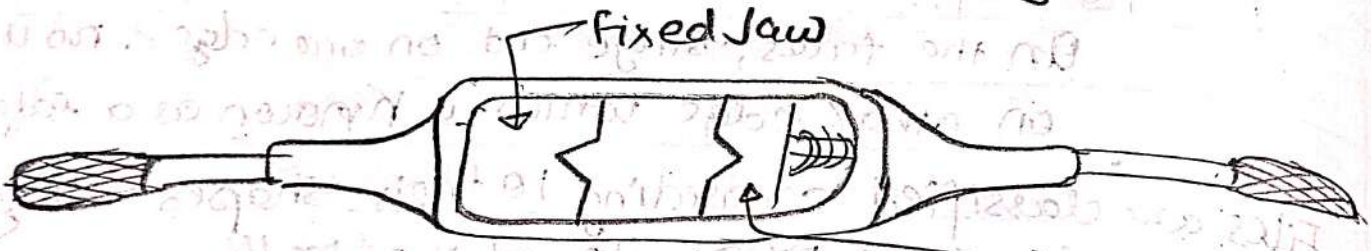


Fig. Tap wrench

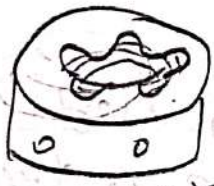


Fig. Solid Die

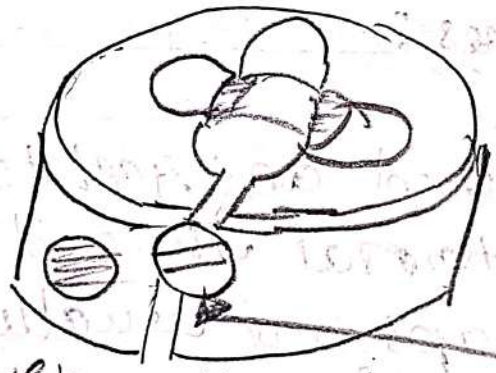


Fig. Adjustable Split Die

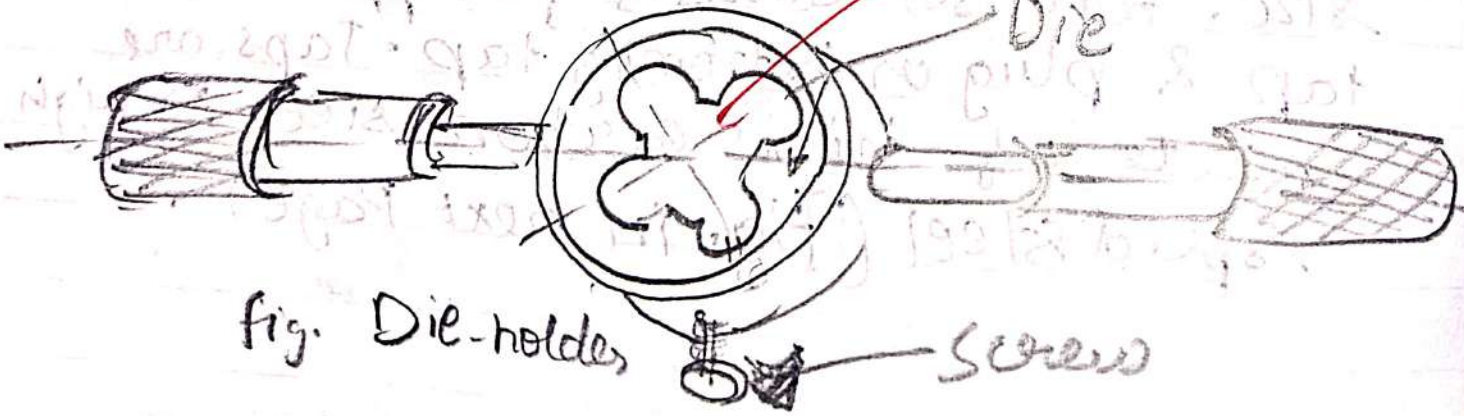


Fig. Die-holder

(b) Dies & Die-holders :-

Dies are the cutting tools used for making external threads. Dies are made either solid or split type. They are fixed in a die-stock for holding & adjusting the die gap. They are made of steel or High carbon steel.

(4) Striking Tools (For fig Next page)

(a) Ball Peen Hammer : It is named upon its shape & material & specified by its weight. It has a flat face which is used for hammering nuts & ball end is used for riveting.

(b) Cross-Peen Hammer : It is similar to ball peen hammer, except the shape of the peen. This is used for chipping riveting, bending & stretching metals & hammering inside the curves & shoulders

(c) Straight-peen Hammer : This is similar to cross-peen hammer but its peen is in line with the hammer handle. It is used for swaging, riveting in restricted places & stretching metals

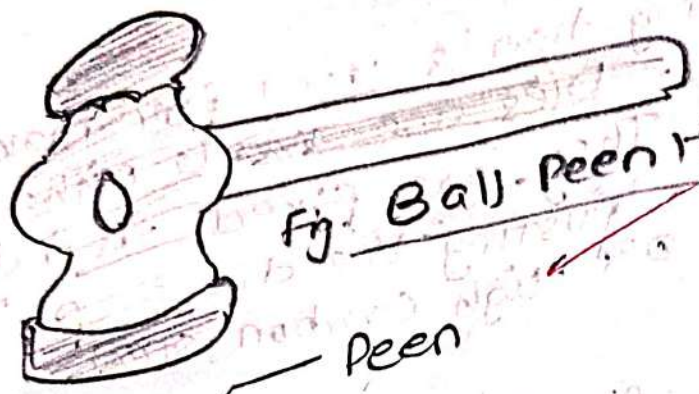


Fig. Ball-Peen Hammer

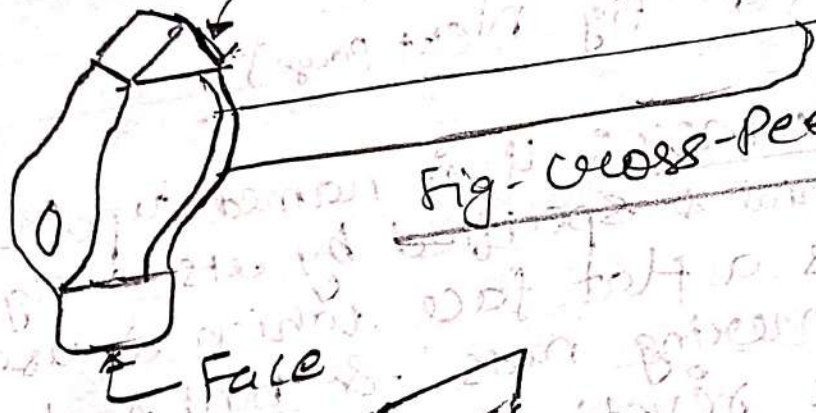


Fig- Cross-Peen Hammer

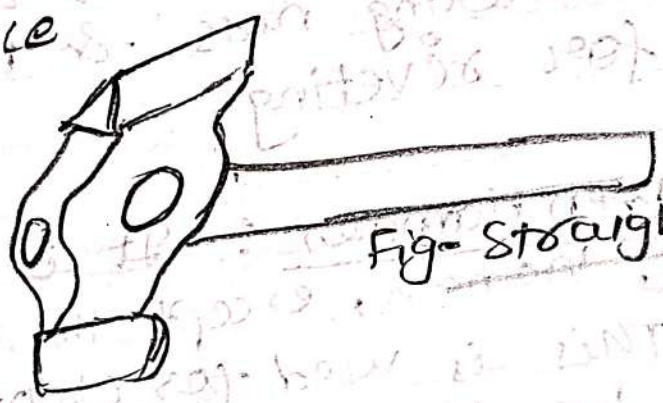


Fig- Straight Peen Hamm

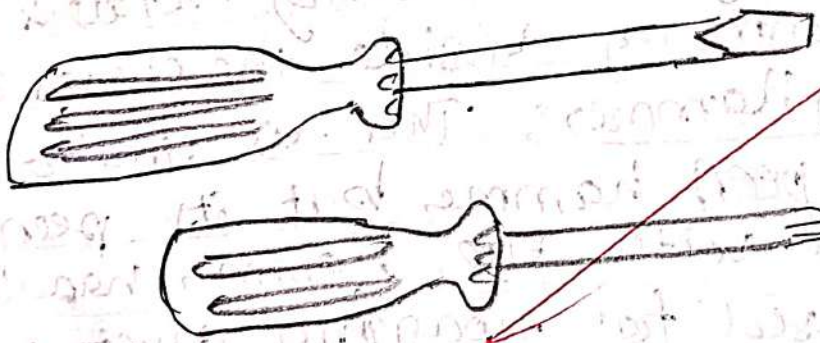


Fig. Screw Drive

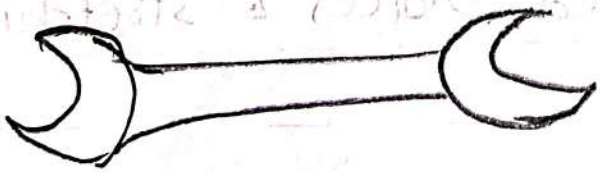


Fig- Doubled ended Spanner

Expt. No.....

Date.....

Page No. 39

⑤ Miscellaneous Tools :

(a) Screw Drivers :- It is designed to turn screws. The grinding of tip to the correct shape is very important. Blade is made of steel & available in different lengths & diameters.

(b) Spanner :- A spanner or wrench is a tool for turning nuts and bolts. It is usually made of forged steel. There are many kinds of spanners. They are named according to the application. The size of spanner denotes the size of bolt on which it can work.

Fitting operations

① Marking :- Measurement is performed on the job by measuring instrument & marking is done by scribber.

② Chipping :- Material is removed with the help of chisels.

③ Hack-sawing :- This operation is required to cut the metal in different sizes & shapes by hacksaw

④ Filing :- This operation is performed with the help of Files, pressure should be exerted in the forward stroke & backward stroke is ideal.

Teacher's Signature : .....

Date .....

Expt. No. .....

⑤ Drilling :- This is done to produce holes with the help of drills. It is done on a drilling machine & a job is held in a machine vice. Drill is fixed on the drilling machine.

⑥ Taping & Dieing :-

Taping is done to cut internal threads with the help of tap & tap holders. Dieing is done to cut external threads with the help of die & die holders.

Precaution

① Loose clothing should be avoided.
② Tools should be placed in their respective places after proper cleaning.
③ one must wear shoes while working in a fitting shop
④ Sharp edge of the cutting tools should be covered when they are not in use.
⑤ one must always wear goggles while chipping metal & while grinding edge on tool.

Teacher's Signature : .....

Expt. No. ..... Date .....

Page No. 41

Question & Answers

1. What do you mean by fitting?

Ans => Working on components with hand tools & instruments mostly on work benches which includes marking, filing, sawing, scraping, drilling, tapping grinding etc are called fitting.

2. Name various fitting operations?

Ans -

(i) Marking out	(vi) Grinding
(ii) Sawing	(vii) Drilling
(iii) Chipping	(viii) Reaming
(iv) Filing	(ix) Tapping
(v) Scraping	(x) Dieing.

3. How do you select shape, size and grade of file.

Ans The coarser the cut of the file, the rougher the finish of the work. Therefore the size of the file and the grade of its cut must be taken into account against the amount of stock to be removed and the fineness of finish that is required.

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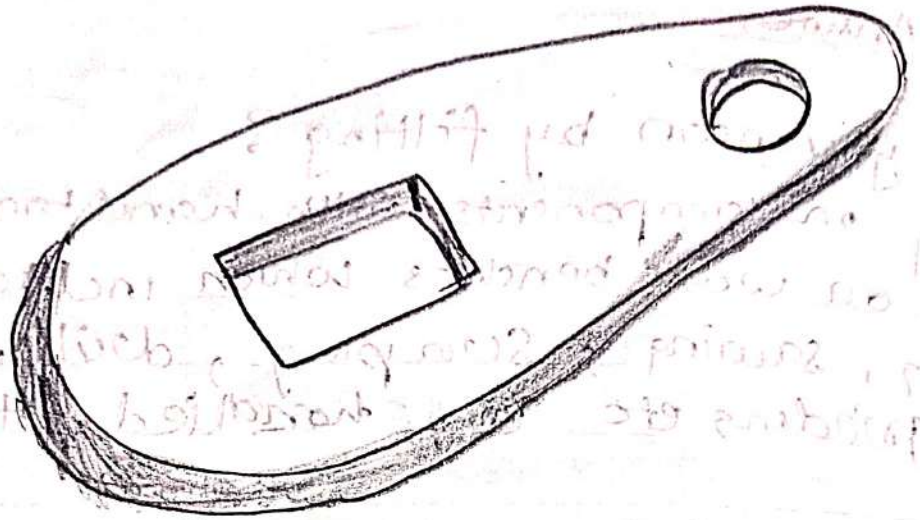

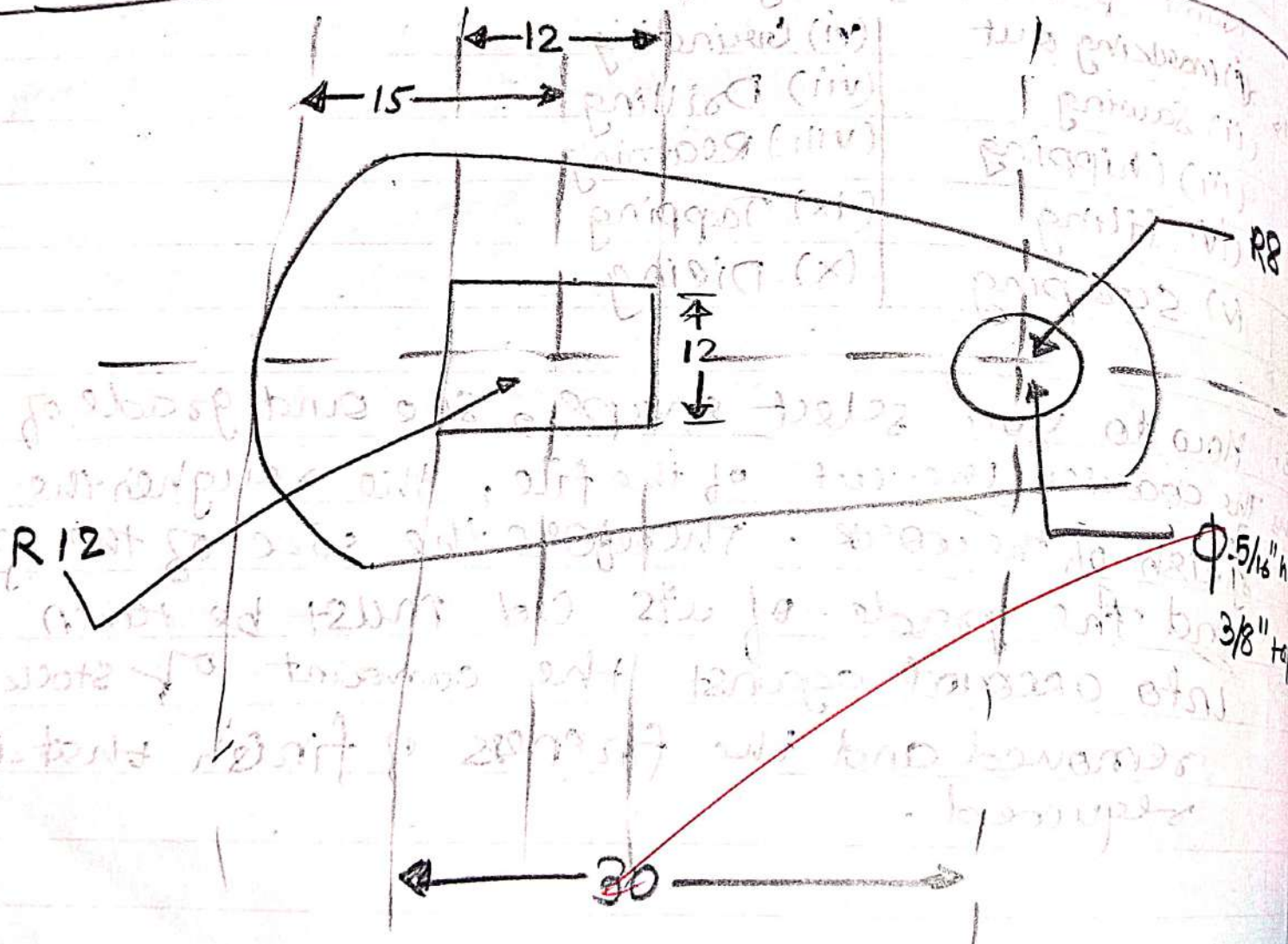

* All dimensions in mm

Experiment - II

Fitting & Assembly Practices

Aim :- To make a job clamping plate as per given drawing by fitting operations & to check for its assembly with a given component.

Tools & Instruments Required :- Try square, 200gm Hammer, dot punch, scribber, steel rule, Jenny Calipers, hack saw, rough flat file, round file, drill & square file.

Process - sheet

Sl. No.	Description	Tools or Instruments used
1.	Given Job is to be checked for dimensions.	Steel rule.
2.	All the edges are checked for the curve	Try square.
3.	Filing is done to make (45 x 30) & thickness (1mm)	rough flat file
4.	Note the portion to be removed & mark.	Scribber, Jenny caliper
5.	Punching is done along the line	Dot punch.
6.	Excess material is cut with hack saw to make it a correct fitting.	Hack saw
7.	For inside Radius (R-8) excess material is removed by hack saw & then filing is done by round file.	Hack saw, round file.
8.	For square portion excess material is removed by hack saw & then filing is done by square file.	Hack saw square file.

Teacher's Signature : _____

Expt. No. .....

Date .....

Page No. 43

Sl No.	Description	Tools or equipments used
9.	Using a drill fit & bench drilling machine job is drilled as per the figure.	drilling machine
10.	Final burrs are removed by filing surface of the fitting job.	Flat file.

Precautions:

(i) keep proper discipline in the fitting shop
(ii) Do not play with tools
(iii) while using hack saw make sure its teeth are sharp & in forward positions.
(iv) While using chisel, direction should be away from working person.

Q. Questions & Answers.

Q-1. How drill sizes are calculated for tapping

Soln:- Before a tap is used for cutting internal threads a hole is to be drilled. The diameter of hole should be such that it should have sufficient material in the hole for tap to cut the thread.

Tap drill size is given by

d = Major diameter - Pitch.

Here $\boxed{d = X \times \frac{7}{8} - \frac{1}{32}}$ (as per the tool we used.)

since tape size $(x) = \frac{3}{8}$

$\therefore$ drill size $= d = \frac{3}{8} \times \frac{7}{8} - \frac{1}{32} = \frac{19}{64}$ "

Teacher's Signature : .....

Date .....

Expt. No. ..... Page No. 44

2. What is draw filing?

Ans → It is a technique used for producing smooth square edges, particularly on pieces of metal. It is method for quick removal of material in which user holds the file handle in the left hand & tip in the right hand. material is removed by applying downward force of the file on material while pulling the file towards the user.

3. What is scraping? what is its purpose?

Ans → scraping is a technique used for removing small scrapes or chips (metal in its relaxed state) to make the metal surface incredibly flat. It gives fine finish to the largely rough-finished in order to smooth them.

4. What do you understand by fits & tolerance?

Ans → The relationship existing between two parts which are to be assembled with respect to the difference on their sizes before assembly is called a fit. Tolerance is defined as the total permissible variation of size. It is the difference between maximum limit & minimum limit of size.

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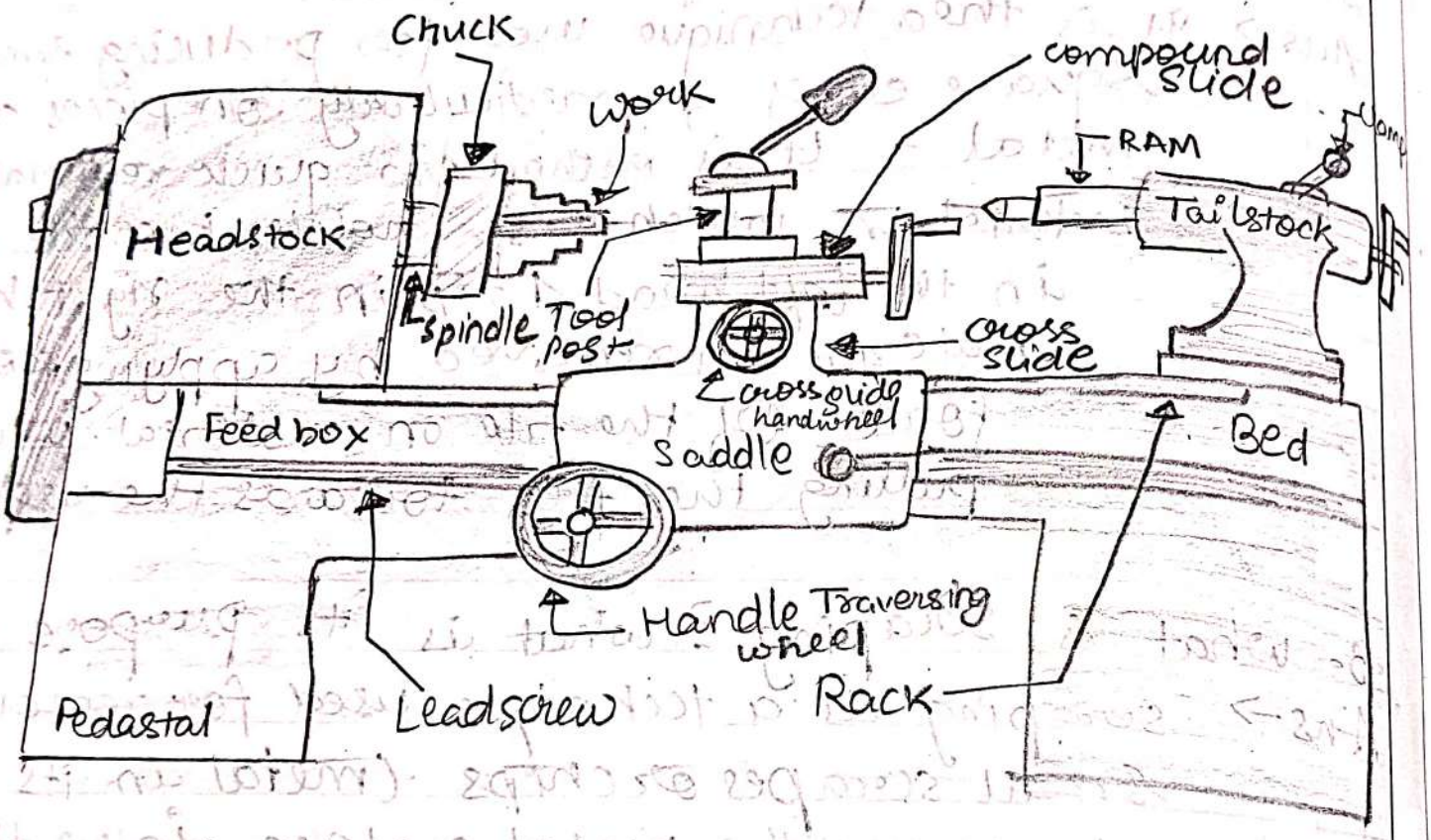

Fig. Centre Lathe

Experiment - I

Centre Lathe Machine.

Objective of Experiment : To study lathe machine & machine a given job as per given drawing.

Job Assignment : To machine a given job as per drawing.

Theory :-

Machine tools are kind of machines on which metal cutting or metal forming processes are carried out. The functions of machine tools are holding the workpiece, holding the tool, moving the tool or workpiece or both relative to each other & supply energy required to cause metal cutting.

Tools & Equipments :

Centre Lathe Machine was invented in 1970. Even today, though this lathe operates with the help of motor. (known as Engine Lathe). Various attachments and accessories are used with the lathe machine.

The worker working on lathe machine i.e. the operator of lathe is called as Turner b'coz on lathe machine many operations such as plain turning, facing, taper turning, drilling, reaming, tapping, boring knurling screw cutting etc are carried out

Teacher's Signature : .....

Date .....

Expt. No. .....

Page No. 96

components of centre lathe machine & their function :-

1. **Bed :-** The bed of lathe machine is the base on which all other parts of lathe are mounted. It is massive & rigid single piece casting made of cast iron or steel to support other active parts of lathe.

On left end of the bed, headstock of lathe machine is located while on right side tailstock is located. The carriage of the machine rests over the bed & slides on it. On top of bed there are two sets of guideways - innerways & outerways. The innerways provide gliding surfaces for the tailstock &. the outerways for the carriage. The guideways of the lathe bed may be flat & inverted V shape.

2. **Head stock**

The main function of headstock is to transmit power to the different parts of a lathe. It comprises of the headstock casting to accommodate all the parts within it including gear train arrangement. It contains speed changing gears & revolving driving spindle to which anyone of several types of work holders is attached

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3. Gear box : Inside the headstock, providing multiple speeds with a geometric ratio by moving levers

4. Spindle : Hole through the headstock to which bar stock can be fed, which allows shafts that are upto 2 times the length between lathe centers to be worked on one end at a time.

5. Chuck : 3-Jaw (self-centering) or 4-Jaw (independent) to clamp part being machined. Chuck allows the mounting of difficult workpieces that are not round, square or triangular

6. Tailstock : Fits on the inner ways of the bed & can slide towards any position the headstock to fit the length of the work piece. An optional taper turning attachment would be mounted to it.

7. Carriage : Moves on outer ways, used for mounting and moving most the cutting tools

8. Cross slide : Mounted on the traverse slide of the carriage & uses a hand wheel to feed tools into the workpiece.

9. Tool Post : To mount tool holders in which the cutting bits are clamped.

10. Compound Rest : Mounted to the cross slide, it pivots around the tool post.

11. Apron : Attached to the front of the carriage it has the mechanism and controls for moving the carriage & cross-slide.

12. Lead screw : For cutting threads.

Lathe operations :- (1) Straight or Plain Turning (2) Facing (3) shoulder turning (4) chamfering (5) Knurling (6) forming (7) Parting off (grooving) (8) Spinning (9) Eccentric turning (10) Drilling (11) Boring (12) centering (13) Thread cutting (14) Taper Turning.

Facing : Facing is the machining of the end surfaces & shoulders of a workpiece. In addition to squaring the ends of the work, facing provides a way to cut work to length accurately. Generally only light cuts are required since the work will have been cut to approximate length or rough machined to the shoulder.

Teacher's Signature : .....

Date .....

Expt. No. .....

Turning: Turning is the machining of excess stock from periphery of the workpiece to reduce the diameter. In most lathe machining operations requiring removal of large amounts of stock, a series of roughing cuts is taken to remove most of the excess stock. Then a finishing cut is taken to accurately size the workpiece

Parting: A parting tool is deeper & narrower than a turning tool. It is designed for making narrow grooves and for cutting off parts.

Drilling: A Lathe can also be used to drill holes accurately concentric with the centerline of a cylindrical part.

Boring: Boring is an operation in which a hole is enlarged with a single point cutting tool.

Moore Tools

Vernier Calliper: used to measure length and diameter of workpiece.

Steel Ruler: used to measer size as clamped by VC

Teacher's Signature : .....

Date .....

Expt. No. .....

Page No. 50

Cutting speed : Rate of meters per min at which the surface of job moves past the cutting tool. Machining at a correct cutting speed is highly important for good tool life & efficient cutting. Too slow cutting speeds reduce productivity & increase manufacturing costs.

Factors affecting cutting speed :-

(i) Kind of material being cut
(ii) cutting tool material
(iii) Shape of cutting tool.
(iv) Rigidity of machine tool & job piece.
(v) Type of cutting fluid being used

Cutting speed is speed at which metal is removed by tool from workpiece. Cutting speed = $\frac{\pi DN}{1000}$ m/min

D: Diameter of job
N: Speed in RPM.

Feed : It is the distance the tool advances for every revolution of the workpiece. It is expressed in mm/r

Calculation :-

$$\tan\alpha = \frac{D-d}{L}$$

$$\text{angle} = \frac{D-d}{L} \times \frac{144}{5}$$

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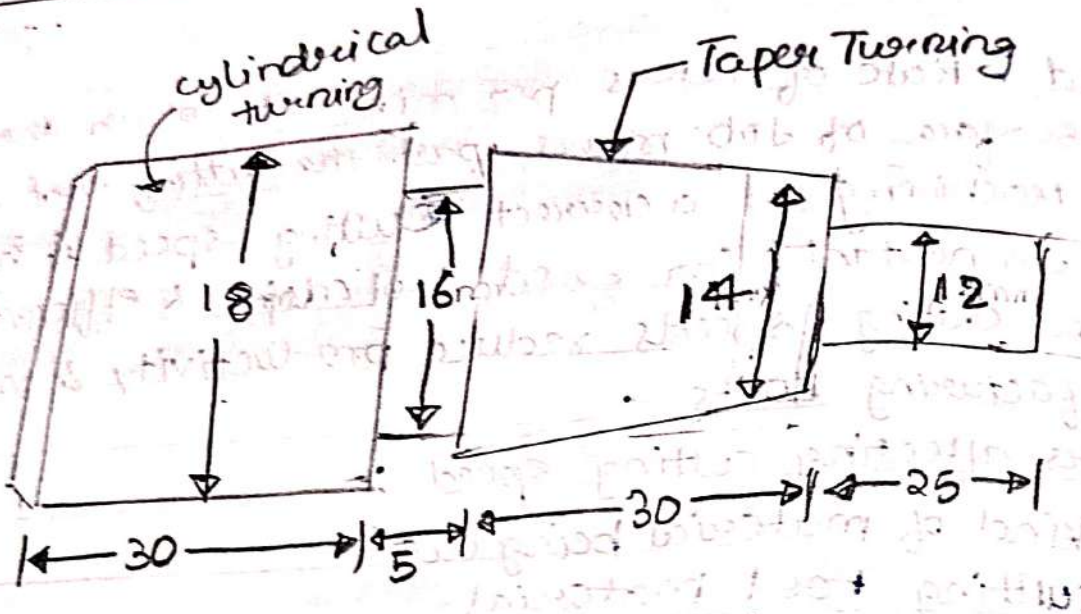

Fig: Taper Turning of Job

Date .....

Expt. No. .....

Process- sheet :-

1) Check the dimensions of the raw material supplied according to the drawing.
2) Face the end of the Job & drill a counter sink.
3) The workpiece is fixed in the Chunk of lathe machine and is tightened using chuck key.
4) Now the single point cutting tool is fixed in the tool post using tool post key.
5) Length of 90 mm is marked on workpiece with the help of single point cutting tool.
6) The turning operation is started and 20 mm diameter is obtained throughout the workpiece.
7) Then 14 mm diameter is established in 25 mm length of the workpiece.
8) Then 18 mm diameter is established in 5mm length below taper area.
9) Then the compound slide is set to required taper angle of 3.84° which is found by formula

$$\text{angle} = \frac{D-d}{l} \times \frac{144}{5}$$

D : big Diameter
d : small Diameter
l : length of taper turn

10) The tool is now moved for tapering by the help of cross slide. This process is repeated through cross slide by axial feed till the diameter in the rod end is reduced to 20 mm.

Teacher's Signature : .....

Date .....

Expt. No. .....

Page No. 5

Precautions :-

1) Round bar (work-piece) must be tightly secured from chuck using chuck key.
2) Tool must be tightly secured using tool post key.
3) It was ensured that the chuck key was removed before switching on the machine
4) During tapering longitudinal feed to be given to the tool by compound slide only.

Q. **Questions & Answers**

Q. 1. What is turning ?

Ans → In this operation, circular section are produced by moving the workpiece against the cutting tool edge of the turning tool.

Q. 2. Define cutting speed, feed and depth of cut on a centre lathe.

Ans → **Cutting speed :** The speed at which metal is removed by tool from the workpiece is called 'cutting speed.

Cutting speed = $(\pi DN/1000)$ mm/min D: Diameter of job, N: speed in RPM

Feed : The distance (in mm) travelled by the tool for one revolution of the workpiece during turning is called feed

Depth of cut : Depth of cut is defined as the distance through which the cutting tool is plunged into the workpiece surface.

Teacher's Signature : .....

3. How will you drill a hole in a Job on a latho Machine?

Sol^n :- The Job piece is held in a suitable device such as chuck or face peaks as a usual and the drill is held in a stock, after setting the work in proper position.

4. How is the size of lathe machine designated

Ans -> The size of a lathe machine is given by maximum diameter of swing & the main length of the bar.

5. Make a block diagram of centre lathe & explain the principal parts?

Ans -> The major component of lathe include bed, headstock, tailstock, carriage, lead screw.

1) The bed is the base or foundation of the lathe & support the weight of the carriage, headstock etc.

2) Headstock is the source of power for the work & the tool. It contains and supports the spindle and its driving mechanism

3) Tailstock is used to support one end of workpiece. or to hold various cutting tools and other elements.

4) The carriage is made up of apron, saddle, cross-slide It moves along bed between head stock & tail stock.

5) Lead screw is used for thread cutting.

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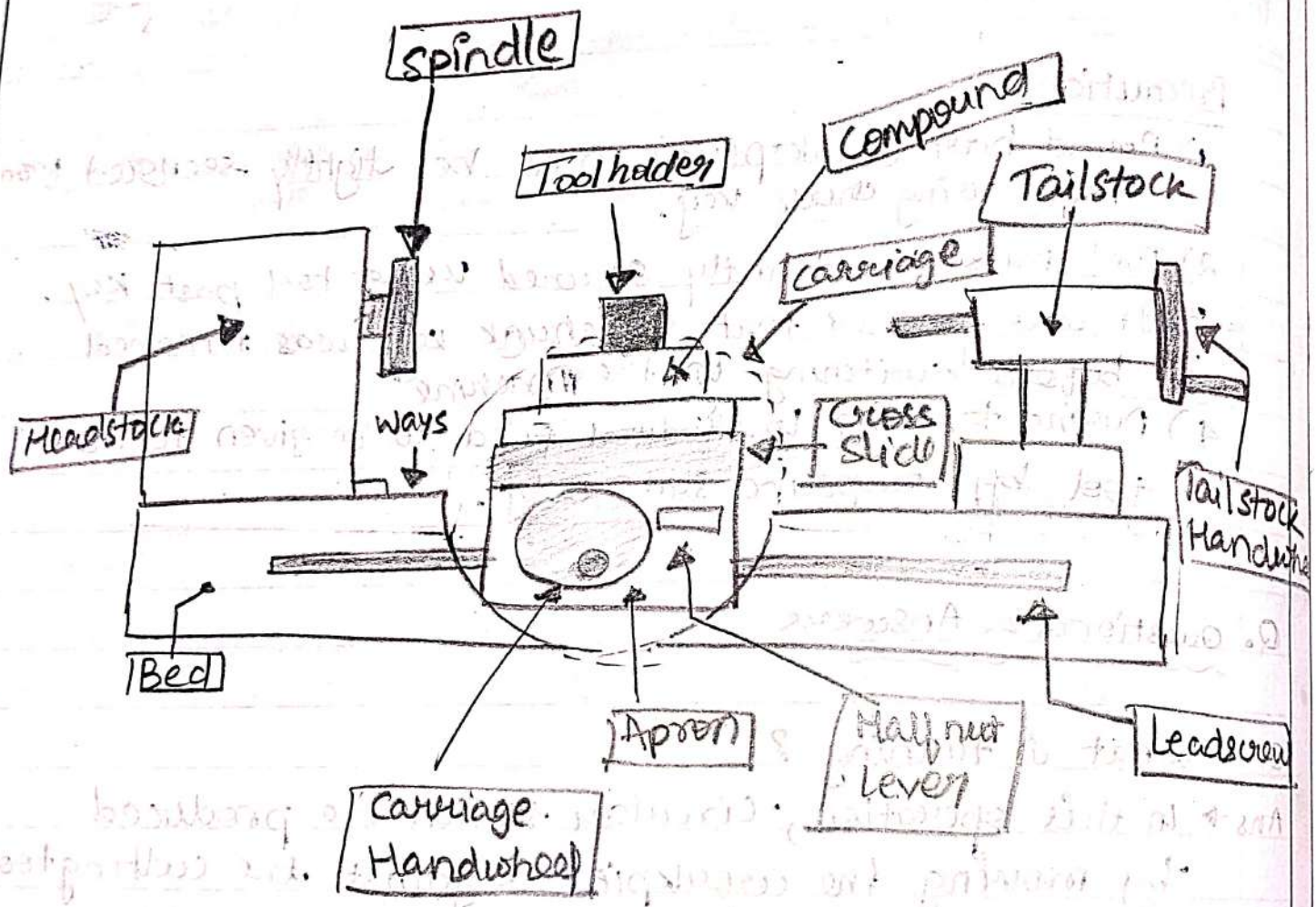

Fig. Block Diagram of centre Lathe.

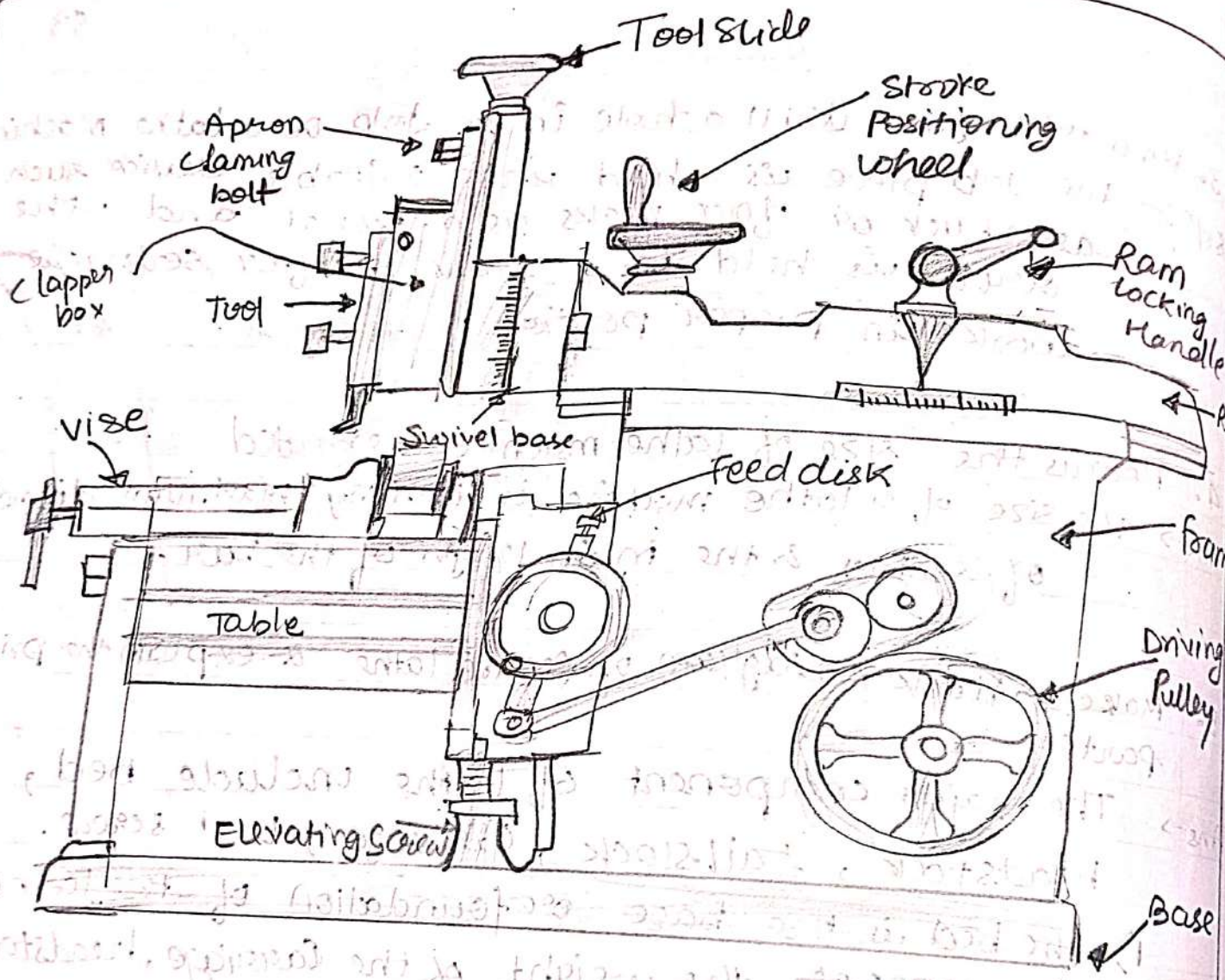

Fig. Shaper Machine

Experiment - II

Shaper Machine

Aim :- To study shaper machine and to machine a given job on shaper as per drawing.

Job Assignment : To machine a given job as per drawing

Theory :-

Shaper machine is a machine tool used primarily for producing a flat or plane surface which may be in a horizontal, a vertical or an angular plane. It is also used for making slots, grooves & keyways It is used for producing contours of concave/convex or a combination of these.

Working Principle :-

The job is rigidly fixed on the machine table The single point cutting tool held properly in the tool post is mounted on a reciprocating ram. The reciprocating motion of the ram is obtained by a quick return motion mechanism. As ram reciprocates, the tool cuts the material during its forward stroke. During return, there is no cutting action & this stroke is called idle stroke.

Teacher's Signature

The forward & return strokes constitute one operating cycle of the shaper.

* Tools required :

(1) Ram : The Ram slides back & forth in dovetail or square ways to transmit power to the cutter. The starting point and the length of the stoke can be adjusted.

(2) Table Support : Table support are attached front side of the table & used to support the weight of table during working.

(3) Table : The table is moved left & right, usually by hand to position the work under the cutter when setting up. Then, either by hand or more often automatically the table is moved sideways to feed the work under the cutter at the end or beginning of each st

(4) Saddle : The saddle moves up & down (Y-axis) usually manually, to set the rough position of the depth of cut Final depth can be set by the hand crank on the tool head.

(5) Clapper box : The clapper box is needed because the cutter drags over the work on the return stroke. The clapper box is hinged so that the cutting tool will not dig in

Teacher's Signature : .....

Expt. No. ..... Date .....

Page No. 25

(6) Column :- The column supports the ram & the rails for the saddle. The mechanism for moving the ram & table is housed inside the column.

(7) Tool holder : Tool holder are the same as the one used on a engine lathe, though often larger in size. The cutter is sharpened with rake & clearance angles similar smaller because the work surface is usually flat.

(8) Work Holding : Work holding is frequently done in a vise. The vise is specially designed for use in shapers & has long ways which allow the jaws to open up to 14 inches or more.

Base : It is the main body of the machine. It consists all element of machine. It works as pillars for other parts. It is made by cast iron which can take all comprehensive loads.

Tool head : It is situated at the front of the ram. Its main function is to hold the cutting Tool. The tool can be adjusted on it by some of clamps.

Teacher's Signature : .....

(11) Cross-ways : It consists vertical & horizontal table sideways which allow the motion of table It is attach with some cross movements mechanism.

(12) Stoke Adjuster : It is attached below the table It is used to control the stroke length which further controls the ram movement.

Shaper size : The size of a shaper is the maximum length of stroke which it can take Horizontal shapers are most often made with strokes from 175 to 900 mm long, though some smaller and larger sizes are available.

Drive Mechanism : It provides the reciprocating motion to the ram, hence to the tool. For proper cutting action with minimum vibrations it needs a slower forward stroke & to save machining time a faster idle reverse stroke of the ram. A shaper drive mechanism is always designed to serve this purpose, & this is known as Quick Return.

Mechanism : This type of drive can be obtained by any of the following mechanisms.

(i) Crank & slotted link mechanism
(ii) Whitworth quick return mechanism
(iii) Hydraulic quick return mechanism

Teacher's Signature : .....

Date .....

Expt. No. ..... Page No. 58

* Cutting Parameters

Cutting Speed :

It is rate of speed at which the metal is removed by the tool. It is expressed in meter per minute.

$$\text{Cutting speed} = \frac{\text{Length of the cutting stroke}}{\text{Time taken for cutting}}$$

$$V = \frac{\pi L (1+m)}{1000}$$

L : length of cutting stroke (in mm)
m : ratio b/w return time & cutting time
π : RPM of the bull gear.

Feed : Relative movement of the tool in a direction ⊥r to the movement of the ram. Expressed in mm per stroke. Feed is given at the end of the stroke.

Depth of cut : It is the thickness of metal removed in one cut. It is expressed in mm.

Machining time : Total time taken for completing the cut

$$T = \frac{L B (1+m)}{1000 V S}$$

L : length of stroke (in mm)
B : Breadth of workpiece.
S : feed (stroke) mm/double stroke.
m : ratio b/w return & cutting time
v : cutting speed in m/min.

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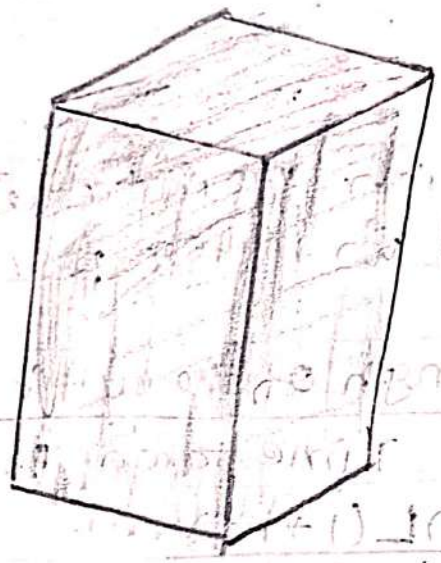

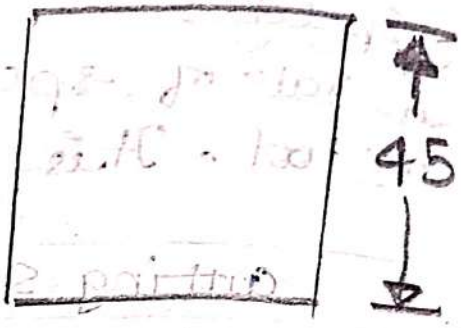
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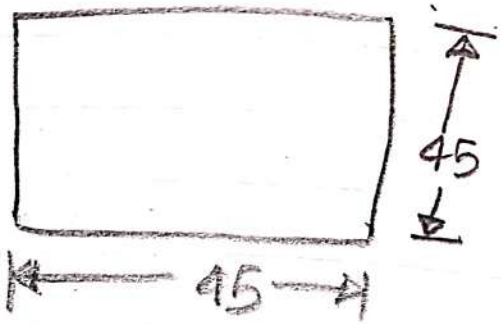
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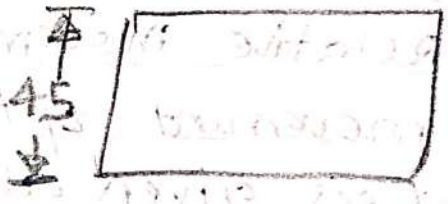
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Date .....

Expt. No. .....

Page No. 59

Tools for performing experiment

- Machine (Shaper machine)
- Steel parallels
- Marking block
- Spanner
- Single point tools
- Try square
- Centre punch
- Hammer
- Work piece.
- Chuck key
- Vernier calliper
- Steel rule.

Process sheet

S.No	Description	Tools & Instruments.
1.	Mount & align the job.	Machine, marking block, steel parallels, shaping tool, spanner.
2.	Clamp the shaping tool	Hammer
3.	Set the number of cycles, ~~stroke length, stroke position~~, feed.	Gear box
4.	Machine longitudinal slides successively.	Roughing tools, finishing tool etc
5.	Mark on the block of cube	Try square, protactor
6.	Smoothen cube by machine	Shaping tool

Teacher's Signature : .....

Expt. No..... Page No.....

S.No.	Description	Tools & Equipments
7.	Clamp grooving tool & shape the groove.	Grooming tool
8.	Set tool slide and required angle & required angle & oblique face.	Finishing tool.
9.	Reclamp work piece and machine grooves or longitudinal slides	Grooming tool, spanner etc
10.	check for size etc	measuring tools
11.	Finish the work piece.	Smooth file.

Precautions :-

1) Measurement of workpiece should be taken only after machine is off.
2) The stroke should be longer than the length of work piece.
3) Use properly sharpened tools
4) Job must be set & clamped properly.

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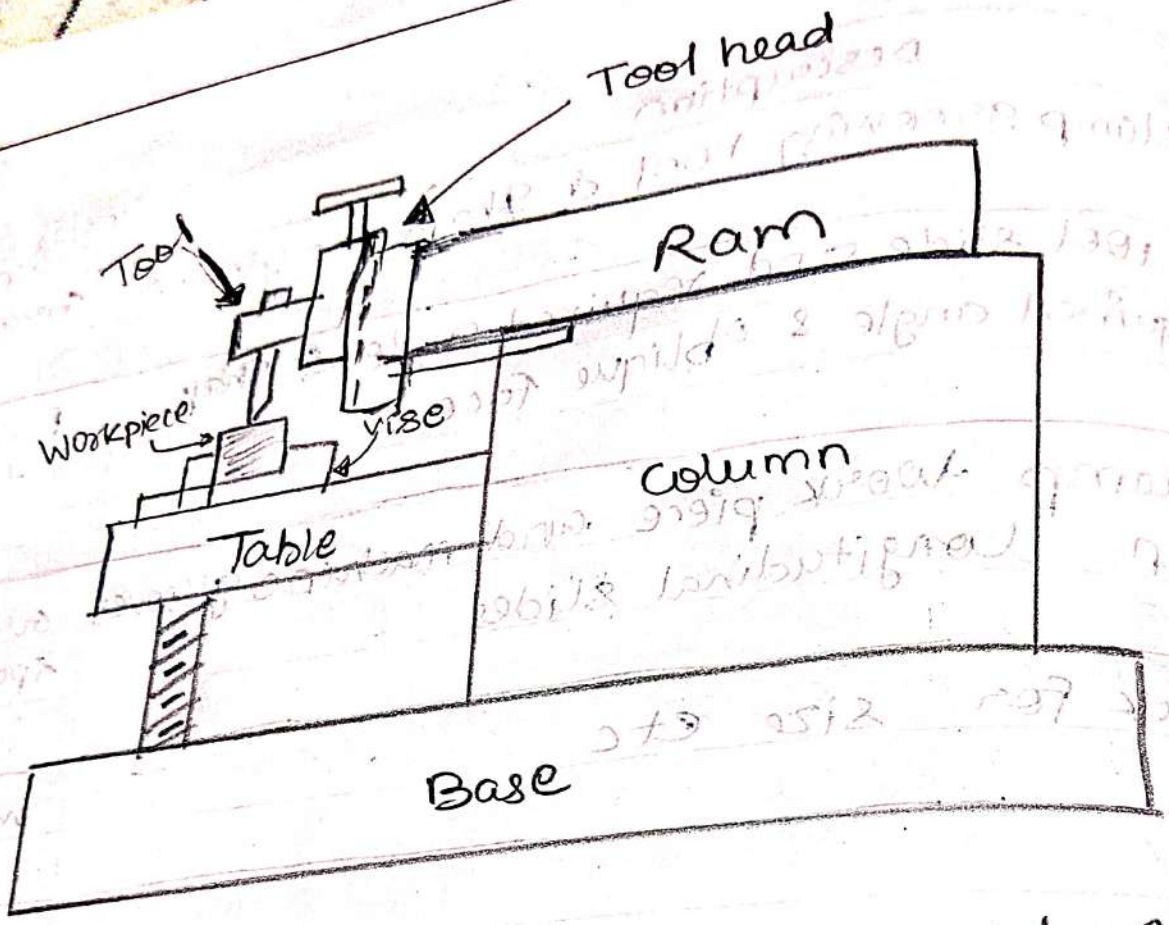

Fig. Block Diagram of shaper

Date .....

Expt. No. ..... Page No. 61

Questions & Answers

Q.1. What is the purpose of a shaper machine.

Ans→ Shaper machine is a machine used to produce flat surfaces. The flat surfaces may be horizontal vertical or straight. It cuts only in straight line.

Q. 2. Why the ram of a shaping machine travels at a faster speed during return?

Ans→ The cutting stroke of the shaper machine is made by moving the tool. The shapes cuts in one direction, so return stroke is faster to reduce loss of time.

Q. 3. How will you specify the size of shaper machine?

Ans→ The size of shaper is defined as the maximum length of stroke it can take. The length of stroke indicates in addition to general size of machines

Q. 4. Make a block diagram of a shaper machine and explain its principal parts?

Ans→ The main parts of shaper machine are base, column, ram, table, tool head, and driving mechanism

1) Base is heavy casting & is necessary for machine & other parts.

2. Column is a heavy casting and is mounted on base & is main support for the operating.

3) The ram is used to performs the main motion. It moves back & forth.

4) The tool head has a short feed screw to adjust the tool for proper depth & cut.

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