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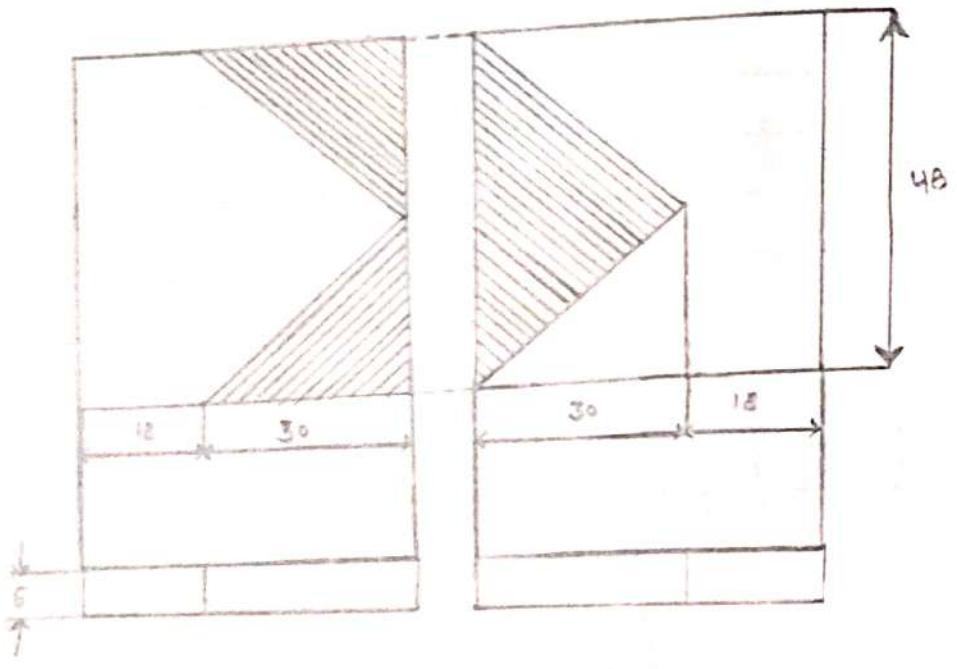
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FITTING

SHOP

Teacher's Signature _____



Job No. 1

All Dimensions are in mm

FITTING SHOP

Expt. No. 1

Page No. 1 Date 28/04/2023

Experiment NO-1

Aim

To make a male part of a joint in fitting shop of a given piece of mild steel flat bar.

Raw Materials

Mild steel of size (50mm x 50mm x 5mm)

Tools Required:-

Hand Hack saw, Steel rule, Try square, Vernier height gauge, Bastard file, triangular steel, Round file, Scriber, V block, Bench vice, Pipe vice, Vernier caliper.

Operations:-

- i) Measuring ii) Marking iii) Cutting iv) Filing
- v) Edge making vi) Layout vii) Finishing viii) joining

Procedure:-

- i) Clamp the work piece in the bench vice, keeping the flat surface just 2mm to 3mm above the jaws of the vice.
- ii) File carefully the flat surface of the work piece without touching the surface of bench vice.
- iii) Check the flatness of filed surface with the help of try square.
- iv) Color one surface of the work piece with wet chalk and allow it to dry for 5-10 minutes.
- v) Mark the work piece with the help of steel rules &

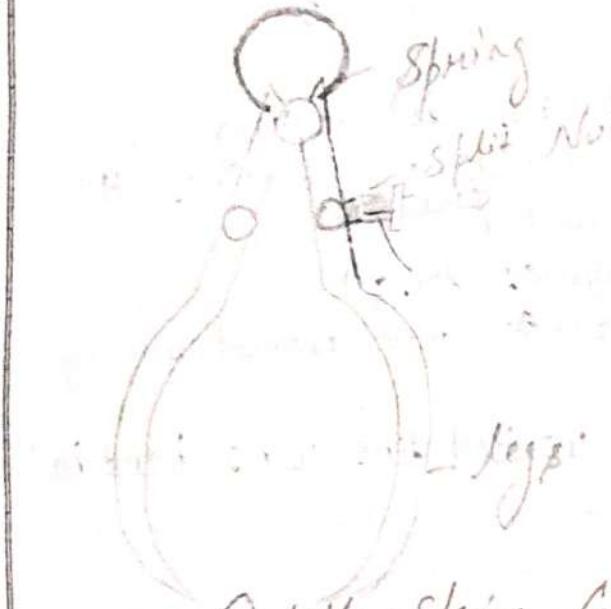
Teacher's Signature _____

scriber, according to the drawing for cutting.

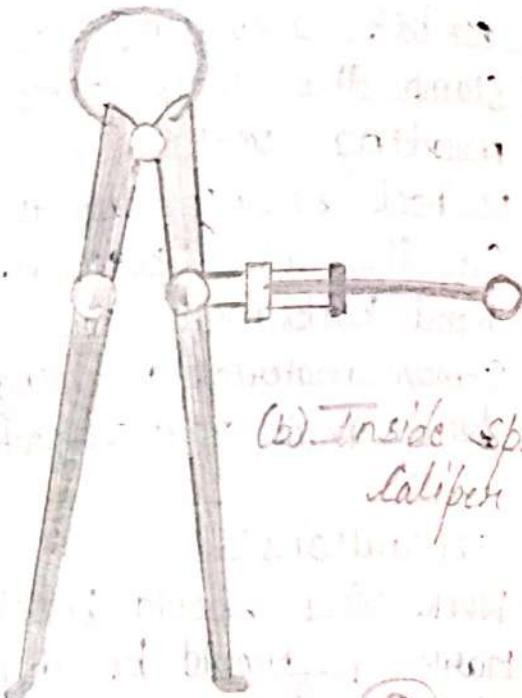
- vi) Clamp the work piece in the bench vice keeping the marking vertical for hack sawing.
- vii) Do hack sawing up to the required length.
- viii) Cut the work piece on the ~~marked~~ line marked line by hand hacksaw.
- ix) Remove material according to the worked line using hand hacksaw from male part respectively.

Precautions:

- i) Work piece should be clamped tightly in the bench vice.
- ii) Marking should be done carefully.
- iii) Filing and sawing should be done carefully and accurately.
- iv) Surfaces should be surface-finished correctly.



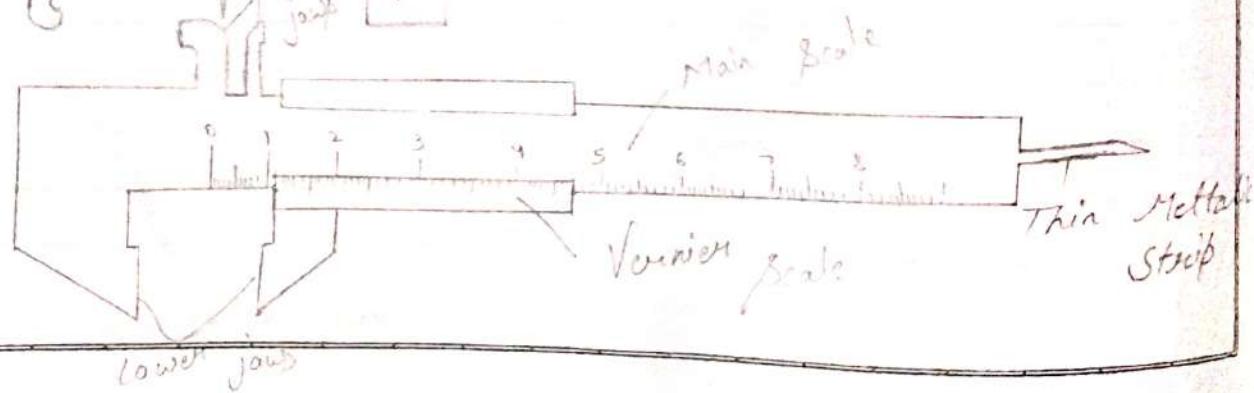
(a) Outside Spring Calipers



(b) Inside Spring Calipers



(c) odd leg calipers



Expt. No. 2

Page No. 3 Date 28/04/2023

Experiment No. 2

To make a male part of a joint in fitting shop of a given piece of mild steel flat bar.

AIM:-

RAW MATERIAL:-

Mild steel of size (50 mm x 50 mm x 5 mm)

TOOLS REQUIRED:-

Hand bark saw, Steel rule, Try square, Vernier height gauge, Bastard file, Triangular file, Round file, scriber, V-block, bench vice, pipe vice, Vernier caliper

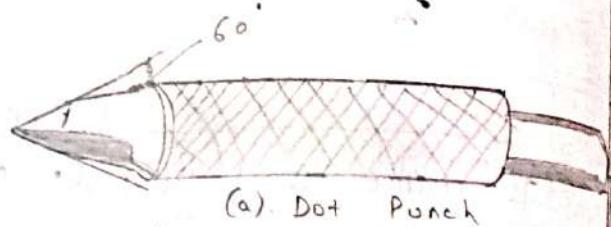
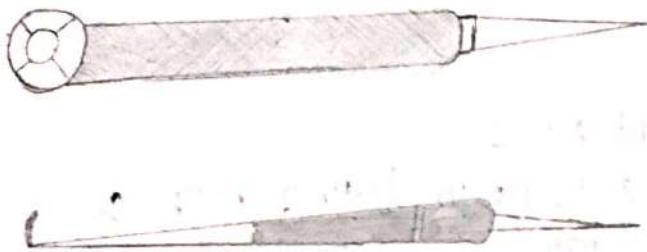
Operations

- i) Measuring
- ii) Marking
- iii) Cutting
- iv) filing
- v) Edge making
- vi) Layout
- vii) Marking
- viii) Cutting
- ix) Finishing
- x) Joining

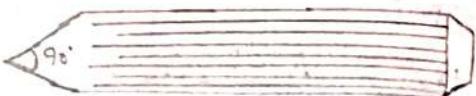
Theory:-

Some operations are easy & economical to perform by

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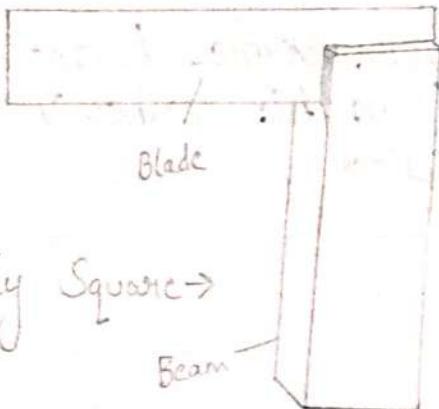
(a) Dot Punch



(b) Centre Punch

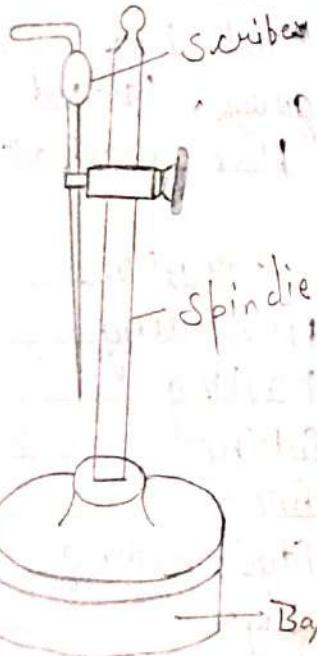
Scribers

Punches.



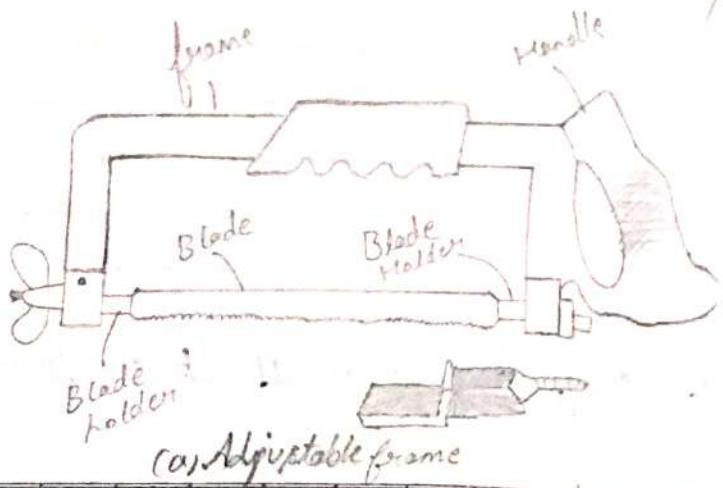
Try Square →

Beam

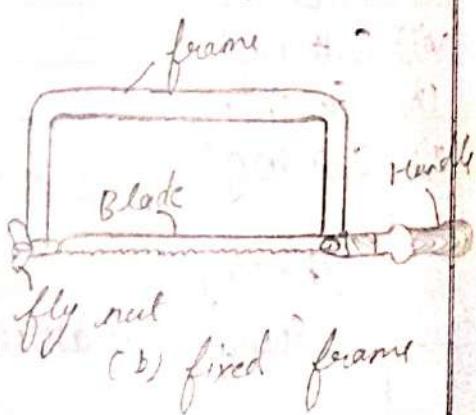


Surface Gauge →

Base



(a) Adjustable frame



Hand Hacksaw

hand than by the help of machine filing is a process by which the metal is removed in the form of small particles from the work piece with the help of file.

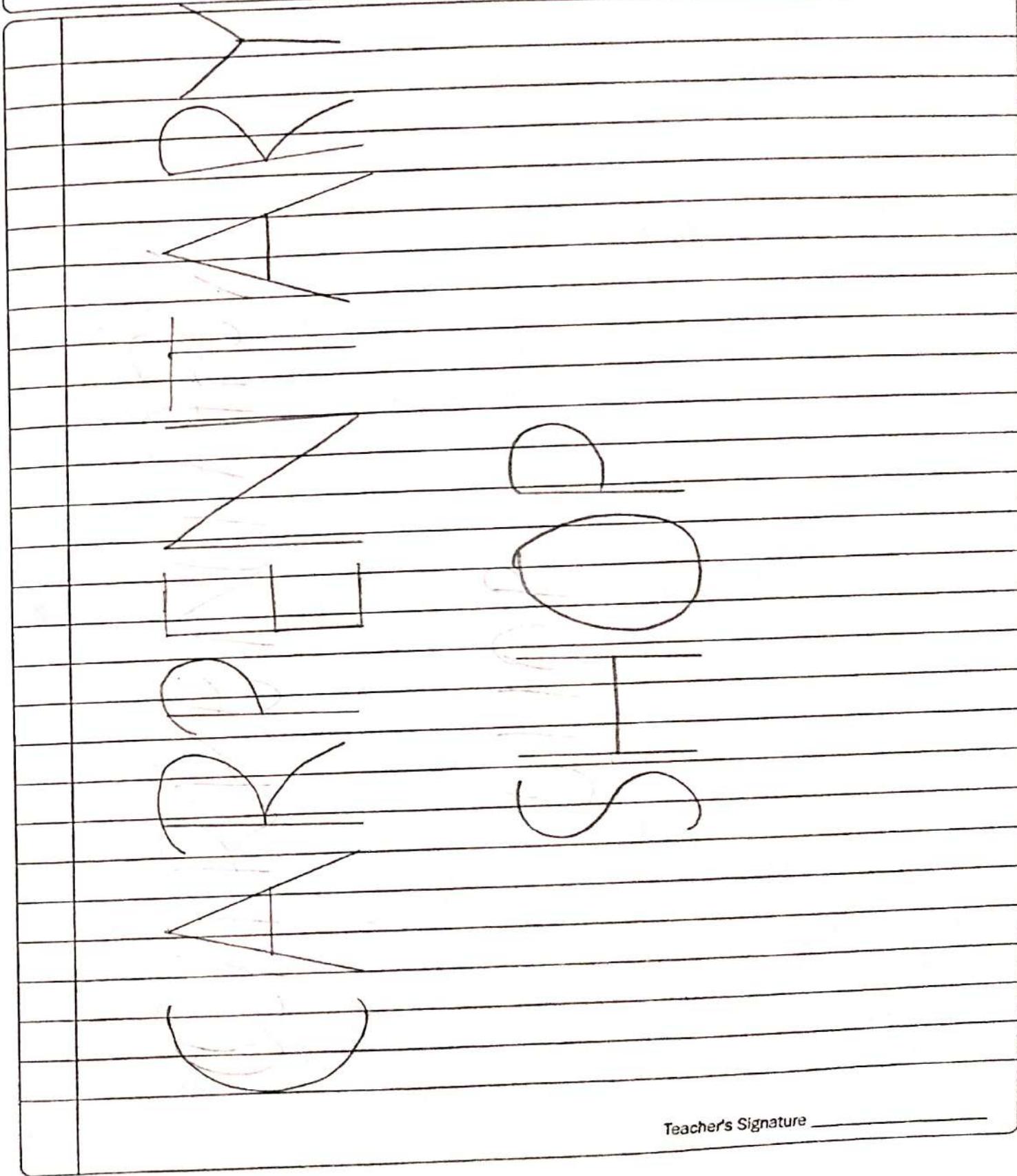
For filing the work piece is tightly clamped in the bench vice, the surface to be filed is kept horizontal. The file is held in position on the work piece by both hands. The handle of the file is in the right hand and the left hand is on the second end, pressing it downwards. The file is moved forwards horizontally.

Precautions -

- i) Work piece should be clamped tightly in the bench vice.
- ii) Marking should be done carefully.
- iii) Filing and sawing should be done carefully and accurately.
- iv) Surfaces should be surface-finished correctly.

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Page No. 5 Date _____

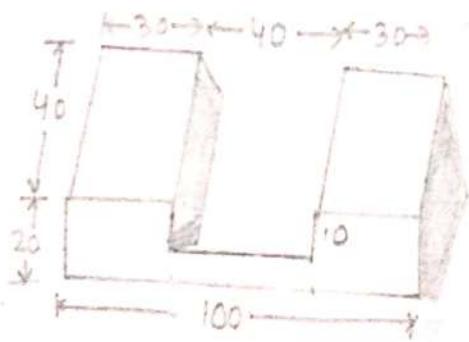
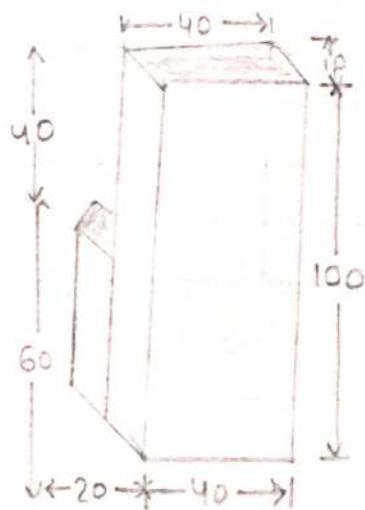
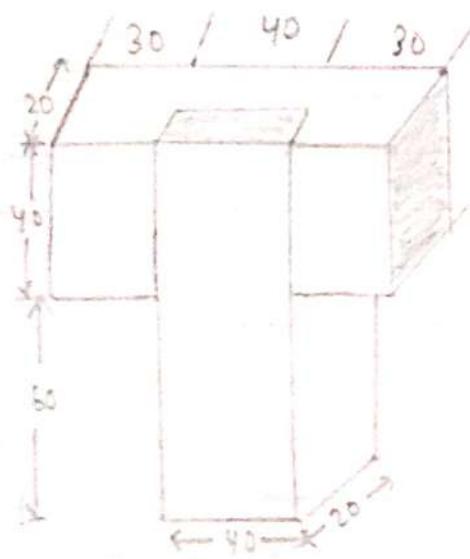


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Job No. 1 - 'T' Half Lap Joint

Raw Material - Kail wood

Dimensions: $100 \times 40 \times 20 \text{ MM} = 02 \text{ Pieces}$
(All Dimensions are in mm)



Aim

To prepare a T-half lap joint with the help of kail wood.

Raw material

Kali wood of dimension 100 x 30 x 30 mm - 02 Nos.

Tools Required

Steel rule, Try square, marking gauge, iron jack plane, firmer chisel, carpentry vice, Rasp cut file, Rip saw, Tenon saw, Dove tail saw, Mallet

Operations

- i) Measuring
- ii) Marking
- iii) Sawing
- iv) Planning
- v) Chiseling
- vi) Finishing

Procedure

- i) Wooden piece of required size from the stock is fitted properly in the carpentry vice.
- ii) Prepare a smooth surface of wood with the help of iron jackplane.
- iii) After marking the required size, check the accuracy by try - square.

- iv) Mark the piece as per drawing with the help of steel rule, try-square pencil and marking gauge.
- v) Hold the piece in the carpentry vice and cut it by the rip saw on the marked lines i.e., along the across the grains of wood.
- vi) Remove the ~~undesired~~ undesired part with the help of tenon saw, firmer chisel and wooden mallet.
- vii) After removing the material part, the left remaining part of the work piece is smoothened with the help of rasp cut file.
- viii) Check the fitness of the required half lap T-joint by fitting both parts.

Precautions:-

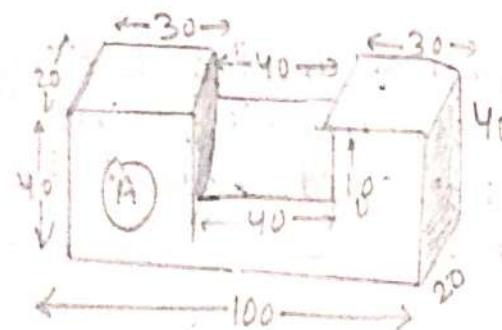
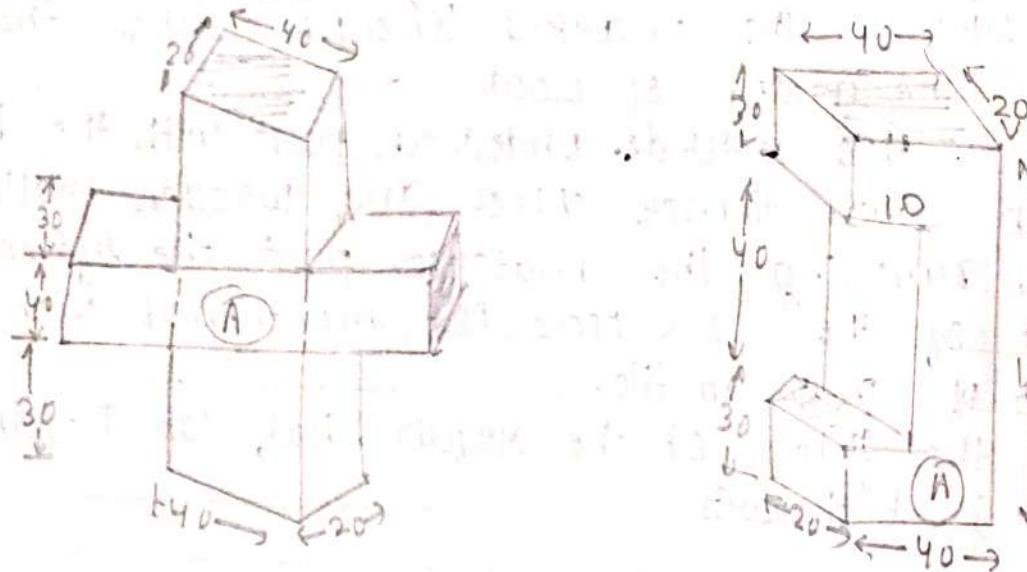
- i) Wooden piece should be hold properly in the vice before planning and sawing.
- ii) Marking should be done accurately and properly.
- iii) Plane the job accurately and cutting should be done carefully.
- iv) Always take clearance in the cutting operation & do not work on marking line.
- v) Tools which are not used, should be kept in their respective positions.

Job no - 2

Raw material: kail wood

Dimensions: $100 \times 40 \times 20 = 02$ Piece

(All dimension in mm)



Aim:- To prepare a cross half lap joint with the help of Kali wood.

Raw material:- Kali wood pieces of dimension $100 \times 30 \times 30$ mm - 02 Nos.

Tools Required:- Steel rule, Try square, Marking gauge, Iron jack plane, Firmer chisel, Carpentry vise, Rasp cut file, Rip saw, Tenon saw, Dovetail saw, Mallet.

Operations :

- i) Measuring
- ii) Marking
- iii) Sawing
- iv) Planning
- v) Chiseling
- vi) Finishing

Procedure :

- i) Wooden piece of required size from the stock is fitted properly in the carpentry vise.
- ii) Prepare a smooth surface of wood with the help of Iron jack plane.
- iii) After marking the required size, check the accuracy by Try square.
- iv) Mark the piece as per drawing with the help of

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the last time we left, it was about 10 AM
and we had to leave at 1 PM.

We stopped to have lunch at a small town
and I took a walk around the place.

We were about 10 miles from the city of
Cochabamba and about 10 miles from the
city of Sucre. We had to stop because
of a flat tire.

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Cochabamba and about 10 miles from the
city of Sucre. We had to stop because
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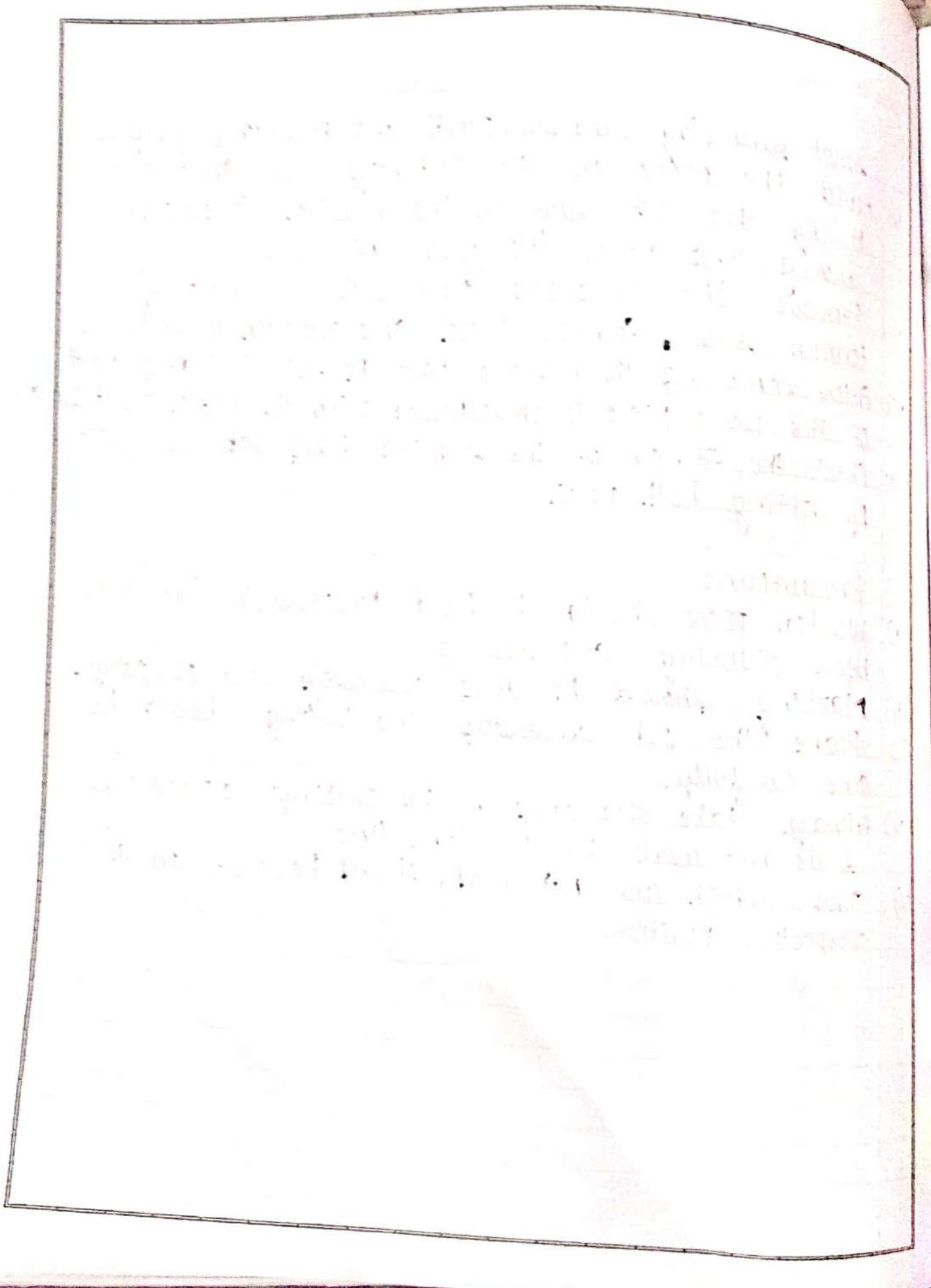
- steel rule, try square, pencil and marking gauge.
- v. Hold the piece in the carpentry vice and cut it by the rip saw on the marked lines i.e. along and across the grains of wood.
 - vi) Remove the undesired part with the help of tenon saw, firmer chisel and wooden mallet.
 - vii) After removing the material part, the left remaining part of the work piece is smoothened with the help of rasp & file.
 - viii) Check the fitness of the required half lap cross joint by fitting both parts.

Precautions

- i) Wooden piece should be held properly in the vice before planning and sawing.
- ii) Marking should be done accurately and properly.
- iii) Plane the job accurately and cutting should be done carefully.
- iv) Always take clearance in the cutting operation & do not work on marking line.
- v) Tools which are not used, should be kept in their respective positions.

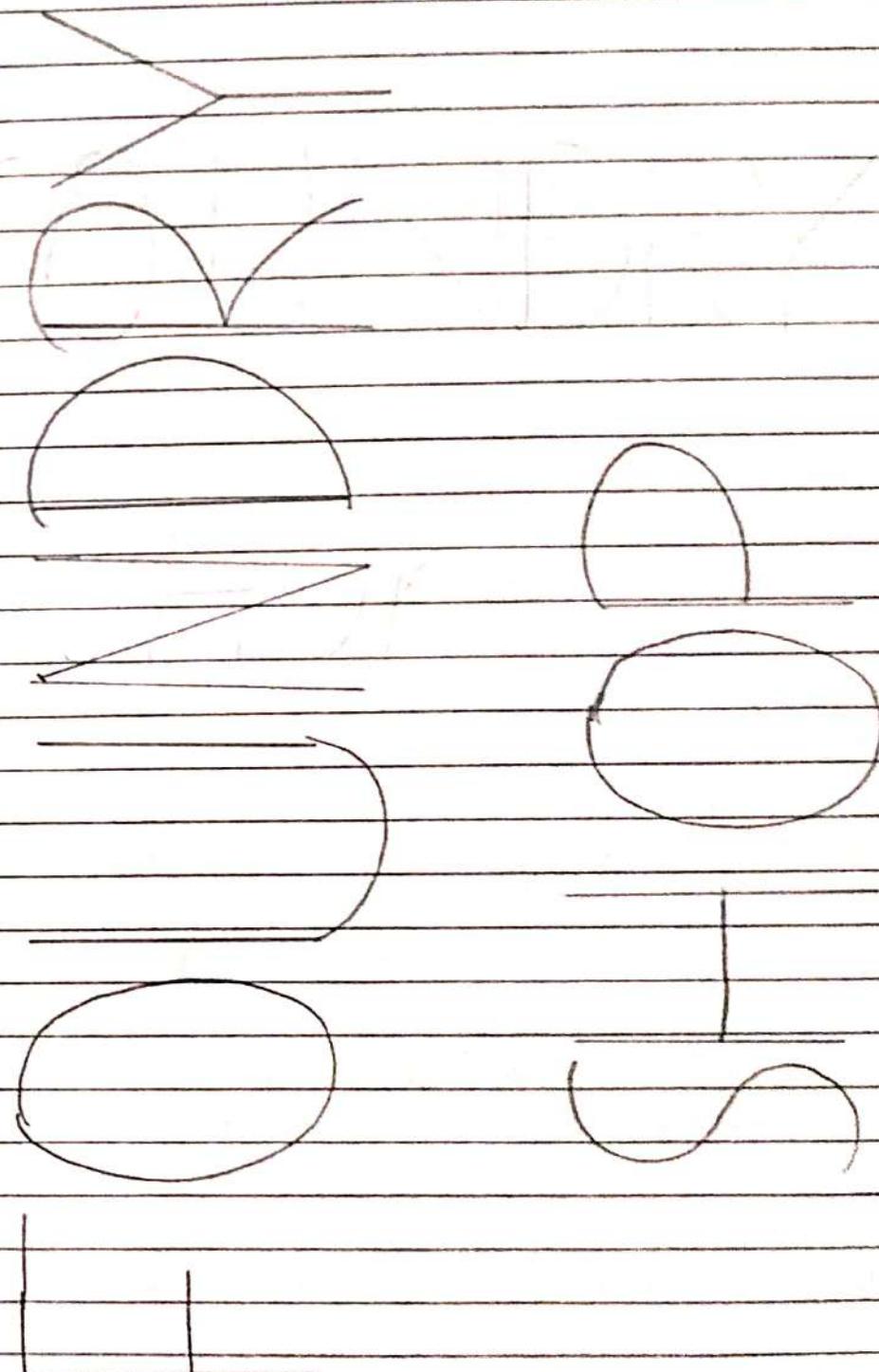
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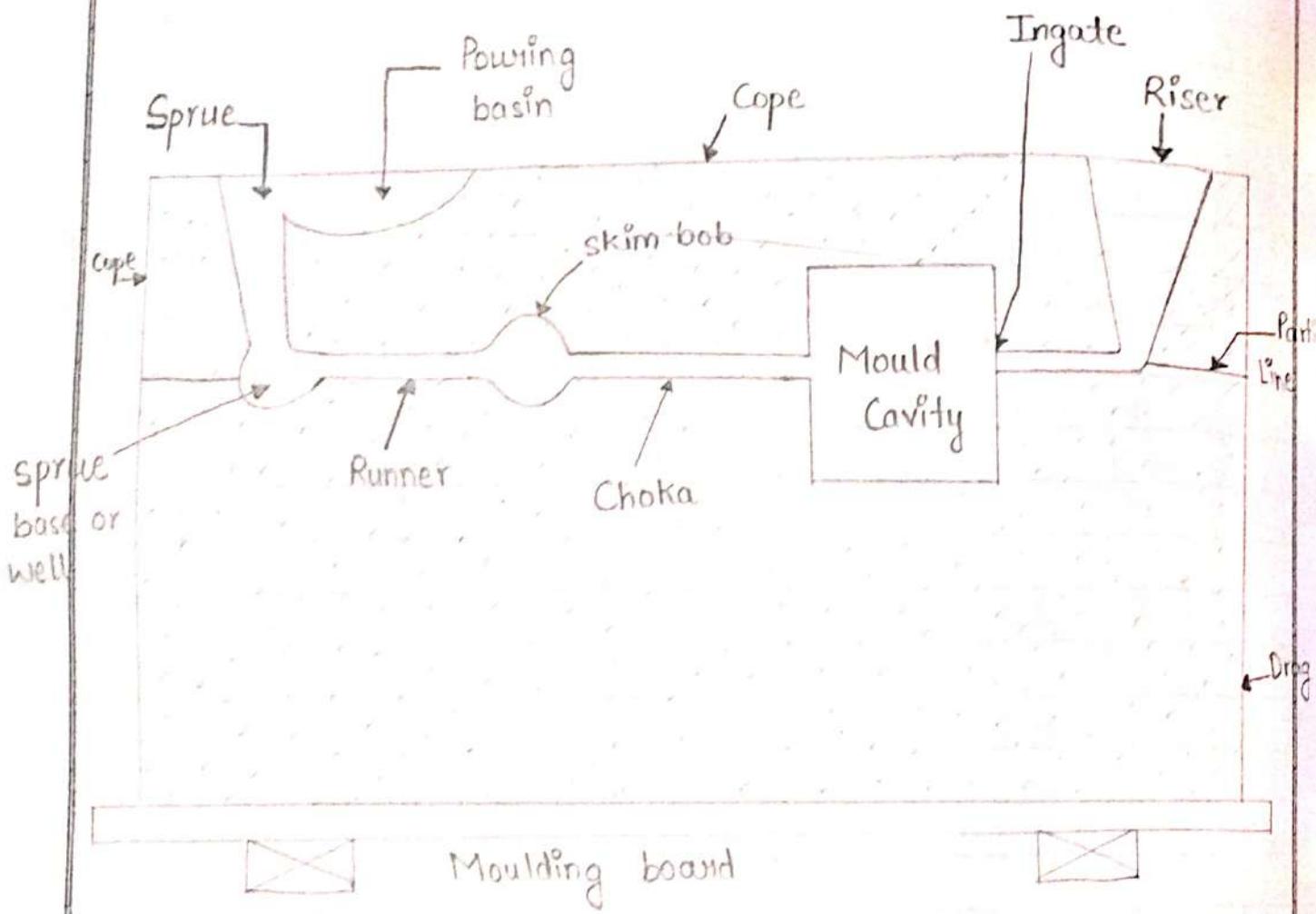


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Schematic Illustration of Sand moulding

Objective - To make a mould of given pattern and produce a casting.

Equipments - Moulding sand, cope and drag, molten metal, gating system, peen hammer, sprue pins, slab trowels, shovel, vent wire, strike off bar, draw spike, gate cutter etc.

Theory:

Moulding Sand

Silica sand found in many natural deposits is suited for moulding because it can withstand high temperature without breakdown. Sand is low in cost, has long life, and is available in a wide range of grain sizes and shapes. The disadvantages are that sand has a high expansion rate when subjected to heat and has a tendency to fuse with the metal.

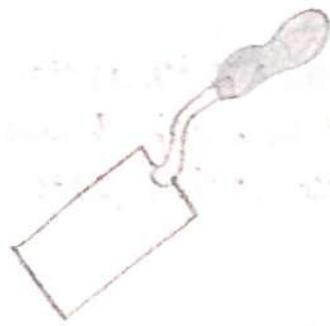
Types of Moulding Sand

Foundry sand can be grouped as:-

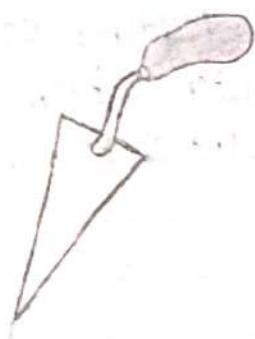
1. Natural Sand :- It contains insufficient amount of binding clay and hence can be used directly.
2. Synthetic Sand :- These are clay free high silica sand. Suitable binders are added to them to make usable for foundry work.

Moulding sand can be further classified according to its

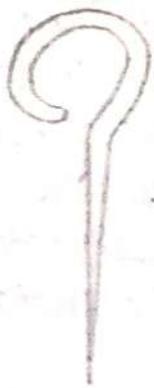
Foundry Hand Tools - I



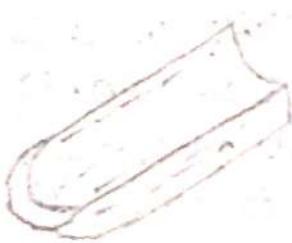
Towels



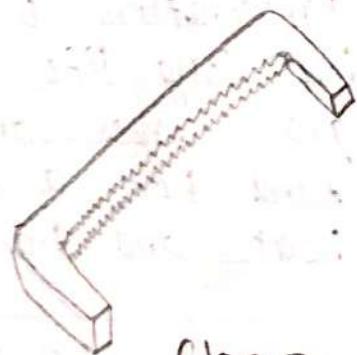
Gagger



Draw
Spike



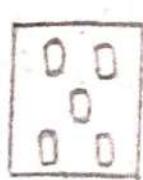
Draw
Screw



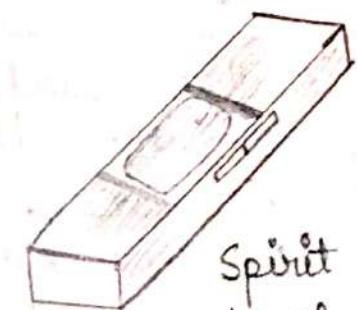
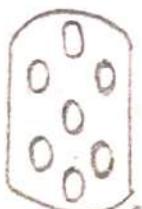
Clamp



Mallet



Rippling Plates



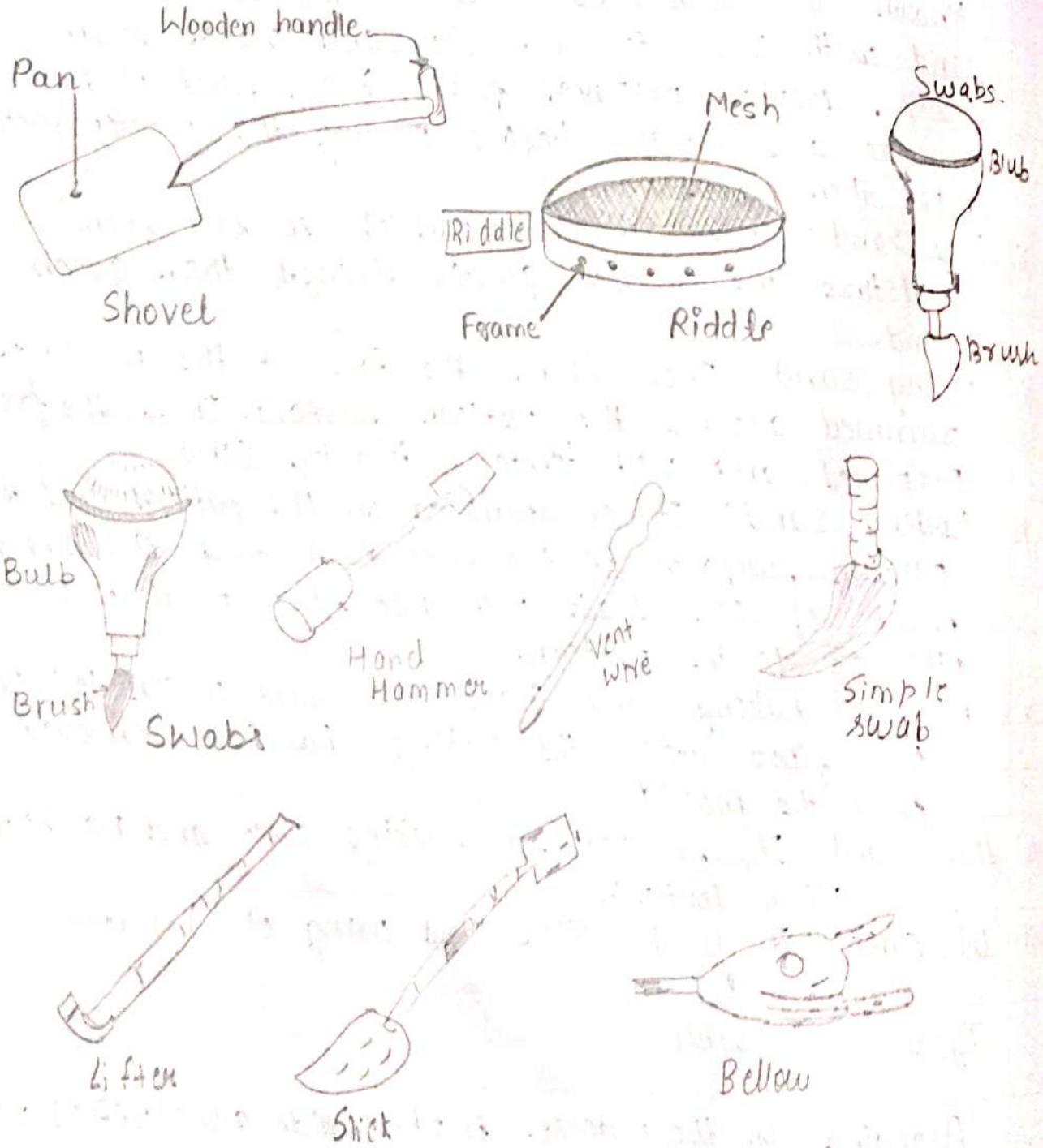
Spirit
level

- Composition and use, into the following categories.
- i) Green Sand:- Foundry sand containing moisture is known as green sand. It is a mixture of silica sand with 20% to 30% clay and water from 6-8%. Moulds prepared from green sand do not require any baking before pouring the molten metal into them.
 - ii) Dry Sand:- It is the sand which is free from moisture and possesses greater strength than green sand.
 - iii) Facing sand:- These forms the face of the mould i.e., rammed around the pattern surface. It is the fresh prepared and well tempered foundry sand.
 - iv) Parting sand:- It is sprinkled on the pattern and the parting surfaces of the mould so that the sand mass of one flask does not stick to that of the other or to the pattern.
 - v) Floor or baking sand:- It is the sand which left on the floor after the casting has been removed from the mould.
 - vi) Core sand:- It is used for making cores and has high silica content.
 - vii) Oil sand:- It is the silica sand using oil binders.

Types of Moulds.

Depending on the materials used, moulds are classified as follows:

FOUNDRY HAND TOOLS - II



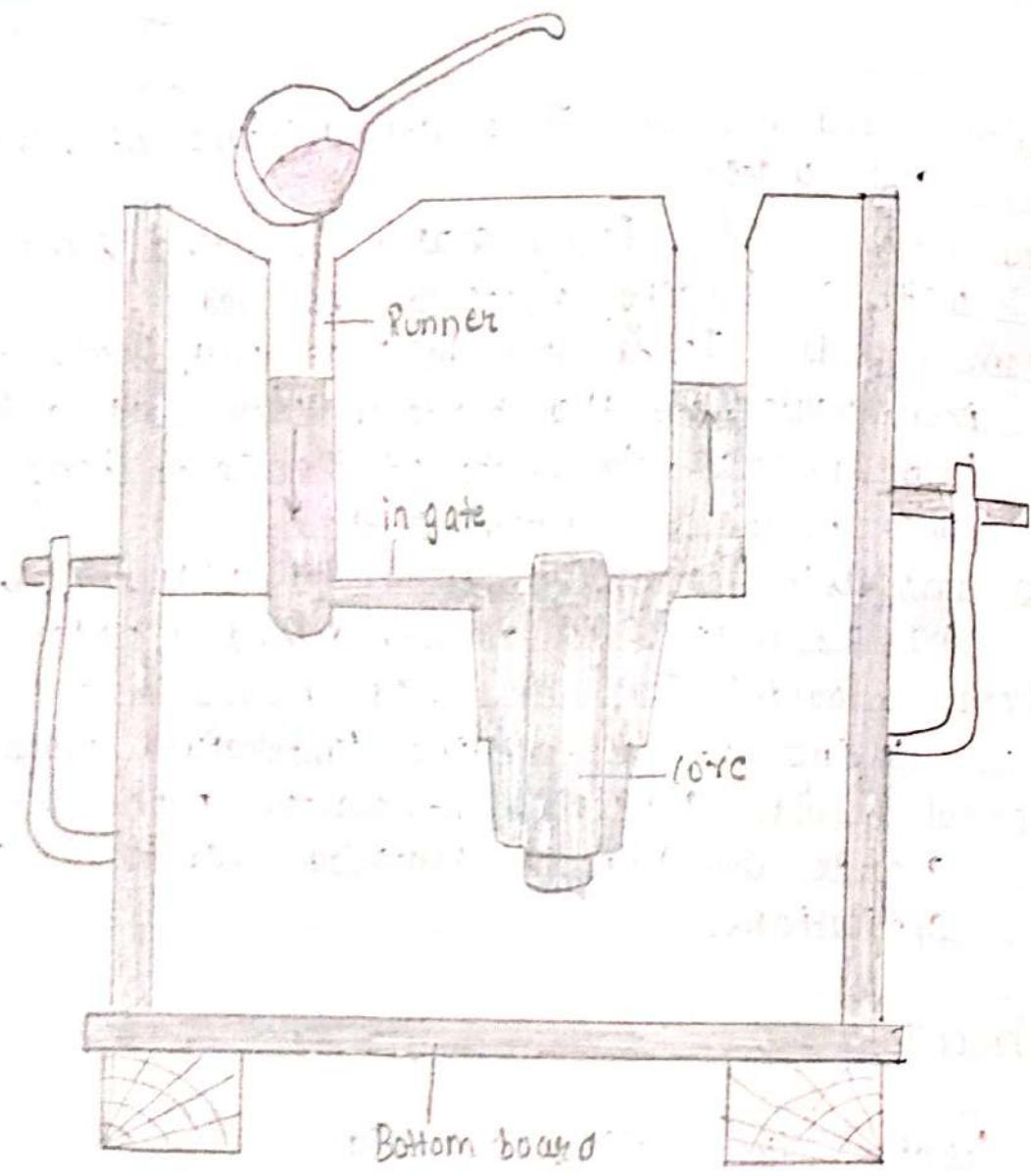
1. Green - sand moulds:- These are mixture of sand, clay, and water.
2. Dry sand moulds:- Fairly coarse moulding sand mixed with a binding material is used.
3. Loam moulds:- It is first built up with bricks or large iron parts are then plastered over with a thick loam mortar, the shape of the cavity being obtained with sweep or skeleton patterns.
4. CO_2 moulds:- Clean sand is mixed with sodium silicate and the mixture is rammed around a pattern.
5. Metal moulds:- These are used mainly in the direct casting of low-melting temperature alloys.
6. Special moulds:- Plastics, cement, plaster, paper, wood and rubber are all mould materials used to fit particular applications.

Procedure

Procedure for making a mould

1. Firstly, sand is rammed by rammer.
2. The water is sprinkled over the sand and suitable quantity of bentonites, ~~dexzin~~ are mixed with sand for bonding strength.
3. The prepared sand is poured in the mould box and rammed keeping the pattern at bottom of the mould box.
4. After the mould box is rammed over the pattern is withdrawn.
5. The mould surface is dried for a certain time.

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Sand Casting Process layout

6 The molten metal is poured to make desired casting.

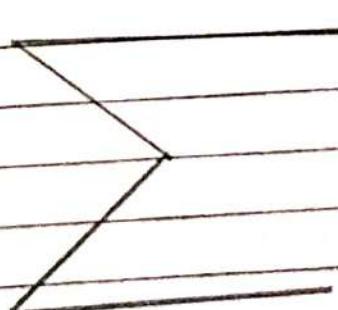
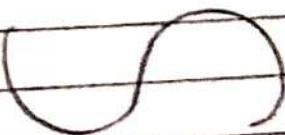
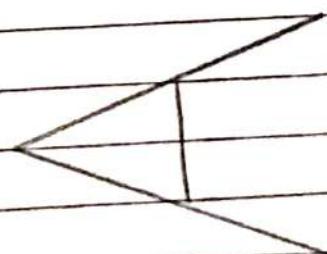
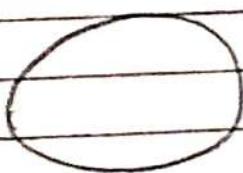
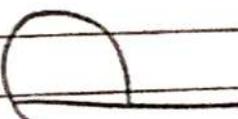
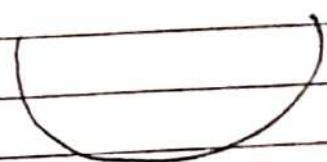
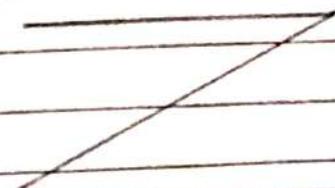
Precaution:

- Ramming should be done properly otherwise mould may break up during rolling over.
- Sand mixing should be done with the help of hand by wearing hand gloves.
- The mould prepared must be strong enough to hold the weight of the metal.
- To keep a safe distance from furnace during melting.
- Molten metal should be poured in the mould gradually to avoid splashing.
- Proper safety measure should be adopted.

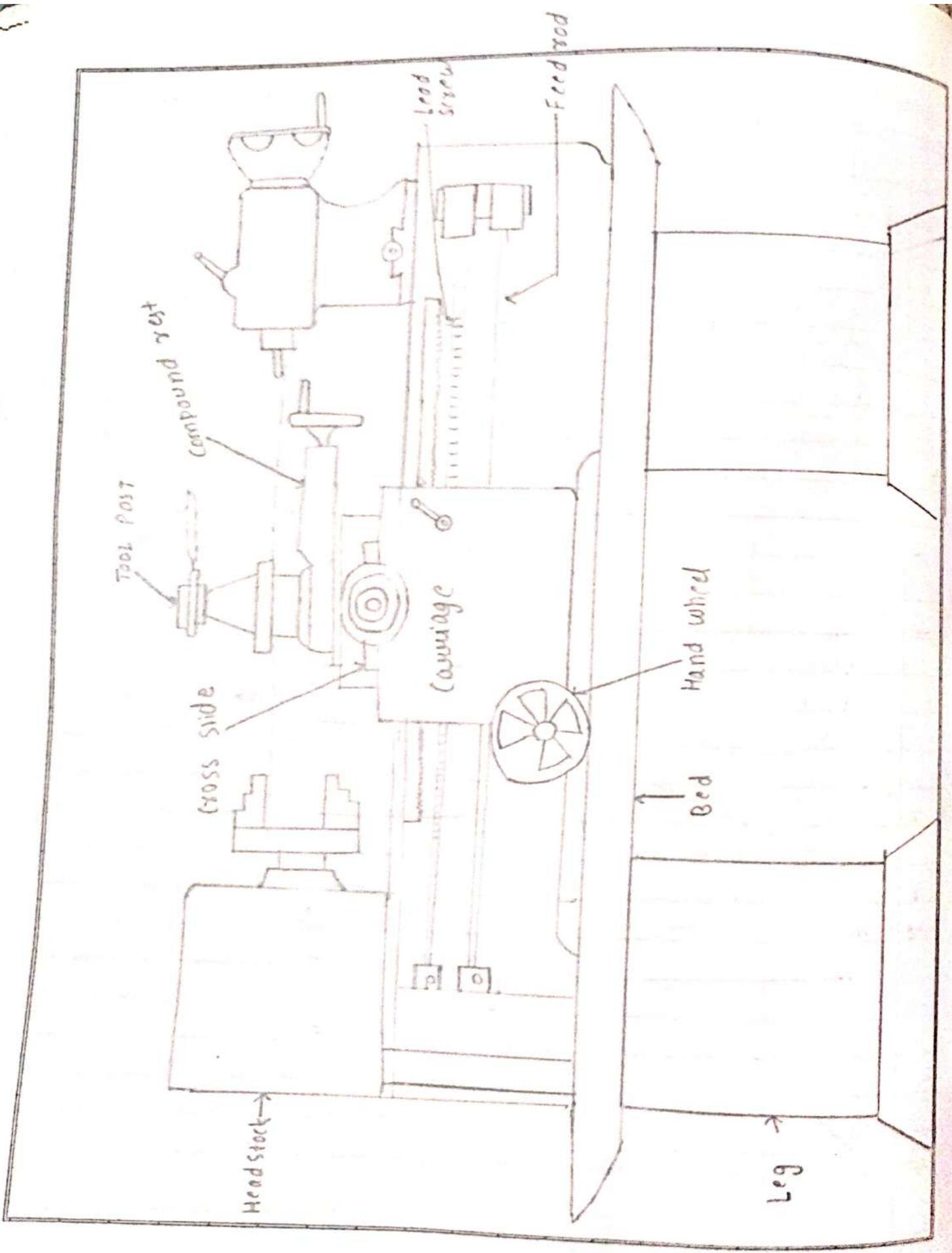
and the first few days of the month
I had a bad cold & was unable to sleep
well & the last two days I have been
unable to sleep & I am now about
as bad as I ever was. I have been
able to get a few hours of sleep
but it has been very fitful & I have
been unable to get up in time to go
out & get a walk in the morning.
I have been able to get a few hours of sleep
but it has been very fitful & I have
been unable to get up in time to go
out & get a walk in the morning.

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Machine Section

Introduction

It is the life of all good workshops and involves the maximum investment as compared to other section. All the common machine operations like centering, facing, simple plain turning, step turning, knurling, grooving, taper turning, drilling, boring, external threading, internal threading, gear cutting, spiral milling, helical milling, shaping, grinding and similar operations successfully performed in this section.

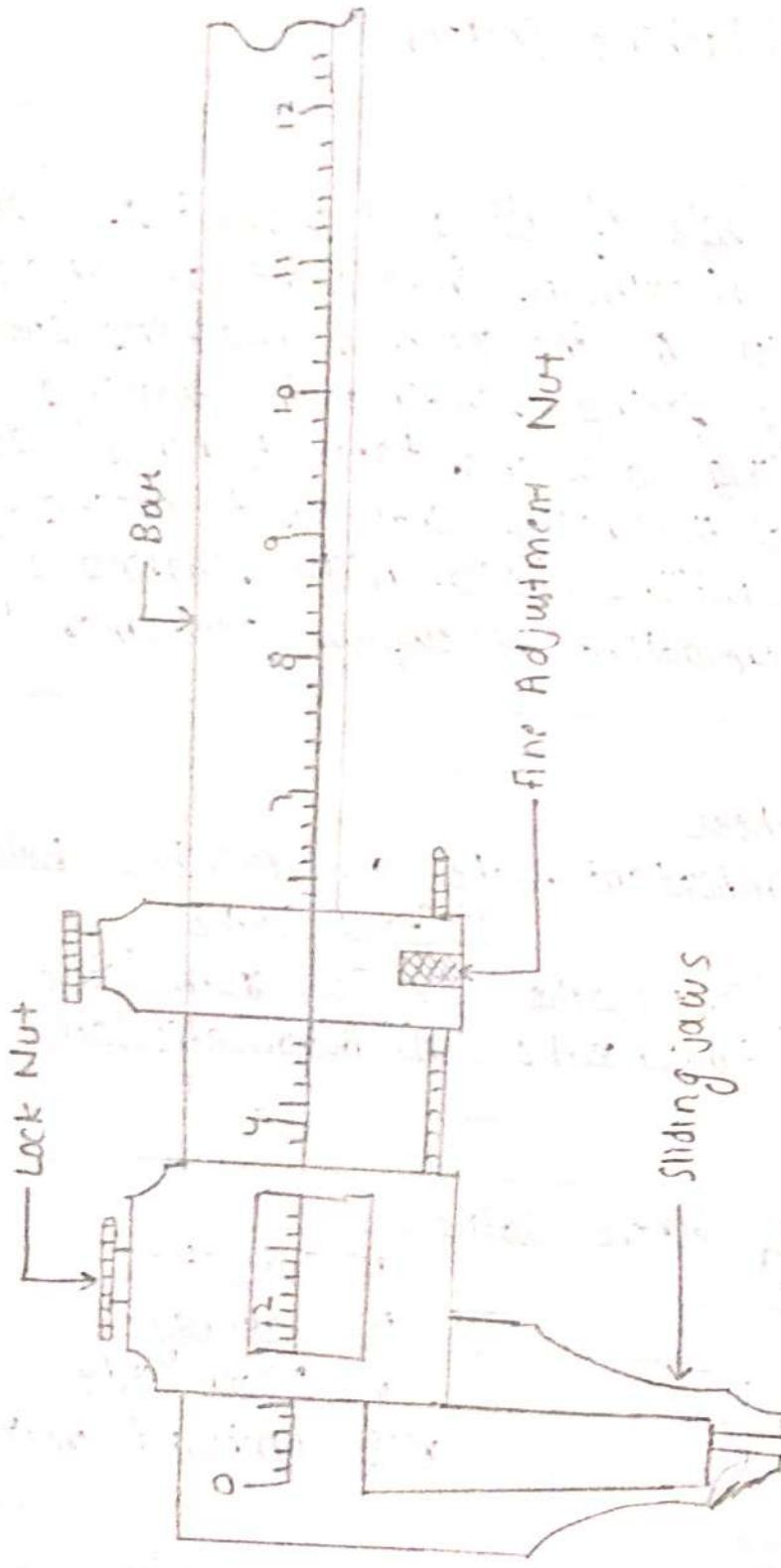
Types of Lathes

Some important lathes are described below:-

- i) Bench Lathe
- ii) Speed Lathe
- iii) Engine Lathe / Centre Lathe
- iv) Tool Room Lathe
- v) Capstan and Turret Lathe
- vi) Automatic Lathe
- vii) CNG Lathe

Main parts of Centre Lathe.

- i) Head Stock
- ii) Tail Stock
- iii) Bed
- iv) Carriage
- v) Legs
- vi) Main Slide
- vii) Cross Slide
- viii) Compound rest slide
- ix) Tool Post.



Vernier Caliper

Tools used in lathe. In the lathe the tools are classified as under

- i) Measuring tools
- ii) Cutting tools

1. Measuring Tools: Measuring tools are used to produce components to an exact size. The tools are given below:

- | | |
|--------------------|--------------------|
| a) Vernier caliper | b) Screw gauge |
| c) Steel scale | d) Outside caliper |
| e) Inside calliper | f) Depth gauge |
| g) Surface gauge | h) Dial Indicator |

2. Cutting tools: Cutting tools are used to remove the materials. The tools are given below.

- | | |
|---|-------------------|
| a) Single point cutting tool / turning tool | b) Threading tool |
| b) Grooving tool | c) Smooth file |
| c) Knurling tool | |

LATHE ACCESSORIES - The device used for holding and supporting the work piece and the cutting tool on a lathe are known as accessories.

These include following

- | | |
|----------------------------|-------------------|
| i) Chucks | ii) Driving plate |
| iii) Lathe dogs / carriers | iv) Tool holders |
| v) Tool posts | vi) Centers |
| vi) Collets | vii) Rests |
| viii) Master Mandrels | ix) Face plate |

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xii) Jigs and fixtures

Experiment - 1

Aim

To perform different operations with the help of Mild steel.

Raw material.

Mild steel round bar.

Machine & Tools required

Centre lathe, steel rule, vernier calliper, Outside calliper, Inside calliper, Knurling tool, Single point cutting tool, Surface gauge, Grooving tool.

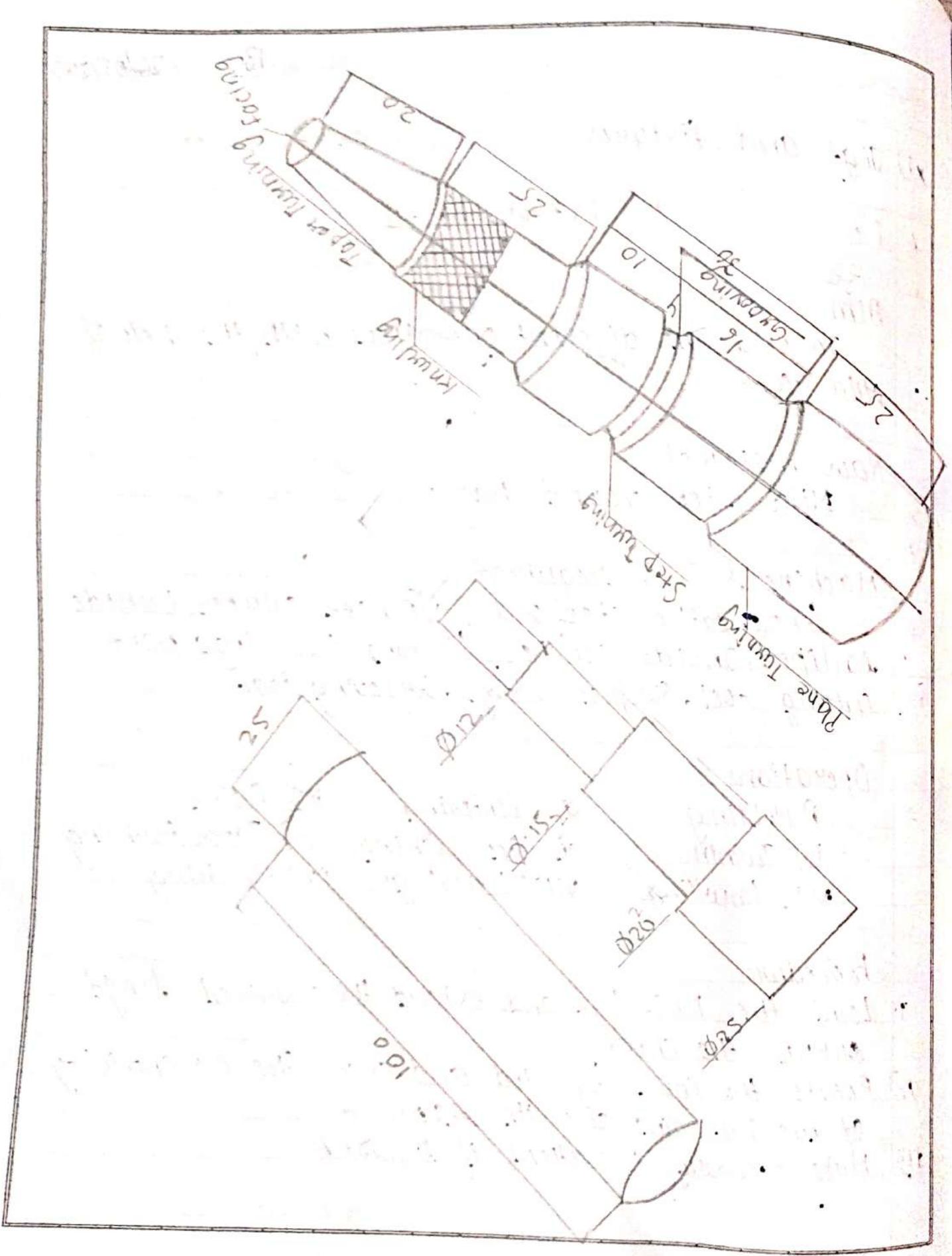
Operations

- | | | |
|--------------|-----------------|-------------------|
| i) Holding | ii) Centering | iii) Facing |
| iv) Turning | v) Step Turning | vi) Taper turning |
| vi) Knurling | vii) Grooving | viii) Finishing |

Procedure

- i) Load the M.S. bar and extend the required length outside the chuck.
- ii) Rotate the chuck by hand and check the concentricity of the bar and also its alignment.
- iii) Make necessary corrections if required.

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- iv) Turn plain for the total required length.
- v) Using a single point cutting tool make the cutting edge and marks undercuts.
- vi) Face the end, using single point cutting tool.
- vii) Hold the diamond knurling tool in the tool post and feed it across the work axis.
- viii) Maintaining the total pressure on the job, move the knurling tool left to right and right to left to provide the knurls an appropriate location on the job.
- ix) Using a parting tool for make undercuts.
- x) Calculate the angle for compound rest swivel and set the compound rest at that angle, holding the same turning tool in position as in turning operation.
- xi) Now, turn the taper by moving the cross slide from right to left or left to right.
- xii) Several pauses may have to made till the required taper is obtained.
- xiii) Restore the cross slide to its original position.

Result

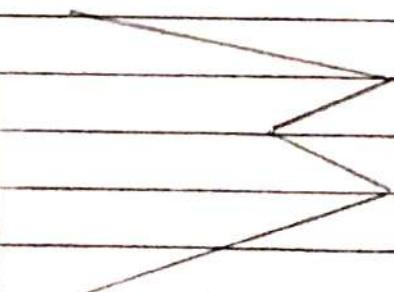
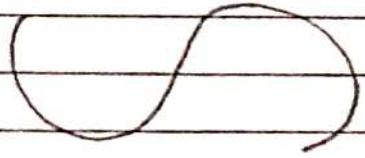
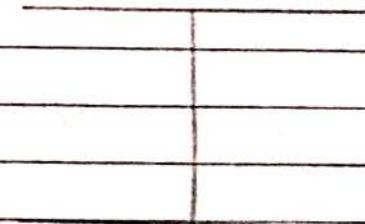
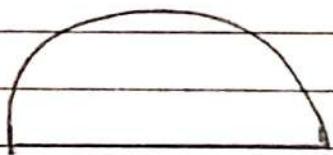
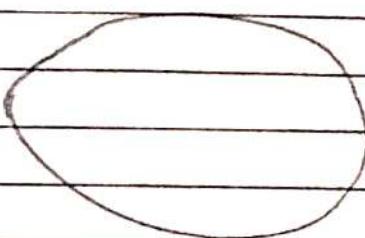
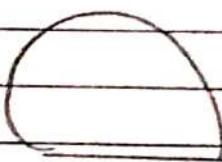
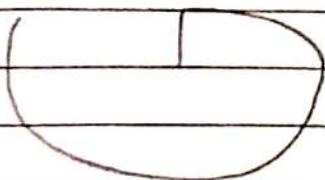
The Required work piece is made from the given
M. S. Bar

- Precautions:-
- i) Loose clothing should be avoided
 - ii) Wear shoes while working in the shop.
 - iii) Do not take experiment on running machine.
 - iv) Never talk with the follower when the experiment is running.

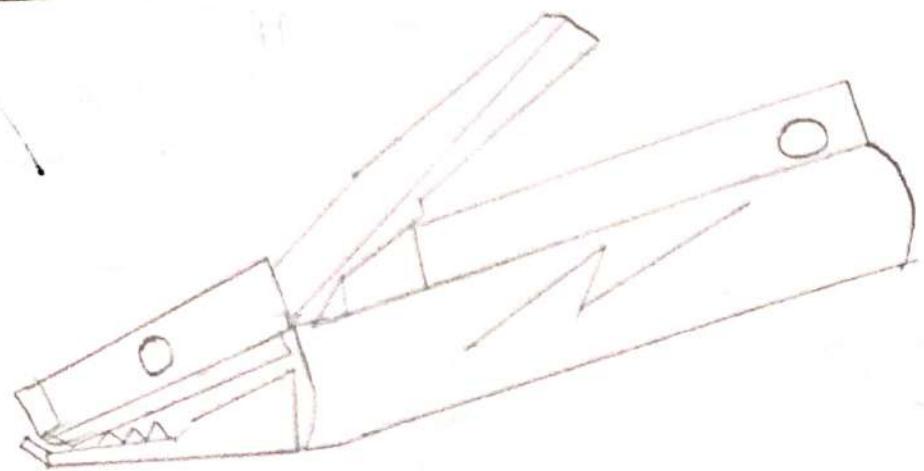
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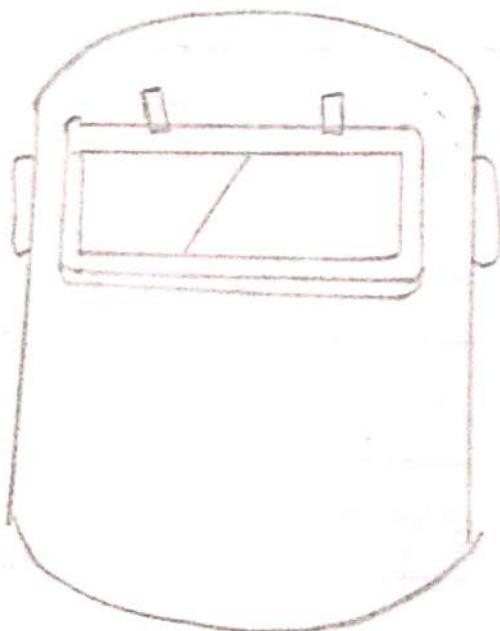
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Electrode Holders



Holding Electrodes



Hand Screen

Aim - To prepare a V-butt joint using electric arc welding machine of given dimension

Materials: Mild steel of size (30mm x 50mm x 5mm)

Machine Tools Required:-

Steel rule, Try square, Bantard file, Chipping hammer,
Wire brush, face shield, Apron, Bench vice, Electrodes,
Electric welding machine with all accessories

Operations:-

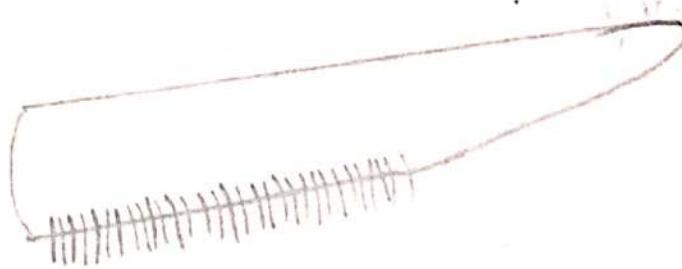
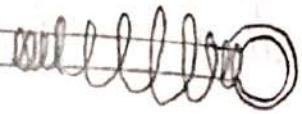
- i) Filing
- ii) Edge making
- iii) Tacking
- iv) Welding
- v) Chipping
- vi) Brushing

Theory:-

Welding may be defined as the process of joining metals by the application of heat, with or without the application of pressure and filler metal, in such a way that the welded component is a continuity of homogeneous material have the same composition and characteristics of the two parts to be joined together.

Some of the reasons for the same are as follows:

- i) As compared to riveting and casting welding is a more



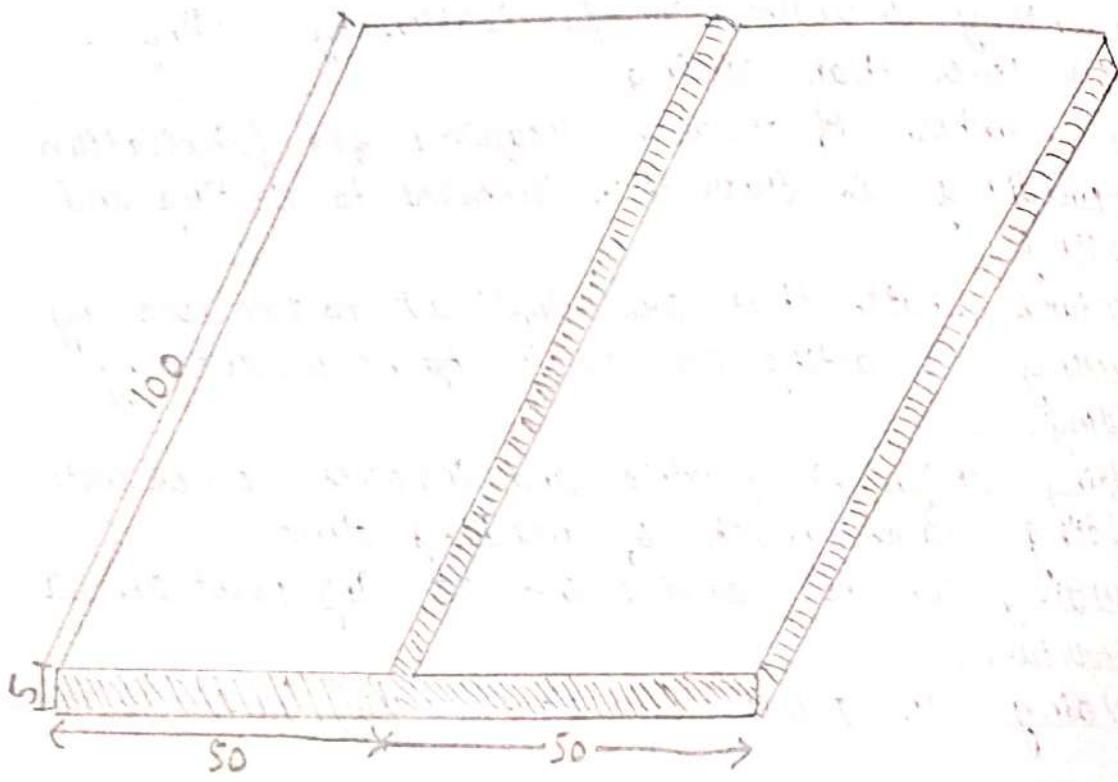
Wire brush

economical and faster process.

- ii) Dissimilar metals can be joined by welding
- iii) Fabrication of welded structure is simpler in comparison to a cast part.
- iv) Inventory involved in fabrication by welding is much lesser than casting.
- v) The number of persons required for fabrication by welding is lesser than compared to riveting and casting.
- vi) Structural shapes that are difficult to produce by riveting or casting can easily be produced by welding.
- vii) Welding design is flexible and involves lower costs.
- viii) Welding saves much of machining time.
- ix) Welding can be carried out at any point on a structure.
- x) Welding can produce 100% efficient joints.

Welding has the following advantages:-

- i) It produces a permanent joint.
- ii) The overall cost of welding equipment is generally low.
- iii) Many portable welding instruments are available.
- iv) A large number of metals can be welded.
- v) A good weld is as strong as the base metal.
- vi) Welding can be employed from limited position to any length.
- vii) Welding operations can be mechanized for production.



Single V-butt Joint

Arc welding is a welding process in which, to form a molten pool of metal, heat is produced by an electric arc, generally without the application of a filler metal. It uses either ac or dc for striking the arc between the electrode and the work piece. One terminal is connected to the electrode, the other to the work piece and the circuit is completed through an air gap between the electrode and the work piece. The welding circuit consists of a welding machine, lead cables, electrode holder, electrode and the work piece itself.

Procedure

1. Clamp the work piece in the bench vice, keeping the flat surface just 2mm to 3mm.
2. File carefully the flat surface of the work piece without touching the surface of bench vice.
3. Prepare the edges of the both pieces through 45 degree and make a V shape for the welding operation.
4. After edge preparations, place the two piece in proper position on the welding table for the butt joint preparation.
5. Hold the electrode in the welding holder and switch on welding transformer.
6. Make a minimum distance b/w the job and the electrode to produce a suitable arc.
7. Prepare a proper arc at one end to the other end at a proper speed to complete the weld.

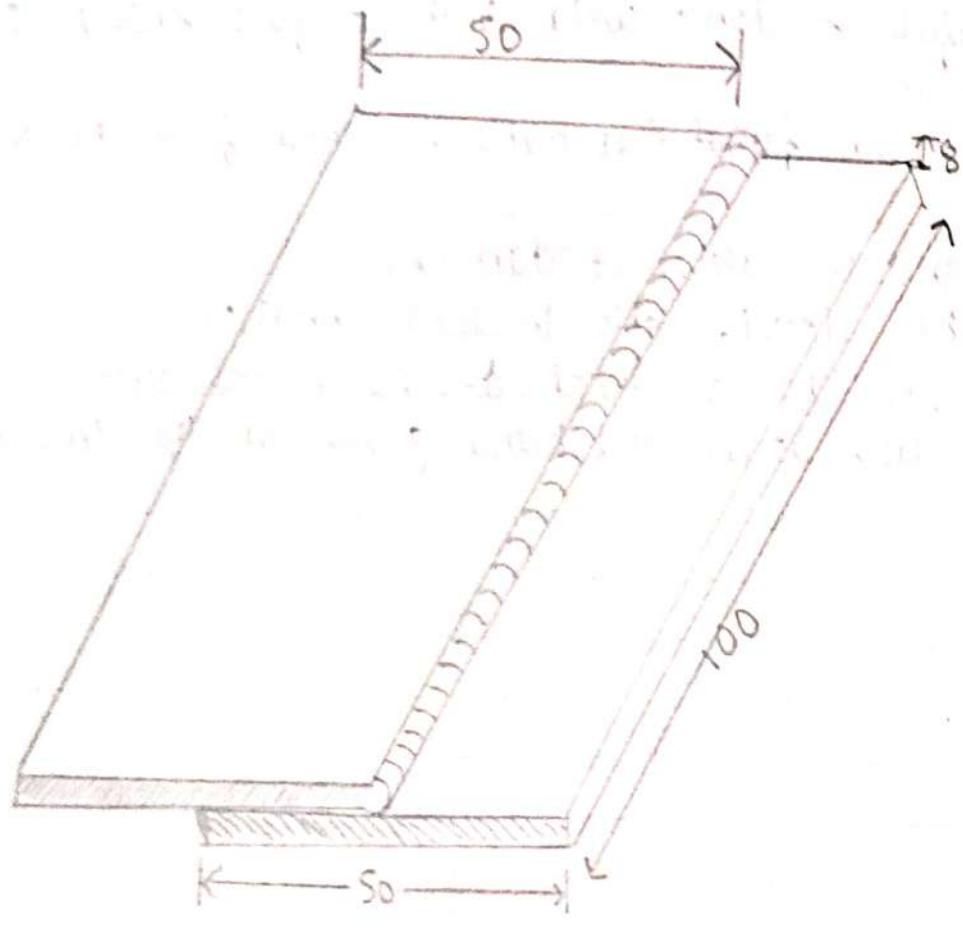
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Precautions:

- i) Work piece should be clamped tightly in the bench vice.
- ii) The joints of the cable should not be loose.
- iii) Be careful & don't weld without face shield or google and apron.
- iv) Remove all forms of flammable material from the welding area.
- v) Speed the insulation if damaged.
- vi) Keep the electric cable in good condition.
- vii) Don't see the produced arc by naked eyes.
- ix) Always use apron and hand gloves at the time of welding.

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Lap Joint

Aim:- To prepare a lap joint using electric arc welding machine of given dimension.

Materials: Mild steel of size (50mm x 50mm x 5mm)

Machine & Tools required

Steel rule, Try square, Bastard file, Face shield, Electrodes, Chipping hammer, Wire brush, Bench vice, Apron, Electric arc welding machine along with all its accessories.

Operations:-

Filing

Edge making

Tacking

Welding

Chipping

Brushing

Procedure

Clamp the work piece in the bench vice, keeping the flat surface just 2mm to 3mm above the jaws of the vice.

- i) File carefully the flat surface of the work piece without touching the surface of bench vice.
- ii) Prepare the edges of the both pieces through 45 degree. And make a V shape for the welding operation.
- iii) After edge preparations, place the two piece in proper

and the
we finally got to the hotel and had
dinner with the children again.
Then we went to the hills to buy
some wild mushrooms and for the first time
I saw a mushroom that I could
not identify. It was white with a brown
ring around the stem and a yellow
cap. I have never seen one like it.
After dinner we went to the beach
and I swam in the ocean. The water
was very cold but I enjoyed it.
We stayed at the hotel all night
and the next morning we got up early
and went to the beach again. We
spent most of the day swimming
and sunbathing. It was a great day.

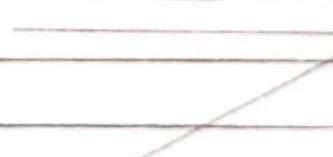
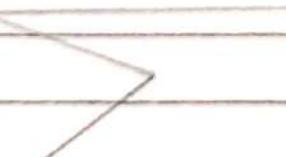
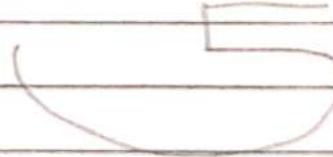
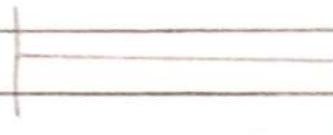
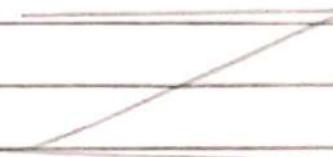
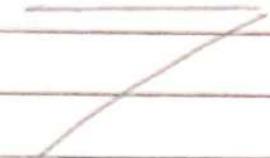
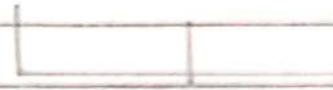
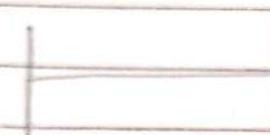
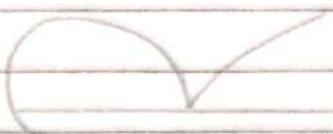
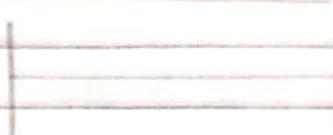
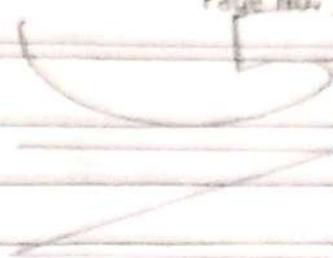
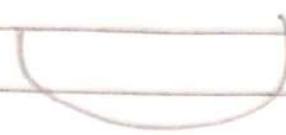
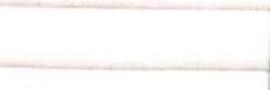
- position on the welding table for the lap joint preparation.
- IV) Hold the electrode in the welding holder and switch on the welding transformer
 - V) After welding on both sides remove the extra filler metals burs from the weld by chipping hammer and wire brush

Precautions:-

- i) Work piece should be clamped tightly in the bench vice.
- ii) The joints of the cable should not be loose.
- iii) Be careful & don't weld without face shield or google and apron.
- iv) Remove the flammable material from the welding area.
- v) Keep the electric cable in good condition. Repair the insulation if damaged.
- vi) Keep your skin covered as far as possible.
- vii) Don't see the produced arc by naked eyes.
- viii) Always use apron and hand gloves at the time of welding.

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Object - To study and working of a simple measuring instrument vernier calipers.

Apparatus Used:- i) Vernier Caliper

$$\begin{aligned}\text{Least count} &= \frac{\text{Value of one division of main scale}}{\text{Total no of division on vernier scale}} \\ &= \frac{1 \text{ mm}}{50} \\ &= 0.02 \text{ mm.}\end{aligned}$$

2) Work piece of various cross section with different diameters.

Principle: Vernier caliper is the most commonly used instrument for measuring outer and inner diameters.

It work on the principle of vernier scale which is some fixed unit of length (Ex - 49 mm).

Divide into 1 less or 1 more part of the unit (Ex: 49 mm are divided into 50 parts). The exact measurement with up to 0.02 mm accuracy can be determined by the coinciding line between main scale and vernier scale.

$$\text{Total reading} = \text{M.S.R} + \text{V.S.C} * \text{L.C}$$

where,

M.S.R = Main Scale Reading

V.S.C = Vernier scale coincidence

L.C = Least Count

Procedure:-

- The least count is to be determined.

for Big Workpiece

Measuring Dimension	Trial	Main Scale Reading	Vernier scale coincidence	VSC x LC	Total dimension
Big diameter	1	59	39	39×0.02	59.78
	2	59	40	40×0.02	59.8
	3	59	39	39×0.02	59.78
Inner diameter	1	45	36	36×0.02	45.72
	2	45	35	35×0.02	45.72
Height	1	117	0	0×0.02	117
	2	117	0	0×0.02	117

for Small workpiece

Measuring Dimension	Trial	Main Scale reading (mm)	Vernier scale coincidence	VSC x LC	Total dimension
Big dia.	1	25	15	15×0.02	25.30
	2	25	15	15×0.02	25.30
	3	25	18	18×0.02	25.36
Inner dia.	1	21	10	10×0.02	21.40
	2	21	8	8×0.02	21.16
Height	1	90	2	2×0.02	90.04
	2	90	2	2×0.02	90.04

2. The work piece is placed between the jaws of vernier caliper correctly.
3. The reading on main scale which is just behind the first vernier scale division is noted as main scale reading.
4. The division on vernier scale which coincides with the line on main scale is noted down as vernier coincidence.
5. The diameter can be calculated using the given formula

Result

- Outer diameter of the workpiece is 59.78 mm
- Inner diameter of the workpiece is 45.71 mm
- Height of the workpiece: 117 mm

Precautions

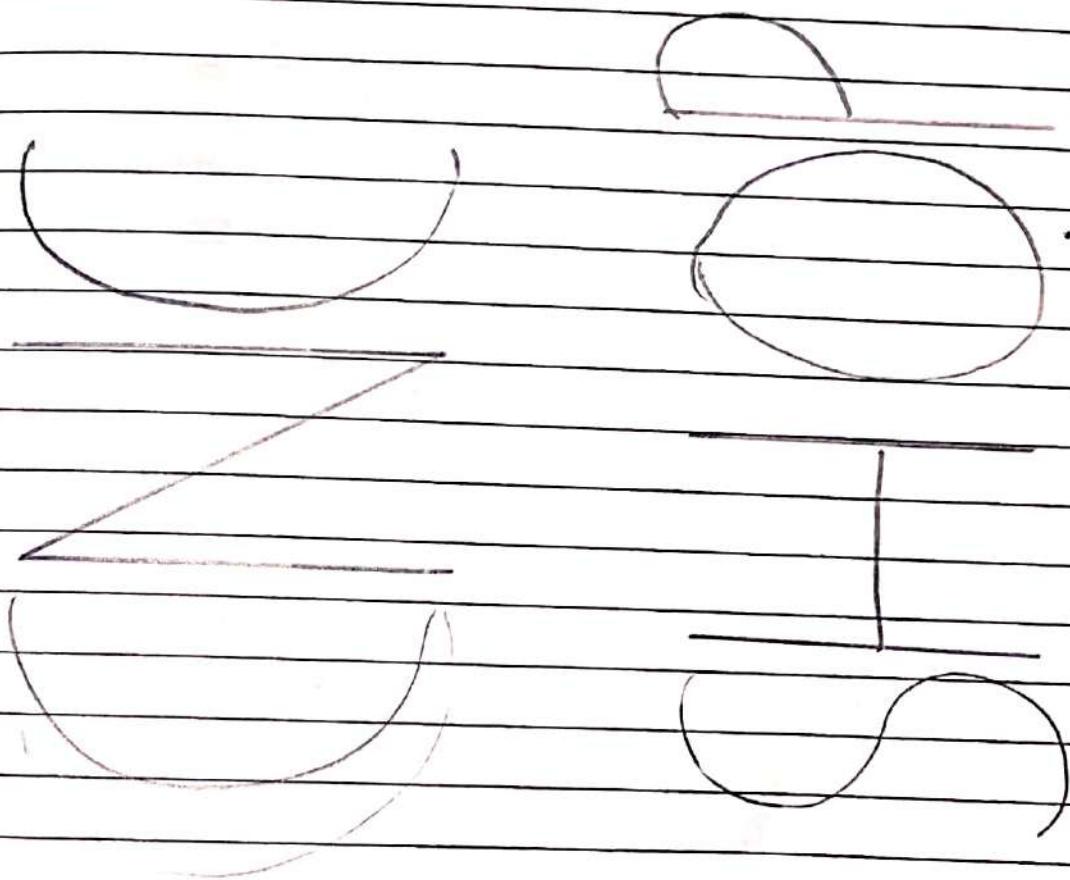
- Make sure the vernier caliper are clean
- Clean the measuring face with paper or cloth.
- Make sure the workpiece axis is perpendicular to the vernier caliper.

Application

It is used to measure the external diameter, the internal diameter, and the length of the given specimen.

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In a CNC machine, all the numerical functions are controlled by the computer. The computer stores the program which are required to operate the machine.

The computer also gives the display of various parameters of the machine - like spindle speed, feed rate, etc. It consists of electronic instrumentation to measure the output.

CNC stands for computer numerical control. It is a machine controlled by a computer. Its external appearance is similar to that of an NC machine. Tape or computer keyboard or TUTOR keyboard is used as input media for CNC machines. For NC machines tape has to be fit repeatedly to produce repeated jobs.

But for CNC machines tape is fit once and the program is stored in the memory and can be run repeatedly to produce repeated jobs.

Basic CNC Concept

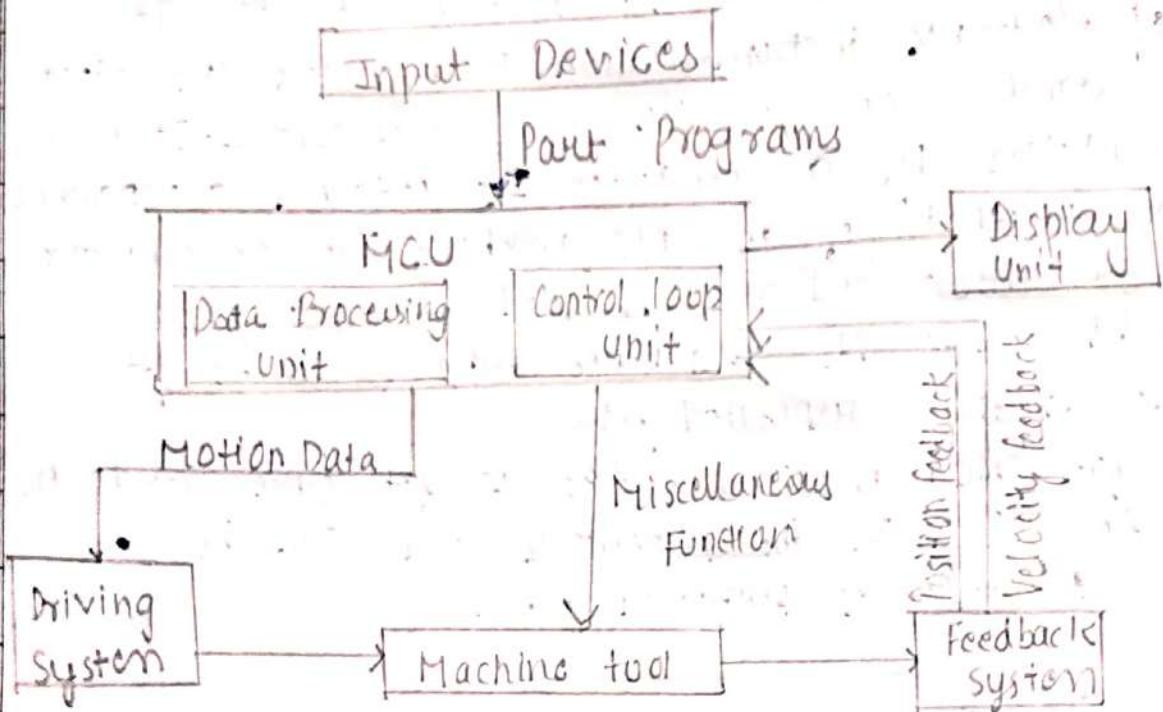
A CNC system can be described in terms of three major elements

1. Hardware
2. Software and
3. Information

Features of CNC machine

The features of CNC machines are as follows:

- Part program input may be through the keyboard.
- The part program is entered into the micro computer and stored in the memory.



Basic elements of the CNC Machine

- The entered part program can be edited for any errors or design changes.
- A graphical display of the cutter path and shape of the finished work is possible before actually running the program.
- Tool wear compensation is possible.
- Able to get machine utilization information's like the number of components produced, time per component, time for setting the job etc.,
- The sub-program facility is also possible for repetitive machining sequences.

The main parts of the CNC machines are

- 1) Input devices
- 2) Machine control unit (MCU)
- 3) Machine tool
- 4) Driving system
- 5) Feed back system
- 6) Display unit

How CNC machines works.

The figure shows the CNC machine working:

First, the part program is entered into the MCU of the CNC.

The MCU processes all the data and according to the program prepared, it prepares all the motion commands and gives them to the driving system.

The feedback system records the position and velocity measurements of the machine tool and gives a feedback signal to the MCU. In the MCU, the feedback signals are compared with reference signals and if errors occurs, it corrects it and send new signals to the machine tool to be corrected.

- The display unit is used to see all the programs, commands, and other data. It works like the eye of the machine.

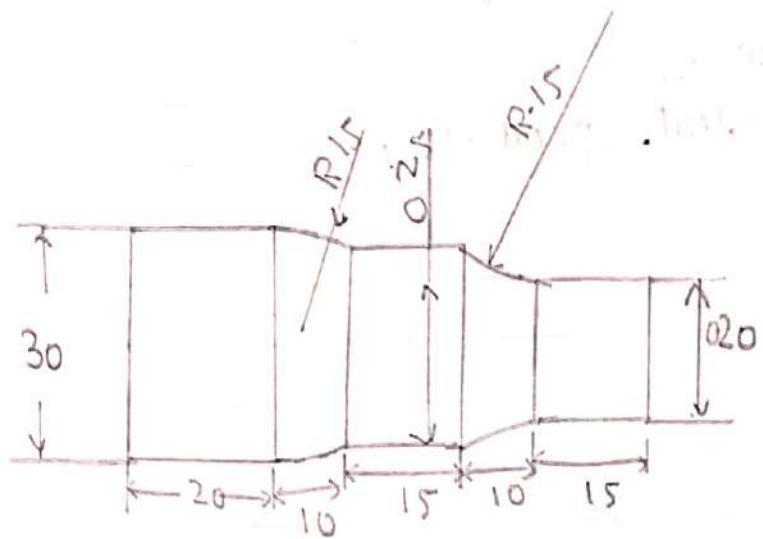
Advantages of CNC machine

- Following are the advantages of CNC machine
- The CNC machine can produce jobs with highest accuracy & per precision than any other manual machine. It eliminates human error.
 - It can be operated for 24 hrs in a day. Higher flexibility also.
 - A highly skilled operator is not needed to run a CNC machine.
 - It is suitable for batch production.
 - It requires less space for its operations.
 - More operational safety.

Disadvantages of CNC machine

- Following are the disadvantages of CNC machine
- The cost of a CNC machine is much higher than a manually operated machine.

- Initial cost is high.
- Parts of the CNC machines are costly.
- Maintenance costs are significantly higher in the case of CNC.
- Maintenance cost is more.
- Not suitable for small scale production.



Diagram

CNC Turning

Aim: Work piece setting methods, tool setting method.

CNC part programming

N1 F0.5 S1200 T0101 M06 M03

N10 G00 X35Z2

N30 G71 U0.5R1

N35 G71 P36 G90 U0.05 W0.05

N36 G01 X20Z0

N50 G01 X20Z-15

N60 G02 X25 Z-25 R15

N70 G01 X25 Z-40

N80 G03 X30 Z-50 R-15

N90 G01 X30 Z-70

N100 G28 U0 W0

N110 M05 M30

List of M1 Code

S. RNO	CODE	FUNCTION
1	M00	PROGRAM HALT
2	M01	OPTIONAL PROGRAM STOP
3	M02	PROGRAM END
4	M03	SPINDLE START CLOCKWISE
5	M04	SPINDLE START ANTICLOCKWISE
6	M05	SPINDLE STOP
7	M07	COOLANT NO. 1 ON
8	M08	COOLANT NO. 2 ON
9	M09	COOLANT OFF
10	M13	SPINDLE CLOCKWISE & COOLANT ON
11	M014	SPINDLE ANTICLOCKWISE & COOLANT ON
12	M030	PROGRAM END & REWIND
13	M098	START OF SUBROUTINE
14	M099	END OF SUBROUTINE

List of G-Codes

SNO	Code	Function
1	G00	Rapid positioning
2	G01	Linear interpolation
3	G02	Clockwise circular interpolation.
4	G03	Counter clockwise circular interpolation
5	G04	DWELL in seconds
6	G06	Parabolic interpolation.
7	G20	Inch programming
8	G21	Metric programming
9	G28	Automatic returns to reference point
10	G32	Thread cutting cycle
11	G70	Finishing cycle
12	G71	Stock removal in turning
13	G72	Stock removal in Facing
14	G73	Pattern repeating cycle
15	G74	Peck Drilling canned cycle
16	G90	Diameter cutting cycle.
17	G92	Threading canned cycle.
18	G96	Constant Surface speed on
19	G97	Constant Surface speed OFF