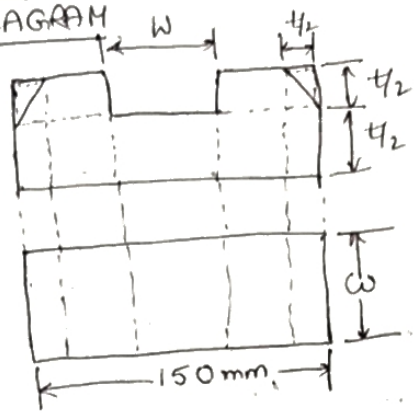
Workshop Technology.

dt: 18/01/18

CARPENTRY SHOP

JOB DIAGRAM



Introduction

Carpentry may be designated as the process of making wooden articles and components such as floor, partition, door and window. carpentry involves cutting, shaping and fastening wood and other materials together to produce a finished product.

Carpentry Tools

1. Marking tools -
   (a) Marking edge
   (b) Mortise gage
2. Measuring tool -
   (a) Steel tape
   (b) Steel Rule — 1 inch = 2.54 cm / 25.4 mm
   (c) caliper
   (d) Try square.
3. Holding tools -
   (a) Bench vice.
   (b) Bench stop.
   (c) C-clamp.
4. Cutting tool -
   (a) Rip-Saw
   (b) Tenon saw.
   (c) chisel. (types & parts) (Firmer type).
   (d) Jack plane.

5. Boring tools –
   (a) Bradawl.
   (b) Jimlet
   (c) Bit and Drill.

6. Striking tool –
   (a) Cross peen Hammer. (types of hammer & parts)
   (b) Claw hammer
   (c) Mallet. (round or rectangular shape).

Wood

Wood is a porous and fibrous structural tissue found in the stem and root of trees. It is an organic material, a natural composite of cellulose fibres. which are strong in tension embedded in a matrix of lignin which resist compression.

Wood Structure –

Wood is a heterogeneous, cellular and ~~isogen~~ anisotropic material. It consist of a cell and cell wall, are composed of cellulose (40% – 50%). and hemicellulose (50% – 25%) with lignin (15% – 30%).

D

Difference b/w Hard wood & Soft wood

Hard wood	Soft wood
1. Comes from angiosperm trees that are not monocots, and trees are usually with broaded leaves.	1. Comes from gymnosperm trees which are usually have needles and cone type leaves.
2. These are more likely to be found in furniture, flooring etc.	2. Wide range of application in building components, paper etc.
3. These trees are balsa, mahogany, oak etc.	3. Examples are Sedak, pine etc.

**

Seasoning =

Seasoning is a process of removing the moisture contained from wood to minimize the structural problem

There are 2 types of Seasoning -

1. Air Seasoning / natural Seasoning.
2. Kiln / artificial Seasoning.

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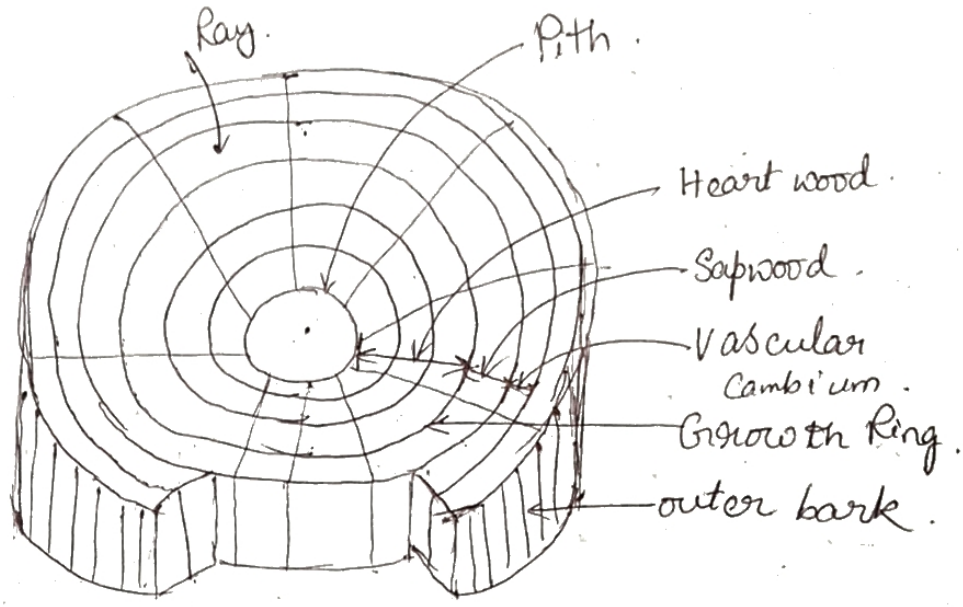
1. Log.
2. Batten.
3. plank.
4. Beam.

[Workshop Technology by Hazra And Chowdhury. Vol-I].



Heart wood – It is ~~that~~ a wood that as a result of a ~~result~~ natural occuring chemical transformation has become more resistant to decay.

Sap wood - the younger, outermost wood and its principle function is to conduct water from the root to the leaves.

Foundry Shop

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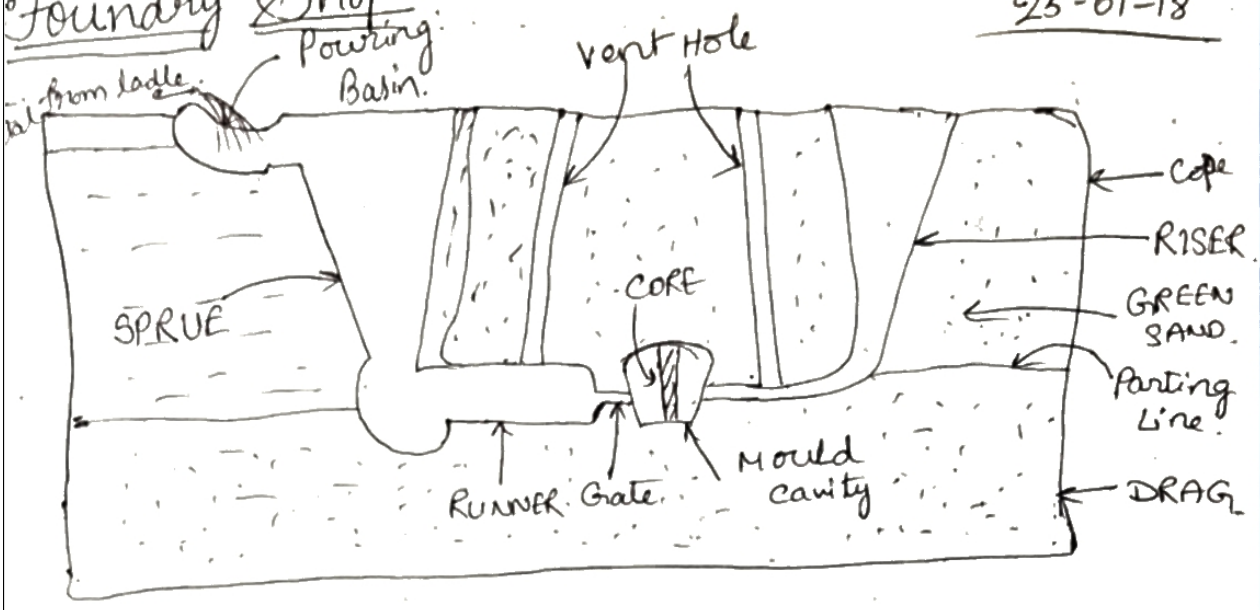


Corepin - required to make core fixed.

Flask

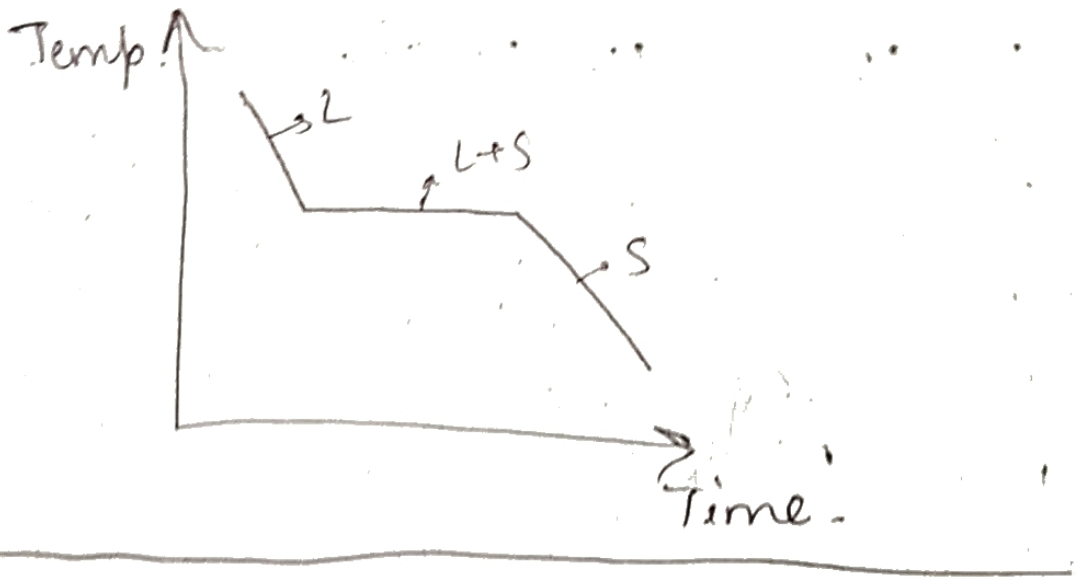
Pattern :- A pattern is the replica of the part to be cast and is used to prepare the mould cavity.

Pattern material :

1. Wood (teak, burma, Mahogany and etc.)
2. Metal (Aluminium, Steel, cast Iron etc)
3. plaster of paris
4. ~~casting~~ plastic
5. Wax.

Different allowances in pattern making :

1. Shrinkage allowance.
2. Draft allowance. - (max 3°).
3. Machining allowance.
4. Distorsion allowance / camber allowance
5. Shaking allowance / rapping allowance.


Temp
L
L+S
S
Time

FITTING SHOP

01/02/18

Casting

Pattern colour code :

1. Red or Orange on surfaces not to be finished and left as cast.
2. Yellow on surfaces to be machined
3. Black on core prints for unmachined.
4. Yellow ~~strip~~ strip on back on core prints for machine opening.
5. Diagonal black strip with clear varnish on to strengthen the weak pattern.

properties of moulding Sand : (Follow board).

1. porosity
2. Flow ability
3. Adhesiveness
4. cohesiveness
5. ~~flowability~~ collapsibility.
6. Refractoriness (ability to withstand. at high temp.)
7. Strength.

Green Sand

The moulding sand that certain moisture is known as green sand.

Dry Sand

when the moisture in the moulding sand is completely expelled called Dry Sand.

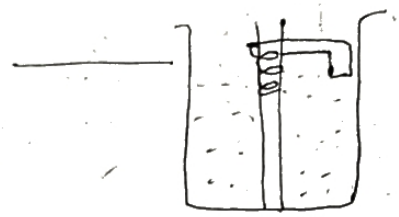
Clay.

There are 2 types of clay used for binding edges / agent.

1. Kaolinite ($Al_2O_3\ 2SiO_2\ 2H_2O$)
2. Bentonite ($Al_2O_3, 4SiO_2, xH_2O\ nH_2O$)

Different types of pattern :-

1. Single piece or Solid pattern.
2. Split pattern.
3. Sweep pattern
4. Skeleton pattern,
5. Segemental pattern
6. Loose piece pattern.
7. Match plate pattern.
8. Shell pattern.



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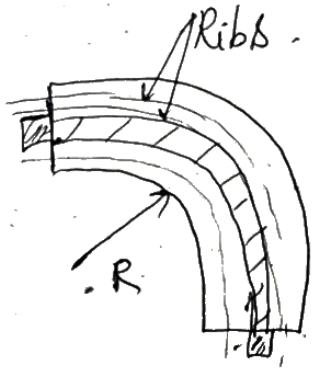

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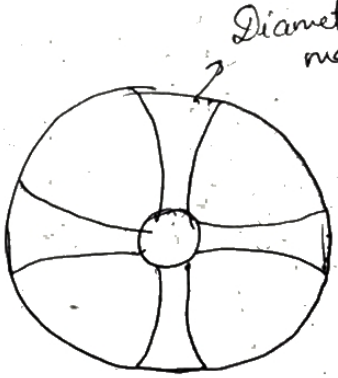
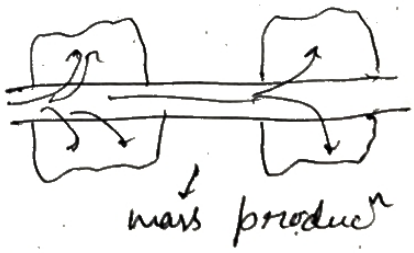


6.

7.



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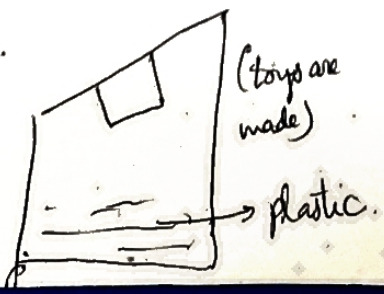


Moulding Sand :-

1. Silicon (70-85%)
2. clay (10-20%)
3. water (2-8%)
4. Additives (1-4%)

Types of Sand :

1. Green Sand
2. Dry Sand.
3. Facing Sand
4. parting Sand.
5. Backing Sand

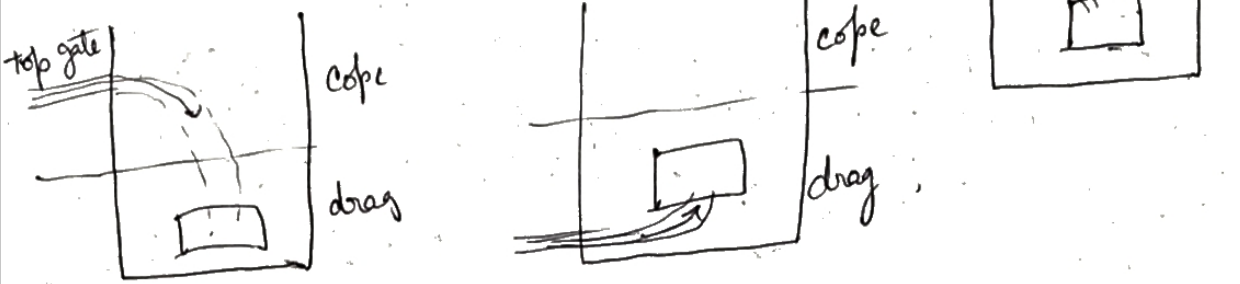
Gate :

There 2 types of gate :.

1. Top gate
2. Bottom Gate
3. parting Gate.

↓ used in ferrous material

↓ used in non-ferrous.



adv: Gravity

disadv: unfinished surface, Splash due to temp diff.

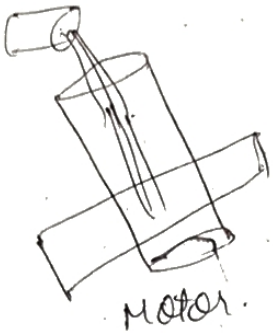
adv :

disadv.

Gating Ratio :-

	Sprue	runner	Gate
1. Non-pressurised →	1	4	4
2. pressurised gating →	1	2	1

Centrifugal casting :



Cleaning of the casting :

1. Fettling. → (Removing runner, riser etc.)
2. Sand Blasting.

Defects in casting process :

1. Gas defect.
   a. Blow holes (large ") b. Scar c. pin holes (Small ")

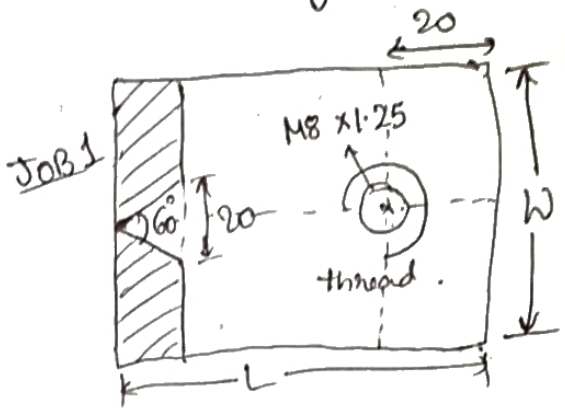
2. Shrinkage defects.
   a. chilled surface
3. Moulding material defects
   a. Drop and dirt. b. Cuts and washes
   c. Buckles d. Metal penetration (Foreign metal)

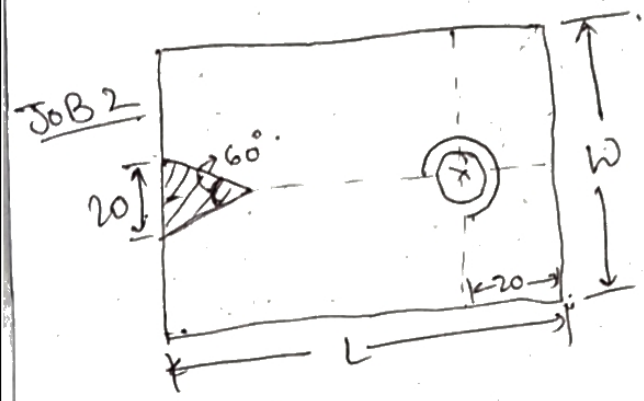
4. pouring metal defects :
   a. Misrun b. Cold shunt (Lower layer gets cooled at the mid way) c. Slag inclusions (Metal ಜೊತೆ ಬರುವ)
5. Metallurgical defects :
   a. Hot crack

Fitting Shop

Dt: 8/2/18

Job Diagram



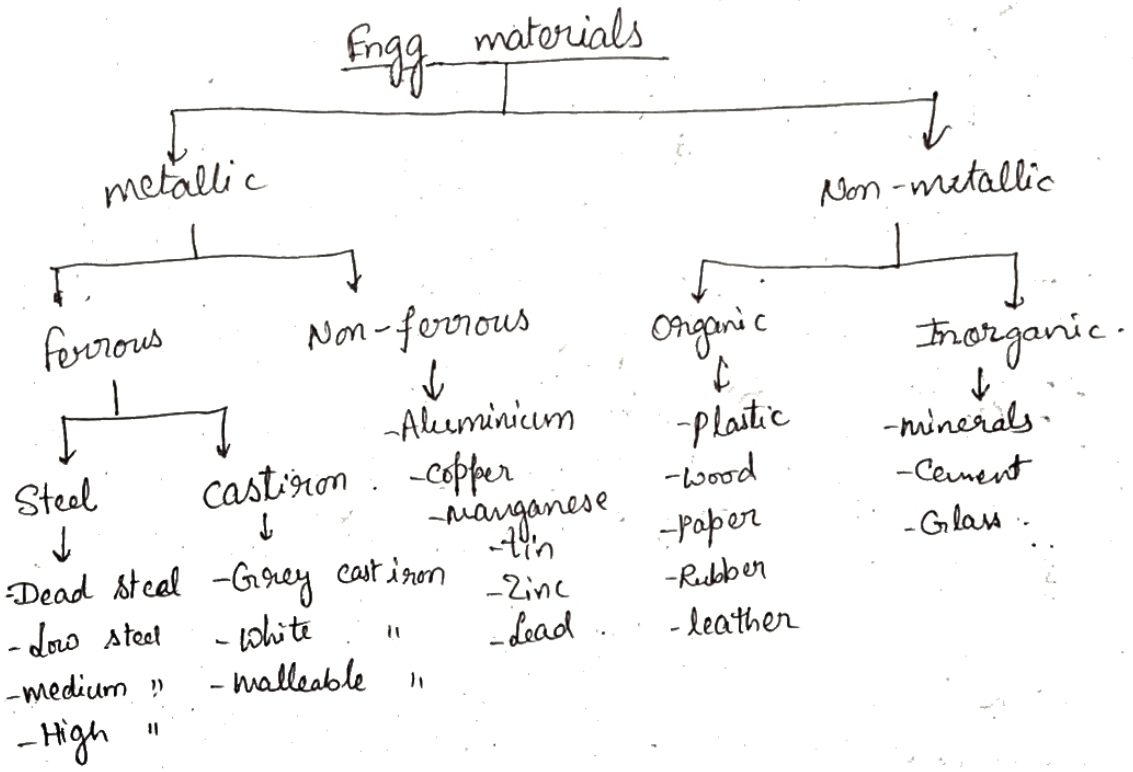


1. Hack saw
2. Steel Rule
3. Try Square
4. Divider
5. Scriber
6. Odd-leg caliper
7. Punch
8. Ball peen hammer.

Fitting Shop: Fitting is the assembly together of the parts and removing metals to secure necessary fit and may or may not carried out at bench. All fitting job require large number of operation to finish the work in desired shape.

The operation basically require for fitting shop are:

1. filing op. 2. Sawing op 3. Marking op. 4. Drilling op. 5. tapping op 6. Dieing op.



Classification of Metal:

Metals are classified into 2 categories:

1. ferrous: These are mostly used because of the development of the technology. That has produced thousand of different alloys & Grades. That provide a wide range of ferrous materials.
They are classified as (a) Pig Iron (b) Cast Iron

NOTE: All iron & Steel product are derived from Pig Iron.

2. Non-ferrous materials :

The metal which don't contain Iron as base metal: their melting point are lower than that of ferrous matels.

uses of 2:-

(i) Resistance to corrosion.

(ii) Ø Low density.

(iii) Good formability.

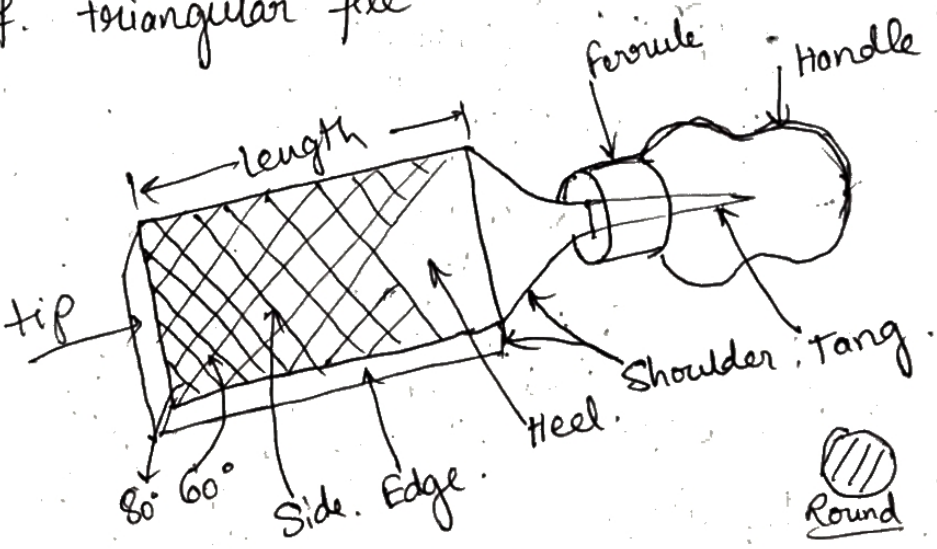
Tool used for various purposes :

1. Fitting tool :

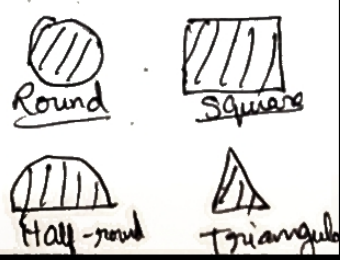
These tools are widely used in the engineering work shop.

A file cuts all metals except the hardened Steel.

a. Flat file.
b. Hand file.
c. Square file
d. Round file.
e. Half Round file.
f. triangular file.



Double cut file

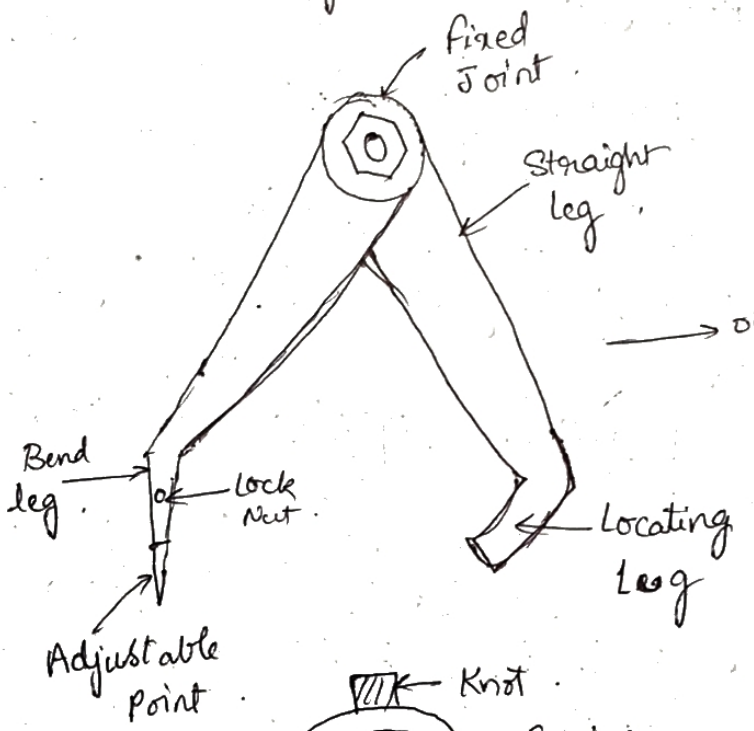


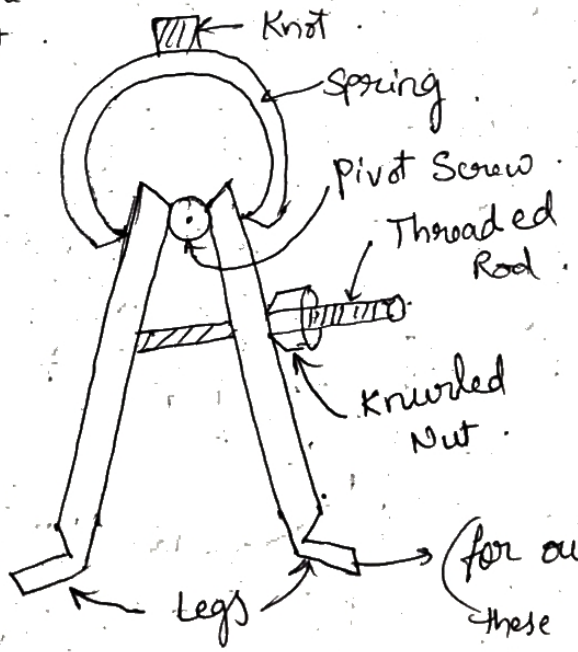
2. Calliper :

They are used to transfer and compare a dimension from one object to another.

There are basically 3 types of calliper:

a. outside calliper.
b. Inside calliper.
c. Odd - leg "



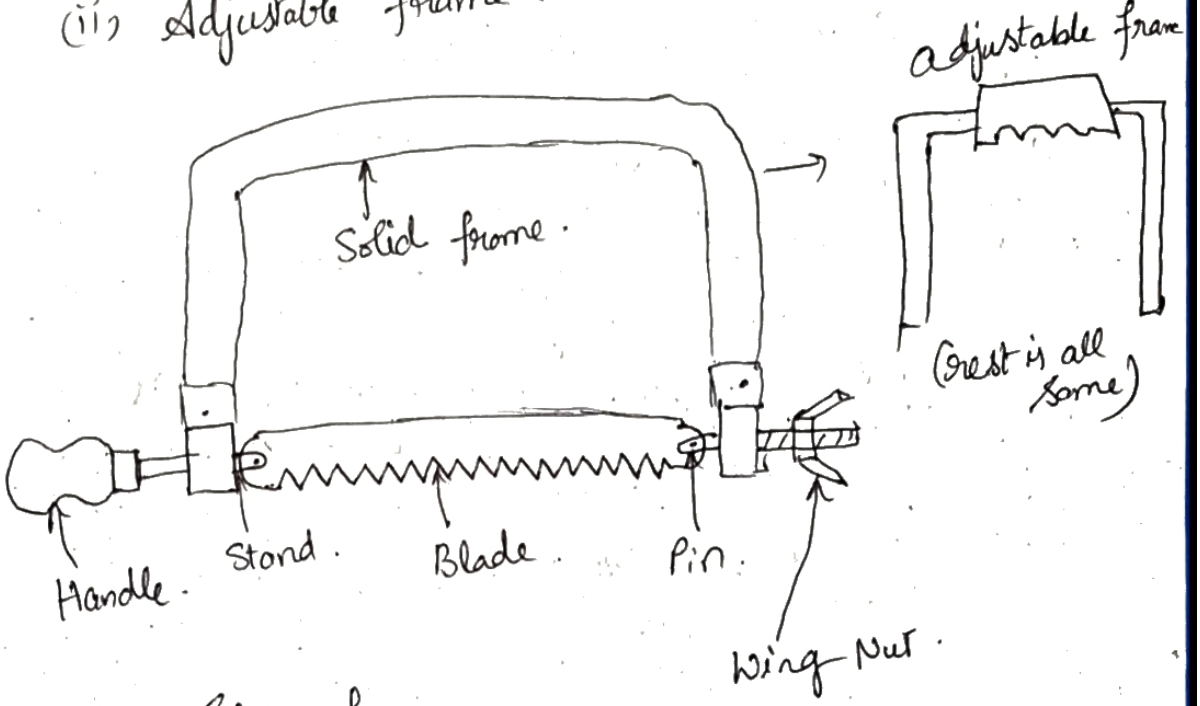


3. Cutting Tool :

Hack Saw is used of sawing operation. It can cut all the metal except Hardened Steel.

There are basically 2 types of frame we used in Hack Saw.

(i) Solid frame
(ii) Adjustable frame.



Solid frame

4. Basically there are 2 types of Punch.

(i) centre.
(ii) Dot.

Dot Punch!

Centre punch.

Dt: 15/2/18.

Fitting Shop

class (II)

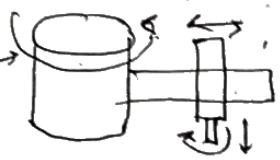
Drilling

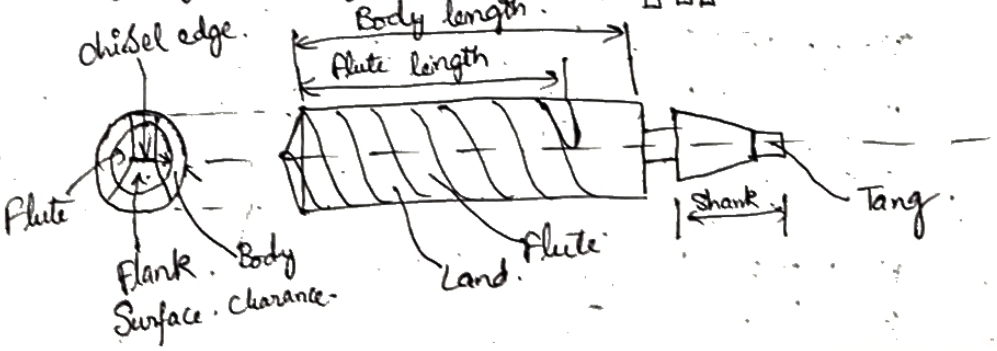
Classification of Drills :

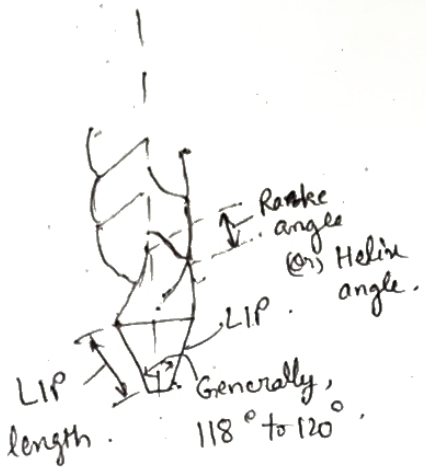
1) According to the type Shank.
   a. parallel Shank. b. tapper Shank.
2) According to the types of flutes
   a. Flat drills b. twist drills.
3) According to the length.
   a. Stub series drills b. Long series drills.
4) According to the tool material.
   a. High Speed Steel drills
   b. carbide tipped drills.

Types of Drills

a) portable drilling machine (in electrical)
b) upright drilling machine
c) Radial type of drilling machine →
d) Gang drilling machine →







NOTE

Drill Size = 0.8 × tap Size

tap: tap has external thread but on work piece it put internal thread.

there are 3 types of taps.

a) Rougher (b) Intermediate (c) finisher.

Die: Die has internal thread, but on the work piece it put external thread.

NOTE

1) High Speed Steel ⇒ 18-4-1

18 is for tungsten (%), 4% → chromium

1% — Vd.

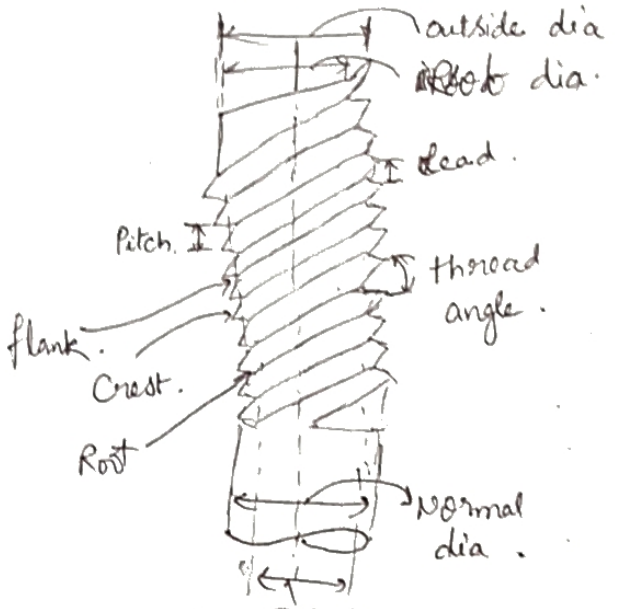
2) Molebdenum high speed Steel ⇒ 6-6-4-2 (4 → chromium, 2 → Venadiu)

6 → tungsten, 6 → Molebdenum

3) Super high Speed Steel ⇒ 24-2-12.

24 → tungsten, 2 → Vd, 12 → Cobalt.

Threading



→ Lead: After completing one complete revolution, the bolt travels the distance is known as Lead.

Effective dia → Considered b/w outside dia & Root dia.

→ Crest to crest or Root to Root distance is known as pitch

Basically there are different kinds of thread.

(1) Matrick thread.
(2) BSW (British Standard Whit worth thread).
(3) BSP (British Standard pipe thread)
(4) Knuckeal thread.
(5) Buttsries thread.
(6) ~~Semi~~ ACME thread.
(7) Square thread

Steel :- It is an alloy of Iron and carbon with carbon content upto maximum 1.5%.

(1) Dead ~~mild~~ Steel (0.15% C)
(2) Low carbon / mild Steel. (0.15% C - 0.45% C)
(3) Medium carbon Steel (0.45% - 0.8% Carbon)
(4) High carbon Steel (0.8% - 1.5% C).

22-02-18

Lathe

Types of Lathe:

1. Bench Lathe.
2. Speed Lathe (not fixed rpm).
3. Engine Lathe (works with engine not Electricity).
4. capstan Lathe (used for small ~~object~~ job).
5. Automatic Lathe.
6. Semi Automatic Lathe.
7. turret Lathe (used for long job).

classification of Lathe:

1. Height of centre over bed
2. Maximum swing over bed -
3. Maximum swing over carriage
4. Maximum swing over gap.
5. Maximum distance between centre (live centre & Dead centre)
6. Length of bed -
7. Number of Speed and ~~feed~~ feed

Parts of Lathe:

1. Bed.
2. Head Stock.
   (a) cone pulley. (b) Back gear (c) main spindle
   (d) live centre (e)
3. Tail Stock
   (a) Dead centre (b)
4. carriage.
   (a) Saddle (b) cross-slide (c) compound rest.
   (d) tool post (e) apron mechanism

5) Feed Mechanism.
6) Legs.

Chuck

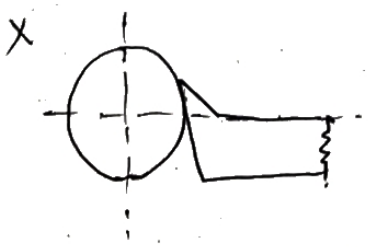
1. Three jaw universal chuck
2. Four jaw Independent chuck
3. Combination chuck
4. Magnetic chuck.

Basic Operation in Lathe :

1. Turning
2. Facing
3. Tapper turning.
4. parting.
5. threading.
6. Drilling.
7. Boring.
8. Knurling.  used for grip.
9. grooving.
10. Spinning
11. ~~cum~~ Grinding
12. Chamfering.
13. polishing.

Correct Setting of turning tool:

(i)



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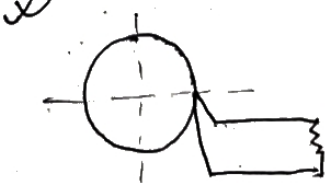

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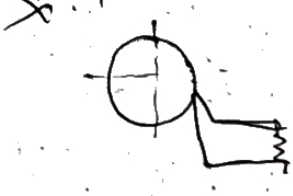


Dt: 8/3/18

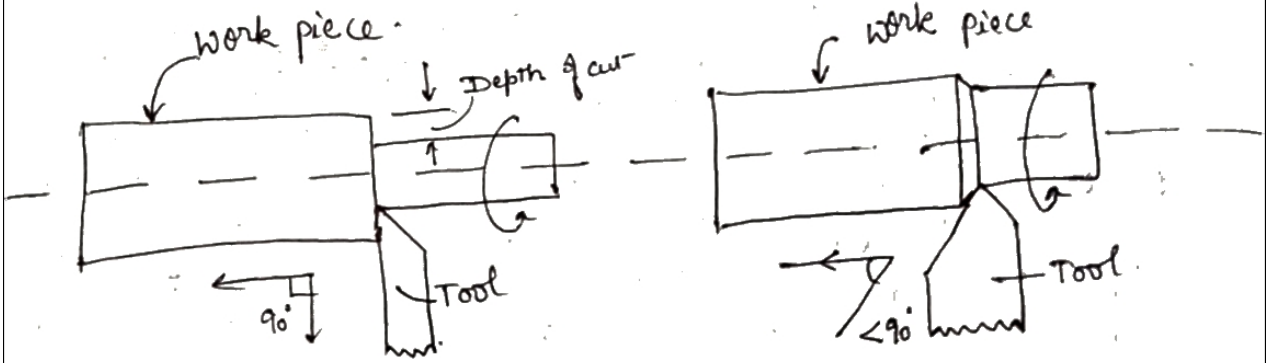
Methods of taper turning

1. Tail Stock Set over method.
2. By Swivelling the compound rest
3. By using the taper turning attachment.

Cutting tool material

1. High carbon Steel
2. High Speed Steel (used)
3. Stellite
4. cemented carbide
5. ceramics
6. Diamond

Orthogonal and Oblique Cutting –



Orthogonal
(force acts in x, y direction only)

Oblique
(force acts in x, y, z dir)

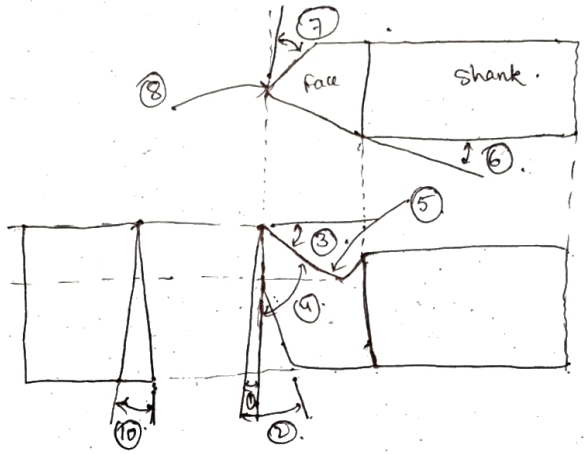
classification of cutting tool:

1. Single point tool – Lathe, Shipping, planning
2. Multi. point cutting tool – Milling, grinding, broaching

Important terms about tool:

1. Shank
2. Face
3. point
4. Flank.

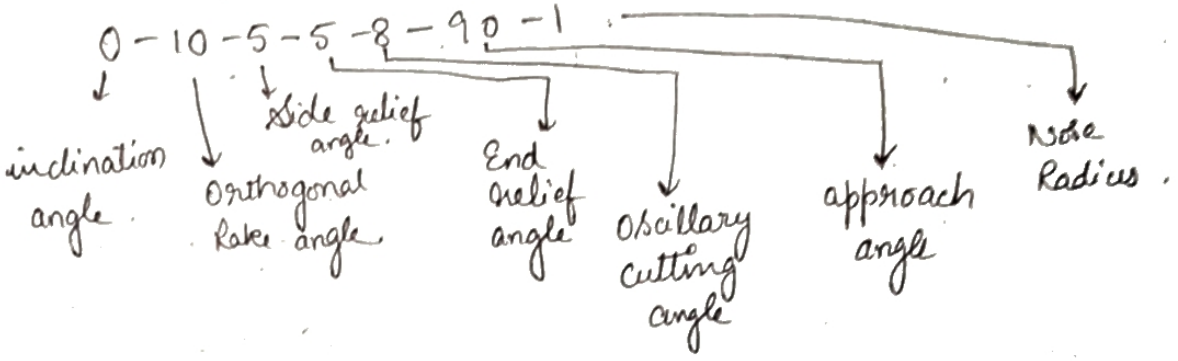
** principle point angles of Single point tool:



(1) End Relief angle
(2) clearance angle
(3) Top rake angle
(4) Lip angle.
(5) Face
(6) Side cutting edge angle
(7) End cutting edge angle
(8) Nose radius.
(9) Side Rake angle.
(10) Side clearance angle.

Tool designation.

ORS System (Orthogonal Rake System)



Properties of cutting tool material :

1. Red Hardness.
2. toughness.
3. Wear resistance.
4. thermal conductivity.
5. Machine ability.

Thread cutting operation.

$$\frac{\text{Driver gear teeth}}{\text{Driven gear teeth.}} = \frac{\text{Lead of Screw to be cut}}{\text{Lead of lead Screw ~~thread~~ to be cut.}}$$

(Or)

$$\frac{\text{Driver}}{\text{Driven}} = \frac{5}{127} \times \frac{\text{Lead of Screw to be cut in mm}}{\text{Lead ~~of thread~~ Screw in inches.}}$$

(Or)

$$\frac{\text{Driver}}{\text{Driven}} = \frac{127}{5} \times \frac{\text{Lead of Screw to be cut in inches}}{\text{Lead Screw in mm.}}$$

$\frac{127}{5}$ → gear ratio.

127 → universal gear teeth.

Dt: 29/3/18

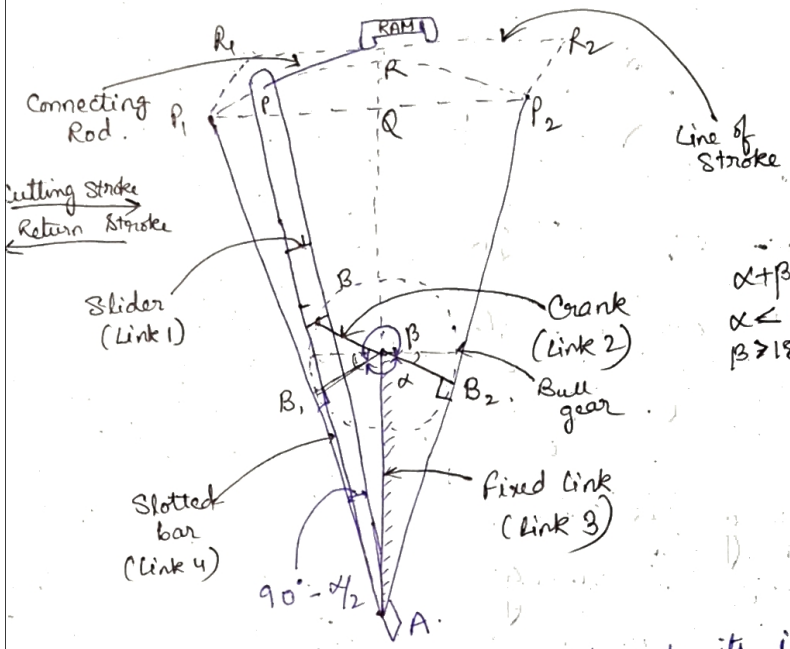
Shaping Machine

principle parts of the Shaper :

1. Base
2. Column
3. Cross-rail
4. Table
5. RAM.
6. Tool head
7. Vice.

Size and Specification :

1. Length of a Stroke.
2. Maximum horizontal travel of table
3. Maximum Vertical travel of the table
4. Maximum distance between table to RAM.
5. Max. Vertical travel of tool Slide
6. Length and Depth of table Slide.
7. power of motor. (1 - 1.5 hp)
8. No. of RAM Cycles per minute.
9. Weight of the machine
10. Floor Space.



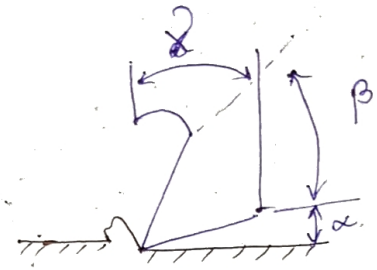
$\alpha + \beta = 360^\circ$
$\alpha < 180^\circ$
$\beta > 180^\circ$

The mechanism that will reduce to its ideal time to a minimum, such mechanism is known as Quick return mechanism.

The ratio between two angles and hence b/w the corresponding time is approx 3:2. Generally this angles are 220° and 140° respectively.

$$\text{Stroke length} = 2AP \times \frac{CB}{AC}$$

Angles of Shaper tool :



α = clearance angle.
β = wedge angle
γ = Rake angle.

Shaping operation :

1. Horizontal cutting
2. Vertical cutting
3. Angular cutting
4. Contour cutting (Curve)

→ pawl & Ratched mechanism.

Milling Machine

Size and Specification:

1. The maximum length of longitudinal, cross and Vertical travel of the table.
2. Number of Spindle Speed.
3. ~~Num~~ Floor Space required.
4. No. of table Speed and feed.
5. Net weight required.

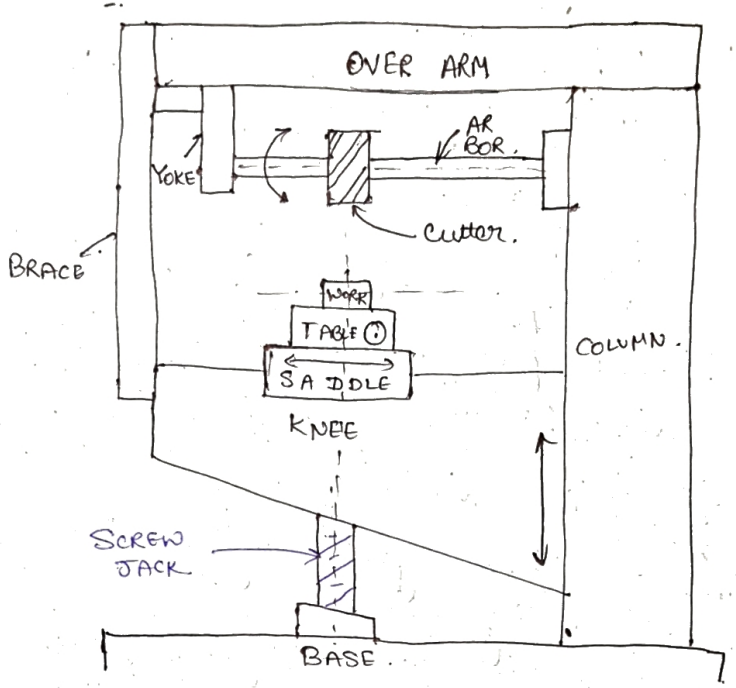
Types of Milling machine:

1. Column and knee type milling machine.
   a. Hand milling machine
   * b. plane or horizontal milling machine.
   c. Vertical milling machine
   d. Universal m. m.
2. Fixed bed type milling machine.
3. production milling machine.
4. Special purpose milling machine.

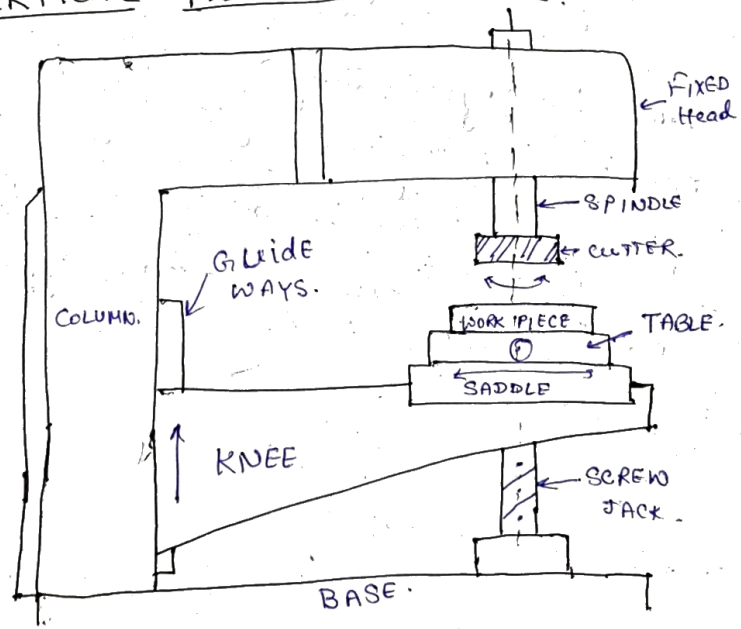
principle parts of column and knee type milling machine:

1. Base
2. Column
3. Knee.
4. Saddle.
5. Table
6. Over arm

* PLAIN / HORIZONTAL MILLING MACHINE



VERTICAL MILLING MACHINE

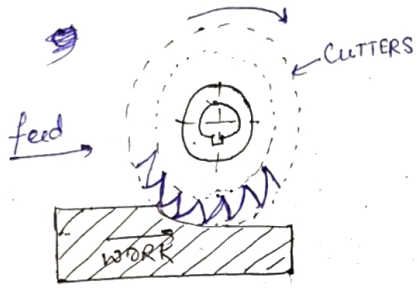


Milling method :

1. Up Or Conventional milling

a) In this method of milling, the cutter rotates in a direction opposite to that in which the work is feed.

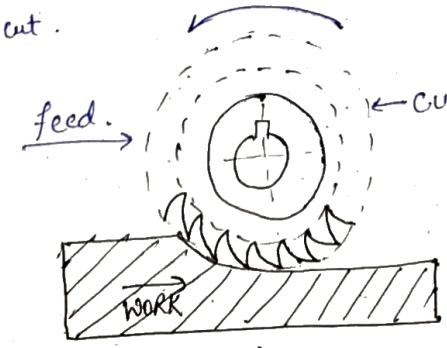
b) The chip thickness in Conventional m.m is minimum at the start of the cut and max. at the end of the cut.



2. Down or climb milling.

a) In this method, the direction of rotation of the cutter coincides with the direction of work field.

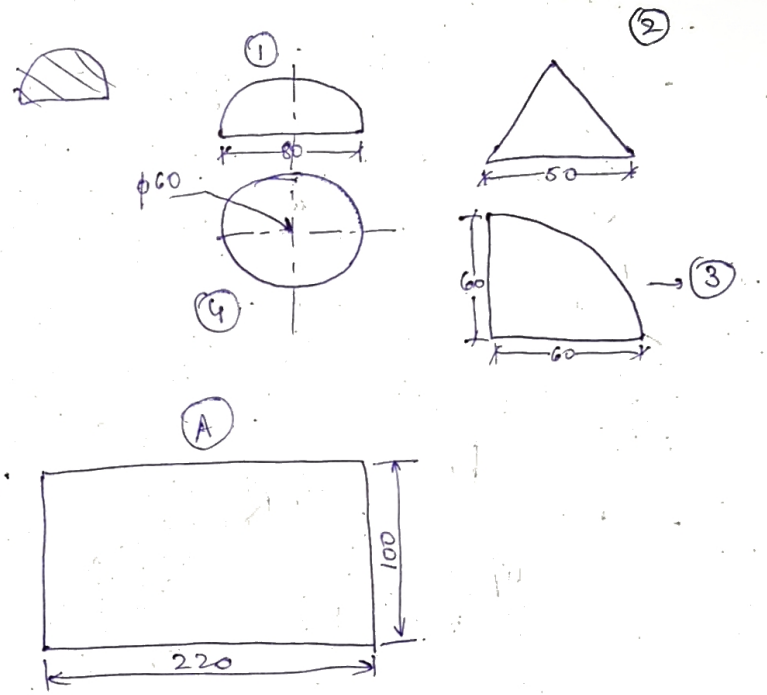
b) the chip thickness in climb m.m. is max. at the start of the cut and min. at the end of the cut.



Gas Welding

Dt:- 5/4/18

JOB Diagram :



Introduction

Gas welding is a fusion welding process. It joins metal using the heat of combustion of an ~~acetalene~~ oxygen and fuel gas (propane, butane, hydrogen, acetylene), mixture.

Types of welding flame :

1. Neutral flame :

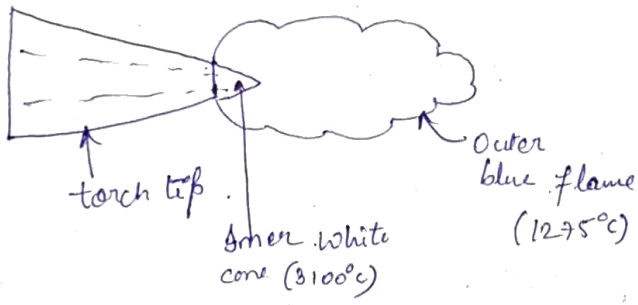
a) A Neutral flame is produced when approximately equal volume of oxygen & [illegible] in the welding torch. and

burned at the torch tip.

More accurately the oxygen to acetylene ratio is (1.1:1)

A neutral flame is commonly used for

a. Mild Steel.
b. Stainless steel
c. Cast Iron.
d. Copper.
e. Aluminium.



2) Oxidising flame:

(i) If after the neutral flame, supply of oxygen is further increased, the result will be an oxidising flame. An oxidising flame can be recognized by the small white cone, which is shorter, much bluer in colour and more pointed than that of neutral flame.

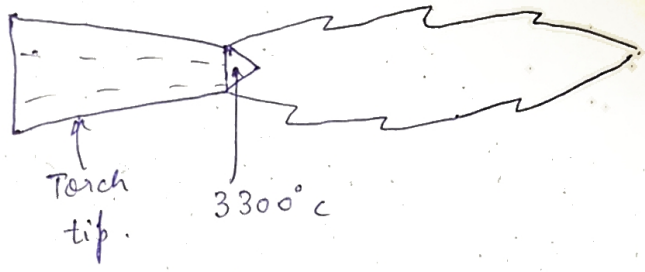
(ii) the oxygen: Acetylene ratio is,

$O_2 : C_2H_2 \equiv 1.5 : 1$

(iii) Oxidising flame is commonly used for.

(a) Copper base alloy.

(b) Zinc base alloy.



3) Carburising flame:

(i) A carburising flame can be recognised by acetylene feather which exist between the inner cone and outer cone.
The outer ~~flame~~ cone is longer than that of neutral flame and is usually much brighter in colour.

(ii) A carburising flame is commonly used for

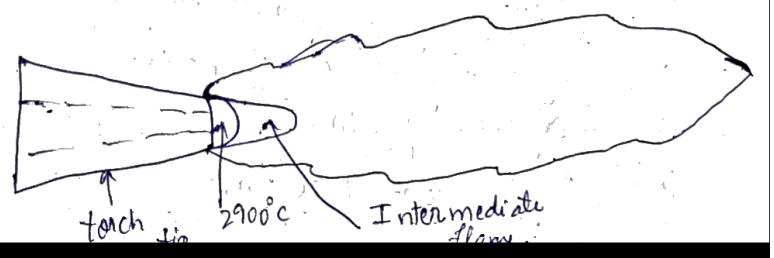
(a) Oxygen free copper alloy.

(b) High carbon steel

(c) cast iron.

(d)

(iii) $O_2 : C_2H_2 \equiv 1 : 1.5$



Chemistry of oxyacetylene flame:

Stage I.

$$C_2H_2 + O_2 \longrightarrow 2CO + H_2 + \Delta$$

$$2C_2H_2 + 2O_2 \longrightarrow 4CO + 2H_2 + \Delta \quad \text{---(i)}$$

Stage II.

$$4CO + 2H_2 + 3O_2 \longrightarrow 4CO_2 + 2H_2O + \Delta \quad \text{---(ii)}$$

From (i) and (ii)

$$2C_2H_2 + 5O_2 \longrightarrow 4CO_2 + 2H_2O$$

Gas welding can't be done in shortage of air. because 'CO' is injuries to human

Welding filler metal rods and fluxes:

1. Cast Iron — Borax / Boric acid
2. Stainless Steel — Borax / Boric acid / fluorspar.
3. Magnesium and its alloy — Sodium chloride, potassium fluoride, $BaCl_2$ etc.

Gas welding equipment

1. Oxygen gas cylinder.
2. Acetylene gas cylinder.
3. Oxygen - pressure regulator
4. Acetylene - pressure regulator
5. Oxygen gas hose pipe

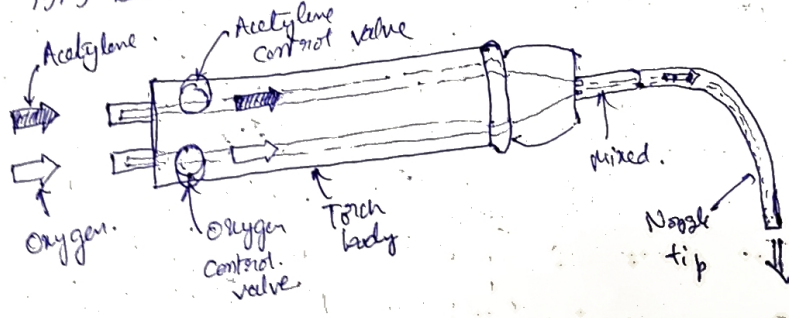
6. Acetylene gas hose pipe.
7. welding torch.
8. Trolleys
9. Filler rod and fluxes.
10. Goggles.

Oxygen Gas Cylinder

1. The oxygen cylinder are painted in black or blue in colour.
2. The size of oxygen cylinder are 3400, 5200 and 6800 litre
3. Oxygen cylinder pressure for mild steel is 136.6 bar.

Acetylene gas cylinder

1. An Acetylene cylinder are painted in Red or maroon in colour
2. The pressure of Acetylene gas cylinder is 15.5 bar.



Welding Torch.

Welding Nozzel tip Selection :

1. position of the weld.
2. The type of joint.
3. The job thickness and size of welding flame.

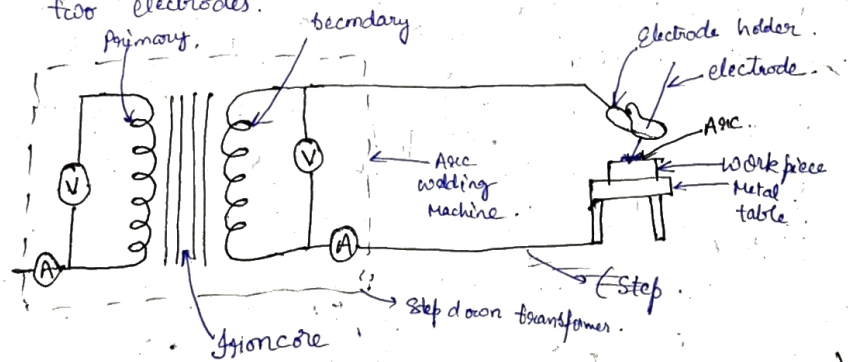
Dt: 12/4/18

Manual Metal Arc Welding.
(MMAW)

Principle of Arc

An arc is generated between two conductors of electricity, cathode and anode when they are touched to establish the flow of current and then seperated by a small distance.

An arc is sustain electrical discharge through the ionized gas column known as plasma between the two electrodes.

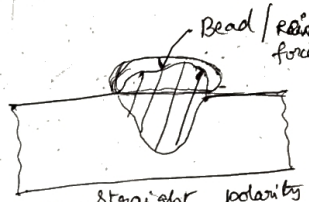


Arc welding equipment (two types of power).

1. Alternating current → here the power used is also less expensive & there is practically no noise in the operation of welding transformer. In ac welding, normally transformer is used.

2. Direct current : DC welding is more expensive than ac welding. In DC welding about 70% of the heat is liberated near the anode. (If more heat is req.) It is used for thicker sheet and it is termed as Here the work piece can be made as anode, liberating large heat near it. This is termed as Straight polarity or DCEN (Direct current electrode negative)

However



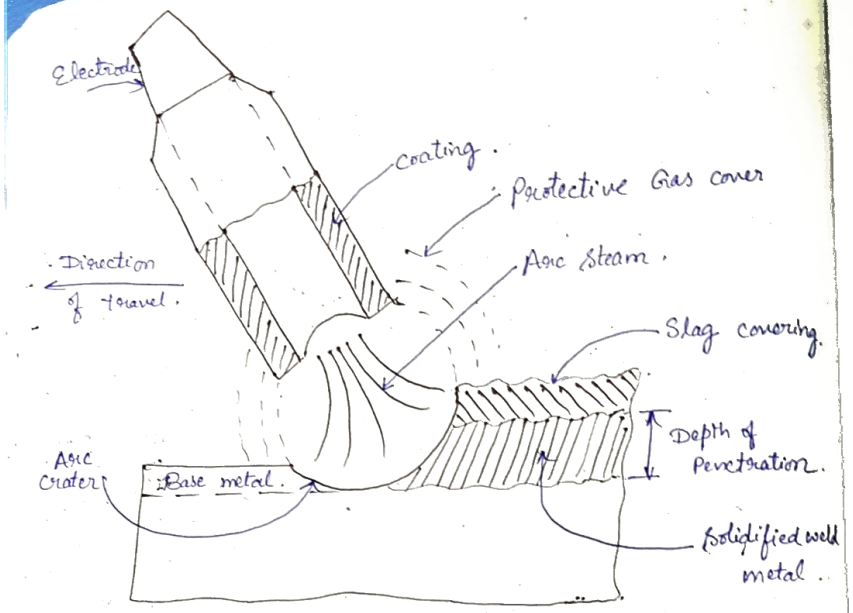
DC – Straight polarity

However, for thinner material where less heat is required, the workpiece is made negative. This is termed as reversed polarity or DCEP. (Direct current Electrode positive)

DC- reverse polarity

Electrodes : There are basically two types of electrodes- (i) consumable electrode : these are made up of various materials depending on the purpose and chemical composition of the metals to be welded. They are made up of steel, cast iron, copper, bronze, brass etc.

(ii) Non- Consumable electrodes : These are made up of carbon, graphite and tungsten.



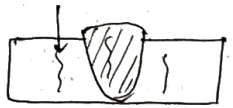
Al, cu, Brass → difficulty due to soft nature.
Mild steel → easy.

Defects in welding:

a. under cut.

b. porosity

c. Cracks.



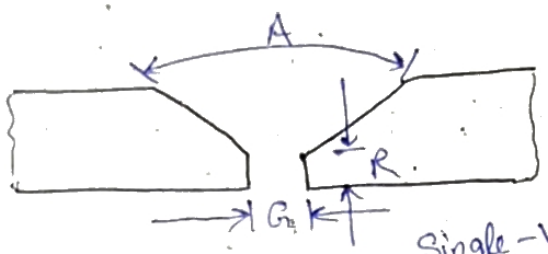
d. Slag inclusions

e. Lack of fusion.

f. Lack of penetration.

Typical Edge preparation for Butt joint

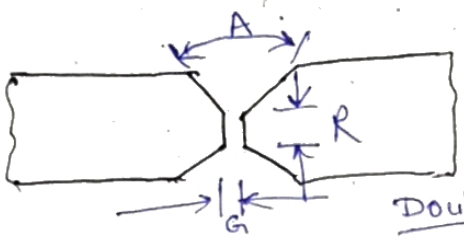
1)



Single-V

A = 60°-70°
R = 1-3 mm
G = 1-3 mm

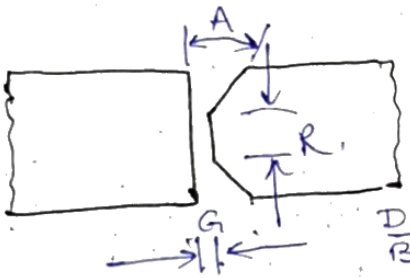
2)



Double-V

A = 60°
R = 0-3 mm
G = 0-3 mm

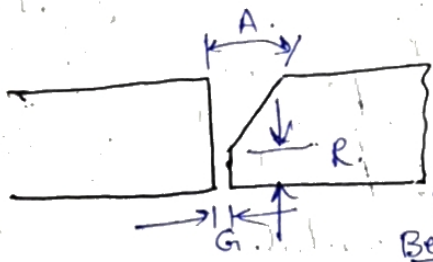
3)



Double Bevel butt

A = 45° - 50°
R = 0 - 1.5 mm
G = 5 - 8 mm

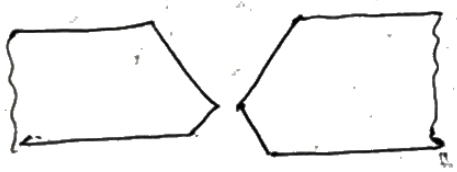
4)



Single Bevel butt

A = 45° - 50°
R = 0 - 3 mm
G = 3 - 5 mm

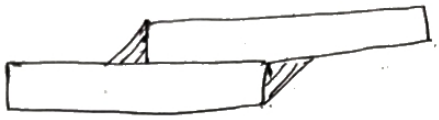
5)



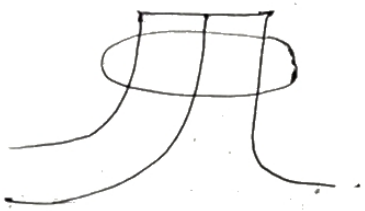
Types of joints:

1. Butt joint

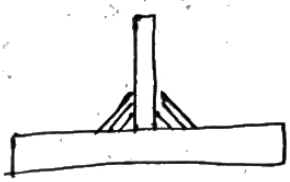
2) Lap joint



3) Edge joint.



4) T-Joint



5) corner joint.

Welding : welding is a process of joining of similar and dissimilar metals by application of heat to a welding temperature with or without the application of pressure and with or without addition of filler metal

Left ward welding & Rightward welding.