BASIC TECHNOLOGY 8TH MAY, 2019

TOPIC: METAL WORK MACHINES

Metal work machine: are those devices powered by electrical motor, gas, fuel intended to process metal make things out of metal in a skilful manner.

However, the following structure are made from metallic materials e.g. ships, bridges, engine parts and delicate jewellery.

TYPES OF METAL WORK MACHINES

- Lathe machines
- Planning machine (shaper and planer)
- Milling machine
- Grinding machine
- Drill press

THE LATHE MACHINE

LATHE MACHINES: this is the father of all machine. It is a multi-purpose machine which is used to for carrying out functions such as;

Facing: reducing the length of work piece

Turning: reducing the cross, section, (usually the diameter) of work piece.

Boring: creating holes in work piece.

Cutting: parting work pieces into two.

Threading: cutting threads in/on work pieces

Tampering with a form tool/compound side

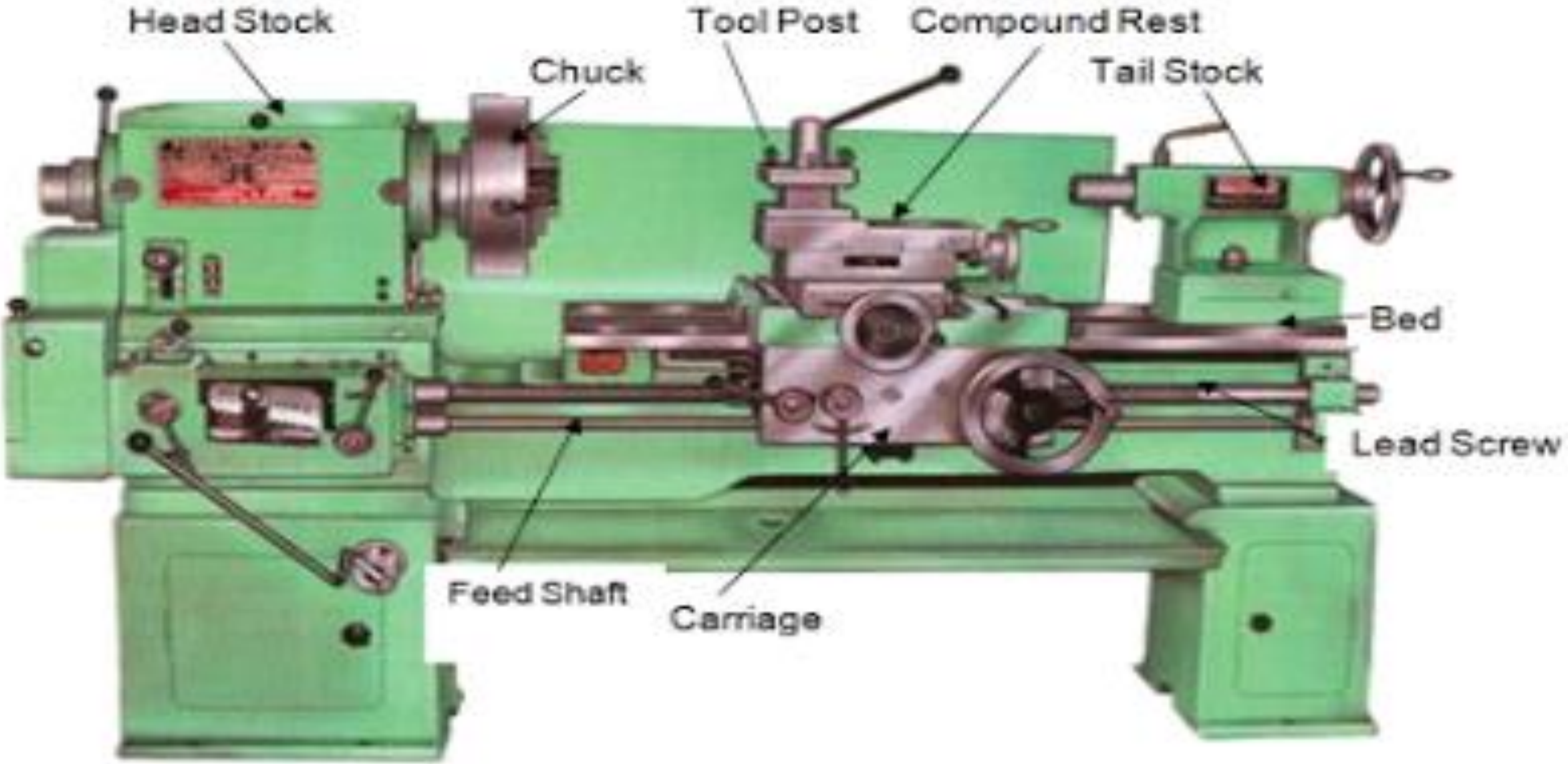
Chamfering:

CIRCULAR SAW: It is primary used for ripping and deep cutting.

SURFACE PLANER: It is called jointer because it is used for planning edges of wood for joint making and at time the machine is called jacker because it jacks the surface roughness of wood.

THICKNESSER or panel is used for planning wood to pre- determined thickness and width.

THE LATHE MACHINE



PART OF A LATHE MACHINE

1. Bed
2. Tool post
3. Chuck
4. Head stock
5. Tail stock
6. Lead screw
7. Legs
8. Carriage
9. Apron
10. Chips pan

11. Guide ways
12. Speed control
13. Spindle

Bed : it is the main body of the machine. All main components are bolted on it. It is usually made by cast iron due to its high compressive strength and lubrication quality.

Tool Post: it is bolted on the carriage. It is used to hold the tool at correct position.

Chuck: it is used to hold the workspace. It is bolted on the spindle which rotates the chuck and work piece.

Head Stuck: is the main body parts which are placed at left side of bed. It serve as holding device for the gear chain, spindle, driving pulley etc. it is also made by cast iron.

Tail Stuck: this is situated on bed. It is placed at right hand side of the bed. The main function of the tail stock to support the job when required

Lead Screw: is situated at the bottom side of bed which is used to move the carriage automatically during thread cutting.

Legs: these are used to carry all the loads of the machine. They are bolted on the floor which prevents vibration.

Carriage: it is situated between the head stock and the tail stock. It is used to hold and move the tool post on the bed vertically and horizontally.

Apron: it is situated on the carriage. It consist all controlling and moving mechanism.

Chips Pan: this is place lower side of the bed. The main function of it is to carries all chips removed by work piece.

Guide Ways: this take care of movement of stock and carriage on bed.

Speed Controller: this is a switch situated on head stock which controls the speed of spindle

Spindle: is the main part of lathe which holds and rotate the chuck.

Top Slide: The top slide is mounted on the compound rest and can be moved along its ways by means of the lead screw joining them. The top slide has flat locations upon which the tool post or tool holder can be mounted.

The Apron: The apron is fitted to the front and underneath the saddle. It provides a hand wheel and gearing which locates in the rack on the underside of the bed, by which motion along the bed can be transmitted manually or automatically.

The tool post: It carries the cutting tool and secure the tool in that position.

GRINDING MACHINE

Grinding Machines: is a machine use to remove materials from work piece by means of abrasive which can generate substantial amount of heat. However, A typical grinding machine consists of a bed with fixture to guide and hold the work piece and a power driven grinding wheel spinning at the required speed. A coolant is used to cool the work piece to prevent over heating.

TYPES OF GRINDING MACHINE

The different types of grinding machine are listed below.

- Belt grinder
- Bench grinder
- Cylinder grinder
- Surface grinder
- Tool and cutter grinder
- Gear grinder.

MILLING MACHINE

A milling Machine: is a machine use to removes metal by rotating a multi- toothed cutter that is fed into the moving work piece. The spindle can be fed up and down with a quill feed lever on the head. Most milling machines have power feed for one or more axes. Power feed is smoother than manual feed and capable of producing a better surface finish. Power feed also reduces the operators fatigue level on long cuts.

CLASSIFICATION OF MILLING MACHINE

The primary classification of milling machines is based on mill orientation. However, classifications are sometimes made according to method of control, size, purpose and power source.

The two primary classifications of milling machines are;

- Vertical milling machine
- Horizontal milling machine.

HORIZONTAL MILLING MACHINE

This is when the cutting tool and the spindle move in a horizontal manner. The main parts of the horizontal milling machine are over arm, arbor bracket, cutting tools, machine vice, cross transverse handle, knee, vertical transverse. Etc.

VERTICAL MILLING MACHINE

This is when the cutting tool and the spindle move up and down. The essential parts of vertical milling machine are base, column, knee, saddle, table, ram, tool head etc.

FOLDING MACHINE

A Folding Machine: is used primarily for the folding of metal sheets. Metal sheets can be folded with either a buckle or a knife.

There are three types of folding machines. They are

- **Buckle Folder:** it works by feeding the paper at high speed until no further movement wherein the paper buckles.

WOOD WORK MACHINE

TYPES OF WOOD WORK MACHINES

1. Portable power tools.

2. machine

Portable Power Tools: These are tools held by hand and powered by electricity. They are mainly used to carry out small jobs such as fitting, installation, assembly or finishing work, etc.

EXAMPLES OF PORTABLE TOOLS

- Sander
- Hand drill
- Fret saw

Sander: This is a power tool used to smoothen the surface of wood by abrasion with sand paper. The paper is attached to a rotating mechanism within a housing. It can be powered electrically or by compressed air.

Types of sanding machine are belt sander, flap sander, disc sander etc.

Hand drill: This is an electricity powered tool for drilling holes on wood.

Fret saw: This is a general workshop machine for cutting wood. It consists of a blade, a handle, an on/off switch and guard to protect the operator in case the blade breaks.

WOOD WORK MACHINE

Woodwork Machines: are machines that are intended to process wood.

Wood work machines include;

- Circular Saw
- Surface planer
- Thicknesser
- Drill press
- Wood lathe
- Band saw

- **Circular Saw:** This are used to saw timber to the required size for furniture making. They are power on /off electrically with a handle. They have blade and protective guard.
- **Band Saw:** this is a power tool that uses a blade consisting of a continuous band of metal with teeth along one edge to cut various pieces. It is very useful for cutting irregular or curved shapes and can accommodate large size of timber.

- **Surface Planer:** This is used to remove saw marks and for turning up wood edges to make them straight and to produce a flat surface. It can also be used for producing rebating, chamfering, bevelling, tapering.
- **Thicknessing Machine:** this is used for planning wood to a specific thickness after surface planning.
- **Drill Press** is used to create holes in wood pieces
- **Wood Lathe** is used for turning wood pieces into different shapes. Turning is done between centres or on the face plate

CARE AND MAINTENANCE OF WOOD WORK MACHINE

Types Of Woodwork Machine

Wood lathe

Care And Maintenance

Care and maintenance

Clean the tapers, the head stock, the tailstock and the bed regularly to remove chippings, shavings, dust, and moist. Lubricate the moving parts.

- Machine accessories and component parts should be properly kept

- All machine parts and accessories should be carefully handled and properly stored. All completely damaged parts should be replaced immediately

- **Circular saw**

  1. Clean regularly with a brush to remove saw dust
  2. Blunt blades should be sharpened or replaced if broken

- **Surface planer**

  1. Clean regularly to remove sawdust and lubricate moving parts

- **Portable power tools (belt sander, hand drill, fret saw)**

- Portable power tools(belt are sander,hand drill, fret saw)

1. Check to be sure the guards not damage

2. Keep in a safe place after use, away from moist.

BELT AND CHAIN DRIVER

BELT DRIVE SYSTEM: is a mechanical method of transferring rotary motion between two shaft. The belt is a looped strip of flexible material, used to mechanically link two or more rotating shaft.

However the belt drives may be used as a source of motion, to efficiently transmit power. Therefore, in a two pulley system, the belt can either drive the pulleys in the same direction of the shafts is opposite. The pulley could have the same diameter if the same speed is to be maintained, while in the case of different speed the diameters pulley should not be the same. This is because, the smaller the pulley, the higher the speed. The motion is transferred from the driving pulley (driver) to the driven pulley via the friction between the belt and pulley materials.

TYPES OF BELT DRIVES AND THEIR APPLICATION OR USE.

1. **Flat Belt:** it is used for long distance, between shafts
2. **Vee – Belt:** it is used for short distance, but higher power transmission.
3. **Rope Belt:** it used for lower power transmission as in sewing machine
4. **Timing or Synchronous Belt:** it is used for lower power.

ADVATANGES AND DISADVANTAGES OF BELT DRIVES

S/N	ADVATAGES BELT DRIVE	DISTANGES OF BELT DRIVE
1	**It is relatively lower in cost.**	**- it is relatively large size.**
2	**It is relatively lower in cost.**	**- it has short life span.**
3	**It is easy to maintain.**	**- it requires tensioner.**

5	**It does not required lubricant**	**Variation of tension ratio of the driver**
6	It is easy to maintain	Heavy stress on the shaft and bearing
7	It can operate at high speed	
8	It is smooth and quiet in operation	

CHAIN DRIVES SYSTEM

CHAIN DRIVES SYSTEM: is a mechanical means of transmitting power from one place to another. The chain is made up of series of pin – connected link providing flexibility while enabling the chain to transmit large tensile forces when transmitting power between rotating shaft.

The chain engage mating – toothed wheels called **Sprocket.** It is often used to convey power to the wheels of a vehicle, particularly bicycles, motorcycles, oil – well, drilling machine, chain conveyor and agricultural machinery.

TYPES OF CHAIN DRIVES

1. Roller chain
2. More chain

APPLICATION OR USE OF CHAIN DRIVES

1. Bicycles
2. Motorcycle
3. Timing chain
4. Chain saw
5. Chain pump
6. Watt steam engine

ADVANTAGES AND DISADVANTAGES OF CHAIN DRIVES

S/N	ADVANTAGES	DISADVANTAGES
1	It is stronger than belt.	- It is relatively heavy.
2.	It is very efficient method of power transmission.	- It wear faster than belt if not properly lubricated.
3	It can be easily shifted to another gear in other to vary the gear ratio.	- It suffer the potential vibration.
4		- There is variation in speed or surging.

GEAR

GEAR: these are toothed machine element mounted on shafts to transmit mechanical power from one shaft to another. It has a toothed edges that help them to engage or mesh with one another as it converts one form of motion to another. It can also be used to increase or reduce the speeds of power transmission system.

TYPES OF GEAR

1. **Spur Gear:** it has a gear teeth cut on discs with the internal gear which are cut round inside and external gear which are cut on the circumference.
2. **Rack Gear:** these types of gear are cut on a (linear) straight materials
3. **Bevel or Helical Gear:** are gears with their teeth inclined to the axis of the shafts in the form of a helix.
4. **Sprocket Gear:** these are used in chain drives

5. Wheel gear

USES OF GEARS

1. Power transmission
2. Speed selection
3. Conversion of motion
4. Changing direction of motion or force

GEAR RATIO (ſ)

GEAR RATIO: is the ratio of the angular velocity of the input (drive) gear to the angular velocity of the output (driven) gear. The gear ratio **(ſ)** between two meshing gears is given by

$$ſ = \frac{NA}{NB} = \frac{Driven}{Driver}$$

Where NA is the number of teeth on gear A

Where NB is the number of teeth on gear B

Let's say we have two gears in a mesh

- **Gear 1 (driver gear)** is turning at speed S_1 **and** has T_1 number of teeth.
- **Gear 2(the driven gear)** is turning at speed S_2 and has T_2 number of teeth

Then $S_1 \times T_1 = S_2 \times T_2$

Example:

A gear has 20 teeth. Its speed of rotation is 10 rpm. The gear drives another gear with 10 teeth. Determine the speed of the 10 tooth gear.

Solution

$S1 \times T_1 = S_2 \times T_2$

S1 = 10, T1 = 20, S2 =? T2 = 10

$S2 = S1 \times \frac{T1}{T2} = 10 \times \frac{20}{10} = 20$ Revolution per minutes (rpm).

HYDRAULIC AND PNEUMATIC MACHINES

HYDRAULIC MACHINES: are devices that uses liquids power to transmit pressure equally from one point to another.

EXAMPLES OF HYDRAULIC DEVICES

1. **Hydraulic Jack:** this used to lift heavy loads like a cars.
2. **Hydraulic Pump:** are devices powered by a mechanical energy source to deliver high pressure fluid flow to the pump outlet.
3. **Hydraulic Press:** are devices used for drilling holes.
4. **Hydraulic Cylinder:** are devices that uses pressure liquid (e.g. oil) to produce linear motion and force.
5. **Hydraulic Motor:** are device that transfers rotational kinetic energy to mechanical devices.

6. Hydraulic hose: this can be found in power steering, brake lines and air condition hose
7. Jackhammers
8. Dump truck
9. Plastic and aluminum extruder
10. Bobcats
11. Hose crimper
12. Hydraulic bending machine

ADVANTAGES OF HYDRAULIC MACHINE

1. It provide high force due to compressibility
2. Its liquid does not absorb any supplies energy
3. Working fluid is incompressible so it requires minimum or no spring actions
4. No need for bleeding off.

PNEUMATIC MACHINES

Pneumatic Machines: are devices that uses gases (air) to produce mechanical motion and force.

Examples of pneumatic machines

1. Air brake on trucks, train and buses
2. Cable jet – for install

3. Dental drill
4. Air engine
5. Pipe organ
6. Player piano
7. Pneumatic air – guns
8. Pneumatic motor
9. Pneumatic tyres
10. Pneumatic cylinder
11. Pneumatic launcher
12. Pneumatic bladder
13. Vacuum pump

ADVANTAGES OF PNEUMATIC MACHINES

1. It has simple design and control
2. It is reliable
3. It is very safe – no fire, no overload

FUNCTION OF LUBRICANT

- Reduce the friction and wear between meshing (moving) surfaces.
- In case of enclosed gears, lubricants help carry away the heat developed during tooth contact or meshing of gears.