Lecture Hour 1: *INTRODUCTION*

Heat engine is a machine for converting heat, developed by burning fuel into useful work. It can be said that heat engine is equipment which generates thermal energy and transforms it into mechanical energy.

CLASSIFICATION OF HEAT ENGINES

1. Based on combustion of fuel:

(i) External combustion engine

(ii) Internal combustion engine.

External combustion engine

Here, the working medium, the steam, is generated in a boiler, located out side the engine and allowed in to the cylinder to operate the piston to do mechanical work.

Internal combustion engine

In internal combustion engine, the combustion of fuel takes place inside the engine cylinder and heat is generated within the cylinder. This heat is added to the air inside the cylinder and thus the pressure of the air is increased tremendously. This high pressure air moves the piston which rotates the crank shaft and thus mechanical work is done

2. Based on fuel used

1. Diesel engine 2. Petrol engine 3. Gas engine

Diesel engine – Diesel is used as fuel

Petrol engine – Petrol is used as fuel

Gas engines – propane, butane or methane gases are used

3. Based ignition of fuel

1. Spark ignition engine (Carburetor type engines)

2. Compression ignition engine (injector type engines)

Spark ignition engine – a mixture of air and fuel is drawn in to the engine cylinder. Ignition of fuel is done by using a spark plug. The spark plug produces a spark and ignites the air- fuel mixture. Such combustion is called constant volume combustion (C.V.C.).

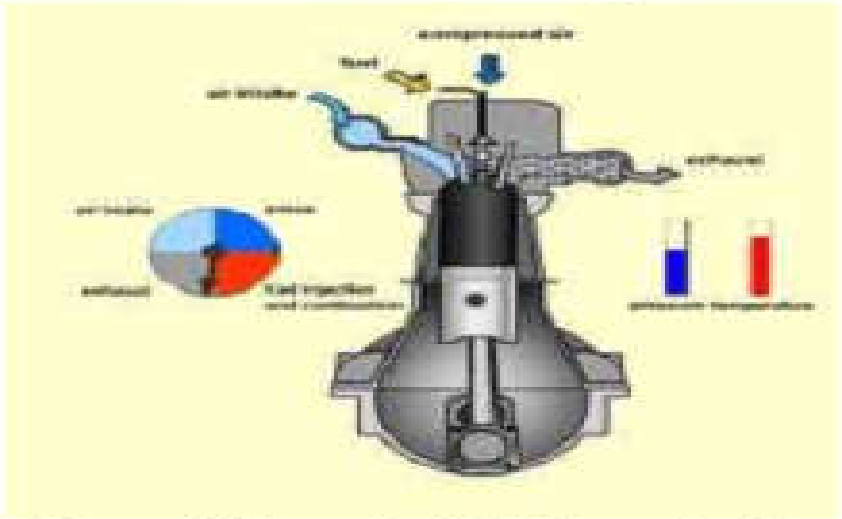
Compression ignition engine – In compression ignition engines air is compressed in to the engine cylinder,. Due to this the temperature of the compressed air rises to 700-900 C. At this stage diesel is sprayed in to the cylinder in fine particles. Due to a very high temperature, the fuel gets ignited. This type of combustion is called constant pressure combustion (CP.C.) because the pressure inside the cylinder is almost constant when combustion is taking place.

4. Based on working cycle

1. Four stroke cycle engine - When the cycle is completed in two revolutions of the crankshaft, it is called four stroke cycle engine.

2. Two stroke cycle engine. - When the cycle is completed in one revolution of the crankshaft, it is called two stroke cycle engine

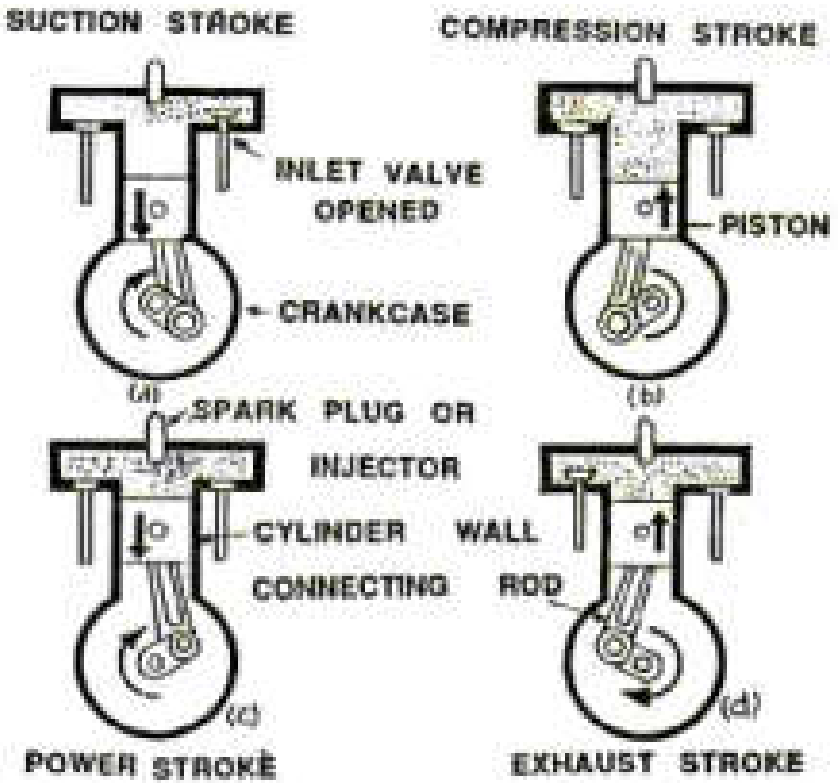
I.C. engine converts the reciprocating motion of piston into rotary motion of the crankshaft by means of a connecting rod. The piston which reciprocating in the cylinder is very close fit in the cylinder. Rings are inserted in the circumferential grooves of the piston to prevent leakage of gases from sides of the piston. Usually a cylinder is bored in a cylinder block and a gasket, made of copper sheet or asbestos is inserted between the cylinder and the cylinder head to avoid ant leakage. The combustion space is provided at the top of the cylinder head where combustion takes place.



The connecting rod connects the piston and the crankshaft. The end of the connecting rod connecting the piston is called small end. A pin called gudgeon pin or wrist pin is provided for connecting the piston and the connecting rod at the small end. . The other end of the connecting rod connecting the crank shaft is called big end. When piston is moved up and down, the motion is transmitted to the crank shaft by the connecting ***FOUR STROKE ENGINE***rod and the crank shaft makes rotary motion. The crankshaft rotates in main bearings which are fitted the crankcase. A flywheel is provided at one end of the crankshaft for smoothing the uneven torque produced by the engine. There is an oil sump at the bottom of the engine which contains lubricating oil for lubricating different parts of the engine.

Lecture Hour 2: FOUR STROKE ENGINE

A four-stroke engine (also known as four-cycle) is an internal combustion engine in which the piston completes four separate strokes which comprise a single thermodynamic cycle. A stroke refers to the full travel of the piston along the cylinder, in either direction. While risqué slang among some automotive enthusiasts names these respectively the "suck," "squeeze," "bang" and "blow" strokes, they are more commonly termed



Lecture Hour 3: Two Stroke Engine

In two stroke cycle engines, the whole sequence of events i.e., suction, compression, power and exhaust are completed in two strokes of the piston i.e. One revolution of the crankshaft. There is no valve in this type of engine. Gas movement takes place through holes called ports in the cylinder. The crankcase of the engine is air tight in which the crankshaft rotates.

Upward stroke of the piston (Suction + Compression)

When the piston moves upward it covers two of the ports, the exhaust port and transfer port, which are normally almost opposite to each other. This traps the charge of air- fuel mixture drawn already in to the cylinder. Further upward movement of the piston compresses the charge and also uncovers the suction port. Now fresh mixture is drawn through this port into the crankcase. Just before the end of this stroke, the mixture in thecylinder is ignited by a spark plug (Fig 2 c &d). Thus, during this stroke both suction and compression events are completed.

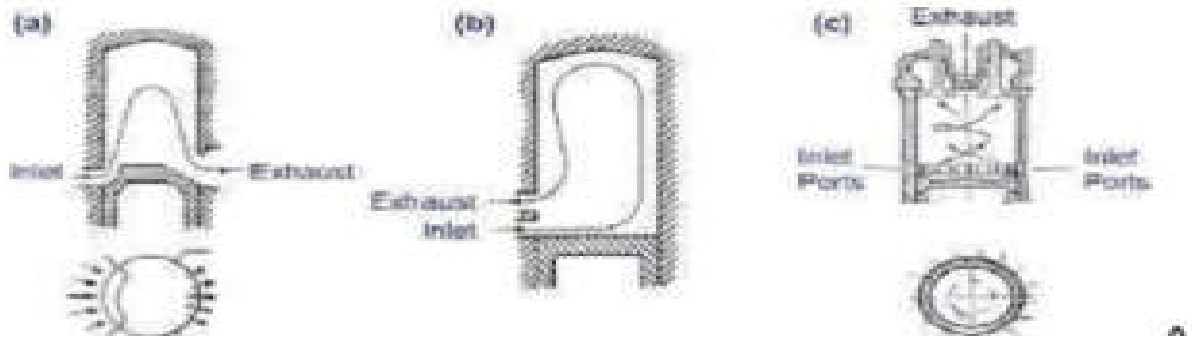
Downward stroke (Power + Exhaust)

Burning of the fuel rises the temperature and pressure of the gases which forces the piston to move down the cylinder. When the piston moves down, it closes the suction port, trapping the fresh charge drawn into the crankcase during the previous upward stroke. Further downward movement of the piston uncovers first the exhaust port and then the transfer port. Now fresh charge in the crankcase moves in to the cylinder through the transfer port driving out the burnt gases through the exhaust port. Special shaped piston crown deflect the incoming mixture up around the cylinder so that it can help in driving out the exhaust gases . During the downward stroke of the piston power and exhaust events are completed.

SCAVENGING PROCESS

A basic part of the cycle of an internal combustion engine is the supply of fresh air and removal of exhaust gases. This is the gas exchange process. Scavenging is the removal of exhaust gases by blowing in fresh air. Charging is the filling of the engine cylinder with a supply or charge of fresh air ready for compression. With supercharging a large mass of air is supplied to the cylinder by blowing it in under pressure.

Efficient scavenging is essential to ensure a sufficient supply of fresh air for combustion. In the four-stroke cycle engine there is an adequate overlap between the air inlet valve opening and the exhaust valve closing. With two-stroke cycle engines this overlap is limited and some slight mixing of exhaust gases and incoming air does occur.



CROSS FLOW SCAVENGING (Fig a)

In cross scavenging the incoming air is directed upwards, pushing the exhaust gases before it. The exhaust gases then travel down and out of the exhaust ports. Figure above illustrates the process.

LOOP FLOW SCAVENGING (Fig b)

In loop scavenging the incoming air passes over the piston crown then rises towards the cylinder head. The exhaust gases are forced before the air passing down and out of exhaust ports located just above the inlet ports. The process is shown in Figure below.

UNIFLOW SCAVENGING (Fig c)

With uniflow scavenging the incoming air enters at the lower end of the cylinder and leaves at the top. The outlet at the top of the cylinder may be ports or a large valve. The process is shown here.

Lecture Hour 5: Rotary Valve Engine

A rotary valve engine is always a two stroke engine. Most rotary valve engines are rotax engines. Although other rotary engines such as suzuki and kawasaki have been made.

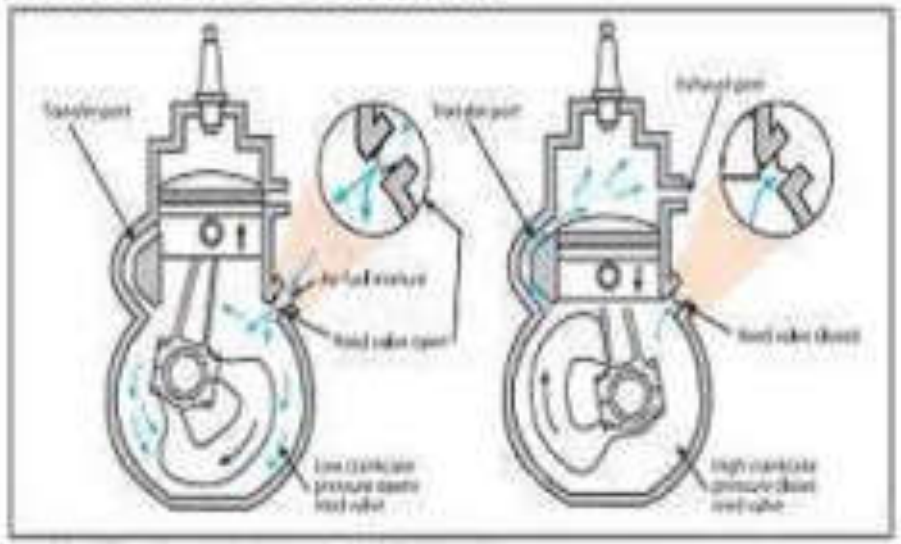
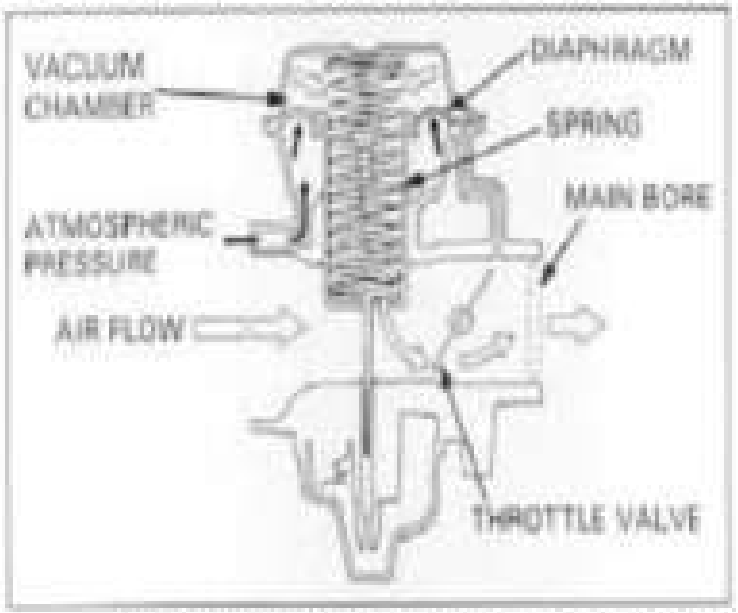


Figure 4-1. Reed valve is open with low pressure and closes when the pressure increases

Rotax engines are used in snowmobiles, jet-skis and motorcycles and aircraft engines. A rotary valve refers to the intake of a two stroke engine.

Lecture Hour 6: Constant Vaccum Carburetor



A vacuum actuated valve for a constant vacuum type carburetor is formed with a first guide hole, a jet needle engaging step portion and a jet needle insertion hole therein. A spring seat has an outer cylindrical portion in an upper portion thereof, and an inner cylindrical portion and a jet needle supporting cylindrical portion therein.

The outer cylindrical portion of the spring seat is arranged on the outer circumference of a diaphragm plate. The jet needle supporting cylindrical portion is inserted within a first guide hole. A lower end of a vacuum actuated valve return spring engages with a spring seating flange of the spring seat. A flange portion of a jet needle is restricted by the jet needle engaging step portion and the jet needle supporting cylindrical portion.

Lecture Hour 7: Splash Lubrication System

The splash system is no longer used in automotive engines. It is widely used in small four-cycle engines for lawn mowers, outboard marine operation, and so on.

In the splash lubricating system, oil is splashed up from the oil pan or oil trays in the lower part of the crankcase. The oil is thrown upward as droplets or fine mist and provides adequate lubrication to valve mechanisms, piston pins, cylinder walls, and piston rings.

In the engine, dippers on the connecting-rod bearing caps enter the oil pan with each crankshaft revolution to produce the oil splash. A passage is drilled in each connecting rod from the dipper to the bearing to ensure lubrication.

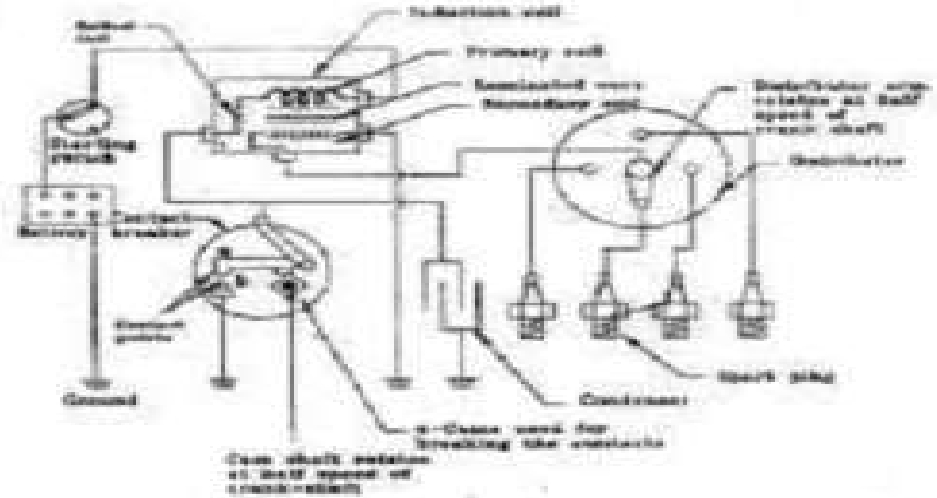
This system is too uncertain for automotive applications. One reason is that the level of oil in the crankcase will vary greatly the amount of lubrication received by the engine. A high level results in excess lubrication and oil consumption and a slightly low level results in inadequate lubrication and failure of the engine.

Lecture Hour 8: Battery Coil Ignition System & Magetor ignition system

Figure 4.2 shows line diagram of battery ignition system for a 4-cylinder petrol engine. It mainly consists of a 6 or 12 volt battery, ammeter, ignition switch, auto-transformer (step up transformer), contact breaker, capacitor, distributor rotor, distributor contact points, spark plugs, etc.

Note that the Figure 4.1 shows the ignition system for 4-cylinder petrol engine, here there are 4-spark plugs and contact breaker cam has 4-corners. (If it is for 6-cylinder engine it will have 6-spark plugs and contact breaker cam will be a perfect hexagon).

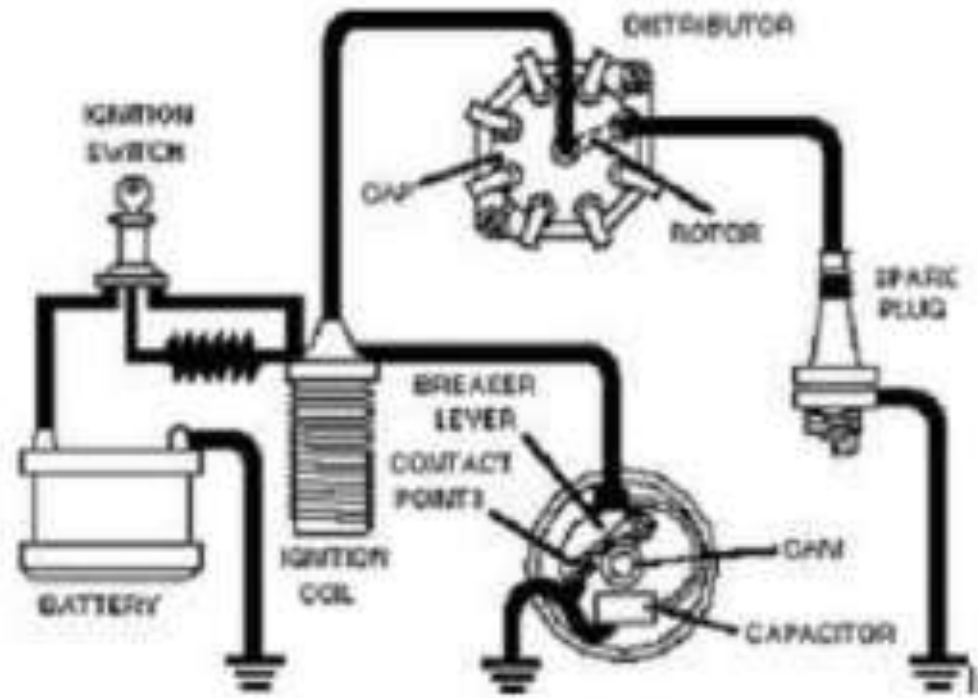
The ignition system is divided into 2-circuits :



Primary Circuit : It consists of 6 or 12 V battery, ammeter, ignition switch, primary winding it has 200-300 turns of 20 SWG (Sharps Wire Gauge) gauge wire, contact breaker, capacitor.(ii) Secondary Circuit : It consists of secondary winding. Secondary winding consists of about 21000 turns of 40 (S WG) gauge wire. Bottom end of which is connected to bottom end of primary and top end of secondary winding is connected to centre of distributor rotor. Distributor rotors rotate and make contacts with contact points and are connected to spark plugs which are fitted in cylinder heads (engine earth).

(iii) Working : When the ignition switch is closed and engine in cranked, as soon as the contact breaker closes, a low voltage current will flow through the primary winding. It is also to be noted that the contact beaker cam opens and closes the circuit 4-times (for 4 cylinders) in one revolution. When the contact breaker opens the contact, the magnetic field begins to collapse. Because of this collapsing magnetic field, current will be induced in the secondary winding. And because of more turns (@ 21000 turns) of secondary, voltage goes unto 28000-30000 volts.

MAGNETOR IGNTION SYSTEM

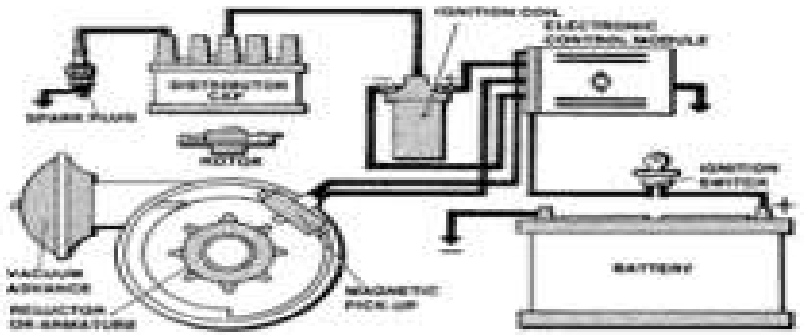


In this case magneto will produce and supply the required current to the primary winding. In this case as shown, we can have rotating magneto with fixed coil or rotating coil with fixed magneto for producing and supplying current to primary, remaining arrangement is same as that of a battery ignition system.

Lecture Hour 9: Electronic Ignition System

The need for higher mileage, reduced emissions and greater reliability has led to the development of the electronic ignition systems. These systems generate a much stronger spark which is needed to ignite leaner fuel mixtures. Breaker point systems needed a resistor to reduce the operating voltage of the primary circuit in order to prolong the life of the points. The primary circuit of the electronic ignition systems operate on full battery voltage which helps to develop a stronger spark. Spark plug gaps have widened due to the ability of the increased voltage to jump the larger gap. Cleaner combustion and less deposits have led to longer spark plug life.

In some systems, the ignition coil has been moved inside the distributor cap. This system is said to have an internal coil as opposed to the conventional external one.



Electronic Ignition systems are not as complicated as they may first appear. In fact, they differ only slightly from conventional point ignition systems. Like conventional ignition systems, electronic systems have two circuits: a primary circuit and a secondary circuit. The entire secondary circuit is the same as in a conventional ignition system. In addition, the section of the primary circuit from the battery to the battery terminal at the coil is the same as in a conventional ignition system.

Electronic ignition systems differ from conventional ignition systems in the distributor component area. Instead of a distributor cam, breaker plate, points, and condenser, an electronic ignition system has an armature (called by various names such as a trigger wheel, reluctor, etc.), a pickup coil (stator, sensor, etc.), and an electronic control module.

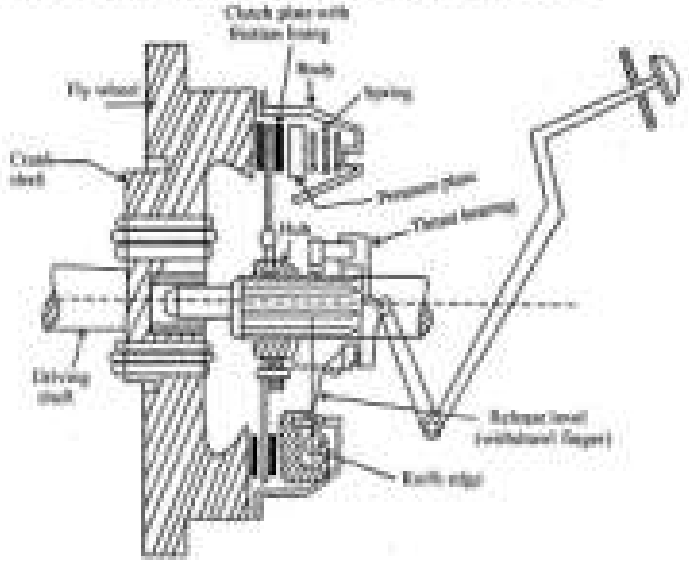
CHASSIS AND SUB SYSTEMS

Lecture Hour 1: Single Plate Clutch

A clutch is a mechanical device that provides for the transmission power (and therefore usually motion) from one component (the driving member) to another (the driven member) when engaged, but can be disengaged.

Clutches are used whenever the transmission of power or motion must be controlled either in amount or over time (e.g., electric screwdrivers limit how much torque is transmitted through use of a clutch; clutches control whether automobiles transmit engine power to the wheels).

The three levers (also known as release levers or fingers) are carried on pivots suspended from the case of the body. These are arranged in such a manner so that the pressure plate moves away from the flywheel by the inward movement of a trust bearing. The bearing is mounted upon a forked shaft and moves forward when the clutch pedal is pressed



Lecture Hour 2 : Multiplate Clutch

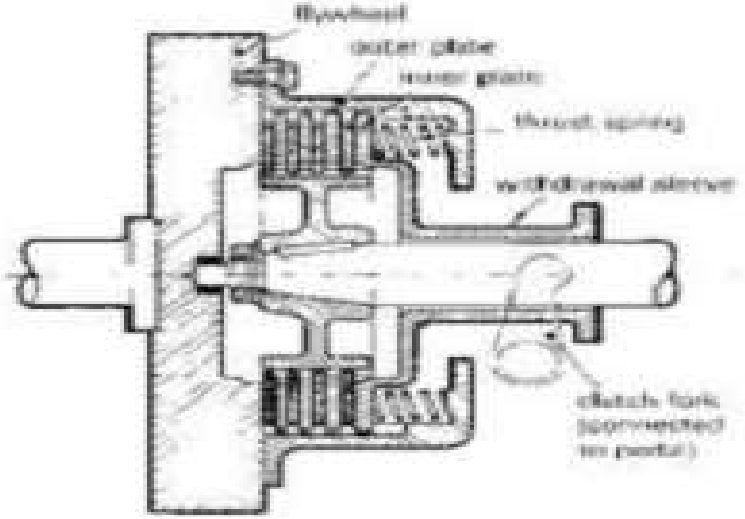


Fig. Multi plate clutch

Automobiles uses various kinds of clutches such as singleplate or multiplate clutch. Each clutch has got its own design construction and working principle. Multiplate clutch consists of a number of clutch plates, where as singleplate clutch has only one clutch plate. As the number of clutch plates are increased, the friction surface also increase. The increased number of friction surfaces in clutch increases the capacity of the clutch to transmit torque in automobiles.

The plates are alternately fitted to the engine shaft and gear box shaft. They are firmly pressed by strong coil springs and assembled in a dru,. Each of the alternate plate slides in grooves on the flywheel and the other slides on splines on the pressure plate. Therefore, each alternate plate has inner and outer splines.

The multipleate clutches operating condition may be dry or wet. When the clutch is operated in an oil bath, it is called a wet clutch. When the clutch is operated dry, it is called dry clutch. The wet clutches are generally used in conjunction with the automatic transmission automotives.

Multiplate clutch works in the same way as the single plate clutch i.e. by operating the clutch pedal. The multiplate clutches are used in heavy commercial vehicles, **automobiles**, racing cars and motor cycles for transmitting high torque.

Lecture Hour 3: Centrifugal Clutches

A centrifugal clutch is a clutch that uses centrifugal force to connect two concentric shafts, with the driving shaft nested inside the driven shaft.

The input of the clutch is connected to the engine crankshaft while the output may drive a shaft, chain, or belt. As engine RPM increases, weighted arms in the clutch swing outward and force the clutch to engage. The most common types have friction pads or shoes radially mounted that engage the inside of the rim of a housing. On the center shaft there are an assorted amount of extension springs, which connect to a clutch shoe. When the center shaft spins fast enough, the springs extend causing the clutch shoes to engage the friction face. It can be compared to a drum brake in reverse. This type can be found on most home built karts, lawn and garden equipment, fuel powered model cars and low power chainsaws. Another type used in racing karts has friction and clutch disks stacked together like a motorcycle clutch. The weighted arms force these disks together and engage the clutch.

Lecture Hour 4: CHASSIS

The two-wheeler chassis consists of the frame, suspension, wheels and brakes. The chassis is what truly sets the overall style of the two-wheeler. Automotive chassis is the main carriage systems of a vehicle. The type determines the gearing configuration, flex and the type of modifications that can be accommodated.

Frame: The frame serves as a skeleton upon which parts like gearbox and engine are mounted. It can be made of steel, aluminum or an alloy. It keeps the wheels in line to maintain the handling of the two-wheeler.

Suspension: It is a collection of springs and shock absorbers. It can be of two types: front suspension and rear suspension. It insulates both the rider and the bulk of the machine from road shocks and also keeps the wheels in the closest possible contact with the ground and gives control of the vehicle to the rider. The front suspension helps to guide the front wheel, to steer, to spring, to dampen, and to provide support under braking.

Wheels: A wheel is a circular object which with an axle, allows low friction in motion by rolling. A wheel is made up of the rim and spokes or disc plate. Wheels should be aligned properly because it directly influences driving. Two-wheeler wheels are generally of aluminum or steel rims with spokes.

Brakes: Generally, there are two independent brakes on a two-wheeler: one set on the front wheel and one on the rear, however, there are many models which have 'linked brakes' and apply both at the same time. The front brake is generally much more powerful than the rear brake. Brakes can either be drum or disc based. When the rider operates one of the brakes, a fluid element known as hydraulics is pressurized to provide the required forces to squeeze the brake pad material onto the rotor and slow down or stop the vehicle.

Lecture Hour 5: Gear Box:

GEAR BOX

A gear is a toothed wheel designed to transmit the force to another gear or toothed component. The teeth of a gear is known as cogs. They are shaped to minimize wear, vibration and noise and at the same time maximize the efficiency of power transmission.

Gears of different size, the larger one is called a wheel and the smaller one is called a pinion, are used in pairs so that the force of the driving gear can produce a larger force in the driven gear, that also at a lower speed or it can be for the purpose of producing a smaller force at a higher speed.

The motorcycle gear box contains a number of gears in different sizes. In the process of gear switching, different pairs of gearwheels lock together. A large and small wheel lock together in the lowest or slowest gear. Similar size wheels lock together in the highest or fastest gear.

The motorcycle gear box is the component that makes the actual ratio between the engine and the driving wheels. It is also referred to as transmission gear.

Types of Motorcyle Gear Box:

In a general manner, the motorcycle gear box can be of three types, they are:

- **Horizontally Split:** It has a seam on the horizontal plane.
- **Vertically Split:** It has a seam on the vertical plane.
- **Cassette Type:** The gears are loaded in from one side.

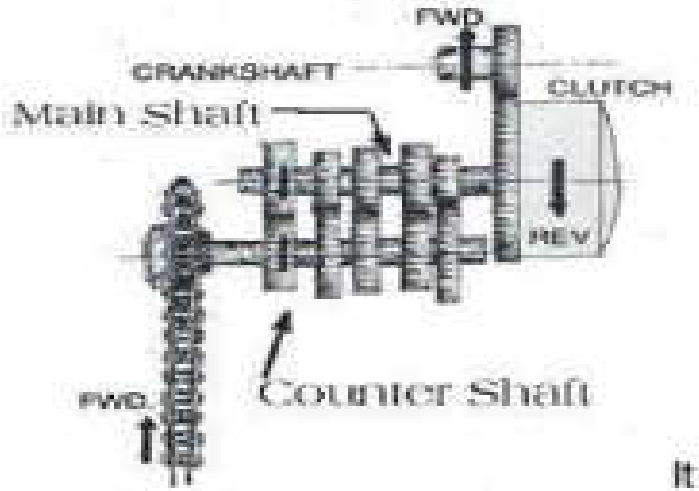
Characteristics of Gear Box:

The gears are constantly meshed with one another and they are always spinning.

Uses of Gear Box:

- It controls gear and shaft alignment.
- It controls the engine RPM.
- It protects the gears and lubricants from water, dust and other environmental contaminants.

Function of Gear Box:
A gearbox is a mechanical method of transferring energy from one device to another and is used to increase torque while reducing speed. Torque is the power generated through the bending or twisting of a solid material. This term is often used interchangeably with transmission



It is located at the junction point of a power shaft, the gearbox is often used to create a right angle change in direction, as is seen in a rotary mower or a helicopter. Each unit is made with a specific purpose in mind, and the gear ratio used is designed to provide the level of force required. This ratio is fixed and cannot be changed once the box is constructed. The only possible modification after the fact is an adjustment that allows the shaft speed to increase, along with a corresponding reduction in torque.

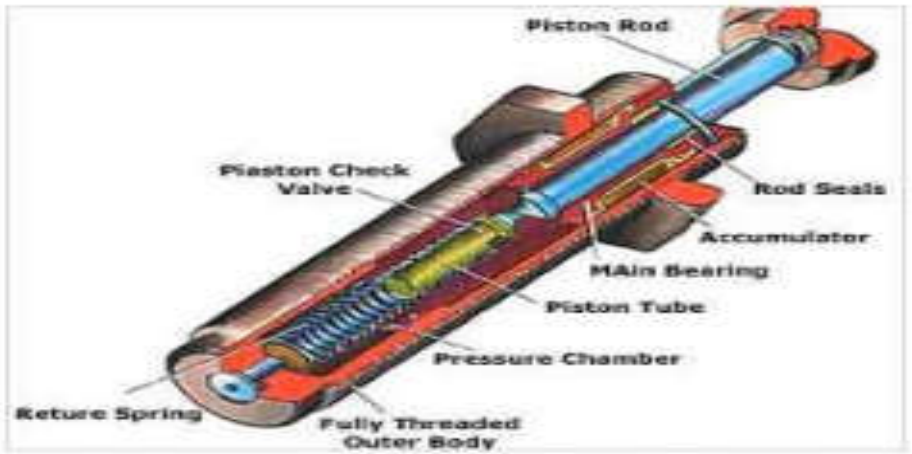
In a situation where multiple speeds are needed, a transmission with multiple gears can be used to increase torque while slowing down the output speed. This design is commonly found in automobile transmissions. The same principle can be used to create an overdrive gear that increases output speed while decreasing torque.

Lecture Hour 6: Shock Absorber

A Two Wheeler Shock Absorber is a mechanical device meant to smooth out or damp a sudden shock impulse and dissipate kinetic energy. It is also known as Damper. Shock absorbers must absorb or dissipate energy.

Functions of Two Wheeler Shock Absorbers:

- They absorb the shock from bumps on the road and helps to make riding safe and smooth.
- They allow the use of soft springs while controlling the rate of suspension movement in response to bumps.
- They also, along with hysteresis in the tire itself, damp the motion of the unsprung weight up and down on the springiness of the tire.
- Shock Absorber system make the vehicle manageable.



Materials used for making Shock absorbers:

The most commonly used materials for making these absorbers are:

- Steel
- Aluminum

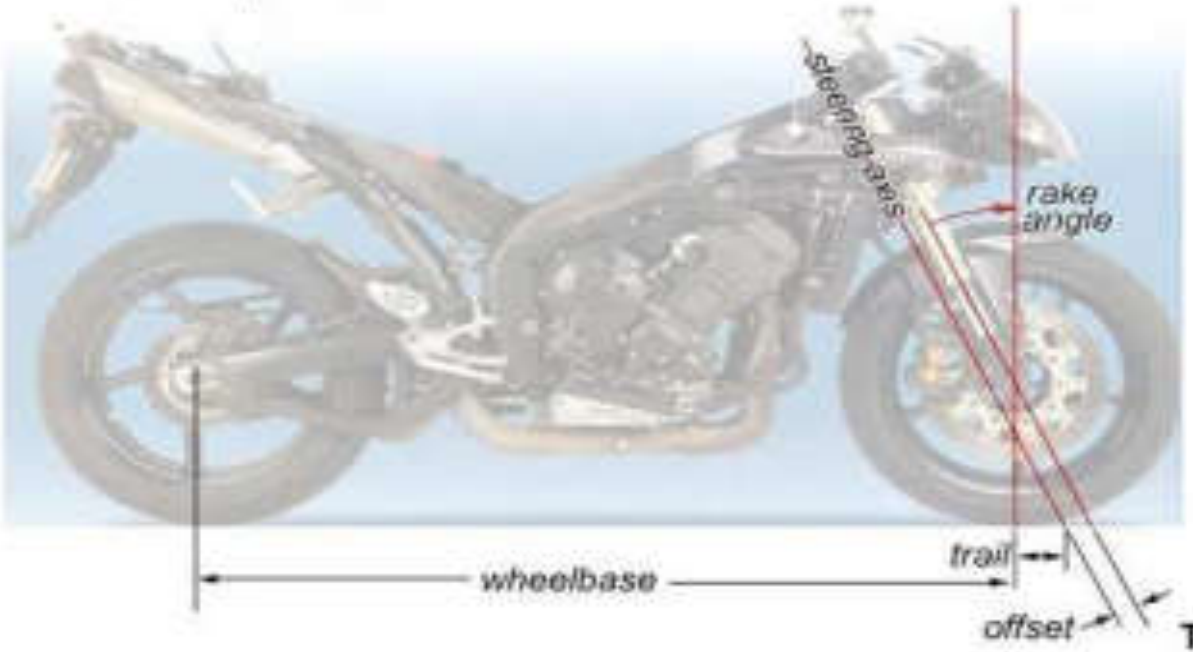
Maintenance of Shock Absorbers:

- It should be checked regularly.
- Oils should be changed according to the recommended time.

Lecture Hour 7: SUSPENSION SYSTEM

Introduction:

A Motorcycle Suspension System consists of a spring coupled to a viscous damping element, a piston, in a cylinder filled with oil. The piston smooths out vibrations induced by the vehicle while moving as it moves through the oil. The flow of oil through the piston is regulated by an adjustable elastic deformable flap called a shim.



Types of Motorcycle Suspension:

- **Front Suspension:** The predominant type of front suspension is the suspension fork. The bottom part of the fork is fitted over the tubes that connect the fork to the frame. When the vehicle hits a bump, the spring gets compressed and the piston forces fluid through the orifice.
- Rear Suspension: Most of the time the rear suspension are used as a shock absorber.

Functions of Motorcycle Suspension:

The main functions of the motorcycle suspensions are:

- To insulate both the rider and the bulk of the machine from road shocks. It makes a much safer and comfortable ride and is important for proper mechanical reliability and longevity.
- To keep the wheels in the closest possible contact with the ground and gives control of the vehicle to the rider.
- The front suspension helps to guides the front wheel, to steer, to spring, to dampen, and to provide support under braking.

Materials used for making Suspensions:

The materials most commonly used for making suspensions are:

- Steel
- Aluminum

Maintenance of Suspensions:

- The suspensions should be checked for loose nuts and bolts and leaks.
- The swing arm bearings should be lubricated monthly.

Lecture Hour 8: FRONT SUSPENSION

Front suspension is often implemented with a set of shock absorbers in the front fork. The suspension travel and handling characteristics vary depending on the type of mountain biking the fork is designed for. For instance, manufacturers produce different forks for cross-country (XC), downhill (DH), and freeride riding.

Suspension fork design has advanced in recent years with suspension forks becoming increasingly sophisticated. The amount of travel available has typically increased. When suspension forks were introduced 80-100 mm of travel was deemed sufficient for a downhill mountain bike. Typically this amount of travel is now more normal for cross country disciplines. Downhill forks can now offer in the region of 170 to 203 mm of travel for handling the most extreme terrain.

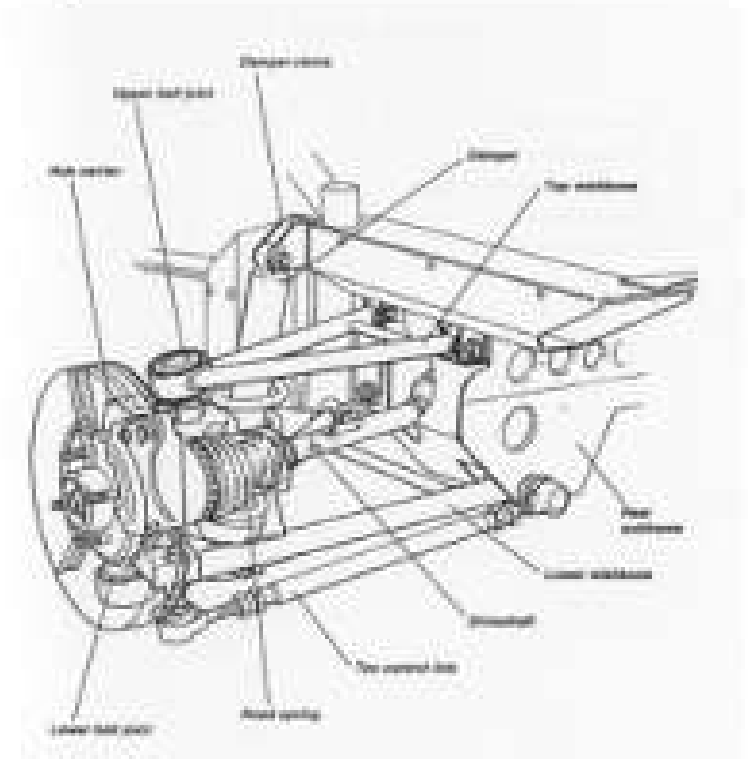
Other advances in design include adjustable travel allowing riders to adapt the forks travel to the specific terrain profile. eg less travel for uphill sections more travel for downhill sections. Advanced designs also often feature the ability to lockout the fork to completely eliminate or drastically reduce the fork's travel for more efficient riding over smooth sections of terrain. This lockout can sometime be activated remotely by a cable and lever on the handlebars.

The shock absorber usually consists of two parts:
a spring and a **damper or dashpot.**

Lecture Hour 9: REAR SUSPENSION

Perhaps because front suspension has been easier to implement and more readily adopted, it is often assumed, and rear suspension is sometimes synonymous with full suspension.

Full suspension mountain bike technology has made great advances since first appearing in the early 1990s. Early full suspension frames were heavy and tended to bounce up and down while a rider pedaled. This movement was called pedal bob, kickback, or monkey motion and took power out of a rider's pedal stoke — especially during climbs up steep hills. Input from hard braking efforts (known as brake jack) also negatively affected early full suspension designs. When a rider hit the brakes, these early designs lost some of their ability to absorb bumps — and this happened in situations where the rear suspension was needed most.



BRAKES, WHEELS AND TYRES

Lecture Hour 1 : Introduction:

Brakes are the devices for slowing and stopping the vehicle. The braking operation is reverse of the acceleration to the vehicle.

Purpose of brakes:

The main purpose of fitting brakes on motor vehicle are as given under

(i) In emergencies to bring the vehicle to rest in the shortest possible distance

(ii) To control the vehicle when it is descending along the hills.

(iii) To keep the vehicle in desired position after bringing it in complete rest when there is no deiver

To fulfill the above needs two independent braking system are provided in the vehicle.

(a) Service brake which is operated by foot padel in regular operation

(b) Emergency brake which os operated by a hand lever while parking the vehicle

Some very important aspects about the Braking System are:

1. It is important that there is no air in the hydraulic braking system. Bleeding of the system is the means of keeping the hydraulic braking system air-free.

2. The amount of friction material on the brake pads are very important, replacing worn brake pads is the quickest way to increased the braking power of a vehicle.

3. The condition of the brake fluid is very vital.

4. The braking system require constant checking and worn and torn parts should be replaced.

5. Lubrication is a must to lengthen the life of the brake system parts.

Parts of a Brake System:

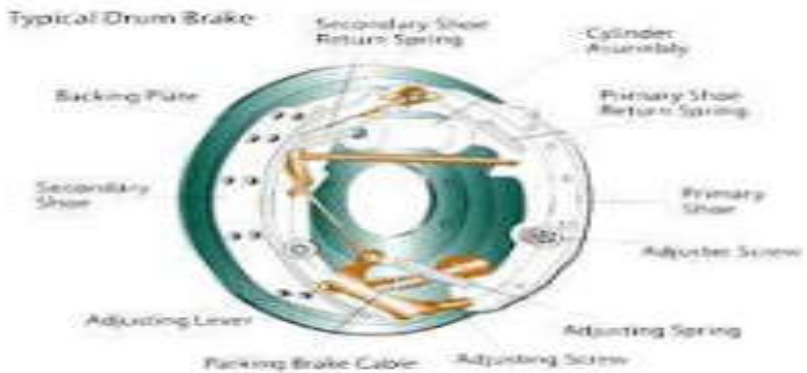
The important parts of a Brake System are:

- Brake Pads
- Brake Levers
- Brake Shoes
- Brake Lining
- Brake Drums
- Sprockets
- Brake Wire/Line
- Brake Cylinder
- Brake Fluid

Components of Disk brake:

- brake calipers
- brake pads
- rotors

Lecture Hour 2: Drum brake

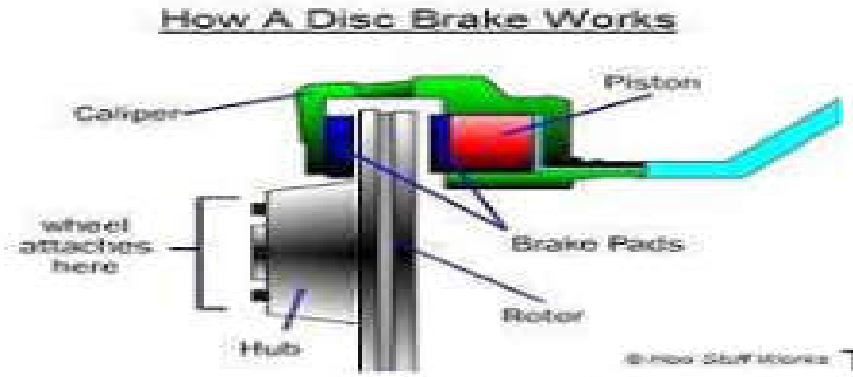


The principle of operation of drum brakes

In the drum brake friction force is due to the fact that under the action of the cam forces the brake pads located inside the inner surfaces are pressed against the brake drums. Thanks much private housing pads are well protected from the effects of corrosion (water, salt, dust) and dirt (sand, stones, mud), even when driving on hard terrain. When using the brakes, S-shaped cam brake cylinder by adjusting the brake lever and the shaft rotates the S-shaped cam, thereby pressing the brake shoes with linings to the brake drum. Adjusting levers Automatic self-adjusting levers align the brake pads wear and drums, establishing between them a constant air gap.

Lecture Hour 3: Disc Brake

When a brake lever or pedal is pressed, the push rod which is connected to lever or pedal and master cylinder piston pushes the master cylinder piston. This movement allows the master cylinder piston to slide and push the return spring inside the bore of master cylinder, which generates pressure in reservoir tank. At this moment a primary seal allows the brake fluid of reservoir tank to flow over it into the brake hosepipes. A secondary seal ensures that the brake fluid does not go other side.



Then the fluid enters in to cylinder bore of caliper assembly via brake hosepipes and pushes the caliper piston or pistons. At this time the piston ring moves in rolling shape with piston. Then the caliper piston pushes brake pad. This movement causes brake pads to stick with brake disc which creates friction and stops the brake disc/rotor to rotate. This way disk brake system stops or slows down the vehicle.

When the brake lever or pedal is released the piston ring pushes the caliper piston back to cylinder bore of caliper till both, caliper piston and piston ring come into their original shape. At this time retraction spring pushes the brake pads to their original position. The return spring in master cylinder assembly pushes the master cylinder piston back into its original position and allows the fluid to flow back to reservoir via hosepipe and master cylinder bore.

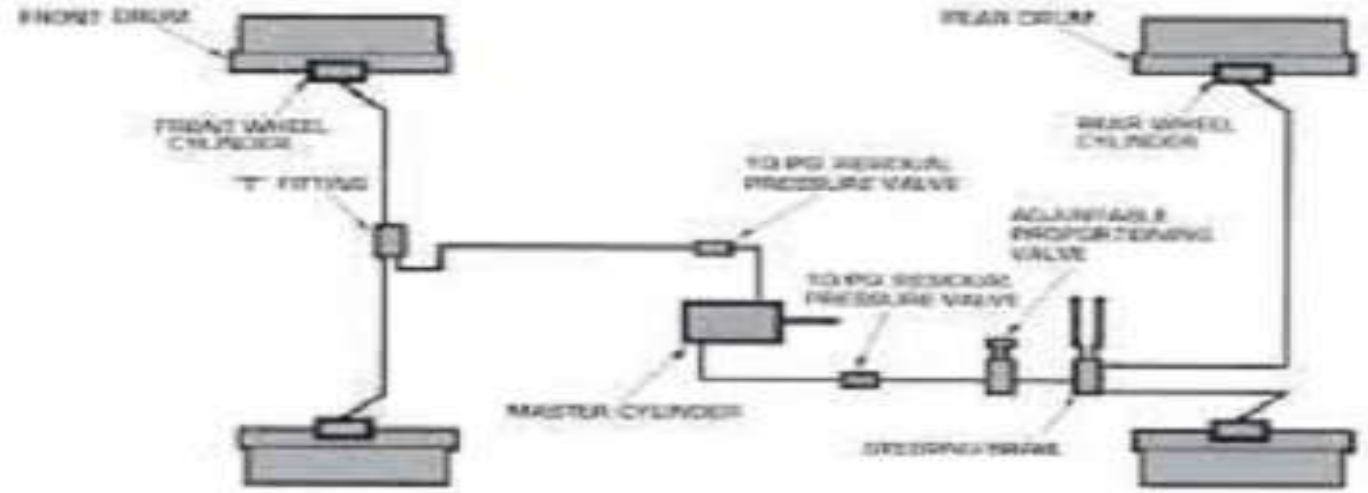
Advantages of Disk Brake:

- Disk brake requires less effort (brake torque) to stop the vehicle compare to drum brake.
- It generates less heat compare to drum brake for the same brake torque.
- Ease of maintenance as disk brake is outside the wheel rim.
- It cools down faster compare to drum brake.

Disadvantages of Disk Brake:

- It is expensive compare to drum brake.
- More skills require to operate disk brake compare to drum brake that's the reason why some people are not comfortable with disk brake
- If any air remains in disk brake system, it can cause accident as the brake will not work effectively.
- Disk brake assembly has more moving parts and much complex than drum brake.
- It requires lot of effort at maintenance front like brake fluid (bleeding), change of brake pads etc compare to drum brake.

Lecture Hour 4: Brake Layout



Wheel parts:

A wheel is a circular object which with an axle, allows low friction in motion by rolling. A wheel is made up of the rim and spokes or disc plate. The standard size of wheels for two-wheelers is 17 inch. Wheels should be aligned properly because it directly influences driving.

Lecture Hour 5: Wheels

Wheels must be strong enough to support the vehicle and withstand the forces caused by normal operation. At the same time, they must be as light as possible, to help keep un-sprung weight to a minimum Wheels can be made from cast aluminium alloy or magnesium alloy. Alloy wheels are popular because of their appearance and because they are lighter than similar steel wheels. Aluminium is a better conductor of heat, so alloy wheels can dissipate heat from brakes and tyres more effectively than steel ones. Most wheels have ventilation holes in the flange, so air can circulate to the brakes. Most passenger car wheels are of well, or drop-centre design. This design
allows for tyre removal and fitting. The removal and fitting of tyres should be carried out according to manufactures instructions.

Types of Wheels

Passenger cars normally use rims which are of well based, or drop-centre design. The drop enter is used for mounting and demounting the tyre onto the rim. Wheels must be strong enough to carry the
mass of the vehicle and withstand the forces that are generated during use. The wheel centre must accurately locate the wheel rim centrally on the axle. It must also provide the required distance from
the centreline of the wheel, to the face of the mounting flange. This is called offset. Offset is important because it brings the tyre centreline into close alignment with the larger inner hub bearing and reduces load on the stub axle.

Lecture Hour 1: Introduction to Moped, Scooter, and Motorcycle

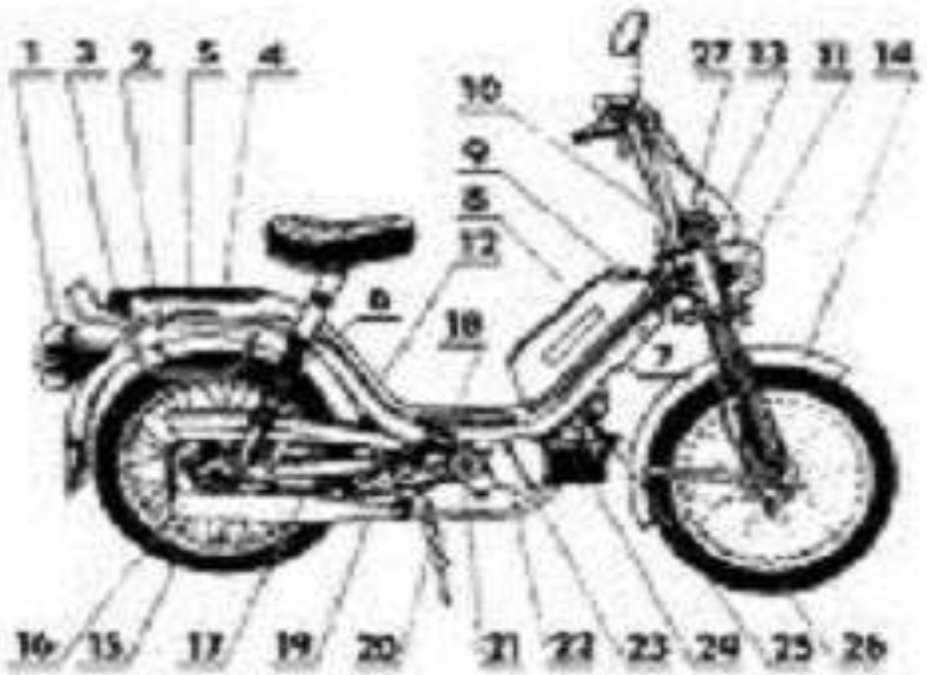


Fig. 1 Jawa Moped — Main Parts
1. Tail lamp, 2. Rear mudguard, 3. Tire pump, 4. Luggage carrier, 5. Tool kit, 6. Rear telescopic suspension unit, 7. Intake air cleaner, 8. Fuel tank, 9. Fuel tank filler cap, 10. Handlebars, 11. Headlamp, 12. Frame, 13. Front fork, 14. Front mudguard, 15. Rear wheel, 16. Exhaust silencer, 17. Pedal drive transmission chain, 18. Pedal cranks and pedals, 19. Engine drive transmission chain, 20. Stand, 21. Engine drive disengaging lug, 22. Alternator rotor cover, 23. Exhaust pipe, 24. Engine, 25. Spark plug with cable shoe, 26. Front wheel, 27. Speedometer.


MOTORCYCLE
passenger restraint handle
dual seat
gas tank
handlebar
dashboard
headlight
front mudguard
tail light
rear mudguard
spring suspension
telescopic shock absorber
wheel
disk brake
aluminium rim
exhaust pipe
main stand
frame