

# Chapter-3 Braking system

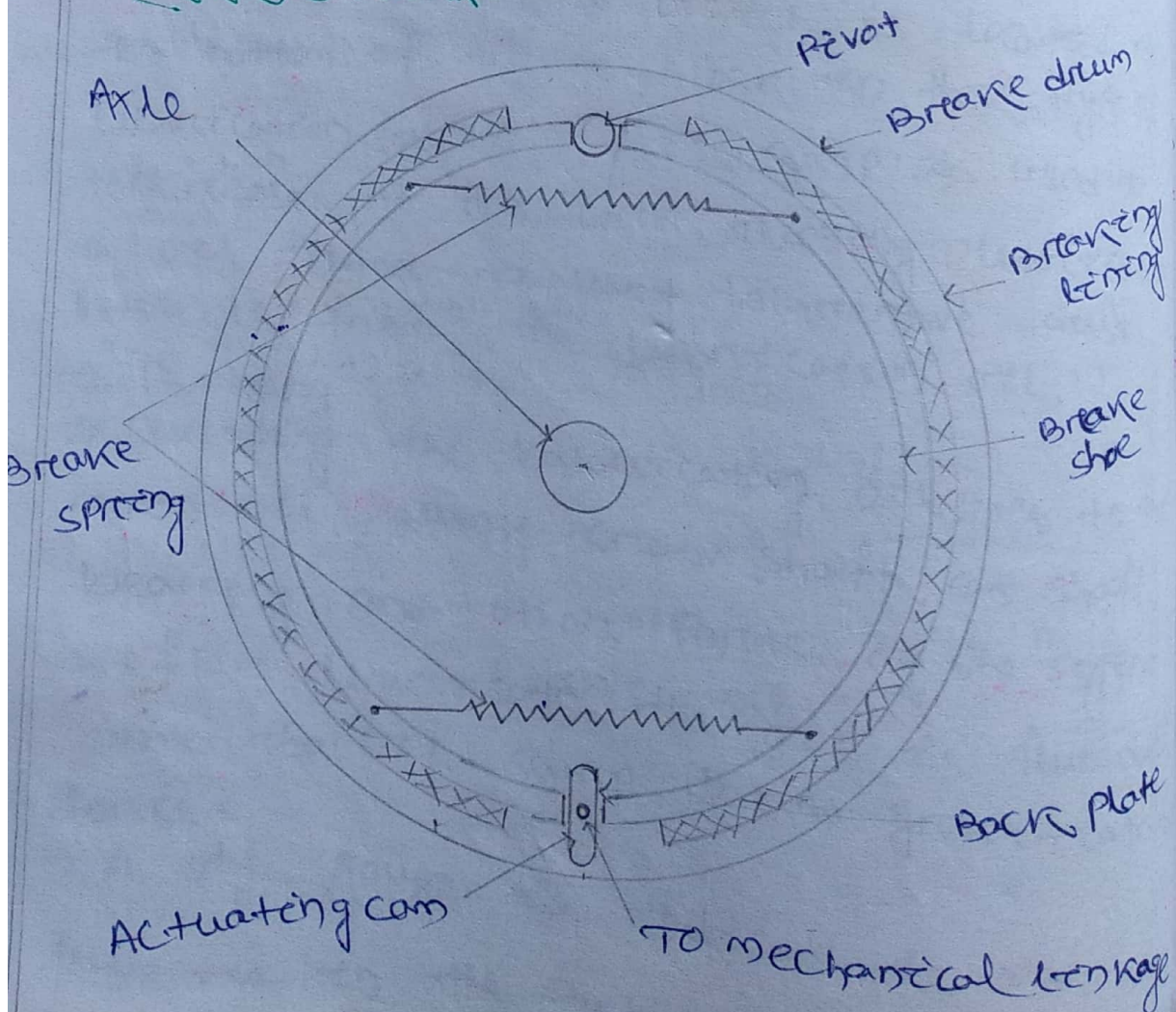
## Function of brake

TO STOP OR SLOW DOWN THE VEHICLE  
IN THE SHORTEST POSSIBLE DISTANCE.  
→ TO CONTROL THE VEHICLE WHEN REACHING  
AND DESCENDING THE HILL.

## Types of brake

- 1) Mechanical brake
  - Drum brake
  - Disc brake.
  - Parking brake
- 2) Hydraulic brake
- 3) Power brake
  - Air brake.
  - Air assisted hydraulic
  - Electric brake
  - Vacuum brake.

## Drum Brake





It is the simplest type of the brake widely used in most of the vehicle it consist of brake shoe friction lining retainering spring and rotating cam assembly.

→ The brake drum is mounted on the wheel axle.

→ The brake shoe are mounted inside the brake drum one end of the brake shaft pivoted to the back plate on the other end is free move by means of rotating cam assembly.

→ The rotating cam assembly can operated by brake paddle throo mechanical linkages.

→ The brake shoe are held in position inside the brake drum by rotating speed.

→ The friction lag linings are provided between brake drum and brake shoe.

→ When the driver press the brake paddle the rotating cam assembly actuate throo mechanical linkages which result it expand throo brake shoe.

→ When the driver press the brake paddle the

→ Due to this the brake shoe are expanded inner housing of the brake drum, this result the speed of brake drum is slow down.



→ When the driver released the brake pedal due to the returning spring the brake shoe are returning to original position and the rotating change in position this result the brake are released.

### Dish brake

The motor vehicle are now being fitted with dish brake system instead of drum brake.

→ The dish brake system is widely used for two wheelers and four wheelers it consist of rotating dish, caliper housing and fluid reservoir.

→ The brake force is applied by means of hydraulic pressure inside the caliper housing it having piston, cylinder and brake lining. The cylinder is connected to a fluid reservoir throo fluid line it may be single acting type or double acting type.

→ In single acting cylinder the brake pressure act on one cylinder and in double acting both the cylinders actuated during application of brake.

→ When the driver pressure the brake pedal the fluid's pressure act inside the cylinder it will move the outward friction lining.



- The revolving dish rotated in between two friction lining.
- When the hydraulic pressure actuated the friction lining patch in the revolving dish this result it will slow down the rotational speed of the revolving dish.
- In a single acting cylinder only one cylinder actuated in the brake pressure.
- In a double acting both the cylinders are actuated in the brake pressure.

### Hydraulic Brake

The hydraulic brake system the brake force is applied by means of fluid pressure.

- The hydraulic brake system consist of master cylinder, wheel cylinder and front wheel.
- It also consist of brake drum inside the wheel all the brake chamber connected to the master cylinder throo flexible fluid line.
- The master cylinder connected to the fluid line and also called as heart of hydraulic brake system.
- The brake force is produced by inside the master cylinder which is operated by brake pedal.
- The hydraulic system field with brake

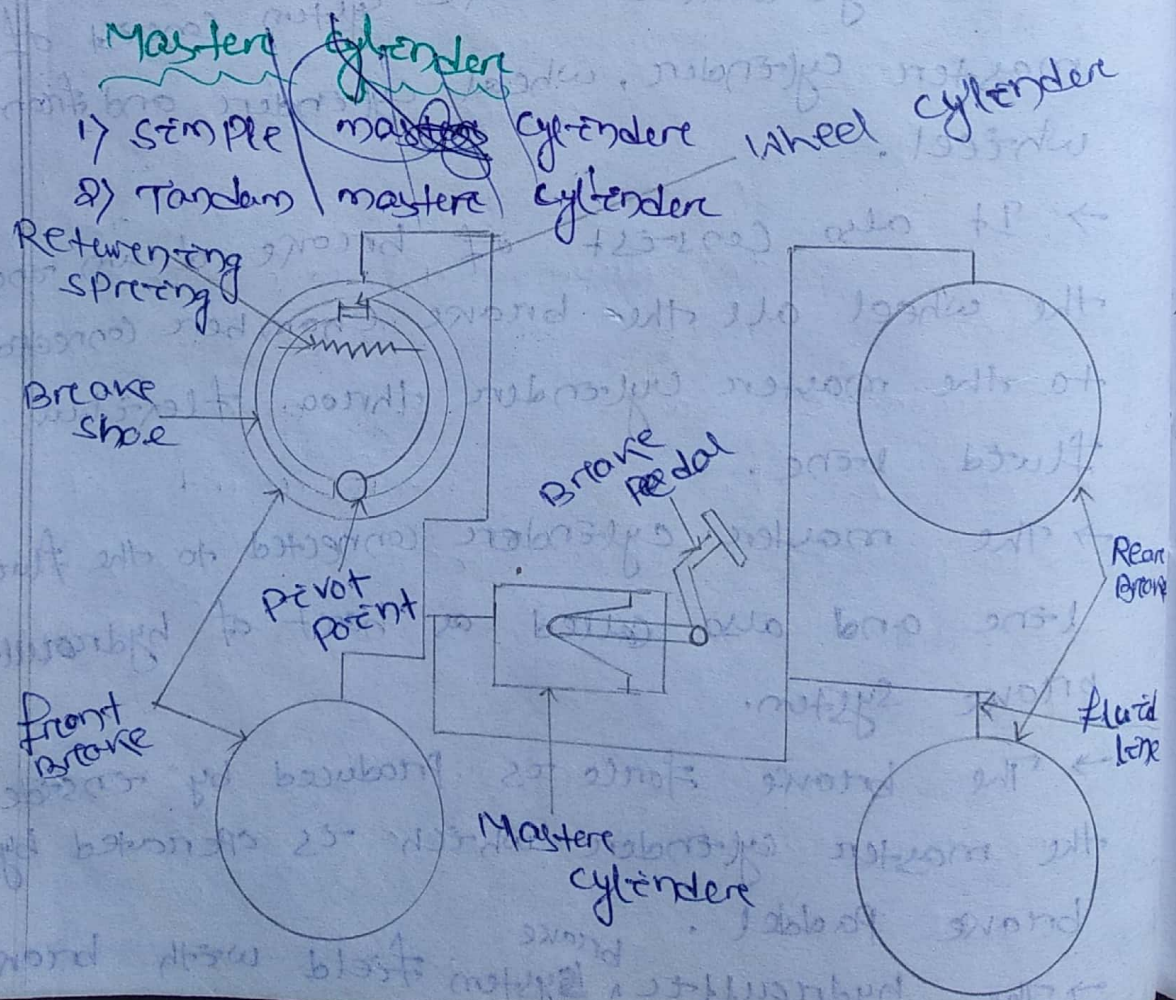


fluid  
 → When the driver press the brake paddle the master cylinder actuated and produced hydraulic pressure in entire circuit.

→ The high pressure brake fluid enter in to the wheel cylinder to expand the brake shoe.

→ When the brake shoe are expanded it touches inner housing of the brake drum this result fluid on the brake drum.

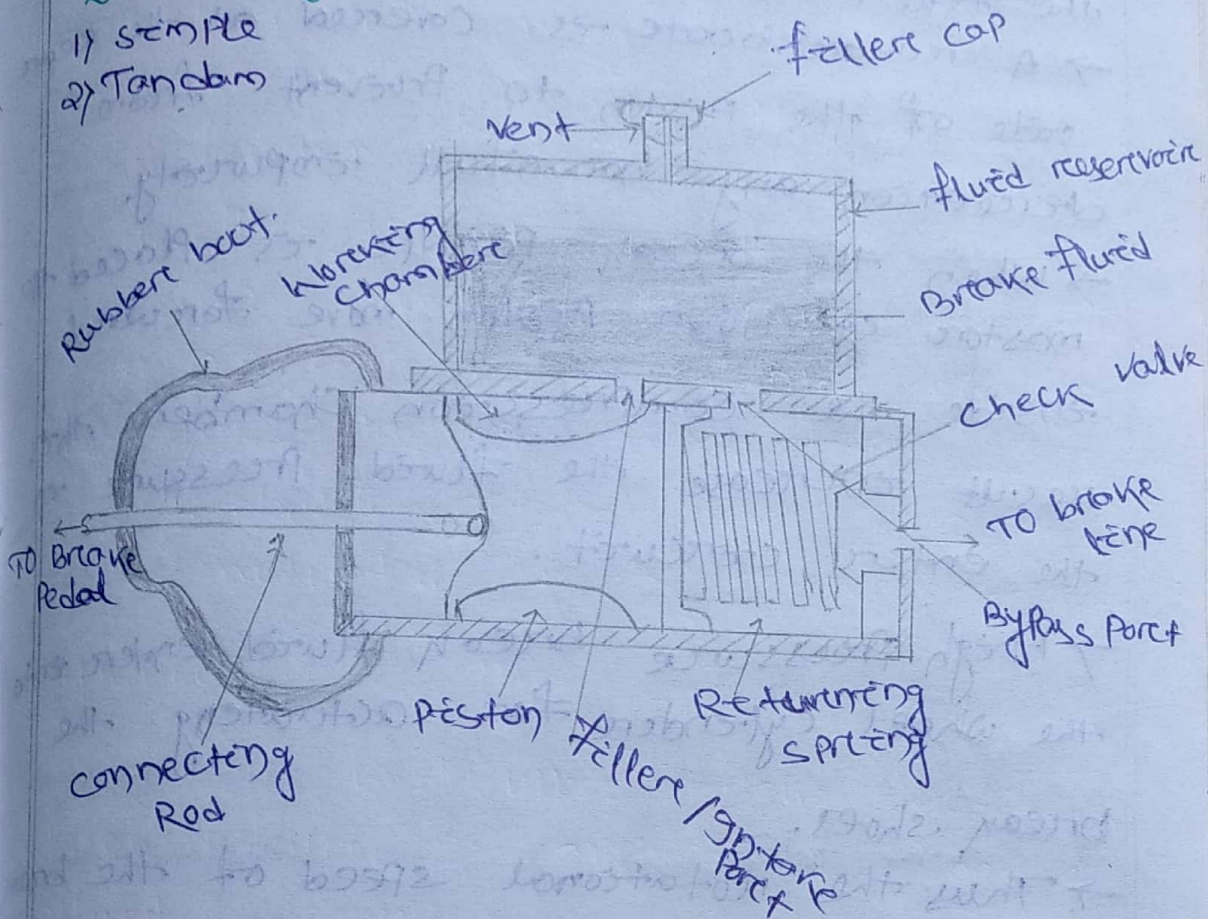
→ When the driver released the brake paddle the pressure the entire system will be drop down due to this the brakes are released.





## Master cylinder

- 1) simple
- 2) Tandem



The master cylinder is part of the hydraulic brake system which consists of two chambers.

→ One is fluid chamber which contains brake fluid and there is compression chamber in which the piston can operate.

→ The passage are (and) connected in between two chambers the larger port is called filler or vent port which is connected to the hollow part of the piston the smaller is called relief or bypass port.

→ The reservoir is vented on filler cap so that the atmospheric pressure flow through



the failure point.

→ A rebore boote is covered at the rear side of the piston to prevent from deterioration any harmful impurity.

→ When the break paddle is placed the master cylinder piston move forward inside the compression chamber this result increase the fluid pressure in the entire circuit.

→ High pressure break fluid enter into the wheel cylinder for actuating the break shoes.

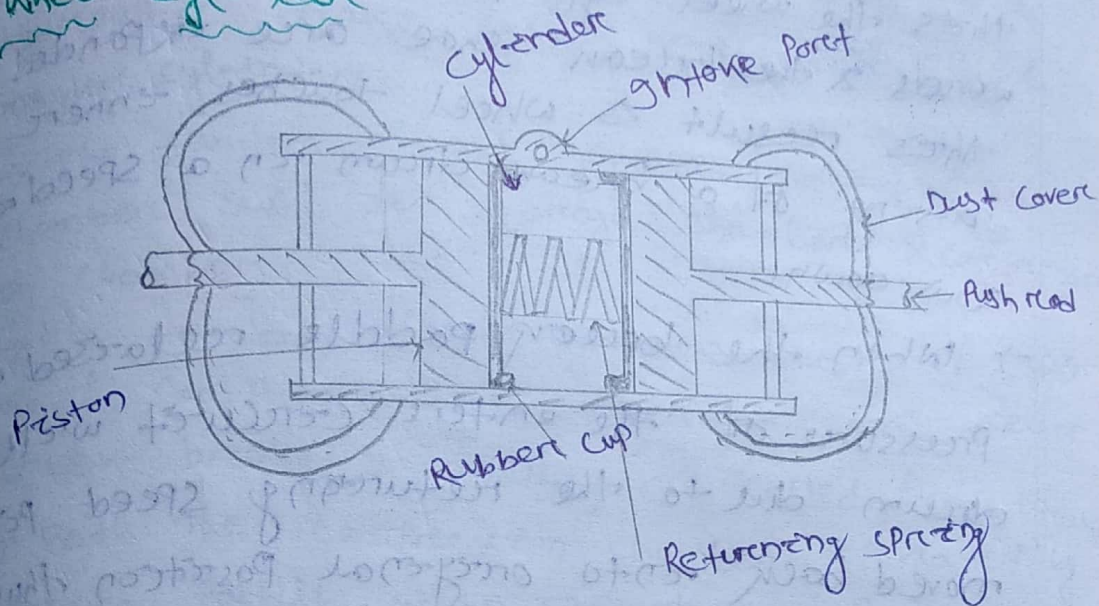
→ Thus the rotational speed of the break drum slow down.

→ When the break paddle is released due to the spring force the piston return backed into its original position & the break fluid return to reservoir throo bypass port this result the pressure entire system is break down.

→ Due to this to the return back to its original position & the break released.



## Wheel Cylinder



→ The wheel cylinder is most second important part of a hydraulic brake system which is locate inside the brake drum.

→ It consist of a two piston placed opposite to each other throo returning speed.

→ The wheel cylinder is used instead of rotating cam assembly in a drum brake.

→ The rubber cap act as a oil seal in both piston & cylinder work.

→ The dust covered are produced in each end of the wheel cylinder.

→ When the brake paddle is placed the high pressureise brake fluid enter into the wheel cylinder this result creat max pressure inside the chamber due to

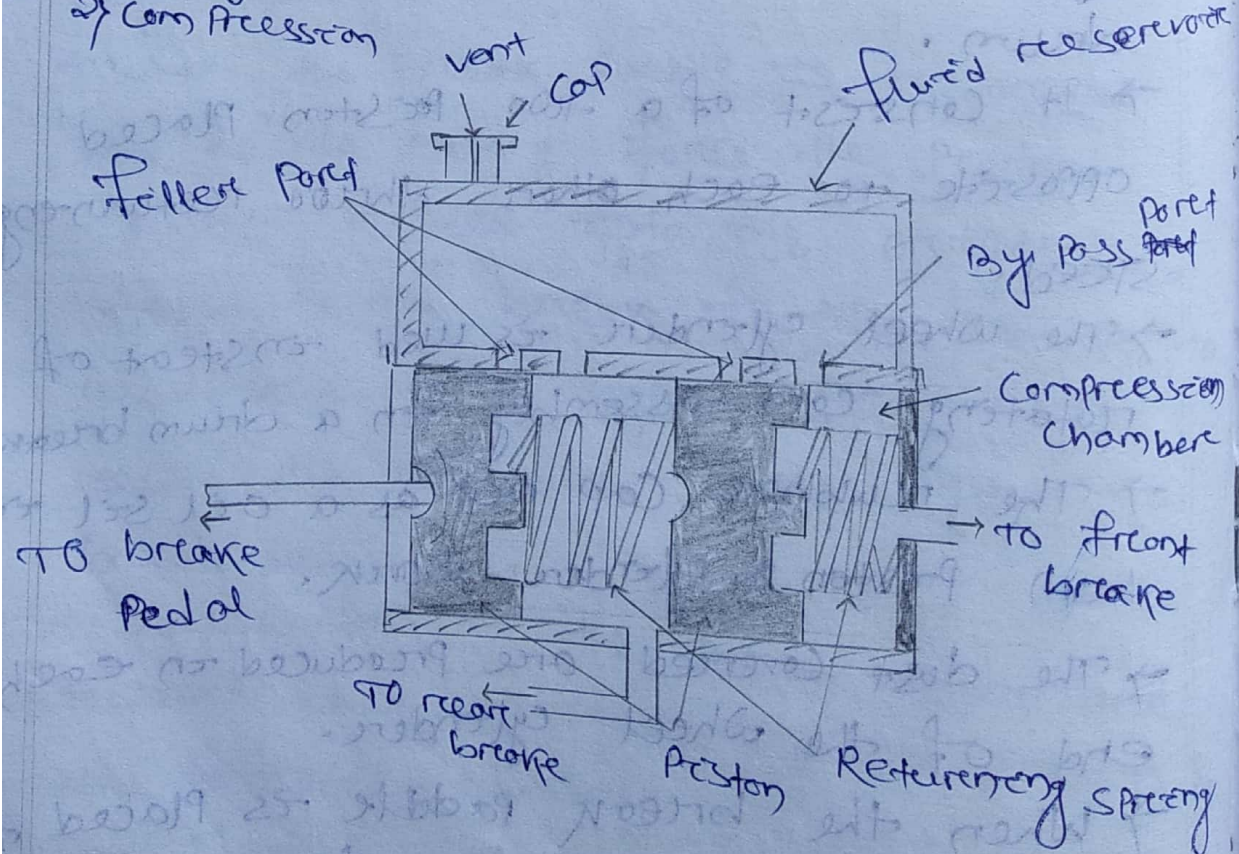


this the wheel cylinder piston moves out  
 wards & the brake shoe are expanded  
 this result is wheel touches inner  
 housing of a brake drum on a speed is  
 slow down.

→ when the brake paddle released the  
 pressure of the entire circuit will  
 drop due to the returning speed piston  
 moved back into original position thus  
 brake shoes are free and the  
 brakes are released.

### Tandem Master cylinder

- 1) Storage
- 2) Compression





The tandem master cylinder is used in a hydraulic brake system instead of simple master cylinder.

→ The tandem master cylinder consist of two chamber such as storage chamber & Compression chamber.

→ The tandem master cylinder consist of two no of Compression Chamber one for rear brake & another is called front brake.

→ Both the Compression Chamber operated by brake Paddle when the driver Press the brake Paddle the piston move forward.

→ Inside the Compression Chamber against the spring force.

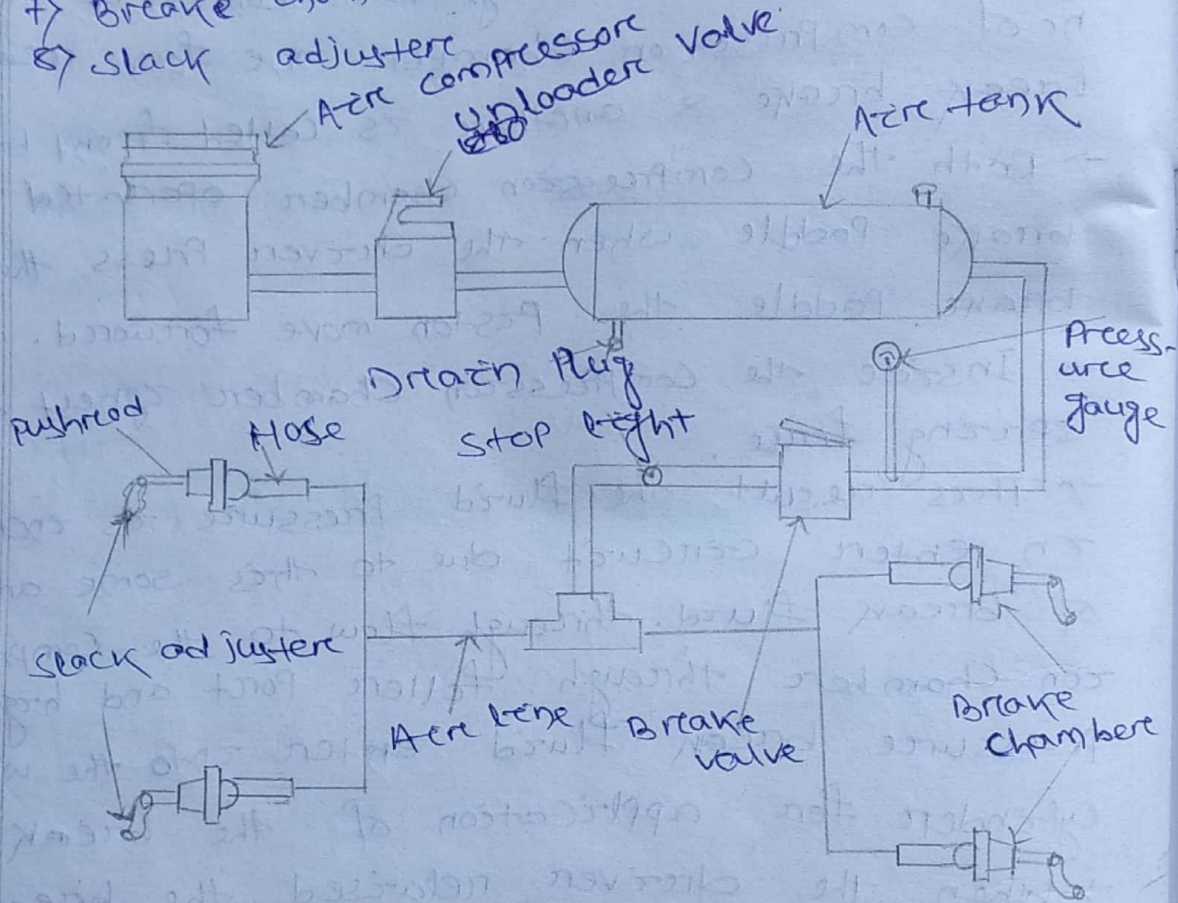
→ This result the fluid pressure is increase in entire circuit due to this some amount of brake fluid through flow to the Compression Chamber through filler Port and high pressure brake fluid enter into the wheel cylinder for application of the brake.

→ When the driver released the brake Paddle the Compression Chamber piston return back to its original position due to spring force and the pressure will be drop down thus the brake are released and the brake fluid return back to rear reservoir through by Pass Port.



## Air Brake

- 1) Air Compressor
- 2) Air tank
- 3) Unloader valve
- 4) Pressure gauge
- 5) Brake valve
- 6) Stop light
- 7) Brake chamber
- 8) Slack adjuster



The air brake system consists of air compressor, unloader valve, air tank, pressure gauge, brake valve, stop light, brake chamber & slack adjuster.

### 1) Air Compressor

The air compressor is used to collect the atmospheric air for application of the brake. The air compressor is driven by means of engine crank shaft. When the air



Compressor is start the atmospheric  
air enter into the cylinder through  
the compressor air & compressed through  
a high pressure delivery the.

### 2) Air tank

→ It is made of up flat steel sheet used to  
store the compressed air for application of  
brake.

→ The compressed air stored inside the  
tank.

### 3) Unloaded valve

→ The unloaded valve located in bet<sup>n</sup> air  
compressor & air tank it acts as a one  
way valve & open in one direction only.

→ The unloaded valve is open during the  
compressed air flow from compressor  
to tank. When the speed of the compressor  
fall down the pressure will be  
decrease.

→ Due to this the stored compressed air  
enter into the compressor due to the  
unloaded valve the compressed air does  
not allowed the flow back.

### Brake valve

It is the control valve which operated  
by the brake paddle.  
→ It control the intensity of braking  
in an air pressure system.



→ It is located in bet<sup>n</sup> reservoir & arrester to the individual brake chamber.

### Brake chamber

The brake chamber convert the energy compressed air into mechanical force & motion necessary to operate the brake.

→ A brake chamber consist of housing which enclosed a movable diaphragm connect by rod bet<sup>n</sup> to the brake so operate the crank shaft.

→ The chamber is divided into two parts by a diaphragm the side opposite to the rod being air type.

→ Air pressure act in the air type piston chamber which is cause deflection of diaphragm & application of brake.

### Quick released valve

→ It is employed in the front brake line to accelerate released of air from the brake chamber.

→ It directly released the pressure elsewhere than through the brake valve.

### Warning

### Warning signal

It is the warning line of buzzer which indicate low air pressure in the circuit.



## Advantages of air brake system

- Much more powerful than the ordinary one mechanical normally it is widely used for heavy vehicle only.
- simplified chassis design.
- The compressed air from the reservoir apart from braking can be used for tyre inflation, vent screenwiper, hole, etc.

## Disadvantages of air brake system

- Involve relatively more parts.
- The air compressor used siphons an ~~sure~~ amount of engine power.



## Common Ignition Coil

Trouble	<u>Cause</u>	<u>Remedies</u>
1. Engine miss 2. Fire engine 3. Stander	<ul style="list-style-type: none"> <li>→ Detached high tension cable.</li> <li>→ Faulty Power Plug.</li> <li>→ Large gap engine power plug.</li> <li>→ Broken the wire on the cable.</li> </ul>	<ul style="list-style-type: none"> <li>→ Attached high tension cable.</li> <li>→ Replaced the spark plug.</li> <li>→ Adjusted the gap to the specified value.</li> <li>→ Replace the wire.</li> </ul>
	<ul style="list-style-type: none"> <li>→ Loss low connection</li> <li>→ Loss contact screw.</li> <li>→ Direct on to distributor &amp; ignition coil.</li> <li>→ Broken plug.</li> <li>→ Run out distributor boss &amp; segment.</li> </ul>	<ul style="list-style-type: none"> <li>→ Tighten LT connection.</li> <li>→ Tighten contact screw.</li> <li>→ Clean the distributor or remove that.</li> <li>→ Change the plug</li> <li>→ Replacement.</li> </ul>
	<ul style="list-style-type: none"> <li>→ Discharge battery.</li> <li>→ Dirty connection</li> <li>→ Loose contact screw.</li> <li>→ Loss condenser.</li> <li>→ defective ignition coil.</li> </ul>	<ul style="list-style-type: none"> <li>→ Change the battery.</li> <li>→ Clean the contacts.</li> <li>→ Tighten it.</li> <li>→ Replaced it.</li> </ul>
	<ul style="list-style-type: none"> <li>→ Incorrect timing.</li> <li>→ Loose plug.</li> <li>→ Automotore governor not moving freely.</li> </ul>	<ul style="list-style-type: none"> <li>→ Adjust the correct timing.</li> <li>→ Replaced them</li> <li>→ Clean the parts of governor.</li> </ul>

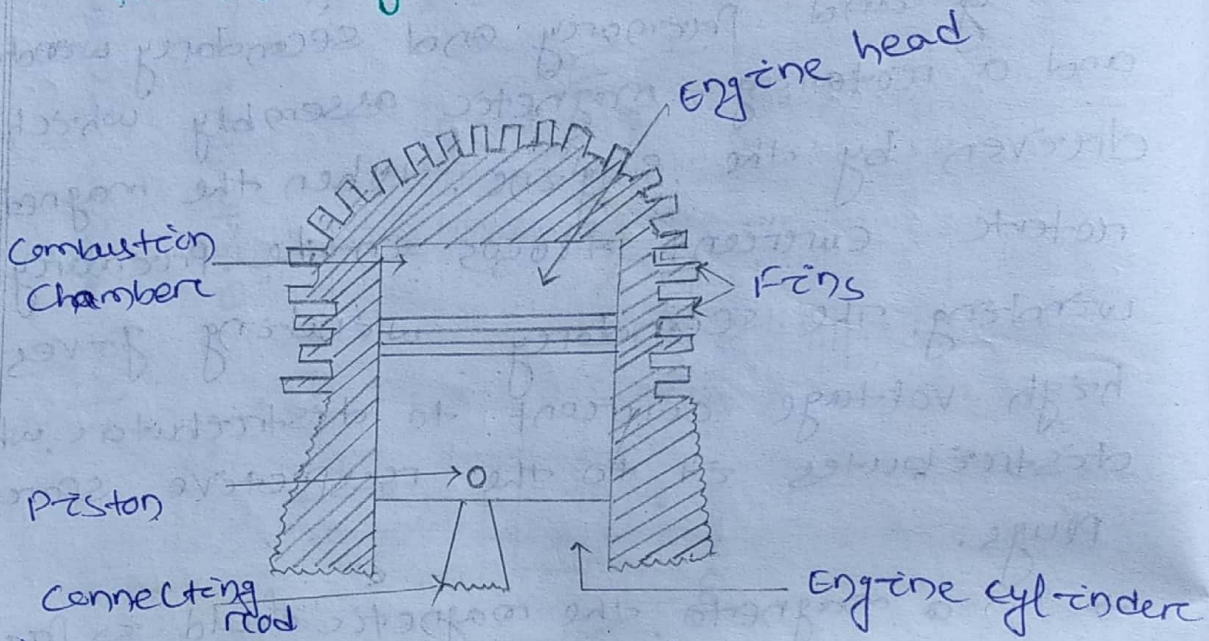


# Chapter 6 Cooling and Lubrication

## Cooling system

- 1) Air cooling.
- 2) Water cooling.
- 3) Liquid cooling.

## Air cooling



→ The air cooling method is widely used in a small displacement engine. In this type of engine system the heat is removed from the engine by the atmospheric air.

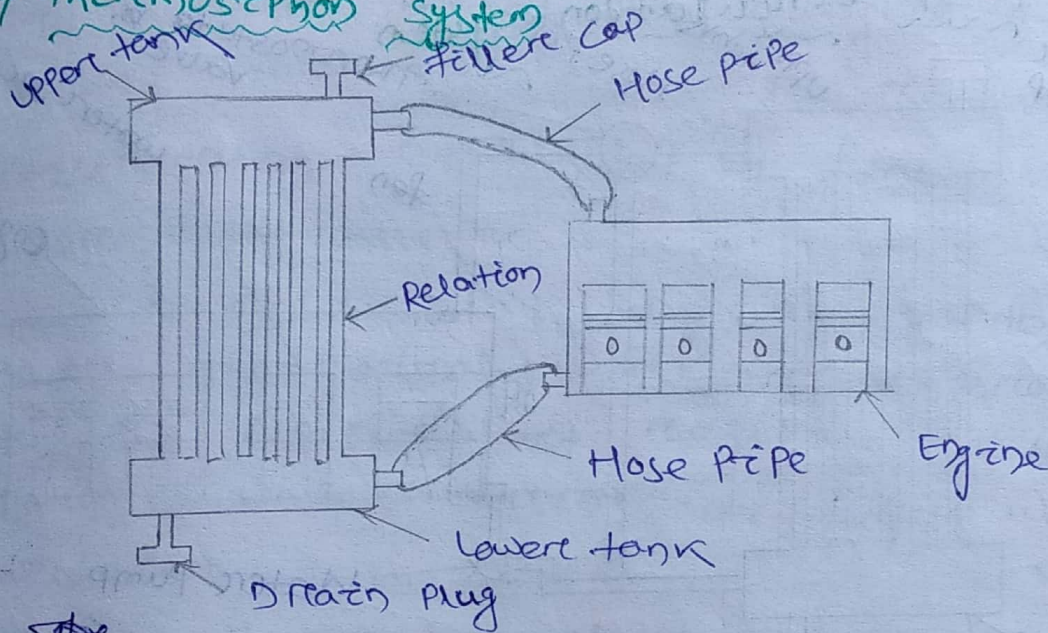
→ Fins and flanges are from surrounding the engine cylinder and increasing area to the atmosphere the basic principle of air cooling method when the fins are in contact with atmospheric air it remove the heat from the fins. The amount of heat dissipated depend on the following factors.



- 1) surface area of metal contact with air.
- 2) Rate of air flow.
- 3) Conductivity of metal.
- 4) The temperature difference between heated surface and air.

## Water Cooling system

### Thermosiphon system

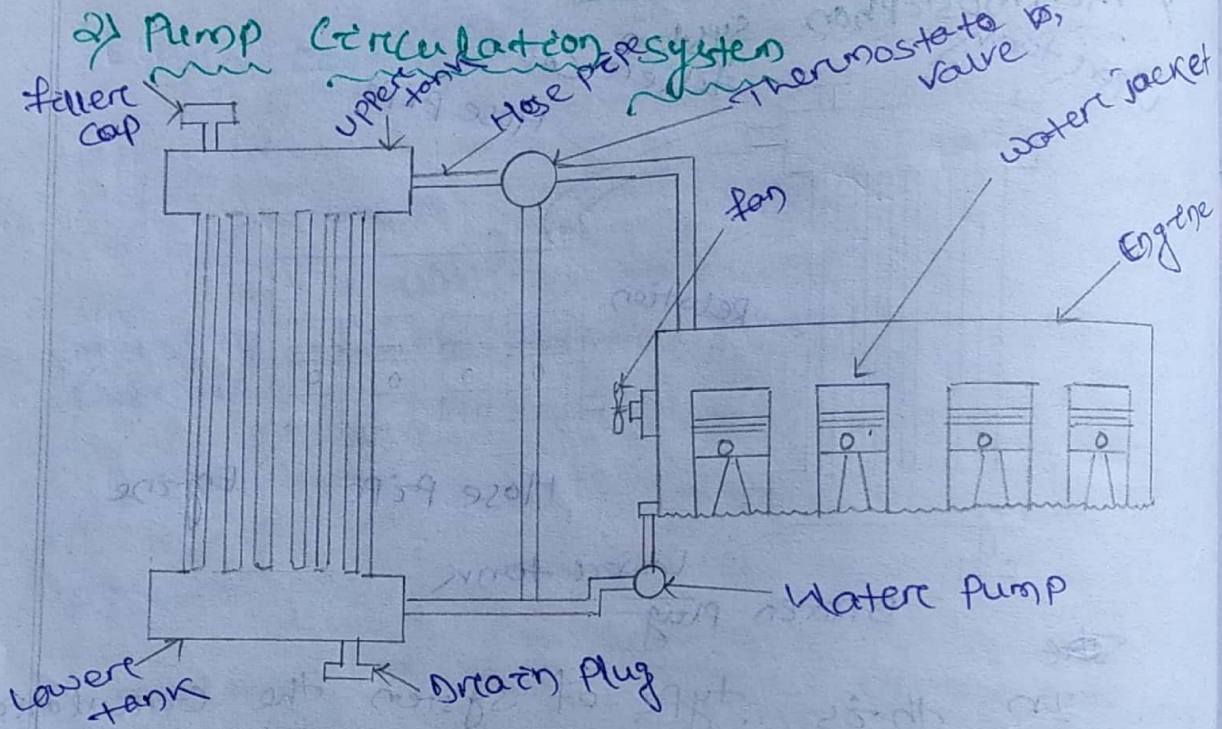


~~The~~ In this type of system the circulation of the water is obtained by different density of hot and cold regions of water. The area no water pump is used the circulation of water.

→ The circulation of water can be possible by different region of water. The hot water jacket from the engine being heated rises up and goes the upper tank of radiator thro' hose pipe. When it is flow from upper to bottom tank it will be cold down contact with atmospheric air.



→ This system is quite simple and cheap but the cooling process is very slow to maintain of constant temperature level inside the radiator if the water level falls down the circulation will discontinue and the cooling system in fact.



→ In this type of cooling system the circulation of water is obtained by a pump the pump is driven by means v-belt from the pulley of engine crank shaft the cooling effect is more the circulation of water become faster if the engine speed is increased there is no necessity of maintaining water level in the radiator the pump method consist of radiator, thermostat valve, fan, water pump and water jacket.



## Radiator

The radiator is a device having a large amount of cooling surfaces consist of upper and bottom tank.

→ The upper tank is connected to the water outlet from the engine throo flexible hose pipe and the lower tank is connected the water inlet of the engine throo water pump. The radiator is tubular construction surrounded by fans.

## Thermostat valve

A thermostat valve is used to maintain the normal working temperature in the circuit it regulate the circulation of water during different working condition.

→ The thermostat valve work automatically in the cooling system.

## Pump

A pump is used the water cooling system in velocity of circulating water.

→ The pump is driven by means of belt drive mounted in front in the engine.

## Fan

The fan is located behind the radiator and driven by v-belt drive throo the engine crank shaft.



## Water Jacket

The water jacket are cast into the engine cylinder throo the Passes provided surrounding the engine cylinder.  
→ When the water jacket are circulated around the engine cylinder it can remove heat from the engine.

## Lubrication System

- 1) Petroil system ✓
- 2) Splash system / scoop x
- 3) Pressure system ✓
- 4) Semi Pressure system x
- 5) Dry sump system ✓

### 1) Petroil system

→ This type of lubrication system adap. ted in two-stroke engine like a motor cycle etc.

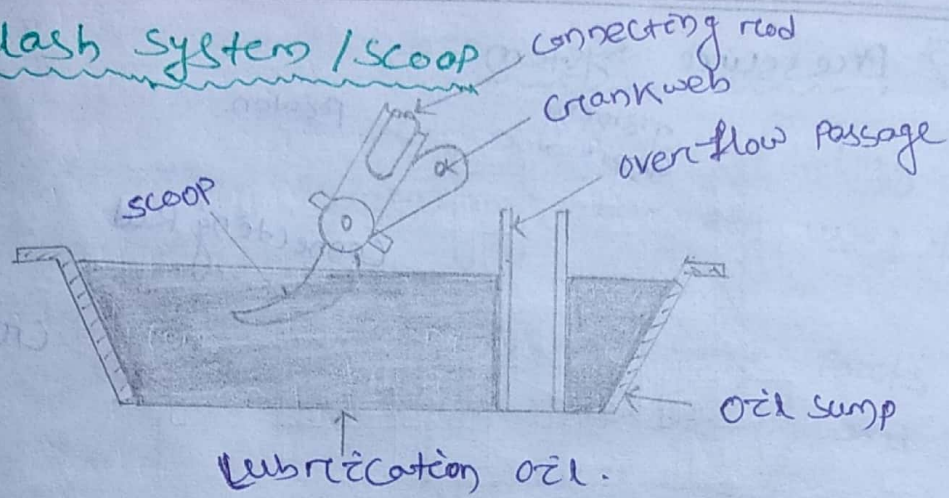
→ It is the simplest form of where the lubrication it does not contain any oil sump, oil pump etc.

→ But the lubricating oil mix into petrol will falling enter the tank in a specific ratio.

→ The lubrication oil converted into small oil particle and enter into the engine cylinder duration the operation the oil particles lubricate engine crank and other parts of the engine.



## 2) splash system / scoop



In this type of lubrication system the lubrication oil is stored in a separate tank is called oil sump, which is located at the bottom of the engine block at the end of the connecting rod scoop is formed for lubrication purpose.

→ When the scoop is deep into the oil sump which contains some amount of lubrication oil and splash to the cylinder wall in this process.

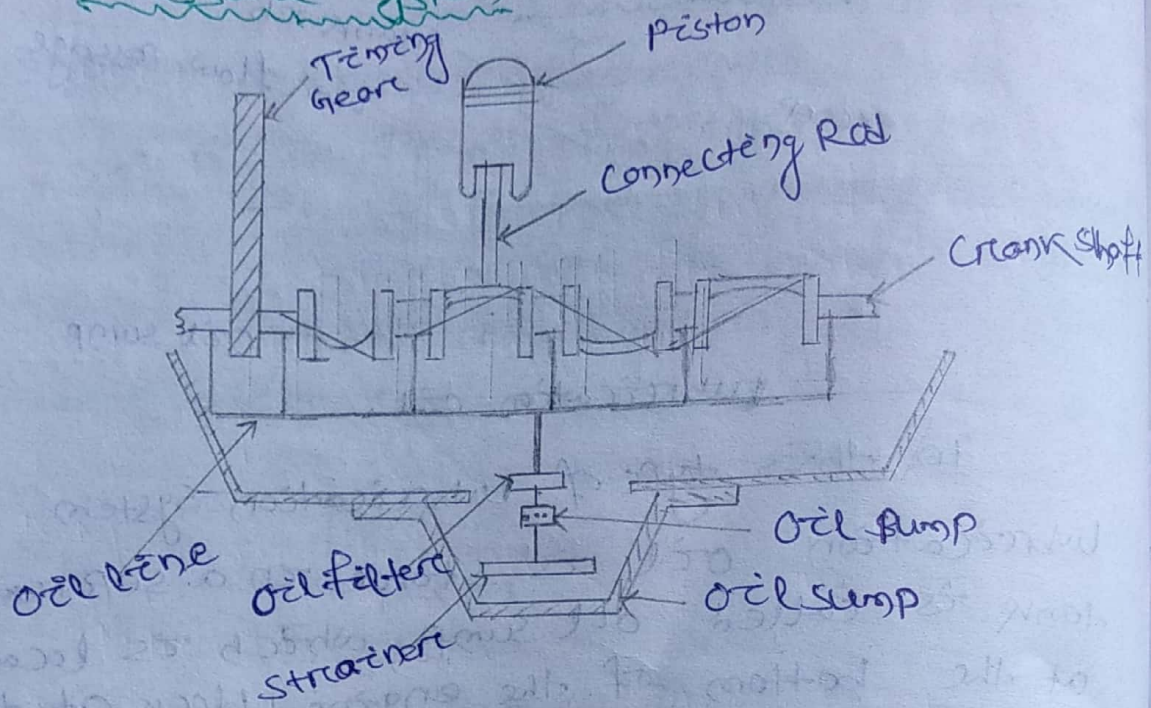
→ It lubricate engine parts and cylinder wall in this process.

→ If the level of lubrication oil fall down in the oil sump the lubrication process is completely stop.

→ Due to this reason this type of lubrication system is completely obsolete. ↓ is ~~now~~ now days.



### 3) Pressure system



→ In this type of lubrication system the engine parts are lubricated under pressure.

→ The lubrication oil in a separate tank is called oil sump which is located in the bottom of engine block in this type of lubrication system a oil pump is used to increase the pressure during lubrication a oil filter is used to remove dust particle from the lubrication oil.

→ ~~During~~

→ During the lubrication oil goes to the main oil gallery crankshaft, cam shaft, bearing and other parts of the engine.

→ After lubricate the oil is flow down into the oil sump due to gravitational force.

→ A oil gauge is indicate the maximum pressure in the system.

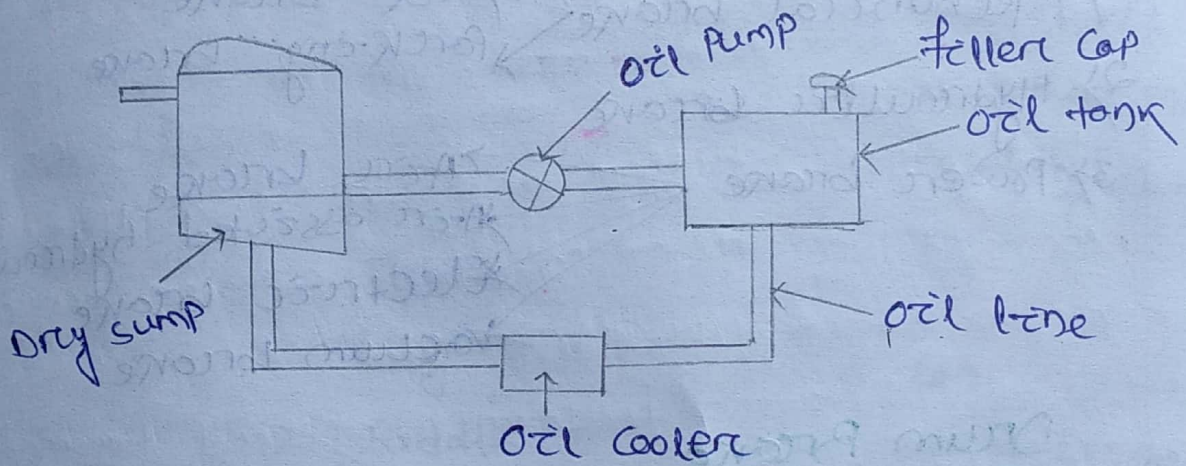


#### 4) Semi-Pressure System

It is the combination of splash and pressure system is widely used for four stroke engine.

→ In semi pressure system some parts are lubricated by pressure system and some part lubricated by splash system.

#### 5) Dry Sump System

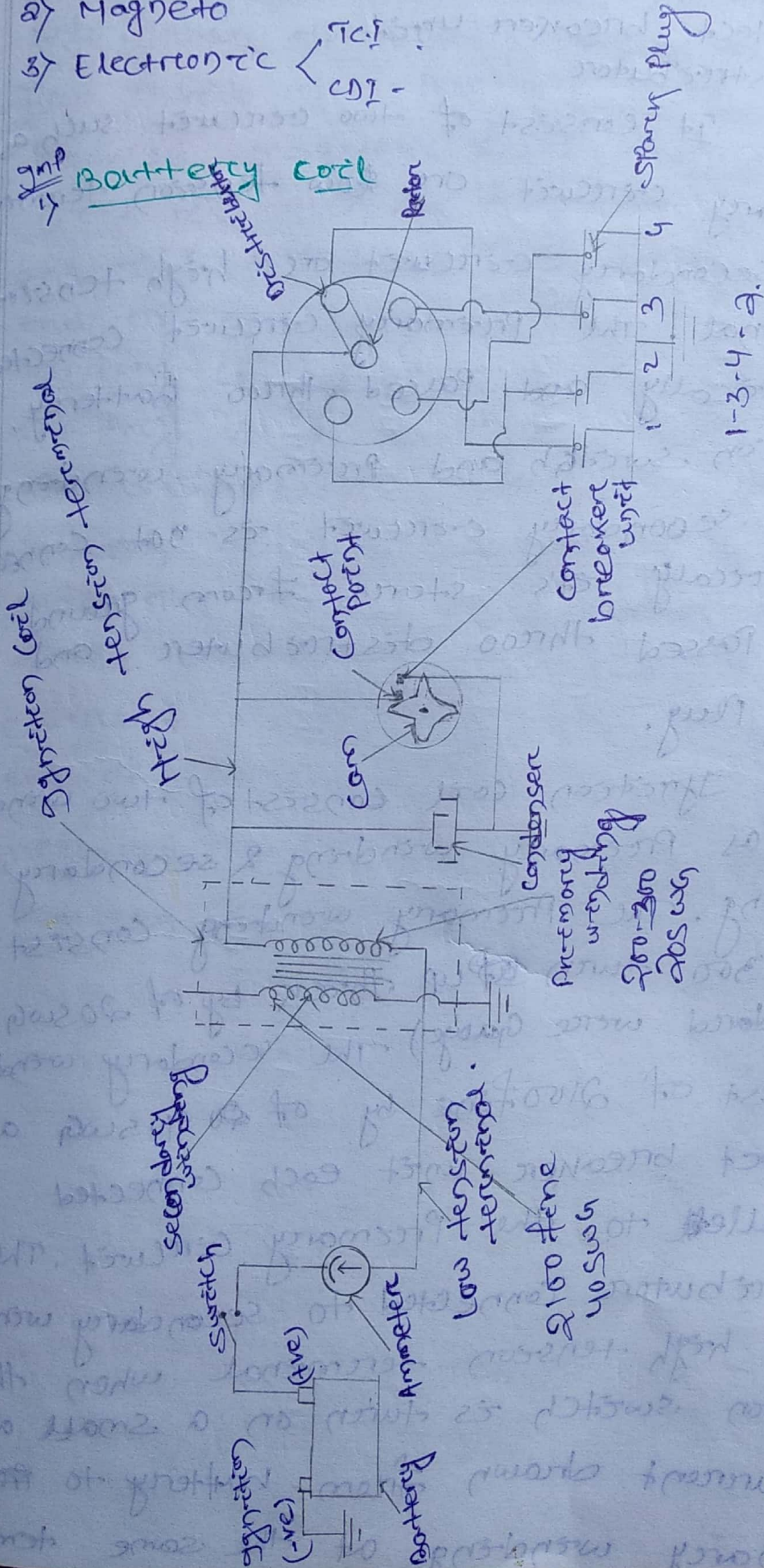




# Chapter - 7 Ignition system

- 1) Battery coil
- 2) Magneto
- 3) Electronic {
  - TIC
  - CI

## Battery coil





## The battery coil ignition system

- i) Battery
- ii) Ignition coil
- iii) Contact breaker unit
- iv) Distributors

It consists of two circuits such as primary circuit or low tension terminal and secondary circuit or high tension terminal. The primary circuit connected electrically and passed through battery, ignition switch and primary winding. → The secondary circuit is not connected electrically it's stored from ground and passed through distributor and

spark plug.

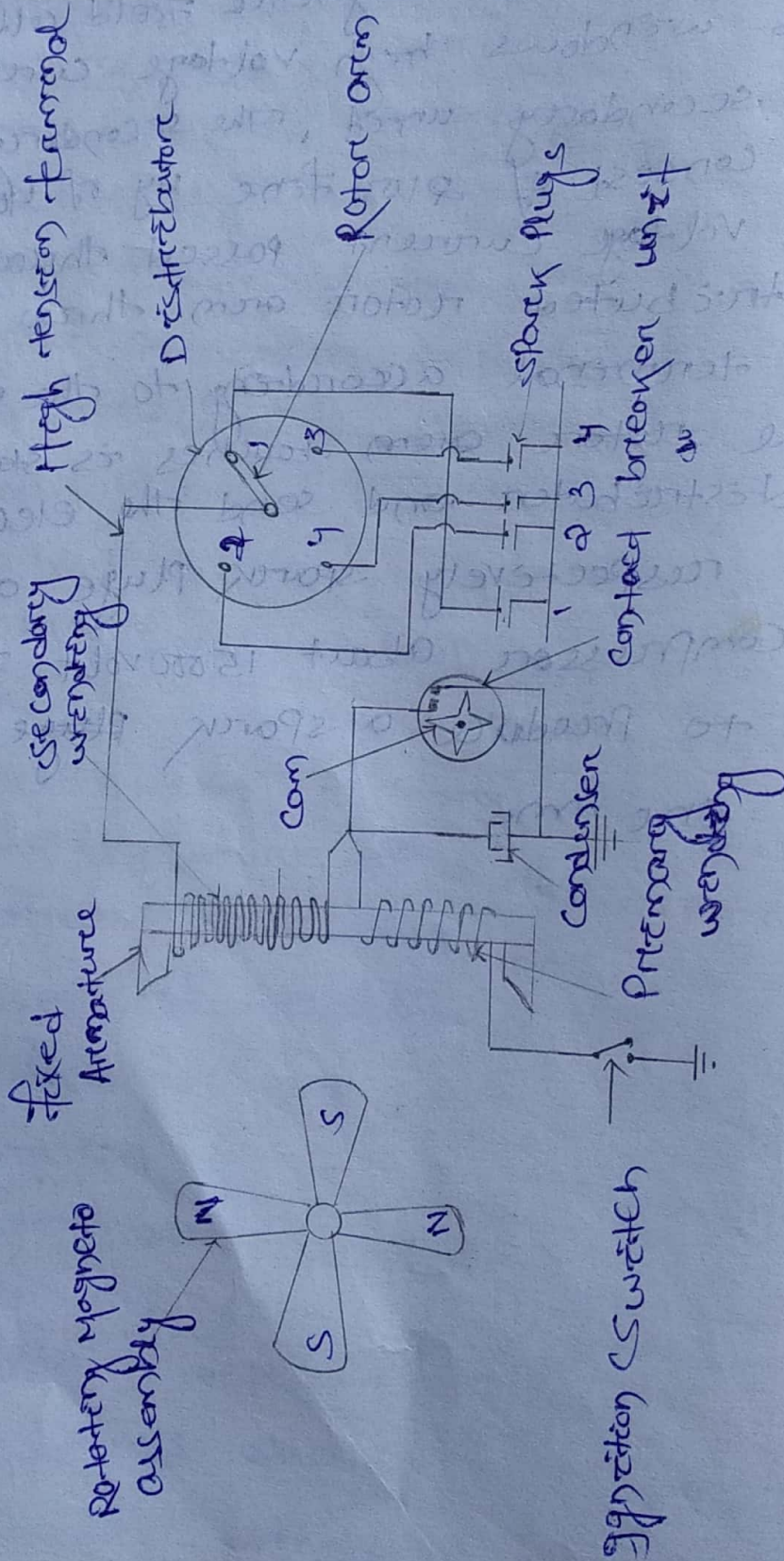
→ The ignition coil consists of two windings such as primary winding & secondary winding. The primary winding consists of 200 to 300 turns of wire of 20 SWG (standard wire gauge). The secondary winding consists of 21000 turns of 40 SWG a contact breaker unit each connected parallel to the primary circuit. The distributor connected to secondary winding through high tension terminal when the ignition switch is turned on a small amount of current drawn from battery to the primary winding at the same time



the contact point remaining closed position. A condenser is connected parallel to the contact breaker unit for prolong their life. When the small amount of current flow inside the primary unit it's produced magnetic field. When the contact point is open the magnetic field collapses and it's induces high voltage current end in secondary unit. The secondary winding consist of 2100 turns by of 40 swg. The high voltage current passed through the distributed rotor arm throo high tension terminal according to the firing order the rotor arm touches is statement of the distributor and send the electric current respectively spark plug at the end of compressor about 15000 volt is required to produce a spark plug in between one mm.



# 9mp Ass Magneto Ignition System





Magneto ignition system for a four-cylinder engine. It consists of a magneto instead of a battery, which produces and supplies current in the primary winding. The remaining ~~the~~ arrangement in the system is the same as that in the battery ignition system. The magneto consists of a fixed armature having ~~and~~ primary and secondary windings and a rotating magnetic assembly which is driven by the engine. When the magnets rotate, current flows in the primary winding. The secondary winding gives high voltage current to distributor, which distributes it to the respective spark plugs.

→ In a magneto, the magnetic field is produced by means of permanent magnets whereas in conventional generator, the magnetic field is produced by passing some of the generated current through the field winding which produces the magnetic field.

→ The magneto may be either rotating armature type or rotating magnet type.

→ In rotating armature type magneto, the armature carrying the primary and secondary windings and the condenser, rotate between the poles of a stationary horse shoe magnet.