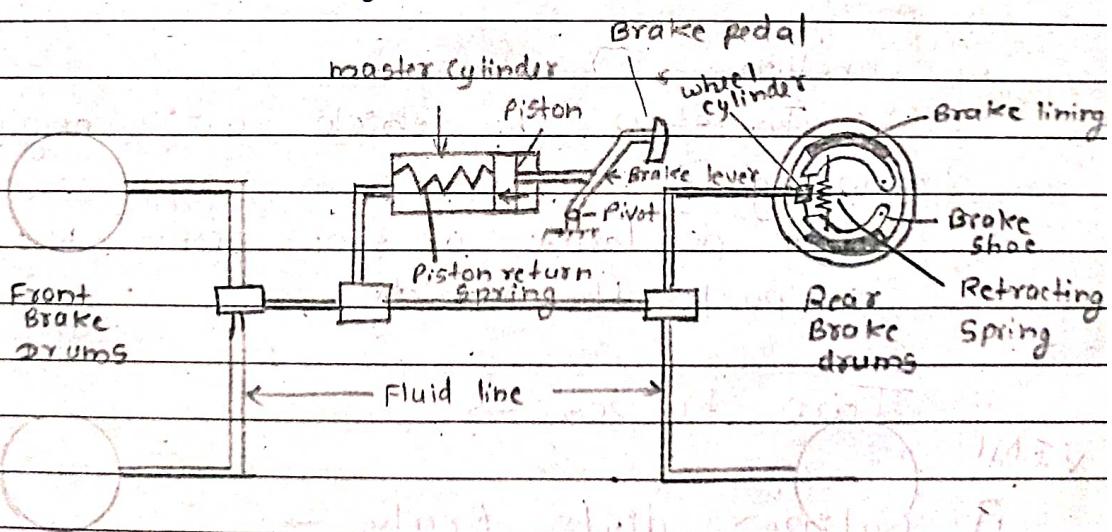


Unit → 4th

i) Braking System →

Braking System is an arrangement of various linkages and components used to slow down to or completely stop the moving vehicle within the shortest possible dist. by applying the artificial frictional resistance. In the process of performing the function, the brake absorbs I.E of moving vehicle and converts it to heat energy. This is done by converting the I.E of the vehicle into heat energy & this heat dissipated in surrounding air.

In hybrid vehicles, the energy absorbed by brakes is converted into electrical energy & stored in battery and this is called regenerative brake system.



Components →

1) Brake pedal and lever →

To apply brake, driver presses the brake pedal.

2) Master Cylinder →

The brake pedal is connected to the piston of the master cylinder through brake lever.

Date

and and other mechanical linkages.

3) Fluid lines →

The FL carry High pressure brake fluid from master cylinder to the four wheel cylinders.

4) Wheel cylinder →

In wheel cylinders, the high pressure brake fluid applies the force on the pistons of the wheel cylinders.

5) Brakes →

The pistons of the wheel cylinder provide the actuating force for →

i) Brake shoes in case of drum brakes

OR

ii) Calipers in case of disk brakes.

Function →

To stop the vehicle while engine is running.

To decelerate or slow down the vehicle

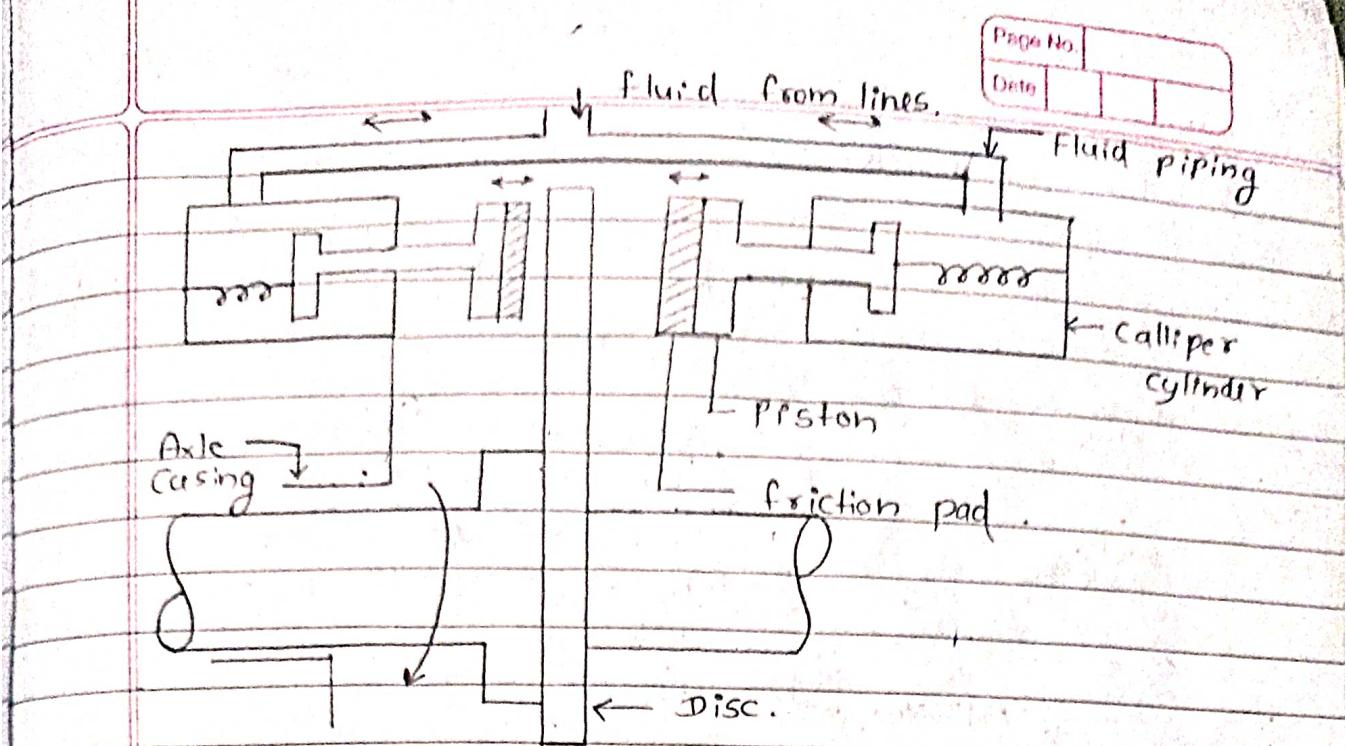
To park the vehicle.

Two types →

VIMP

i) Caliper disk brake →

It consists of a rotating brake disc mounted on the wheel and two friction pads positioned on either side of the disc. It consists of a cast iron or steel pressed disc.



when the brake lever or pedal is operated,
The breaking effort is transmitted to the
hydraulic Caliper through pressurized fluid.

The pressurized fluid pushes the two piston towards the break disc.

The friction betw the brake pads on the stationary pistons and the rotating brake disk causes the braking of vehicle

when the brake lever is released the two pistons are pushed back up by the retractor springs.

ADV →

- Simple in operation
- wear & tear is uniform
- Heat dissipation is faster.

DADV →

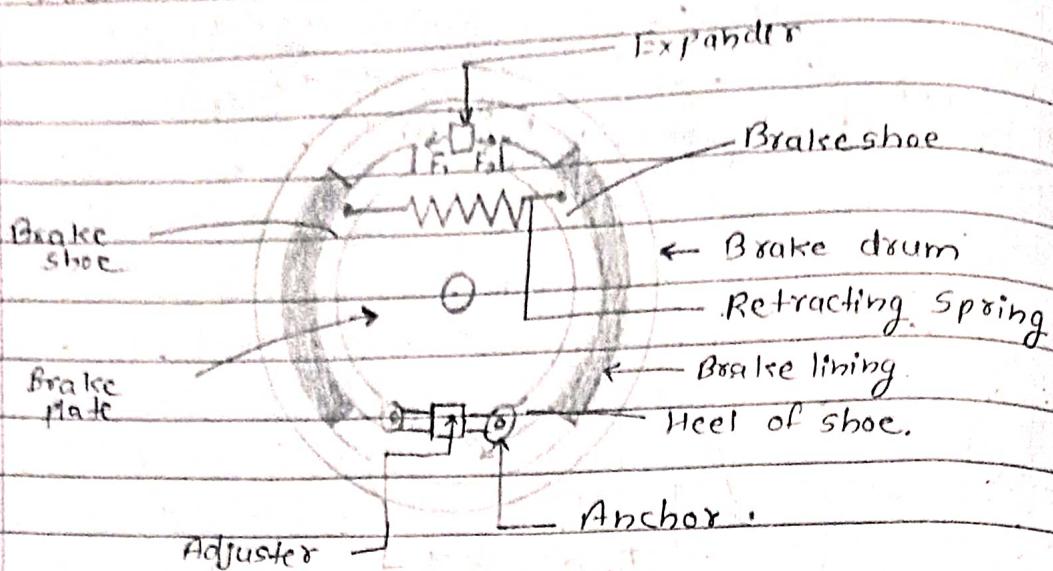
- Cost high
- Require high pressure intensity fluid.

Appl'n →

Used In Motorcycles, Conveyers, racing Cars, Vehicles

bcz of excellent control.

2) Drum Brake →



It consists of two shoes! The outer surface of the shoes are lined with some friction material.

Each shoe is pivoted at one end about the hinge - pin and subjected to an actuating force, on both the shoes is applied by a wheel cylinder.

When the actuating force is applied, the shoes are pressed against the rotatorying brake drum, thus causing the brake drum either to retard or stop completely.

When the AF is released, the retracting spring return the brake shoes, so that they no longer contact the drum.

ADV →

Consists of large friction shoes providing better braking.

Overall system design and construction is simple.

Drum brakes are ^{least} most economical at cost.

• **DAV →**

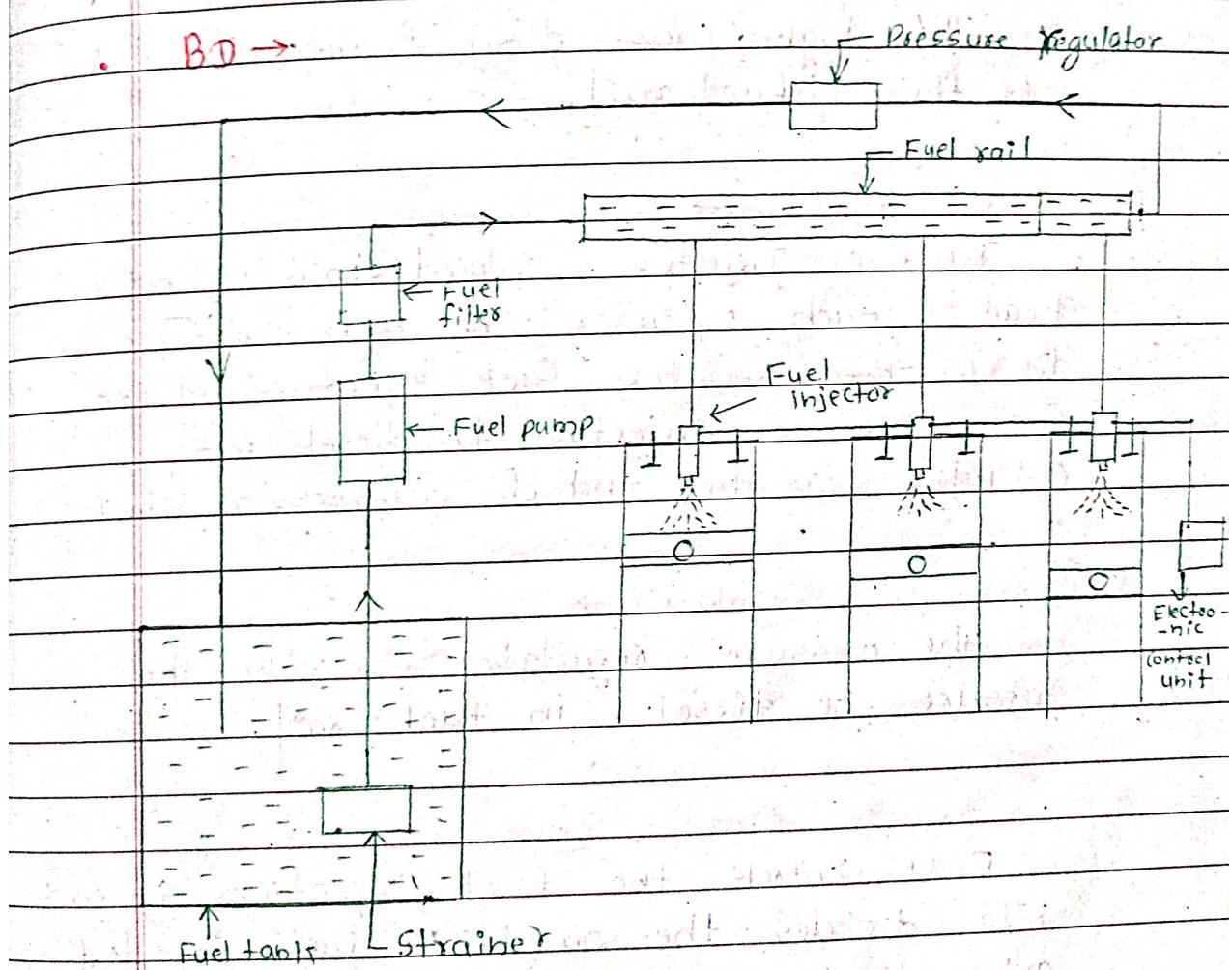
- The wear & tear on brake shoes is not uniform.
- Size is more than drum.
- Replacement of this requires dismantling of entire brake drum and back plate & assembly.

• **Applic. →** The drum brakes are used in automobile vehicles.

VIMP

2) Fuel supply sys. in Diesel engine →

• **BD →**



• **Components →**

i) **Diesel tank →**

Diesel is stored in diesel tank

2) Fuel pump →

The fuel pump increases the pressure of diesel before feeding it to the fuel rail. The fuel pump is driven by engine camshaft or electric motor.

3) Fuel filter →

The high press. diesel passes through the fuel filter where it is filtered so as to remove the dirt particles.

4) Fuel rail →

The high press. diesel is then supplied to the fuel rail.

5) Fuel injector →

The fuel Injector is placed in a cylinder head of each cylinder. The high pressure diesel enters in the fuel injector and the fuel injector injects the diesel into cylinder at the end of compression stroke.

6) Pressure Regulator →

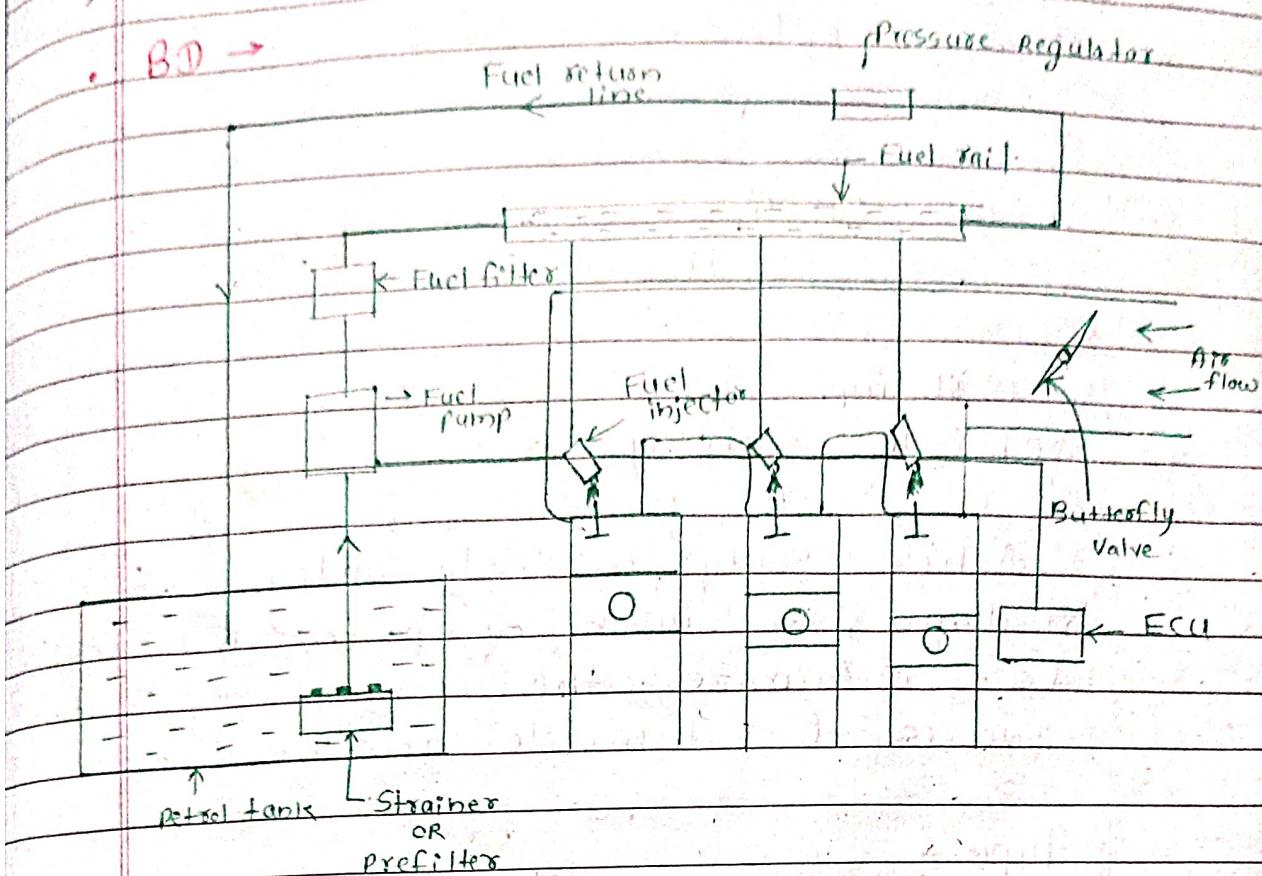
The pressure regulator controls the pressure of diesel in fuel rail.

7) Electronic Control unit (ECU) →

ECU controls the fuel injection system. It decides the amnt of fuel injected and timing of fuel injection in each cylinder.

Supply

3) Fuel Sys in petro| engine →



- Components →

i) Petrol tank →

Petrol is stored in petrol tank

ii) Fuel pump →

Fuel pump increases the pressure of the petrol before feeding it to the fuel rail.

iii) Fuel filter →

— II —

iv) FR →

— II —

v) FI →

The fuel injector is placed in a intake manifold of each cylinder. The H.P petrol enters the fuel injector and fuel injector injects the petrol into intake manifold at high velocity. The homogeneous air and petrol mixture then enters the engine cylinder.

through the inlet valve.

vii) Pressure regulator →

—11—

viii) ECU →

—11—

Most imp.
4) Vehicle Safety →

Vehicle Safety is study and practice of design, construction, equipment & regulation to minimize the occurrence & consequences of automobile accidents.

Types →

i) Active Safety System →

(Primary safety system)

Active Safety sys are the Safety Systems which help to prevent the accidents.

The following Components can helps to reduce the accidents →

most imp Anti-lock braking system (ABS) →

i) Good mirrors should be there

ii) Vehicle noise should be minimum

iii) Suspension System and steering sys. should be comfortable

iv) Headlights with adequate intensity

v) More visibility to driver and min. blind spots to increase efficiency of driver in heavy traffic and during parking

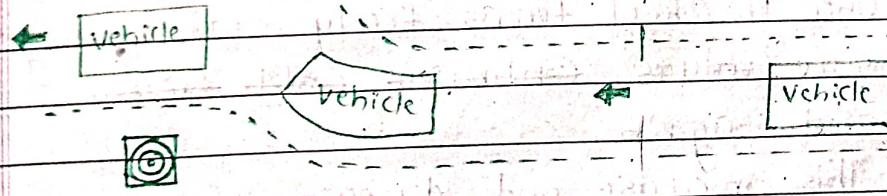
Ex → Anti-lock Braking System (ABS) →

i) Need of ABS →

The when sudden brake is applied on slippery road , the wheels of vehicle stop spinning rotating. The locking of wheels reduce the grip both tyres and road surface and there is no steering control on skidding vehicle. The driver losses control over the vehicle.

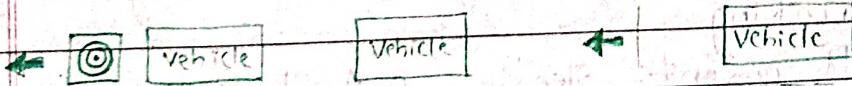
ii) ABS →

The ABS increases the stopping dist. on slippery roads . This prevents the wheels from locking up during braking , and it helps in maintaining contact of wheels with road surface. This helps driver to maintain steering control



with ABS (steering control)

Braking pt



without ABS (No steering control)

• Components of ABS →

- i) Electronic Control Unit (ECU)
- ii) Speed Sensors
- iii) Hydraulic Control Unit
- iv) ABS Control Valves
- v) Control Algorithms

• Working →

The wheel speed sensors continuously monitor the speed of wheels and send this info. to ECU.

If the wheel is about to lock under heavy braking, the hydraulic control unit reduces the braking pressure of that single wheel until the wheel turns freely. Threat of locking is past.

Once the wheel turns freely, the braking pressure ~~reduces~~ continues until driver is increased again.

This increase and decrease of braking pressure continues until driver reduces the force applied on brake pedal.

• Advantages →

- i) Maintains steering control during emergency braking
- ii) It prevents steering control during emergency braking
- iii) It increases braking dist on slippery roads and reduces the braking dist on normal roads

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- Disadvantages →
 - i) Vibrations are felt at the brake Pedal during breaking.
 - ii) Its cost is very high.

 - Apps →
 It is used on aircraft's, modern motorcycles, cars, buses and trucks.

ii) Passive Safety System →

passive safety systems are the safety systems which protect the passengers once the accidents takes place. The passive safety systems do nothing until the vehicle crash. Once the vehicle crash, the passive safety systems comes into action ~~literally~~.

Ex →

i) Seat belts →

Seat belts are designed to secure the passengers against harmful and dangerous movements arising out of due to sudden stop of vehicle.

Working →

When driver applies sudden brakes and stops the vehicle passenger and vehicle are travelling at same speed.

When the vehicle is travelling at a smooth speed, the seat belt is loose and passenger can make comfortable movements.

When driver applies the break and stops the vehicle suddenly, the seat belts applies opposite force on driver and passengers to prevent them from hitting against interior part of the vehicle.

2) Air Bag →

Airbag is an inflatable cushion designed to protect driver and passengers of car from serious injury in case of collision. Airbag is a gas filled pillow.

Working →

After detecting the impact, air bags inflate quickly to cushion the driver and passenger with a gas filled pillows.

Airbag provide the en-

Components of air bag system →

- i) Crash Sensor
- ii) Inflator or gas generator
- iii) Air bag
- iv) Air bag electronic control unit (AECU)

5) Suspension System →

Suspension sys. is mounted betn the automobile chassis and the axles to isolate the vehicle body from road shocks.

Suspension System consists of a spring or Spring and damper. The damper which is known as shock absorber, consists of piston cylinder arrangement filled with oil.

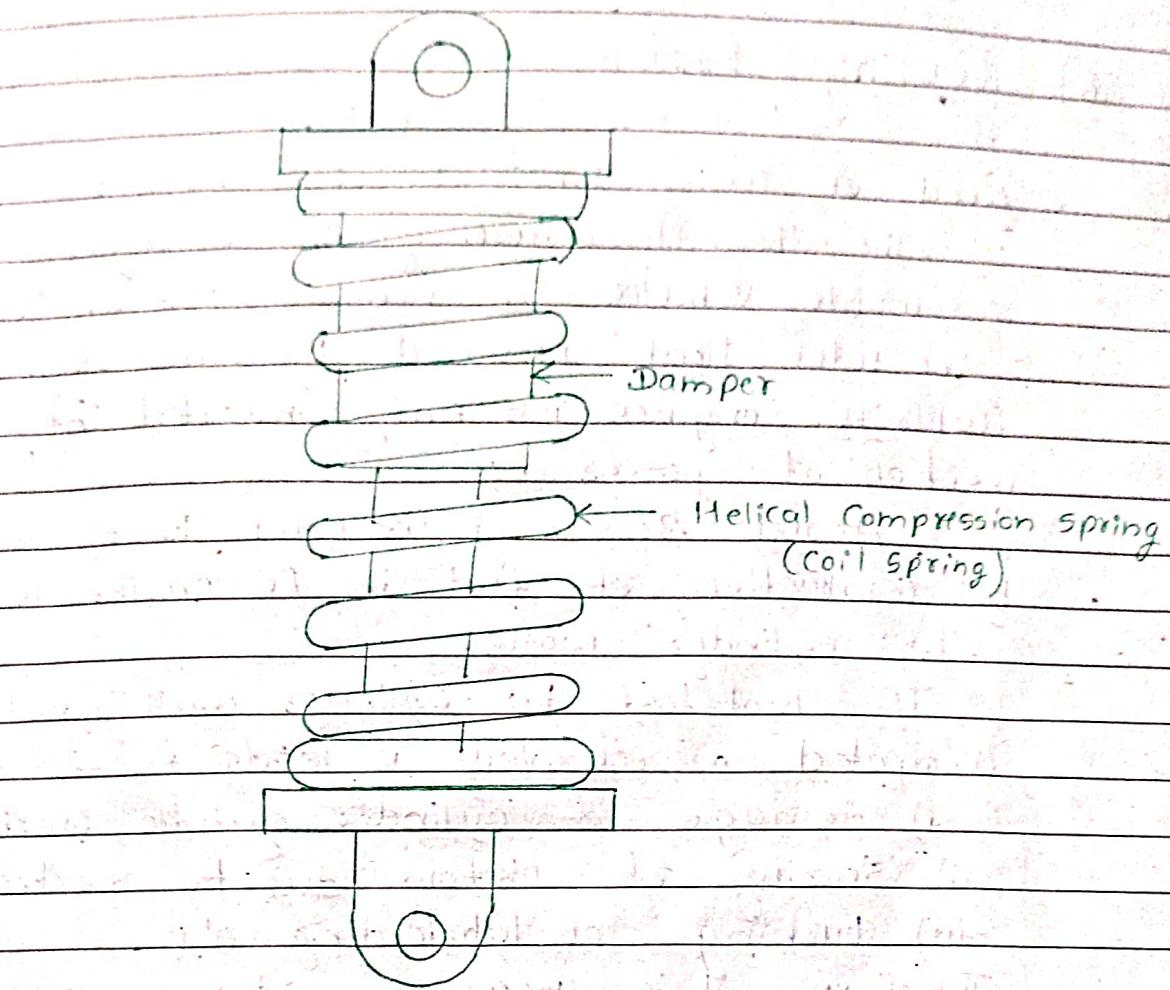
• Functions of suspension sys →

- i) To isolate the vehicle body from road shocks
- ii) To safeguard the passengers from road shocks
- iii) To maintain contact betw tyres and road surface with varying loadings.

Types :-

- Leaf Spring → No till now
- Telescopic Suspension System → VIMP

i) Telescopic Suspension System →



Components and Working →

i) Helical Compression Spring (coil spring) →
The helical compression spring absorbs the energy of road shock. Due to this the spring tends to oscillate.

ii) Damper (shock absorber) → Damper consists of piston cylinder arrangement filled with the oil. The oil in damper restricts the oscillation of helical compression spring.

• Aprils →

The load carrying capacity of coil spring and damper is less than the leaf spring. It is used in two wheelers and light motor vehicles.

6) Cooling System →

• Need of Cooling in automobile engine →

The thermal efficiency of IC engines used in automobile vehicles is around 30%. Therefore the total heat produced by combustion of fuel in IC engines is not converted into mechanical power.

About 30% of the total heat produced by combustion of fuel in IC engine is lost to cylinder walls.

If heat lost to cylinder wall is not dissipated or removed it leads to →

- i) damage of cylinder due to overheating
- ii) Seizing of piston due to overheating
- iii) burning of lubricating oil

Therefore, it is necessary to provide cooling system to dissipate the heat from form from cylinder wall so as to maintain the temp. of cylinder wall within the limits.

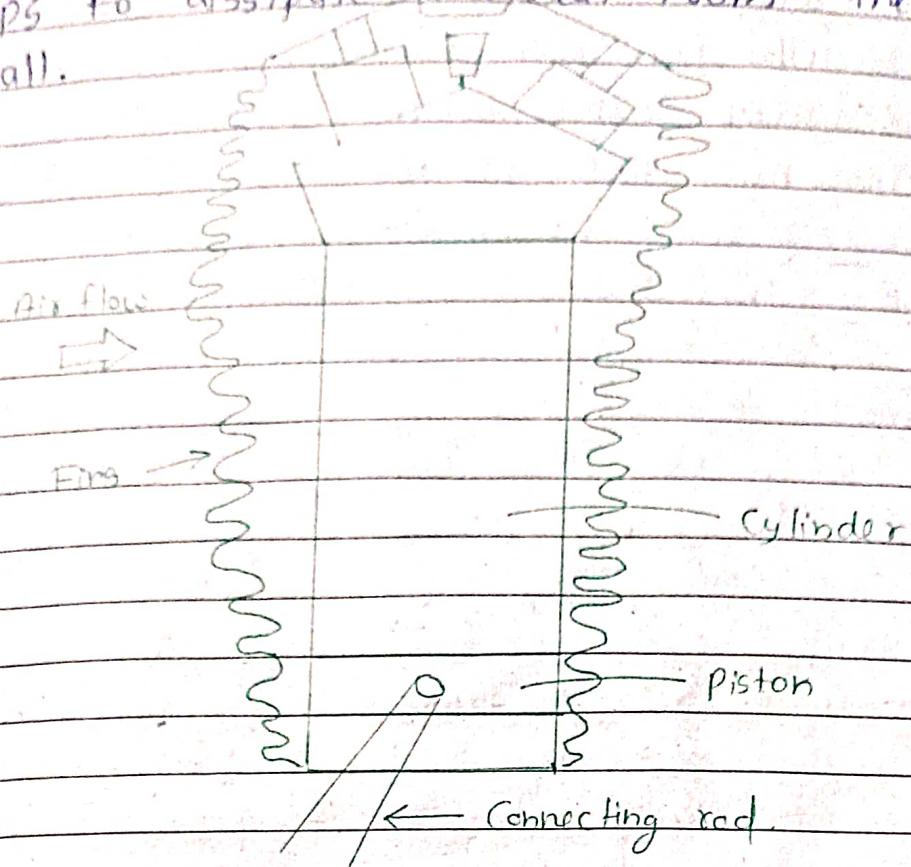
• Methods of Cooling →

i) Air Cooling System →

In air cooling sys. the fins are provided on the surface on the cylinder.

The fins increases the surface area available for dissipation of heat.

The air flowing over the surface of the cylinder helps to dissipate the heat from the cylinder wall.



• Applns →

Air cooling system is used in two-wheelers. It is not effective in high capacity engines like engines.

i) water cooling sys →

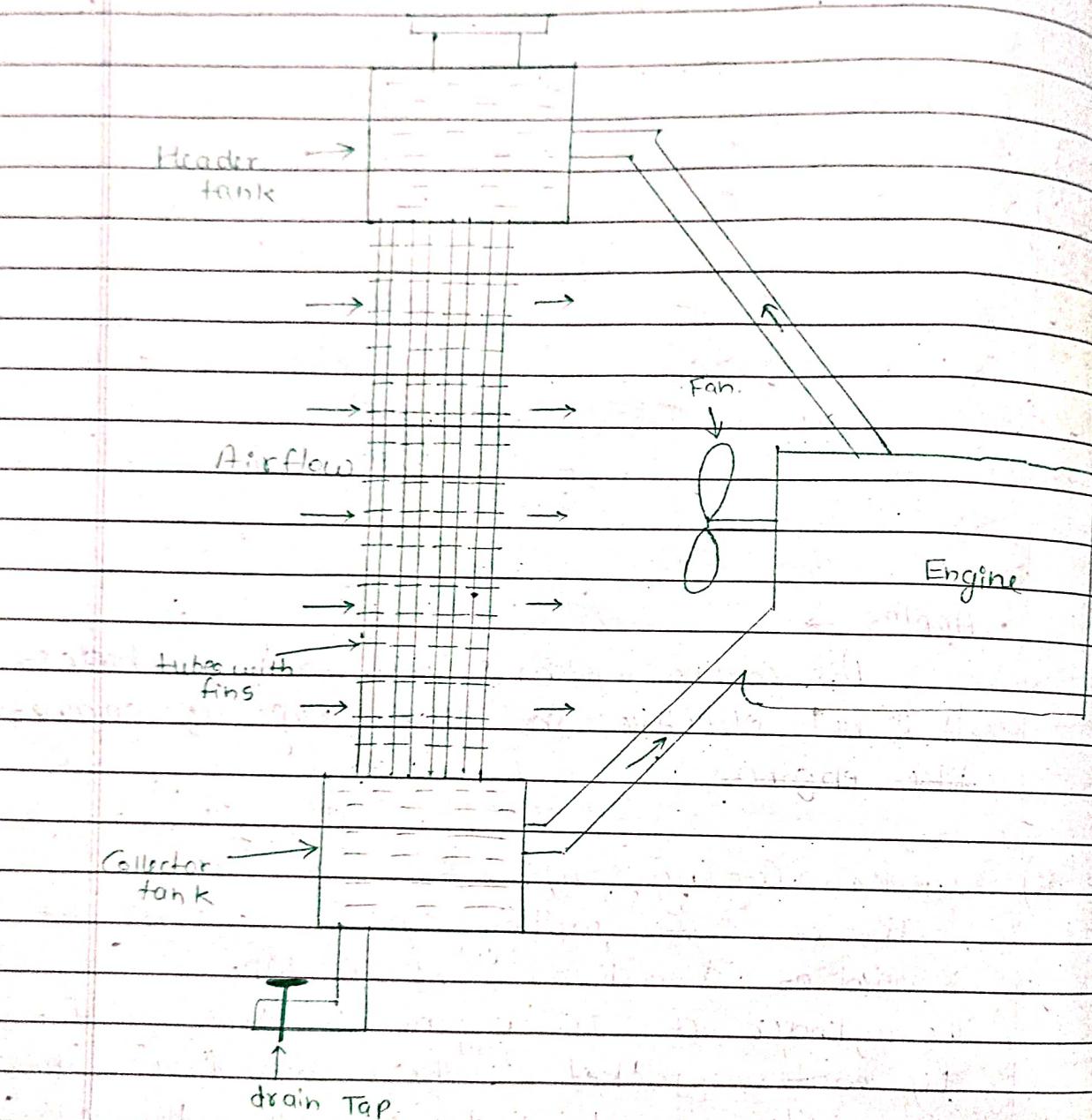
In a water cooling sys., the water or is used as a medium of coolant.

The cylinder of IC engine is surrounded by water jacket. The water flows through the water jacket and absorbs the heat from cylinder.

The hot water from ^{water} engine jacket flows through the radiator. The radiator consists of header tank, collector tank and tubes with fins. The hot water flows through the radiator tubes where it loses its heat to air.

The cold water is again supplied to water jacket.

The fan allows the air to flow over the radiator tubes, which helps to cool the coolant flowing through the radiator tubes.



→ Apps →

water cooling sys. is highly effective
Hence it is used in four wheelers.