

Necessity of engine cooling.

- Due to the air-fuel combustion in engine cylinders, the temperature reach about 2500°C , which is cause weld the moving parts
- This high temperature should be avoided by proper cooling to reduce to 200°C - 250°C temperature
- Cooling system keep the engine at it's most efficient operating temperature.
- cooling system absorbs unnecessary heat from different part
- Duty of the cooling system is to keep the engine from getting too hot - not to keep it cool.

Defects of cooling system

- Thermal efficiency is decreased due to more loss of heat to the cylinder walls.
- Viscosity of lubricant increases at low temperature, it increases friction
- Too much cooling lower the thermal efficiency

Function of Lubrication :-

- To reduce friction between the moving parts
- To reduce wear of the moving parts
- To acts as a cooling medium for removing heat

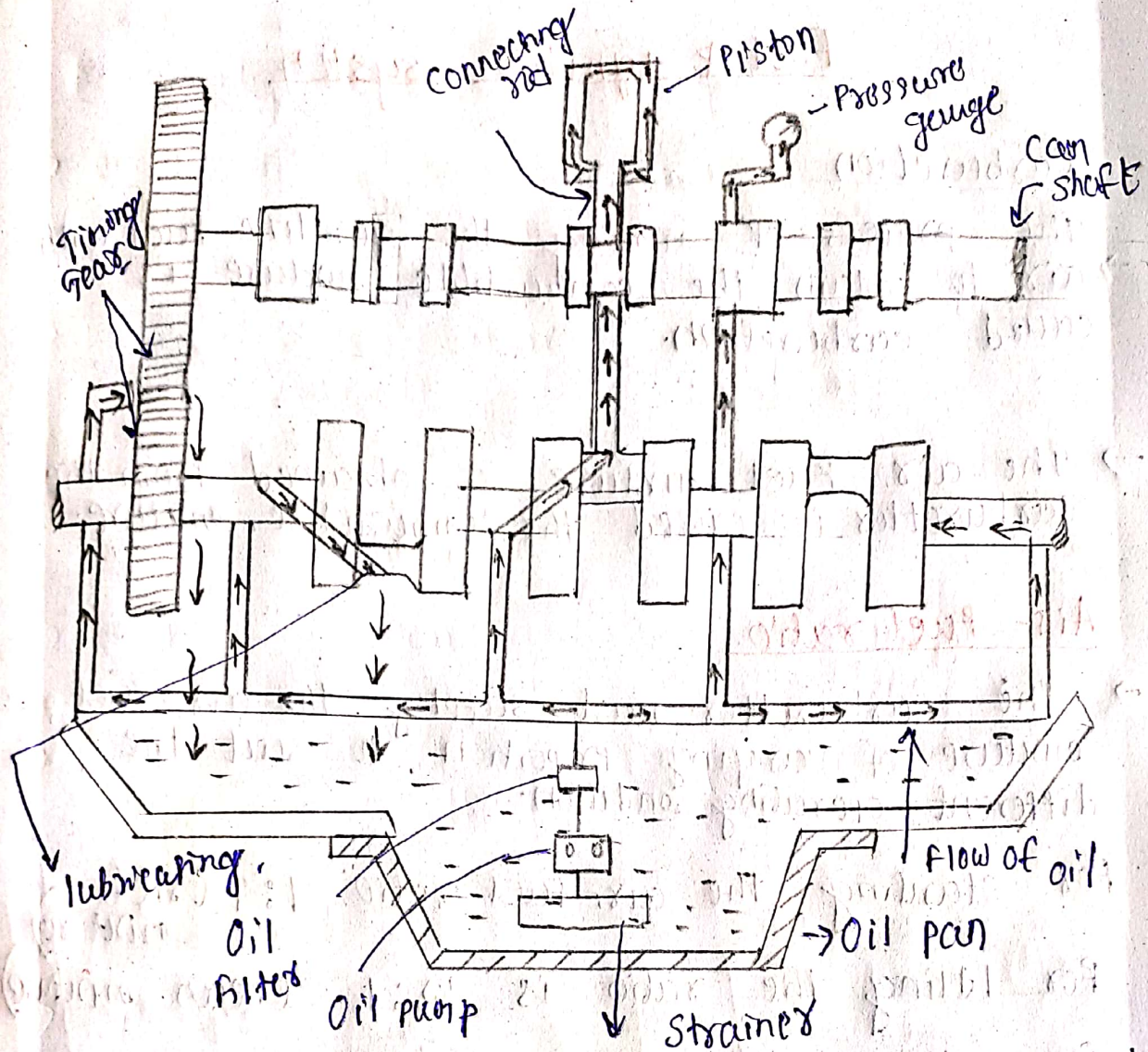
- 4 → To keep the engine parts clean, especially piston rings & ring grooves, oilway & filters.
- To form a good seal between piston rings & cylinder walls.
- To prevent deposition of carbon, soot & lacquer.
- To absorb & carry away harmful substances resulting from incomplete combustion.
- To resist oxidation which causes sludge & lacquers.
- To absorb shocks between bearing & other engine parts.

Lubricating system: -

Following are the lubricating system used

- 1 - Petrol system
- 2 - Splash system
- 3 - Pressure system
- 4 - Semi pressure system
- 5 - Dry sump system.

- Pressure system is subject point of view.
- In this system of lubrication, the engine parts are lubricated under pressure feed. The lubricating oil is stored in a separate tank or the sump.
- From where an oil pump takes the oil through a strainer & delivers it through a filter to the main oil gallery.
- The oil from the main gallery goes to the main bearing, from where some of it after lubricating the main bearing, falls back to the sump.



→ Some oil is splashed to lubricate the cylinder walls & remaining goes through a hole to the crank-pin.

→ From the crank pin it goes to the piston pin through a hole in the connecting rod web, where it lubricates the piston ring.

Fuel & Ignition system

Carburetion

→ The process of mixing the gasoline fuel with air to obtain the combustible mixture is called carburetion.

→ The air-fuel mixture so obtained from the carburettor is called the combustible mixture.

Air-fuel ratio

→ The carburettor must supply the air-fuel mixture of varying proportion to suit the different operating condition.

For starting the air-fuel ratio 9:1 (rich mixture)

For idling the ratio is 12:1 (lean mixture)

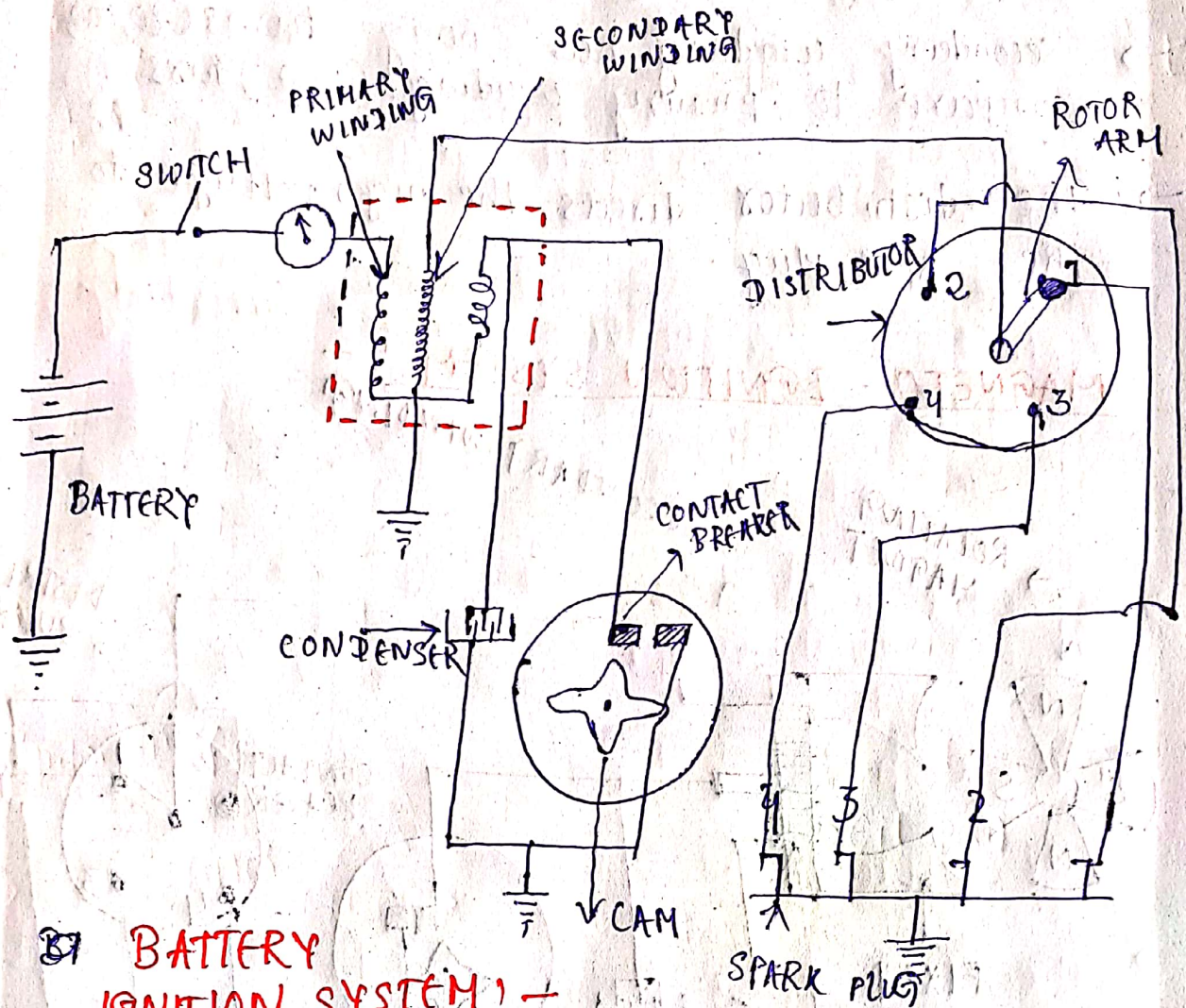
for intermediate speeds between 35 to 105 km/h

Battery Ignition system :-

→ The primary ignition circuit starts from battery & passes through switch, ammeter, primary winding, contact breaker points to ground.

→ A condenser is connected to parallel to contact breaker point, one end connected to contact breaker arm, other is grounded.

The secondary ignition circuit is not connected to primary circuit. It starts from ground & passes through secondary winding, distributors, spark plug to the ground.



BATTERY IGNITION SYSTEM! -

- The ignition coil steps us 6 or 12 volts to 20,000 to 30,000 V which produce spark
- The rotor revolves & distributes the current to the 4 segment to spark plug

Purpose of condenser is to reduce arcing at the breaker points

Working

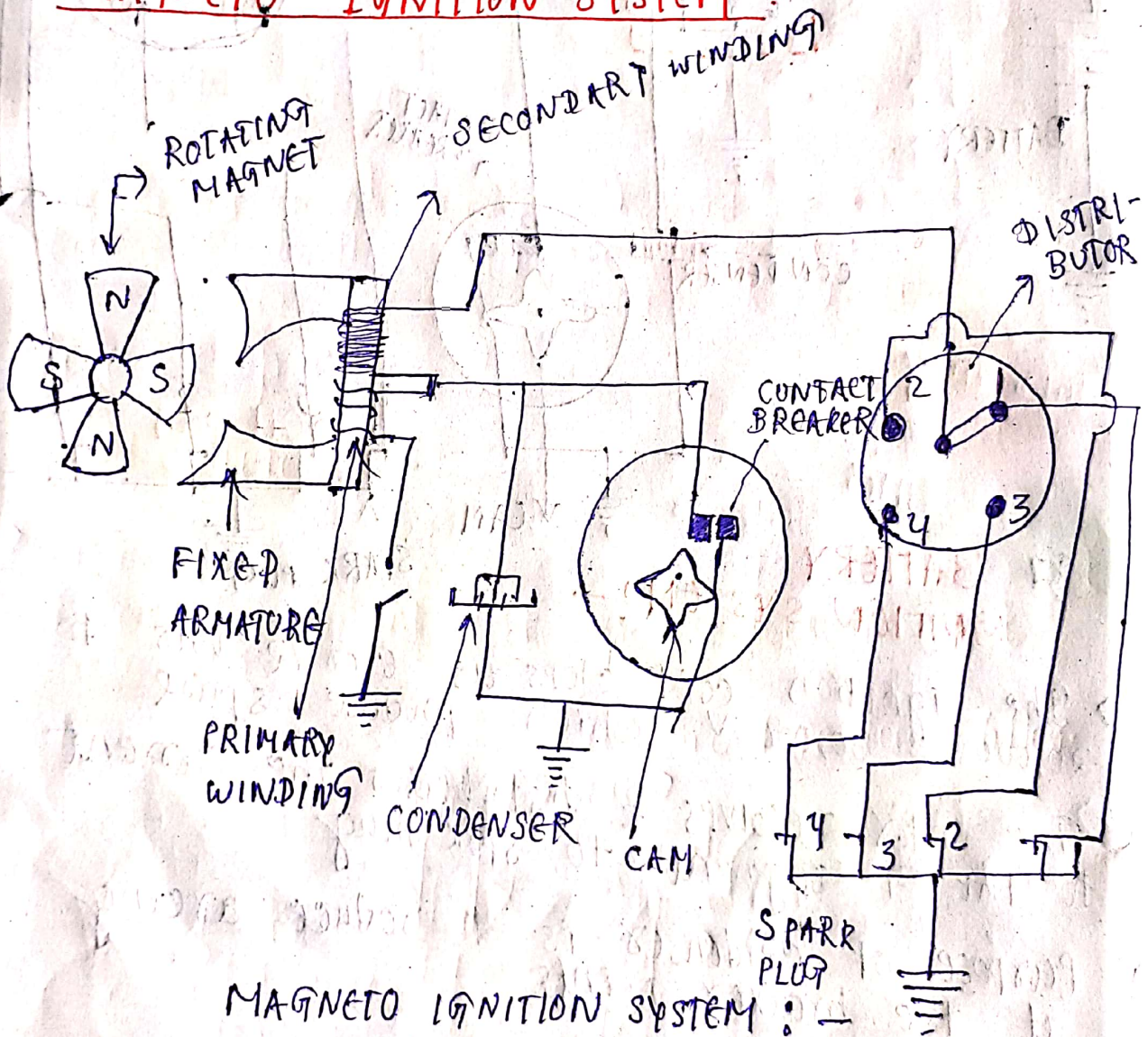
- When the ignition switch is on, current flow from battery through primary winding that produces magnetic field in the coil
- When the contact points open, the magnetic field collapses

& the movement of magnetic field induces current in secondary winding coil.

→ Secondary winding has many turns (20,000) compare to primary winding (200) turns

→ The distributor directs the high voltage to the spark plug.

MAGNETO - IGNITION SYSTEM



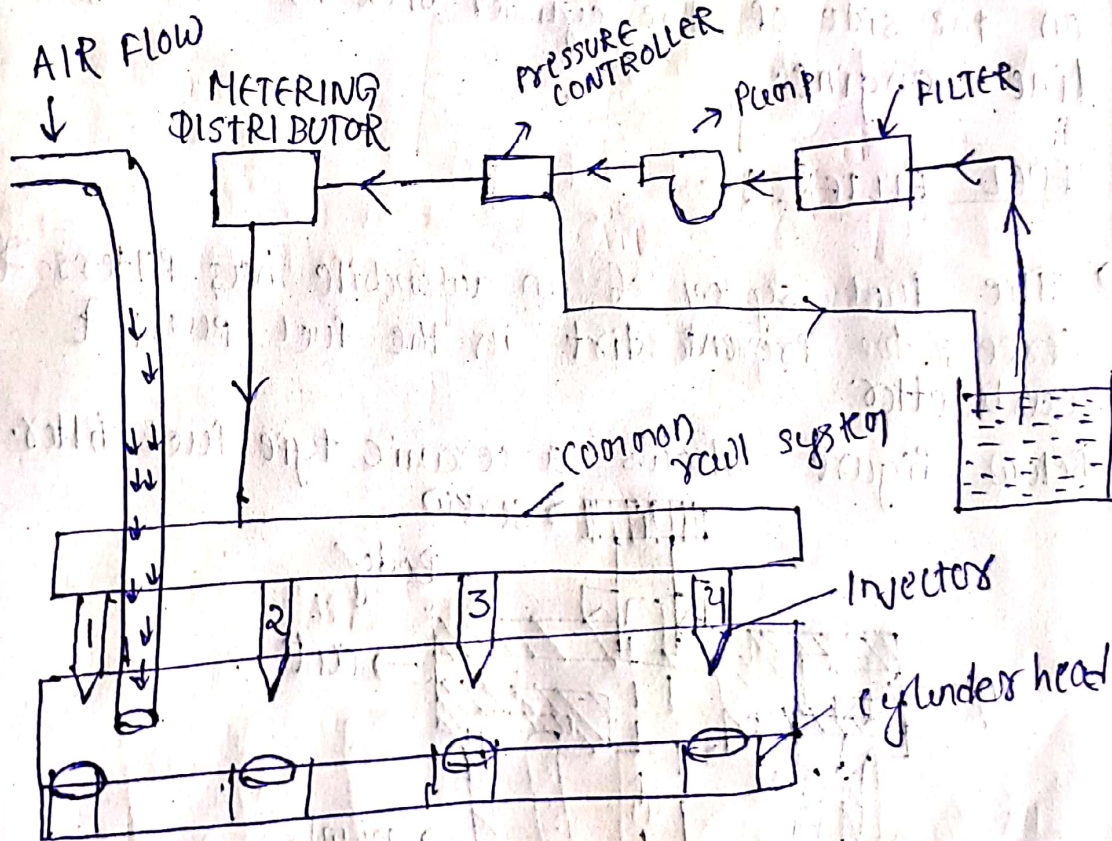
MAGNETO IGNITION SYSTEM :-

→ Here all the things same to battery ignition system, but ~~but~~ Magneto is replaced in the space of battery

- Rotating Magnetic assembly which is driven by the engine, when magnet rotate, current flows in the primary winding
- The secondary winding gives the high voltage current to the distributor, which supply the current to spark plug.

MULTI POINT FUEL INJECTION SYSTEM :-

- Here each cylinder has injectors to supply fuel.



- In this system 1st fuel control is sucking from tank through pump, it before passes from filter, then it goes to the pressure controller, if it is excess pressure, the fuel is again fed to the fuel tank.
- from pressure controller, it goes to the metering distributor system.

(7)

- fuel from the metering distributor system direct goes separately according to the hole to respective injector to cylinder
- Suppose a fuel come to 1 no injector then it go to the manifold, where air mixes & charge prepare, it then supply to cylinder
- In this way this mechanism separately applied to respective cylinder according to time.

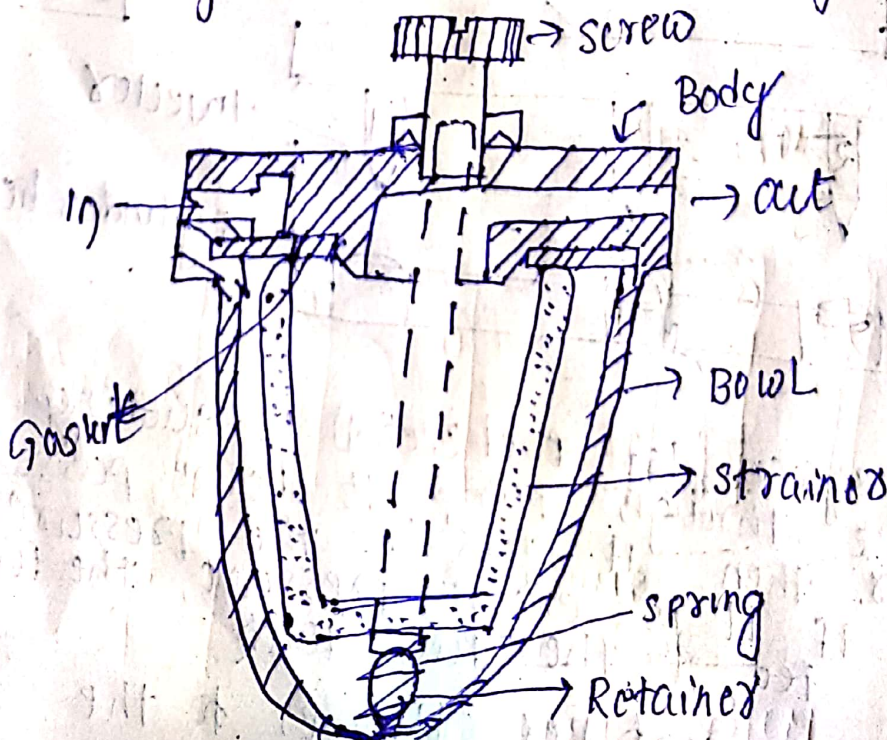
WORKING PRINCIPLE OF FUEL FEED PUMP (DIESEL ENGINES)

- Mechanical fuel pump is operated by an eccentric on the engine camshaft. It is mounted on the side of the cylinder block in line engine.

FUEL FILTER :-

- The fuel system of an automobile has filters & screens to prevent dirt in the fuel pump & carburettor.

Below figure shows a ceramic type fuel filter.



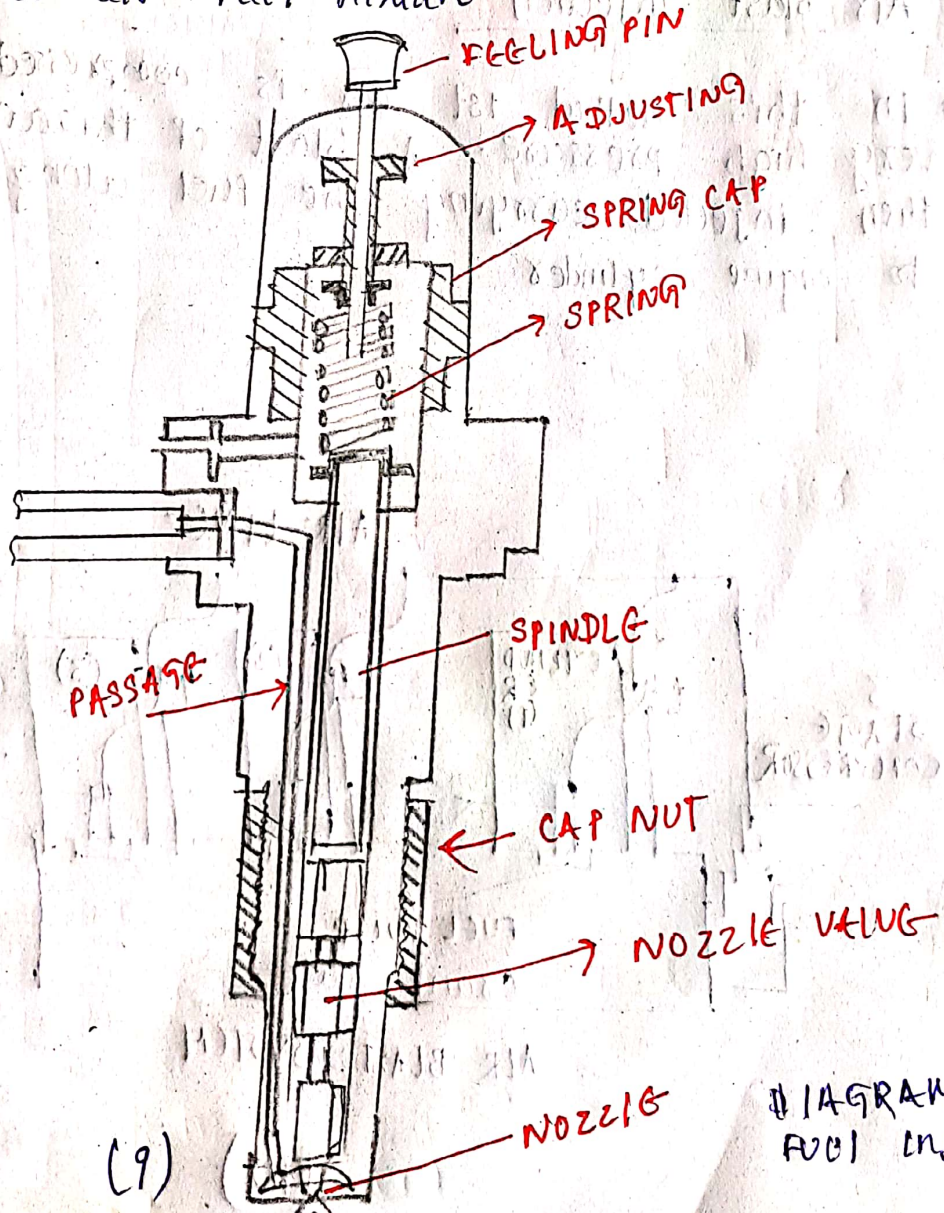
Working

It serves to catch any water or foreign particles that were not filtered out in the fuel pump sedimental bowl

- The fuel ~~pump~~ entering the glass bowl passes through a ceramic filter which separates the foreign particles & the filtered fuel comes out from it
- The water & sediments are collected in the bowl which can be removed for cleaning.

→ FUEL INJECTOR :-

A fuel injector is an electronically controlled mechanical device which is used to inject the fuel in to the engine for preparation of correct air-fuel mixture.



- Compression spring controls the pressure upon the plunger by which the needle valve opens
- A nozzle is attached to the body of the injector by cap nut

WORKING

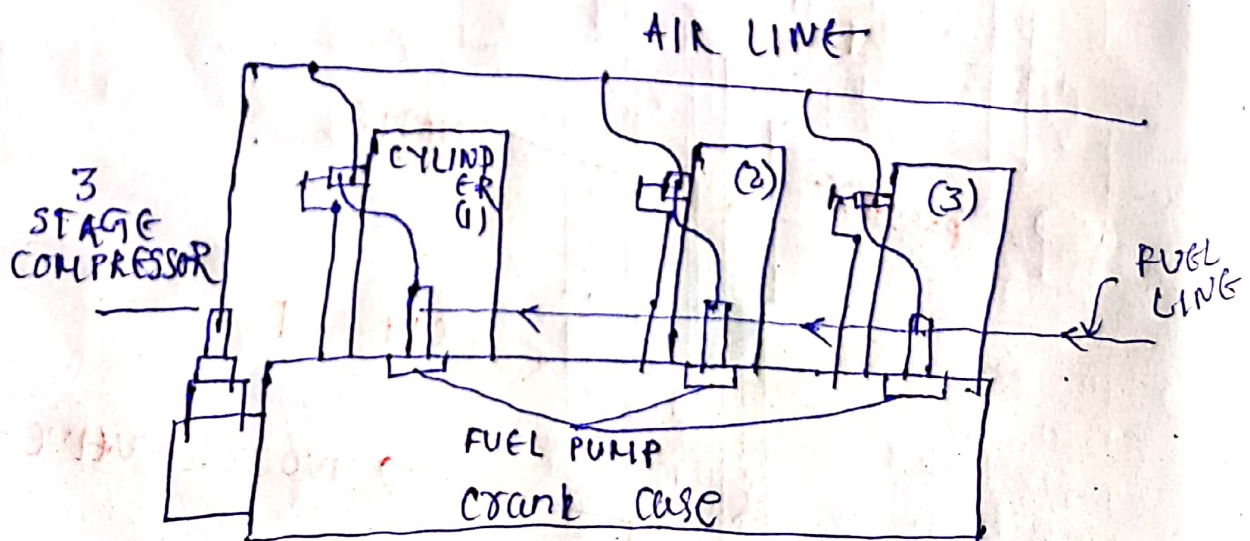
- When the needle valve is raised from its seat by the pressure of the fuel acting on the conical or stepped face valve, the injection of fuel takes place.

METHOD OF FUEL INJECTION :-

- 1- Air blast injection
- 1- Solid Injection

Air blast injection

- In this method 1st air is compressed to a very high pressure. A blast of this air is then injected carrying the fuel along with to engine cylinder.



AIR BLAST SYSTEM

→ The high pressure air requires multistage compressor so as to keep the air bottles charged

→ This method is expensive.

SOLID INJECTION

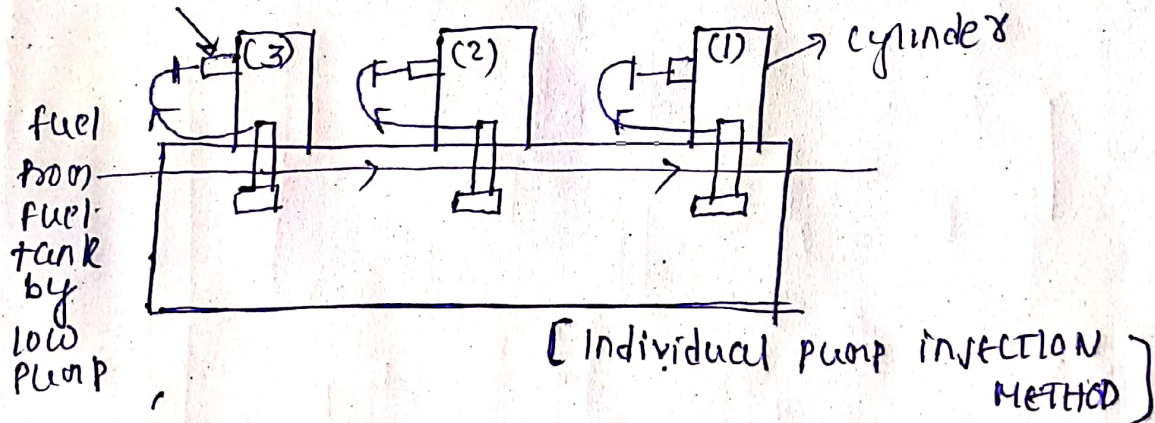
It is of type (1) common rail system
(1) Individual pump system.

(1) Individual pump cylinder

→ The high pressure fuel by the help of individual pump also goes to respective cylinder with separate metering unit

→ It is a compact method

INJECTION VALVE



(2) COMMON RAIL INJECTION

HERE, fuel is pumped by multi cylinder pump to common rail, by which the fuel supply to respective cylinder.

