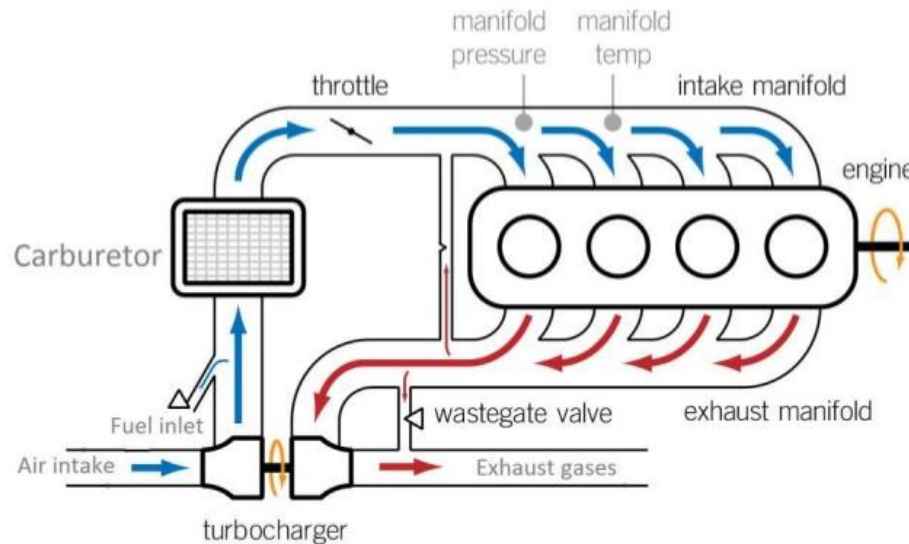


Lect.- 4

Air supply and exhaust system- Pre cleaners, oil soaked element type and oil bath type air cleaners; Fuel supply system.



Er. J. K. Gaur

Associate Professor and Head

Deptt. of Ag. Engineering

S.K.R.A.U., Bikaner

Air supply system

An IC engine uses large quantities of air for combustion, the ratio being 14 -15:1 (air fuel ratio).

The main components of air intake system are:

- (i) air cleaner
- (ii) supercharger (auxiliary unit)
- (iii) intake manifold
- (iv) intake valve/intake port.

- **Air cleaner** – It is a device, which filters and removes dust, moisture and other foreign matter from the air before it reaches the engine cylinder.
- There are many types of air cleaners but the types commonly used in tractors are (a) Oil wetted mesh type (b) Dry air type and (c) Wet type or oil bath air cleaners.

Pre - cleaner

- A pre - cleaner is provided in the upper portion of the main cleaner. When the engine is running, the air is first drawn through the pre-cleaner. Here large dust particles are removed from air stream, thus reducing much of the load (90%) on the main cleaner.
- **The pre-cleaner functions on the centrifugal principle.** By means of vans and baffles it gives a rotary motion to the air, thus causing the heavier dust particles to be thrown out due to centrifugal force and the pre-cleaned air is allowed in the air cleaner.



Pre- cleaner



Pre - cleaner cap assembly

Oil wetted mesh air cleaner

- It consists of a copper mesh or nylon wire, wetted with oil to catch the dust particles from the air which are made to pass through it.
- This type of filter, however, gets clogged with dust quickly, thus, seriously affecting the air flow through it and rendering it inefficient in removing the fine particles of dust from air.

Dry air cleaner

- The main cleaning element is usually of multi-wire netting or nylon hair or paper (resin-impregnated paper element).
- The element is of larger surface area, reduces the air speed while passing through and consequently particle or dirt in the air is deposited on or stopped by its surface.
- It is quite efficient in dust removal and easy to service but costlier to maintain because the filter element requires replacement very often.
- It maintains air cleaning efficiency at all engine speeds.

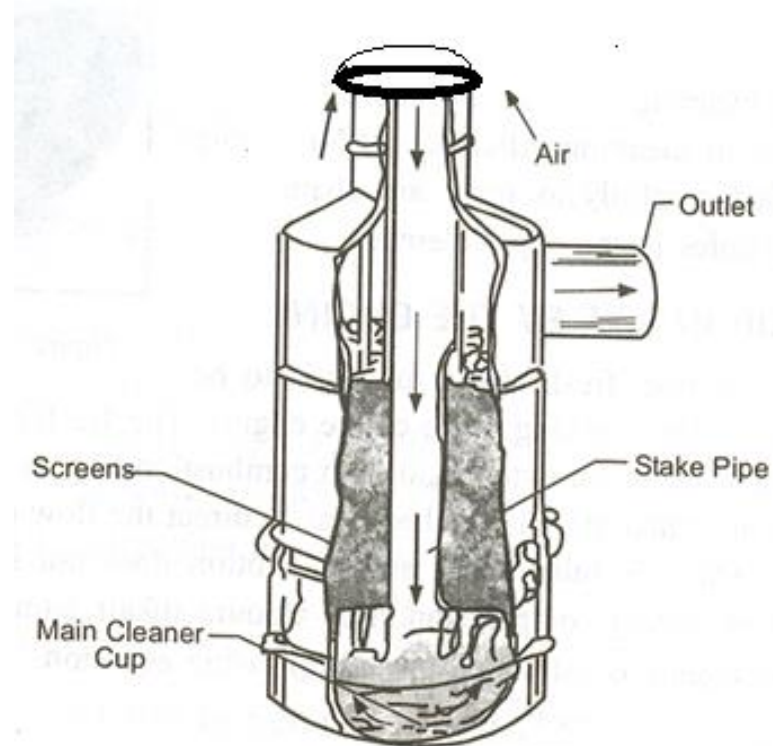
Oil bath type air cleaner

It has a bowl type container in its bottom filled with mobile oil and above it, a strainer is placed.

Air makes a sharp 180° turn.

The bowl has one oil level mark.

In dusty working conditions, the oil of bowl should be changed after every 10-12 hours otherwise, change the oil after every 40-50 hours. Mostly SAE 30 or 40 lubricating oils are used



Supercharger

- This is an auxiliary unit and only high horsepower range engines are provided with superchargers.
- A supercharger is a device for increasing the air pressure into the engine so that more fuel can be burnt and the engine output is increased. The pressure inside the manifold of a supercharger engine will be greater than the atmospheric pressure.
- Supercharged air is provided either by positive displacement rotary blowers or by centrifugal blowers driven by engine itself.

Intake manifold

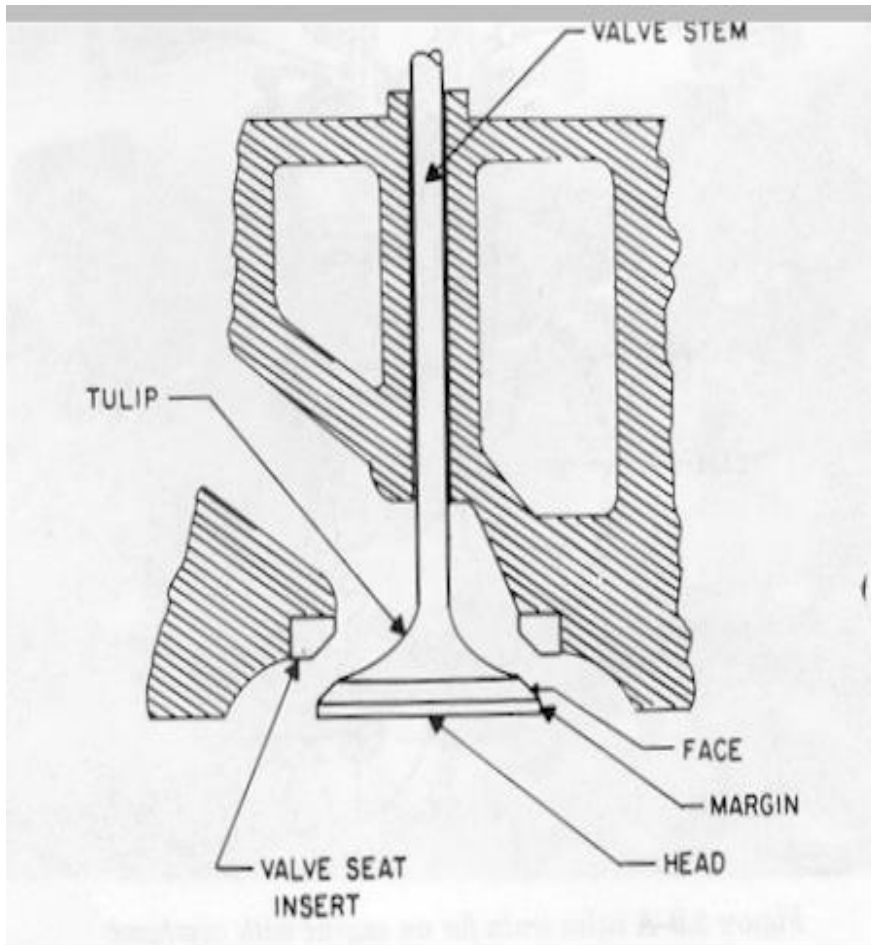
- The inlet manifold is required to deliver into the cylinders either fuel from air cleaners or a mixture of fuel and air from the carburetor.
- It is made in one or two pieces either from cast iron or aluminum alloy.



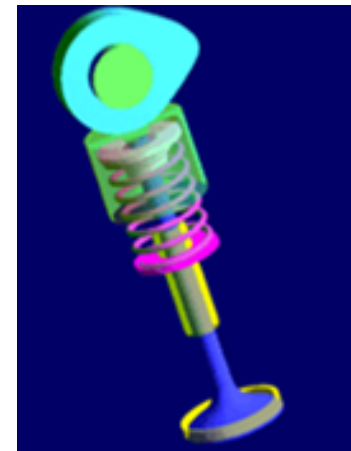
Intake valve and intake port

- The intake valve of an IC engine is meant to admit air or air fuel mixture into the cylinder.
- The valves used in tractor engines are of the poppet or mushroom type. The poppet valve consists of a valve head and a valve stem.
- The face ground at an angle of 30° to 45° at the outer edge to match the valve seat in the cylinder block.
- In two stroke engine intake port is provided instead of inlet valve.

Valves



- Each cylinder will have:
 - Intake valve
 - Exhaust valve
- Valve nomenclature
 - Head
 - Margin
 - Face
 - Tulip
 - Stem



Exhaust system

The exhaust system comprises of following parts:

1. **Exhaust Valve**- opens to allow burnt gases to escape during exhaust stroke and closes to seal combustion.
2. **Exhaust Manifold**- Combines cylinders together to form one pipe for the elimination of exhaust gases.



4. **Turbocharger**-The objective of a turbocharger is to improve an engine's volumetric efficiency by increasing density of the intake gas (usually air) allowing more power per engine cycle.

This is an exhaust driven turbine, which drives a centrifugal compressor wheel. The compressor passage is usually located between the air cleaner and engine intake manifold, while the turbine is located between the exhaust manifold and muffler.

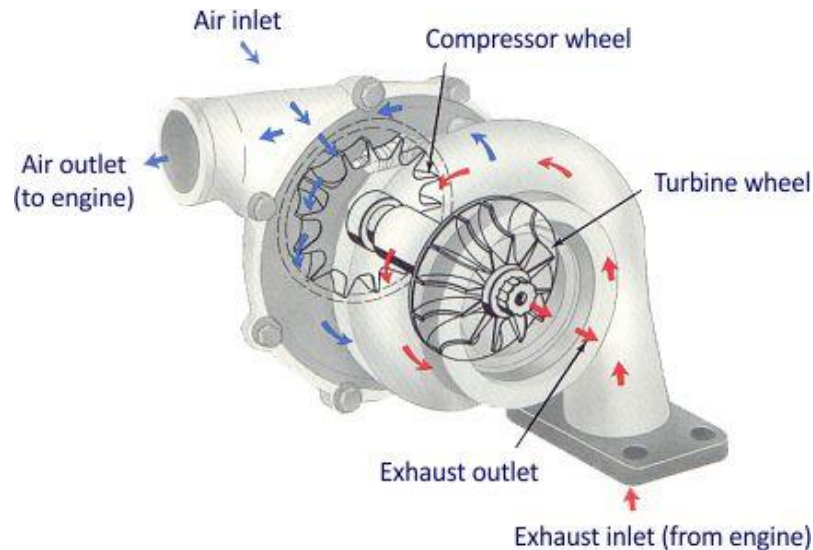


Fig. Turbocharger

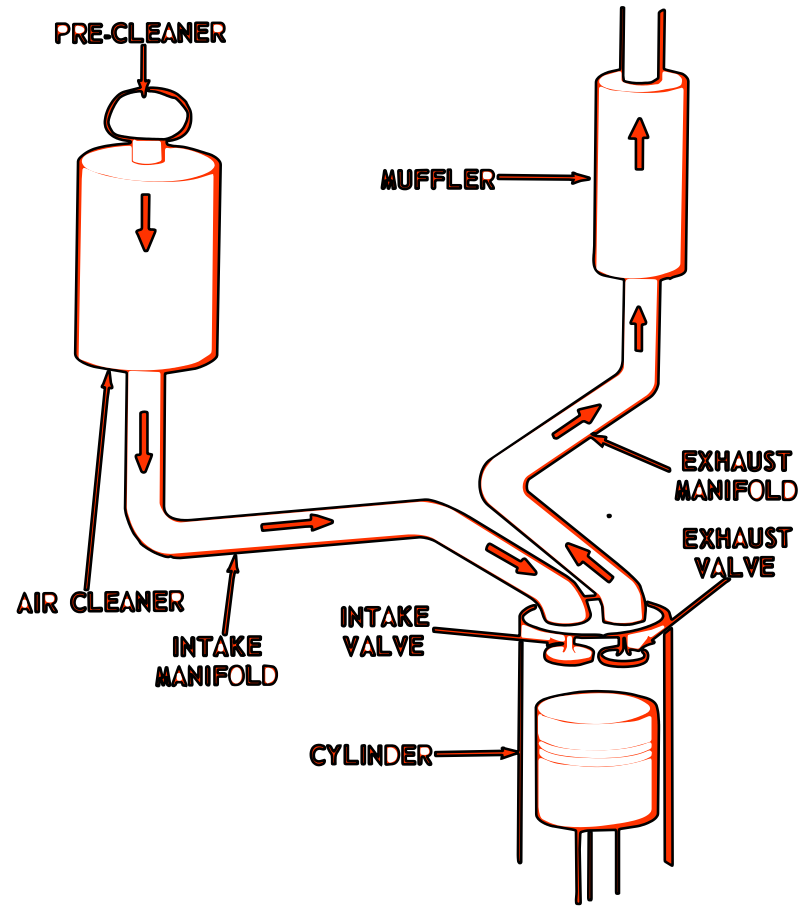
4. Muffler- Quiets engine noise and eliminates sparks.



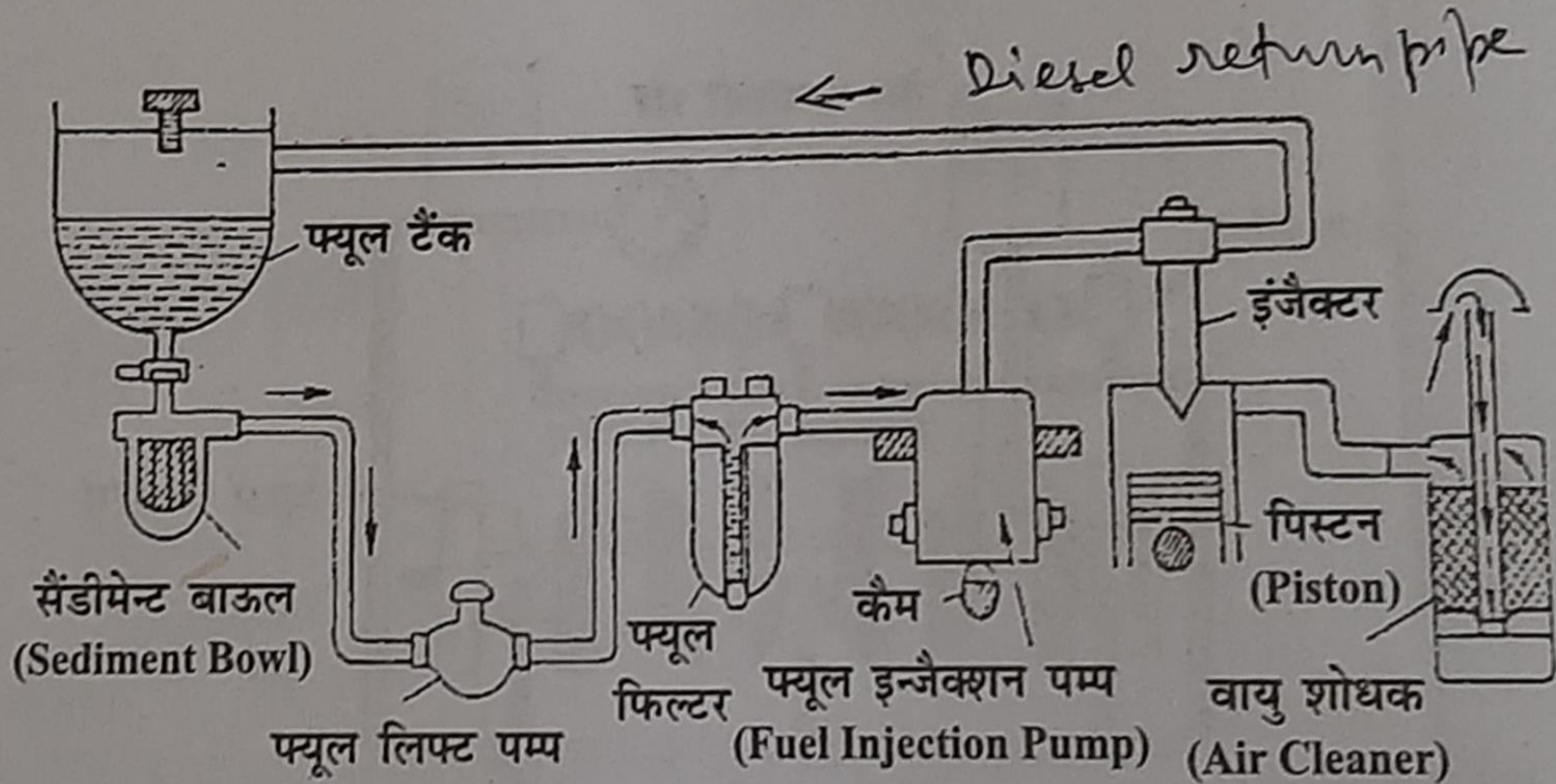
5. Exhaust Cap (if used)- Prevents rain, insects, debris, etc. from entering engine while at rest.



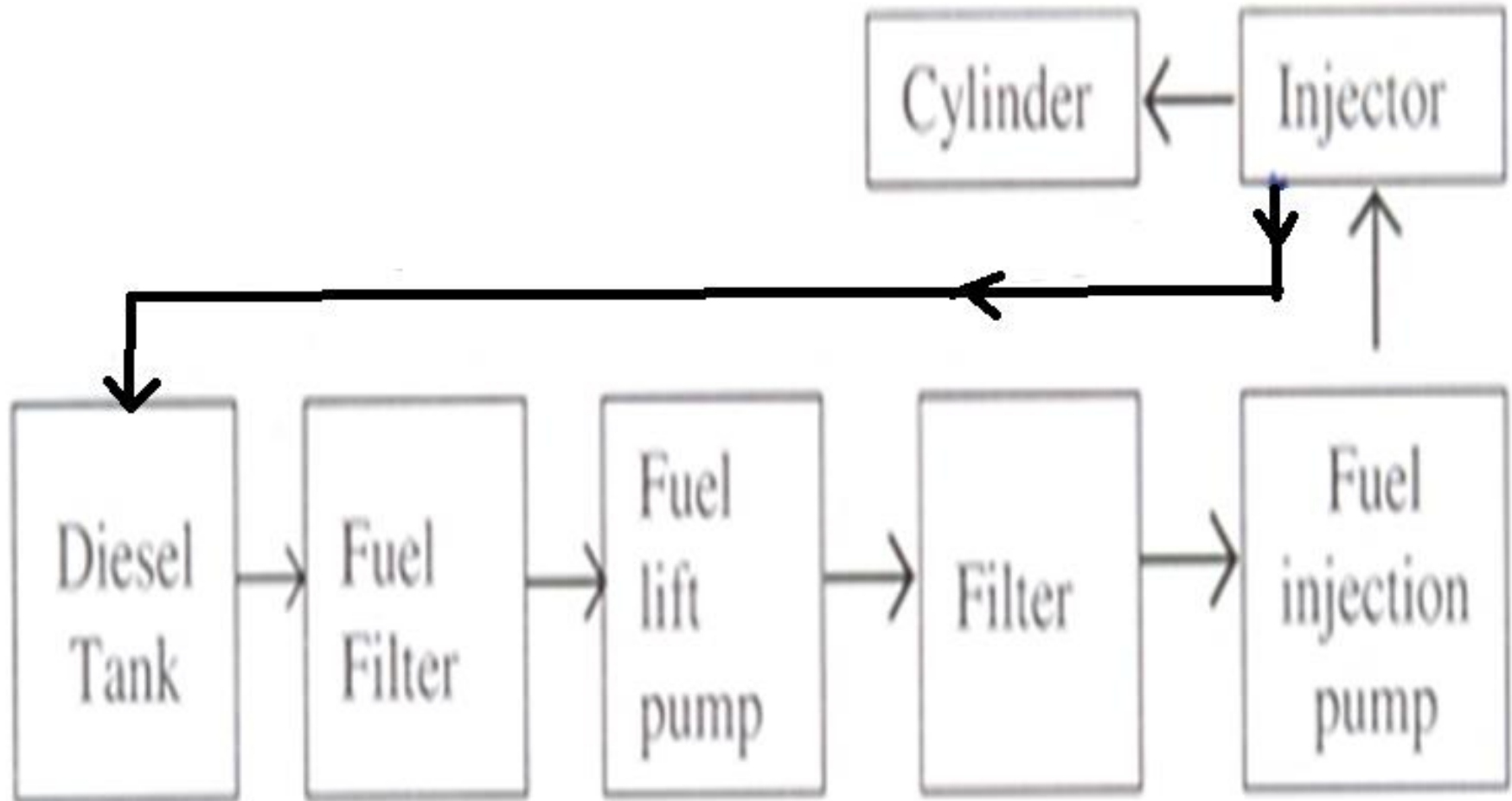
Air intake and exhaust system



Fuel supply system in diesel engine



Flow diagram of fuel system

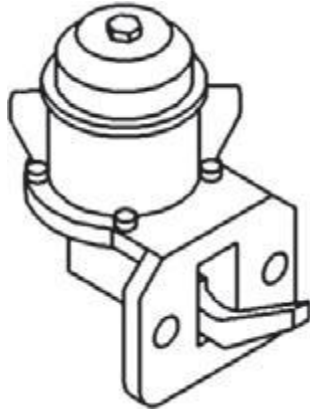


Fuel system operation

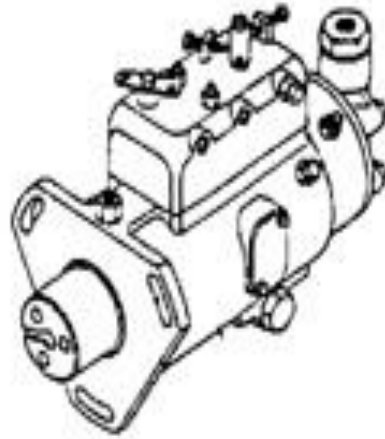
- During engine operation, the fuel is supplied by gravity from fuel tank to the primary filter where coarse impurities are removed.
- From the primary filter, the fuel is drawn by fuel transfer pump. This pump is also known as **fuel lift pump**, is activated by a cam on the engine camshaft.
- The fuel lift pump forces fuel under low pressure (2.5 kg/cm^2) through the secondary fuel filter to the injection pump, which is generally driven by the camshaft.

- The purpose of fuel injection pump is to deliver a metered quantity of fuel at a predetermined time under pressure (120 to 175 kg/cm² or more) through the high pressure tubes to the injection nozzles or injectors.
- Fuel injector is the component which delivers finely atomized fuel under high pressure to combustion chamber of the engine. Modern tractor engines use fuel injectors which have multiple holes.
- The fuel that leaks out from the injection nozzles passes out through leakage pipe and returns to the fuel tank through the over flow pipe.

Fuel system components



Fuel lift pump



Fuel injector pump

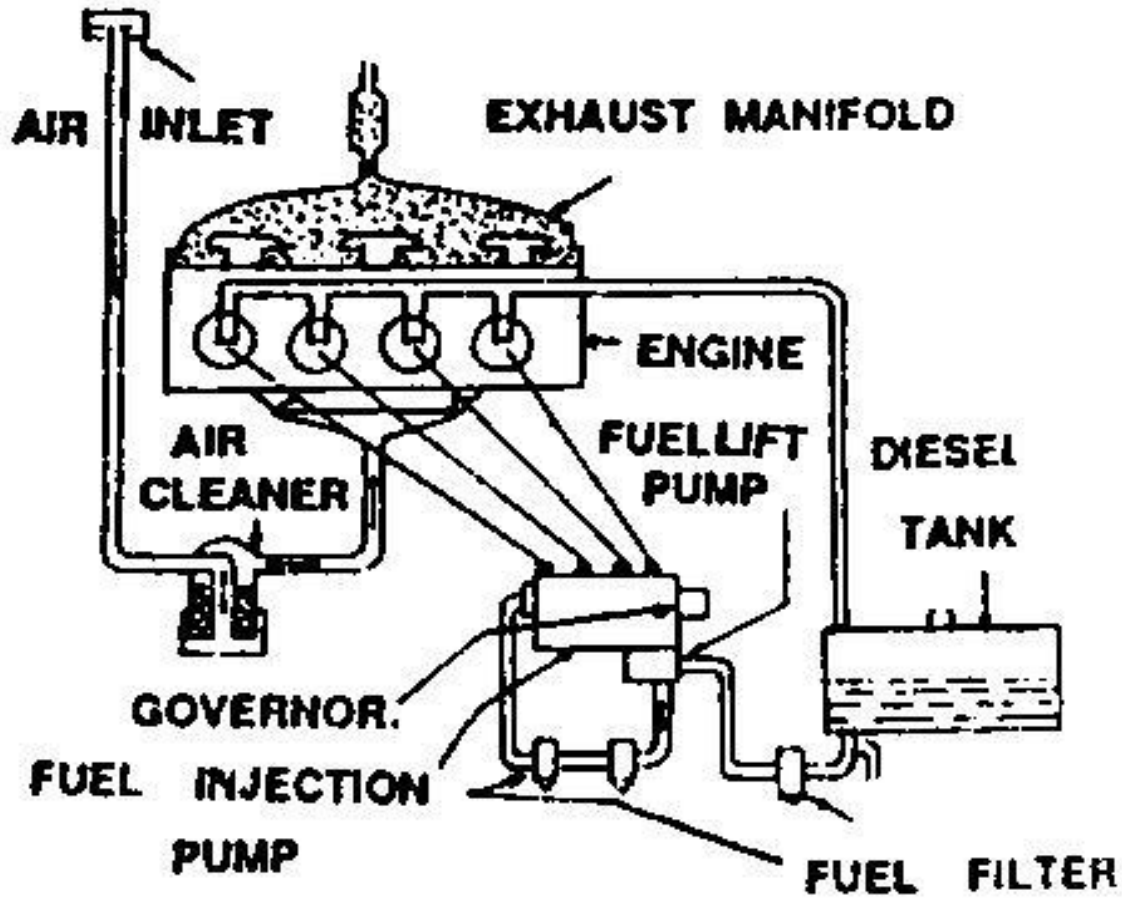


Spark plug



Sediment bowl assembly

Air and fuel supply system in diesel engine



FUEL SUPPLY SYSTEM IN SPARK IGNITION ENGINE

FUEL SUPPLY SYSTEM IN SPARK IGNITION ENGINE

The fuel supply system of spark ignition engine consists of

- Fuel tank
- Fuel filter
- Sediment bowl
- Fuel lift pump
- Carburettor
- Fuel pipes

Fuel supply in spark ignition engine

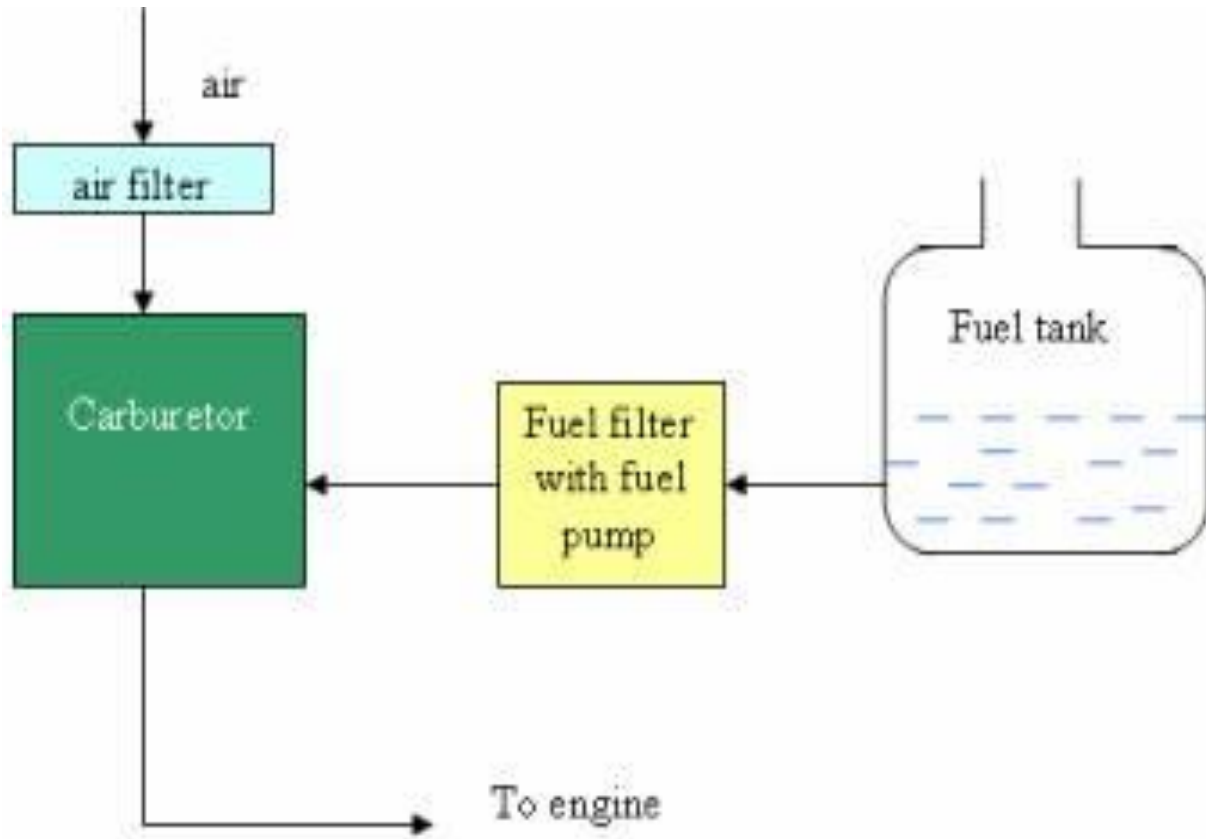


Diagram of fuel system of spark ignition engine.

