I.C. ENGINES -INTRODUCTION

Any machine which derives heat energy from the combustion of fuel and converts part of this energy into mechanical work is known as a heat engine. Heat engines are mainly divided into two groups, viz., External combustion engines and Internal combustion engines. In internal combustion engines, the combustion of fuel in the presence of air takes place inside the cylinder and the products of combustion directly act on the piston to develop power. Internal combustion engines are further classified as petrol engines, diesel engines and gas engines according to the type of the fuel used. These are commonly used for road vehicles, locomotives and for several industrial applications.

CLASSIFICATION OF I.C. ENGINES

Engines can be classified as follows:

1. According to the type of fuel used
    a) Petrol engines
    b) Diesel engines
    c) Gas engines
2. According to the cooling system
    a) Air cooled engine
    b) Water cooled engine
3. According to the cycle of operation
    a) Four stoke cycle engine
    b) Two stroke cycle engine
4. According to the charge pressure

a) Naturally aspirated engine

b) Supercharged/Turbocharged cog

5.According to the number of cylinders

a) Single cylinder engine

b) Multi cylinder engine

6.Ignition method

a) Spark ignition (S.I) engines and

b) Compression ignition (C.I) engines

7. Arrangement of cylinders (or) cylinder design

a) Vertical engines

b) Horizontal engines

c)V-type engines

d) In-line engines

e) Opposed cylinder engines and

f) Radial engines

8.Thermodynamic cycle (or) Method of heat addition

a) Otto cycle engines (combustion at constant

b) Diesel cycle engines (combustion at constant pressure

c) Dual combustion engines (or) semi-diesel engines

9.Method of governing (or) Method of control

a) Quantity governed engines

b) Quality governed engines and

c) Hit and miss governing engines

10.Field of application

a) Stationary engines

b)Mobile engines and

c)Portable engines

11.Speed

a)Low speed engines

b)Medium speed engines

c) High speed engine

APPLICATION OF IC. ENGINES

The L.C. Engines are generally used for

1. Road vehicle (e.g., scooter, motor cycle, buses etc.)
2. Aircraft
3. Locomotive, Tractors
4. Construction in civil engineering equipment such as bull sharers etc.
5. Pumping sets
6. Cinemas
7. Hospital
8. Several industrial applications
9. Electrical Generator
10. Boats and ships

COMPONENTS OF IC ENGINE

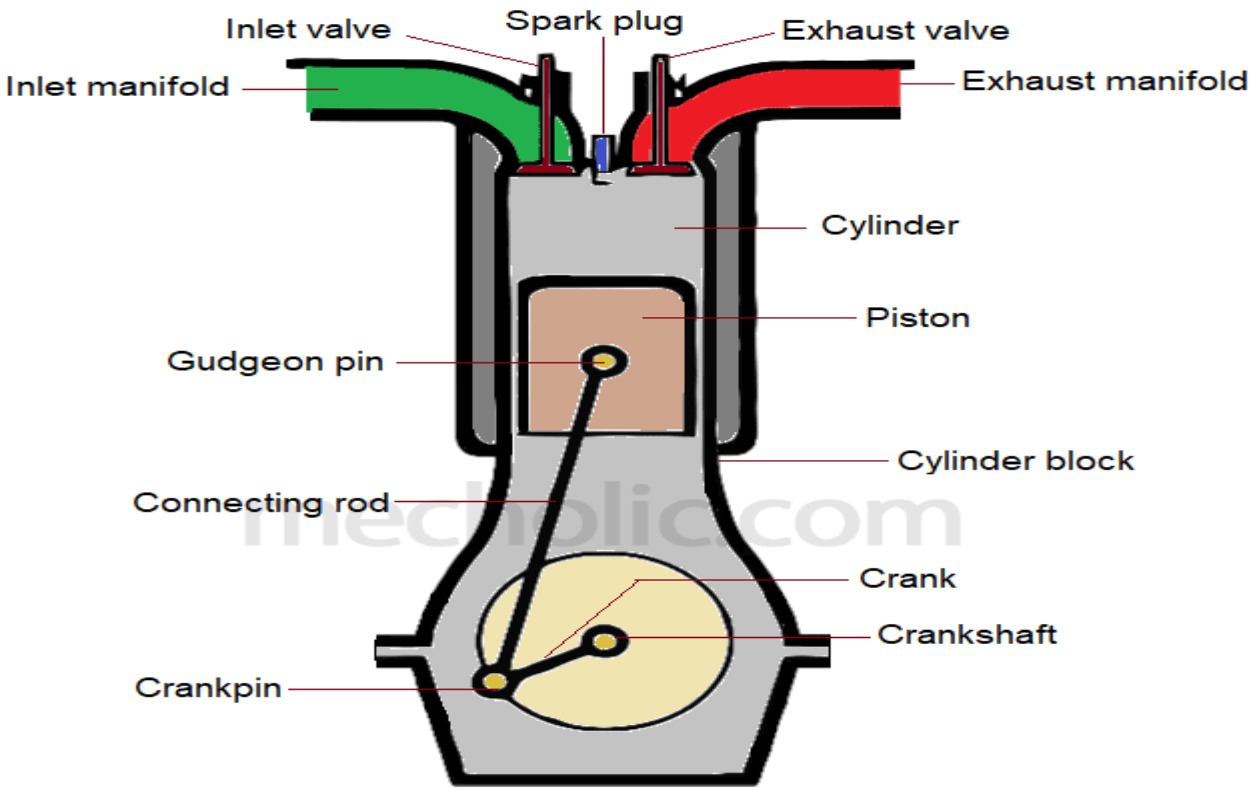


Fig-IC engine (online source)

Basic Components of LC Engine

1.Cylinder:

The cylinder permits the piston to move to and fro.

The cylinder is made of cast iron or steel or an Aluminium alloy.

2. Cylinder Head:

It is fitted on the top of the cylinder.

A gasket is provided between the cylinder and the cylinder head to prevent the leakage of hot gases.

The cylinder head also accommodates the inlet valve, the exhaust valve and the spark plug or injector

3. Piston:

It transmits the force exerted by the burning gases to the connecting rod and finally to the crank shaft.

The piston is usually made of cast iron or steel or aluminium alloy.

4. Piston Rings:

Two different types of piston rings are housed in the circumferential grooves provided on the after surface of the piston.

Function of upper rings known as compression rings is to provide gas tight sealing to maintain the compression pressure inside the cylinder and to prevent the leakage of burnt gases into the crank case.

The function of the lower rings is to scrap the used lubricating oil into the crank case, These rings are called oil scraper rings.

5. Connecting Rod:

This transmits the force from the piston to the crank shaft.

It also help in converting the reciprocating motion of the piston into the rotary motion of the crank shift.

For the lubrication of the piston pin in the connecting rod, a small hole is provided from the big end to the small end.

The small end of the connecting rod is attached to the piston by a gadgeon pin.

6.Crank Shaft:

Alloy steels are wed for the crank shaft to withstand the high stress and strain.

The crank shaft is provided with suitable holes to help in the lubrication system.

The crank case serves as a sump for the lubricating oil.

7.Fly wheel:

It is mounted on the crank shaft.

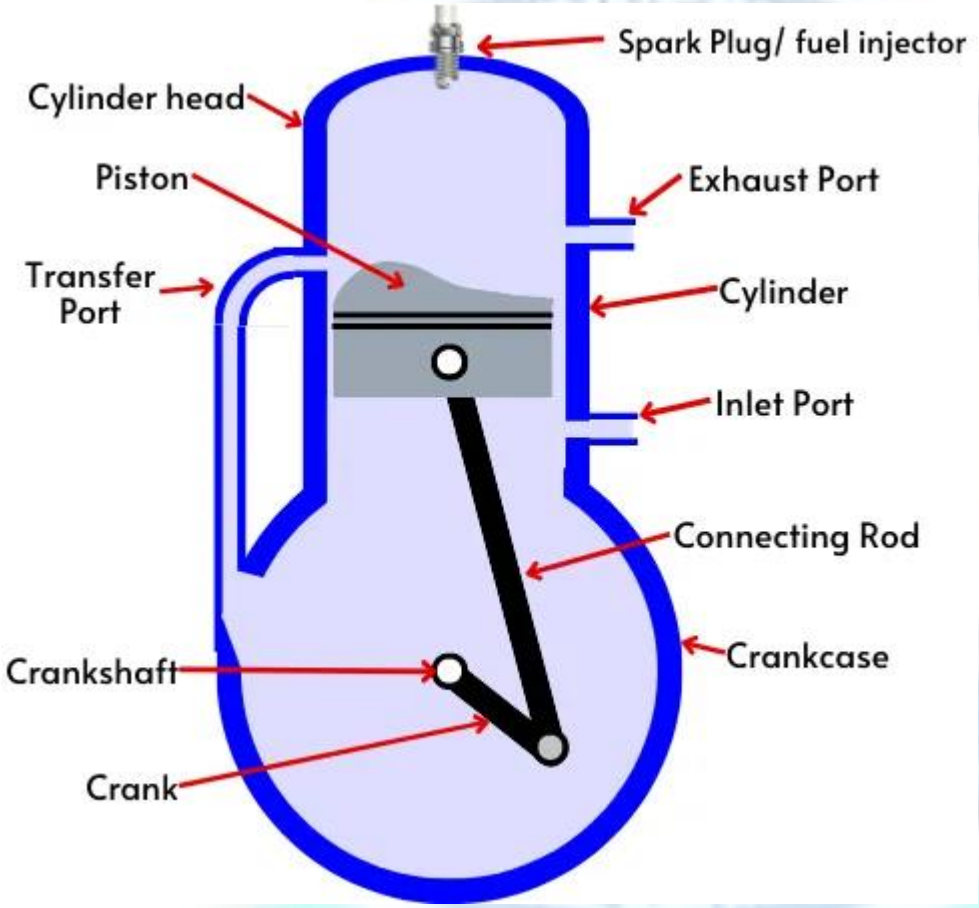
The flywheel stores the excess energy during the power spoke of the engine and helps the movement of the piston during the remaining idle strokes.

8.Cams:

Properly designed cams control the opening and closing of the inlet and exhaust valves in the case of four stoke engines.

Cams are rotated by a cam shaft driven by the crank shaft gears.

Construction and working principle of two stroke petrol engine.



Construction :

A piston reciprocates inside the cylinder

It is connected to the crankshaft by means of connecting rod and crank

There are no valves in two stroke engines, instead of valves ports are cut on the cylinder walls.

There are three ports, namely inlet, exhaust and transfer ports.

The closing and opening of the ports are obtained by the movement of piston. The crown of piston is made in to a shape to perform this.

A spark plug is also provided

First Stroke : (Compression, ignition and inductance)

(Upward stroke of piston)

(a) ***compression:***

The piston moves up from Bottom Dead Centre (BDC) to Top Dead Centre (TDC) Both transfer and exhaust ports are covered by the piston.

Air fuel mixture which is transferred already into the engine cylinder is compressed by moving piston.

The pressure and temperature increases at the end of compression.

(a) Ignition and Inductance:

Piston almost reaches the top dead centre

The air fuel mixture inside the cylinder is ignited by means of an electric spark produced by a spark plug

At the same time, the inlet port is uncovered by the plane.

Fresh air fuel mixture enters the crankcase through the inlet port.

Second Stroke: (Downward Stroke of the engine) :

(b) Expansion and Crankcase compression

The burning gases expand in the cylinder

The burning gases force the piston to move down. Thus useful work is obtained.

When the piston moves down, the air fuel mixture in the crankcase is partially compressed.

This compression is known as ***Crank case compression.***

(c) ***Exhaust and transfer:***

At the end of expansion, exhaust port is uncovered.

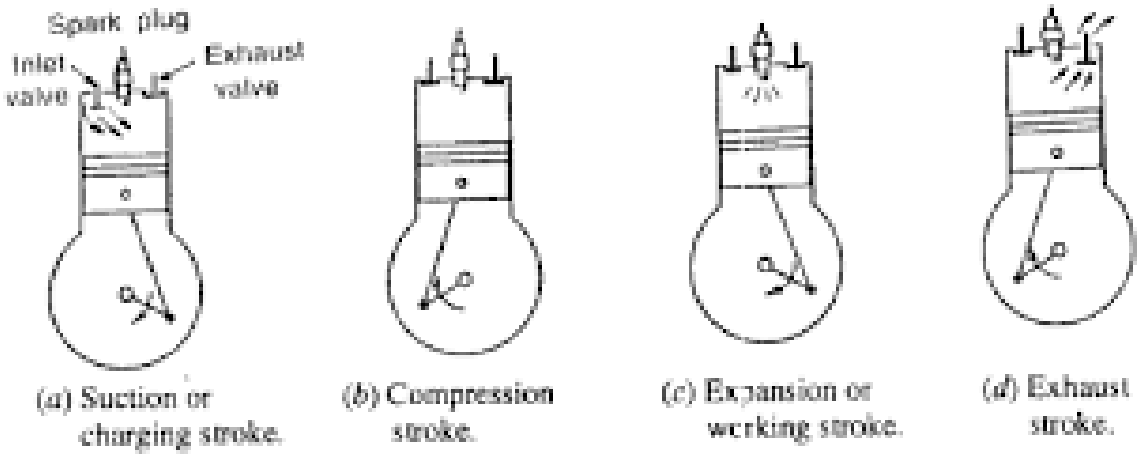
Burnt gases escape to the atmosphere.

Transfer port is also opened. The partially compressed air fuel mixture enters the cylinder through the transfer port.

The crown of the piston is made of a deflected shape. So the fresh charge entering the cylinder is deflected upwards in the cylinder.

Thus the escape of fresh charge along with the exhaust gases is reduced.

Working of four stroke petrol engine.



Four-stroke cycle petrol engine.

Suction stroke: During suction stroke, the inlet valve opens and fuel-air mixture is sucked in the engine cylinder. Thus the piston moves from top dead centre (T.D.C.) to bottom dead centre (B.D.C.). The exhaust valve remains closed throughout the stroke.

Compression stroke: During this stroke both the inlet and exhaust valves remain closed. The piston moves towards (T.D.C.) and compresses the enclosed fuel-air mixture drawn. At the end

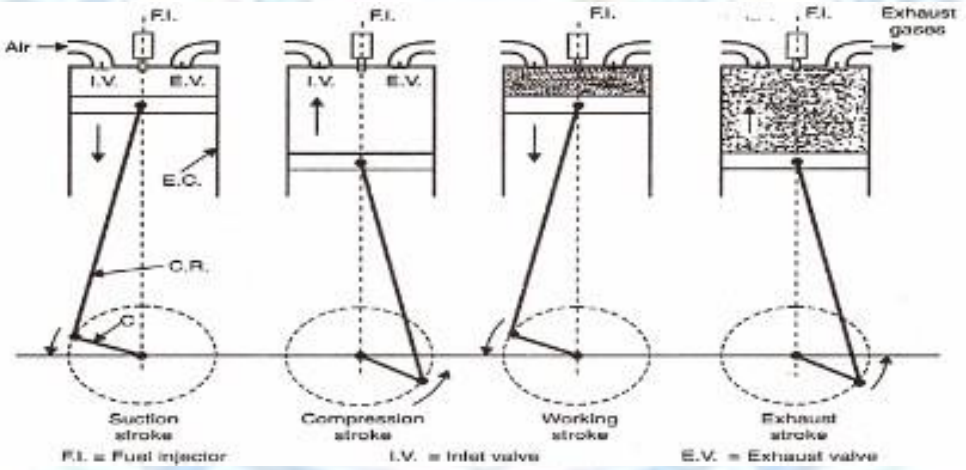
of this stroke the operating plug initiates a spark which ignites the mixture and combustion takes place at constant pressure.

Power stroke or Expansion stroke: In this stroke both the valves remain closed during the start of this stroke but when the piston just reaches the B.D.C. the exhaust valve opens.

When the mixture is ignited by the spark plug the hot gases are produced which drive or throw the piston from T.D.C. to B.D.C. and thus the work is obtained in this stroke.

Exhaust stroke: During the exhaust stroke, the gases from which the work has been collected become useless after the completion of the expansion stroke and are made to escape through exhaust valve to the atmosphere. This removal of gas is accomplished during this stroke. The piston moves from B.D.C. to T.D.C. and the exhaust gases are driven out of the engine cylinder.

Four stroke diesel engine.



Suction stroke: During the suction stroke, the piston moves from TDC to BDC., the inlet valve opens and the air at atmospheric pressure is drawn inside the engine cylinder. The exhaust valve remains closed during this stroke..

Compression stroke: The air drawn at atmospheric pressure during the suction stroke is compressed to high pressure and temperature as the piston moves from B.D.C. to T.D.C. Both the inlet and exhaust valves do not open during any part of this stroke.

Power stroke or Expansion stroke: As the piston starts moving from T.D.C to B.D.C, the quantity of fuel is injected into the hot compressed air in fine sprays by the fuel injector and it (fuel) starts burning at constant pressure.

The fuel is injected at the end of compression stroke but in actual practice the ignition of the fuel starts before the end of the compression stroke. The hot gases of the cylinder expand thus doing the work on the piston.

Exhaust stroke: The piston moves from the B.D.C. to T.D.C. and the exhaust gases escape to the atmosphere through the exhaust valve. When the piston reaches the T.D.C. the exhaust valve closes and the cycle is completed.