



Introduction to I.C. Engines

TOPICS :

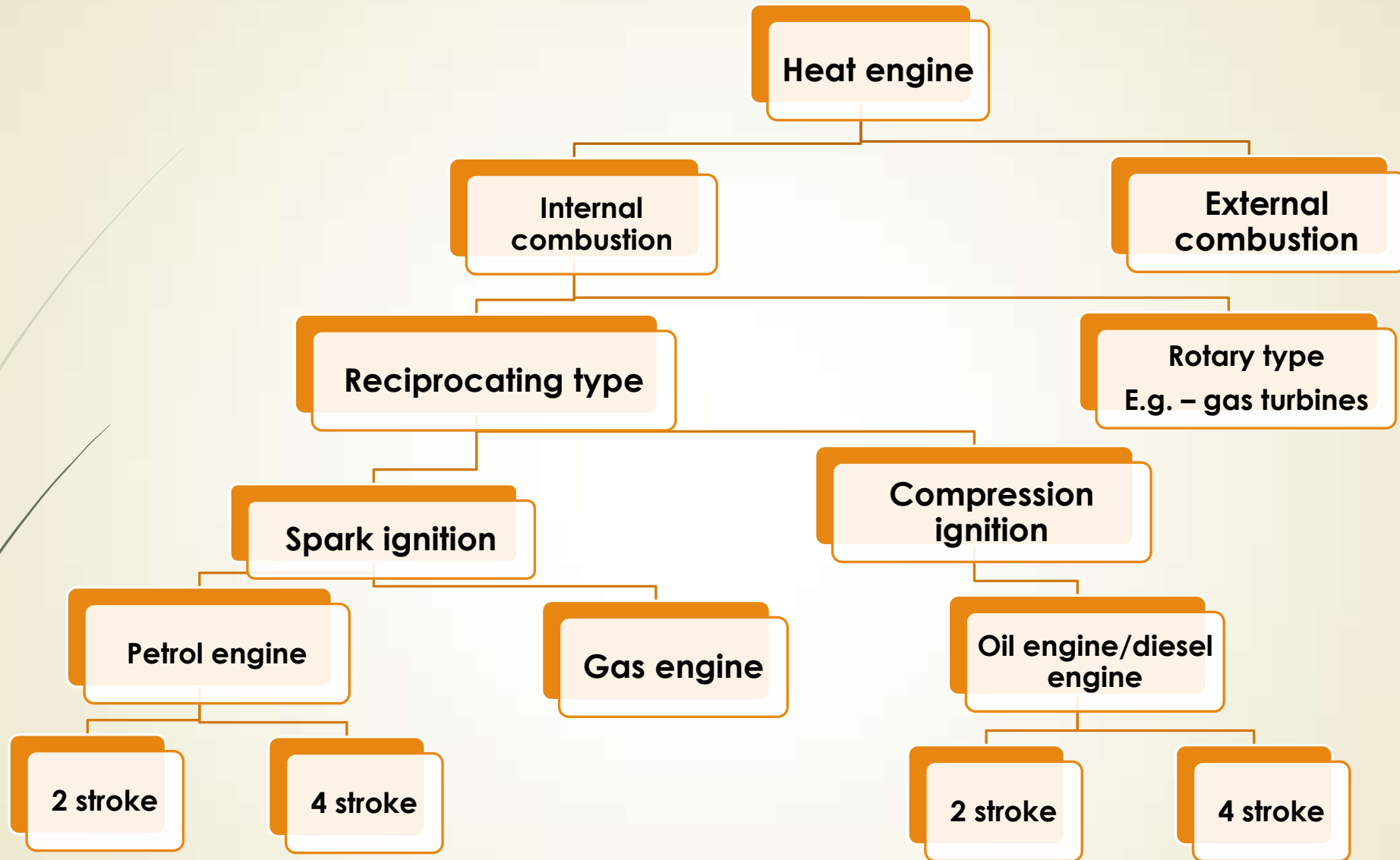
- Heat engine
- Classification of Heat Engine
- Applications of I.C. Engine
- Classification of I.C. engines
- Different parts of I.C. engine
- Two & four stroke engine



HEAT ENGINE

DEFINITION :

Any type of engine or machine which derives heat energy from the combustion of fuel or any other source and converts energy into mechanical work is termed as Heat Engine.



APPLICATIONS OF I.C. ENGINE

- ▶ *I.C.* engines have many applications, including:
- ▶ Road vehicles(e.g. scooter , motorcycle , buses etc.)
- ▶ Aircraft
- ▶ Motorboats
- ▶ Small machines, such as lawn mowers, chainsaws and portable engine-generators



Classification of I.C. Engine

► I.C. engines may be classified as given below :

1. According to cycle of operation :
2. According to arrangement of cylinder
3. According to method of ignition
4. According to method of cooling the cylinder
5. According to number of cylinder
6. According to air intake process

Different parts of I.C. Engine

A. Parts common to both diesel & petrol engine

Cylinder

Cylinder head

Piston

Piston Rings

Connecting rod

Crankshaft

Crank

Engine bearing

Crankcase

Flywheel

Governor

Valves



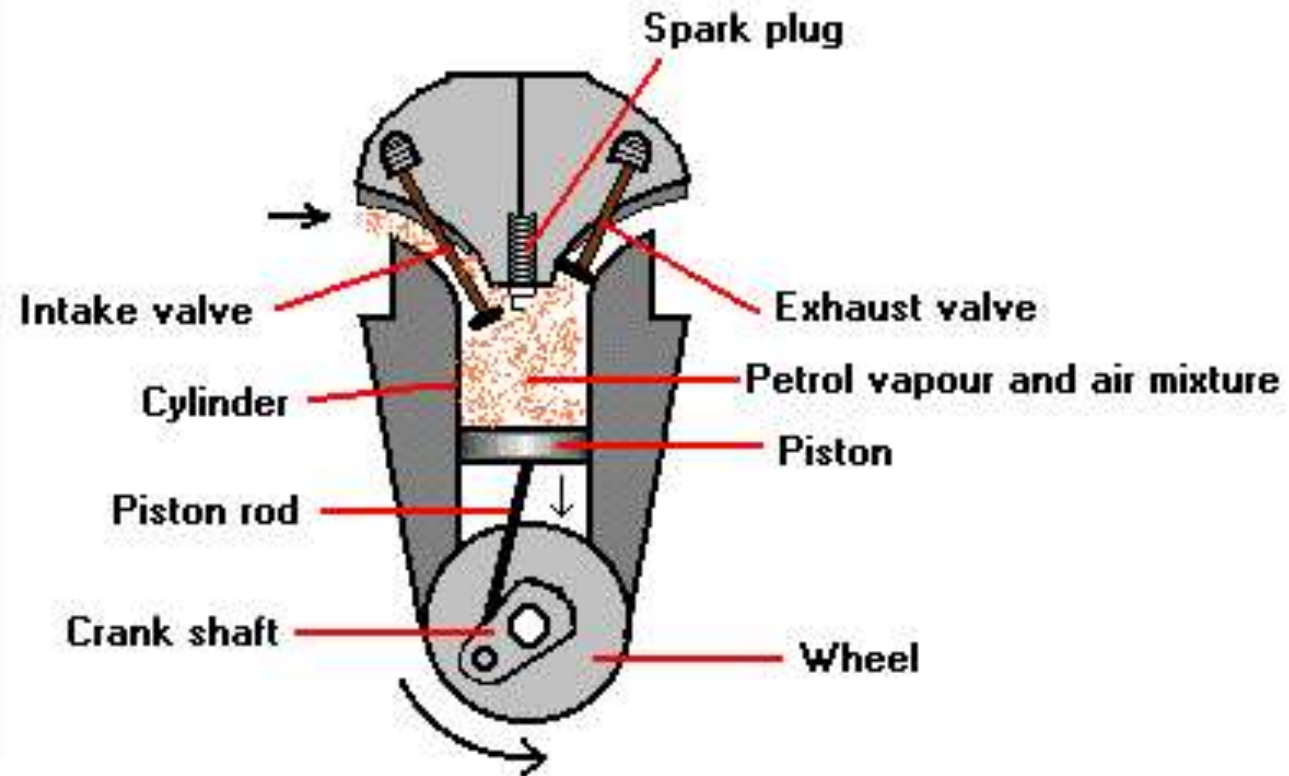
- **Parts common to Petrol engine only**

- **Spark plug**
- **Carburetor**

- **Parts common to Diesel engine only**

- **Injector**
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A. Parts common to both diesel & petrol engine



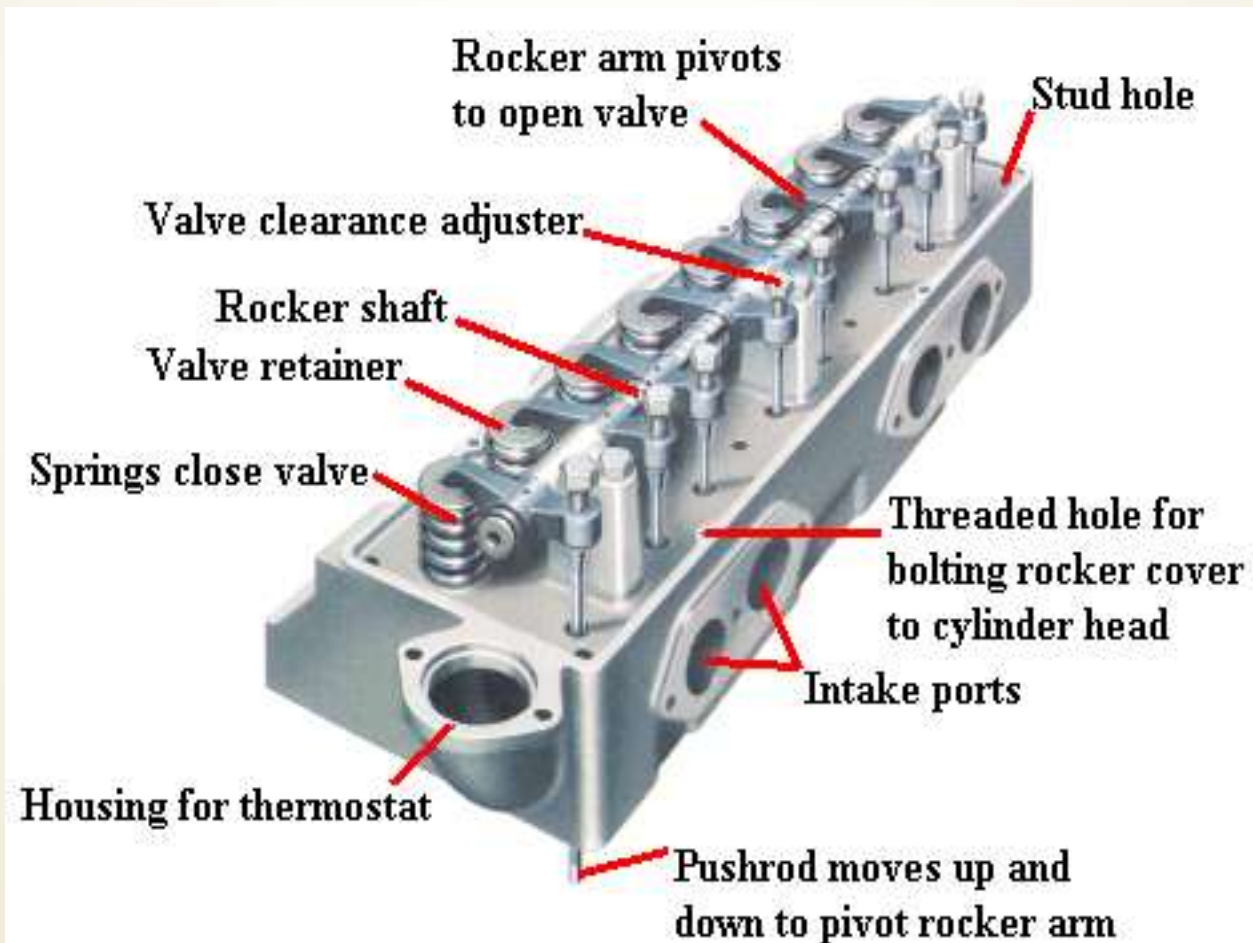


► Cylinder:

- It contains gas under pressure and guides the piston.
- It is in direct contact with the products of combustion and it must be cooled.

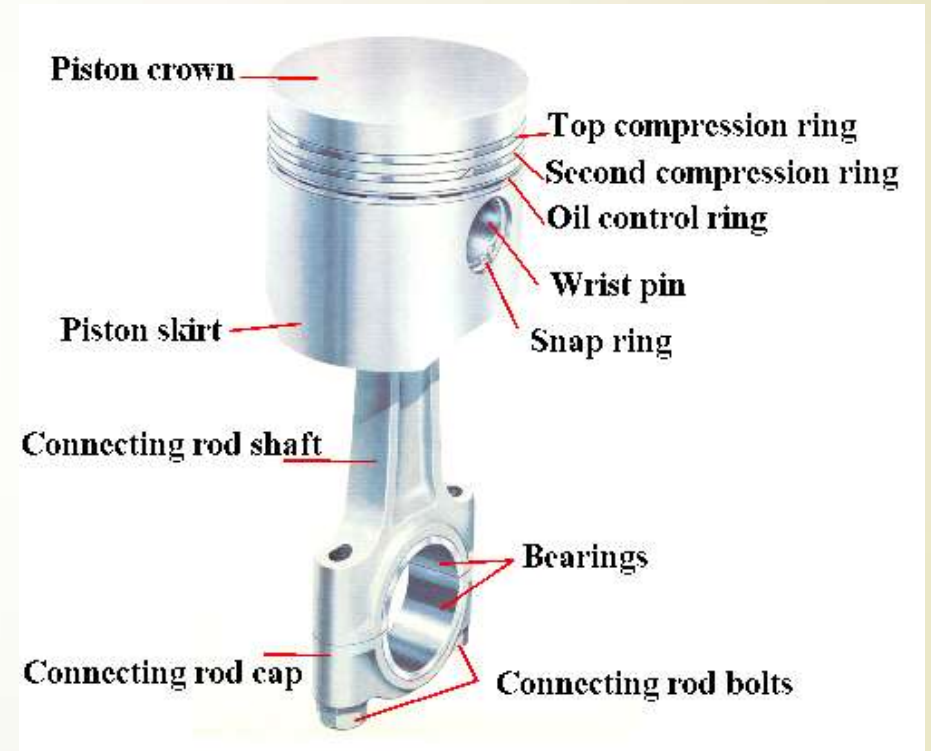
Cylinder head:

Its main purpose is to seal the working ends of the cylinders and not to permit entry and exit of gases on cover head valve engines



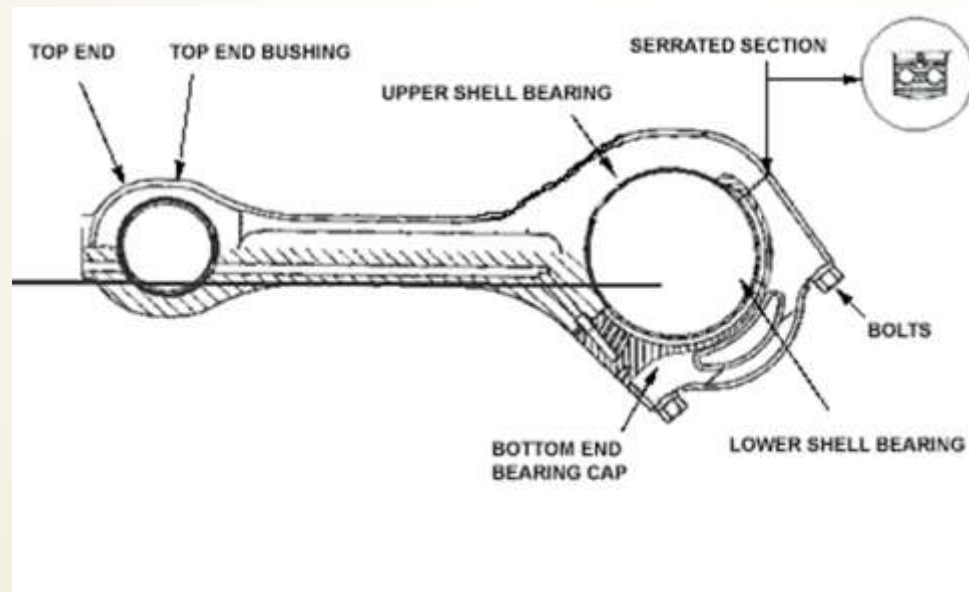
Piston

- The piston must –
 - give gas tight seal to the cylinder .
 - slide freely
 - be light
 - be strong

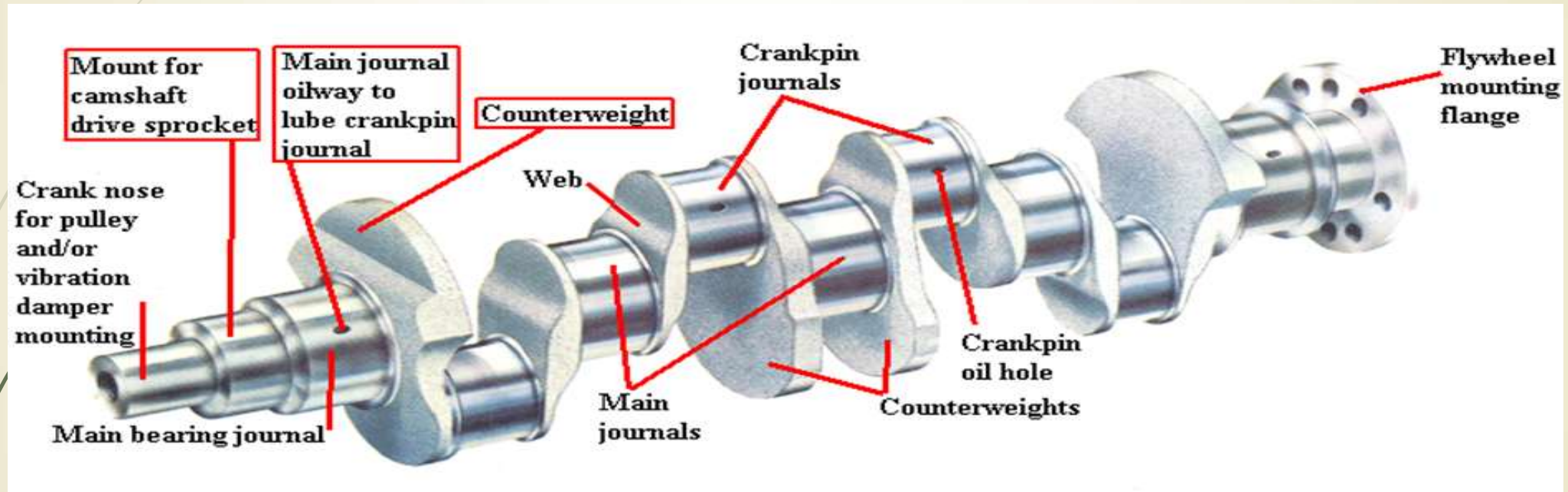


Connecting rod

The connecting rod transmits the piston load to the crank .
Thus it converts reciprocating motion of piston into rotary motion
of crankshaft



Crankshaft



The crankshaft is attached to the connecting rod in offset areas called throws – where the downward power pulses change into rotating motion.

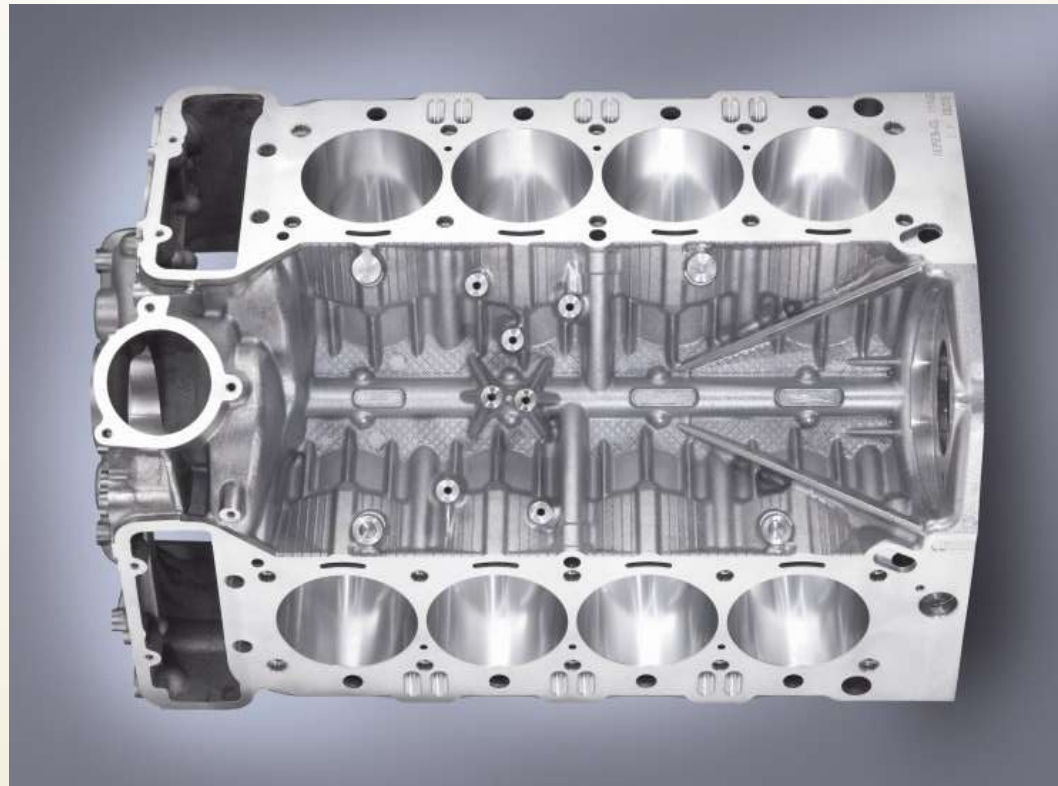
Engine Bearing

- ▶ The crankshaft is supported by bearing .
- ▶ Everywhere there is rotary action in the engine , bearings are used to support the moving parts.
- ▶ Its purpose is reduce the friction and allow parts to move freely.



Crankcase

- ▶ The main body of the engine of which the cylinders are attached and which contains the crankshaft and crankshaft bearing is called crankcase.



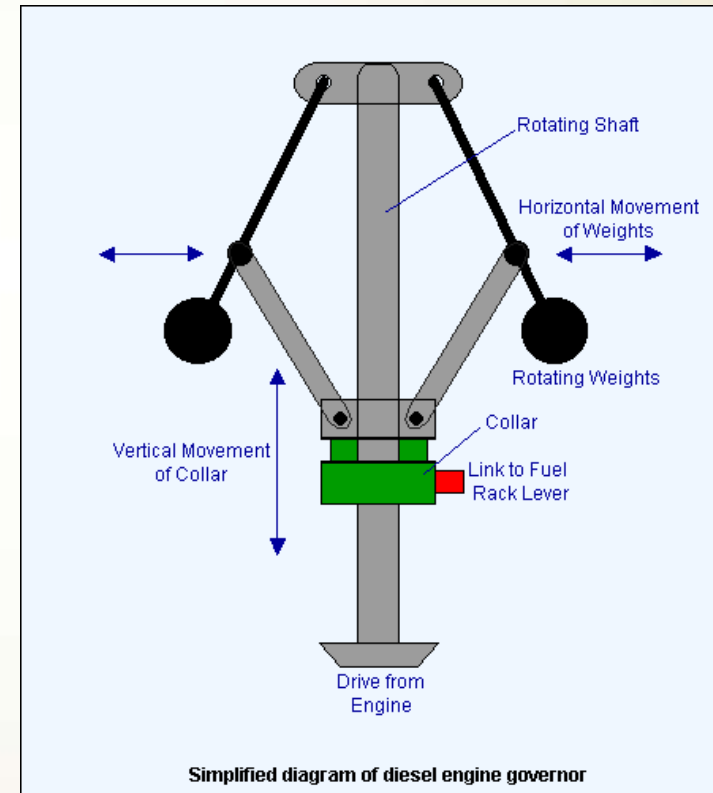
Flywheel

- ▶ Functions:
 - Stores energy required to rotate the shaft during preparatory strokes.
 - Makes crankshaft rotation more uniform.
 - Facilitates the starting of the engine and overcoming the short time overloads.



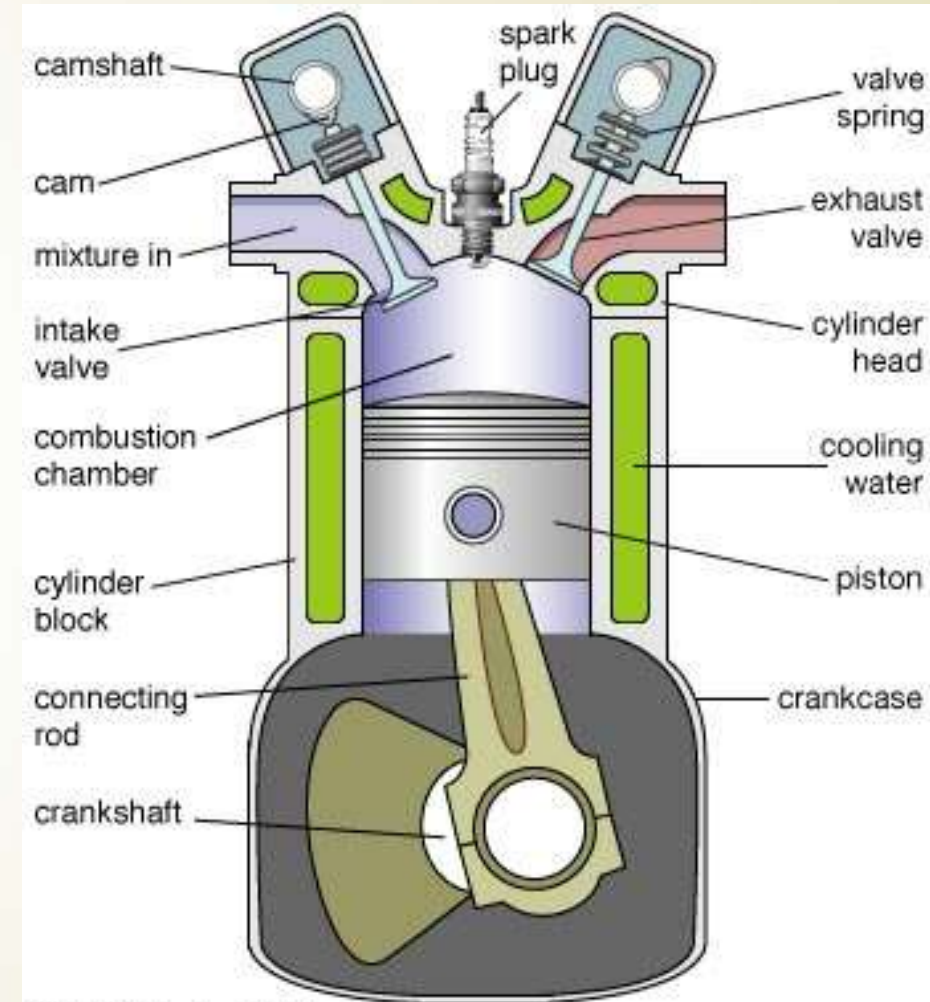
Governor

- ❑ A device for regulating automatically output of a machine by regulating the supply of working fluid.
- ❑ When the speed decreases due to increase in load the supply valve is opened by mechanism operated by governor and the engine therefore speeds up again to its original speed.
- ❑ Thus the function of a governor is to control the fluctuations of engine speed due to changes of load.



Valves

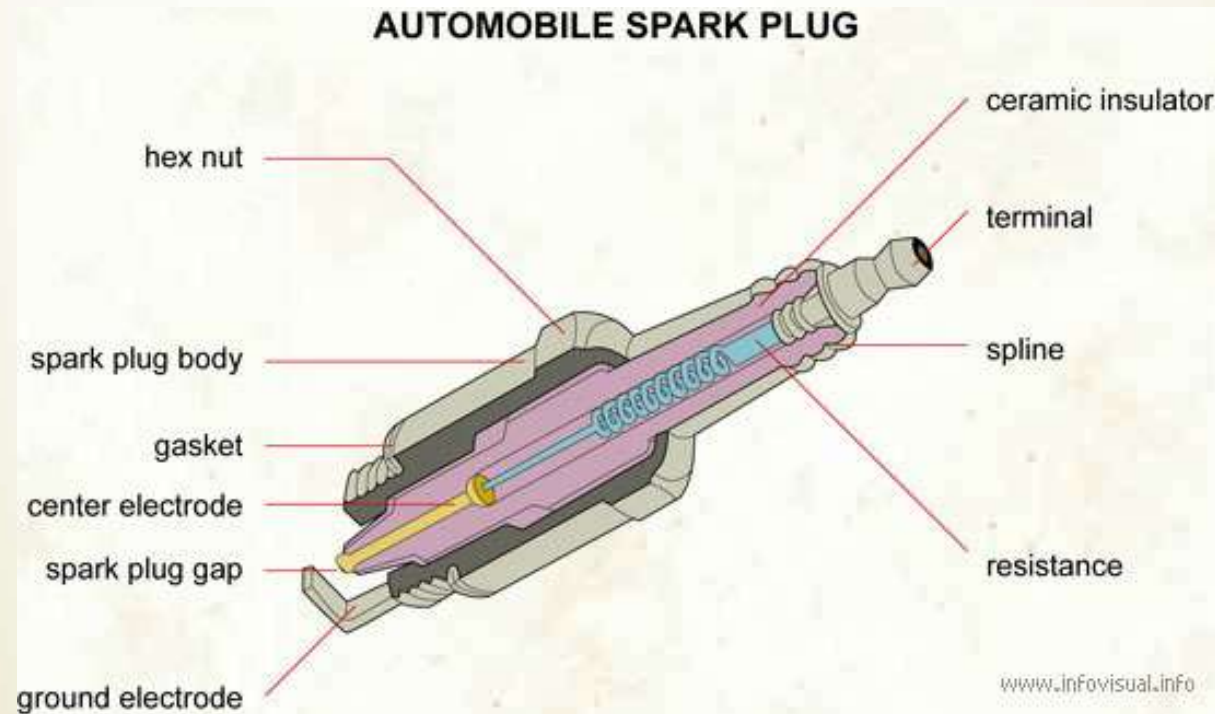
- ▶ A valve is a device that regulates, directs or controls the flow of a fluid (gases, liquids, fluidized solids, or slurries) by opening, closing, or partially obstructing various passageways.
- ▶ The intake and exhaust valves open at the proper time to let in air and fuel and to let out exhaust.
- ▶ Note that both valves are closed during compression and combustion so that the combustion chamber is sealed.



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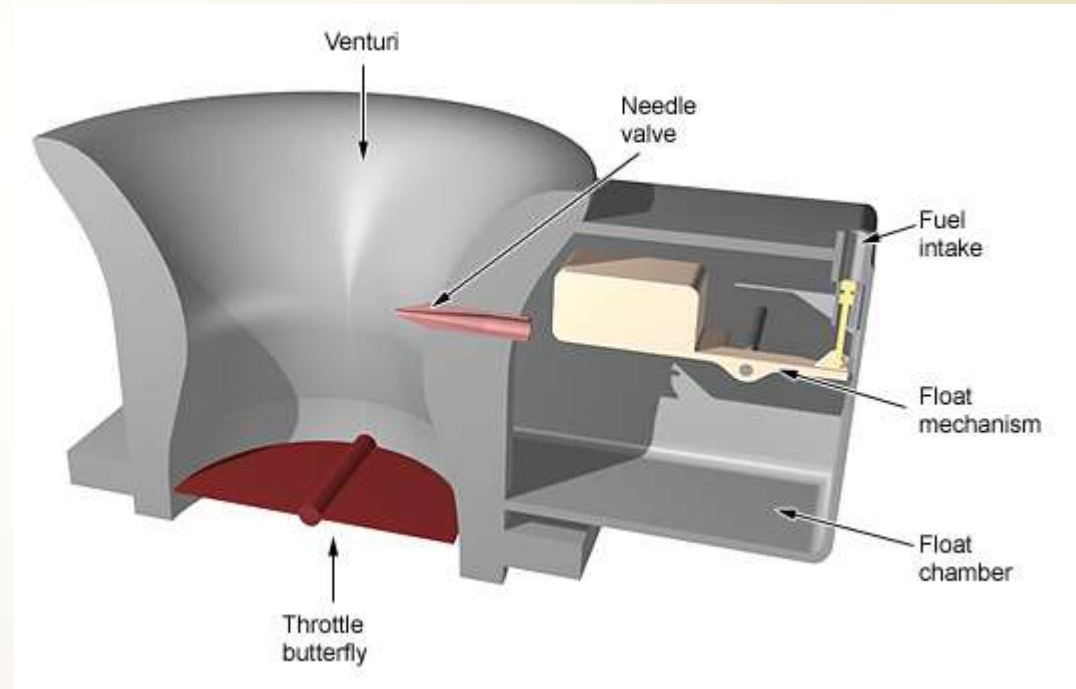
Spark Plug :

- The main function of a sparkplug is to conduct the high potential from the ignition system into the combustion chamber.
- It provides the proper gap across which spark is produced by applying high voltage , to ignite the mixture in the ignition chamber.



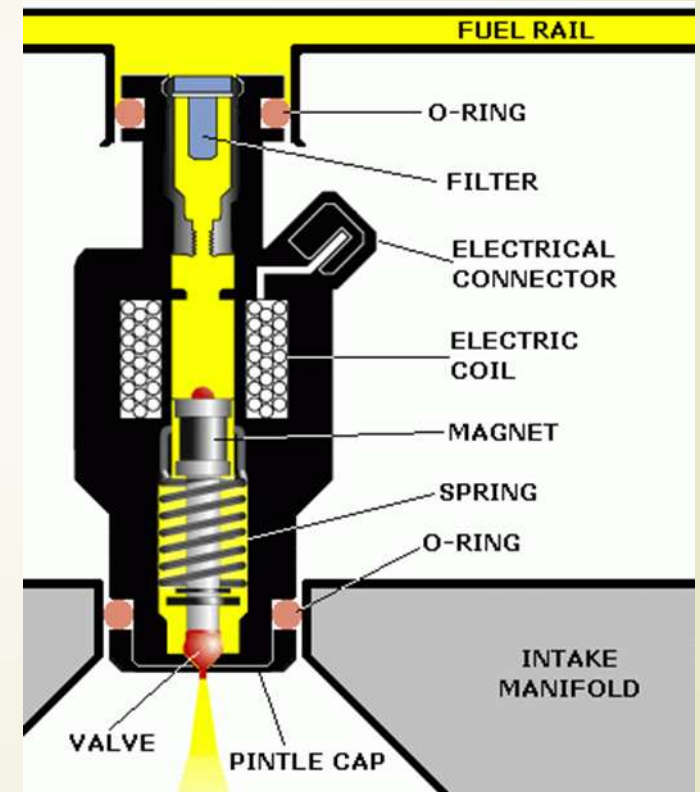
Carburetor

- ▶ The function of a carburetor is to atomize and meter the liquid fuel and mix it with the air as it enters the induction system of the engine .
- ▶ Maintaining fuel-air proportion under all conditions of operation appropriate to the conditions.



Fuel atomizer or injector

- ▶ Fuel injection is a system for mixing fuel with air in an internal combustion engine. It has become the primary fuel delivery system used in automotive petrol engines, having almost completely replaced carburetors in the late 1980s.
- ▶ The primary difference between carburetors and fuel injection is that fuel injection atomizes the fuel by forcibly pumping it through a small nozzle under high pressure, while a carburettor relies on low pressure created by intake air rushing through it to add the fuel to the airstream.
- ▶ The fuel injector is only a nozzle and a valve: the power to inject the fuel comes from a pump or a pressure container farther back in the fuel supply.





Two Stroke I.C. engine

- ▶ A two-stroke engine is an internal combustion engine which completes the thermodynamic cycle in two movements of the piston (compared to twice that number for a four-stroke engine).
- ▶ This increased efficiency is accomplished by using the beginning of the compression stroke and the end of the combustion stroke to simultaneously perform the intake and exhaust (or scavenging) functions.

Working principle of 2-stroke engine

► 1st stroke(Upward stroke):

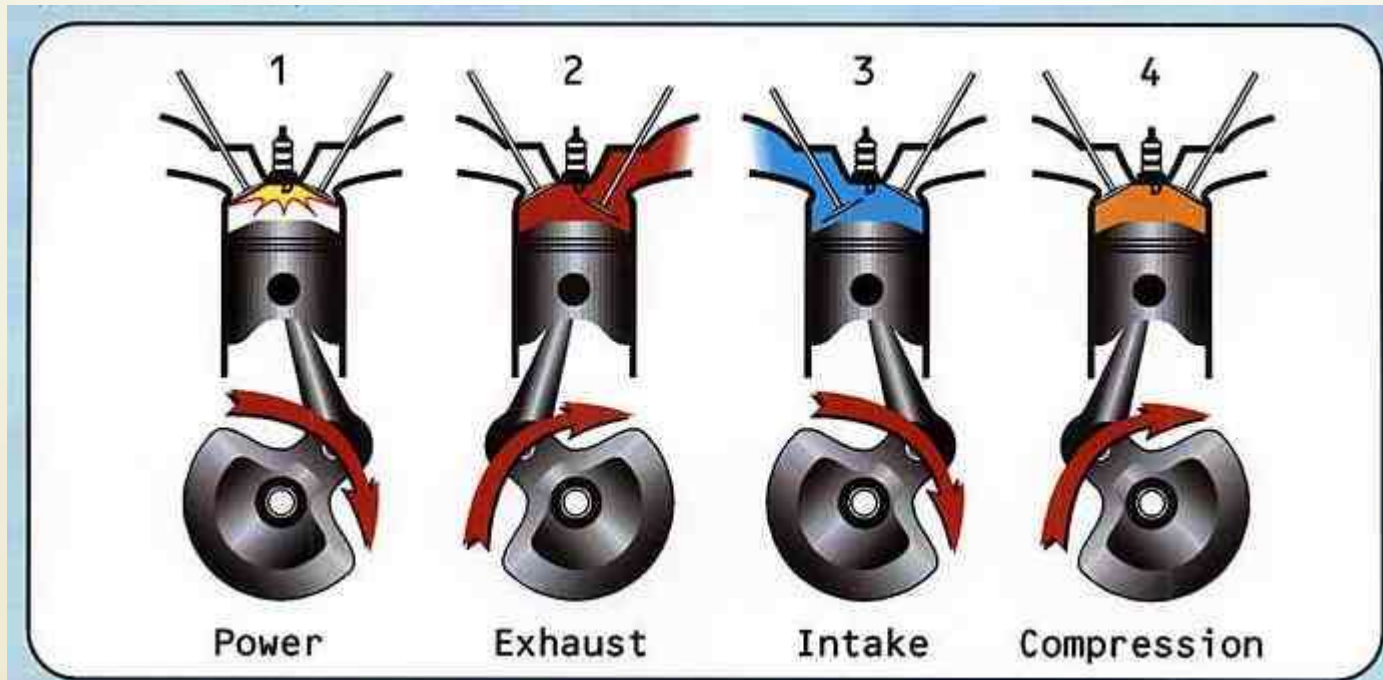
- 1st stroke: The piston is at the bottom of the cylinder. A pipe at the left side is opened and lets the fuel mixture, which is already compressed a bit, flow from the lower to the upper part of the cylinder.
- The fresh gases expulse now the exhaust through an ejection pipe, which is not closed by the piston at this moment

► 2nd stroke(Downward stroke):

- 2nd stroke: After being hurried upward, the piston now covers the pipe on the left side and the ejection pipe. Because there is no way out any more, the upper, fresh gas mixture gets compressed now.
- At the same time in the part below fresh gas is taken in by the piston driving upward through the open suction pipe.
- At the upper dead-centre, the compressed fuel mixture is ignited by the sparking plug, due to explosion the piston is pressed downward while it compresses the fresh gas below at the same time . The process begins again as soon as the piston arrives at its lowest point.

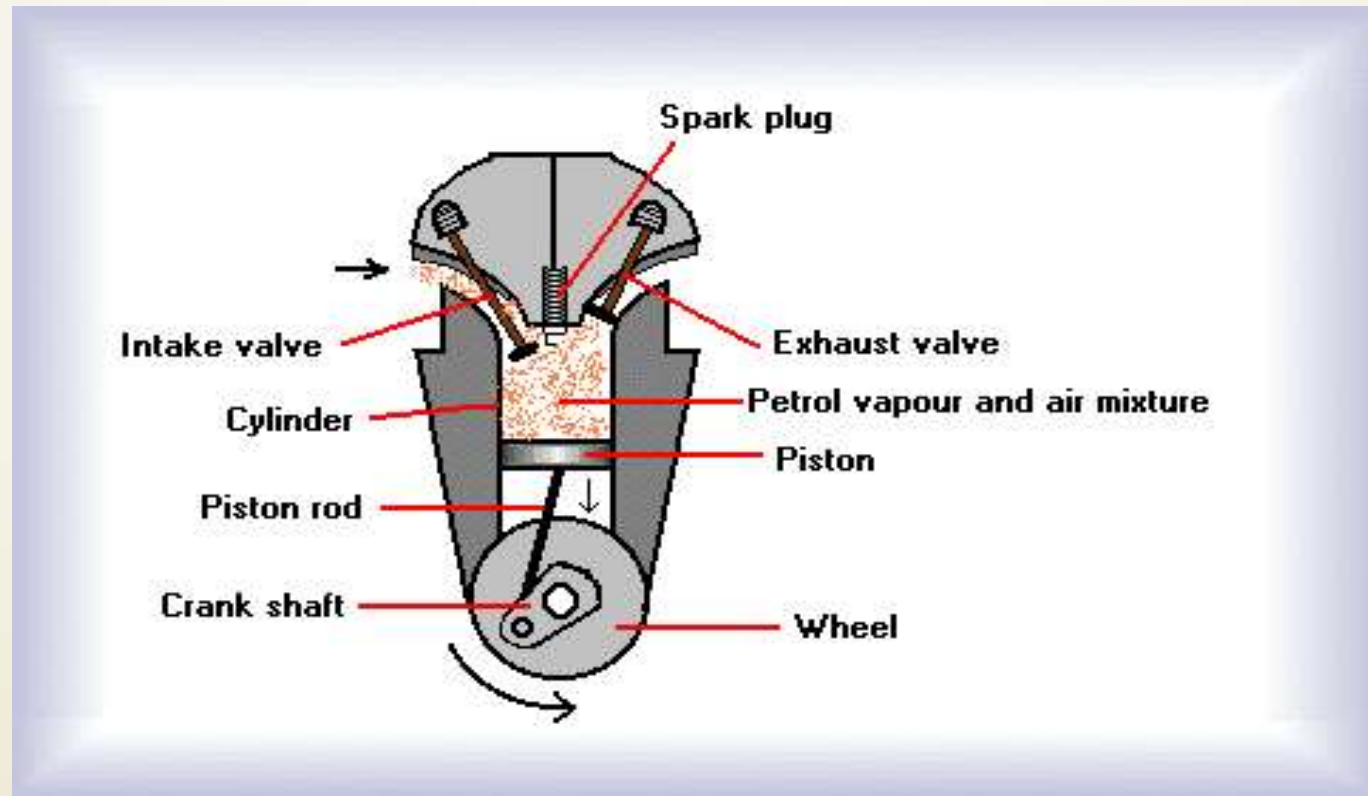
Four stroke engine

- ▶ The four strokes refer to intake, compression, combustion (power), and exhaust strokes that occur during two crankshaft rotations per working cycle of the engine.



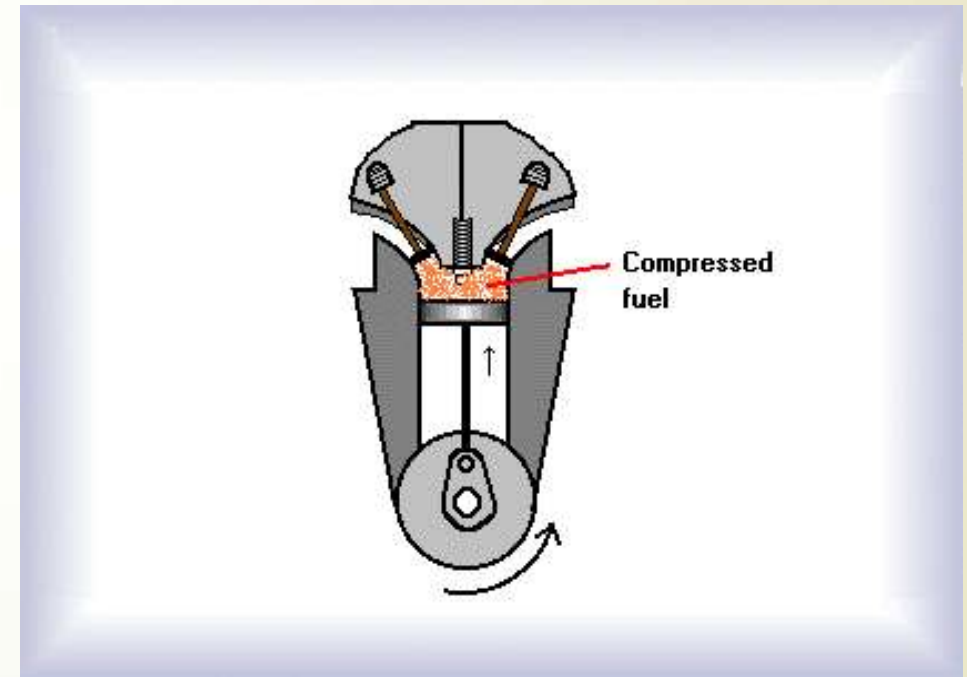
Working principle of 4-stroke engine

- ▶ **1st stroke (Intake or suction):**
- ▶ The piston moves from top dead centre to bottom dead centre ; the inlet valve opens .
- ▶ The piston sucks in the fuel-air-mixture from the carburettor into the cylinder.



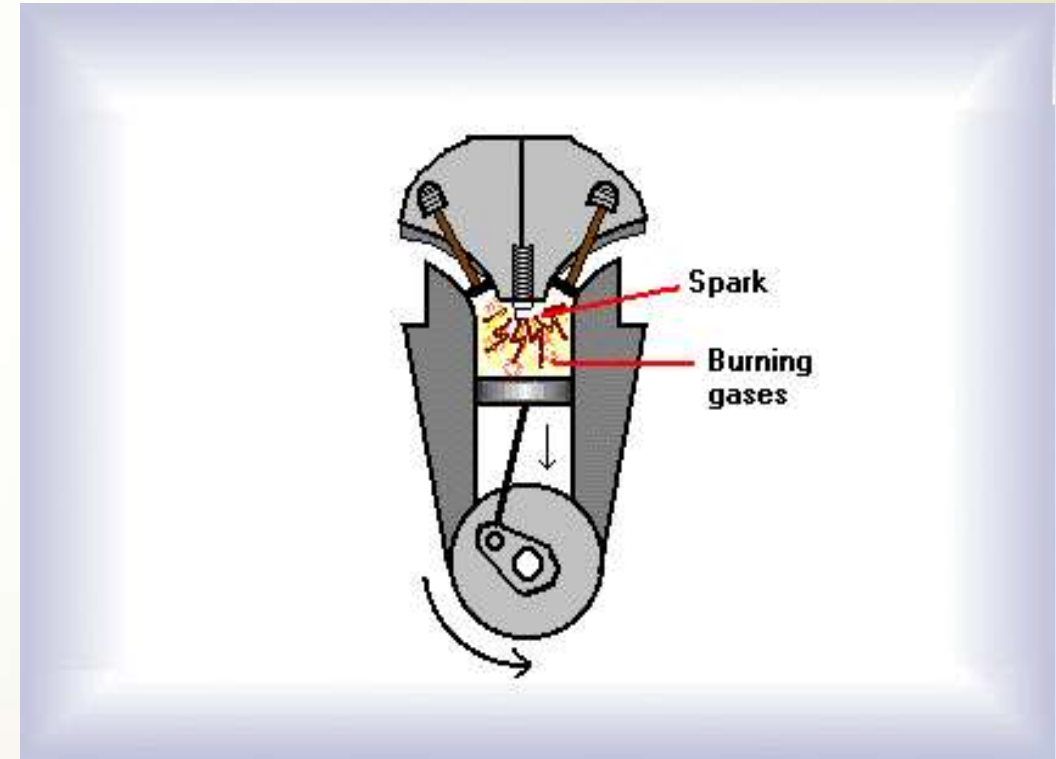
2nd stroke (compression):

- ▶ The piston moves towards the top dead centre and compresses the mixture.
- ▶ The pressure of the mixture rises in the cylinder to a value of about 8 bar.
- ▶ Just before the end of the end of this stroke spark plug initiates a spark which ignites the mixture and combustion takes place at a constant volume
- ▶ Both inlet and outlet valves are closed during this stroke



Expansion or working stroke:

- ▶ When the mixture is ignited by the spark plug the hot gases are produced which drive the piston from T.D.C. to B.D.C. and thus the work is obtained .
- ▶ The flywheel mounted on the engine shaft stores energy during this stroke and supplies it to other three strokes .
- ▶ Both the valves remain closed during the start of this stroke but when the piston just reaches BDC , the exhaust valve opens.



4th stroke (Exhaust):

- ▶ The piston presses the exhaust out of the cylinder.
- ▶ This is also called Scavenging

