TRACTORS

TRACTORS- TYPES AND UTILITIES

Tractor is a self-propelled power unit having wheels or tracks for operating agricultural implements and machines including trailers. Tractor engine is used as a prime mover for active tools and stationary farm machinery through power-take off (pto) or belt pulley.

Wheel tractors

TRACTOR DEVELOPMENT

The present tractor is the result of gradual development of machine in different stages. History of tractor development is given below.

1890- The word tractor appeared first on record in a patent issued on a tractor or traction engine invented by George H. Harris of Chicago

1906- Successful gasoline tractor was introduced by Charles w. Hart and Charles H. Parr of Charles City, Iowa

1908- First Winnipeg tractor trails were held

1911- First tractor demonstration was held at Omaha (Nebraska)

1915-1919- Power take off was introduced

1920-1924- All purpose was developed

1936- 1937 – Diesel engine was used in tractor and pneumatic tires were introduced

1950-1960- Manufacturing of diesel tractors on extensive basis throughout the world was taken up

1960-1961 – Tractor manufacturing was started in India by first manufacturer M/s Eicher

Good Earth

1962-1970 – Manufacturers like Tractor and Farm Equipment, Madras, Hindustan tractors at Baroda, Escorts Tractors at Faridabad and International Harvester in Bombay started work during this period

1971- Escorts Tractor Ltd.Started producing Ford Tractors

1973- Manufacture of HMT Tractor was started

1974- Manufacture of Pitti and Kirlosker Tractor was started

1975- Harsha Tractors was established

1981- Auto tractors were started

1982- Universal Tractors was established

1983-2003- GTCL tractors, M.M Tractors, Sonalika, VST, L&T, Bajaj Tractors were Produced.

CLASSIFICATION OF TRACTORS

Tractors can be classified as,

A. According to design:

a) Riding type, four wheel type
b) Walking behind tractor or two wheel power tiller

B. According to traction:

a) Track type
    i. Full track
    ii. Half track
b) Wheel type
    i. Two wheel type
    ii. Tricycle
    iii. Four wheel

C. According to utility:

i. General purpose
ii. All purpose
iii. Orchard
iv. Industrial
v. Garden

Two wheel tractor: single axle walk behind tractor is known as power tiller guided by hand and used in rice growing area. Recently, riding type power tillers have been developed and are being manufactured and have better operator comfort. These are more useful for small land holders and popular in rice fields, hilly areas. Power tiller are also used for seed preparations, sowings, hauling, pumping, transporting and other stationary works. Power tiller is equipped with rotary tiller and powered by horizontal single cylinder engine of 5hp to 15hp.


Power tillers

Three wheel type tractor: It's also known as tricycle type tractor. Front two wheels of this tractor are much closed. Row crop tractor is suitable for intercultural purpose. The tractor manufacturer Farmall was famous for tricycle type in 1930 to 1970.

Three wheel tractor

Four wheel tractor: A prime mover which is designed to pull, push, carry and operate implements used for agricultural work is farm tractor. These includes row crops, high crops and utility tractors. The row crops and high crops have adjustable treads that allow careful navigation through crop rows. It has two large traction wheel at rear and two small wheels at front. Used for ploughing, tilling, harrowing, planting, pushing, lifting, hauling transporting and provide PTO work such as rotavations, drilling, harvesting, pumping, threshing, levelling, etc. Power range of farm tractor is 10kW to 75kW and maximum speed is 35km/hr. rear roll bar frame and rollover protective cab provided on tractor to prevent the operator from any accident or over turn of tractor.

Four wheel tractor

Four wheel drive or 4WD have been designed to get more traction drawbar power and pull. In such type tractor power is transmitted at front wheel as well as rear wheel to get more traction and better stability. In this traction tyres are provided on the front also. These may be smaller or equal in size of rear tyres. Power range of these tractors is from 15kW to 100kW .

Tract type tractor: Have limited use in agriculture. A tractor which have endless iron tract passing round driving sprocket and pinion are known as tract laying or crawler tractors. They have the following operations:

i. Commercial orchard cultivation and maintenance
ii. Farm operation in hilly areas
iii. Land cleaning and earth moving works.

Tractor performance can be improved by using tracks rather than wheels and tyres. The weight of tractor is spread over a large area between track and soil, thereby improving traction. In agriculture work more drawbar power, pull and reduced soil compaction is achieved with crawler tractors. Power range of these tractor is from 20kW to 100kW and maximum road speed is about 10km/hr in agriculture work. Tracked machine is limited to heave pull jobs only.

Crawler tractor

UTILITY TRACTORS

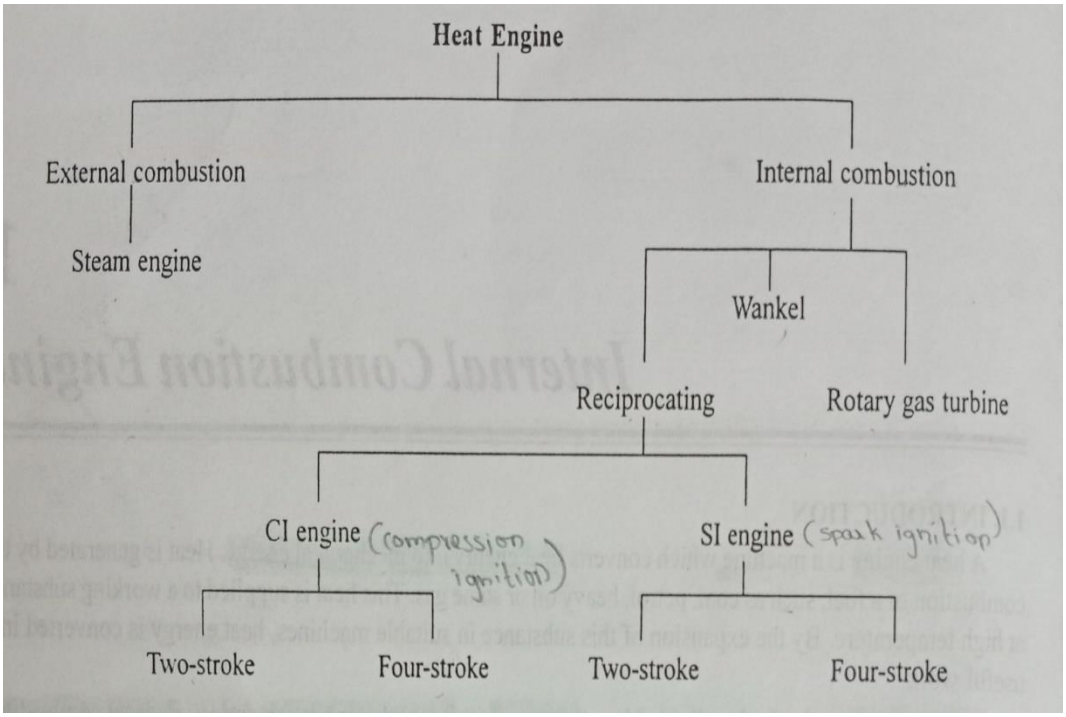
i. **Compact utility tractor (CUT):** This type of tractors are designed specially for landscaping and land management only. Compact utility is a small model four wheel drive tractor.
ii. **Garden tractor:** used in domestic operations like gardening, grass cutting etc. They have strong axles, frame and transmission. These tractors have very low ground clearance and are designed for light duty work.
iii. **Orchard tractor:** they differ little from a utility tractor. Mainly they are used in orchard area.
iv. **Industrial tractors:** it is limited to work for loading, unloading, lifting etc. in industries.

INTERNAL COMBUSTION ENGINE:

A heat engine is a machine which converts heat energy into mechanical energy. Heat is generated by the combustion of a fuel, such as coal, petrol, heavy oil or some gas. This heat is supplied to a working substance at high temperature. By the expansion of this substance in suitable machines, heat energy is converted into useful work.

Heat engines can be further divided into two types (i) external combustion and (ii) internal combustion In a steam engine the combustion of fuel takes place outside the engine and the steam thus formed is used to run the engine. Thus, it is known as external combustion engine. In the case of internal combustion engine, the combustion of fuel takes place inside the engine cylinder itself.

To understand the basic principle of the internal combustion (IC) engine, consider how a gun propels a bullet from its barrel by the rapid burning (explosive power) of a combustible mixture (fuel charge). The cylinder of the IC engine corresponds to the gun barrel while the piston corresponds to the bullet. The piston, fitted with rings to seal in power, is connected to a crank by a connecting rod. Thus, instead of the power being forced out of the cylinder bore, the piston's outward movement converts it to the rotational movement of a crankshaft. The piston never leaves the cylinder bore. The momentum of the crankshaft and flywheel always returns the piston to its former position, ready to receive another power impulse. The various types of heat engines are:



Types of heat engine

The IC engine can be further classified as: (i) stationary or mobile. (ii) Horizontal or vertical and (iii) low, medium or high speed. The two distinct types of IC engines used for either mobile or stationary operations are: (i) diesel and (ii) carburetor.

Carburetor Type IC Engine:

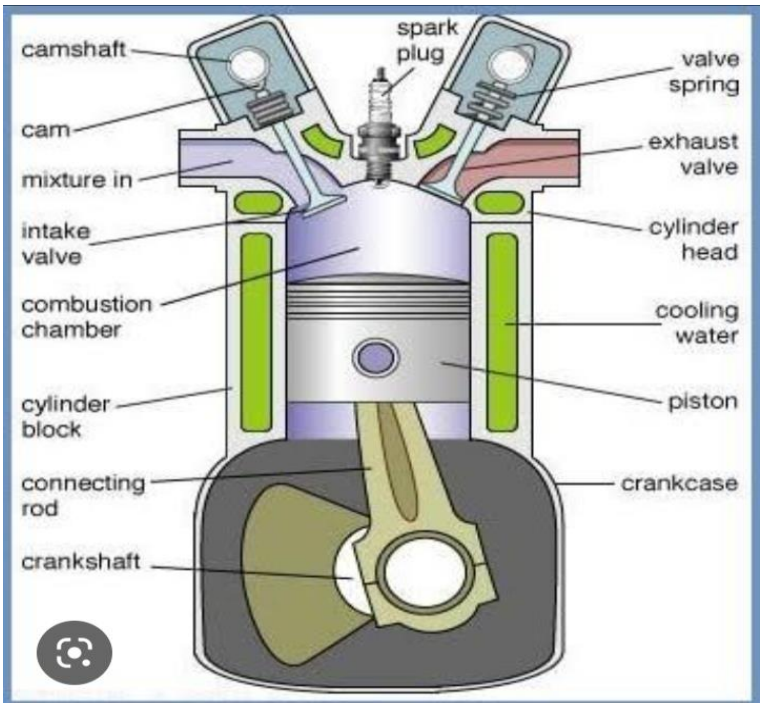
In this engine liquid fuel is atomized, vaporized and mixed with air in correct proportion before being taken to the engine cylinder through the intake manifolds. The ignition of the mixture is caused by an electric spark and is known as spark ignition.

Diesel Type IC Engine:

In this only the liquid fuel is injected in the cylinder under high pressure.

CONSTRUCTIONAL FEATURES OF IC ENGINE

The principal parts of such an engine are shown in Figure. A brief description of these parts is given below:



Cross section of petrol engine

Cylinder:

The cylinder of an IC engine constitutes the basic and supporting portion of the engine power unit. Its major function is to provide space in which the piston can operate to draw in the fuel mixture or air (depending upon spark ignition or compression ignition), compress it, allow it to expand and thus generate power.

The cylinder is usually made of high grade cast iron. In some cases, to give greater strength and wear resistance with less weight, chromium, nickel and molybdenum are added to the cast iron.

The piston of an engine is the first part to begin movement and to transmit power to the crankshaft as a result of the pressure and energy generated by the combustion of the fuel. The piston is closed at one end and open on the other end to permit direct attachment of the connecting rod and its free action.

The materials used for pistons are grey cast iron, cast steel and aluminum alloy trend is to use only aluminum alloy pistons in the tractor engine.

Piston Rings:

These are made of cast iron on account of their ability to retain bearing qualities and elasticity indefinitely. The primary function of the piston rings is to retain compression and at the same time reduce the cylinder wall and piston wall contact area to a minimum, thus reducing friction losses and excessive wear. The other important functions of piston rings are the control of the lubricating oil, cylinder lubrication, and transmission of heat away from the piston and from the cylinder walls. Piston rings are classified as compression rings and oil rings depending on their function and location on the piston.

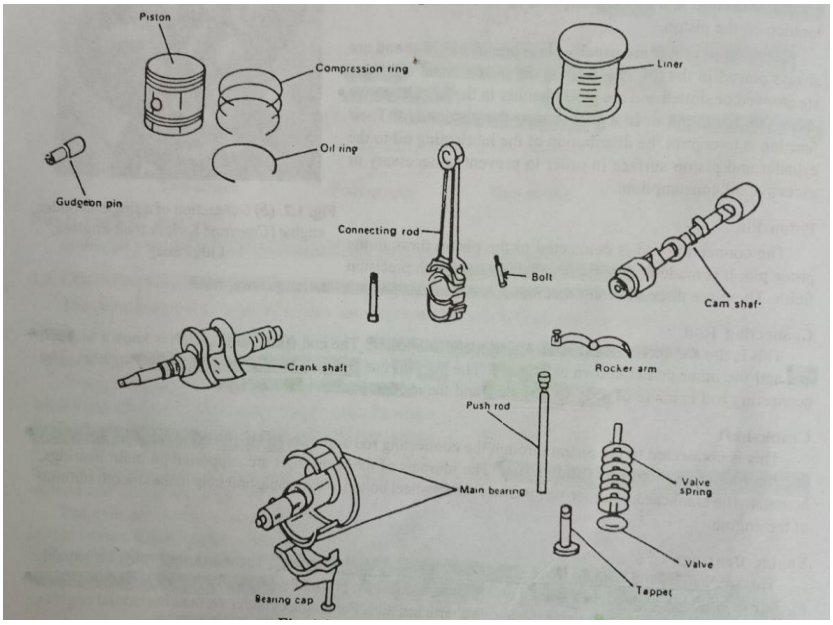
Compression rings are usually plain one piece rings and are always placed in the grooves nearest the piston head. Oil rings are grooved or slotted and are located either in the lowest groove above the piston pin or in a groove near the piston skirt: Their function is to control the distribution of the lubricating oil to the cylinder and piston surface in order to prevent unnecessary or excessive oil consumption.

Piston Pin:

The connecting rod is connected to the piston through the piston pin. It is made of case hardened alloy steel with precision finish. There are three different methods to connect the piston to the connecting rod.

Connecting Rod:

This is the connection between the piston and crankshaft. The end connecting piston is known as small end and the other end is known as big end. The big end has two halves of a bearing bolted together. The connecting rod is made of drop forged steel and the section is of the F-beam type.



Components of diesel engine

Crankshaft:

This is connected to the piston through the connecting rod and converts the linear motion of the piston into the rotational motion of the flywheel. The journals of the crankshaft are supported on main bearings, housed in the crankcase Counter-weights and the flywheel bolted to the crankshaft help in the smooth running of the engine.

Engine Bearings:

The crankshaft and camshaft are supported on anti-friction bearings. These bearings must be capable of withstanding high speed, heavy load and high temperatures. Normally, babbit, cadmium, silver or copper lead is coated on a steel back to give the above characteristics. For single cylinder vertical/horizontal engines, the present trend is to use ball bearing in place of main bearings of the thin shell type.

Valves:

To allow the air to enter into the cylinder or the exhaust, gases to escape from the cylinder, valves are provided, known as inlet and exhaust valves respectively. The valve are mounted either on the cylinder head or on the cylinder block.

Camshaft:

The valves are operated by the action of the camshaft which has separate cams for the inlet and exhaust valves. The cam lifts the valve against the pressure of the spring and as soon as it changes position the spring closes the valve. The cam gets drive through either the gear or sprocket and chain system from the crankshaft. It rotates at half the speed of the camshaft crankshaft.

Flywheel:

This is usually made of cast iron and its primary function is to maintain uniform engine speed by carrying the crankshaft through the intervals when it is not receiving power from a piston. The size of the flywheel varies with the number of cylinders and the type and size of the engine. It also helps in balancing rotating masses.