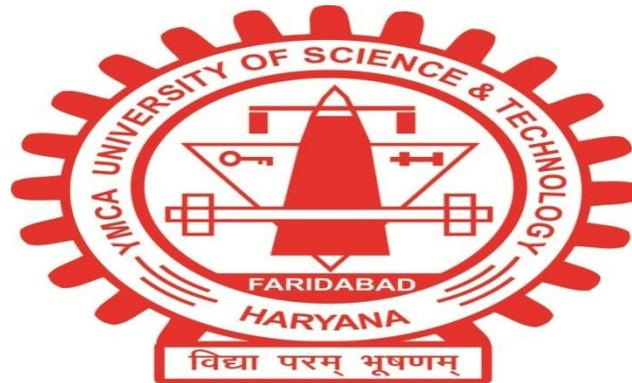


SEMINAR REPORT

ON

FOUR STROKE DIESEL ENGINE



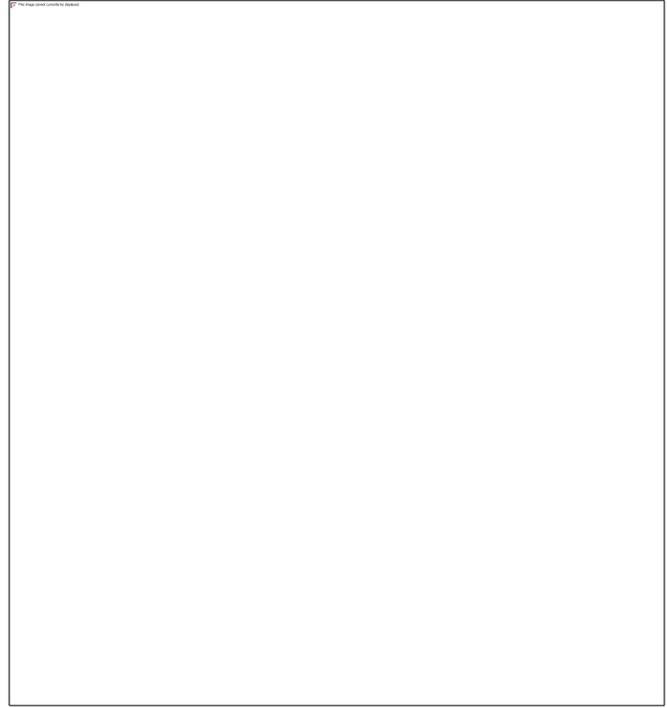
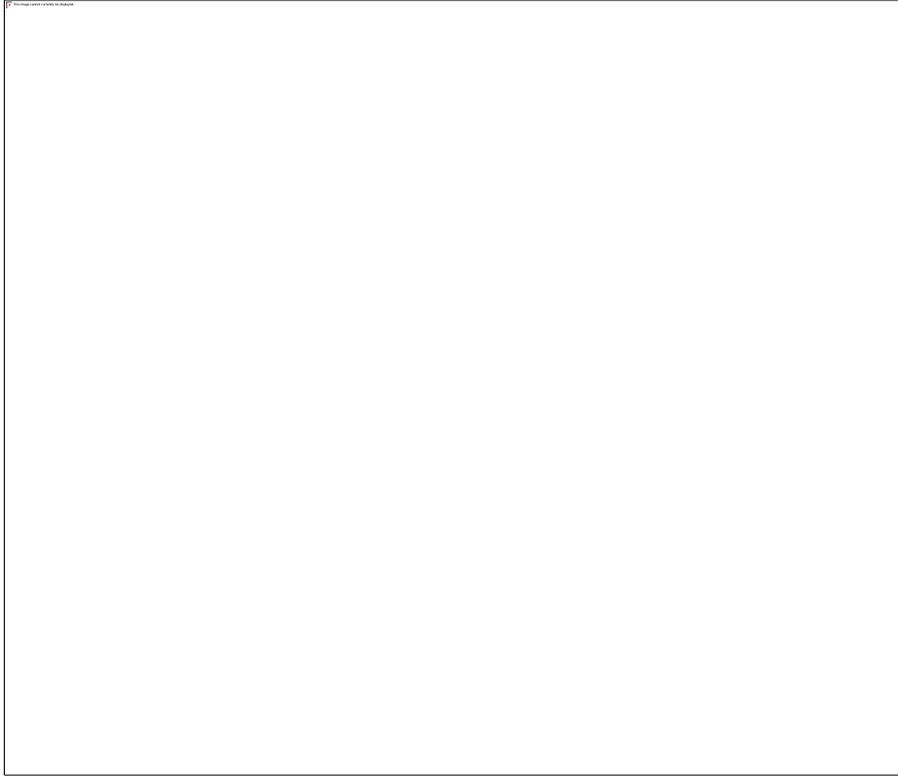
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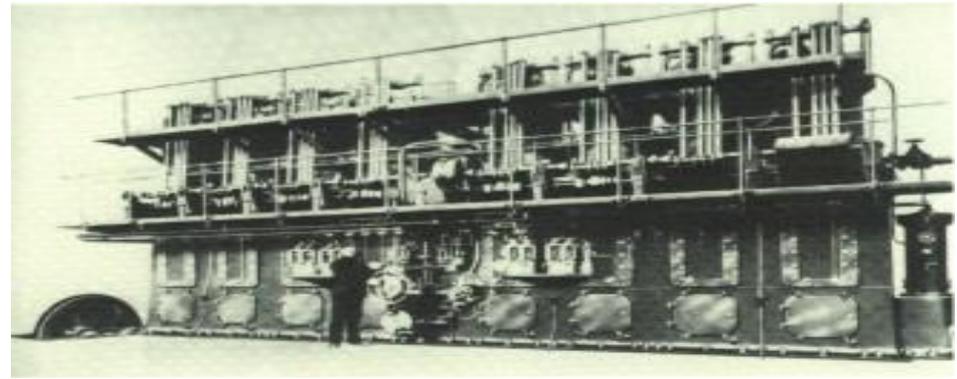
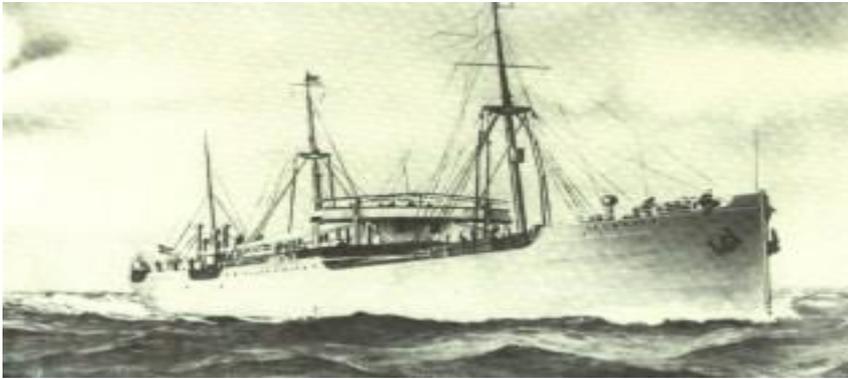
The 4 Stroke Diesel Cycle



Nickolaus Otto invented the 4 stroke cycle in 1862. More details of how the four stroke spark ignition cycle works, together with pictures of Otto's first engines can be found **here**

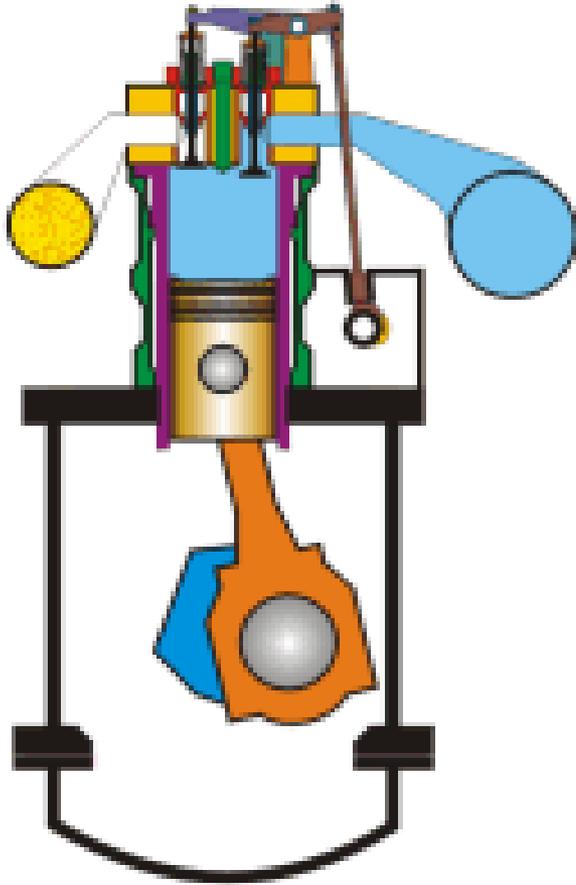


In 1892 Rudolph Diesel invented the compression ignition engine, now named after him. The first working engine was built at the Augsburg Maschinenfabrik (now part of the MAN B&W group) in 1897. The single cylinder engine was used to power stationary machinery. It weighed five tonnes and produced 20 hp at 172 rpm! The engine operated at 26.2% efficiency, a very significant improvement on the 20% achieved by the best petrol engines of the time.



- In 1912 the first ocean going vessel to have diesel engines installed was the Selandia. The engines were 8 cylinder 4 strokes. An idea of their size can be got from the man standing by the engine controls half way down the engine.
- The four stroke cycle is so called because it takes four strokes of the piston to complete the processes needed to convert the energy in the fuel into work. Because the engine is reciprocating, this means that the piston must move up and down the cylinder twice, and therefore the crankshaft must revolve twice.
- The four strokes of the piston are known as the induction stroke, the compression stroke, the power stroke, and the exhaust stroke. Students sometimes remember this as "suck, squeeze, bang, blow."

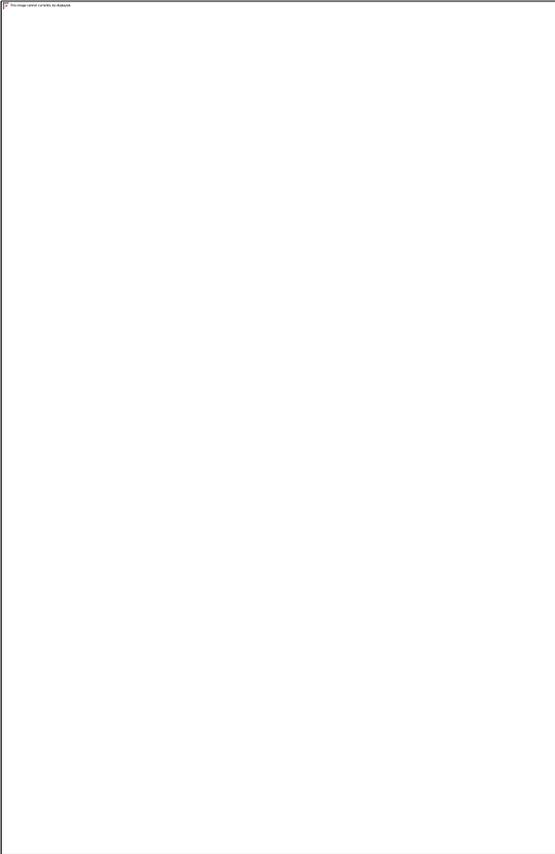
1. INDUCTION:



- The crankshaft is rotating clockwise and the piston is moving down the cylinder. The inlet valve is open and a fresh charge of air is being drawn or pushed into the cylinder by the turbocharger

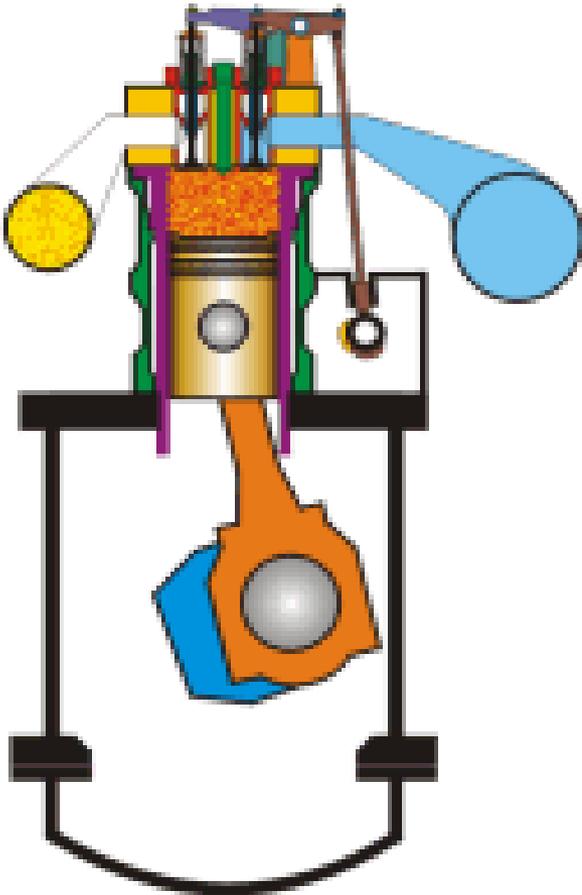
2. COMPRESSION:

- The inlet valve has closed and the charge of air is being compressed by the piston as it moves up the cylinder. Because energy is being transferred into the air, its pressure and temperature increase. By the time the piston is approaching the top of the cylinder (known as Top Dead Centre or TDC) the pressure is over 100 bar and the temperature over 500°C

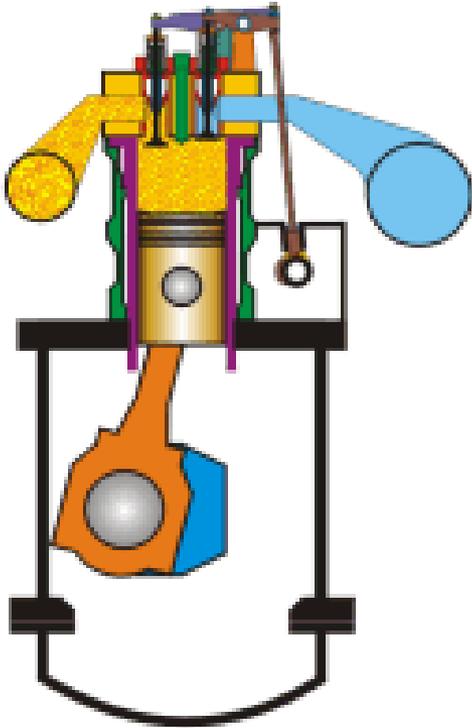


3. POWER:

- Just before TDC fuel is injected into the cylinder by the fuel injector. The fuel is "atomised" into tiny droplets. Because they are very small these droplets heat up very quickly and start to burn as the piston passes over TDC. The expanding gas from the fuel burning in the oxygen forces the piston down the cylinder, turning the crankshaft. It is during this stroke that work energy is being put into the engine; during the other 3 strokes of the piston, the engine is having to do the work.

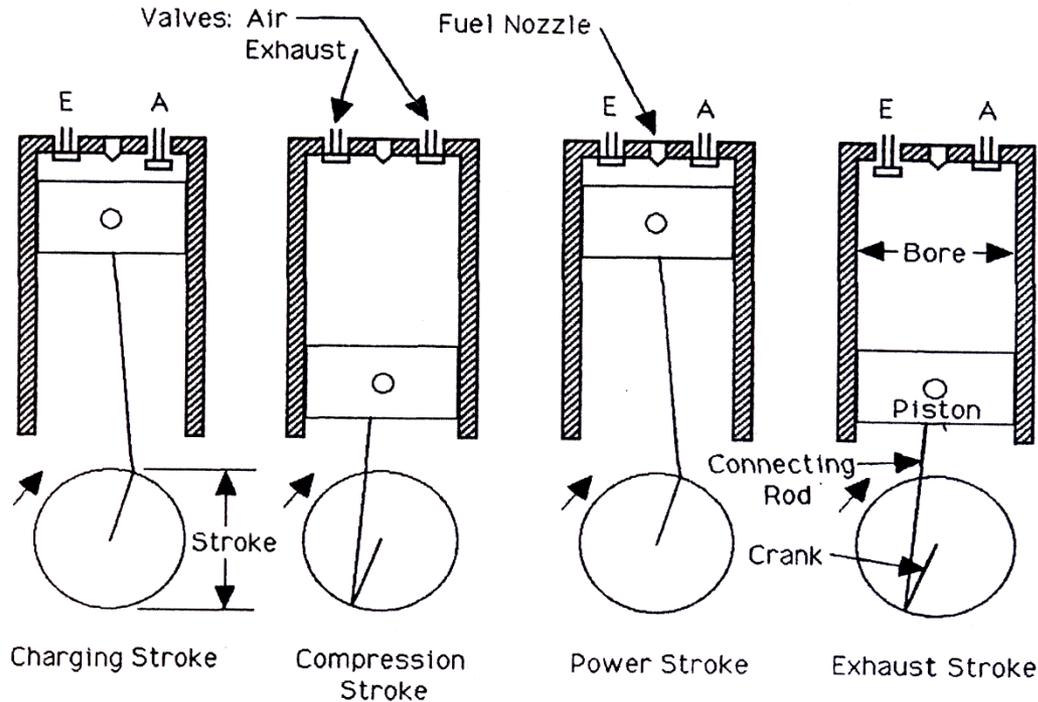


4. EXHAUST



- As the piston approaches the bottom of the cylinder (known as Bottom Dead Centre or BDC) the exhaust valve starts to open. As the piston now moves up the cylinder, the hot gases (consisting mostly of nitrogen, carbon dioxide, water vapour and unused oxygen) are expelled from the cylinder.
- As the Piston approaches TDC again the inlet valve starts to open and the cycle repeats itself

Working Principle 4 stroke engine

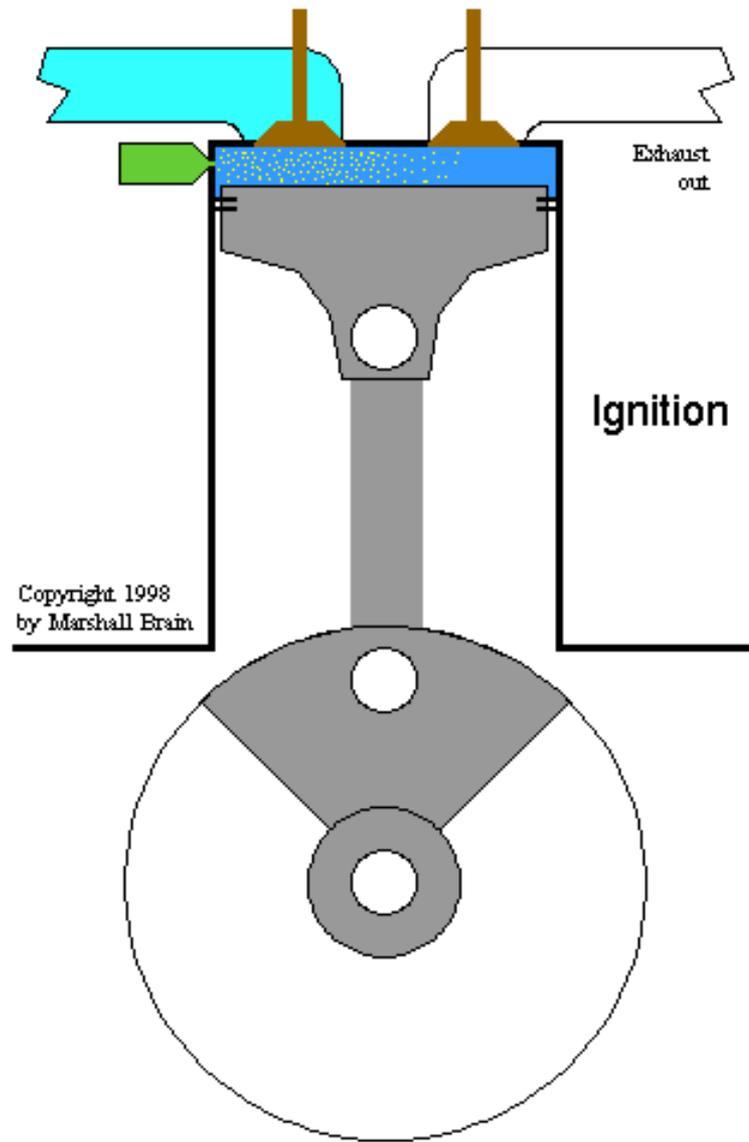


✚ Induction stroke

✚ Compression stroke – at the end pr. = 35 bar, temp. = 540 ° C

✚ Power stroke – temp = 1650° C

✚ Exhaust stroke



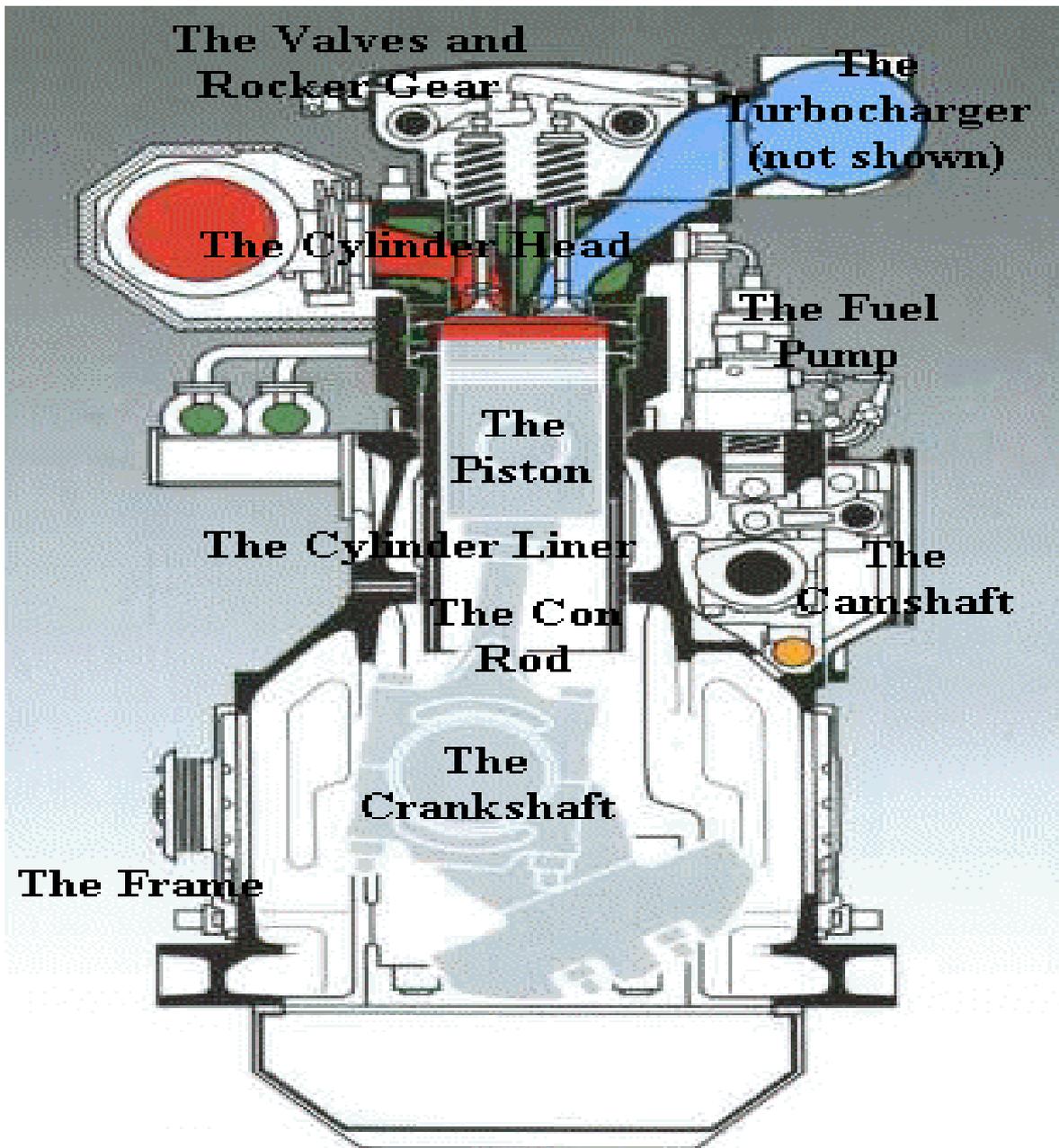
Four stroke engine

- The medium speed 4 stroke trunk piston engine can be found on most medium to large merchant vessels even if the main engine is either a steam turbine or a 2 stroke crosshead engine. In these cases it will often be found that the electrical power is supplied by alternators driven by medium speed 4 stroke engines.

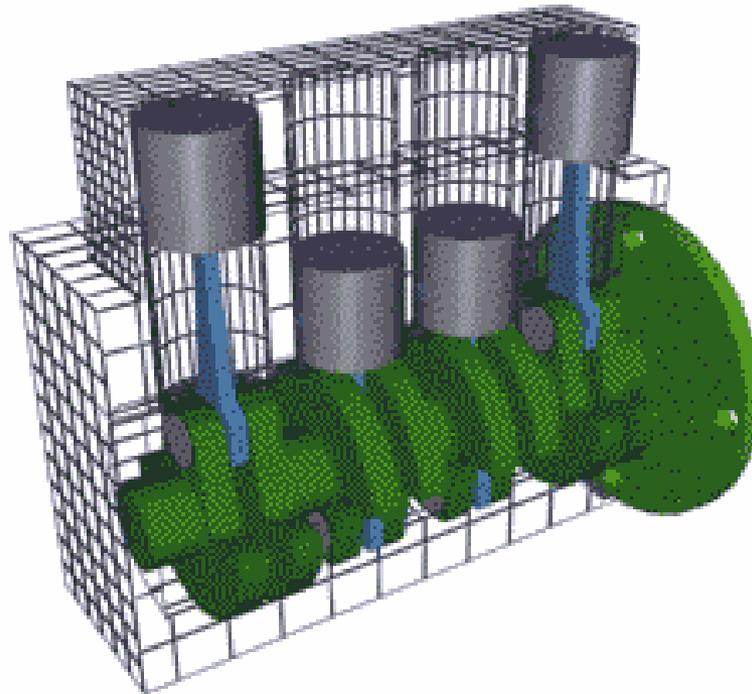
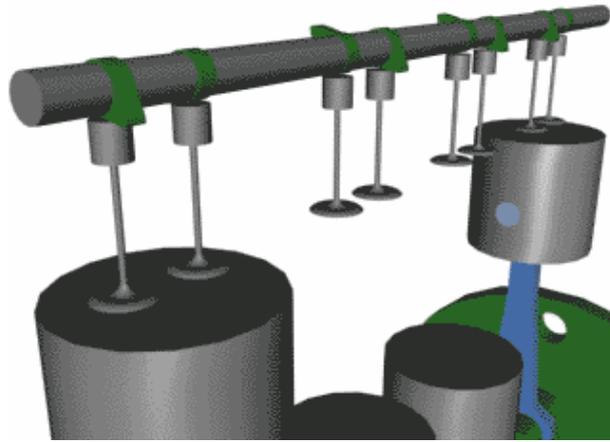
- They are the favoured method of propulsion on ships where head room is a minimum, for instance, on ferries and passenger vessels, and where, as is the current trend for these ships, diesel electric propulsion is utilised. Diesel electric propulsion allows the engines to be placed wherever is most suitable, as they no longer have to be aligned with reduction gearing and shafting as is the case with conventional installations.

Generally, medium speed engines run at between 250 - 850 RPM. Above this range they are defined as high speed engines. Although not as powerful as their 2 stroke crosshead cousins, the largest 4 stroke engines are delivering just over 2000kW per cylinder. Advances in design and materials have led to an increase in efficiency, together with an increase in turbocharger pressure ratios which allow a greater quantity of fuel to be burnt per cycle. Medium speed engines have a higher power to weight ratio than the slow speed two strokes, but due to the higher speeds tend to have reduced maintenance intervals. The largest of these engines have a bore of 640mm and a stroke of 900mm (Wartsila 64), although engines which are nearly "square" are more the norm: For example, the Sulzer ZA40 has a bore of 400mm and a stroke of 560mm or the MAN-B&W 58/64 which has a bore of 580mm and a stroke of 640mm. A square engine is one where the bore is equal to the stroke.

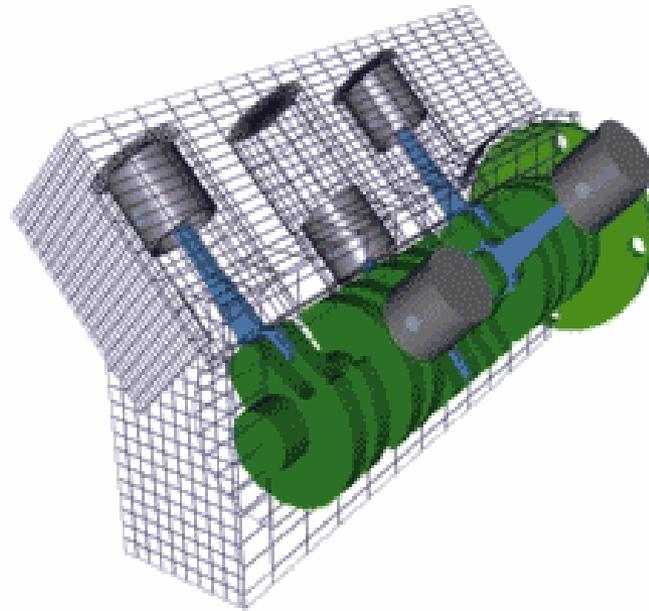
The name "Trunk Piston" refers to the piston skirt or trunk. The purpose of the skirt or trunk in four-stroke cycle engines is to act in a similar manner to a crosshead. It takes the thrust caused by connecting-rod angularity and transmits it to the side of the cylinder liner, in the same way as the crosshead slipper transmits the thrust to the crosshead guide. With such engines, which are termed trunk-piston engines, the engine height is considerably reduced compared with that of a crosshead engine of similar power and speed. The engine-manufacturing costs are also reduced. It means of course that there is no separation between the crankcase and the liner and piston. This has its disadvantages, especially when considering the choice of lubricating oils when burning high sulphur residual fuels.



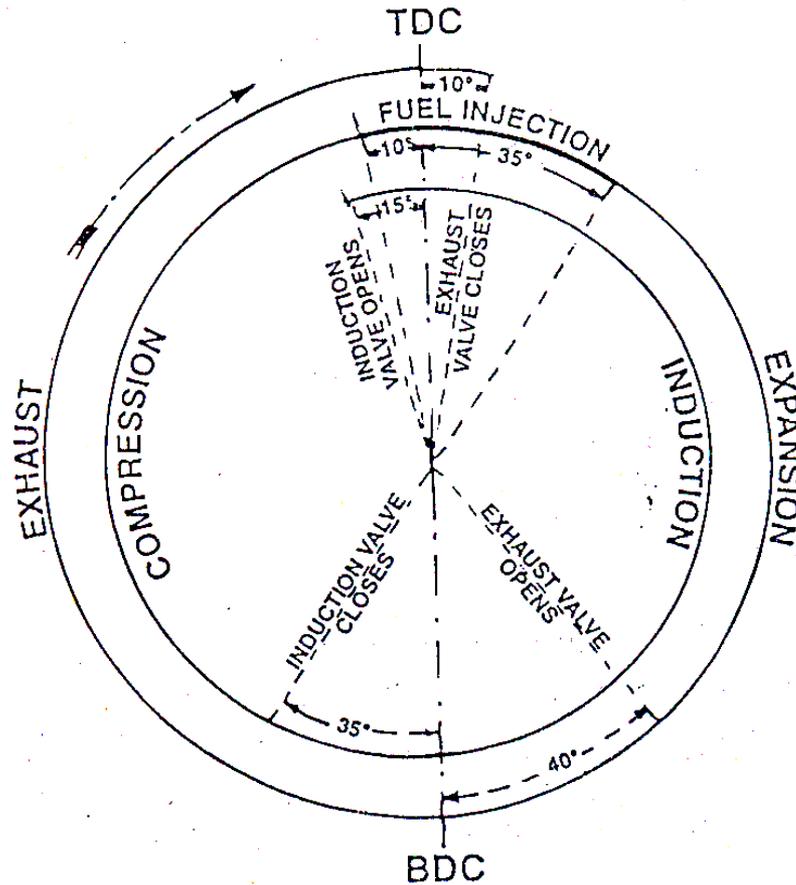
4 stroke
engine
working



4 stroke V type engine



Four stroke timing diagram



**TIMING DIAGRAM FOR A
FOUR-STROKE DIESEL ENGINE**

Thank you