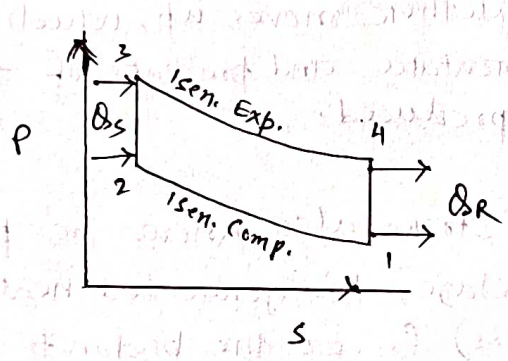
PETROL ENGINE

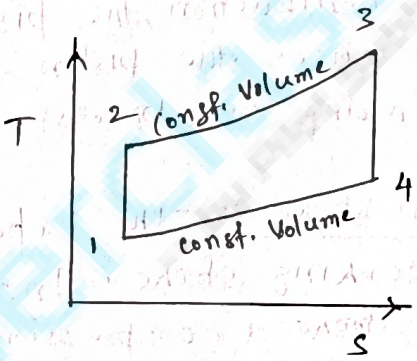
Working Principle :- The petrol engine, also known as spark ignition (SI) engine working principle is similare to the compression ~~ratio~~ ignition (CI) engine, but there is little difference.

A petrol engine works according to the Otto cycle. A petrol engine works in the following process —

* Process 1-2 : Adiabatic (Isentropic) compression
* Process 2-3 : Constant-volume heat addition
* Process 3-4 : Adiabatic (Isentropic) expansion
* Process 4-1 : Constant-volume heat rejection



P-V Diagrame



T-S Diagrame

Petrol Engine engine works on below ways —

* Suction stroke
* Compression stroke
* Expansion or Working or Power Stroke
* Exhaust Stroke

~~* Compression stroke~~
~~* Working stroke~~
~~*~~

⇒ **Suction Stroke :-** For the suction stroke or Intake stroke, the moves piston moves downward. As it moves down, a vaccum creates inside the combustion chamber, due to that, the air-fuel mixture starts coming from the outside into the combustion chamber in correct proportion.

In this stroke, the suction valve opens, and the exhaust valve remains closed.

⇒ **Compression Stroke :-** When the suction process of the air-fuel mixture completes according to the requirements, the piston travels upwards for the air-fuel mixture compression.

As the piston moves up, it pressurizes the mixture into the combustion chamber. During this stroke, the intake valve and exhaust valve are closed.

Due to the compression stroke or process, the temperature of the air-fuel mixture became very high.

At the end of the compression process, a spark plug fires a spark and ignites the air-fuel mixture.

Due to the provided spark, the combustion process of the air-fuel mixture occurs inside the combustion chamber. Due to this combustion, the piston further moves up, which further increases the ~~piston~~ temperature and pressure of the mixture. During this process, heat produced.

⇒ Expansion Stroke :- The expansion stroke also known as power stroke or working stroke. In this stage, the generated heat in the previous stroke (compression process) forces the piston to move downward (TDC to BDC) and turns the crankshaft.

Due to piston's downward motion, the air-fuel mixture expands inside the chamber, and the pressure of the mixture decreases.

⇒ Exhaust stroke :- In this stroke, the piston moves upward, opens the exhaust valve, and releases useless gases from the combustion chamber.

After completing the exhaust stroke, the piston again moves down and all four strokes repeat.

Parts of Petol Engine :- The main parts of Petrol engine are given below —

1. Spark plug
2. Cylinder or Combustion chamber
3. Carburetor
4. Piston
5. Intake or suction valve
6. Connecting rod
7. Exhaust Valve

DIESEL ENGINE

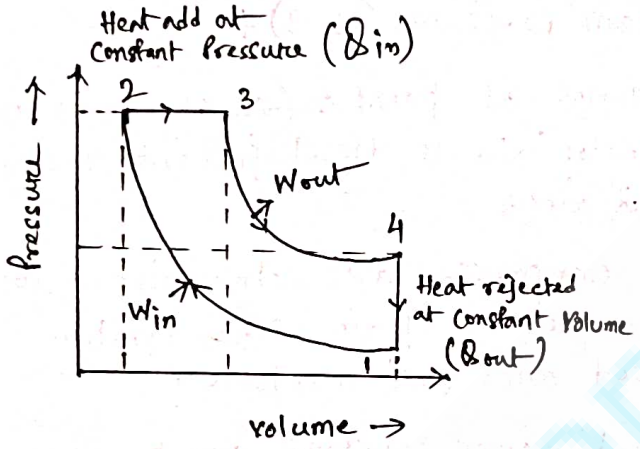
Working Principle of Diesel Engine —

A diesel engine works on the basic principle of the diesel cycle consists of four processes those are —

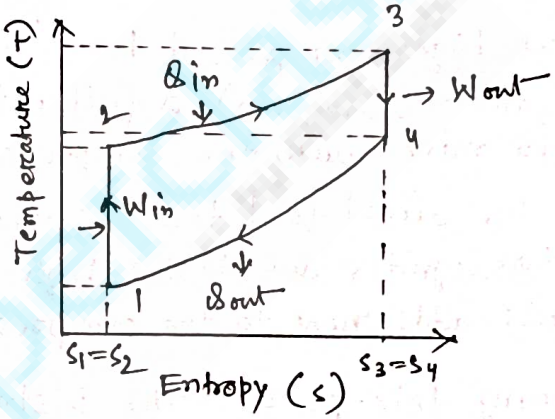
1. Suction Stroke
2. Compression Stroke
3. Expansion stroke
4. Exhaust stroke

OR

1. Process-1 (suction) (0-1)
2. Process-2 [Isentropic Compression] (1-2)
3. Heat Addition at Constant Pressure Process-2 (2-3)
4. Isentropic Expansion Process-4 (3-4)



P-V Diagram



T-S Diagram

⇒ Process-1 [Suction Stroke] - (0-1):

- For the suction of air, the engine piston moves from TDC to BDC (downward stroke). As it moves downward, the fresh air starts entering the engine cylinder from the ~~at~~ atmosphere.
- During this process, the exhaust valve remains closed, and the suction valve opens.

⇒ Process 2 Isentropic Compression (1-2):-

- After suction, the suction valve closes and the piston moves up (from BDC to TDC)
- During the compression process, the temperature of the air increases from T_1 to T_2 the volume reduces from V_1 to V_2 and pressure rises from P_1 to P_2.

- However during this whole process, there is no change in ~~entropy~~ enthalpy ($S_1 = S_2$).
- This process is known as Isentropic because there is ~~change~~ no change of enthalpy.
- In isentropic compression, the air is compressed up to such high ~~temperature~~ temperature and pressure that the air-fuel mixture ignites ~~itself~~ & itself, and it doesn't need any extra external heat source or spark plug.

⇒ Process 3 Heat Addition at Constant Pressure (2-3) :-

- When highly compressed ⅄ air reaches at point 2 (as shown in the PV and TS diagram), a fuel injector injects diesel fuel into the cylinder, which mixes with the compressed air.
- As the diesel fuel touches the compressed air, the air-fuel mixture ignites due to the high compression of air. This ignition process adds heat to the compressed air-fuel mixture.
- During this process, the piston becomes constant, and pressure also remains constant ($P_2 = P_3$). However, enthalpy increases from S_2 to S_3, temperature increases from T_2 to T_3, and also volume increases from V_2 to V_3.

⇒ Process 4 Isentropic Expansion (3-4) :-

- In this process, the mixture expands into the cylinder.
- Due to the expansion, the heat of the ignited air-fuel mixture works on the piston and forces it to move down, which rotates the crankshaft. This rotation of the crankshaft further moves the car.
- During this whole process, the pressure of mixture falls from P_3 to P_4, Volume increases from V_3 to V_4, and temperature also reduces from T_3 to T_4, However, entropy doesn't change $S_3 = S_4$.

⇒ Process 5 Constant Volume Heat Rejection (4-1) :-

- After the expansion process, the piston moves downward to remove the waste heat from the cylinder.

TRANSMISSION SYSTEM

The mechanism that transmits the power developed by the engine of automobile to the engine to the driving wheels is called the Transmission System (Power Train). It is composed of —

- Clutch
- The gear box
- Propeller shaft
- Universal joints
- Rear axle
- Wheel
- Tyres

⇒ Requirements of Transmission System —

- Provide means of connection and disconnection of engine with rest of power train train without shock and smoothly.
- Provide a varied leverage between the engine and the drive wheels.
- Provide means to transfer power in opposite direction.
- Enable power transmission at varied angles and varied lengths.
- Enable speed reduction between engine and the drive wheels in the ratio of 5:1.
- Enable direction of power flow at right angles.
- Provide means to drive the driving wheels and at different speed when required.
- Bear the effect of torque reaction, driving thrust and braking effort effectively.

⇒ Main Units of Transmission System —

- Clutch
- Gear Box
- Transfer Case
- Propeller Shaft and Universal Joints
- Final Drive
- Differential
- Torque Tube
- Road wheel

Type of Transmission System —

1. Manual Transmission
2. Intelligent Manual Transmission (IMT)
3. Automated Manual Transmission (AMT)
4. Automatic Transmission (AT)
5. Continously Variable Transmission (CVT)
6. Semi-automatic Transmission
7. Dual-clutch
8. Sequential
9. Torque Converter
10. Tiptonic

=> Manual Transmission —

A manual transmission is a system that requires the driver to manually select a gear by operating a gear stick and clutch to change gears. This transmission system is consists of a set of gear (different sizes) along with a pair of shafts.

Advantages —

- It is considered better for off-road purposes.
- This type of transmission system provide high torque load.

Disadvantages —

- Not everyone can drive.
- Higher learner curve.
- These are require more work during driving.

=> Intelligent Manual Transmission —

Simply and quite accurately put the Intelligent Manual Transmission is a clutchless manual transmission. It is similare to the manual gearbox, it has gears and gear lever. The drivers almost feel like an automatic car as the IMT doesn't have a clutch padel, but just a brake and an acceleretor pedal.

Advantages —

- By using IMT car, you can have complete control over what gear your car is in and you would not have to rely on software.
- The cost of an IMT is also closer to that of a regulare manual transmission.

Causes and Remedies of clutch troubles —

Here is some common causes of clutch problems and their potential and potential remedies ——

⇒Worn Clutch Disc —

Cause : Over time, the clutch disc can wear down, leading to decreased friction and reduced clutch engagement. This can result in slipping or difficulty shifting gears.

Remedy : The remedy for a worn clutch disc is to replace it with a new one. It is recommended to replace the entire clutch assembly, including the pressure plate and release bearing, to ensure proper functiony.

⇒Clutch Cable or Hydraulic System Issues —

Cause : In vehicles with manual transmissions, a worn or stretched clutch cable or problems with the hydraulic system (clutch master cylinder, salve cylinder, or hydraulic lines) can cause clutch malfuntions.

Remedy : For cable-operated clutches, replacing the worn or stretched clutch cable is necessary. In hydraulic systems, checking for leaks and ensuring proper fluid levels is important. If there are any damaged components, they should be repaired or be replaced accordingly.

⇒Air in the Hydraulic System —

Cause : Air bubbles bubbles in the hydraulic system can lead to a soft or spongy clutch pedal, resulting in incomplete disengagement or engagement of the clutch.

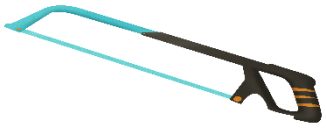
Remedy : Bleeding the hydraulic system to remove air is usually the solution. This involves opening the bleeder valve on the slave cylinder or clutch release cylinder and allowing the air to escape while keeping the master cylinder reservoire filled with the appropriate fluid.

Important things with all important points

1. Hacksaw Frames

Types:

- Adjustable Frame: Can hold different blade lengths (commonly 10 and 12 inches).
- Fixed Frame: Designed for a specific blade length.



Construction:

- Material: Typically made from steel or aluminium for durability.
- Handle: Usually a pistol grip or a straight handle for user comfort.
- Pins: Used to secure the blade at each end of the frame.

Features:

- Tension Adjustment: Allows tightening or loosening of the blade for optimal cutting.
- Blade Positioning: Some frames allow blades to be positioned at different angles for versatile cutting.

Use:

- Suitable for cutting various materials like metal, plastic, and wood.
- Commonly used in metalworking, plumbing, and DIY projects.

Care and Maintenance:

- Regularly check and adjust blade tension.
- Clean and lubricate the frame to prevent rust.
- Replace worn or damaged parts like pins or handles.

2. Hacksaw Blades

Material: Most commonly made from high-speed steel (HSS) for strength and durability. Some blades have a bimetal construction, combining HSS teeth with a flexible steel back.

Types and Sizes:

- Length: Commonly 10 to 12 inches.
- Teeth Per Inch (TPI): Varies based on material to be cut (14 to 32 TPI are common).
- Type: Regular for straight cuts; Wavy for smoother cuts in thin materials.

Selection: Choose a blade with higher TPI for harder materials and finer cuts. Lower TPI blades are better for softer materials and faster, rougher cuts.

Installation and Usage:

- Install with teeth facing forward for standard cutting.
- Ensure blade is properly tensioned in the frame.
- Use with appropriate cutting lubricant for metals.

Care and Maintenance:

- Store blades in a dry place to prevent rust.
- Replace blades that are bent, broken, or have dull teeth.
- Avoid using excessive force to prolong blade life.

Safety:

- Wear safety glasses to protect eyes from flying particles.
- Use gloves to protect hands from sharp edges.

3. Surface Gauge

A surface gauge is a precision tool used in metalworking for scribing lines and measuring flatness or alignment on workpieces.

Purpose and Use:

- Used for marking and measuring in metalworking.
- Assists in scribing lines on workpieces, typically in layout work.
- Helps in checking the flatness or alignment of workpieces on surface plates.

Components:

- Base: Heavy and rigid, usually made of cast iron for stability.
- Column (or Upright): Vertical member, often with adjustable height.
- Scriber (or Scribing Tool): Hardened steel rod for marking; adjustable in height and angle.
- Clamping Mechanism: To secure the scriber at desired position.

Types:

- Simple Surface Gauge: Basic design with limited features.

- Universal Surface Gauge: More versatile with additional adjustments.

Construction:

- Precision-engineered for accuracy.
- Base may have a V-groove to facilitate use on cylindrical surfaces.
- Durable materials to resist wear and maintain accuracy.

Usage Guidelines:

- Place on a clean, flat surface plate for accurate measurements.
- Adjust scriber to required height and lock in place.
- Use light, even pressure to scribe lines.
- Can be used with a dial indicator for more precise measurements.

Maintenance:

- Regularly clean to remove debris and prevent rust.
- Check for wear and accuracy, especially on the scriber point.
- Store in a dry, protected place when not in use.

Safety Tips:

- Handle with care to avoid damaging the precision surfaces.
- Keep fingers away from the scriber point to prevent injury.

Applications:

- Common in machine shops and tool rooms.
- Essential for toolmaking, machining, and inspection processes.

Advantages:

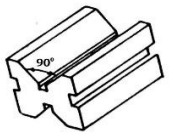
- Provides a precise and reliable method for marking and measuring.
- Versatile tool compatible with various workpiece sizes and shapes.

Limitations:

- Requires a stable and flat reference surface.
- Manual operation; less efficient for large-scale production.

4. V-Blocks

V-Blocks are precision tools for securely holding cylindrical objects during machining, inspection, and layout in metalworking and toolmaking.



Purpose: Used for holding cylindrical workpieces during inspection, layout, and machining.

Construction: Made of hardened steel, cast iron, or other durable materials. Shaped like a "V" to cradle cylindrical objects.

Types:

- Solid: One-piece construction.
- Adjustable: Two-piece design for versatility.

Sizes and Capacity: Available in various sizes to accommodate different diameters of workpieces.

Accuracy: Precision-ground for high accuracy in alignment and dimension.

Accessories: Often used with clamps for secure holding. Magnetic bases for easy attachment to metal surfaces.

Maintenance: Keep clean and rust-free. Store properly to avoid damage.

Applications:

- Widely used in metalworking, machining, and toolmaking.
- Ideal for round or cylindrical parts.

Advantages:

- Ensures stable and accurate positioning of workpieces.
- Facilitates precise machining operations.

5. Marking Off Table

A marking off table is a precision-machined, flat surface used for accurate layout and marking in metalworking and fabrication.

Purpose: Used for accurate layout and marking of workpieces in metalworking.

Construction: Flat, rigid surface, typically made of cast iron. Precision-machined for flatness and smoothness.

Size: Available in various sizes to accommodate different project needs.

Features:

- Often features T-slots or holes for securing workpieces or tools.
- Surface may be treated to resist rust and wear.