



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35.



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DEPARTMENT OF AUTOMOBILE ENGINEERING

23AUT202 – AUTOMOTIVE ENGINES AND EMISSION CONTROL

II YEAR / III SEMESTER

Topic – **Combustion Chambers for SI & CI Engines**



S.I. engine Combustion Chamber Design



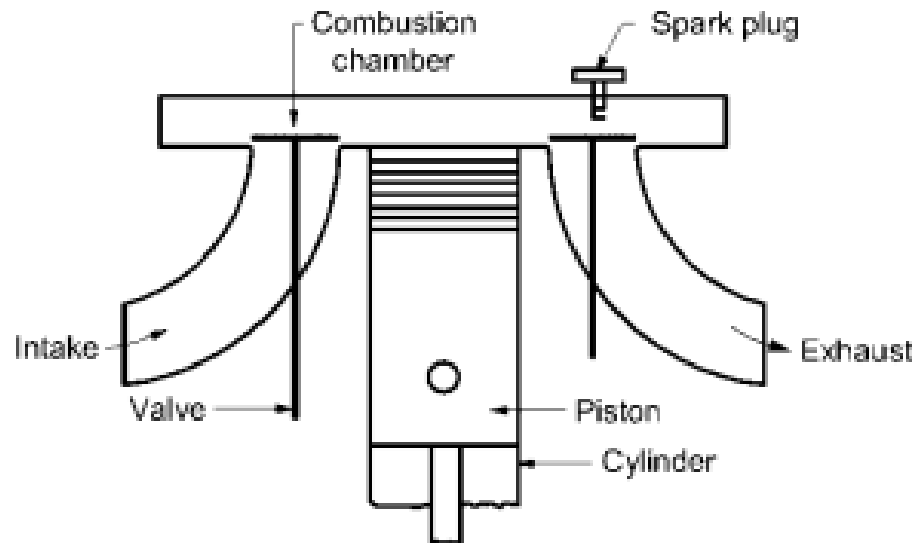
- Design of combustion chamber for S.I engine is very important for following reasons,
 - 1. To achieve high power output.
 - 2. To achieve high thermal efficiency.
 - 3. Smooth running of engine.
 - 4. To avoid knocking or detonation.
 - 5. Long life of engine.
 - 6. Minimum maintenance of engine



Types of Combustion Chambers for S.I. Engines

T-Head Combustion Chamber

- It was used by Ford in 1908 but it is obsolete today.
- It has the following disadvantages :
 1. It needs two cam shafts to operate each valve separately.
 2. Long flame travel, therefore, it has more tendency to detonate. Compression ratios were limited to 5 : 1.
 3. Has high surface-volume ratio.

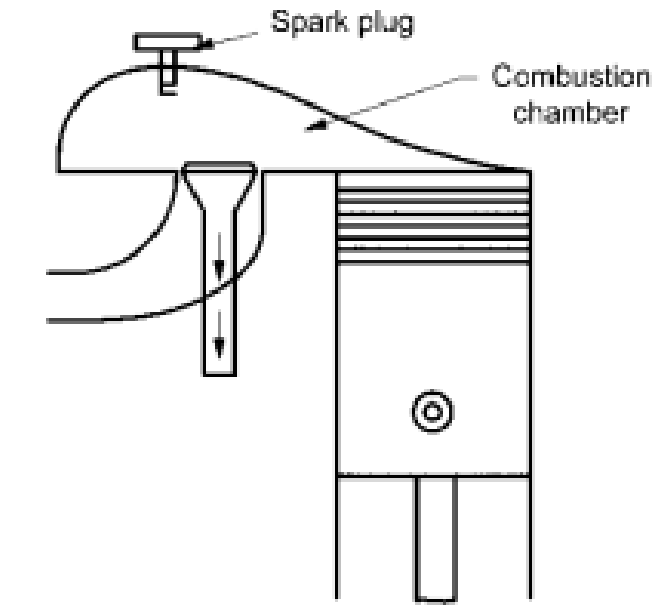




Recardo Turbulent Combustion Chamber



- The design of combustion chamber as suggested by Recardo in the year 1919. However, modifications have been carried out in the design given at later stages.
- The Recardo combustion chamber overcomes the disadvantages experienced in the L-head combustion chamber.
- Recardo combustion chamber provides a turbulent head.





The salient features of this combustion chamber are :

- 1. Combustion chamber provides high turbulence. Because at top dead centre position only a thin layer of charge exists between the piston crown and combustion chamber, due to this the whole charge is pushed back in the combustion chamber during the compression stroke, therefore, it provides additional turbulence.
- 2. Combustion chamber ensures a more homogeneous mixture of fuel and air by scouring away the layer of stagnant gas clinging to the chamber walls.
- 3. The piston comes in closed contact with the combustion chamber head in this design, it reduces the effective length of flame travel. Hence, tendency to detonation is reduced.



4. Because of contact of piston with chamber the mass of end gas is negligible. Therefore impact of detonation will be negligible even if detonation occurs.
5. The detonation tendency is further reduced since the end gas is a thin layer and it is cooled by comparatively cooler cylinder head.
6. Spark plug is centrally located in the combustion chamber, the length of flame travel is reduced. It results into reduced tendency to detonate.



Modern S.I. Engine Combustion Chambers

- After the period of 1950 the combustion chambers used are either overhead valve, also called as I-head, combustion chambers or the F-head combustion chambers. Overhead combustion chambers were first introduced in Ambassador Car in the year 1959.
- The overhead and F-combustion chamber designs are based on principles of Ricardo combustion chamber with certain modifications.
- The advantages of overhead valve combustion chambers on L-head combustion chambers are as follows :
 - 1. Use of large valves or valve lifts and reduced passage ways provides better breathing of the engine, it increases volumetric efficiency of the engine with reduced pumping losses.
 - 2. It gives less tendency to detonate due to reduced flame travel.
 - 3. Less force on head bolts and reduced possibility of leakage.



Modern S.I. Engine Combustion Chambers

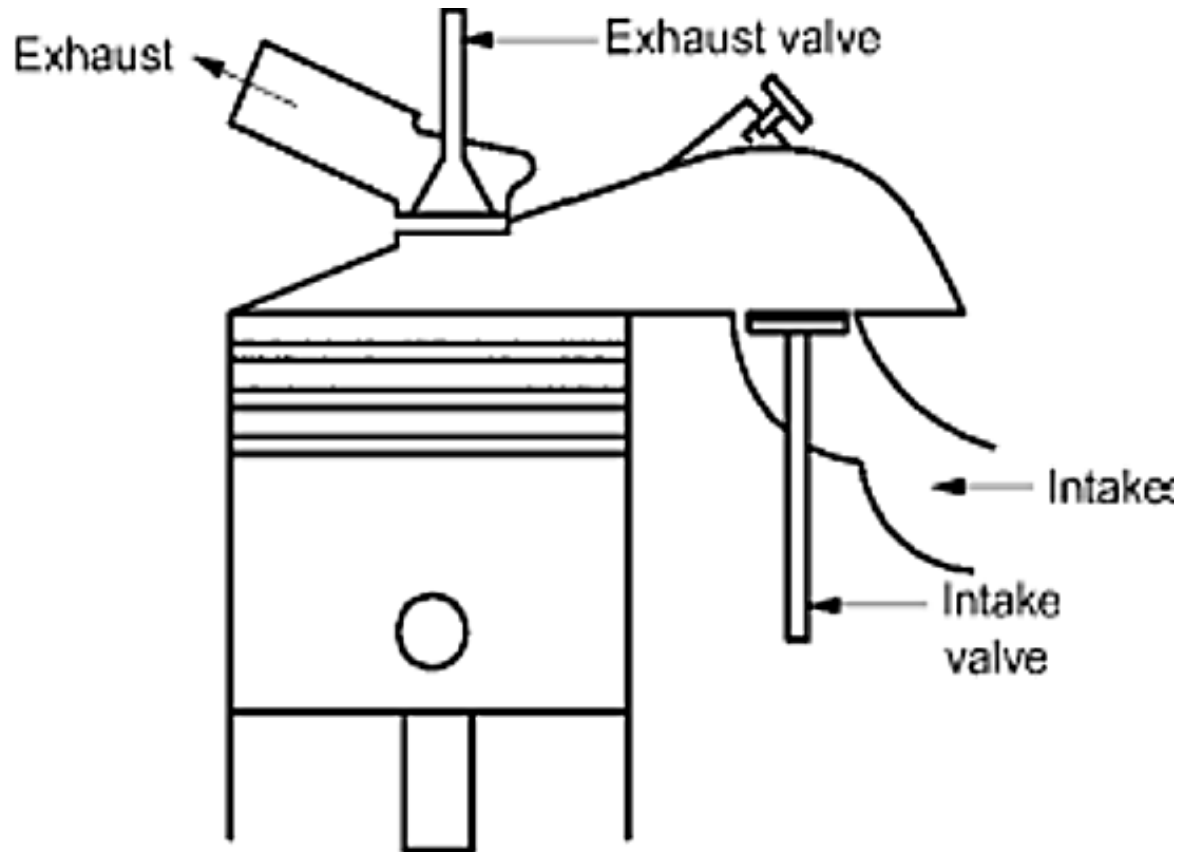
- 4. Exhaust valve is incorporated in the combustion chamber head instead of cylinder block. Therefore, heat failures limited to head only.
- 5. Uses low surface-volume ratio, it reduces the heat losses and increases power output and efficiency.



F-Head Combustion Chamber



- Figure shows the combustion chamber similar to combustion chamber used by Willy's Jeep in India.
- This combustion chamber has all the advantages of modern combustion chambers listed above. The inlet valve is kept in vertical position with large intake area to increase breathing of air and reduce the pumping losses.
- The air during compression stroke creates turbulence due to back flow of air into the chamber.
- Additional turbulence is created by the left hand portion of the piston head when at TDC by squish action.

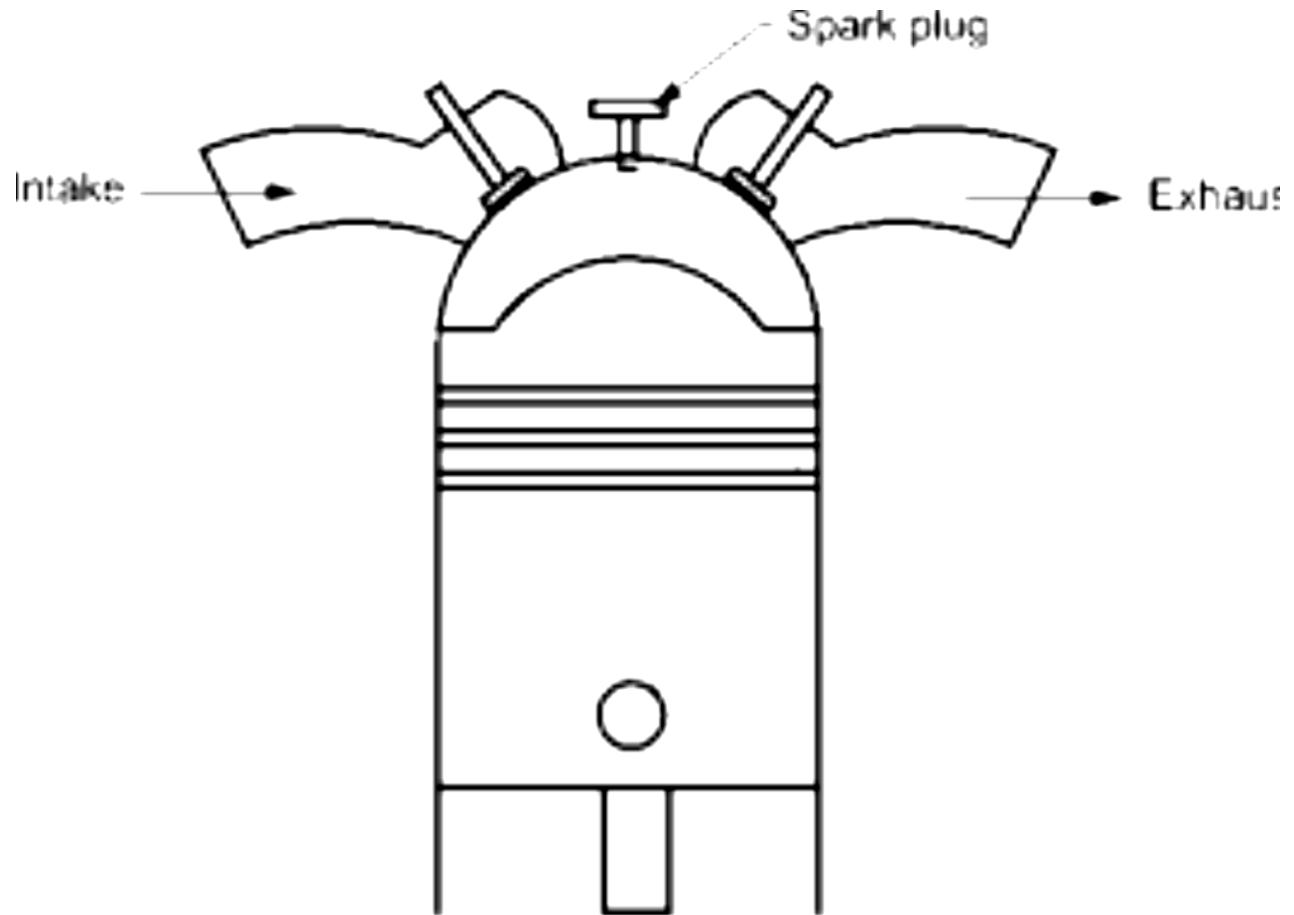




Combustion Chamber for Jaguar Engine



- It utilises the principle that the hemispherical shape gives the minimum surface to volume ratio.
- Such a concept is useful to reduce the head losses thereby increasing the output power and thermal efficiency of the engine.
- The combustion chamber is designed hemispherical shape with inlet and exhaust valves placed on the sides of the head.
- Valves are operated in inclined position.
- Hemispherical shape used not only reduces the heat transfer losses by virtue of low surface to volume ratio, it also permits to use the larger diameter valves, therefore, has higher volumetric efficiency.
- The crown of piston is so shaped to produce required turbulence, therefore, the flame speeds are increased, hence, reduces the tendency to detonate.
- Spark plug is located centrally which reduces the flame travel and again it helps in preventing detonation.





Thank You !