

STRATIFIED CHARGE ENGINE

- The **stratified charge** engine is *usually defined as a S.I. engine* (stratified diesel engine has also been developed) *in which the mixture in the zone of spark plug is very much richer than that in the rest of the combustion chamber i.e one which burns leaner overall fuel-air mixtures*
- **Charge stratification** *means providing different fuel-air mixture strengths at various places in the combustion chamber.*
- The stratified charge engine combines the advantages of both petrol engines (very good full load power characteristics e.g. high degree of air utilisation, high speed and flexibility) and diesel engines (good part-load characteristics) and at the same time avoids as far as possible their disadvantages.

Classification

1. Those using fuel injection and positive ignition (including swirl stratified charge engines)

(a) Stratification by fuel injection and positive ignition :

1. Ricardo system
2. Pre-chamber stratified charge engine
3. Volkswagon PCI stratified charge engine
4. Broderson method of stratification.

(b) Swirl stratified charge engine :

1. Witzby swirl stratification process
2. Texaco combustion process (TCP)
3. Ford combustion process (FCP)
4. Ford PROCO
5. Deutz combustion process (AD-process).

Classification

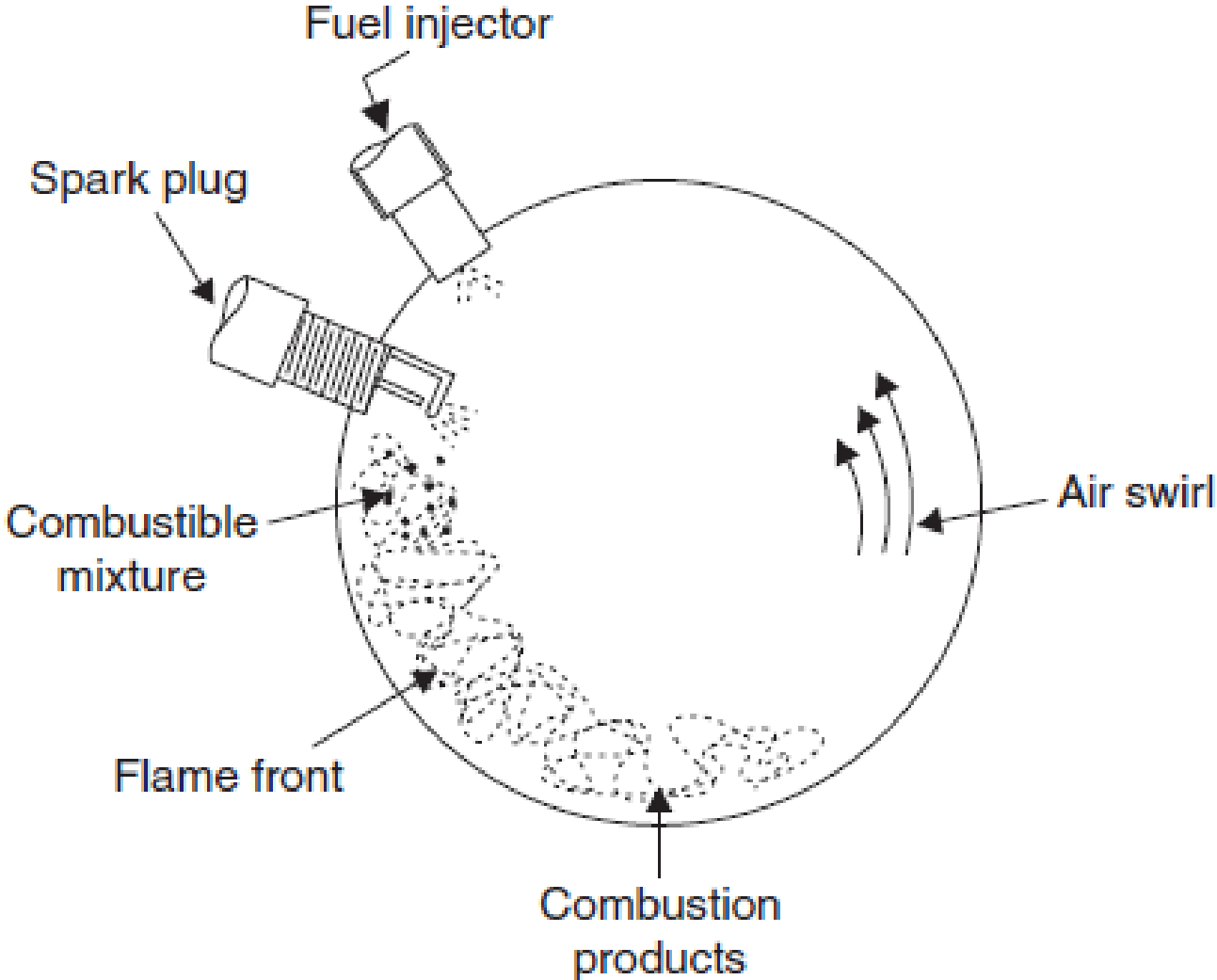
- 2. ***Stratification by carburetion alone***
 1. Russian stratified charge concept.
 2. Institute Francias Du Petrols (IFP) process.
 3. Honda CVCC (Compound Vertex Controlled Combustion) engine.

Texaco combustion process

- The carburetted S.I. engine has several problems and areas of potential weaknesses, these are given below :
 - (i) The end charge has a long residence time. It may become highly reactive, and it may cause knock. Therefore a fuel of high octane rating is required.
 - (ii) Homogeneous mixtures with the fuel-air limits of propagating a flame yield relatively low enthalpy efficiencies and also relatively high HC and NOx emissions.
 - (iii) Throttling as a means of controlling output induces a pumping loss.
 - (iv)
 - (v) Flame quenching at the walls adds to air pollution.

To overcome these weaknesses (and hopefully without adding others) stratified charged engine has been developed.

Barber's Texaco combustion process



Advantages of Stratified Charge Engines

1. Compact, lightweight design and good fuel economy.
2. Good part-load efficiency.
3. Exhibit multi-fuel capability.
4. The rich mixture near the spark plug and lean mixture near the piston surface *provides cushioning to the explosive combustion.*
5. *Resist the knocking* and provide smooth combustion resulting in smooth and quiet engine operation over the entire speed and load range.
6. Low level of exhaust emissions ; NO_x is *reduced* considerably.
7. Usually *no starting problem.*
8. *Can tolerate wide quality of fuels.*
9. Can be manufactured by the existing technology.

Disadvantages of Stratified Charge Engines

1. For a given engine size, charge stratification results in *reduced power*.
2. These engines create *high noise level at low load conditions*.
3. *More complex design* to supply rich and lean mixture, and quantity is varied with load on the engine.
4. *Higher weight* than that of a conventional engine.
5. Unthrottled stratified charge engines *emit high percentage of HC* (due to either incomplete combustion of lean charge or occasional misfire of the charge at part load conditions).
6. Reliability is yet to be well established.
7. Higher manufacturing cost.