

## **Chapter six**

### **Mixture formation in diesel engine**

#### **Introduction:**

In diesel engine there an internal method of mixture formation. So the conditions in Diesel in diesel engine are difficult because of

1. Short time of fuel injection (20-40)<sup>o</sup>C.A.
2. Greater viscosity of Diesel fuel
3. Bad evaporation of Diesel fuel

There are two basic method of mixture formation in diesel engine

1. Volume way (fuel goes to air)
2. Thermal way (air goes to fuel)

#### 1. Volume way of mixture formation:

Is characterized by a multi holes nozzle and corresponding form of combustion chamber.

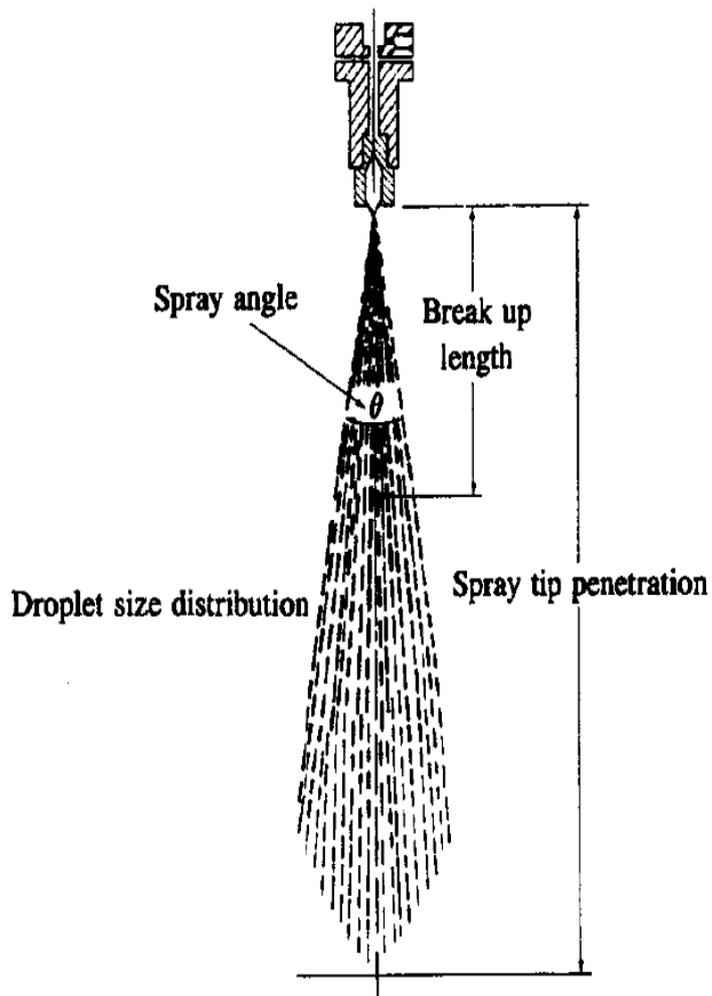


Figure 6.1 Schematic of diesel fuel spray

The geometry of spray depends on many parameters particularly on the following

1. Air specific mass in combustion chamber

2. Fuel viscosity

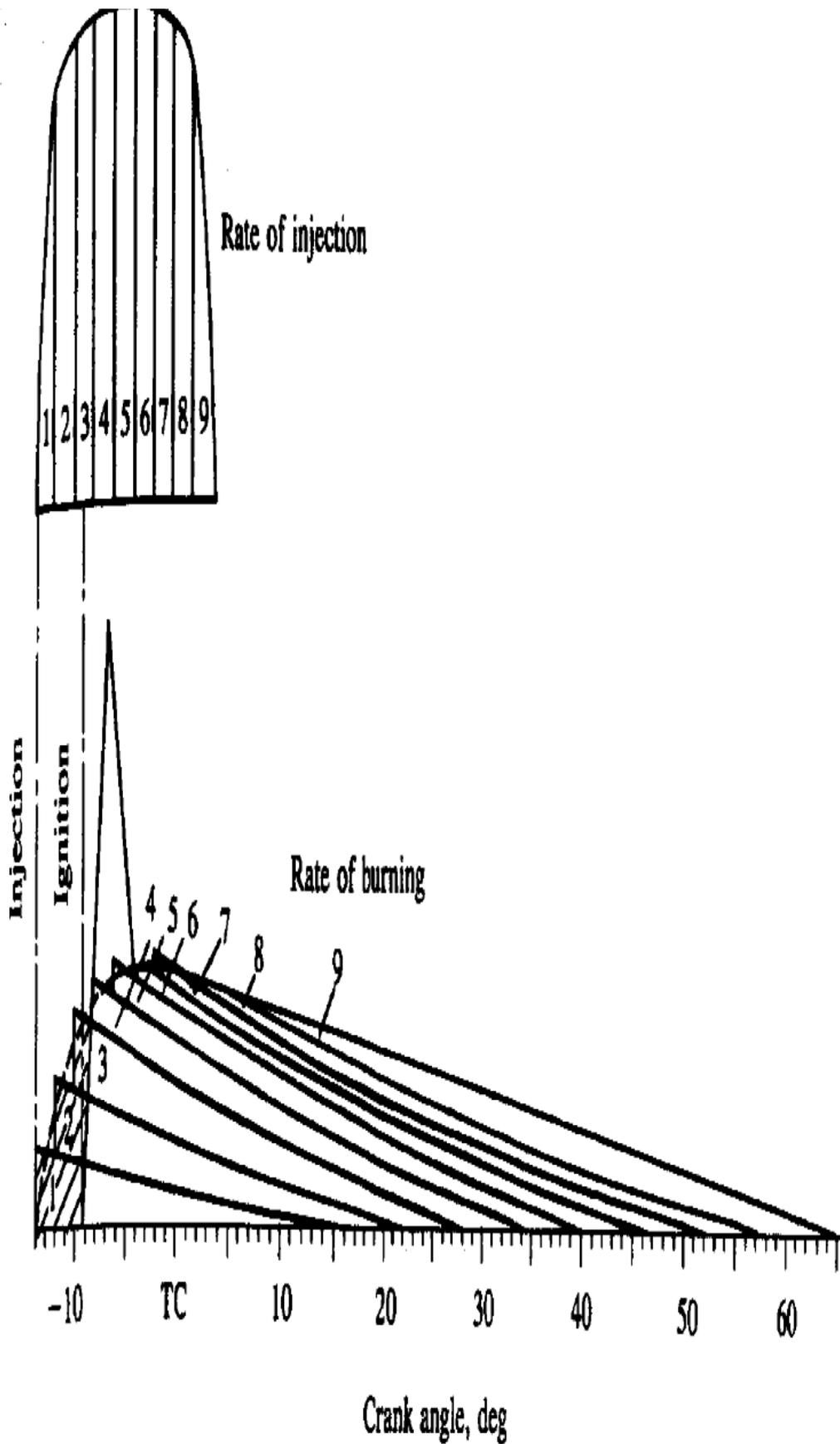
3. Orifice diameter

2. Thermal way of mixture formation

Fuel is injected into the combustion chamber to form a thin film of fuel (i.e. evaporated and mixing with air takes place continuously)

Dr Meurer of M.A.N. Germany after 20 years of research developed in 1954 (M process) engine which run without typical diesel combustion noise and hence it was named "whisper engine".

The M combustion chamber is a special type of open combustion chamber, having combustion chamber in the piston cavity



**Factor affecting combustion in a compression ignition engine**

- **Fuel properties:**

Viscosity and surface tension of the fuel influence the degree of atomization and the volatility of the fuel affects the rate of formation of combustible mixture. These properties generally influence the physical part of the ignition lag period. The chemical reaction characteristic of the fuel represented by its cetan number will influence mainly the chemical part of the ignition lag. The higher the percentage of the paraffin hydrocarbons in the fuel the higher will be its cetan number. The ignition delay of the fuel will be shorter and smoother engine operation will result. With higher percentage of aromatic hydrocarbons in the fuel the ignition delay will be longer and the engine operation will be rough when such fuels are used in the engine.

- **Injection advance:**

If the injection is timed a few degrees of crank rotation before TDC the ignition lag is minimum, since the average pressure and temperature of air during this period are high. The rate of pressure rise and the maximum pressure will be moderate. A greater injection advance will increase the ignition lag due to lower average pressure and temperature of air during this period. The rate of pressure rise and maximum pressure will increase sharply due to great amount of fuel accumulated in the combustion chamber up to the moment of injection and also due to piston motion (reduction or change in combustion chamber volume).

- **Compression ratio:**

A higher compression ratio reduces the ignition lag because the temperature and pressure of air at the beginning of injection is

higher. The rate of pressure rise is reduced and the operation of the engine is smoother.

- **Pressure and temperature of inlet air:**

Increases of both these factors decreases the ignition lag and therefor help in smooth running of the engine.

- **Speed of engine:**

A change in speed of engine affect the volumetric efficiency, spray characteristic and intensity of swirl motion of air. The time ignition lags slightly decreases due to increase in volumetric efficiency and the temperature of the residual gas will increase in engine speed. But the lag increases of crank travel increases.

Ordinary injection equipment injects a given quantity of fuel per degree of crank angle travel, therefor the total quantity of fuel injected during ignition lag increases with increase in speed of the engine and results in higher rate of pressure rise and increase maximum pressure.