04 · April · 2022

Fuel Injection System in SI engine

Apart from the several disadvantages of carboration system, the fuel injection in the SI engine is an alternative. Fuel injection is getting popularity on modern vehicle with multi cylinder engine. Fuel injection is a system for mixing fuel with air in an internal combition engine

1. The fuel speed at the point of delivery is greater than air speed, therefore fuel is properly automized into very fine droplets.
2. Proper spray pattern to ensure rapid mixing of fuel & air.
3. Accurate metering of the fuel injector per cycle. The quantity of the fuel meter should Ready to met changing speed and load.
4. Timing of fuel injection can monitered in the cycle to obtain maximum power ensuring.

5. Proper control of rate of injetion the amount of fuel deliver into the air stream going which forces under fuel pressure

6. The desire heat is release pattern is achieved during combution.

7. Un

08-Apl-2022

Lubrication System:

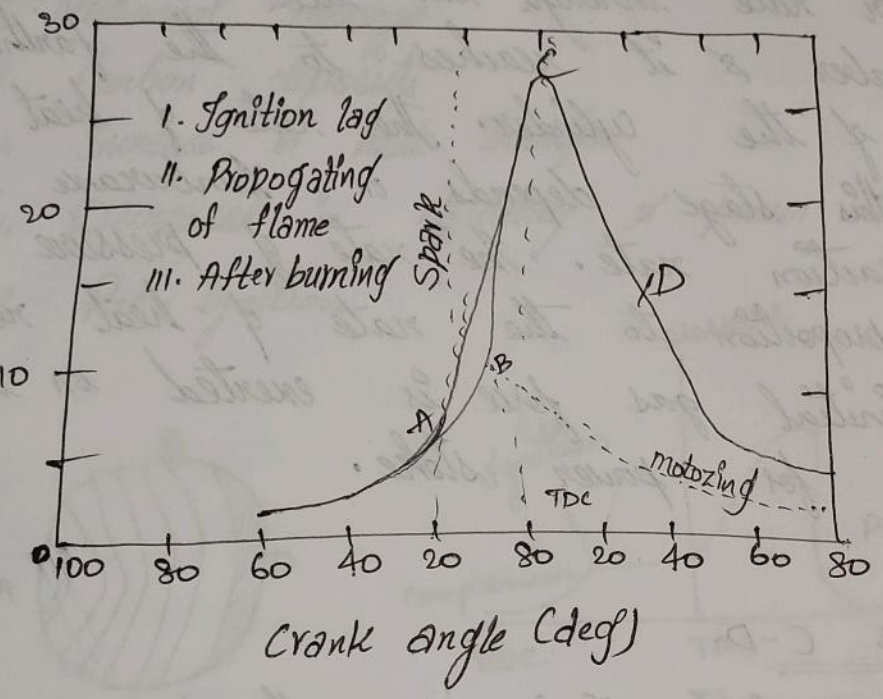
The various

1. Mist lubrication system
2. Wet sump lubrication system
3. Dry sump

UNIT- II

12- Apr -2022

Normal Combustion in SI engine



Stage 1 A-B It is refered as the preparation phase (ignition lag) in which fuel elinent become ready to react chemically with the O_2 & compressed air. The chemical process which depends on T & P & nature of charge. The growth & development of the propogating nucleus of flame takes place in this phase.

Stage 2 B-C

The 2nd stage occurs when the piston approches the TDC & the flame is propogated at a faster rate through out the combustion chamber & it reaches to the farthest end of the cylinder. The rate of heat release in this stage depends on turbulance intensity & reaction rate. The rate of pressure rise is proportion to the rate of heat release. The initial gas force is exerted on the piston for power stoke.

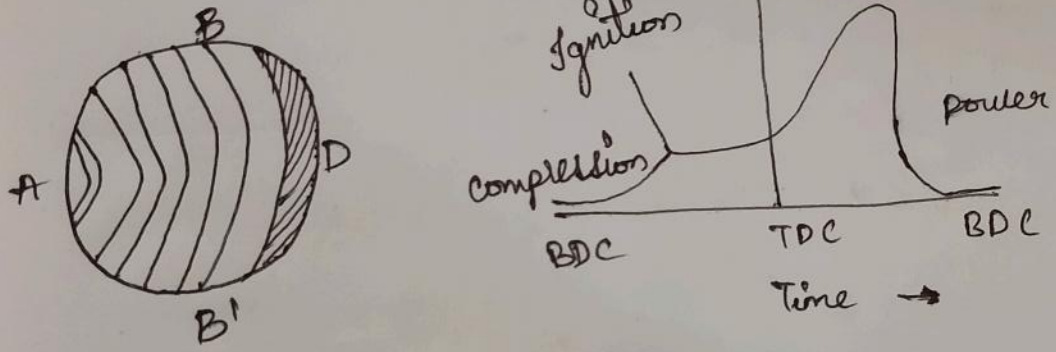
Stage 3 C-D

This stage starts from the movement at which maximum P is reached in the cylinder. This stage occurs during earlier part of the expansion stock & the flame velocity decreases & the rate of combustion becomes slowed. There is no pressure raise during this stage.

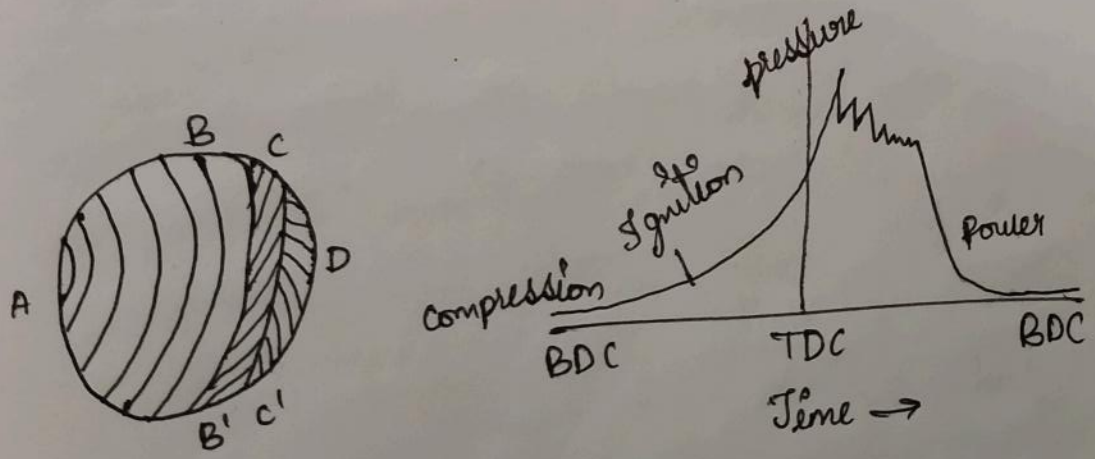
19-Apr-2022

Effects of Detonation:

i. Noise and Roughness
ii. Mechanical damage
iii. Carbon deposists
iv. Increase in heat transfer
v. Decreased in effiiency & power output
vi. Pre-ignition



Normal combustion



combustion with detonation

27-May-2022

Volumetric efficiency

Ratio of mass of actual charge inducted into the cylinder to the mass of charge corresponding to the swept volume

$$\eta_{vol} = \frac{\text{actual mass flow rate of the charge}}{\text{density} \times \text{swept vol per second}}$$

$$\eta_{vol} = \frac{\dot{m}_a}{\rho\left(\frac{\pi}{4} d^2 L\right)\frac{n}{60}}$$

ρ = density

L = Stroke

n = no. of effective suction strokes per cycle per minute

= N for a two stroke

= $\frac{N}{2}$ for 4 stroke

$$\eta_{vol} = \frac{V_{air}}{V_s}$$

Q) A rope brake dynamometer is used to measure the brake power of a single cylinder four stroke cycle petrol engine. It is found that the torque due to torque load was 175 N/m and engine make 500 rpm. Determine the break power developed by the engine.

Sol Given Torque (T) = 175

A Single cylinder four stroke cycle per engine.

N = 500 rpm

$$Bp = \frac{2\pi NT}{60,000}$$

$$= \frac{2 \times \pi \times 500 \times 175}{60,000} = 9.162 \text{ KW}$$

Q) A four cylinder, four stroke petrol engine develops indicated power of 14.7KN at 1000 rpm. The mean effective pressure is 5.5 bar. Calculate the bore & Stroke of the engine, if the Stroke is 1.5 times the bore.

Sol Given

K = 4

Ip = 14.7 KN

N = 1000 rpm

$$n = \frac{N}{2} = \frac{1000}{2} = 500$$

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$L = 1.5d$

$A = \frac{\pi}{4} d^2$

$IP = Pm \frac{LANK}{60}$

$$= \frac{550 \times 14.7 \times 1.5d \times \frac{\pi}{4} d^2 \times \frac{1000}{2} \times 4}{60}$$

$d^3 = 6.806 \times 10^{-3} m^3$

$d = 0.08796 m = 87.96mm$

6) A four cylinder, 2 stroke cycle petrol engine develops 35 KW at 2500 rpm. The mean effective pressure on each piston is 8 bar & mechanical efficiency is 80%. Calculate the diameter of each cylinder if the stroke ratio is 1.5 also calculate the fuel consumption of the engine if the break thermal efficiency is 28%. Calculate the Kerosene value of the fuel is 43,900 KJ/Kg

A four cylinder gasolin engine operators on four stroke engine the bore of each cylinder is 90 mm & the stroke is 110 mm. The clearence volume 60cc at a speed of 3500 rpm. The fuel consumption is 18 kg/hr & torque developed is 140 Nm. Calculate

1. Break power
2. ~~MAEP of the Calo~~ Break mean effective
3. $C_v = 42000$
4. Relative efficiency on a break power basesassuming the engine works on constant cyles

$K = 4$
$d = 90\,mm$
$L = 110\,mm$
$B_c = 60\,cc$

1. Break power

$$BP = \frac{2\pi NT}{60,000} = \frac{2 \times \pi \times 3 \cancel{500} \times 140}{\cancel{60000}\ 30}$$

$$= \cancel{2 \times \pi \times N \times 14} = 51.31\,KW$$

2. Heat supplied by fuel

$$\cancel{BP}_{nom} = P_{mb} \frac{LANK}{60}$$

$$P_{mb} = \frac{BP \times 60}{LANK}$$

$$= \frac{51.31 \times 60 \times 2}{0.11 \times \frac{\pi}{4} (9 \times 10^{-3}) \times 3500 \times 4}$$

$$= 6.28 \text{ bar}$$

$$\dot{Q}_m = \dot{m}_f \times C_V$$

$$= \left(\frac{18}{3600}\right) \times 42000$$

$$= 210 \text{ KW}$$

BP thermal efficiency

$$\eta_{bth} = \frac{BP}{Q_{in}} = \frac{51.31}{210} = 24.4\%$$

Relative efficiency

Swept volume

$$V_s = \frac{\pi}{4} d^2 L$$

$$= \frac{\pi}{4} \times (90 \times 10^{-3}) \times 0.11$$

$$= 7 \times 10^{-4} \text{ m}^3$$

$$= 700 \text{ cc}$$

Total volume of cylinder

$$V_1 = V_s + V_c = 700 + 60 = 760 \text{ cc}$$

compression ratio $r = \frac{V_1}{V_c} = \frac{760}{60} = 12.67$

Air stand

η_{th} =

η ot

η_{rel}

b) The

en

c

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Air standard efficiency of otto cycle

$$\eta_{as} = 1 - \frac{1}{r^{\gamma-1}} = 1 - \frac{1}{(12.67)^{1.4-1}}$$

$$\eta_{otto} = 63.78\%$$

$$\eta_{relative} = \frac{\eta_{actual}}{\eta_{air\ stand}}$$

$$= \frac{24.4}{63.78}$$

$$\eta_{rel} = 38.25\%$$

6) The following data & results refers to two stroke engine indicated mean effective pressure cylinder dia 21cm piston stroke(L) 28cm engine speed (N) 360 rpm, Break torque 620 K/m. Fuel consumption 8.1 Calorific value 42,700 . Calculate

1. Mechanical effiency
2. Indicated thermal effi
3. Break thermal effi
4. Break specific consumption in Kg/KW

17-June-2022

A single cylinder four stroke diesel engine works on the following data

Cylinder bore 15cm

Stroke 25cm

Speed N = 250 rpm

Area of the indicated diagram = 6cm²

length of the indicated diagram = 9cm

Spring constant = 7.5 bar/cm

Break specific fuel consumption = 0.24 Kg/KwH

Calorific fuel (Cv) = 42000 KJ/Kg

Diameter of break wheel = 70cm

Rope diameter = 3.5cm

Break load = 40 Kg

Calculate

1. Break power
2. Indicated mean effective pressure
3. Indicated power
4. Mechanical efficiency
5. Indicated thermal efficiency

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$$R_{brake} = \frac{D_{brake} + d_{rope}}{2}$$

$$P_{mi} = \frac{\text{Area of indicated diag}}{\text{length of indicated diag}} \times \text{Spring Const}$$

$$\frac{6}{9} \times 7.5 = 5 \text{ bar} \leftarrow$$

21-June-2022

Refrigerator

The science providing & maintaining the below that of the temperature is called Refrigerator.

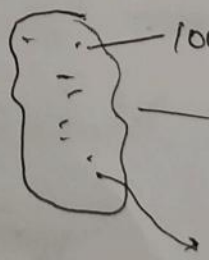
The capacity of refrigerator machine in the terms of tonnes of refrigeration (TR)

1TR is the amount of refrigerating effect (heat removed) produced by uniform melting of 1 ton (1000Kg) of ice from and at 0°C in 24 hrs using specific enthalpy of fusion of ice as 333.43 KJ/Kg

$$1TR = \frac{1000\,(Kg) \times 333.43\,(KJ/Kg)}{24\,(h) \times 60\,(min)}$$

LH wah

SH



American society

1TR = 1016

$$\frac{1016 \times 33.43}{24 \times 60} = 233.25$$

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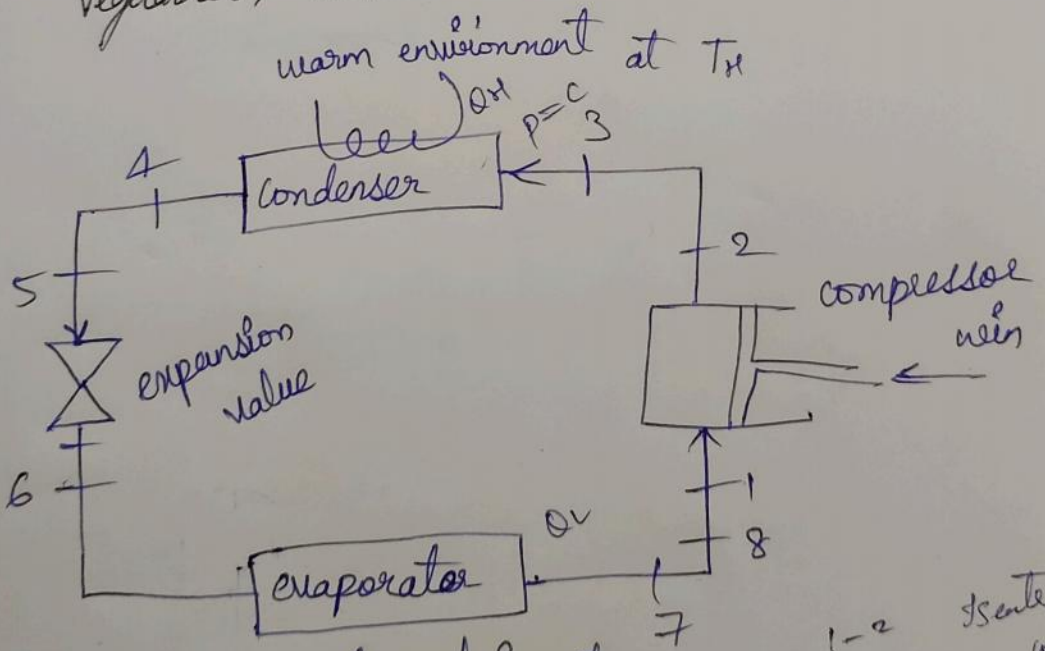
Application

1. It is used for preservation items like fruits, vegetables, fish, meat and etc
2. Refrigeration is used for storing drugs, vaccines.
3. It is used in operations
4. It is used for preservation of ice creams.
5. It is used for providing comfort air conditioning in schools, colleges, etc

Industries to employ working environment for employees to work, pesetion, used in cold storages for preservation of fruits & vegetables, control rooms & air crafts.



1-2 Isentropic comp
2-3 - cont press heat rej
3-4 - Isentropic expn
4-1 - cont press heat abstn