Modified Internal Combustion Engine using Compress Air

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Abstract— In this paper we have discussed about internal combustion engine with compressed air. Nowadays large numbers of automobiles are running on road, and these uses petrol, diesel, gasoline, etc. as a fuel. We have discussed V-shape engine, in that one of cylinder work on air fuel mixture and another cylinder works on compressed air, so that engine economy will be increased, that reduce pollution also increase mileage of our automobile. This will have beneficial for future automotive world and can run long lasting with minimum fuel source.

Keywords: V-Shape Engine, Internal Combustion Engine, Compress Air, IC Engine

I. INTRODUCTION

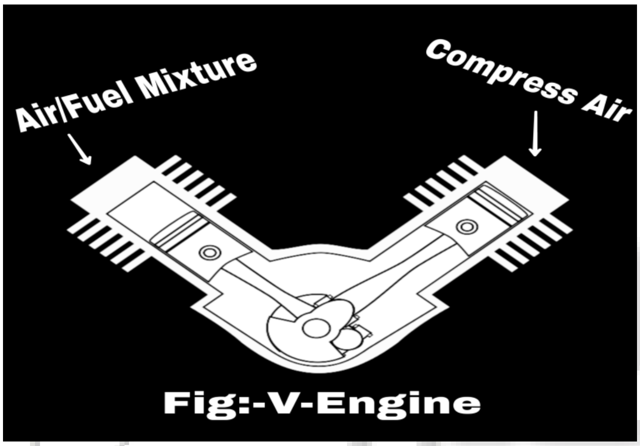

Fig. 1: V-Engine

In this paper we have introduce new arrangement of cylinder in modification of IC engine. In V-engine the cylinder and pistons are aligned, in two separate planes or banks, so they appear to be in a "V" when viewed along the axis of the crank shaft. Normal working of IC engine in includes air fuel mixture to complete combustion cycle; in addition to this we have introduced compressed, in V-engines one cylinder will normally works on air fuel mixture while another cylinder will works on compressed air (15psi) that will, such that requirement of air-fuel mixture will be minimum. Due to this the efficiency of our automobile will be increase. V-engine is more compact than straight engine with cylinders of the same dimensions and number. This effect increases with the number of cylinders in the engine; there might be no noticeable difference in overall size between v-twin and straight engine.

II. WORKING

Four stroke cycle IC engine- A four-stroke (also four-cycle) engine is an internal combustion (IC) engine in which the piston completes four separate strokes while turning the crankshaft. A stroke refers to the full travel of the piston along the cylinder, in either direction. The four separate strokes are termed as below;

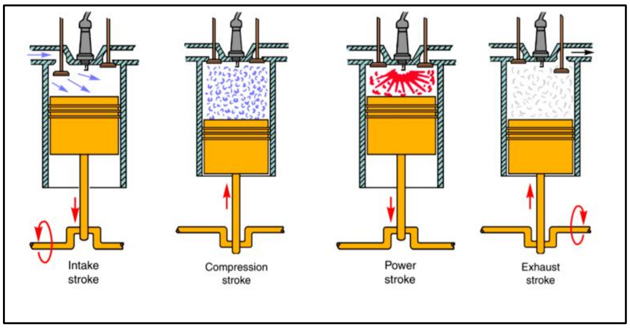

Fig. 2: Four stroke engine

A. *Intake:*

Also known as induction or suction. This stroke of the piston begins at top dead center (T.D.C.) and ends at bottom dead center (B.D.C.). In this stroke the intake valve must be in the open position while the piston pulls an air-fuel mixture into the cylinder by producing vacuum pressure into the cylinder through its downward motion. The piston is moving down as air is being sucked in by the downward motion against the piston.

B. *Compression:*

This stroke begins at B.D.C, or just at the end of the suction stroke, and ends at T.D.C. In this stroke the piston compresses the air-fuel mixture in preparation for ignition during the power stroke (below). Both the intake and exhaust valves are closed during this stage.

C. *Combustion:*

Also known as power or ignition. This is the start of the second revolution of the four stroke cycle. At this point the crankshaft has completed a full 360 degree revolution. While the piston is at T.D.C. (the end of the compression stroke) the compressed air-fuel mixture is ignited by a spark plug (in a gasoline engine) or by heat generated by high compression (diesel engines), forcefully returning the piston to B.D.C. This stroke produces mechanical work from the engine to turn the crankshaft.

D. *Exhaust:*

Also known as outlet. During the exhaust stroke, the piston, once again, returns from B.D.C. to T.D.C. while the exhaust valve is open. This action expels the spent air-fuel mixture through the exhaust valve.

E. *Compressed Air Working*

In this paper we have discuss about theoretical working of V-shape arrangement engine, as earlier fig. shows working of modified IC engine.

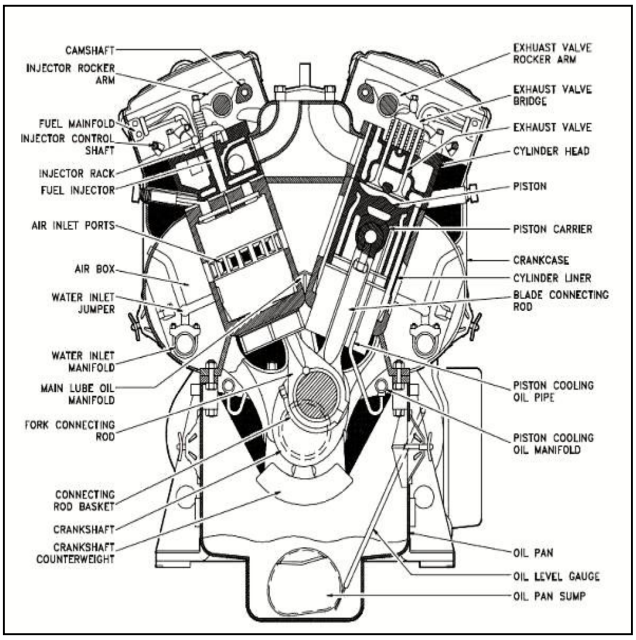

Fig. 3: Modified IC Engine

F. Suction

Suction stroke will contain air fuel mixture in one cylinder while another will have compressed air at a same time, required air-fuel ratio will be minimum as (14:7:1) as we introduced compressed air. Exhaust will be done as, exaust valve will opens, burnt particles released from cylinder (1) and used compressed air released to atmosphere, and this will reduce pollution, as possible.

III. ABOUT OTTO CYCLE

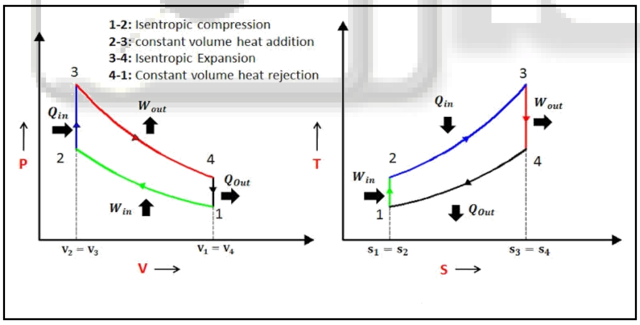

Fig. 4: P-V and T-S Diagram of Otto cycle

A. Total Cylinder Volume:

It is the total volume (maximum volume) of the cylinder in which Otto cycle takes place. In Otto cycle, Total cylinder volume = V1 = V4 = Vc + Vs where,

Vc → Clearance Volume

Vs → Stroke Volume

B. Clearance Volume (Vc):

At the end of the compression stroke, the piston approaches the Top Dead Center (TDC) position. The minimum volume of the space inside the cylinder, at the end of the compression stroke, is called clearance volume (Vc). In Otto cycle, Clearance Volume, Vc = V2 (See p-V diagram above)

C. Stroke Volume (Vs):

In Otto cycle, stroke volume is the difference between total cylinder volume and clearance volume .Stroke Volume, Vs = Total Cylinder Volume – Clearance Volume = V1 – V2 = V4 – V3

Compression Ratio: Compression ratio (r) is the ratio of total cylinder volume to the clearance volume.

r= {Total Cylinder Volume}/{Clearance Volume}

r= {V1/V2}/{V4/V3}

Now that we know the basic terms, let us derive expressions for T2 and T3. These expressions will be useful for us to derive the expression for air-standard efficiency of Otto cycle. For finding T2, we take process 1-2 and for finding T3, we take process 3-4.

D. Process 1-2:

This process is an isentropic (reversible adiabatic) process. For this process, the relation between T and V is as follows:

$$\frac{T_2}{T_1} = \left(\frac{V_1}{V_2}\right)^{\gamma - 1} = r^{\gamma - 1} \quad \left(\text{Since}, \frac{V_1}{V_2} = r\right)$$

$$T_2 = T_1 \times r^{\gamma - 1} \quad ..... (i)$$

E. Process 3-4:

This is also an isentropic process. The relation between T and V in this process is similar to the relation between T and V in process 1-2:

Here,

$$\frac{T_3}{T_4} = \left(\frac{V_4}{V_3}\right)^{\gamma - 1} = r^{\gamma - 1} \quad \left(\text{Since}, \frac{V_4}{V_3} = r\right)$$

$$T_3 = T_4 \times r^{\gamma - 1} \quad ..... (ii)$$

F. Air-standard efficiency of Otto cycle:

It is defined as the ratio between works done during Otto cycle to the heat supplied during Otto cycle. Air-Standard Efficiency (thermal efficiency) of Otto cycle,

$$\eta_{th} = \frac{\text{Work Done}}{\text{Heat Supplied}}$$

$$\eta_{th} = 1 - \frac{(T_4 - T_1)}{(T_3 - T_2)}$$

$$\eta_{th} = 1 - \frac{(T_4 - T_1)}{\left(T_4 (r)^{\gamma - 1} - T_1 (r)^{\gamma - 1}\right)} \quad [\text{From } (i) \text{ and } (ii)]$$

$$\eta_{th} = 1 - \frac{(T_4 - T_1)}{(T_4 - T_1)(r)^{\gamma - 1}}$$

$$\eta_{th} = 1 - \frac{1}{r^{(\gamma - 1)}}$$

IV. COMPRESSED AIR CYLINDER AUTONOMY

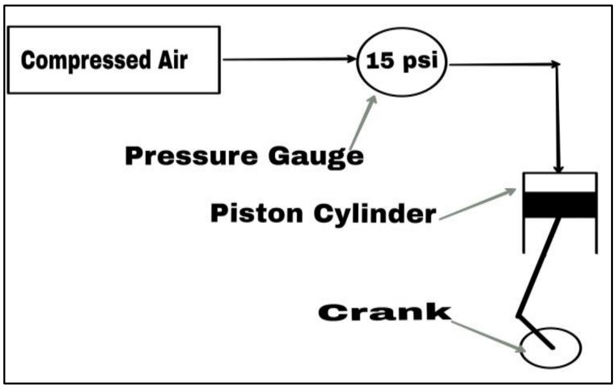

Fig. 5: Block Diagram of Compressed Engine

Bore stroke= 73x71.1 mm
Compression Ratio= 11.0: 1
Pressure required to drive or movement of piston = 15psi
Engine rpm=4000rpm
D=73mm
L=71.1mm
N=4000rpm
Compression ratio = 11.0
Pm=15psi = 1.03521 bar = 103421.35 N/m^2
Tmax=115N.m
Power required;
P= 2x3.14NT/60x1000
P=2x3.14x4000x115/60x1000
P=48.17KW
I.P=Pm x L x A x N/60x1000
I.P=2.05x10^9KW

A. *Efficiency*

$$\eta = 1 - \frac{1}{(r_c)^{\gamma - 1}}$$

$$= 1 - \frac{1}{(11)^{1.4-1}}$$

$$\boxed{\eta = 61.67\%}$$

V. ADVANTAGES

- Engine economy will be increase.
- Fuel requirement lowered.
- Pollution free.

VI. DISADVANTAGE

- Compressed air cylinder assembly increases weight of vehicle.

VII. CONCLUSION

In this way, we have make our theoretical paper for modified internal combustion engine, which will have maximum efficiency with minimum air fuel mixture ratio requirement that will advantageous environment.

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