Performance of Six Stroke Engine in a Hybrid Vehicle

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Abstract: *The aim of the obtainable paper is to realize the newest trends in internal incineration Engine while maintaining its leading spotlight on six stroke engine. The essential idea to this paper is to execute a six stroke engine joined to an electric motor in hybrid vehicle. This would then be numerically analyzed with obtainable hybrid vehicles like cycles, car etc. The important characteristic is to in reality combine the valuable actions of both hybrid machinery and six stroke engines. The parameters all through the assessment are efficiencies, fuel expenditure, etc. The enlargement of a more resourceful six stroke internal burning engine – the final two strokes calculated to harness the desecrate heat energy – has been explored moderately unproductively for over 100 years. Recent advances in technologies, materials, analytical modeling and simulation capabilities has opened the possibility of major advances towards the design and enlargement of a dependable, cost efficient and ultra efficient six stroke engine. The paper progresses with the governing six stroke engine principles in ideal case and then slowly implementing the idea in practical sagacity with four stroke engine.*

Keywords: *Six Stroke Cycle, Air Induction organization, Water Injection structure, Hybrid vehicles.*

I. INTRODUCTION

The **six-stroke engine** is a type of internal combustion engine based on the four-stroke engine, but with supplementary intricacy anticipated to make it more resourceful and reduce emission. Two types of six-stroke engine. The first move toward is single piston proposed and another one is opposed piston. There are working mutually. Single piston design, the engine captures the warm vanished commencing the four-stroke Otto cycle and uses it to control a supplementary power and fatigue stroke of the piston in the corresponding container. Designs use moreover mist or air as the functioning fluid for the further influence stroke. Opposed piston design, uses a second conflicting piston in every cylinder that moves at partially the cyclical velocity of the foremost piston, thus generous six piston arrangements per cycle. Functionally, the second piston replaces the valve instrument of a conventional engine but also increases the firmness proportion.

It consists of six strokes which are outstanding to the sweeping hybridization of two strokes and four strokes, i.e. the piston in every shift goes up and down six times for the vaccination of energy. The six stroke engine consists of 2 chambers having domestic incineration and al fresco incineration where, the unemployed or waste heat up from the 4 stroke Otto cycle is then worn to carry out additional strokes. These 2 supplementary strokes augment the work extracted per unit input of force, which then guide to 40% enlarge in fuel competence than the four stroke Otto succession. The six strokes of the four stroke cycles are as follows: The principal

stroke in the succession is the intake stroke. Throughout this stroke, the piston is moving effortless and the intake valve is discharge.

This descending association of the piston produces a fractional vacuum in the container, and air and fuel sprint into the cylinder standard the open intake valve. While the piston reaches foundation quiet center at the end of the intake stroke the ingestion valve closes and seals the upper end of the container. As the crankshaft continues to go around, it pushes the concerning rod up alongside the piston. The piston then moves increasing and compresses the explosive mixture in the container. This achievement is known as the compression stroke. In gasoline engines, the assortment is compacted to about one-eighth of its innovative amount. As the piston reaches top deceased center at the end of the firmness stroke, the ignition system produces a stimulating flash. The flash sets fire to the fuel-air concoction. In smoldering, the mixture gets exceedingly hot and expands in all guidelines.

The heaviness rises to about 600 to 700 pounds per square inch. Because the piston is the only ingredient that can progress, the force fashioned by the mounting gases services the piston down. This energy is approved through the regarding rod to the crankpin on the crankshaft. Behind the fuel-air concoction has burned, it must be unfurnished origination the container. Consequently, the weaken valve opens as the authority stroke is completed and the piston starts back up on the weaken stroke. The piston services the burned gases of the cylinder past the unfasten drain regulator.

II. SIX STROKE ENGINE AND ITS PROCESS

i. Air induction system:

The six strokes engines as discussed earlier are basically used for high power output and high fuel efficiency. In the air induction system, the air from air filter is then passed to the mass flow sensor. Higher compression engines have the benefit of maximizing the amount of useful energy extracted per unit of fuel. Therefore, the thermal efficiency of the engine is increased in accordance with the vapor power cycle analysis of the second law of thermodynamics. The motivation all engines are not elevated firmness is because for any specified octane, the fuel will impulsively spark off with a privileged than normal solidity ratio. These are called preignition, discharge and can cause severe engine damage. This leads to detonation effect or pre-ignition in the system. This effect produces clamor which is at the moment eliminate by using a silencer. This heat can auxiliary be eliminated by the intercoolers which help in cooling the warmth of the hot compacted air and thus shrink its heaviness. This increases the performance by rejecting heat into the atmosphere. As it provides higher power and is useful in high load capacity engine, this system can be seen in aircrafts.

ii. Water injection:

The water may attract heat as the associate is compacted, thus dropping firmness work. An accompanying effect come presently throughout burning when the water absorb gigantic amounts of heat up as it vaporizes, falling peak warmth and consequential NO_x construction, and plummeting the amount of heat energy immersed into the container walls. Certain additional engines can assistance for

further from the power use of water vaccination. Archetypal pulse jet engines have enormously poor fuel effectiveness, unambiguous fuel employment, and driving force. Water injection has been demonstrated to use the desecrate heat that causes a pulse jet to glow red hot furthermore convert it into force. It cools the engine, it pulls additional air in, and it reduces effluence. Water injection and other earnings of boost may be competent to renovate the pulse jet from a noisy, inefficient tube to a cleaner burning and powerful enough engine that may be of use in lightweight aircraft.

Water as it is notorious for its unswerving properties has a particular heat importance of about 4.18 J/g ^{o}C The vaporization of any liquid is in use into version by its chattels called as 'the concealed heat of vaporization' which determines the revolutionize in state of water from liquor to gaseous circumstances. The water injection classification is initialized after the warmth exceeds 40^{o}C. It gives higher solidity ratios and thus provides antiknock properties to the classification which help in shielding the system from discharge as well as present a resourceful influence stroke. The water injection method is presumed to be better than air induction method while water have a superior heat combination faculty than air also when air absorbs the heat and expands in the 5th stroke it generates towering pressures in the locomotive head important to high anxiety on container.

iii. Advantages of six-stroke engine:

- Thermal competence accomplishment 50%.
- Fuel utilization concentrated by more than 40%.
- Diminution of chemical, blast and the pollution.
- Two expansions (work) all the way through six strokes.

iv. Disadvantages of six-stroke engine:

- Multifarious head intend.
- Composite come design for fatigue.
- Heavier engine.
- Thermodynamically the engine id unwavering, yet the conniving of parts happen to more and further complex as the target prerequisite increases.

III. HYBRID TECHNOLOGY

The gasoline-electric hybrid vehicle is immediately what it sounds resembling a cross involving a gasoline-powered vehicle and a magnetic vehicle. A gas-powered vehicle has a fuel container, which provisions gasoline to the locomotive. The engine then turns communication, which turns the wheels. The hybrid is conciliation. It attempts to appreciably augment the mileage and diminish the emissions of a gas motorized vehicle whereas overcoming the shortcomings of a stimulating vehicle.

To be useful to us, a vehicle must meet assured lowest amount necessities. The vehicle must be able to:

- Drive at smallest amount 300 miles (482 km) prior to re-fueling.
- Be refueled speedily and effortlessly.
- Keep up among the additional traffic on the highway.

Gasoline-electric hybrid vehicle surround the subsequent parts:

Gasoline engine- The hybrid vehicle has a gasoline engine greatly approximating the one you will unearth on nearly all vehicles. Nevertheless, the engine on a hybrid is less significant and uses

sophisticated technologies to decrease emissions and Increase effectiveness.

Fuel reservoir–The fuel container in a hybrid is the vigor cargo space apparatus for the gasoline locomotive. Gasoline has greatly elevated energy compactness than batteries do.

Electric motor- The electric cruise on a hybrid vehicle is very difficult. Sophisticated electronics tolerate it to act as a cruise as well as an originator. For example, when it needs to, it can describe liveliness from the batteries to speed up the vehicle.

Generator– The generator is analogous to an electric cruise, but it acts scarcely to create electrical authority. It is worn recurrently on sequence hybrids.

Batteries–The batteries in a hybrid vehicle are the power storage apparatus for the stimulating motor. Dissimilar the gasoline in the fuel cistern, which cans solitary power the gasoline locomotive, the stimulating motor on an amalgam vehicle can put vigor into the batteries.

Transmission–The transmission on a hybrid vehicle performs the equivalent indispensable occupation as the transmission on an unadventurous vehicle.

IV. OBJECTIVES OF HYBRID VEHICLE

The prime aim to investigate a six stroke engine alongside with a hybrid vehicle is taken into selflessness on the basis of its fuel effectiveness and power saving. The working of 4stroke engine is very well known and the remaining two strokes. The hybrid cars substantiate a regenerative braking system which helps in maintaining the fuel efficiency by charging the regenerative batteries after the engine is congested. Thus, the arrangement of six strokes and a hybrid vehicle would lead into an extraordinary vehicle engine machinery, which will not only increase the existing fuel efficiency in total of the system with regards to its personality fuel efficiencies but would also renew the total system in terms of its mileage, supremacy harvest and most extensively it's stipulate.

V. PROS AND CONS

PROS:

- Superior for the atmosphere
- Fuel resourceful
- With the aid of new technologies, hybrids tolerate the same kind of routine like ordinary vehicle.
- Wherever you may go, hybrids have tax assistance and hoard money spent on fuel
- The car doesn't requirements to expend much liveliness to do the similar task because hybrids are made using lighter materials
- Hybrids can acquire everyplace from 48-60 miles per gallon. As a result you can save your cash even the worth of gas scramble
- The motivation why people covet to have a hybrid is since of slighter damage it caused to the atmosphere than the established automobile gas automobile. Hybrids emit less toxic emissions compared to the vehicles with gab.

CONS:

- It's in reality that abundant hybrids vehicle arrive with great warranties. But, if incredible goes immoral with the vehicle, parts may not be as voluntarily presented as common car parts for established vehicle.
- Hybrid vehicle used multipart dual coercion that make it high repairing cost and not all

technicalities are qualified to work on hybrid vehicles.

- Hybrids are built for market and not for velocity. The total supremacy output of the hybrid is often taken away than an equivalent gas mechanical vehicle.

VI. CONCLUSION

The augmented effectiveness is a result of recuperating heat principally from the locomotive incineration gases. The improved heat is changed to involuntary vigor at the crankshaft by intensifying condensation in the engine incineration compartment. This structure of waste heat is improved & is proficient by using a six-stroke engine cycle. It will be explain that hybrid vehicle are the largest part imperative in our day today life but it's barely contest at the future atmosphere not in this location. The paper conclude that the implementation of accommodating conclusion of a hybrid vehicle and six stroke engines would help in the betterment of globe economic organization as it helps in lessening of effluence and it would also maintain the improvement of vehicle industry as it focuses on fuel effectiveness which has become a prime objective. Six-stroke engine is a most developing economic field. That's help to vehicle improvement for future. This structure of waste heat is improved & is proficient by using a six-stroke engine cycle.

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