Internal Combustion Engine

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Abstract - Future internal combustion engines for light duty applications will have to cope with a very complex set of customer, legal and business requirements. Customers are expecting further improvements in durability, reliability, drivability, fuel economy, and cost of ownership. Legal requirements are focused on significant emission and fuel consumption reductions. Additional manufacturing cost reductions will be essential to maintain, or better grow the business in a very competitive environment.

The challenge for the diesel engine will be to meet the future emission standards at affordable cost, while maintaining its fuel economy advantages. Regarding the emissions, advanced diesel technologies will have to focus mainly on NOx reduction. New combustion system concepts in combination with advanced air handling/boosting and control systems offer a promising potential.

The focus for future gasoline engine development will be on fuel economy improvements through improved combustion systems and reduced throttle losses at part load operation. This can be achieved through e.g. direct fuel injection with Stratified lean part load operation. Downsizing in combination with boosting offers an additional potential. Internal combustion engines still have a huge potential to deal with the challenges of the future. In comparison with alternative power train concepts, at least for the next 20 years, the internal combustion engine should be able to maintain its advantages regarding high power density, low manufacturing cost, recyclability, and long driving distance between two refueling events, well established fuel supply infrastructure, and its capability to use a wide variety of fuels.

Despite the green hype, internal-combustion engines will keep powering vehicles for the foreseeable future.

Key Words: I.C.Engine, Compressibility, recyclability

1. Introduction

"It is type of heat engine in which the chemical energy of the fuel is released inside the engine and used directly from chemical work, as opposed to an external combustion engine in which a separate combustor is used to burn the fuel."

A heat engine is a device which transforms the chemical energy of a fuel into thermal energy and uses this energy to produce mechanical work. Heat engines are classified into two types

The ***internal combustion engine*** is an engine in which the combustion of a fuel (normally fossil fuel) occurs with an oxidizer (usually air)in a combustion chamber .In an internal combustion engine the expansion of the high-temperature and-pressure gases produced by combustion applies direct force to some component of the engine, such as pistons, turbine blades ,or a nozzle. This force moves the component over a distance, generating use fuel mechanical energy.

The term ***internal combustion engine*** usually refers to an engine in which combustion is intermittent, such as the more familiar four-stroke and two-stroke piston engines, along with variants, such as the Winkle rotary engine .A second class of internal combustion engine uses continuous combustion gas turbines, jet engines and most, each of which are internal combustion engines on the same principles previously described.

The internal combustion engine (or ICE) is quite different from external combustion engines, such as steam or Sterling engines, in which the energy is delivered to a working fluid not consisting of, mixed with, or contaminated by combustion products. Working fluids can be air, hot water, pressurized water or even liquid sodium, heat and some kind of boiler.

Automotive engineering has seen a spate of innovations in the past decade, MV's (Multiple valve's), DOHC's (Double overhead cams), MPFI (Multi-port fuel injection) and DFI (Direct fuel injection) which, when combined with stronger and lighter carbon composites and metal alloys, are rapidly bringing reciprocating internal combustion engine technology, as we know it, to a point where the full potential of the engine has almost been realized. Extensive coverage in magazines and other media have reported on almost every aspect of the working of these innovations and the advantages their implementation has resulted in, such as better fuel economy, more power and a cleaner engine. What is less widely known is the fact that in spite of the huge amounts of money and man hours spent on researching and implementing these products the overall efficiency of the RI engine has been increased by a mere 5%. The engine is now less than 25% efficient as compared to an original efficiency of less than 20%. The expected improvement in performance has fallen far below expectations.

2. Background

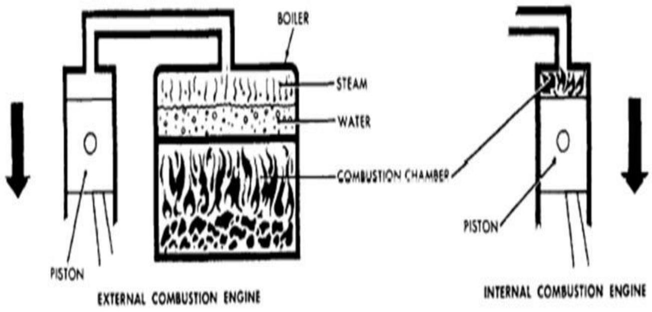
Electrical generators capable of high conversion efficiencies and extremely low exhaust emissions will no doubt power advanced hybrid vehicles and stationary power systems. Fuel cells are generally considered to be ideal devices for the applications where hydrogen or methane is used as fuel. However, the extensive development of the IC engine, and the existence of repair and maintenance industries associated with piston engines provides strong incentives to remain with this technology until fuel cells are proven reliable and cost competitive. In addition, while the fuel cell enjoy high public relations appeal, it seems possible that it may not offer significant efficiency advantages relative to an optimized combustion system. In light of these factors, the capabilities of internal combustion engines have been reviewed.

In regards to thermodynamic efficiency, the Otto cycle for an I.C.Engine cycle. This is due to the fact that the fuel energy is converted to heat at constant volume when the working fluid is at maximum compression. This combustion condition leads to the highest possible peak temperatures, and thus the highest possible thermal efficiencies.

III. Working and description of combustion engine-

We define an engine ‘simple machine that converts heat energy to mechanical energy. The engine does this through either internal or external combustion. Combustion is the act of burning. Internal means inside or enclosed. Thus, in internal combustion engines, the burning of fuel takes place inside the engine; that is, burning takes place within the same cylinder that produces energy to turn the crankshaft. In external combustion engines, such as steam engines, the burning of fuel takes place outside the engine. The external combustion engine contains a boiler that holds water heat applied to the boiler causes the water to boil which produces steam. The steam passes into the engine cylinder under pressure and forces the piston to move downward.

Within internal combustion engine the combustion takes place inside the cylinder and is directly responsible for forcing the piston to move downward. The change of heat energy to mechanical energy by the engine is based on a fundamental law of physics. It states that gas will expand upon the application of heat. The law also states that the compression of gas will increase its temperature. If the gas is confined with no outlet for expansion, the application of heat will increase the pressure of the gas .In an engine, this pressure acts against the head of a piston, causing to move downward



3. Implementation and application-

Internal combustion engines are most commonly used for mobile propulsion systems. In mobile scenarios internal combustion is advantageous, since it can provide high power to weight ratios together with excellent fuel energy-density. These engines have appeared in almost all automobiles, motorbikes, many boats, and in a wide variety of aircraft and locomotives. Where very high power is required, such as jet aircraft, helicopters and large ships, they appear mostly in the form of gas turbines. They are also used for electric generators and by industry.

For low power mobile and many non-mobile applications an electric motor is a competitive alternative. In the future, electric motors may also become competitive for most mobile applications. However, the high cost, weight, and poor energy density of lead-acid batteries and even NiMH batteries and lack of affordable on board electric generators such as fuel cells has largely restricted their use to specialist applications. However recent battery advancements in lightweight Li-ion and Li-poly chemistries are bringing safety, power density, lifespan, and cost to within acceptable or even desirable levels. For example recently battery electric vehicles began to demonstrated 300 miles of range on Lithium, now improved power makes them appealing for plug-in hybrid electric vehicles whose electric range is less critical having internal combustion for unlimited range.

4. CONCLUSIONS

The traditional advantages of internal combustion (IC) engines refer to:

A. The high power density (power to volume and weight).
B. The high energy content and the ease of onboard storage of liquid fuels.
C. The well-established manufacturing processes that has been optimized through many years.
D. The driving distance between two refueling events (which is typically much longer with IC engines than with many of the discussed future alternatives).
E. The well-established worldwide fuel supply infrastructure.
F. The capability to effectively use a variety of alternative gaseous and liquid fuels.
G. IC engines still have a huge potential to effectively deal with most of the sometimes conflicting requirements for future automotive power trains.
In particular they can achieve:

i. Further increase of power and torque.
ii. Further size and weight reductions.
iii. Further improved fuel economy.
iv. Further reduced emissions.

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