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REVIEW ON LATEST AUTOMOTIVE TECHNOLOGIES

PRIYA GUPTA[1], VIKRANT SHARMA[2], MUKUL PALIWAL[3], ATUL KUMAR[4]

1.3rd year MED, MUST, Lakshmangarh.

2.Asst. Prof., MED, MUST, Lakshmangarh

3.Asst. Prof., MED, MUST, Lakshmangarh

4.Asst. Prof., MED, MUST, Lakshmangarh

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Abstract: This paper focuses the technical features and the working of the advanced technologies used in the present or in the future automobiles. The technologies that are examined in this paper are Valvetronic Engines, Downsizing, variable valve timing and Turbocharging, Weight Reduction Materials, Advanced Combustion Modes, Hybrid / Electric Vehicles, Fuel Cells, Alternative Fuels, Batteries and Energy Storage, 42 volt system, Drive by wire Technology, Camless engine, Exhaust gas recirculation, Sterling engine opposed piston engine, Split cycle engine, Free piston engine and Wankel rotary engine. A crucial analysis with their advantages and disadvantages of these technologies are made in this paper. A final inference is drawn that once these technologies are brought in the market they will not only help in providing better modes of transport but will also help in reducing our reliance on conventional fuels.

Keywords: Engine, Fuel cell, batteries, camless Engine, hybrid vehicles

Corresponding Author: PRIYA GUPTA

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INTRODUCTION

The main purpose for new engine technology is changing customer expectations, new environmental regulations & noise, availability of alternate fuels, new emerging markets increased fuel costs and cut throat competition. These drivers are causing researchers to think in the track of more efficient and economical technologies. The above mentioned objectives were obtained by bringing changes in the engines or by fitting it with improved parts in the automobile. This improves not only market value of a vehicle but opens researches in new areas combinations for welding dissimilar metals for better mechanical properties.

A SHORT HISTORY

After the invention of the automobile by Karl Benz in 1886, numerous changes were made to self-powered vehicles so they were better suited to human requirements and abilities. The seatbelt was introduced for steam-powered horseless carriages in the 1800s, but its sole purpose was to keep passengers on their seat, instead of keeping them safe in the case of a collision. Early automobiles were not fitted with any type of gauges. Oil-pump gauges were the first instruments installed inside vehicles. Water-pressure gauges were also fitted around 1900. After around 1910, instruments such as tachometers and clocks were installed inside automobiles. ASH Motors installed the first seatbelt in 1949. In 1952, Daimler Benz, introduced the non-deformable passenger cell, the crumple zone and collapsible steering column.

LATEST AUTOMOTIVE TECHNOLOGIES

(i) VARIABLE VALVE TIMING

In this camshafts are cut with a three-dimensional profile that change along the length of the cam lobe. At one end of the cam lobe is the least aggressive cam profile, and at the other end is the most aggressive. The shape of the cam smoothly combines these two profiles together. A mechanism can slide the whole camshaft laterally so that the valve engages different parts of the cam. The shaft still spins just like a regular camshaft, but earlier by gradually sliding the camshaft laterally as the engine speed and
load increase and in this way the valve timing can be optimized .

(ii) VALVETRONIC ENGINES

Valvetronic engines varies the timing and the lift of the intake valves. The Valvetronic system has a conventional intake cam, but it also uses a secondary eccentric shaft with a series of levers and roller followers, activated by a stepper motor. Based on signals earlier taken mechanically from the accelerator pedal, the stepper motor changes the phase of the eccentric cam, modifying the action of the intake valves. These engines reduce maintenance costs, lowers exhaust emissions, and provides a smoother running engine.

(iii) DOWNSIZING AND TURBOSIZING

Downsized engines are lighter than conventional engines, therefore reducing vehicle mass and thus refining vehicle fuel consumption. In petrol and diesel vehicles, the turbocharger has a centrifugal compressor powered by a turbine that is run by the engine's exhaust gases. Hot exhaust gases flow through the turbine's wheel blades, accelerating the turbine and driving the compressor. Turbocharging recovers the energy of the exhaust gasses to increase the inducted charge, therefore increasing the power-to-displacement ratio. A downsized and turbocharged engine has the potential to have the better performance as a non-downsized, normally aspirated engine, with the advantage of a significant rise of fuel efficiency.

(iv) ADVANCED COMBUSTION MODES

Some of advanced combustion modes includes direct combustion system in both petrol and diesel engine with advance version like GDI (Gasoline direct injection) in petrol CRDI (Common rail diesel injection) in diesel and. Another mode is Some Studies on Advanced Technologies used in Automobiles 345 called (homogeneous charge compression ignition) HCCI. It use spark ignition for heavy load operation but in case of light load the lean mixture can be ignited throughout a cylinder without a spark. The "homogenous charge" is a uniform mix of air, fuel and up to 70 percent of the already-burned exhaust gases. Compression stroke brings the mixture to a controlled self-ignition state and thus no spark is required. Because of the uniform mix in the cylinder, there's no hot flame front, and the mixture burns almost instantly and completely throughout the cylinder.

(v) HYBRID/ELECTRIC VECHILES

Hybrid vehicles are equipped with both combustion and electric engines. This technology holds great ability, especially for its use in smaller vehicles running at lower speeds for short distances, in highly populated urban areas. The two variants recently launched in India are Honda Civic are Toyota Prius.

(vi) FUEL CELL TECHNOLOGY

A fuel cell works as an electrochemical cell by combining hydrogen and oxygen without combustion to produce electricity. Inside a cell fuel hydrogen is passed over a negatively charged pole, or anode, where electrons are stripped off through catalytic action. The hydrogen ions that result then flow through the conducting substance (known as electrolyte) towards a positively charged pole or cathode. The electron flow produces an electric current. The hydrogen ions are left to combine at the cathode with oxygen, producing heat and water. Ethanol, methanol and hydrogen are the main sources of fuel for the production of electricity from fuel cells. The electricity generated drives the car. (Mehrdad Ehsani, 2005).

(vii) WEIGHT REDUCTION MATERIALS

As it takes less energy to accelerate a lighter object than a heavier one, Lightweight materials offer great potential for increasing vehicle efficiency. Substituting cast iron and traditional steel components with lightweight materials such as high strength steel, magnesium (Mg) alloys, carbon fiber, aluminum (Al) alloys and polymer composites can directly lower the weight of a vehicle's body and chassis by up to 50 percent and therefore reduce a vehicle's fuel consumption. A 10% reduction in vehicle weight can result in fuel economy improvement by 6%-8%. The use of lightweight materials could result in needing a smaller and lower cost battery.

(viii) **ALTERNATIVE FUELS**

The alternative fuels being verified at present are Liquefied Petroleum Gas (LPG), Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG), Ethanol, Hydrogen, Methanol, etc. These are designed to reduce emission and release less greenhouse gas emissions.

(ix) BATTERIES AND ENERGY STORAGE

Advanced chemistries allow batteries to operate at higher temperature extremes, last longer, and reduce weight and cost. Other efforts are being constructed to reduce the cost of the ancillary systems, such as cooling, to further reduce the total cost of the battery system.

(x) 42 VOLT SYSTEMS

In future all mechanical control system will be electrically controlled. This includes air conditioning systems, steering, water pumps, suspension systems, alternators and windshields. Start- stop engines are also in the phase of development. There are many projects in place for the execution of heated catalysts to reduce vehicle emissions further. Conversion of these mechanical systems will allow for further vehicle weight reduction and increased fuel efficiency.

(xi) **DRIVE BY WIRE TECHNOLOGY**

Traditional mechanical control systems are replaced by Drive-by-wire, or x-by-wire technology in the automotive industry with electronic control systems using electromechanical actuator and human- machine interfaces such as pedal and steering feel emulators. These includes Throttle-by-wire, Steer-by-wire, Brake-by-wire.

(xii) CAMLESS ENGINES

In a camless engine, electromechanical actuators placed directly on the valves, replace the camshaft. This technology makes it possible to optimize the circulation of gases in the engine both for intake and exhaust, and to employ operating modes that improve
Fuel consumption, clean exhaust technology and performance.

(xiii) EGR (Exhaust-Gas Recirculation Systems)

In I.C. engines when the temperature in the combustion chamber exceeds 2000 K particularly in diesel engines which have higher combustion temperatures. NOx formation which is a highly temperature-dependent phenomenon takes place .Thus, to reduce NOx emissions in the exhaust, it is important to keep peak combustion temperatures controlled. Re-circulating part of the exhaust gas helps in reducing NOx.

(xiv) STIRLING ENGINES

A Stirling engine is a heat engine operated by cyclic compression and expansion of air or other gas, the working fluid, at different temperature levels such that there is a net conversion of heat energy to mechanical work. They run very silent and they don't need any air supply because it uses always the same body of gas. That's why they are used in a lot in submarines. E.g. in the Royal Swedish Navy.

(xv) OPPOSED PISTON ENGINE

The opposed-piston opposed-cylinder architecture has drawn considerable concentration recently with the rise of a new company called Eco motors. This patented design of internal combustion engine will work on a number of different fuels, including gasoline, ethanol and diesel. This eradicates the cylinder head and valve-train components of conventional engines, offering an efficient, compact and simple core engine structure. This result is an engine family which is lighter, more efficient and economical, with lower exhaust emissions.

(xvi) SPLIT CYCLE ENGINE

Split-cycle engines separate the four strokes of intake, compression, power, and exhaust into two separate but paired cylinders. The first cylinder is used for intake and compression. The compressed air is then transferred through a crossover passage from the compression cylinder into the second cylinder, where combustion and exhaust occur.

(xvii) FREE PISTON ENGINE

The free-piston engine is a linear, 'crank less' combustion engine, in which the piston motion is not controlled by a crankshaft but is a result of the interaction of forces from the combustion cylinder gases, a rebound device and a load device. Free piston engines are commonly configured as single piston, dual piston or opposed pistons. As the engine does not have energy storage to drive a gas exchange stroke, so it works on two-stroke operating principle. The advantages are compactness, reduced manufacturing and maintenance costs, and low frictional losses due to the reduced number of moving parts.

(xviii) WANKEL ROTARY ENGINE

The Wankel engine ensure higher power output with fewer moving parts than the Otto cycle engine. Asian car manufacturer Mazda developed the RENESIS engine, a first mass produced Wankel engine, featured on model Mazda RX-8 (Kelvin Fu et al 2001).

CONCLUSION

Different future technologies are studied and there benefits were showed along with their working. Once these technologies become fully functional it will not only make the travelling part of human comfortable but also reduce our dependence on conventional fuels. It has been seen that these technologies are also environment and user friendly.

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