Pneumatic Regenerative Braking System for Vehicle

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ABSTRACT

Throughout the later years there has been an increasing focus on the development of technologies which can reduce the need for fossil fuel without limiting the yielding capacity. Cars have a great deal of the focus about the use of oil. With 10% of the world's populations owning a car and expectation of the world car park tripled in 2050[1] it is crucial to limit the use of fuel for vehicles. The efficiency improvement of vehicles is how to limit the losing of energy (e.g. braking, idle and external energy demanding utilisation) and especially the loss of energy while braking and idling is staked to 40% of the total energy use. Several of these hybrid techniques are continuously under development and they "competes" against each other with the purpose of limiting the need of fossil fuel and to run a vehicle with best overall efficiency. Equal for all hybrid technologies are that they avoid the loss of energy.

Pneumatic hybrid vehicle (PHV) is a technique that could work without adding advanced and expensive materials or components – thereby it would be simpler and cheaper. The option to use air as thrust giving fuel has no pollution and letting a compressor inverting brake energy into compressed air stored in air tank - it would be free to run. With automakers downsizing their engines to reduce engine friction, the kinetic regenerated compressed air has better circumstances as thrust giving fuel. To store compressed air and use it in e.g. four-stroked ICE, it won't have any combustion gasses while running on compressed air. Therefore, to achieve higher efficiency the engine would have to run as two-stroke. To control this, the valve control is a complex matter [4] duo to the shift from combustion and pneumatic mode. Research by L. Guzella et al.[2] has shown fuel improvements up to 35% on gasoline engine approximately the same efficiency as electric hybrid but by far less cost and less complex technique. By implementing the pneumatic technique in the ICE the interaction would be smooth and less complex and costly as with flywheel, electric and fuel cell - thereby improves the driveability for the hybrid vehicle.

Downsizing improves fuel consumption 12-17%[3] and lowers emissions by basically fitting a smaller engine with a turbocharger. A side effect from turbocharged downsized ICE's is turbo lag at lower revs. With storage of compressed air, turbo lag can be minimized thus, downsizing and pneumatic hybrid shows promising.

The result of pneumatic hybrid is: No external implementation exept pressure tank, made by easy recyclable materials as: cast iron and aluminium, low costs.

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[1] http://www.fiafoundation.org/50by50/documents/50BY50_report.pdf page 5.

[2] *Amir Fazeli, Amir Khajepour, Cecile Devaud. Department of Mechanical and Mechatronic Engineering, University of Waterloo, Waterloo, Canada. Applied Energy 88 (2011) 2955-2966*

[3] Development of a 4-Cylinder Gasoline Engine with a Variable Flow Turbo-charger" SAE TECHNICAL PAPER SERIES 2007-01-0263
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