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An investigation into the use of a compressed air loading mechanism as a means of improving the efficiency of a four stroke spark ignition internal combustion engine

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2012-07-04
http://hdl.handle.net/10539/11607

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Abstract

Internal combustion (I.C.) engines typically exhibit a characteristic efficiency profile which varies with operating load and engine speed, and it is widely known that the operating efficiency is poor under low loading conditions. The objective of this project is to investigate whether an energy storing and recovering process, involving compressing air and subsequently using it for propulsion, could be used to achieve better overall efficiency. An engine so modified would operate in two alternate modes. When using fuel, the engine operates as close to maximum efficiency as practicable, with the excess of engine output over driving requirements being absorbed by air-compression loading - driving an external compressor, charging air into a receiver. Later, under low driving requirements, this air is expanded - using the engine cylinders - as a source of propulsion. Heat transfer from the exhaust gases to the stored compressed air is used to improve engine efficiency. Through modelling and simulation, an overall efficiency improvement of 10% over standard engine operation is predicted to be realisable by applying this modification, and scope exists to further improve this figure through improved heat recovery from exhaust gases and improved loading capability.