Turbocharging Single Cylinder Internal Combustion Engines
Technology #16438

Applications

Turbocharging technology for single cylinder engines is applicable to a variety of current and prospective single cylinder diesel engine markets, including tractors, generators, water pumps, rickshaws, motorcycles, lawn mowers, and landscaping equipment.

Problem Addressed

Turbocharging increases the power per capacity of internal combustion engines by forcing more fresh air into the combustion chamber to burn more fuel. However, single cylinder engines are difficult to turbocharge because the intake valve is closed when the exhaustive valve is open. This problem is usually surmounted by adding more cylinders, but in smaller vehicles such as tractors and generators, the engine cost is a large fraction of the overall price of vehicle production. Thus, turbocharging single cylinder engines would have an economic advantage over turbocharging multi-cylinder engines.

Technology

This invention presents a solution for turbocharging single cylinder internal combustion engines by adding an air capacitor to the intake manifold of the engine. During the exhaust stroke of the engine, the turbocharger is mechanically powered by the exhaust gases to compress fresh air. The fresh air is stored in an air capacitor until the intake valve is opened, at which point the pressure in the air capacitor forces fresh air into the cylinder. An optimal capacitor to engine volume ratio allows 80% or more of the turbocharger pressure to be delivered throughout the intake stroke and will not contribute significantly to turbo lag. For smaller capacity engines in the range of 625 cc, the increase in engine size due to an additional air capacitor would be minor. Experimentally, 30% more power has been achieved with a turbocharger single cylinder engine with an air capacitor, compared to the same naturally aspirated engine. It should be possible to produce 40-60% more power in future iterations. The capacitor can be modified to include cooling fins, which would increase the density of its stored air. The capacitor can also be built into the structure of the vehicle such as the frame tubing on a motorcycle or a rickshaw.

Advantages

- 40-60% higher specific power output of turbocharging single cylinder internal combustion engines compared to engines using natural aspiration (30% achieved so far)
- Lower cost of production for single cylinder engines compared to multi-cylinder engines
- 80% or more of turbocharger pressure delivered throughout the intake stroke
- Only a small increase in engine size for smaller capacity engines

Categories For This Invention:
Energy
Hydrocarbons
Diesel Engines

**Intellectual Property:**
Turbocharged single cylinder internal combustion engine using an air capacitor
Issued US Patent
9,222,405

**Inventors:**
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**Publications:**
Experimental Evaluation of a Method for Turbocharging Four-Stroke, Single Cylinder, Internal Combustion Engines
68th Annual Meeting of the APS Division of Fluid Dynamics
November 22, 2015
Method for Turbocharging Single Cylinder Four Stroke Engines
Proceedings of the ASME 2014 IDETC
August 17, 2014

**External Links:**
GEAR Lab
http://gear.mit.edu/

**Image Gallery:**

![Image of Turbocharger and Air Capacitor Diagram]