Multi-Stage Turbo with Continuous Feedback Control
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Abstract
In an internal combustion engine, fuel and air is taken in through an intake, mixed stoichiometrically and ignited in a closed chamber to produce harvestable energy. The ignition of the fuel forces a piston down to allow the expanded gas to escape through an exhaust system. A turbocharger functions as a compressor that forces more air into the intake thus allowing for more fuel to be combined in a stoichiometrical fashion. The increase in the fuel and air mixture results in increased power and cleaner burning fuel.

Boise State University has invented a multi-stage turbo charger system with continuous feedback control for an internal combustion engine that ensures optimum performance throughout the operating range of the engine by controlling the operation of the waste gate. The continuous feedback system is designed to work with a dual sequential turbo system. This system results in higher compression of intake air, thus more engine output. The continuous feedback system still operates the waste gate based on engine conditions and improves turbo efficiency.

Advantages
• In turbo-charged engines with multiple turbo chargers, it is desirable that the turbo chargers operate together efficiently in view of changing engine operating conditions. Many multi-stage turbo systems use on/off controllers, which do not achieve this. The multi-stage turbo of the present invention provides a continuously variable control for a waste gate and promotes better performance throughout the operating range of the engine.
• The PID controller and regulator valve do not regulate the overall manifold pressure ("turbo boost") like some other controllers do. Instead, they control how the two turbo chargers work together and regulate the efficiency of the entire system.
• This configuration eliminates the need to change the spring inside the waste gate if it is desired to change the control characteristics of the waste gate. Since the waste gate is electro-pneumatically controlled, changes can be made on the fly by downloading new parameters to the waste gate controller.
• The system can be implemented in a turbo system that uses one or more turbochargers having a variable geometry turbine or a variable nozzle turbine.
• The PID control algorithm can be more finely tuned to promote high functionality under a wide variety of conditions. This system can be a standalone system or it can be configured to interface with existing engine control units and sensors, with the addition of the appropriate hardware.

Boise State is looking for a Licensee for this technology.

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