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Review Article

A Review Paper on OPOC Engine

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Abstract

As the insist for energy is increasing people look to new technologies to make fuel consumption more efficient. People have adopted engines such as electric motor, hybrid engines and hybrid fuel cells, opposite piston engines and opposite cylinder engines. A combination of these 2 engines, opposite piston and opposite cylinder engines, will be powerful, lighter, smaller, and more efficient while delivering the same amount of power. An OPOC engine doesn't need a valve train like that of standard four stroke engine, it doesn't require the contributing timing parts, thereby eliminating the extra cost that the typical four stroke engine brings with it. These reports elaborate the essential aspects for the development of an OPOC engine and also describe the mechanism of an OPOC engine and the various applications of an OPOC engine.

Keywords: *Energy, Consumption, OPOC, Efficient, Powerful*

Introduction

In abroad after years of exploration and research on Opposite Piston Opposite Cylinder engine, a variety of types of mature products has formed. However, the research of OPOC engine is still in conceptual stage. This new kind of engine has many advantages over traditional engine, brought by its unique structural arrangements, arousing the industry's attention. On comparing it with the diesel engine , it indicate that an OPOC engine has a better self-balancing character, less kinematic inertial force and cylinder lateral pressure, and is helpful in reducing frictional power consumption , and improving the noise vibrations smoothness.

The first diesel engine with opposed pistons, was a prototype built at the Kolomna plant in Russia. The designer Raymond A. Koreyvo on November 6, 1907 patented the engine in France and then displayed the engine at international exhibitions. After these demonstrations similar engines were produced by other companies. Koreyvo filed a claim against these companies which was rejected by the Kolomna plant as the managing director did not want any quarrels with influential foreigners. In the USSR, the opposed piston engine was used only after meetings with German aircraft makers, Junkers, relating to the Jumo 205 opposed piston diesel engine. In the USSR locomotive diesel engines adapted American Fairbanks-Morse designs. These engines were also used in military boats, set out under the world war two Lend-Lease contracts.

Opposed-Piston, Opposed-Cylinder Engine with Modular Displacement Capability EcoMotor's patented engine design creates a ground-breaking internal combustion engine family architecture that will operate on a number of different fuels, including gasoline, diesel, natural gas and ethanol. The opoc's new opposed piston-opposed cylinder direct gas exchange operation provides the well known emissions benefits of 4-cycle engines, the simplicity benefits of 2-cycle engines, the power density of the less well known opposed piston engine, and the extraordinary developments in electronics and combustion technology all tied together in a new and proprietary engine architecture.

The opoc engine comprises two opposing cylinders per module, with a crankshaft between them -- each cylinder has two pistons moving in opposite directions. This innovative design configuration eliminates the cylinder-head and valve-train components of conventional engines, offering an efficient, compact and simple core engine structure. The result is an engine family that is lighter, more efficient and economical, with lower exhaust emissions.

Power Density

The internal combustion piston engine has been the primary means of automotive propulsion for more than a century. Today, thousands of engineers around

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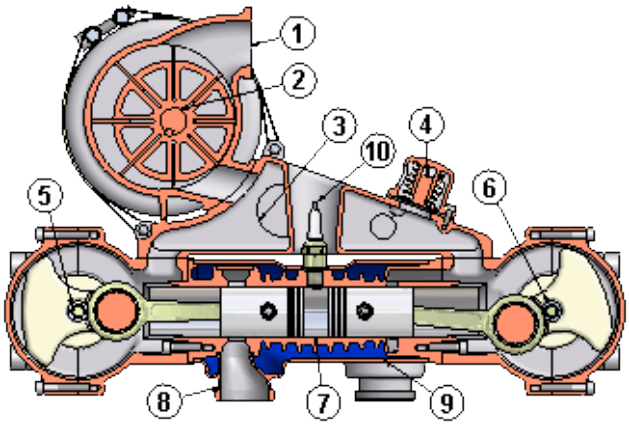
the world are hard at work trying to improve this 19th century invention. Some are striving to make incremental gains; some are hoping for a breakthrough. For all of them, one measuring stick is the acid test for any engine -- power density. As greater power density is achieved, a range of critically important attributes will result, including:

-Lower weight
-Smaller size
-Lower material costs
-Lower friction
-Greater fuel efficiency
-Lower emissions
-Lower heat rejection

Opposite Piston Engine

The engine had two cylinders with four pistons, two crankshafts and a supercharger. The crankshafts were connected by gears. The supercharger takes in the fuel-air mixture, compressing it and pushing it into the air box. From here it reaches the crank housings. On the outlet side it cools the chemically high loaded piston. After ignition the pistons move outwards, performing the power stroke. At first, the outlet piston opens its slots in the cylinder. The remaining pressure accelerates the gas column towards the exhaust. Then the other piston opens the inlet slots. The pressurized fresh mixture pushes the remaining waste gas out. While the inlet is still opened, the outlet is closed. The supercharger forces additional gas into the cylinder until the inlet slots are closed by the piston. Then the compression stroke starts and the cycle repeats.



An example of an opposed-piston engine:

1. Intake for fuel-air mixture
2. Supercharger (here: rotary vane pump; original: Centrex)
3. Air box to buffer and distribute the mixture
4. Waste valve to limit the pressure level
5.Outlet crank mechanism (runs app. 20° before inlet to achieve an asymmetric control diagram)
6.Inlet crank mechanism
7. Cylinder with inlet and outlet slots
8. Exhaust
9. Water cooling jacket
10. Sparkplug

Supercharger

The supercharger takes in the fuel-air mixture, compressing it and pushing it into the air box. From here it reaches the crank housings. On the outlet side it cools the chemically high loaded piston. After ignition the pistons move outwards, performing the power stroke. At first, the outlet piston opens its slots in the cylinder. The remaining pressure accelerates the gas column towards the exhaust. Then the other piston opens the inlet slots. The pressurized fresh mixture pushes the remaining waste gas out. While the inlet is still opened, the outlet is closed. The supercharger forces additional gas into the cylinder until the inlet slots are closed by the piston. Then the compression stroke starts and the cycle repeats.

Inlet crank mechanism

Opposed piston engines should not be confused with flat engines, which are horizontally opposed with one piston per cylinder, and cylinder heads. Some variations of the opposed piston or OP designs use a single crankshaft. The gobronbrillie and doxfordship engines used a crankshaft at one end of the cylinders and a crosshead for the opposing piston. The crank throws for each end were often unequal giving a shorter motion for the end having the higher reciprocating weight in order to help balance.

Opposite cylinder engine

By orienting two identical cylinders, each containing two opposed pistons, symmetrically around a central crank shaft, the forces generated during engine operation are almost entirely balanced. One result of this opposed cylinder (oc) architecture is very low bearing loads, which leads to less friction when compared to conventional engines that do not run in such a balanced fashion. The long outer connecting rods of the opposed cylinder architecture contribute significantly to lowering outer piston side loads. The lower the piston side loads the less the pistons tend to rub against the walls of the cylinder, and thus the lower the friction in the system.

Working of an OPOC Engines

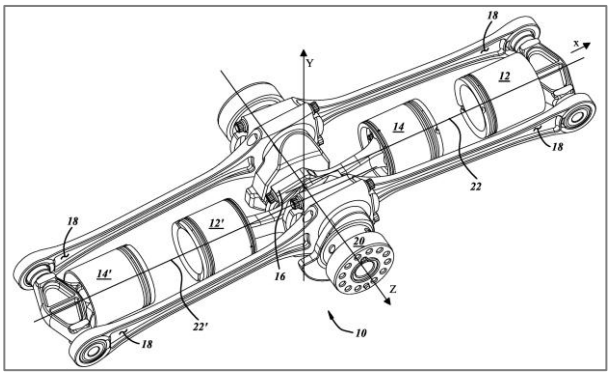
This engine can run on a number of different fuels, including gasoline, diesel and ethanol. The opoc's new opposed piston-opposed cylinder direct gas exchange operation provides the well-known emissions benefit of 4-cycle engines, the simplicity benefits of 2-cycle engines, the power density of the less well known opposed piston engine, and the extraordinary developments in computer and thermodynamics all tied together in a new and proprietary engine building.

It comprises two opposing cylinders per module, with a crankshaft between them; each cylinder has two pistons moving in opposite directions. This innovative design configuration eliminates the cylinder-head and valve-train components of conventional engines, offering an efficient, compact and simple core engine structure. The result is an engine family that is lighter, more efficient and economical, with lower exhaust emissions.

Structural characteristics of OPOC engine

OPOC engine outputs power by a single crank shaft. This type of engine uses the structure of long-short rod ingeniously to put the explosion pressure of internal-external pistons and inertia force on same crank shafts. Compared to the OP engine is has only one crankshaft to the output power. Compared to OC engine, it doesn't have a cylinder head. It is because of this clever design that engine structure is greatly simplified and lighter which makes it compact and efficient.

Analyzing the two stroke scavenging, the side-injection combustion, and the structure of the key components shows the potential of the OPOC concept. It is predicted for the 465 kW (650 hp) OPOC truck engine. The OPOC engine was designed to be modular. Each module is self-contained and delivers 325 hp. The modules are connected together via the Modular Displacement Clutch, which synchronizes the modules for achieving even firing when both modules are functioning. With an optimized scavenging process, the special design features of the OPOC engine offer a significant step towards the potential of the two-stroke engine having double the power density of a four-stroke engine. An estimated 90% scavenging efficiency has been achieved with unique gas exchange characteristics of the OPOC engine and the use of an electric assisted turbocharger. The OPOC engine runs with almost two times the engine speed (3800 rpm) along with a large cylinder stroke (167.53 mm), as a result of the split stroke of the opposed piston structure.



Electrically Controlled Turbocharger

Eco Motors intellectual property also includes an electrically controlled turbocharger technology which incorporates an electric motor in the turbo assembly to regulate boost pressure resulting in a long list of unique advantages:

-Improved combustion efficiency to meet emissions
-Electrically controlled variable compression ratio
-Improved vehicle fuel economy
-Enhanced vehicle drivability due to improved low-end torque
-Eliminates Turbo lag
-Waste heat recovery by generating electricity

Advantages

- OPOC Engine could deliver about 45% greater fuel efficiency
- Greater power density is achieved
- Lower Weight
- Smaller size
- Lower material costs
- Lower friction
- Greater fuel efficiency
- Lower emissions
- Lower heat rejections
- By the use electrically controlled turbocharger, turbo lag can be eliminated and waste heat can be also be recovered by generating electricity.
- No cylinder heads or valve trains

Applications

- Used in sub marines
- Used by USA military
- Used in light transport vehicle.
- Used in commercial vehicles.
- Used in aerospace.
- Used in agriculture, auxiliary power units, generators.

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