EUROPEAN
automotive
DESIGN

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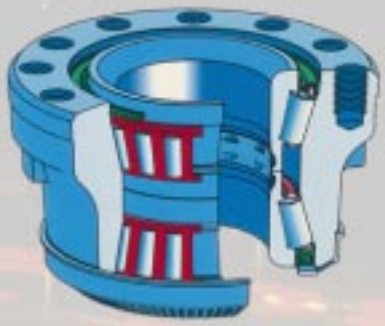

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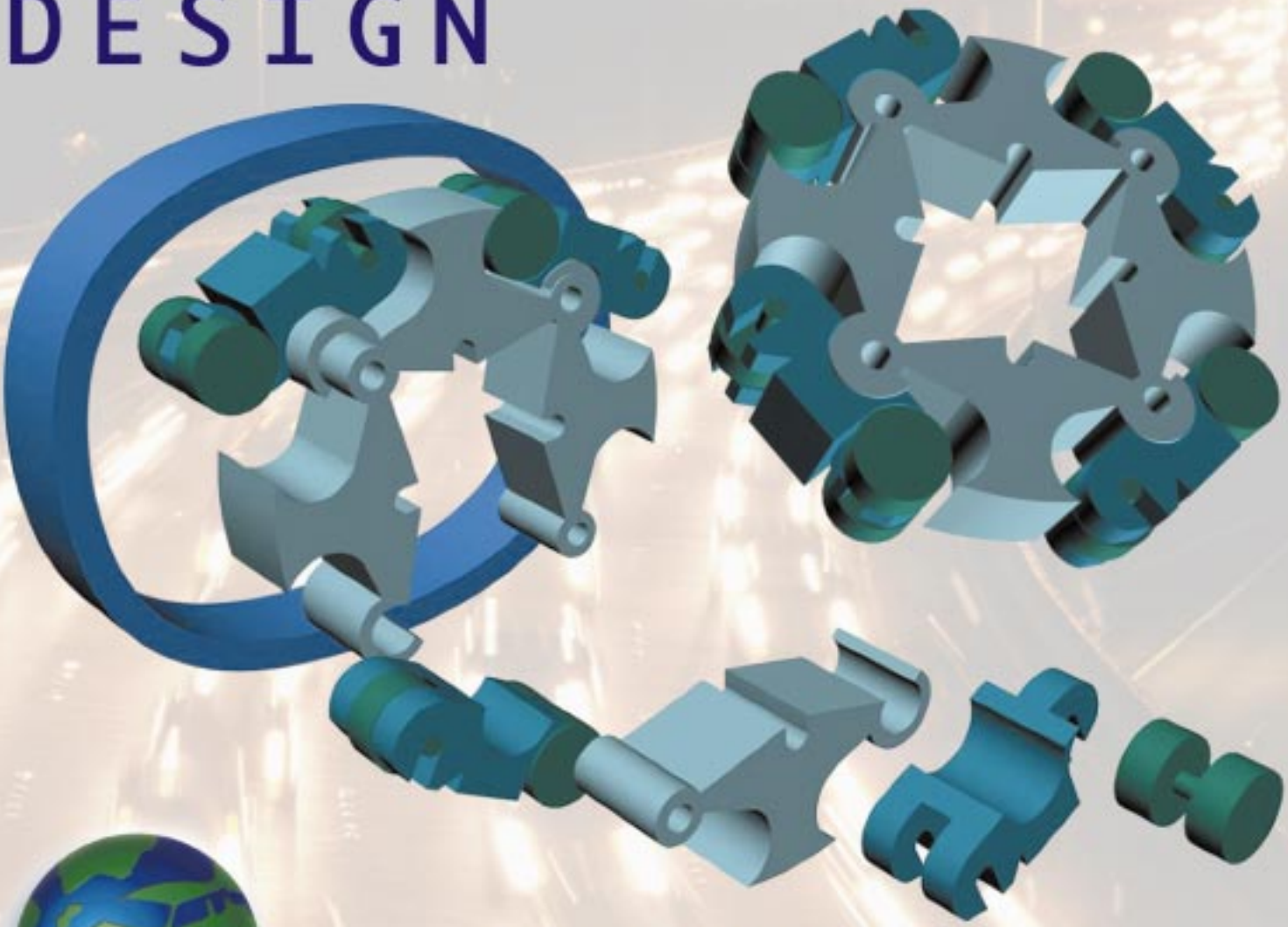

Quasiturbine turns on the power

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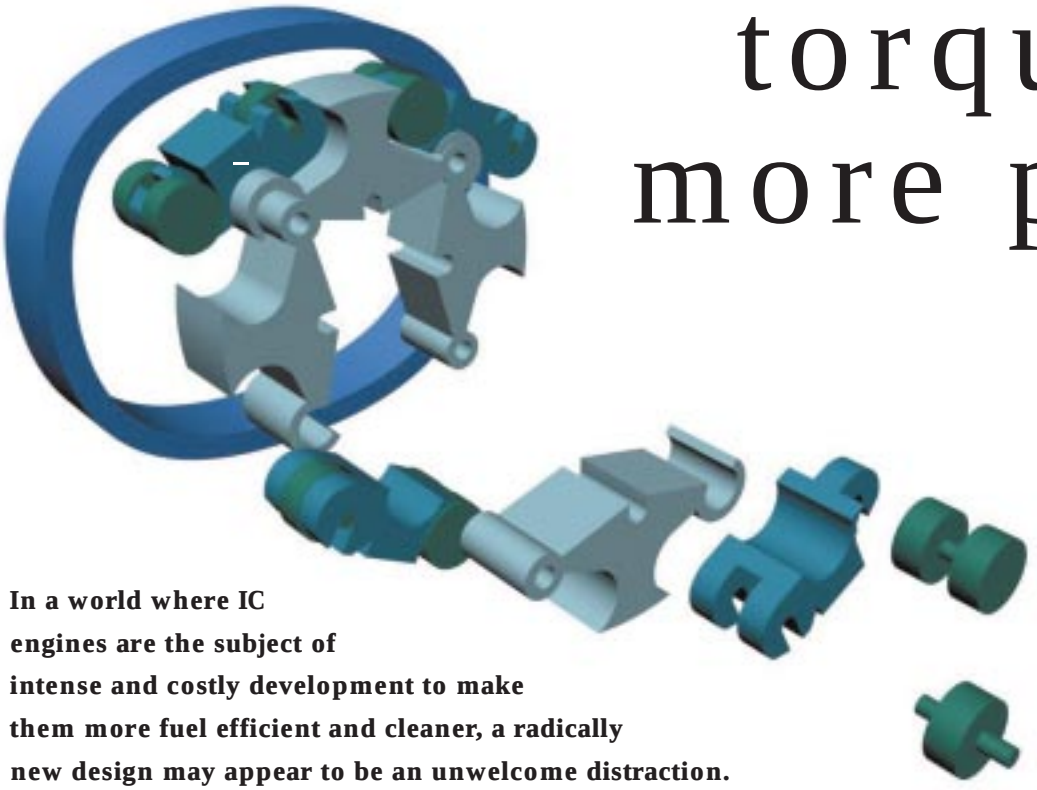
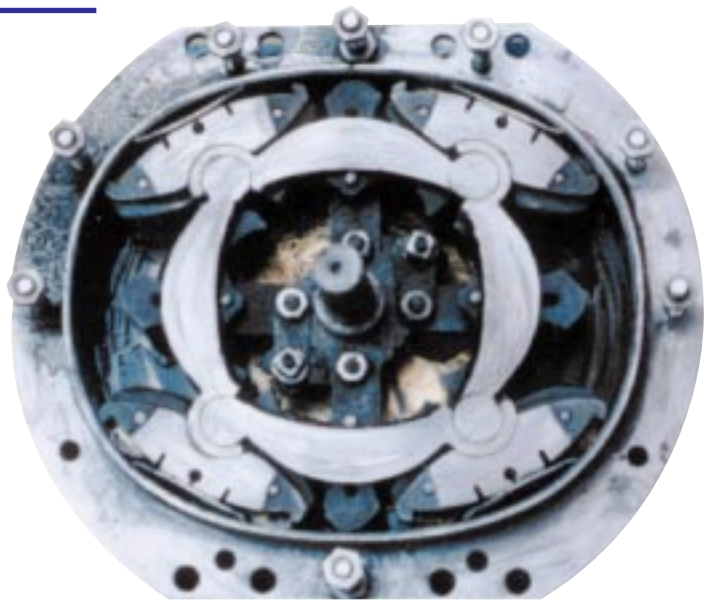
‘Rotary turbine’ torques of more power



In a world where IC engines are the subject of intense and costly development to make them more fuel efficient and cleaner, a radically new design may appear to be an unwelcome distraction. However, Mark Fletcher reports on a rotary turbine with qualities that could make it attractive for use with 21st century hybrids and fuels

An exploded view of the Quasiturbine engine and, below, a small prototype unit

A new engine concept from Canada has a design similar to that of a rotary machine but with the advantages of a gas turbine—all within the confines of chamber whose shape is a cross between an ellipse and a rectangle with rounded corners.



Called the Quasiturbine, the profile provides the engine’s rotary components with a bigger, more uniform, radial path enabling maximum torque to be reached much more quickly than a normal IC engine.

Fuels can be petrol, natural gas, liquid gas, diesel or hydrogen—options that make the design a contender for future hybrid systems. And this capability is enhanced by its central output which facilitates coupling to an electric motor or generator. Indeed, the developers say an electric machine could even be incorporated within the design’s central void.

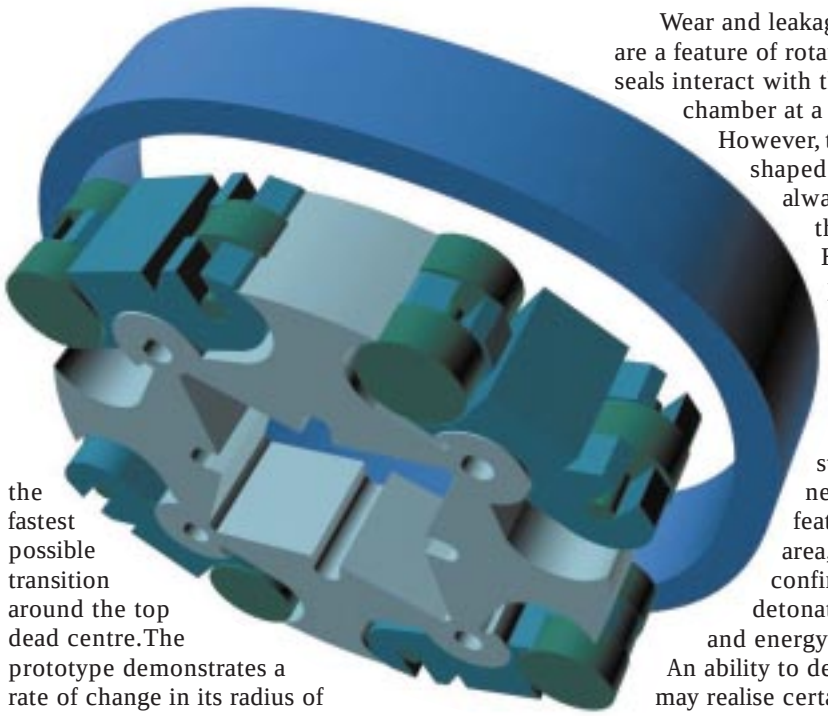
A fixed centre of rotation results in significantly less dynamic vibration and continuous ignition—like a turbine—is provided through ignition transfer slots.

Certainly, many automotive engineers are taking Quasiturbine design very seriously. It is to be shown for the first time at the SAE’s Small Engine Conference in Wisconsin, USA, at the end of this month.

The engine’s internal mechanisms manage to follow the complex internal profile of the chamber via series of carriages which ride on a four-element variable shape rotor. As the engine turns, the variable shaped rotor exhibits a square configuration when two opposing elements are in the 0 and 180deg positions. After further rotation (45deg) it elongates to exhibit a lozenge shape (due to the shape of the chamber) and then back to a square. Where the rotor elements meet they form four pivot points on which the four centrally-pivoted carriages ride. The carriages maintain contact with the inner profile of the chamber due to the rotor’s variable shape.

Quasiturbine has few moving parts and, as it has no oil pan, can be operated in completely submerged conditions. Its method of operation is also claimed to reduce both heat transfer to the engine block and the creation of NOx.

The combustion chamber’s special profile allows



A view of the Quasiturbine engine showing the assembled carriages and rotor

the fastest possible transition around the top dead centre. The prototype demonstrates a rate of change in its radius of 0.42 per cent per degree of rotation. This compares with 0.3 per cent for an elliptical profile and 0 to 0.15 per cent for a piston engine. The greater rate of change enables the engine to reach 50 per cent of its maximum torque after a rotor movement of just 10deg.

Unlike other rotating devices in which torque increases progressively until a maximum is reached, the Quasiturbine rapidly reaches the maximum diameter and then follows it accurately along its entire length. Traditional piston engine designs also present a dilemma when it comes to specifying compression ratios. If the compression ratio is increased the fuel/air intake volume may have to decrease to an unacceptable level. Quasiturbine, on the other hand, permits the construction of a compact detonation (or diesel) engine. Its asymmetric shape allows a higher compression to be reached, for maximum energy extraction, and offers an extended expansion cycle.

Wear and leakage around the tips of the rotor are a feature of rotary engines, mostly because the seals interact with the internal profile of the chamber at a variety of different angles. However, the Quasiturbine's variable-shaped rotor ensures that the tips are always in perpendicular contact with the engine profile.

Hydrogen is currently being promoted as a potential future power source for vehicles. According to Quasiturbine's developers, the Wankel engine was always a good candidate for hydrogen because of its stratifiable intake chamber. The new design also has the necessary features. These include a cold intake area, stratified intake, reduced confinement time, low sensitivity to detonation, less pollutant, robustness and energy efficiency.

An ability to deliver high torque at low speeds may realise certain savings due to increased overall efficiency. According to the developers, gearboxes typically consume between 8 and 12 per cent of engine output energy. For certain applications, the good low-speed torque characteristics of the new engine could remove the need for a gearbox.

It may also turn out to be a particularly quiet engine, mostly because exhaust gases are expelled more gradually than piston engine designs.

Details of the engine can be found on the Internet at www.quasiturbine.com. One section shows various animations including a Realvideo or Windows Media file of the engine being run. To get the full benefit of how the carriages and the variable-shaped rotor interact with the internal profile there is an impressive 3D animation showing the engine cycling.

For more information Enter
Quasiturbine 300

An engine at different phases of rotation showing how the rotor and carriages match the complex internal profile of the combustion chamber. An animation can be seen on the Internet at www.quasiturbine.com