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Could a New High Revving Rotary Engine Really Take Off?

25 August 2022

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Astron Aerospace ("Astron") is seeking to build interest in its patented multi-fuel rotary engine design, the Omega One. The company says that the Omega One can produce 160hp and 170 ft-lbs of torque from a package weighing less than 16kg. The design is modular so that, if more power is required, Omega One engines can be stacked together.

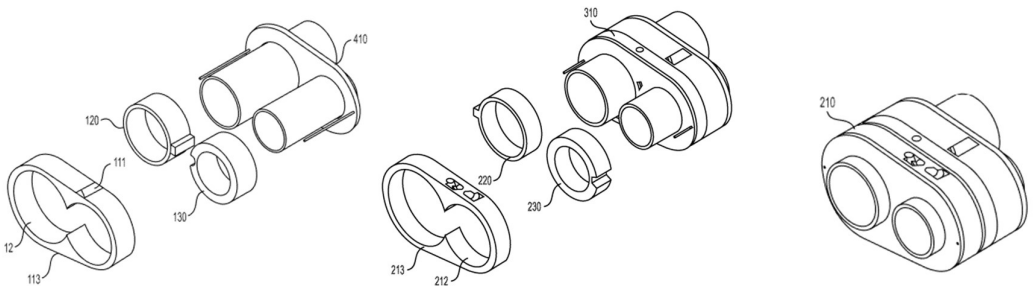
A very high thermal efficiency is predicted for the engine. In fact, early computer modelling predicted 80% thermal efficiency for a package producing 447kW and 1355Nm at 15,000 RPM. This is a high RPM for a 'normal' engine, but the Omega One is intended to idle at 1000 RPM and redline at 25,000 RPM.

Astron say that they can achieve high efficiency through the use of 'skip fire' like technology when the engine is not running under significant load. This means that fuel is only added when needed, for example on every 5th or 10th rotation, which allows high revs to be maintained, but with low fuel consumption. Near zero harmful emissions are claimed, particularly when the engine is running on hydrogen.

High efficiency, low weight and low emissions make the engine appealing as an automotive EV range extender, but the Omega One can also power a vehicle directly. Aston have also made it clear that automotive is not the only target market for the Omega One, and aviation plays a significant part in the company's plans, as their company name suggests.

The Omega One is a rotary engine and does not use reciprocating pistons to define combustion chambers, but it does not operate in the same way as known rotary engines like the **Wankel engine**.

The Omega One uses interlocking gears to synchronise pairs of rotors on counter rotating hollow shafts and this allows the four-stroke combustion cycle to be split in two. One pair of rotors is used for intake and compression and one pair for combustion and exhaust. Between the rotors there is a rotating valve. Each pair of rotors includes a male rotor with a projection and a female rotor with a corresponding recess. The projection acts as a rotating seal in an annular chamber surrounding the male rotor, while the female rotor effectively provides a stationary seal at a point in the annular chamber with the recess allowing the projection to pass. In this way the rotating seal divides the annular chamber into two variable volume chambers - one chamber behind the projection which increases in volume and one chamber ahead of the projection which decreases in volume during rotation of the rotors.



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Air is drawn in by the first pair of rotors during a first rotation and then compressed during a second rotation. This compression provides an effect similar to a supercharger, effectively providing forced induction. The compressed air is forced into a pre-combustion chamber where fuel is added and then the rotating valve allows the fuel/air mixture to pass into an increasing volume variable volume chamber of the second rotor where the mixture is ignited to drive the increase in chamber volume. The combustion drives the second rotor for a first rotation and a second rotation forces the exhaust gasses out of the engine. Astron have produced an **animation** which illustrates the operation of the engine.

Separating the induction/compression operation from the combustion/exhaust operation in this way allows greater flexibility in relative chamber volumes and avoids the need for a single chamber to alternate between these operations.

The new design allows the engine to operate without an equivalent of the apex seals commonly found in Wankel engines. The apex seals in Wankel engines are a common failure point due to wear. These seals can be omitted as the Omega One is intended to be manufactured to very tight tolerances and to run at high RPMs which mean that there is not enough time for problematic leaks to occur during operation.

The low part count in the Omega One also leads to a claimed 100,000 hours between overhauls with only simple maintenance servicing required between overhauls.

The company has already secured significant investment based on the potential of this innovative engine design and has already been granted US patents to protect it.

The earliest application was filed in August 2019 which, in just over a year, resulted in the grant of US patent, **US10844782** (published in November 2020). This rapid allowance was achieved by using the US Prioritized Patent Examination Program known as **Track One**. This rapid allowance may have been a tactic to show potential investors that the design was indeed innovative and protectable. In addition to the already granted US patents there are pending applications that have the potential to give rise to patents in other countries around the world.

It is good to see engine development is ongoing as part of the green revolution and that innovators are working hard to have internal combustion engines seen as a viable alternative to the push for electrification.

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