TRID Systems

Introducing the Spherical Rotary Turbo Engine

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June 2020

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 (Patent number: 9464566)

Introduction

The Spherical Rotary Turbo Engine (SRTE) represents a paradigm-shifting approach that may drastically improve the efficiency of the combustion engine, resulting in fuel savings for consumers and emissions reductions benefiting society. Preliminary simulations indicate the engine could be 30-50% more efficient than traditional engines.

The inventor Ned M Ahdoot retired from the aerospace industry in 2015, after a 40-year career. As a scientist for Aerospace Industries of Sothern California, Ned's responsibilities included developing reconnaissance, communication, and GPS navigation systems for satellites for the United States Air Force, other government agencies and private companies. His company, TRID System, holds a total of 10 patents, spanning topics that include image spectrometry and renewable energy (wave energy).

Technology – an overview

The SRTE will weigh less than the typical piston and cylinder engines. The technology also enables indirect weight-reduction benefits:

- Reduction in the size/ weight of fuel tank
- Only two moving parts under the load
- 30 to 50% reduction in gas consumption compared to piston and cylinder engines
- Spherical shape eliminates the friction problems in the "Wankel" engine (which uses elliptical-shaped housing in which gears create rotational motion of rotors, resulting in heavy friction)

A key aspect of this design is that the rings (depicted in Figure 1) are semi-circle shaped and are attached to the two semi-circle shaped rotors (7, 8); they rotate within the spherical body of the engine. These rings act very similarly to the rings of a typical piston-and-cylinder engine, with the only difference being that they move rotationally and mono-directionally, compared to the bi-directional linear motion of a piston and cylinder engine.

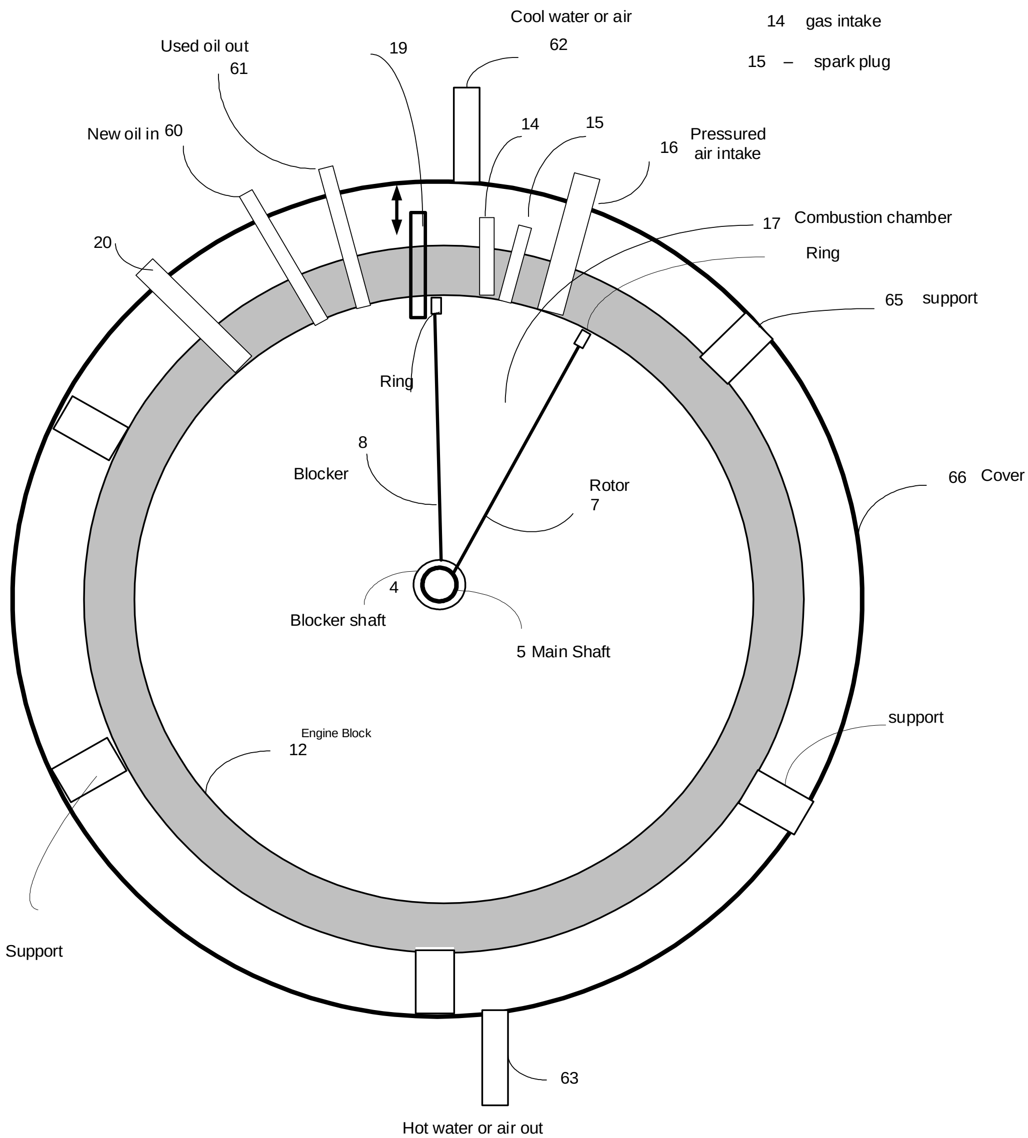

Figure 1 Spherical Rotary Turbo Engine block diagram, looking in from direction of the shaft.

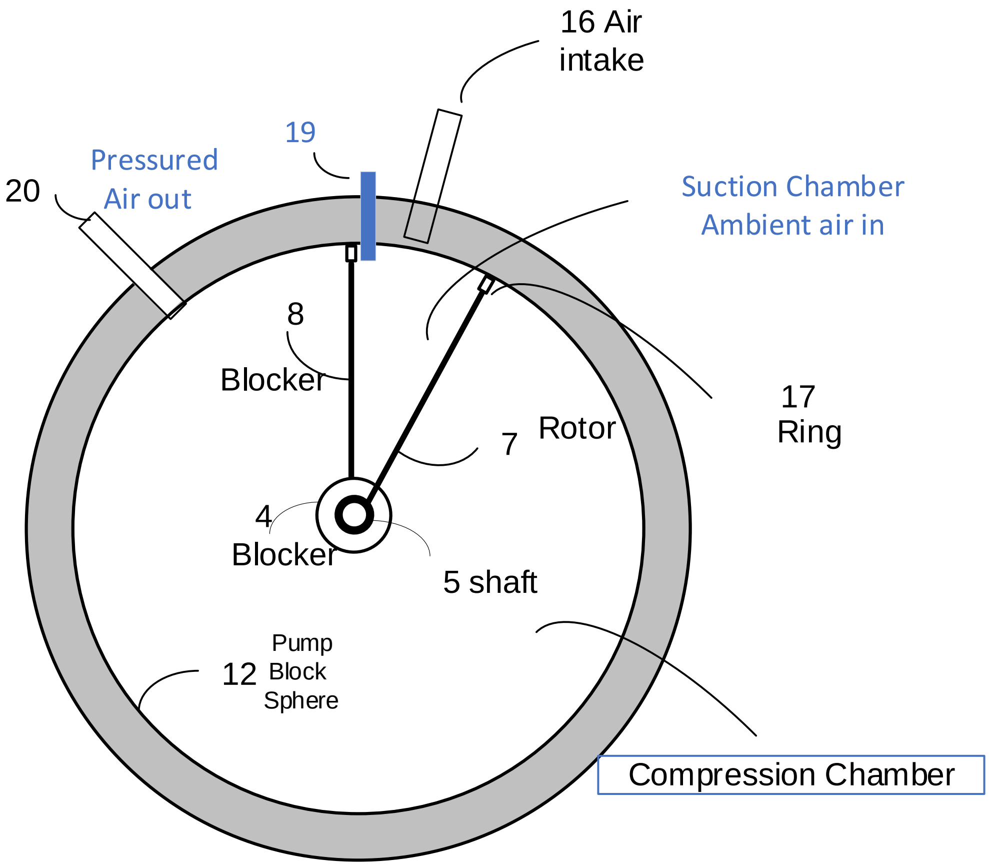

Figure 1A- Spherical pump, Notice that the design and operation of the engine and the pump are exactly alike, with the exception that Blocker (19) is to the right of the Blocker Blade (8) for the engine, whereas for the Pump is to the left.

- For the engine, the combustion chamber is formed between the right side of the Blocker Blade (8) and left side of the Rotor Blade (7)
- For the engine, upon ignition, the Rotor Blade that is attached to the shaft (5) moves fast forward due to the combustion of gas and pressured air that causes the motion of the vehicle while the Blocker Blade (8) is stationary for the combustion force to take place
- For the pump, the compression chamber is between the right side of the Rotor Blade (7) and left side of the Blocker Blade (8)
- For the pump, the intake chamber is between the right side of the Blocker Blade (8) and left side of the Rotor Blade (7)
- For the pump, the Rotor Blade (7) that is attached to the shaft moves forward and the

pressure takes place between the stationary Blocker Blade (8) and moving forward of the Rotor Blade (7)

In both cases of the engine and the pump, the Block pin (19) prevents the motion of the Blocker Blade (8) providing the combustion and compression to take place in one cycle

• The pump provides the suction of the ambient air or liquid to the intake chamber ready for the compression in the next cycle

• The percentage (displacement) volumes of combustion chamber and the compression chamber to the total volume of the engine is far larger the Mazda engine

• The position of air pressure output valve with respect to the position of the housing, provides different degrees of pressured air.

• For the pump, both the ambient air (or gas) intakes and the pressured air out are provided with diode valves

• The operation of the pump resembles human heart with periods of intake, periods of compression and output with periods of inactivity from the stoppage position. During this final (60-degree) phase of the cycle, the stoppage pin retracts to allow the Rotor and the Blocker to pass and begin the cycle once again.

The SRTE is a closed cavity, spherical combustion chamber, operating with the use of an air compressor. In contrast to most compressors in turbo-charged engines – which utilize fan-like blades to generate the burst of power needed for engine acceleration - SRTE generates pressurized air in a closed and controlled cavity Figure 1A.

Figure 1 presents a block diagram of the SRTE. A spherical, combustion chamber (17) is formed between the “Blocker” (8) and Rotor (7). At the start of each combustion cycle, powdered fuel (14) and pressured air (15) are introduced into the compression chamber, at which point the spark plug (16) creates a spark to ignite the mixture. At the ignition time, the combustion chamber is small and is filled with a mixture of pressured air and fuel. The ignition forces the rotor (7) forward towards the back of the Blocker (8) that is stationary for about 300 degrees of a complete cycle, rotating the shaft and thus rotational power for motion of a vehicle.

At the end of the combustion expansion, the exhaust opening (20) vents the exhaust. In the remaining 60-degree cycle-time (approximate), the Blocker begins moving at a fast speed, until it is stopped again by the stopping pin (19). This takes place after the rotor (7) has passed the stoppage point, after which a new cycle begins. The Blocker is attached to a tube-like device that surrounds the main shaft (5). Both blades rotate inside the cavity in a co-centered fashion within one cycle synchronization.

As shown in Figure 1, load is imparted on only two moving parts of the engine: the shaft and the rotor, and the hollow tube shaft that is attached to the blocker blade. Other electronic or mechanical parts are non-load bearing and are subject to minimal wear and tear.

Figure 2 shows the timing diagram for the motions of the Rotor and the Blocker within a single cycle. It is important to remember that the Rotor is constantly is moving and the Blocker is stationary at one location for approximately 300 degrees of the motions of the Rotor, the Blocker begins moving (behind the Rotor), only when it is within 60-degrees

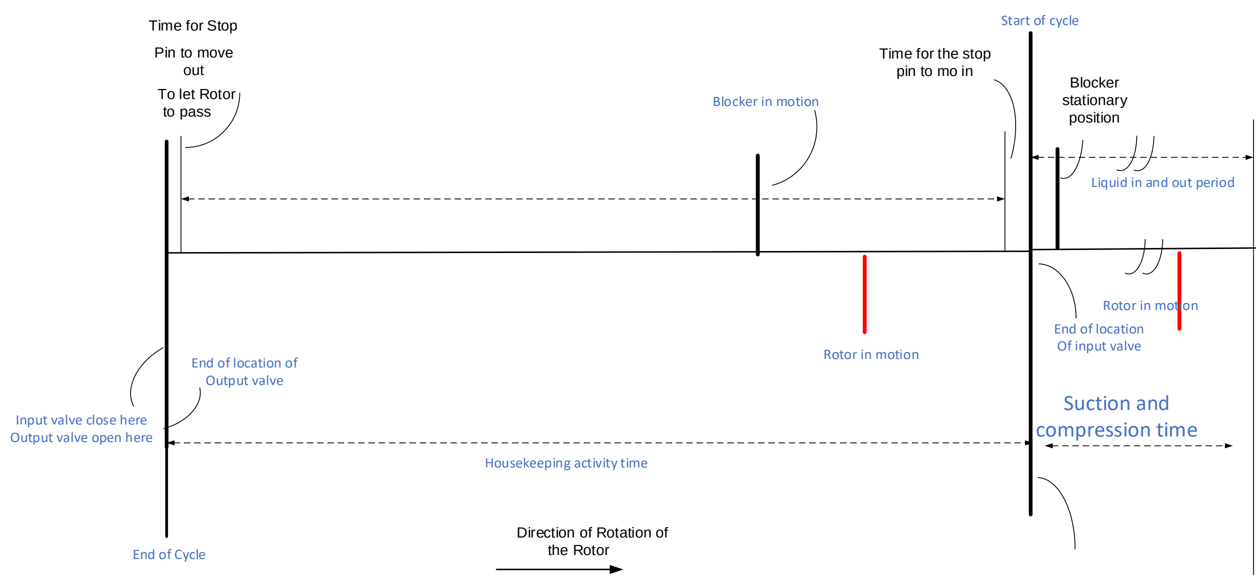

Figure 2 Timing diagram for one cycle of the pump

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Lubrication

A laminated brush-like component is attached to the inner area of the spherical housing (12). It is set up for the rotor (7) to contact the brush for fresh lubricant oil that is for the next single combustion cycle. This contact with the fresh oil occurs during the 60-degree phase of the cycle, in which no compression takes place. The residual used oil is collected during the 300-degree cycle phase, by the Blocker (8) that collects the residual used oil, by a small plastic blade (not shown) connected to Blocker. Residual oil is collected from the same combustion cycle. A small cavity (not shown) in the cylinder housing (12) collects the used oil by suction, during the 60-degree cycle phase.

Technological advantages

The primary difference between SRTE and other internal combustion engines, is that the **combustion chamber expands radially rather than linearly**. This is made possible by allowing combustion to take place within the same cavity which directly rotates the shaft.

This technology affords several key advantages:

- Parts can be manufactured to higher tolerances, a spherical housing and a central shaft, minimizing possible variations which may cause loading (pressure and hammering) between the edge of the rotors and the internal walls of the housing; this prevents friction and minimizes wear and tear of engine parts.
- The blade shape of the Rotor and the Blocker allows for higher combustion chamber volume within the cavity (compared to Wankel engine system – see discussion below). This results in greater torque and output of rotational power.
- Fewer number of moving parts allows the engine to be built economically and with greater efficiency in terms of conversion of gas to heat.
- Significantly lower friction will result in greater fuel efficiency.
- Lower maintenance costs, because of less wear and tear.

  The design allows for the air compression to be implemented within the same cavity (figure not shown) or an externally pressurized air. Figure 4 shows the interconnections of several pumps via the same shaft.

- The Rotor is a pair of blades rotating in a spherical or cylindrical housing along the centerline of the housing resulting in minimal deviation in tolerances of the point of contact between the edge of the Rotor and the housing.

The suction and compression capability of the compressor pump allows for greater freedom in design of engines wherein the source and destination of gas or liquid (to and from the engine) will be independent of their locations in the vicinity of the combustion chamber.

Traditional engine crankshafts operate under a heavy load, requiring constant and heavy cooling, and lubrication accessories, which add weight to the engine. Because it has far fewer moving parts, and its operation results in far less friction, the SRTE requires significantly less lubrication and cooling; cooling requirements are served by using pressured air, further reducing weight and manufacturing cost. Crankshafts are built to bear the heavy load generated by the engine. This invention removes the weight bearing requirement for the shaft and allows flexible distribution of load bearing. As depicted in figures 2 and 3 below, the air compressor can be placed in line with the engine itself, powered by the same shaft; this is the same approach that is used in jet engines. In addition, the compressor functions similarly to the engine, providing 85 to 90% displacement of ambient air (compared to the volume of the compressor).

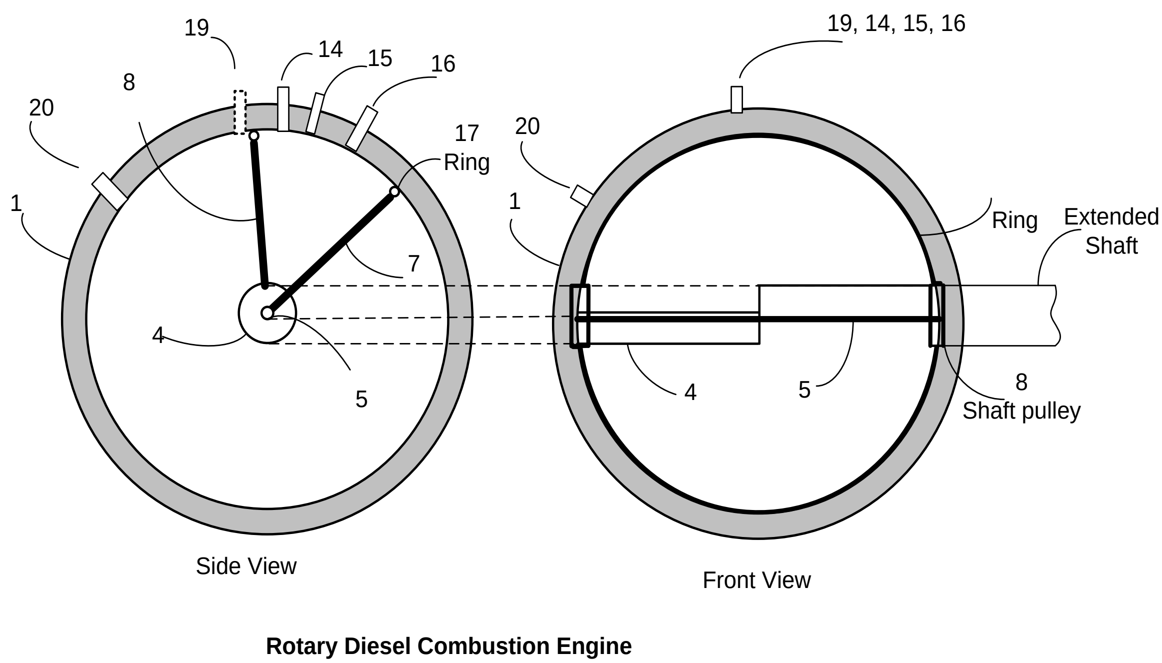

Figure 3 Front and side view of the engine

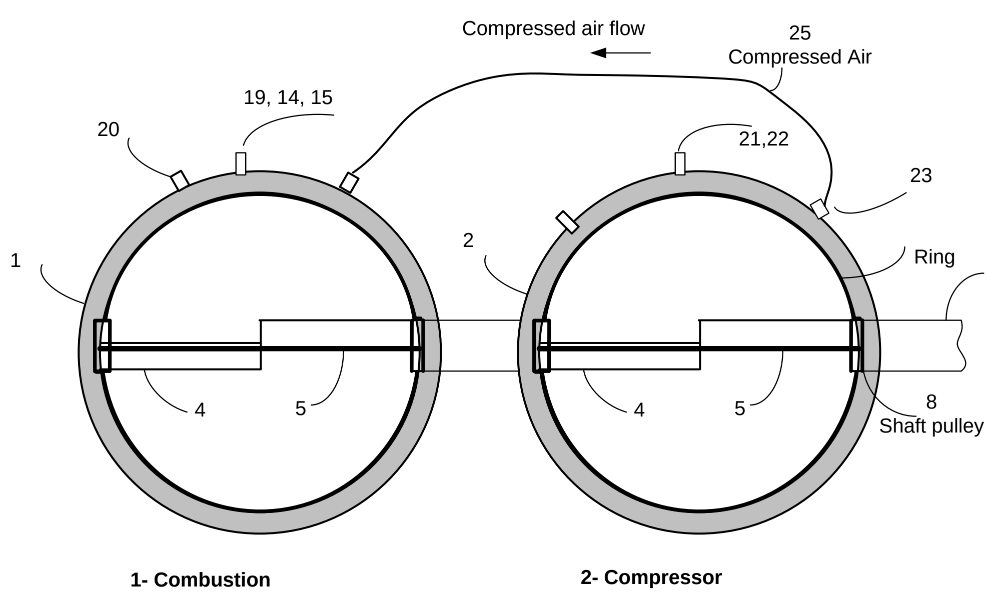

Figure 4 Combination of combustion engine and the compressor (pump).

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- A common shaft runs through the engine and the pump, while the combustion of the engine moves the shaft
  - The pump's input air suction and the output air compression are within the same 360-degree cycle
- The timing of the pressured air out of the pump is in the exact timing of the pressured air into the engine
- Two more pumps can be added and connected to the same shaft in a serial fashion, one for gas injection and one for lubrication oil
- A short length cylindrical housing with short shaft, (contrary to the spherical shape of the engine) are stacked for pumps to minimize the overall length and volume of the engine

Technical discussion in the context of the "Wankel" rotary and piston cylinder engine

The Wankel engine is a type of internal combustion engine which uses an 'elliptical' rotary design housing to convert combustion into rotating motion. All parts rotate in one direction, as opposed to more common reciprocating piston engines. First patented by Felix Wankel in 1929, the first working prototype was produced in 1957. Originally hailed as a game-changer in the automotive industry, the last production car to utilize a Wankel-type engine was the Mazda RX-8 (2002-2012).

Unfortunately, the gear-system and elliptical housing causes excessive war and tear on the rotor and the housing which caused the failure of the Mazda engine. There were also issues with fuel consumption – high levels of fuel were unburned by the end of the combustion cycle and thus were expelled from the chamber before being used; this greatly harmed the engine's fuel efficiency.

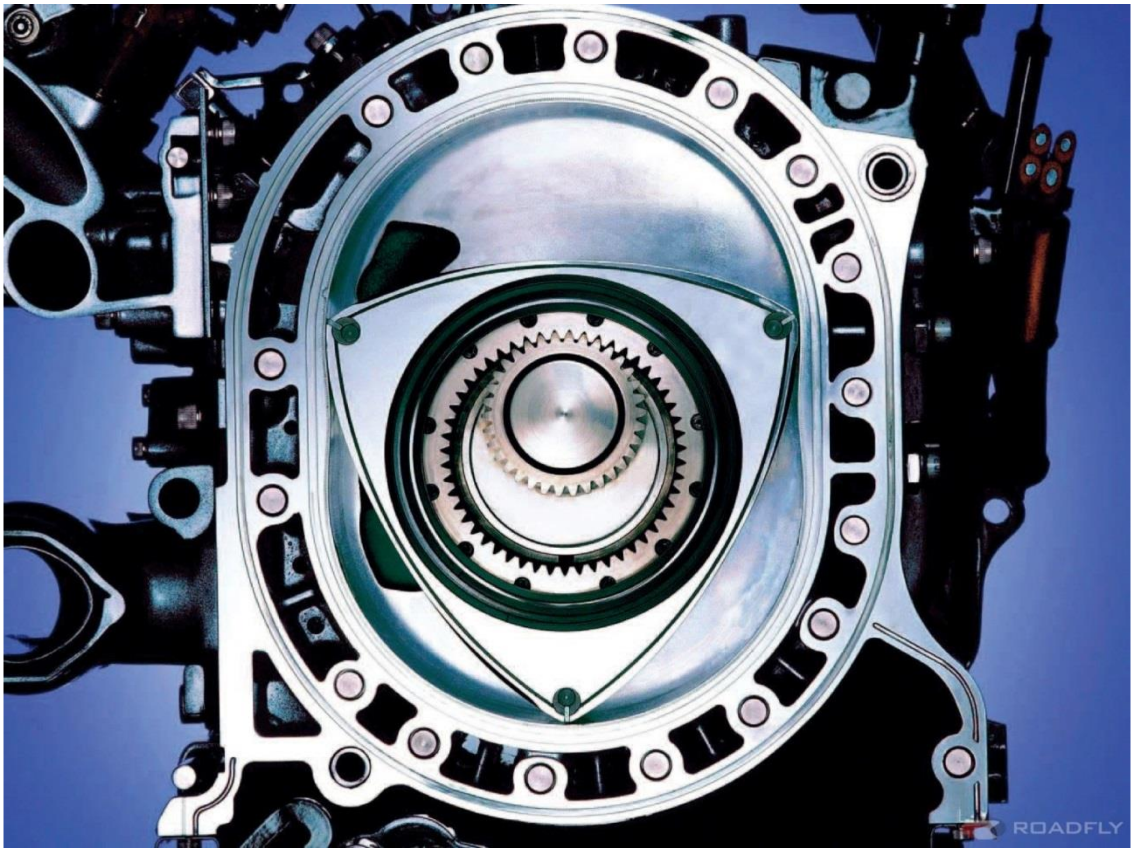

Figure 5. The Mazda engine

Figure 6 Damaged rotor of Wankel engine

Figure 7 Damaged rotor-housing of Wankel engine

The Problem

The problem with the currently designed and developed rotary engines dates to the original Wankel engine. The inherent problem is the fractional nature of the Pi (3.14….) in calculating the circumference of two gears interfacing with each other. Fractional values of circumference on two gears and a non-fractional number of groves on the two gears is the problem. Two set of gears, with un-precise tolerances, connect the rotor to the shaft for elliptical rotation of the Rotor, inside the cavity. This causes banging, and wear and tear on the tips of the triangular rotor and the edges of the elliptical housing.

This problem has been well documented (Figures 6 and 7). Worldwide, there has been great concern regarding the failed Mazda rotary engine. To eliminate the friction problem, various car manufacturers have spent billions of dollars without good results and are reluctant to revisit this technology or subsequent iterations.

This new technology (SRTE) is radically different from the Wankel rotary and piston and cylinder engines. However, our new concept for a spherical rotary turbo engine must be understood by potential manufacturing/ commercial partners before any additional development work is initiated. It is for this reason that a simulation video of the engine-concept (along with the integrated pump) is needed to eliminate doubts and show the potential.

The Solution

The solution to the problems that have been experienced with rotary Mazda engines is the elimination of the elliptical housing and elliptical motions of the rotor. The precise rotation of a shaft, attaching two semi-circle blades, rotating at the center of the rotation of the spherical cavity resolves the friction issue. The media between the edges of the two rotors and the inside of the spherical cavity is a ring lubricating and rotating like the piston and cylinder engine.

This same technology can also be used to create a new type of highly efficient pump. In our technology the pump differs from the present fan-type air compressors used in Turbo engines cars and jet planes. These compressors accelerate air particles into the combustion engine with an open and uncontrolled input and output. The new technology sucks air in and compresses it in a closed system to a specific value.

Compared to other air compressors on the market, our invention has the potential to be much more efficient. Consider a typical pump on the market today, in which input ambient air chamber is roughly 30 % of the volume of the compressor. Our technology offers close to 80% efficiency. It allows a pump to be designed with much more input ambient air to output pressured air efficiency.

TRID System is seeking partners to help finance the R&D needed to bring this innovation closer to commercialization and seeks partners with R&D experience to help conduct the required design, prototyping and analyses.

