Wedge Rotor and Dual Wedge Rotor Unique 3-Dimensional Pump Profiles

DETAILED DESCRIPTION

In most stator-rotor, and rotor-rotor pumping systems total pumping capacity it dictated by just 3 factors: base circle, tooth count, and eccentricity. The tooth count being the total number of teeth on the rotors is already often dictated by a housing port design, or by constraints in ripple in the flow. The same is said for eccentricity. Eccentricity is defined by the difference in rotation axis between the inner gear and the outer gear. For most applications, the only way to increase flow capacity of a gerotor with locked tooth count and eccentricity is to increase base circle. Base circle is defined as the tooth root diameter on the inner gear. Increasing base circle diameter reduces the rigidity of the gear outer gear which can cause failure or poor performance. Using stronger materials may fend off failure, but modulus of most gerotor materials remains fixed. Modulus of the interacting faces contributes to wear properties and performance.

Therefore, given an existing pump system, designers often struggle with ways to increase pump capacity. Embodiments of the present disclosure meet this need to further push the limits of how much fluid given certain constraints can be designed into the active pumping components. Embodiments of the present disclosure specifically use angled and rotated surfaces in the active pump components to increase the rigidity and size of the pumping volumes.

Embodiments of the present disclosure relate most closely to industrial equipment, and transportation equipment lubrication or cooling systems. However, this pumping system is general, and depending upon its composition of materials and design could be used in any general industrial pump system for the transport of nearly all fluids. These rotor systems could be suppling suction for scavenge purposes, pumping from a lower pressure to a high pressure, or a combination of both scavenge purposes andpumping purposes. Given its high fluid pumping potential compared to its size, this system would befavorable for many applications. For this patent, the main example will be within the transportation industry.

Pumping systems are always being strained to produce more flow per pump size. Embodiments of the present disclosure may be assembled using advanced manufacturing techniques, and provide sufficient operational capability for requirements of ultra- high performance pumping systems. With pumps now receiving special heat treatments, coatings, materials, special surface preparation for operation at rotations per minute previously unheard-of, pump engineers are quickly approaching the point where only increases in size can assist in ever faster transmission of fluids. This unique geometry helps optimize the amount of flow a given pump system can produce while providing the bulk modulus of the pump that leads to steady wear free operation.

Embodiments of the present disclosure relate to an improved type of pump design. These pumps are of the type consisting of a driven or driving “inner rotor” or “stator” and a driven or driving “outer rotor” or “stator”. These rotors or stators feature profiles in the X-Y plane which project onto 2 different z planes by scale or by scale and rotation separated by some distance. See Figure 1 for first profile, Figure 2 indicates second profile. When a loft extrusion using linear or curved guide curves is represented between these two profiles, they produce an angled or curvi-linear surface as in Figure 4.

When rotated about an eccentric from each rotor or stator, the combined 3-dimensional sealing volume is larger than a single base circle and has more rigidity. When rotating the profile and changing the scale, it locates the much thicker part of the rotated tooth over the smallest cross section of the rotor giving a huge boost in rigidity which supports even larger base circles.

Embodiments of the present disclosure include fluid pumps, and in this graphical example a single gerotor short for generated rotor, but not excluding the many different configurations this could be implemented on. Trochoidal, Epi-Trochoidal, Integrated Gear, K-Fold, among others, which pump fluid using the interfaceof two different rotors, or stator rotor combinations.

By utilizing the Z axis to change the base circle of the pump profile as the Z-axis moves, you can concentrate cross sectional strength of your material in the OD on one Z axis side of the of the pump in the radial direction to give the outer ring the integrity it needs while dramatically increasing the base circle on the other side of the gerotor to maximize flow.

The summary above is provided to introduce in simplified form a selection of concepts that are further described in the non-provisional patent application. It is not meant to identify key or essential features of the claimed subject matter. Furthermore, the claimed subject matter is not limited to implementations that solve any disadvantages noted above or in any part of this disclosure.

Figures:

Fig 1. Starting base circle

Fig 2. Ending base circle

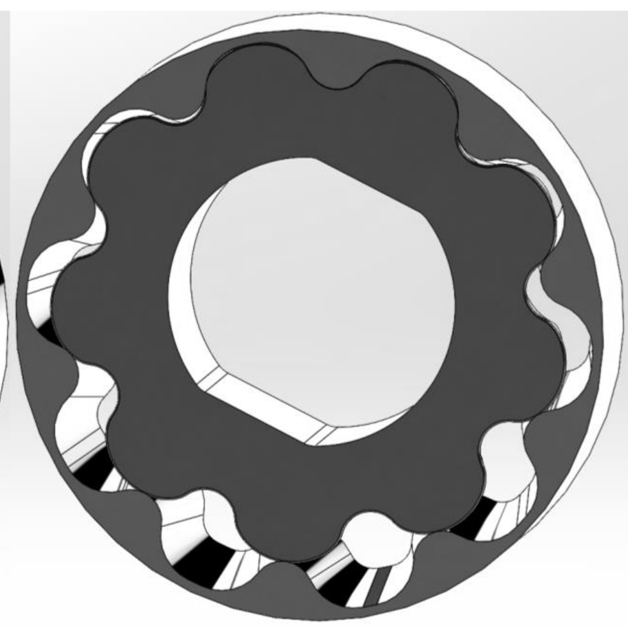


Fig 3. Cross Section 1: On plane cut section of inner and outer rotors

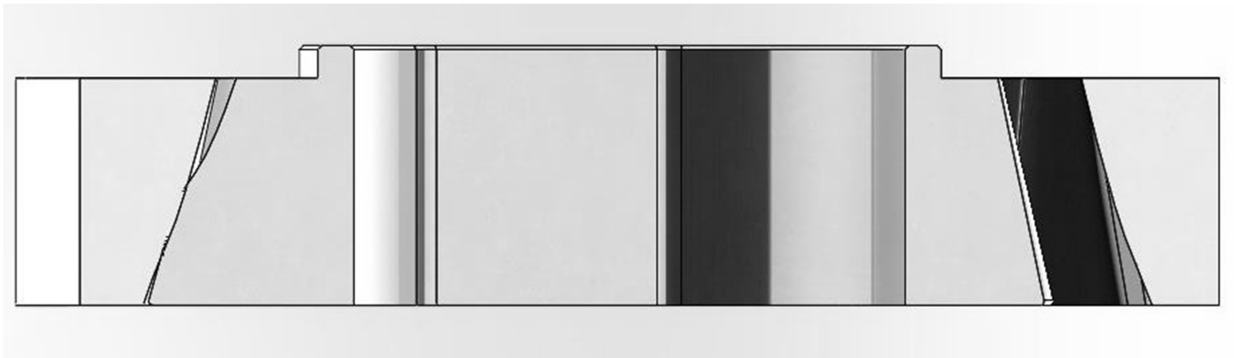


Fig 4 Cross Section 2: – Off plane cut section of outer rotor

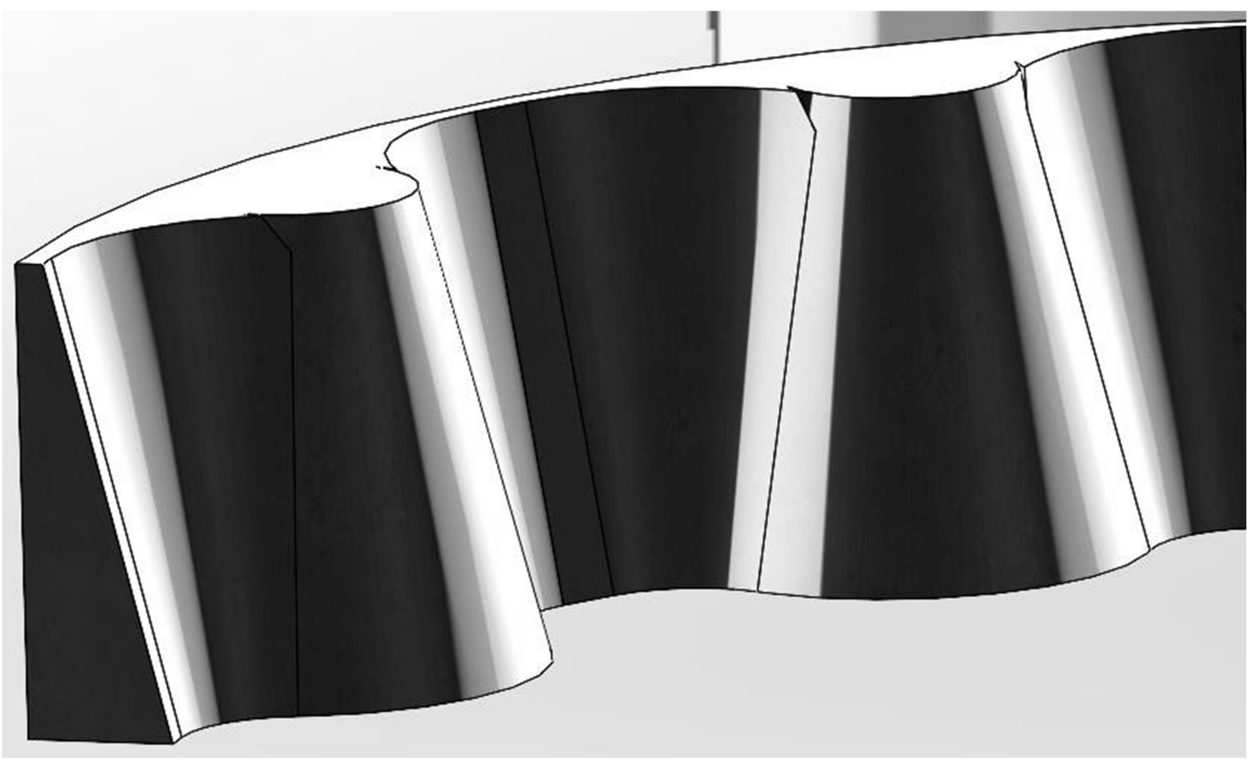


Fig 5 Rotated and Scaled Rotor

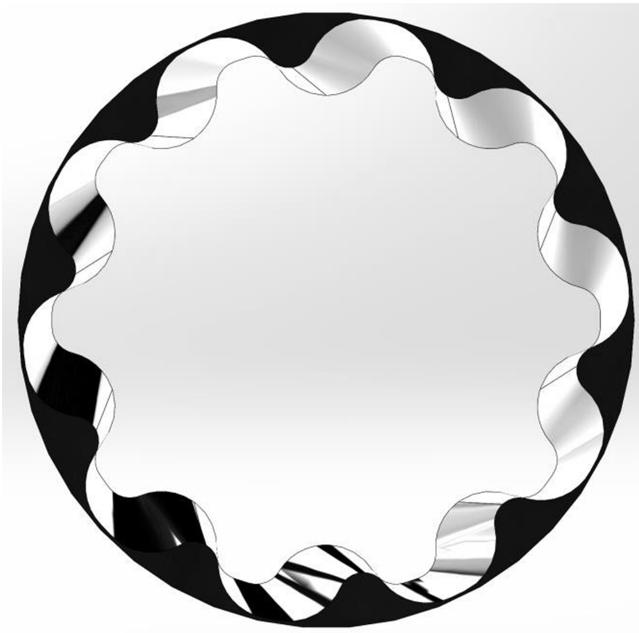
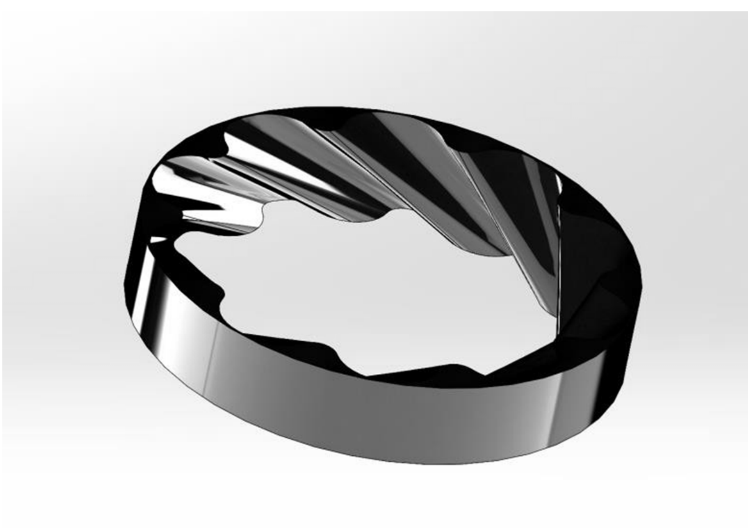


Fig 6 Rotated and Scaled Rotor perspective

Fig. 7 Scaled and Hyper-Rotated Gerotor 2 XY Plane:

Fig. 8 Scaled and Hyper-Rotated Gerotor 2 Perspective :



What is claimed is:

1. A pump assembly, comprising:

an inner element and an outer element, wherein the inner element and outer element are configured to rotationally engage thereby forming a plurality of dynamically changing pumping volumes;

wherein at least one of the inner element or the outer element comprises a rotor; and

wherein a base circle of the rotational engagement between the inner element and the outer element comprises a Z-axis variability.

2. The pump assembly of claim 1, wherein the Z-axis variability comprises a rotational variability.

3. The pump assembly of claim 1, wherein the Z-axis variability comprises a scaling variability.