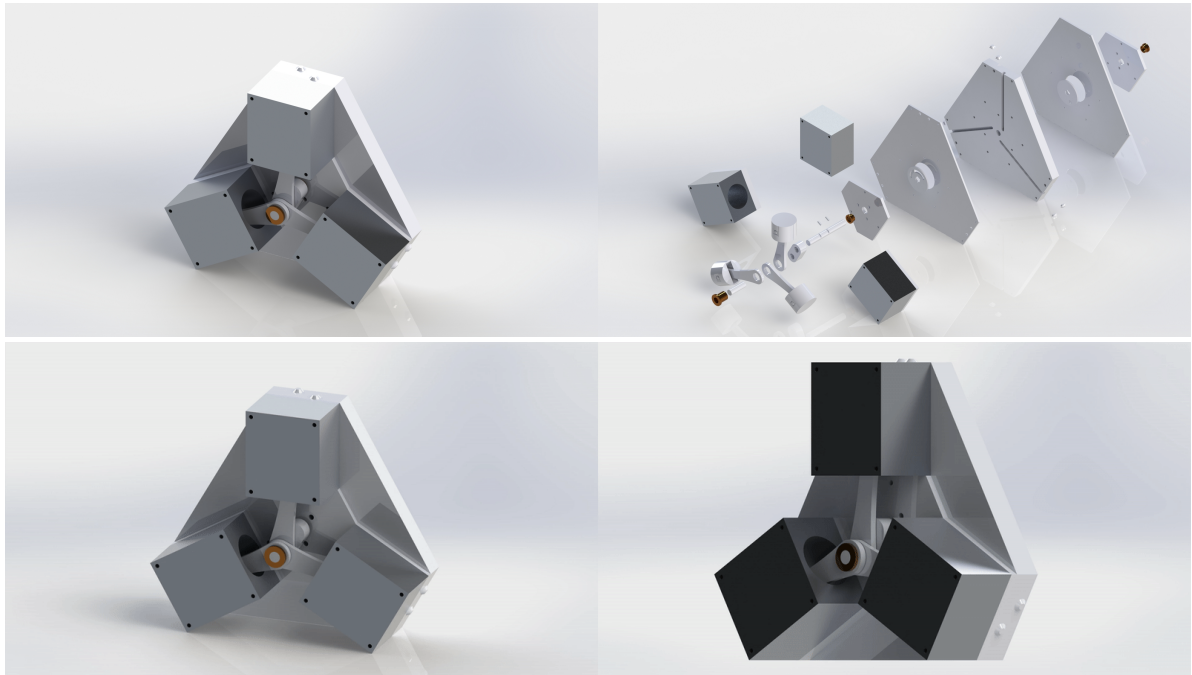


Greensteam Design Report: Disk-actuated Triradial Engine

Tae Rugh, Summer 2020

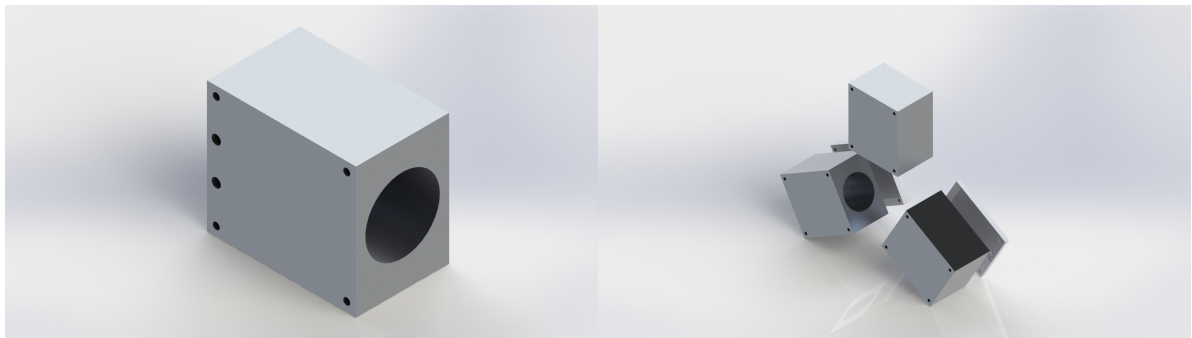


This engine has a triradial layout meaning the 3 cylinders are spaced equally 120° apart around the shaft. Each cylinder is offset slightly from the others so the piston rods may all attach to the same overhung crank. Behind the cylinders, the shaft drives 2 thin disks, on each side of the main plate, which act as the exhaust and inlet valves. Each disk has a slot--the shape of which determines timing and flow rate--which allows exhaust to escape to the atmosphere and inlet steam to enter the cylinders, both through milled manifolds in the main plate. The disks are forced to rotate with the shaft due to the key/keyway mechanism, but are not fixed for translational movement so that they may be pressure sealed against the plate. The advantage of this triradial cylinder layout is that the engine is able to run smoothly without requiring a flywheel. The 2 disks do the same work as 6 traditional poppet-type valves, vastly reducing the number of moving parts but also raising new concerns for sealing. Sealing between the disk and the manifold plate is accomplished by the pressure of the inlet steam itself which pushes against the disk (much like the sliding D valve mechanism). While the pressure addresses sealing, it also creates a large amount of friction, so the disk and plate will have to be heavily lubricated or plated with a low-friction material such as teflon.

Part Breakdown



The crankshaft has a large overhung crank that is responsible for turning all 3 pistons. Since the crank drives all 3 pistons, it is subject to significant forces and must be relatively thick to compensate. A bushing sleeve is fit over the crank pin so the piston rods can rotate smoothly. On the shaft, there are 2 flats which hold the keys that line up with the corresponding disk valves and hold them in place.



The cylinder blocks are separate for each piston and have 2 holes at the head for inlet and exhaust. Spacers are added between 2 of the cylinder blocks and the backing plate so that each cylinder is slightly offset and all 3 piston rods can attach to the same crank without interfering with each other.



The piston consists of the piston head, piston pin, and piston rod. The pin is press-fit to the rod, but given clearance through the head. The pin stays in place by slight contact with the cylinder wall on each side. In this way, the rod is free to rotate along the axis of the pin, but held in place otherwise.



The main plate has 3 manifolds on each side to pass exhaust and inlet steam to and from the cylinders. On each side of the main plate are additional thin plates that cover the milled manifolds and house the disk valves. One last plate on each side covers the disk valves, supports the bronze bushings, and has ports for inlet and exhaust.



Both the inlet disk valve (left) and the exhaust disk valve (right) have a center hole with a keyway for the shaft and key to run through. The length and positions of the curved slots determine valve timing.

Files

- [Master CAD](#)
- [Renders](#)