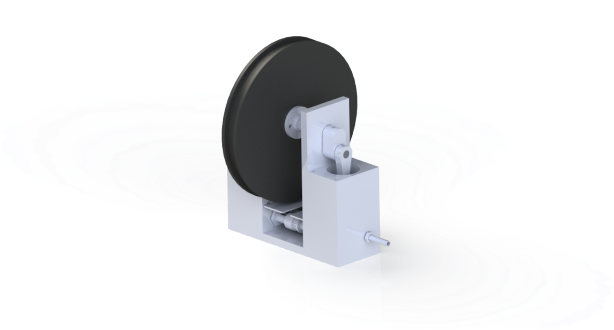
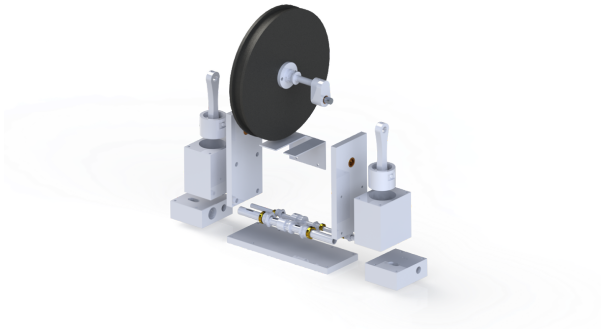
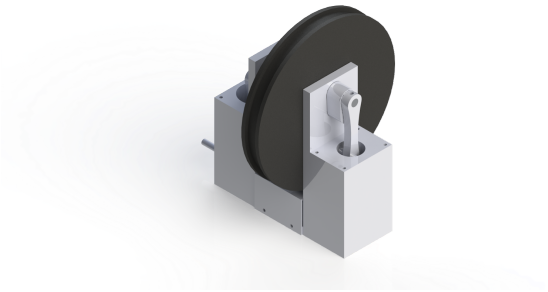
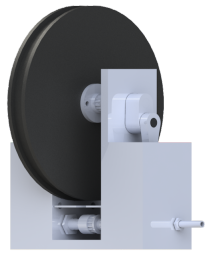
# Greensteam Design Report: 2 Cylinder Rotating Valve Engine 2.0

Shanwen Lo, Fall 2020





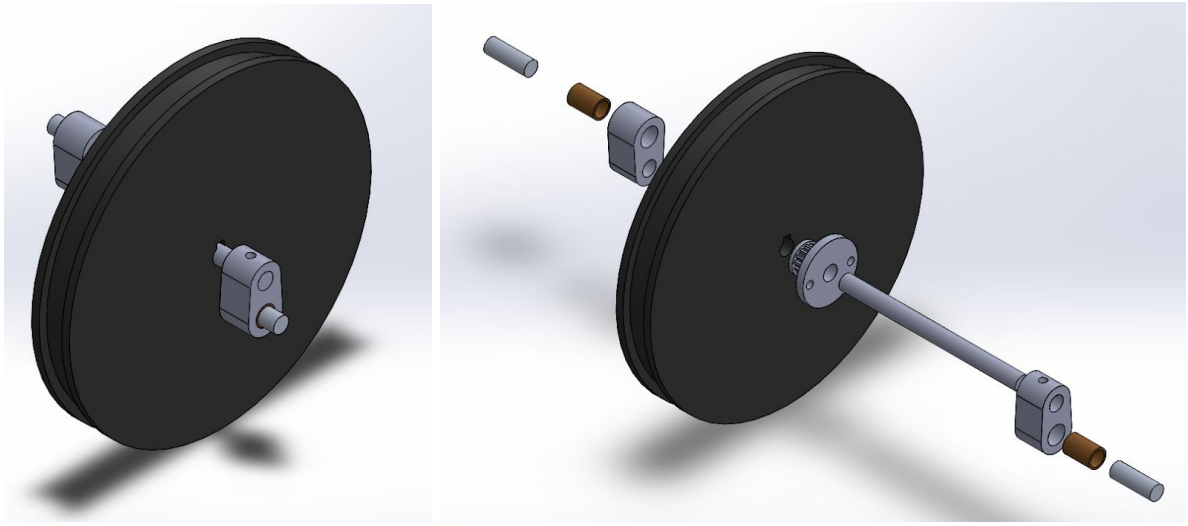




The rotating valve engine is very simple in how it operates due to the simple mechanism that manages the opening and closing of the steam values. The inlet and exhaust valves are a set of hollow cylindrical pipes that rotate in place and are linked to the crankshaft by a timing belt. This design eliminates the need for springs in order to close the valves - a factor contributing to the loss of efficiency in traditional valve mechanisms. However, this is also the main area of concern for the rotating valve engine where design solutions were needed. The main challenge with the valves is creating an effective seal between the inlet/exhaust pipes and the engine block. Due to the fact that these pipes are in rotary motion during the operation of the engine, the seal should also create as little friction as possible to reduce the loss of efficiency. This iteration of the design addresses this problem by firstly reducing the total amount of seals needed. Openings were added to the middle of the exhaust valve to let exhaust steam exit from the middle section of the engine rather than the ends of the pipes - this eliminates two seals from the original design. A steam shield was then added to direct exhaust away from the flywheel and crankshaft of the engine. On top of this, sintered bronze bearings were also implemented onto the inlet/exhaust pipes which would reduce the amount of friction the rotating pipes experience. This iteration's current solution to creating an effective seal is compressing O-rings along the interface that requires sealing. The O-ring is held in place and compressed by a threaded component which will allow the seal to be adjusted to the desired tightness. Finally, components were modified to allow for easy machining and design drawings were created to prepare for manufacturing.

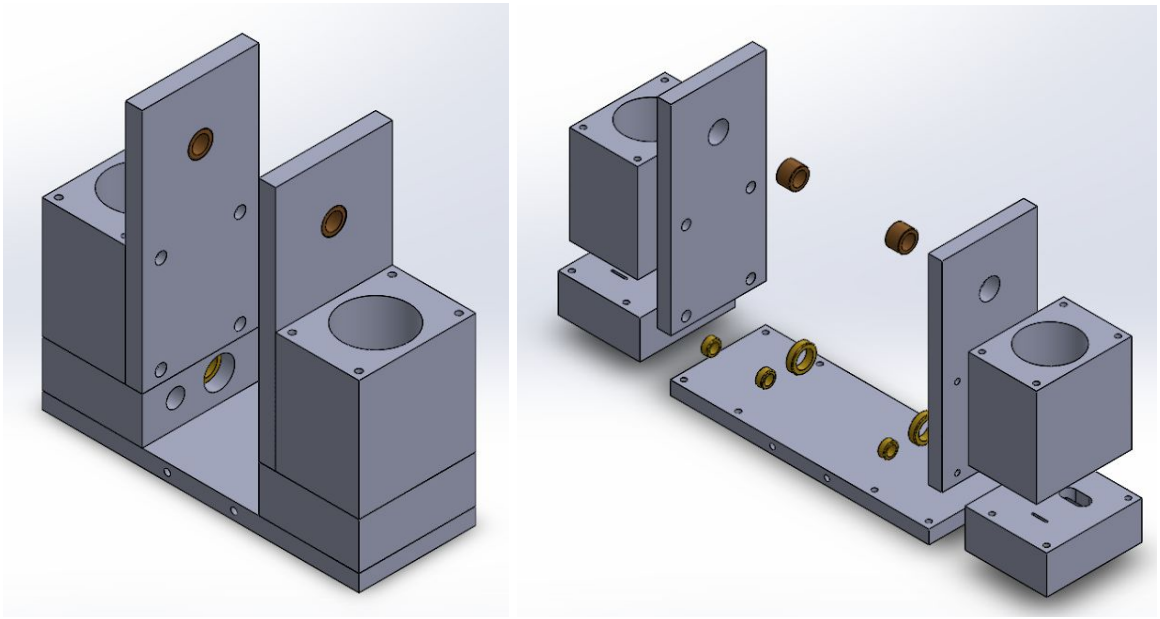
**Part Breakdown**

*Crankshaft:*



The crankshaft for this design uses two overhung cranks that are diametrically opposed - much like a typical bicycle. Since both sides of the crankshaft are occupied by the overhung cranks, this design requires an external drive shaft which will be connected to the flywheel using a pulley. The crankshaft also includes another timing pulley that will drive the rotating valves.

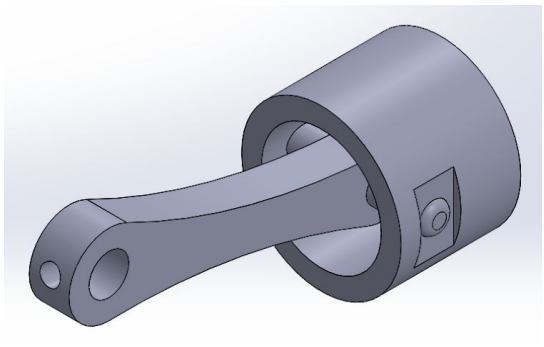
*Cylinder Block:*

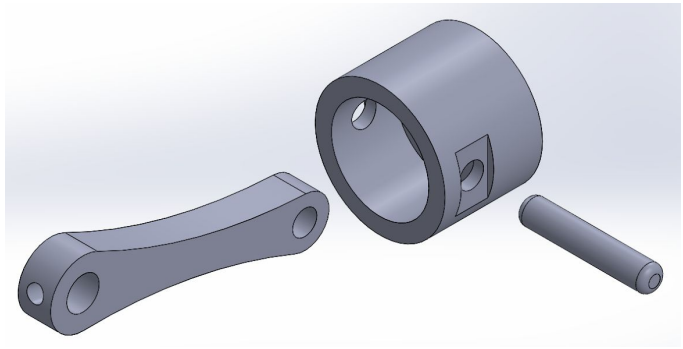


Each cylinder block is split into two components which are secured together. The bottom portion of the block will have 2 cylindrical channels running through it which will hold the rotating valves in place using sintered bronze bearings. There are also openings on the top face which

will feed steam into the top half of the block that acts as the actual cylinder where the piston operates. A support plate which holds the crankshaft in place will be attached to the cylinder blocks and the cylinder blocks are held in place with the base plate.

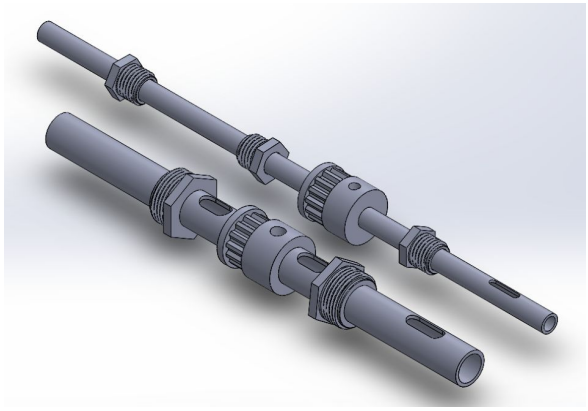
*Piston:*

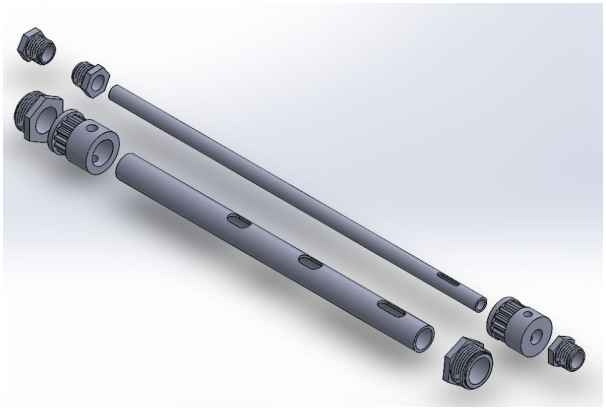




The piston consists of a piston head which will be connected to the piston rod using a press-fit pin. The pin will be fixed in place by the walls of the cylinder block and will allow the piston rod to rotate freely.

*Inlet/Exhaust Valves:*





The inlet and exhaust valves include slotted openings which align with steam ports on the cylinder blocks as they rotate. The pipe will be held in place with sintered bronze bearings which will be press-fit into the cylinder blocks. Timing pulleys are secured into the center of each pipe using set screws and will be driven by a belt from the crankshaft. A threaded compression fittings will compress and hold the o-ring seals in place along the bearings. The two valves are diametrically opposed and the timing of the valves can be adjusted.