Stirling Engine Project 2024-2025

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Aim of the Project

The Aim of the project is to design, build and test a functional beta Stirling engine using Solidworks, SolidCam and various manual machines such as lathes , mills and CNC machines

Background

- A stirling engine is a type of reciprocating external heat engine which uses one or more pistons to achieve work by an input of heat energy from an external source .
- A Stirling engine operates by heating and expanding gas to drive a piston, then cooling and compressing the gas to return it to its original state, repeating the cycle.
- This process converts heat energy into mechanical work using a closed-cycle system with external heat and cooling sources.

Materials

- We used aluminum for the Power piston and displacer piston because it is a lightweight metal which means there would be less friction between the cylinders.

- We also used steel for the
  - Crankshaft
  - Flywheel
  - Flywheel stand

Because it is a strong, durable and cost effective material.

Design

During the design process we were given design specifications to aid us in our design and we created three initial designs for our stirling engine and we chose the most efficient design.

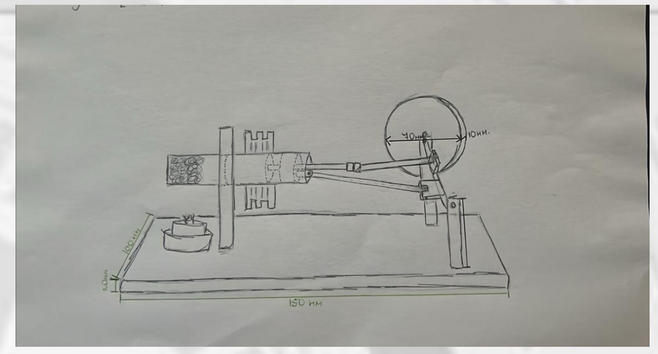
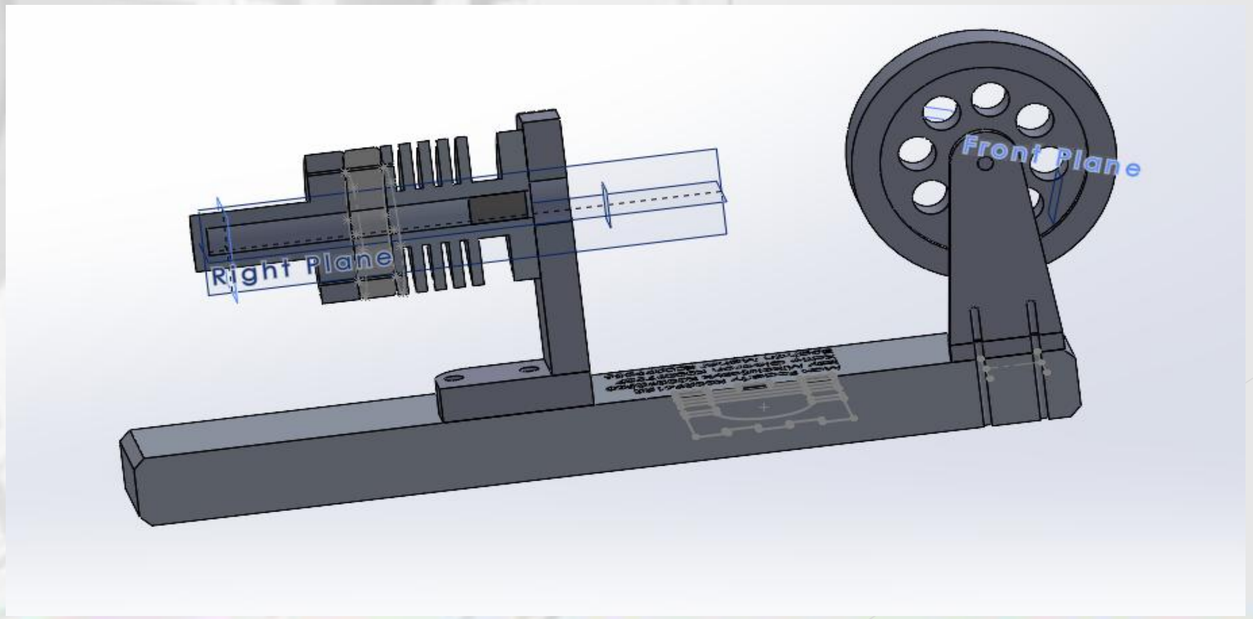


Figure 1: initial stirling design drawing

We then created a solidworks model of our design, gained feedback and looked at ways to improve the design.



Stirling Engine Solidworks Assembly

Manufacturing

CNC Machining : the parts chosen to machine using a CNC were the base, crankshaft and the flywheel due to their complex shapes. We used Solidcam software to create the G-code which instructes the machine to efficiently cut the components.

Lathe : the components we chose to be manufatured on the lathe are the power piston, the displacer piston, the cylinder and the flywheel plastic.We used a lathe because it is efficient in material removal and it has a good quality surface finish.

Milling Machine : Flywheel and cylinder stand , the power piston connecting rod and the displacer piston connecting rod. We used conventional milling and drilling to machine the components.

Conclusion

- This project provided insight into the challenges and effort in product development.
- Research on stirling engines aided in our design to create the product as efficiently as possible
- Creating concept designs allowed us to explore various ideas and select the most effective stirling engine design
- We learned the importance of considering different manufacturing processes to ensure cost efficiency and time management.

References

What is a Stirling Engine? | How does a Stirling Engine work? (mechanicalboost.com)