Design and manufacture a Wirtz pump

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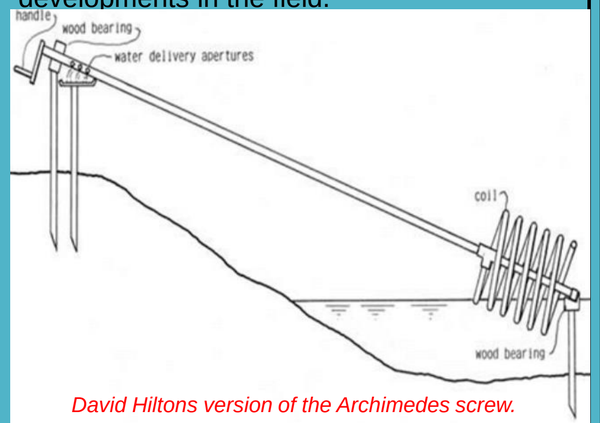
Aim of the Project

- Produce a mind map and Gantt chart to help with project management
- Use Granta-Edupak to select the material based on the environmental factors
- Produce a 3D model of pump
- Source materials through stores for manufacture
- Manufacture pump assembly
- Produce a technical report

Background

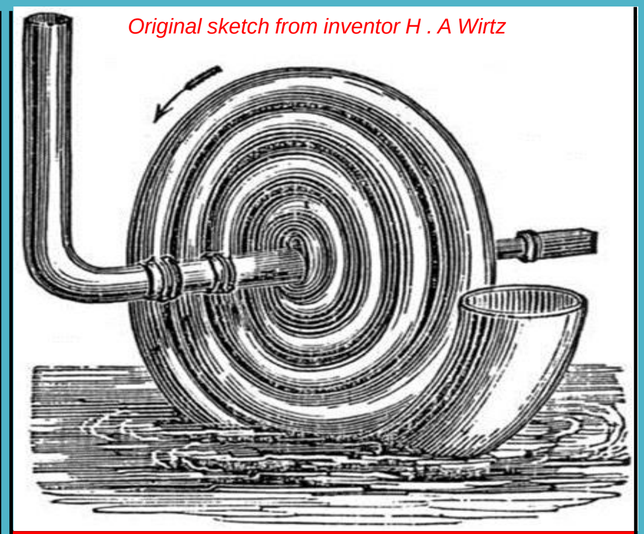
The pump uses the stream's flow to intake liquid, spiralling it through a coil design to build pressure and push water upward.

In 1746, H.A. Wirtz created the Wirtz water pump, initially known as the "spiral pump," incorporating the Archimedes principle. This innovative pump featured a 6-foot diameter and a 160-foot long coil of 1,1/4 inch pipe, capable of pumping 3900 gallons of water daily to a height of 40 feet at a rate of 3 feet per second. This pioneering invention transformed water pumping technology, establishing a foundation for future developments in the field.

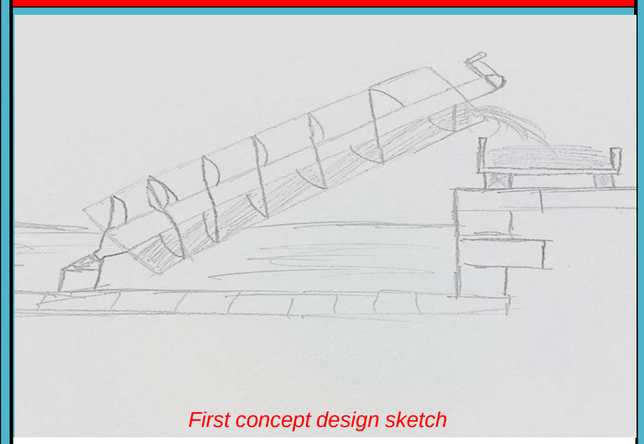


David Hiltons version of the Archimedes screw.

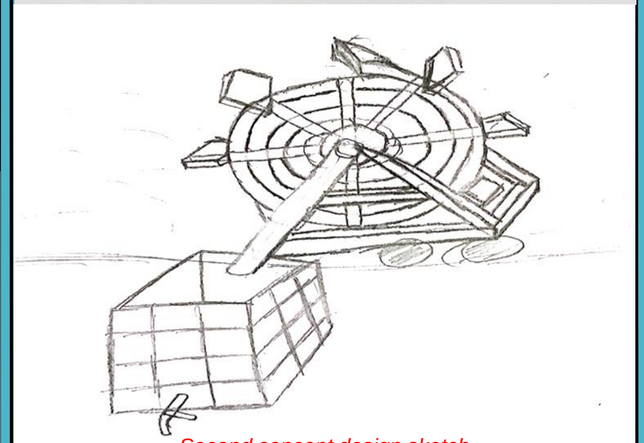
Original sketch from inventor H . A Wirtz



Design



First concept design sketch

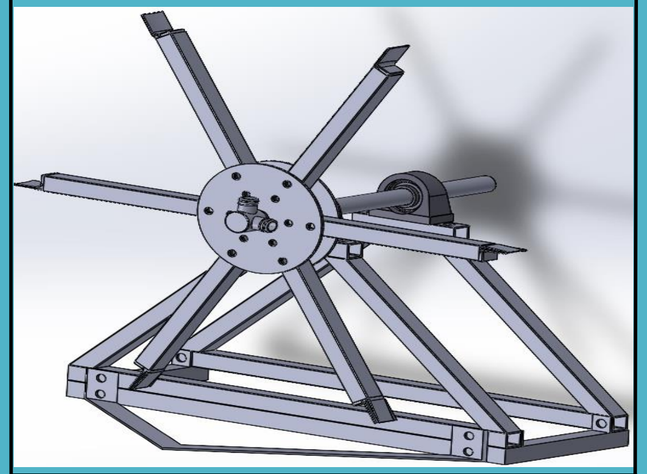


Second concept design sketch

These sketches show the progression of the design process, from here the CAD process commenced.

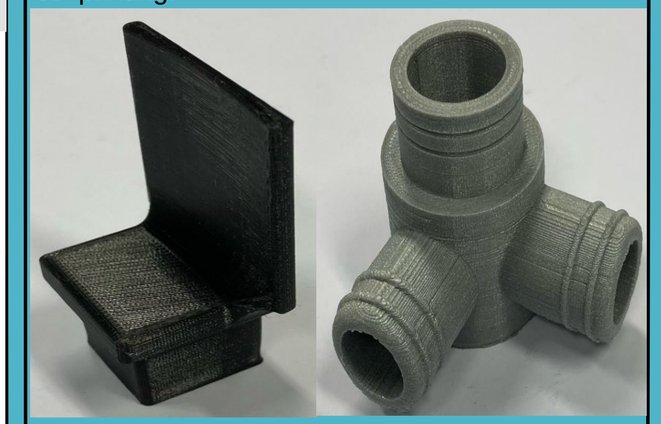
CAD

The CAD modelling was taken from basic principles including the use of two pillow block bearings and a frame to support the main water wheel and volume of water contained in the coil, along with this are parts that are 3D printed.



Manufacturing

This section goes through the manufacturing which varies from drilling, bolting, welding and 3D printing.



These two components from the wheel were 3D printed as they were too complexed for traditional machining processes.

Calculations

	A	B	C	D	E	F
1						
2						
3			Head pressure	6	m h2o	
4			Diameter of coil	0.6	m	
5			Patm	10.33	mh20	
6			% error	0.2		
7			Hn	0.401592		
8			coils	11.98092		
9			%	14.37711		
10						
11			Velocity river	0.0598	m/s	
12			Dia wheel (paddle)	0.6	m	
13						
14			Rpm	1.904459		
15						
16			radius	0.3		
17			Revs / min	1.904459		
18			Length of pipe	2	m	
19						
20			Litres / min	1.0764		
21						

This is the excel calculator I created to distinguish the parameters necessary to develop this pump.

Conclusions

The project concluded that increasing water bills on farms are crucial for livestock welfare. To pump addresses this, water was sourced from a nearby river, pumped into a reservoir above water troughs in sheds for gravity-fed distribution.

References

Tailer, P., 2005. The Spiral Pump. [Online] Available at: https://lurkertech.com/water/pump/tailer/ [Accessed 16 03 2024].

Acknowledgements

- Dr Patrick Walsh.
- Stephen Roughan.
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