EML4551

Team 18: The Centennial Calendar

Virtual Design Review 1

Team Introduction

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Project Introduction

- Resetting a spring in a watch can be such a hassle.

- The faculty of the Advanced Manufacturing Training Center (AMTC) at Tallahassee Community College (TCC) have asked us to tackle this problem.

Project Summary

- Create a calendar that run continuously for 100 years.

- Must utilize all-mechanical workings.

- No maintenance will be required.

Background

Mechanical clocks are typically driven by a pendulum or mainspring.

- Pendulum
  - A pendulum swings in constant motion with a weight attached to the end
- Mainspring
  - Utilizes a wound, spiral torsion spring to store potential energy

The clock mechanism itself consists of various sized gears and wheels that convert the energy within the train.

Prototypes and Ideas

- 10,000 Year Clock by Danny Hills
  - No maintenance
  - Expensive
  - Large
- Temperature dependent energy conversion
- Reduce frictional forces within the system

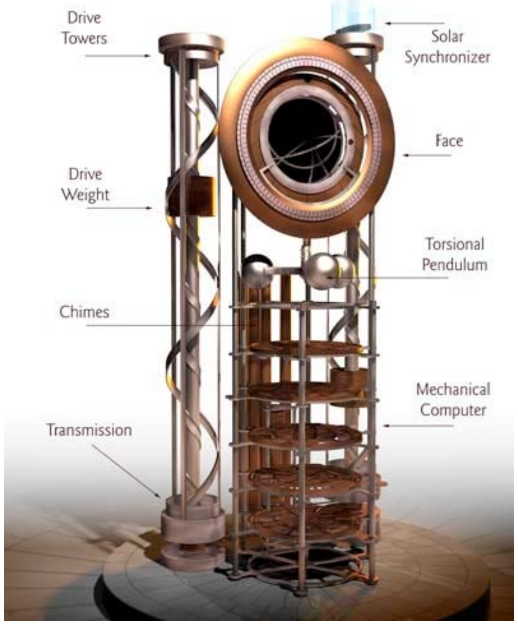

Figure 1 – Danny Hills' 10,000 year clock [1].

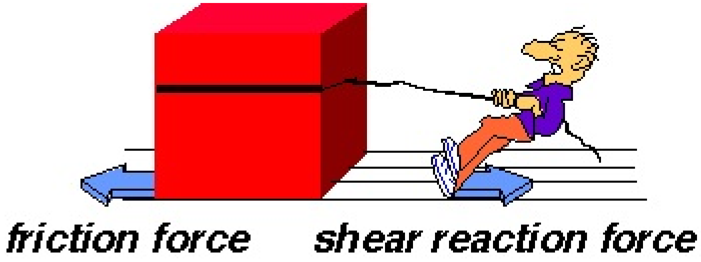

Figure 2 – Frictional forces diagram [2].

Project Scope

- Produce a mechanically-powered, aesthetically-pleasing calendar that accurately displays the date and requires no maintenance.
- Key stakeholders include:
  - The AMTC at TCC and the respective sponsors
  - The team members

Project Scope (cont.)

- Assumptions
  - Availability of tools and design software
  - Little to no maintenance done on the completed device
  - The display will not be tampered with once showcased
  - Final design must be able to fit through a doorway

- Market
  - AMCT faculty (time capsule is cared for by them)
  - Clock manufacturers and aficionados

Customer Needs

Table 1 – Customer Needs Translation Table

Question/Prompt	Customer Statement	Interpreted Need
Typical Uses	I need a mechanism that works with no electrical input.	The mechanism is powered using only mechanical processes.
	I want a mechanical calendar that is accurate to one day.	The mechanism accounts for leap years and non-leap years.
	I want the mechanism to be aesthetically pleasing.	The internal workings of the mechanism are visible to the viewer.
	I do not want the mechanism to be costly.	The mechanism uses cost-effective materials without sacrificing quality.
Likes	I like the layout of the traditional calendar.	The mechanism displays a traditional American date.
	I would like the mechanism to be self-sufficient.	The mechanism is compact and is powered alternatively.

Functional Decomposition

Table 2 – Customer Needs Translation Table

	Date Display	Encasement	Energy Management System	Timekeeping Mechanism	Metric
Date Change	✓			✓	Daily (24 hrs.)
Energy Distribution			✓		24 W/day
Energy Replenishment			✓		723 W/month
Energy Storage			✓		844kWH
Movement	✓		✓	✓	100 years
Tamper-proof	✓	✓			TL-40 Rating
Visibility from a Distance		✓			3 m
Weather-proof		✓	✓		IP-55 Rating

Thank you for your time.

ANY QUESTIONS?

BACKUP SLIDES

Functional Decomposition Flow Chart

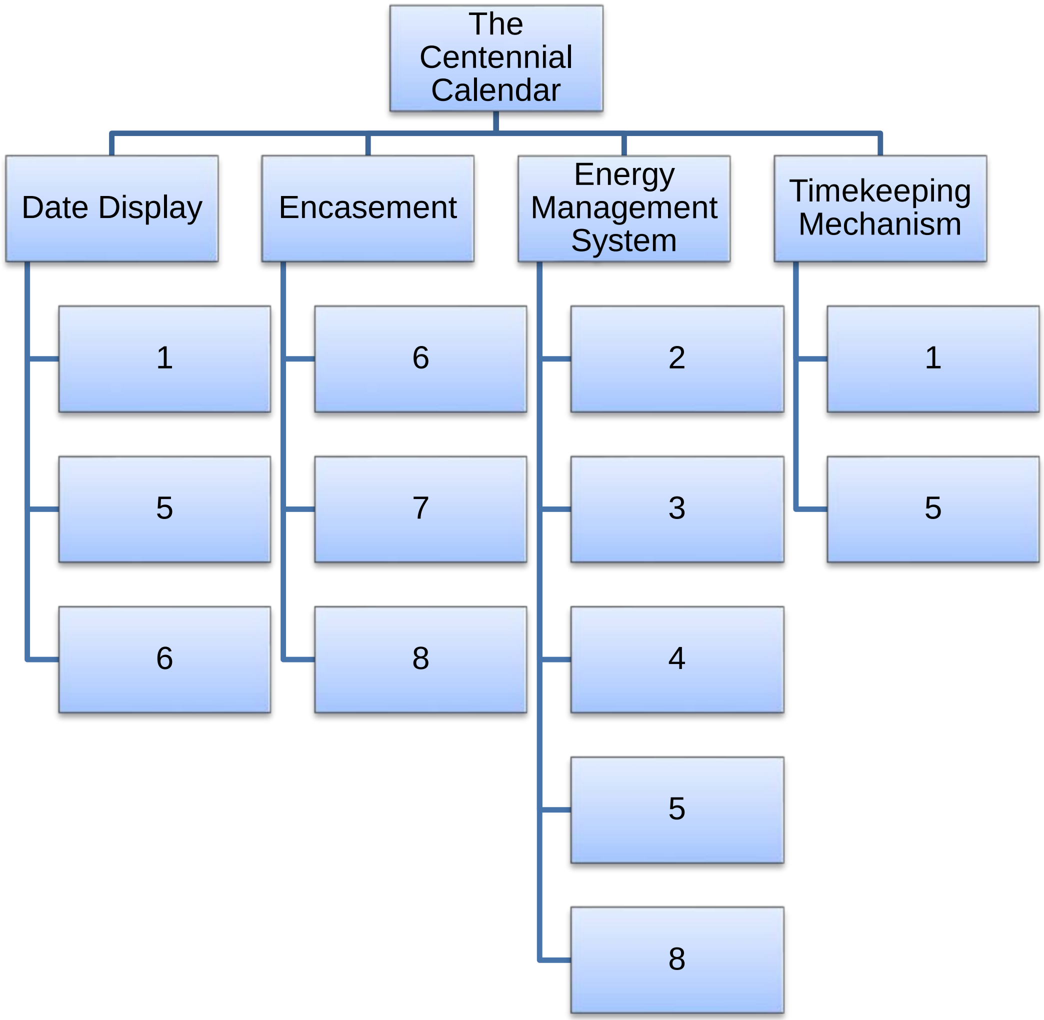

Figure 3 – Functional decomposition flow chart.

Table 3– Functional decomposition flow chart legend.

Item	Component Action	Metric
1	Date Change	Daily (24 hrs.)
2	Energy Distribution	24 WH/day
3	Energy Replenishment	723WH/month
4	Energy Storage	844kWH
5	Movement	100 years
6	Tamper-proof	TL-40 Rating
7	Visibility from a Distance	3 m
8	Weather-proof	IP-55 Rating

Mechanical Power Storage

- Mainspring:

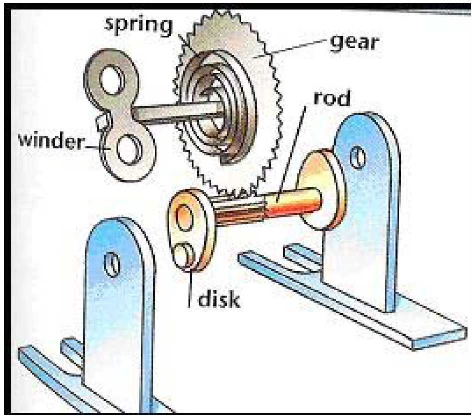

Figure 4 – Mainspring diagram [5].

- Pendulum:

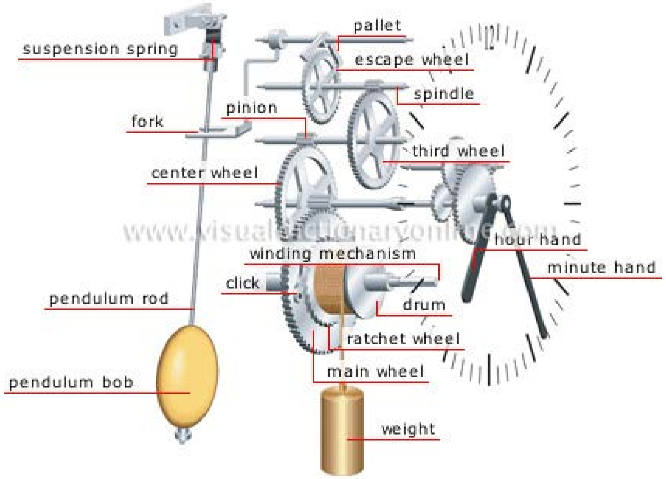

Figure 5 – Pendulum diagram [6].

References

- [1] Tweney, Dylan. "How to make a clock run for 10,000 years." WIRED. 2011. Web.
- [2] Types of Contact Forces. "Education 4 All." N.d. Web.
- [3] Woodford, Chris. "Clockwork (windup) mechanisms." ExplainThatStuff!. 2017. Web.
- [4] "How does it work." National Association of Watch & Clock Collectors." N.d. Web.
- [5] "Gears in every day life!" N.a. N.d. Web.
- [6] "Clocks made with 3D Printed Parts." Stargazers Lounge. Aug. 11, 2017. Web.