sdmay19-15: Capacitor Gun

Week 6 Report
October 12 - October 19
Client: Max Balzer
Faculty Advisor: Mani Mina

Team Members

Grant Larson — *Test and Report Engineer*
Max Balzer — *Meeting Facilitator and Production Engineer*
Bret Tomoson — *Projectile and Power System Designer*
Brett Nelson — *Safety Engineer*
Mark Fowler —*Test Engineer, scribe*
Zachee Saleng — *Engineer designer*

Summary of Progress this Report

We did a lot of work consolidating ideas into our design plan and other design documents. Also, research was done to a point that all issues could be discussed with knowledge on how to solve the problem.

Past Week Accomplishments

- Design Document and parts list - Mark
    - Went through the design document template and worked through what could be answered with what we have accomplished so far.
    - Looked through parts list to find missing parts, looked into solenoids, needed to find one that had enough and was fast enough for our project.

- Power losses and metal machining- Max
    - I found equations to use for heat dissipation and heat due to friction but am struggling to find numerical values for some of them.
    - We put together a parts list so that we can start ordering materials and start the building process.
    - The projectile will experience double the amount of heat as each rail individually. This makes calculating the losses due to friction and heat more complicated. The dimensions of the projectile need to consider the amount of heat the projectile will experience.
    - Mike is out of town this weekend but I think he will be back in town next week. This will be the time our group goes to meet with him to start machining our metal for the rails, projectile, and connection of the capacitors.

- Design document and projectile research-Brett
    - Helped finished the first version of the design document.
    - Looked into different types of projectile we could use when testing.

    - Figured out what materials the projectile would be made out of.

- Completed charging circuit parts list, discussed future requirements - Bret
    - The future plan of our project is currently being evaluated to know what needs to be done in the weeks leading to the first tests.
    - I determined all of the components needed for the charging circuit. (I will be meeting with ETG to decide if those parts are the best options.

- Gathered dimensions to further final calculations for our design -Grant
    - Used our desired muzzle energy to calculate the current needed
    - Used the desired current to calculate how many capacitors of a certain size we needed
    - Used the current to estimate the energy and velocity of the projectile

- A formula was derived that describes the relation of the magnetic field to the current of a capacitor utilizing Lorentz force. - Zachee
    - Design Document. Dimensions for the rails to 2 different types we want to test.
    - Resistance of the rails at each material
    - Sized according to the amount of current we expect to get from our capacitor bank and the estimate value.

Pending Issues

- Mike is out of town so our machining of the metal is put on hold until he gets back.
- Finalize the materials for the housing.
- The parts list needs to be finished.
- Need to figure out ways to potentially charge 450V capacitors
- Need to figure out if a solenoid is the best electrical component to use for the initial velocity or if there is something better suited for that need.

Plans for Upcoming Reporting Period

Use our research and discuss what a realistic model of the project will include. This will require definite answers from the pending issues to drive all dimensions. Also, a parts list will be needed for all auxiliary components that have been determined as necessary.

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Grant Larson	Completed early calculations of energy for the rails. Researched solenoids, capacitors, and heat sinks for our parts list. Created a rudimentary equations sheet. Began a Gantt chart for the year.	5	30
Max Balzer	I found equations to use to calculate some of the losses due to friction and heat. I got final dimensions for the demo rails scaled down from our final rail dimensions. I contacted Mike to set up a meeting time to start machining the metals and he will be back in town next week to do that.	10	44
Bret Tomoson	Found equivalent components needed for the charging circuit. Worked with team to determine new semester plan.	8	36
Brett Nelson	Helped finish the design document. Also did some research to figure out what should the projectile should be. Found the materials that it would be made out of. Found some potentially shapes/sizes to use when we start testing.	8	38
Mark Fowler	Worked on parts list, specifically looked into solenoids that would fit our use and the affordability.	9	34
Zachee Saleng	Worked on design Document. Research to figure out what should be the characteristic of the solenoids. Worked on parts list, specifically solenoids.	5	36

Plans for the Upcoming Week

- In the coming weeks we will be working on: - Zachee
    - Will working on the design parts
    - Will be determined once we finalize the rail size (height, width, and distance).
    - We will produce multiple of different sizes and shapes and first test them on the smaller scale model.
- Finalize parts list, order material - Mark
    - Find a suitable solenoid to order
    - Finalize material list and schematics so they can be presented them to the metal shop and get a better idea what we can accomplish there. Also talk with ETG to see if our materials list will be sufficient and see what issues will pop up from that talk.
- Calculating force and losses through the field - Max
    - Get our parts list finalized so that we can order materials next week.
    - Finish my calculations for losses in the magnetic field. That way we can figure out the total current that will be used from start to finish.
    - Find a battery capable of charging a capacitor bank. We might use a smaller battery and run it to a transformer to step up the voltage and reach 450V.
    - Finalize a meeting time with Mike to start machining our metal.
- Housing materials- Brett
    - Finish the parts list for the housing materials.
        - Keeping in mind of the factors to worry about like high heat, non-conductive metal, and over all have to make sure it is safe to use.
- Charging circuit design - Bret
    - I will be meeting with ETG to determine if the parts selected for the charging circuit are the best for our use.
    - I will also talk with them about sourcing other raw materials that are on the parts list.
- Create complete formula sheet for all calculations to do with the Railgun - Grant
    - Write down how to easily find energy, current, and other variables given design dimensions

Gitlab Activity Summary

Nothing to report.