Catapult Design Project

The Dutch Masters

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Introduction

The Dutch Masters have been asked to designed a safe and reliable catapult to meet the specifications required. The requirements were that it could not exceed 1.5 cubic feet, must be able to throw a 50 gram golf ball, and it had to hit a target that was 3 meters away. This target sat 7.5 inches off the ground, and the diameter was 26 inches with a 3-inch bullseye. Our group also wanted to build a catapult that was safe, consistant, and durable. The Dutch Masters' final catapult has met all specifications, and has kept safety its' top priority.

Brainstorming

The first step in producing our catapult was to brainstorm. Every person in the group came up with individual ideas, used the library, researched on the Internet, and had group discussions. Many ideas were brought to the table, including ideas from a trebuchet. After finding detailed plans on the Internet of how to build a trebuchet the group agreed that it was too complicated. Our group then came up with a list of materials that we could possibly use. The list became smaller as time went on. Some ideas were scratched because they were too complicated, others because the materials were not strong enough. Group members went to Lowe's in order to find all the materials that we would need. The first step in designing our catapult was ready to start.

1st Prototype

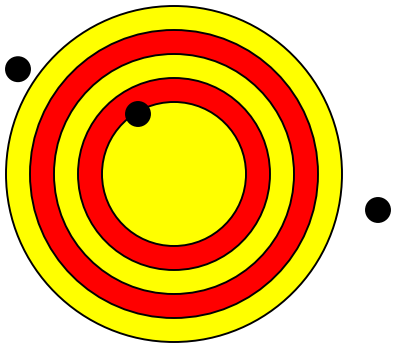
Sketches of the first prototype were created and given to Jonathon Ripper. Due to unavailable space and equipment Jon agreed to take it to his house and build it in time for the first testing. As Jon followed the sketches and remembering what was discussed as a

group, the first prototype was built. To start, a piece of plywood was used as the base, and one rat trap was screwed onto it. The handle was made out of an egg spoon that was tied onto the spring and lever of the rat trap. For safety purposes, a chain was used as the stopping mechanism. In this phase of the design, no trigger mechanism had been in place.

1st Test

On the scheduled day our group went first to fire our catapult. Before getting to shoot our catapult, we knew we were in trouble. The arm of our catapult had broken due to an accident. Attempting to fix the arm, the arm was wrapped in wire to try to keep it secure. When it was our turn, we placed our catapult at the 3-meter marking. Our first shot got a 90 out of 100 points. The next two shots never even hit the bullseye, because the temporary fix to the arm did not work. An example bullseye with our shots can be seen below. Other problems included the force, jumping of the catapult, and problems with the stopping chains. Overall on the first testing, the Dutch Masters came in last place. We had scored only 90 out of 300 points. Many improvements needed to be made, but there were some parts of the design that worked as planned. There were no

problems with the golf ball falling out of the spoon, and the rat trap provided enough force to fire the golf ball the distance needed.



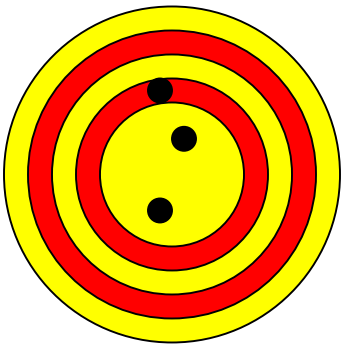
Final Prototype

Again the Dutch Masters were back to the brainstorming sessions. After coming up with new ideas, Jonathan Beckley offered to take it home to re-build our design. Our new design was built onto a heavy, old-aged piece of wood. Now, using two rat traps, an ice cream scoop was attached. This ice cream scoop would better serve the purpose of an arm because of its strength. Two chains were added as our stopping mechanism. On the first prototype only one was used, causing the links to become tangled. Using two individual chains allowed the chains to work better. As stated previously, we needed to include a trigger mechanism. We came up with the idea of a pin-release trigger. The first trigger was placed deeply underneath the firing arm. It was made of two U-wire clamps drilled into the base with a long pin holding down a ring that was connected to the ice cream scoop by a chain. From trial and error, we found this idea would not work properly and consistently the way we needed. So, after a little more brainstorming the use of a fence lock screwed into the base with a strong wire cable hanging form the top of the spoon became our next trigger. The use of the fence lock and wire seemed to work more easily and safely. Also, this trigger kept the force and direction of the firing arm

consistent every time. For a final touch, the catapult was painted. The base was painted blue, with a red rat trap and a silver star right in the middle of the base. The pictures below show the final design.

Final Test

Our group decided that it was time to re-test the catapult. Picking a spot with a lot of room, it was fired. The first shot was a little high, but with the adjusting chains it was easy to fix. Our score went from a 90 to a 290. We are very proud of the improvements that went into our catapult, and are sure that in the fair we will be in the top of the class.



Qualities

Realizing that nobody would use a piece of equipment that was unsafe, we made safety our number one priority. Instead of the commonly used stopping bar, we used stopping chains. Seeing that there was a possibility of a person catching their fingers between the arm and the bar of the catapult, the idea of chains were used. A trigger mechanism was also designed so that the operator could stand at a safe distance in case of

a misfire. As you will see, our final design includes two rat traps. This may not seem safe at first, but when taking a closer look, you will realize that all precautions have been taken. Consistency was a major concern of the Dutch Masters that improved over time. By looking back into the report, you can compare the two targets and see how much the improvement was. To get the catapult consistent a lot of work into it, and it paid off. Durability was our final concern. There is no question about the durability of our final design. It is made out of a solid piece of wood, and all of the metal parts can withstand the forces exerted on them. All of the goals that the group set were accomplished. Some of these goals took more work, but overall all of the members of the group are happy with the outcome.

Conclusion

Overall the Dutch Masters catapult went through a lot of changes. The entire group spent many hours trying to develop a unique catapult that kept our goals in mind. The final catapult was designed to meet the specifications. It is 1.5 cubic feet, with no weight limit, that can throw a 50 gram golf ball to a target placed 3 meters away. All of the materials used to design this catapult are easy to find, and do not cost a lot of money. We feel that our catapult provides safety, durability, and consistency.