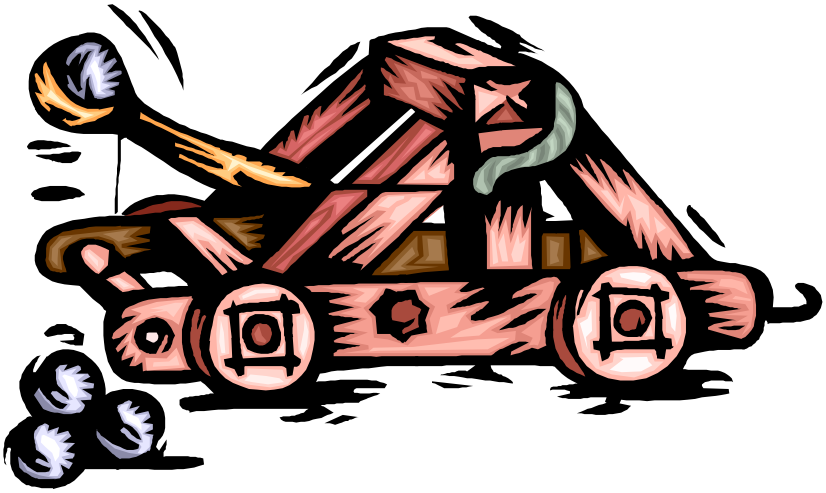
Consensus Consulting Company



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Summary

Our consulting company has been given a task to develop a catapult. This catapult has to launch an object approximately fifty grams a distance of three meters. The design must be accurate to strike a target's bull's eye of three inches in diameter, at twenty and one half inches off the ground. The design could be no larger than one and a half cubic feet. For our own specifications we wanted a design that would be safe, consistently accurate, unique, durable, cost efficient, and light weight. The specifications are that the design could not be is anything mechanically inclined. Later on the developments will be tested among several other companies' ideas to determine the most accurate within the specifications.

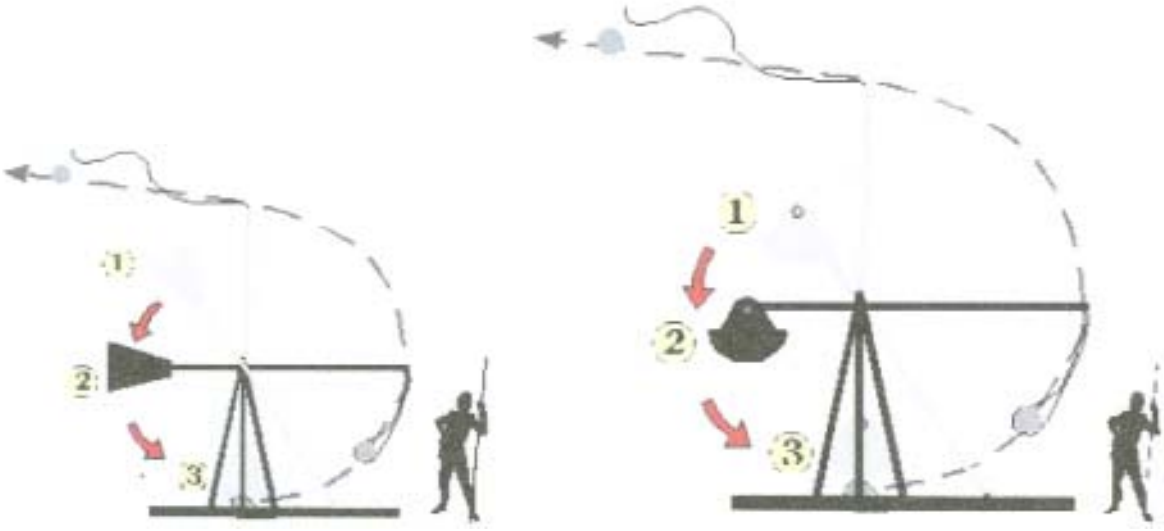
Introduction

As consultants my colleagues and I have obtained a task to design a catapult. The methodology will explain that we broke into groups to develop two catapults. It will tell about the trebuchet catapult and why we though we could us it, and why it did not work. It will also tell about our second spring loaded catapult and why we used that as our final catapult. It will also show our problems with our second catapult and the revisions that we went through. Our results will show in detail the complications and difficulties we had in building the first prototype and what we did to revise them. With these revisions we were able to produce an excellent catapult that met both our personal objectives and the objectives set by our instructor. Our conclusion will state the out come of our own testing. It will also tell how we got our final catapult from mixing the trebuchet and the onager catapult's strengths making one revolutionary catapult.

Methodology

With the objective clear we first began researching the subject of catapults. Through research the history of catapults and basic designs were found. Initially, our group of four split into two individual teams, each one responsible for designing a different type of catapult. One group decided to attempt the trebuchet design, utilizing a counterweight for the launching force and a sling for added power. The other group endeavored to create a spring loaded catapult, using the force of the spring to propel the golf ball.

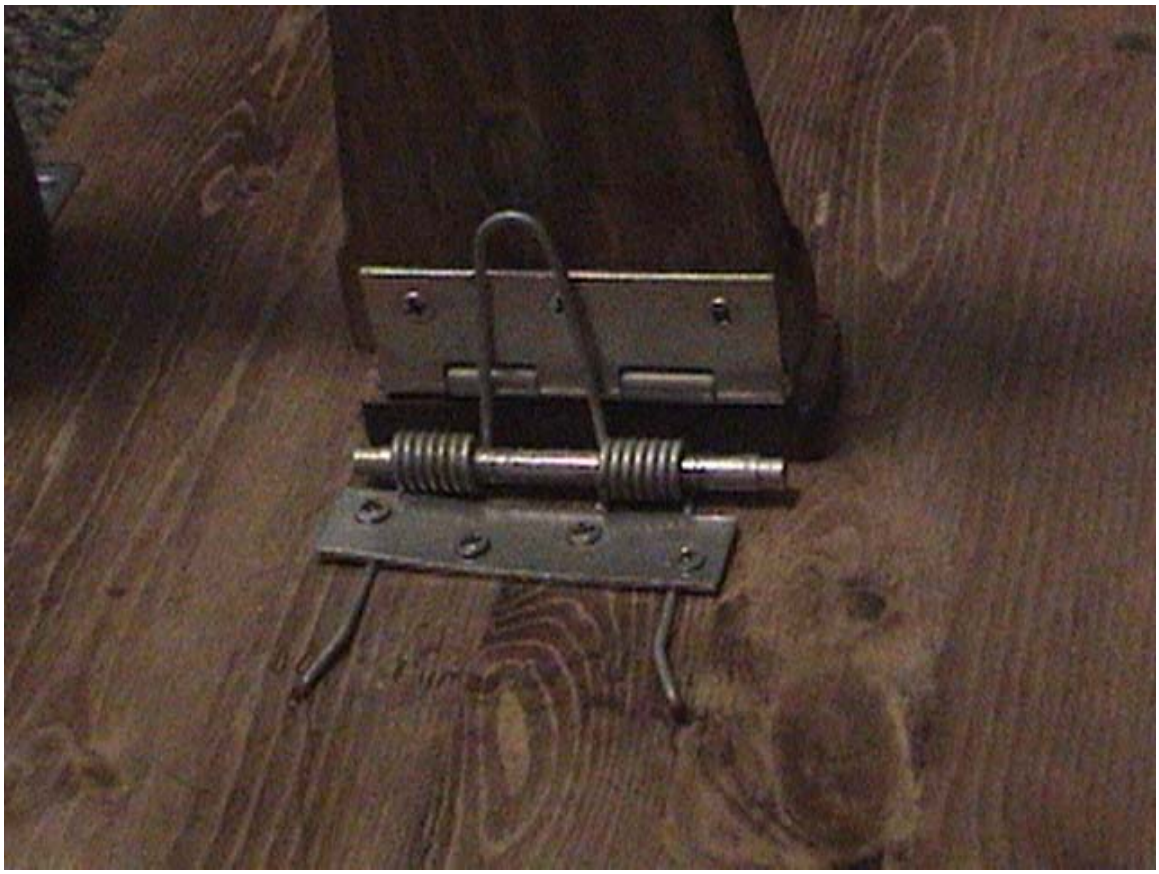
The trebuchet is possibly the simplest catapult design. The entire mechanism relies only on the power of gravity to swing the fulcrum, or catapult arm. On one end of the fulcrum, a heavy counterweight is placed. The counterweight can either be a solid object, or on a pivot, offering more swinging power.



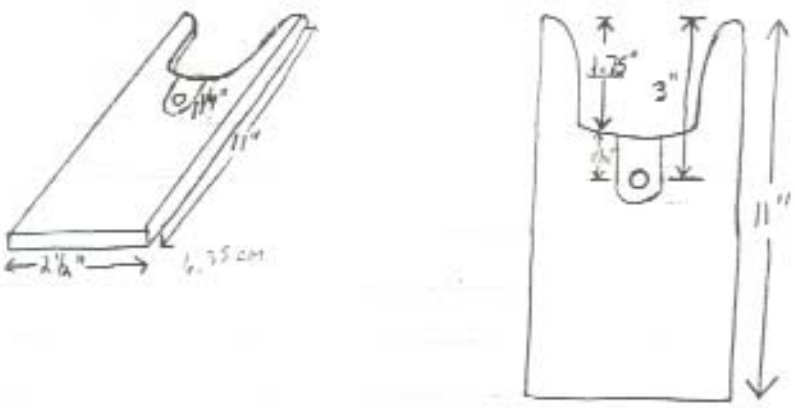
On the other end, a sling is placed, offering more power and accuracy. The group's trebuchet design never got out of the testing and design phase, because its design was

deemed unfit for the objective. Under the size constraints, the trebuchet lacked the power necessary to propel a golf ball. The prototype is very crude, with no improvements over the initial construction, but the spring-loaded catapult proved to be much better and so the trebuchet was scrapped.

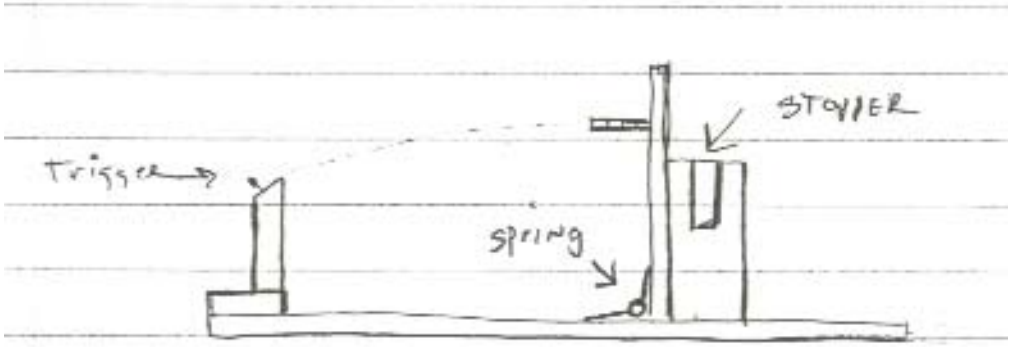
The spring-loaded catapult is another simple design. Our particular design depended on a tubular spring that compressed when the fulcrum was bent backwards. The spring would then be allowed to snap back, launching the golf ball forward. This design proved much better suited for achieving the objective, though still had its share of problems.



On our first prototype of the catapult, several things went wrong. First off, the top of the arm was designed in the shape of a “U”. With this arm we had planned on placing a pouch inside the “u” to hold the golf ball.



This was not a good design because the golf ball kept hitting the arm itself, instead of being able to release freely. Secondly, we could not get the compression that we needed from the spring. We had originally mounted the arm onto a hinge directly to the base, with the spring mounted directly behind the arm. This allowed the arm to go back only until it was restricted by the coil on the spring itself. Also, the original trigger mechanism was placed in such a way that the arm could not extend fully, resulting in severe loss of launching ability. Finally, another complication with the first design is that the release for the trigger mechanism was mounted much too high, limiting the power of the catapult.

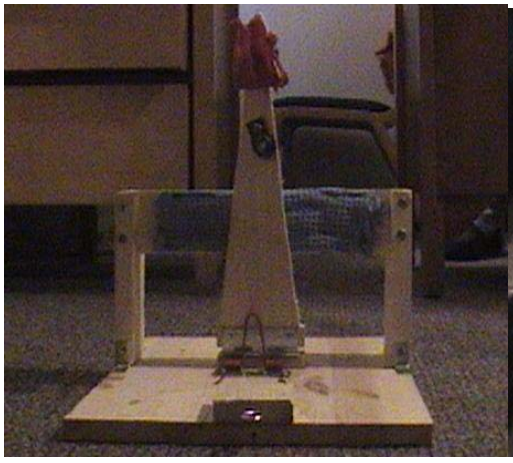


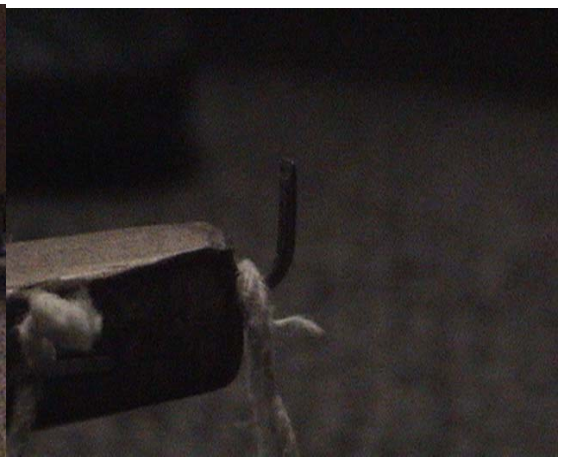
Although these obstacles could have been avoided through more detailed brainstorming and patience, our revisions proved to be very satisfying.

Results

To correct out mistakes, we tried to combine the best aspects of both catapults, the sling from the trebuchet and the small size and power of the spring loaded catapult. Using crude tools and parts, consisting of a screwdriver, drumsticks, duct tape, and shoelaces, we fashioned a new arm equipped with a sling. Without even changing the original spring flaw, the sling design exhibited significantly improved performance. Refining the design further to eliminate the spring and trigger problems, we arrived at our final prototype.

The original arm was replaced with an arm of the same width at the bottom but tapered down to a point at the top. At the top of the arm we placed a nail down through the tip. We then cut off the head of the nail and angled it accordingly to hit a target 3 meters away and 20.5" high.





The pouch for this arm had to be attached to the arm on one end and still have a loop to slide freely on the nail. To do this we took a piece of string approximately 12'' and attached both to opposite sides of the tip of the arm. With these two ends attached, a "U" shaped string was formed. A piece of the durable, yet flexible, material was then

placed on the string at the width of the golf ball. The vertex of the “U” was left open to slide onto and off the nail.

The problem with the compression of the spring was solved by setting the arm on top of a block of wood slightly thicker than the width of the coil on the spring. This adjustment allowed the arm to be fully compressed to the base.

By changing the base of the arm and allowing it to go back farther, we also eliminated the high trigger mechanism, enabling the fulcrum to be locked in place with the spring fully compressed.

Through these revisions, we are confident in the performance and safety of our catapult. It is small, lightweight, and accurate. By simply choosing a different release point on the trigger shaft, a target may be reached at variable distances. Another adjustment that plays a key part in our design is the nail at the top of the arm. Turning this nail from left to right will have a direct effect on the path of golf ball. Also, changing the angle of the nail will change the height of the gold ball's trajectory.

Conclusion

In conclusion we believe that through research, trial and error, and some guess work we have developed a superior catapult design. Our catapult takes some of its design from the trebuchet, such as the sling and the pin to guide the golf ball's trajectory. It also takes from the onager design, for example the spring that powers the arm and crossbar used to stop the arm. This hybrid catapult gives us the best of both worlds. It provides the strength and dependability of the spring design and the versatility and adjustability of the trebuchet.