Engines of War

An entry for the SCA Tasmania Arts and Sciences “Candy Chucking Challenge” competition by Friar Juan Baptistè dé Oliverà.

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Trebuchet: Noun (pr: *tre-boo-shay*)
"Medieval artillery used during sieges; a heavy war engine for hurling large stones and other missiles"
– WordWeb

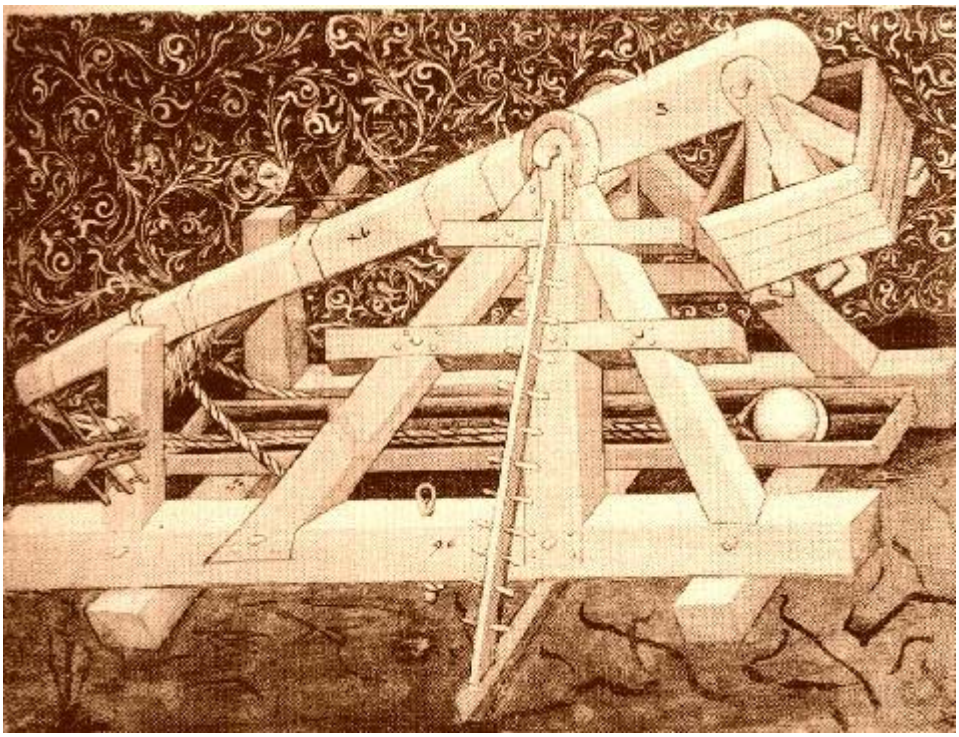

Figure 1 – From Konrad Kyeser's "Bellifortis"

The Trebuchet is said to date to approx. 300AD in China, however, according to the Grey Company –

> "*Resemblance … is to a Middle-Eastern water raising device called a Shaduf.*
> *Interestingly, Chinese records claim the traction trebuchet for themselves, but call the weight-powered machines "Arab" weapons.*"

This seems to indicate that it was developed from a simple water-raising device originally and then altered to serve as a weapon of warfare. Where it originated is difficult to say.

There are two main types of trebuchet. These are: the Tension Trebuchet – a device that gets its power from a tension or spring; and a Counterpoise Trebuchet – a device that gets its power from a counterweight using lever action. The Medieval Lifestyle site contains an good graphical representation of these two styles of engine.

John Goodall tells us that Prince Louis of France introduced the trebuchet in England at the siege of Dover Castle in 1216. The form of the trebuchet used by Louis is not, however, described but must have been easily able to be dismantled as this device is said to have been dismantled and moved to London.

The author will attempt to reproduce and compare both of these main types of ballistic engine.

The Candy Chucking Challenge

To research and construct a small trebuchet or catapult designed to 'chuck' a regular Pascall marshmallow the furthest to be pitted against each other at the Silver Arrow 2007 event. There are a couple of base rules aside from that I leave it up to the individuals constructing such siege weaponry and their calculations

The tabletop siege weapon should be made of materials found in period or reasonable equivalent (ie no plastic. That being said, duct tap in the SCA is considered period so that will be allowed). The base of the weapon should be no more than 50 cm in length. The ammunition is to be one regular Pascall marshmallow.

Tension Trebuchet – "The Toffy Tosser"

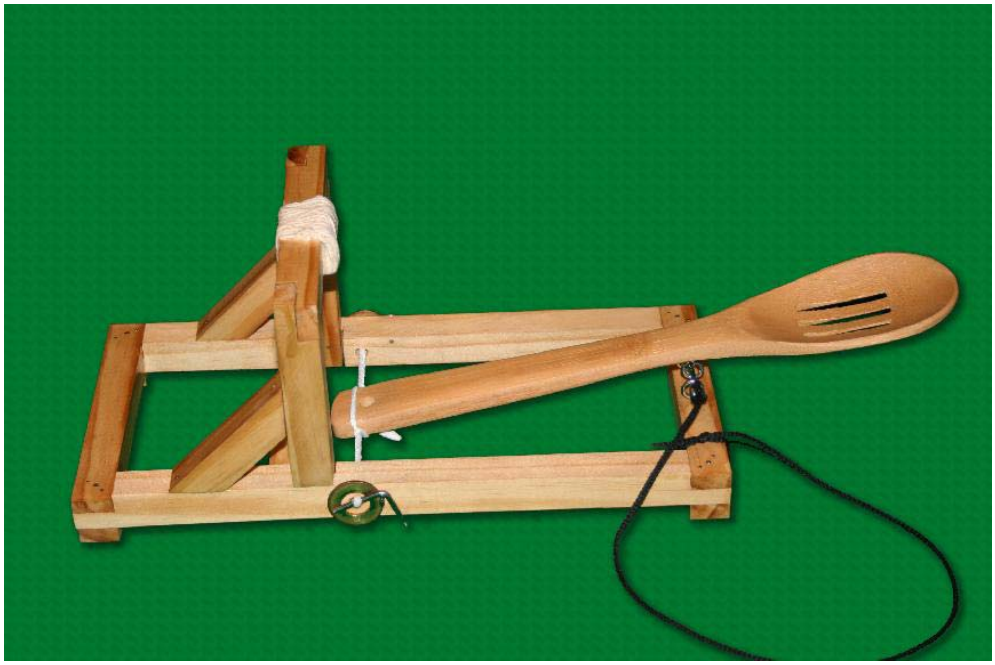

Figure 2 – Tension Trebuchet Primed

The first of the engines of war that was designed and built by Brother Juan was the classic style trebuchet (figure 2).

This engine is a simple torsion driven machine that uses the tension derived from the twisting of a rope to provide forward thrust to the swing arm. The arm is pulled down and secured to the rear of the trebuchets frame and is held against the forward tension of the rope by a simple release mechanism. When the release is triggered, the arm swings rapidly forward and is halted by the upper crossbeam of the trebuchet. The ammunition loaded in the "basket" of the trebuchet continues forward with the momentum imparted by the motion of the swing arm. In this scale model, the trebuchet is 30cm in length and 14cm wide. The device has been recorded firing a projectile (a hazelnut) some 6m distant.

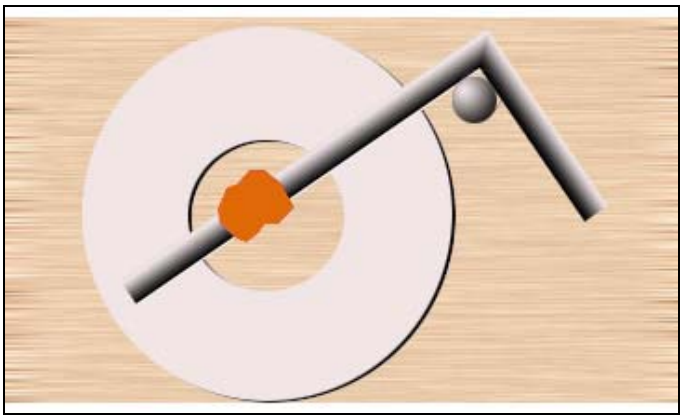

Figure 3 – winding mechanism and brake

The tensioning device (figure 3) that was created for this project was constructed using a pair of brass washers (to allow the winding mechanism to rotate freely) and a pair of nails that were ground and bent to 90º to form both a winding and locking mechanism. Additionally, a pair of nails was used to create a brake for the winding pins to hook. The tensioning "rope" was made from braided craft cord.

The winding pin can be rotated so that the short end can be used to rotate the pin and tension the rope. The short end can then be used to catch on the brake pins.

The trigger was made from three screw eyelets and a trigger pin (made from a ground and bent nail). Two eyelets were screwed into the trebuchet base and another was screwed into the swing arm. The three eyelets are screwed in to line up and allow the trigger pin to pass between them (figure 4 and 5).

Figure 4 - Tension Trebuchet trigger

The tension of the swing arm helps to hold the triggering pin in place.

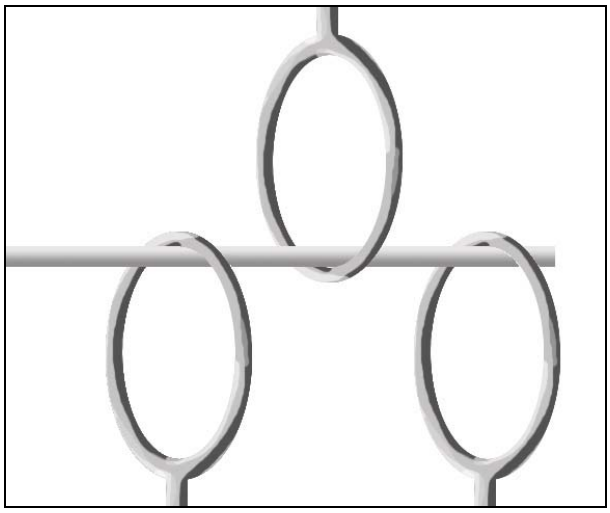

Figure 5 - Trigger Design

It was decided that the easiest and most efficient swing arm for this project was a simple slotted bamboo spoon (bought from K-Mart for $3.95). The use of the slotted spoon was determined to be similar in design to some woodcut images of this style of ballistic machine seen.

Since initial construction, a crossbeam has been added to the tension trebuchet to reduce the amount of frame distortion caused by the winding of the tension rope.

A measurement of the tension on the tensioning rope indicates that at nine complete turns of both the left and right winding pins yields approximately 450 grams of weight.

Counterpoise Trebuchet – "The Caramel Chucker"

Figure 6 - Counterpoise Trebuchet Armed

When many people think of a catapult, this is the kind of thing that they think about (figure 6). This was the second trebuchet that was designed and built by Brother Juan and is based on pictures of counterpoise trebuchets that have been viewed by him, particularly the image of the Bellifortis engine.

In essence, this engine is made of four pieces: The frame (a sturdy a-frame design); the swing arm; a counterweight; and a sling.

The frame supports the swing arm. The swing arm supports the counterweight on the short end and the sling on the long end. Additionally, a projectile chute is added to enable the projectile to be launched cleanly.

In designing the counterpoise trebuchet for this project, Brother Juan decided to keep both designs as similar to each other as possible. Both would have the same footprint (30cm x 14cm) and both would use the same materials (as possible), given the differing nature of each engines motive power. Maintaining such a similarity would give a reasonable comparison between the ballistic capabilities of the two styles of machine. The weight of the counterweight for this trebuchet is approximately 600 grams.

It was decided that the style of joint used in the construction of the counterpoise trebuchet would be rebated joints. Given that the frame contained a number of 45º joints, this meant that I would have a lot of mitre sawing and chiselling to do (figure 7). The use of rebated joints will reduce the overall width of the frame and increase the amount of internal space available for the counterweight. However, the Bellifortis picture seems to depict this kind of joint.

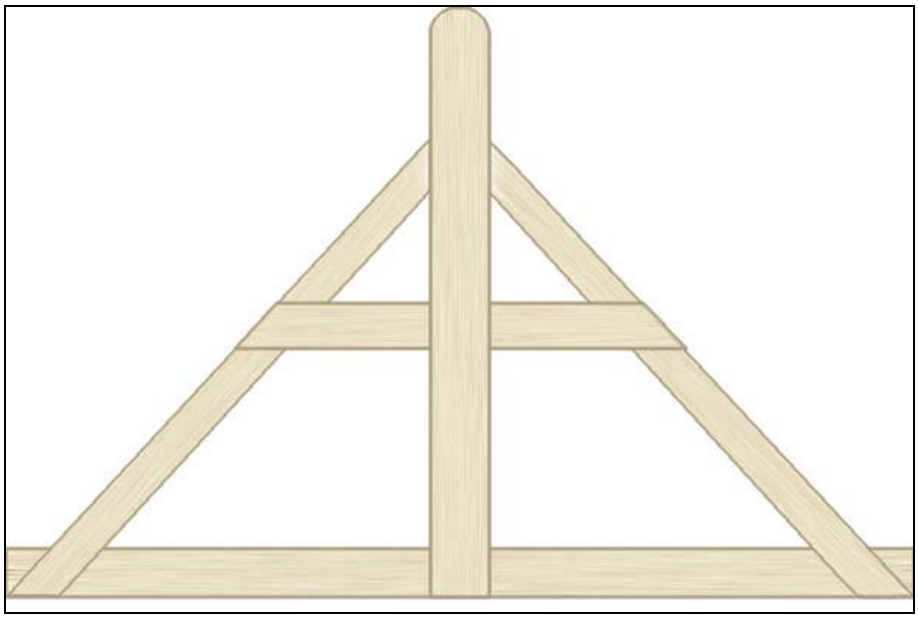

Figure 7 – Counterpoise Trebuchet frame

Two frames of this design were constructed using 18mm square pine. To this frame were added four crossbeams and a 10mm hole was drilled at the apex of each frame to accommodate the 10mm dowel rod that will be used as the trebuchet axel.

The overall design of the counterpoise trebuchet is reflective of the Bellifortis catapult limited by the carpentry ability of Brother Juan, the strength of the construction elements and available materials.

The counterpoise trebuchet was designed without the use of a windlass or other winding mechanism, as it will be possible to arm the device without expending more than human strength in the scale model.

Figure 8 – Counterpoise Trebuchet

The counterweight used in Brother Juan's Counterpoint Trebuchet (figure 8) was constructed by building a box that would fit between the supports of the trebuchet and filled with lead sinkers. A canvas "sheet" was then nailed over the weights to prevent them from flying out when the counterweight swings.

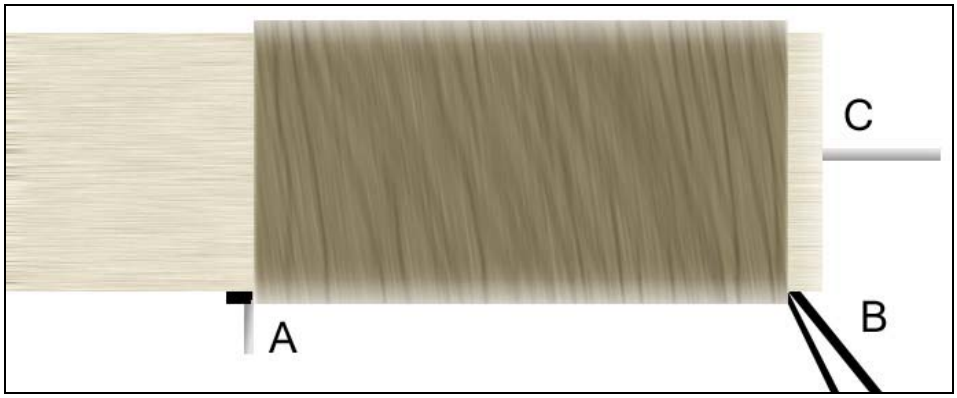

Figure 9 – Sling Attachment

The sling was made by hemming a rectangular sheet of canvas and then attaching two loops of a strong nylon cord. The length of the two loops was adjusted so that they were equal when the trebuchet arm is in the upright position. The fixed loop was attached to a nail (figure 9 – A) in the underside of the trebuchet arm and then bound to the arm using a length of hemp string figure 9 – B). The string was glued down for further stability. The loose end of the sling loop is hooked onto a nail whose head has been filed off to prevent catching (figure 9 – C).

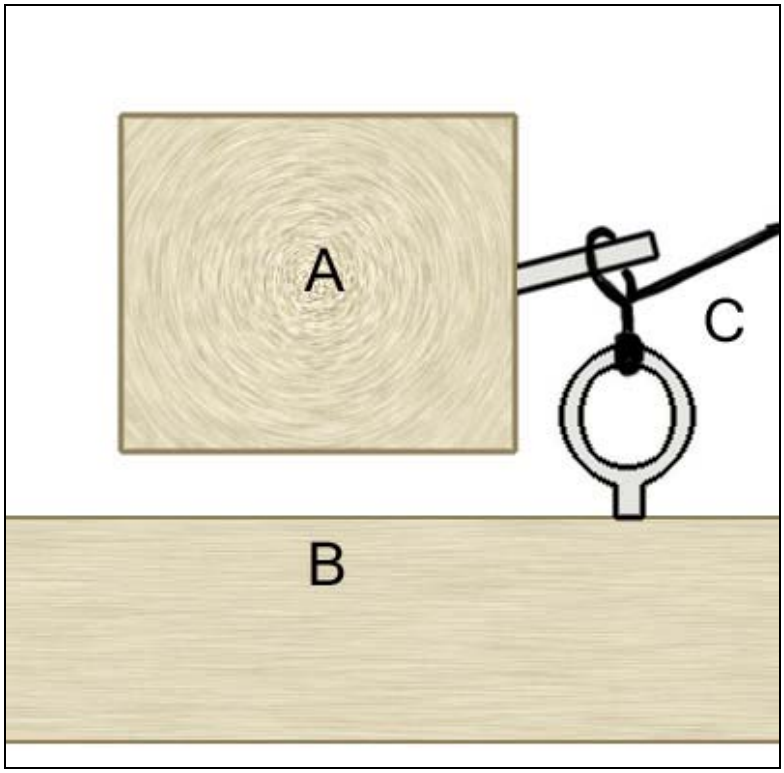

Figure 10 – Counterpoise Trigger

A trigger (figure 10) was made for the counterpoise trebuchet by attaching a screw eyelet (figure 10 – C) to the rear frame of the trebuchet (figure 10 – B) and driving a slightly bent nail (with the head filed off) into the trigger side of the trebuchet arm (figure 10 – A). Attached to the screw eyelet is a length of nylon cord that has been tied to form a loop close to the screw eyelet. The cord is looped over the bent nail to arm the trebuchet. When the long end of the nylon cord is pulled, the loop detaches from the nail, thus releasing the trebuchet arm.

Testing the counterpoise trebuchet demonstrates that this engine will fire a hazelnut approximately 7m.

References

- Grey Company – Historic Trebuchet Illustrations Pt 2 – http://members.iinet.com.au/~rmine/ht/ht02.html
- John Goodall – Dover Castle and the Great Siege of 1216 – http://www.deremilitari.org/RESOURCES/ARTICLES/goodall.htm
- Medieval Lifestyle –Medieval Siege Engines – http://www.medievallifestyle.com/siege-engines.html

Baronial A&S Competition Entry Form

(to be completed by the Entrant at or before Competition)

Event: 2007 Silver Arrow Date: December 2007

Name of Competition: Candy Chucking Challenge

Your SCA Name Juan Baptistè dé Oliverà

Description of Item: Torsion and Counterpoise Trebuchets

Time frame / location in Period: Torsion Catapult used from approx 300 AD, counterpoise used from as early as 1000 AD

Is additional documentation attached? YES / NO

Is this your first attempt at this type of item / skill ? YES/NO

I would consider my experience level in this skill to be: (please circle the appropriate one(s))

Beginner *Intermediate* *Advanced* *Professional*

I agree to have a photo of this entry added to the Ynys Fawr A&S file: YES / NO

I agree to have a photo of this entry and documentation published in Islander: YES / NO