

Siegecraft

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1 Introduction, Perspective

The methods used to take cities during the middle ages were many and varied. Most of them used large weaponry of various types. One particular type was the rock-hurling device, which is the main focus of this paper. The most powerful of these devices was the trebuchet (pronounced trè*bú*šé). Others included the use of the penthouse, a very strong, movable structure, to defend workers who attempted to topple the walls[3]. Another was to simply wait out the enemy. The most effective way was to acquire it through treachery. By far the easiest way to take territory was to simply skip any heavily-fortified castles and cities, and move on to the worse-defended ones: A breached castle is of no immediate use to an invading army. These last two methods, though, do not involve the use of siege weaponry, which is the whole fun of the thing, and were considered cheating and strongly discouraged.

I will therefore stick to taking cities by the book, by using devices designed to hurl various items at the opponents and the walls of their citadels.

2 Designs for Projectile-Hurling Devices

Several designs were used throughout the middle ages, with the main advances coming between 1000 and 1400 CE, when gunpowder was first used for propulsion[3], rendering the castle and mechanical artillery, such as the catapult and trebuchet, obsolete.

There are two main divisions of heavy projectile-hurling devices: those powered by torsion and springs (such as the catapult and ballista), and those powered by the release of a counterweight (such as the trebuchet).

2.1 Torsion- and Spring-Powered

Spring-powered engines are those that use the stored energy from bending a flexible piece of wood to propel their payload[1]. The bow is a smaller example of the concept, although not all spring engines used a bowstring as the interface between the spring and the projectile.

Torsion-powered engines are those that use the elasticity of a twisted skein of hair or cord. The catapult is the canonical example of a torsion-powered engine. The concept is similar to that of a watch-spring: tension is built up by winding it up, rather than by bending the wood back as in a spring-powered engine.

2.2 Counterweight-Powered

Counterweight-Powered engines could throw much heavier missiles than other mechanical artillery, but had shorter ranges and slower release velocities and were generally harder to transport because of the weight of the counterweight. Thus, they were useful almost exclusively in sieges, where neither side had to move around much[1]. There was a variant

which used the power of humans pulling ropes in place of the counterweight; this variant was less accurate and had a shorter range, but was much easier to transport[3].

3 Comparison of Designs

The catapults, ballistas, and other devices that work by storing energy in a spring, are limited in power by the flexibility of the spring. Winding them beyond a certain point will break the spring, releasing enormous amounts of energy in the propulsion of spring fragments at high velocities all around the engine of war. The trebuchet, on the other hand, has no limitation in the weight which can be placed on it, except for the strength of its wood. The materials of which it is made need not be very flexible. They can be the strongest wood available, and may be layered so as to provide any arbitrary amount of strength.

A trebuchet may throw anything which is lighter than the counterweight, when mechanical advantage has been accounted for. The lever in a catapult gives considerably more mechanical advantage to the object being thrown, because the point at which the lever pivots is also the point where the force is applied.

A very large trebuchet (with an arm length of 50 feet and 20,000 pounds of weight) could throw a 300-pound projectile about 300 yards[1]. The largest known catapult could throw a 50-pound projectile about 400 yards.

4 Relevance of Performance Variables

Castle walls can be more than twenty feet thick. They are usually composed of flint bound together with cement[2]. Flinging 50-pound objects at walls this thick and strong is the slow way to tear them down. The weight of my backpack is comparable to that of the heaviest objects a catapult could throw. 300-pound objects, on the other hand, will leave more of a dent. 300 pounds is about twice my weight. While still slow, this larger mass will greatly increase the speed with which a wall may be battered down.

5 Conclusion

The trebuchet was the most effective piece of artillery for the battering down of castle walls, and hence the most powerful siege engine, until the invention of the cannon.

References

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- [2] Encyclopedia Britannica Inc. *Encyclopedia Britannica*, volume 6, page 6:863e. Encyclopedia Britannica, Inc., Chicago, 15th edition, 1983.
- [3] Charles Oman. *A History of The Art of War in the Middle Ages*, volume II. Burt Franklin, New York, 2nd edition, 1924.