

Engineering Mechanics: Dynamics

CIEG311 - Fall 2001

Project #3: 311 Virtual Chunkin Open

It's Halloween and we're in Delaware - that must mean it's Punkin-Chunkin time again!

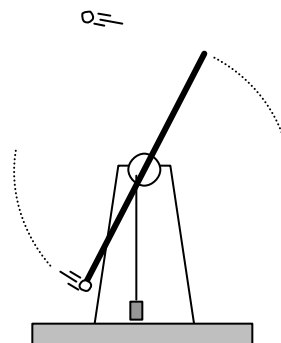
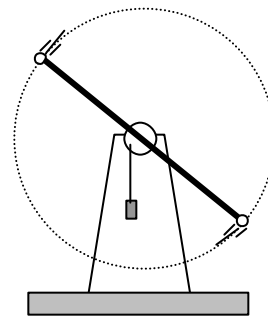
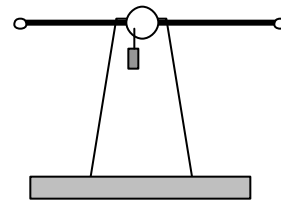
If you haven't heard about Punkin-Chunkin, you haven't been listening to the news around Halloween the last few years. This made in Delaware "sport," has received national attention and is truly one of those "only in America" events.

Punkin-Chunkin began in lower Delaware in 1986, when Bill Thompson and Trey Melson challenged John Ellsworth to a dual, of who could build a machine that would throw a pumpkin the farthest. Thompson and Melson won that first year with a toss of 128 ft. Fifteen years later the annual event has become a huge attraction, drawing contestants and spectators from across the country. For two days in late fall, you can see some of the craziest contraptions fling goards high into the air.

The object in punkin-chunkin is to build a machine that can throw a 10 lb pumpkin as far as possible. A wide variety of different types of punkin-chunkin machines have evolved over the years, they are categorized according to the basic method of propulsion. The classes include human powered, centrifugal, catapult, trebuchet and unlimited air cannon. The unlimited class is where the big guns are found. These machines can achieve tossing distances of close to 1 mile; the world record toss is 4,114 ft.

The operation of any punkin-chunkin machine involves quite a lot of dynamics. My guess is that the majority of machines are not designed or optimized, but are simply built using "seat of the pants" engineering. I have heard, however, that some teams do get technical and do conduct dynamic analyses of their machines and the flight of the pumpkin.

This brings us to the **311 Virtual Chunkin Open!** After watching punkin-chunkin for several years, you and your teammates believe that with your expert background in dynamics, you could build a punkin-chunker and would have a legitimate shot at winning the competition! So, after several late nights around the kitchen table brainstorming for a design, your team decides to build a human powered, centrifugal chunker. Schematics of the chunker are shown at the right.



With the basic concept decided, you now need to get down to brass tacks on the specifics of the machine. The chunker consists of a long arm that is free to rotate about an axle at the top of a tower. The axle is 15 ft above the ground. Connected to the arm is a spool, around which a steel cable is wrapped. A 3000 lb drop weight is hung from the cable. The machine is human powered because team members will hoist the weight to the top of the tower using a pulley and tackle system. To arm the chunker, a pumpkin is attached to one end of the arm using a special gripping mechanism. When the signal is given the weight is released and the arm begins to rotate. When the arm has reached its top speed, a cable, which runs down the inside of the arm, out the axle, to the base of the tower, is pulled which releases the pumpkin, sending it flying into the air. Before you can start building you need to answer the following questions:

- How long should the arm be?
- What should the diameter of the spool be?
- What diameter cable should be used?
- Where/when should the trigger be pulled?
- Based on your final design, what is your estimate of the distance you can toss the pumpkin?

The goal, of course, is to achieve the greatest distance.

Here are some specifics about the parts and materials you will using:

- The arm is constructed of steel and weighs 8 lb/ft.
- The spool is to be fabricated from steel plate, the layout of the spool is shown in the attached sketch. The sides of the spool are made of ¼” thick steel plate, the hub has a thickness of ¼”. The radius of the sides of the spool must be 4” larger than the radius of the hub.
- To make sure the arm is balanced, a 10 lb counter weight is permanently attached to the end of the arm, opposite to the pumpkin.

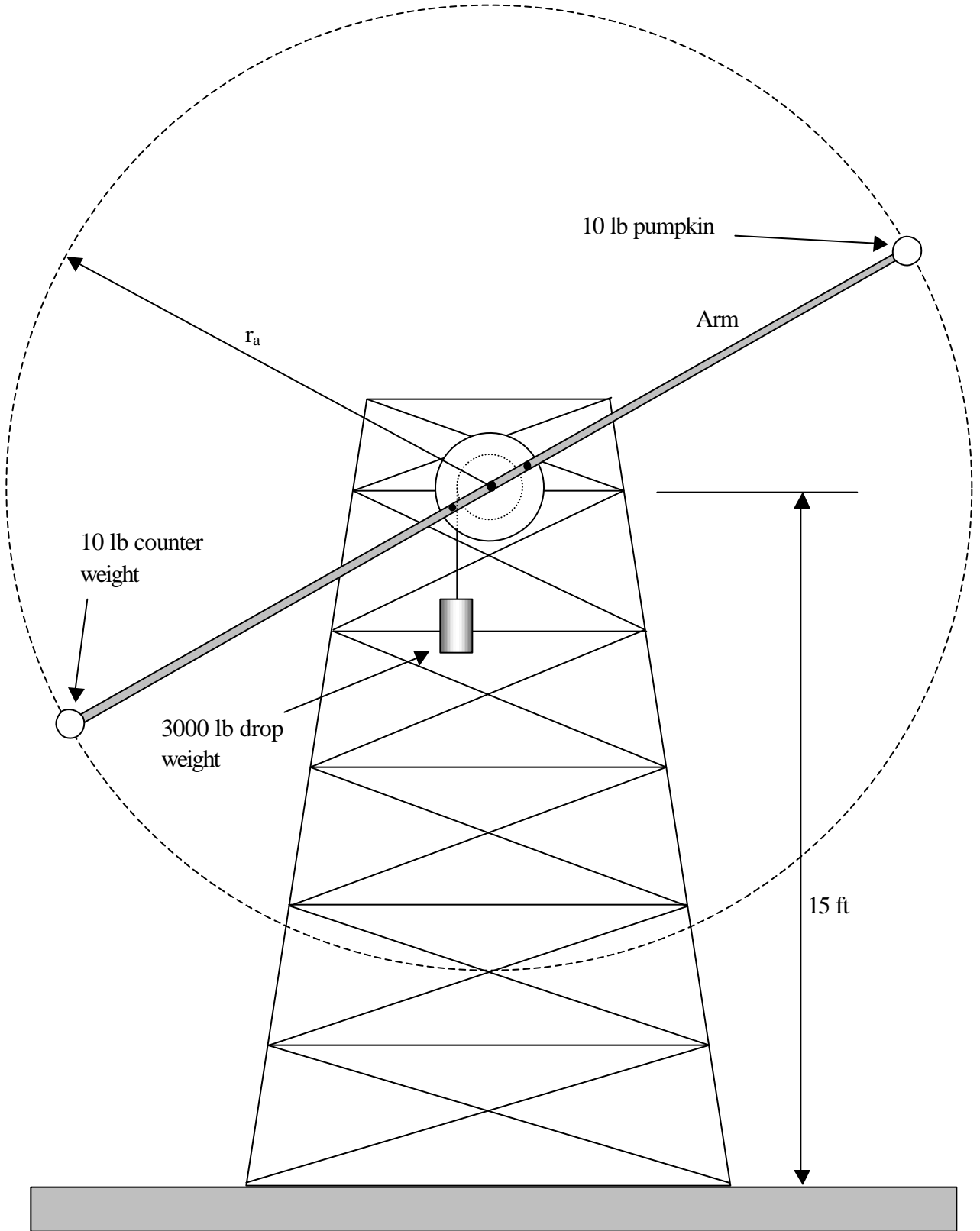
Competition is stiff and you don’t want to give the other competitors any advantage, so it is important that you keep your designs confidential. On the day of the competition (the day the projects are due), all teams will compete in the 311 Virtual Pumpkin-Chunkin competition. The team with the longest, accurate toss (only to be determined after the reports are graded and judged for accuracy by the Grand Chunkin Official) will win a prize! Good luck!

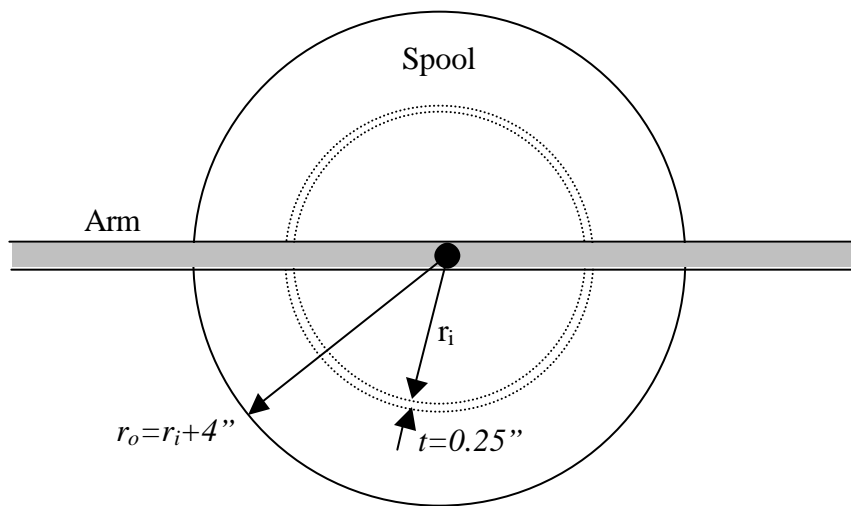
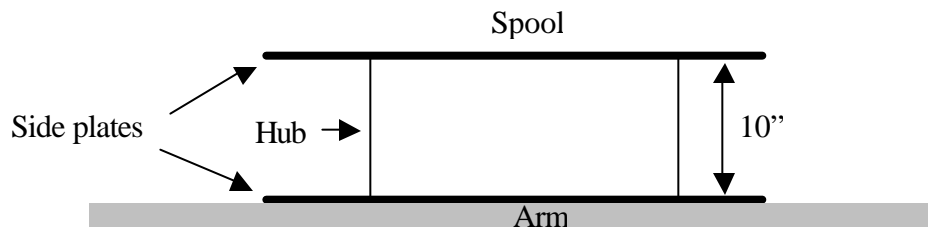
Check out these sites for more info on Pumpkin-Chunkin. This year’s competition is November 2-4.

<http://www.atbeach.com/punkinchunkin/index.html>

<http://www.geocities.com/Heartland/Acres/8558/>

<http://www.atlanticbreezes.com/punkinchunkin/pumpkia.shtml>





Arm weighs 8 lb/ft
 Spool outer radius must be 4" larger than the inner radius (i.e., $r_o = r_i + 4$; $t = 0.25$ " and the thickness of the side plates are $\frac{1}{4}$ ".