

# Counter-Weight Mechanical Pop-Up Dart Trap

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Table of Contents

	Page
Abstract	2
Parts & Cost List	4
Design Concept Drawing	5

**Abstract**

For our design, our team was very interested in creating a completely mechanical system for the dart trap. We split the project into three main categories: Trigger mechanism, firing mechanism, and the raising and lowering mechanism.

We thought it would be fitting for the theme if the trigger mechanism was able to incorporate some sort of pressure plate activation. However, we felt that the pressure plate was too restricting and did not allow for more flexibility on how we trigger the system. Therefore our main design involves using a drawstring and a pin, with an optional pressure plate installation to serve the theme of “Wisconsin Johnson” better. The pin will be inserted through a gear and connected to the main chassis of the system. This will prevent the system from activating unless the pin is missing.

Given that the darts we are shooting are standard nerf darts, we decided that our firing mechanism would be based on the spring-plunger system of a standard Nerf gun. We are deciding to 3D print these parts using PETG filament since they will need to be custom designed to fit the “head” of the system and activate using our drawstring method. Making these parts out of plastic also serves to keep the head of the system lightweight, allowing us to use less counterweights in our raising and lowering mechanism.

Finally, our raising and lowering mechanism is inspired by the timing pulleys and belts on 3D printers. The “head” of the device will be placed on a lightweight platform which will be attached to 4 different timing pulley systems, one at each corner. These will be driven by the counterweight system. The timing pulley allows us to maintain good accuracy for our lifting and lowering as well as transferring forces evenly to the plate. Once the device is finished raising, the main counterweight will be detached from the

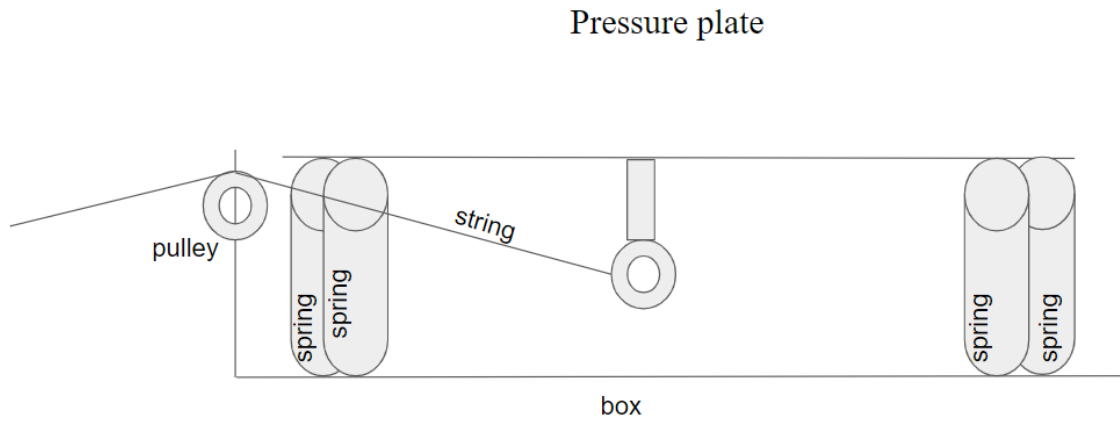
timing pulley system, and a secondary weight attached below the plate supporting the “head” will assist in lowering the “head” back down.

### **Parts & Cost**

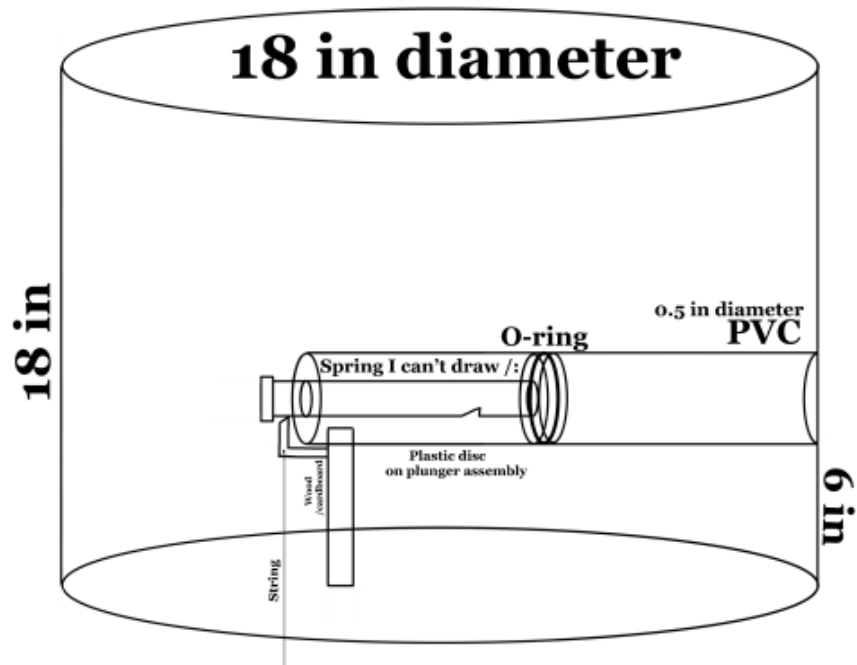
<b>Part</b>	<b>Quantity</b>	<b>Cost per Part</b>	<b>Total Cost</b>
Compression Spring 1/4"x2"	2	0.86	1.72
Compression Spring 1-1/4"x11/16"	1	4.73	4.73
PETG Filament 1kg	1	19.99	19.99
Board 2x4x96	1	4.98	4.98
O-Ring	1	0.79	0.79
Pulley (2" dia)	4	5.2	20.8
Screws 2-1/2" (box)	1	6.27	6.27
Eye Bolts (2" dia.)	2	1.10	2.20
OSB 2'x2'x4'	1	8.82	8.82
Washers (box)	1	9.4	9.40
Safety Cable Wire (12ft)	1	7.99	7.99
Timing Pulley Kit	1	13.99	13.99
2020 Aluminum Extrusion (4')	3	9.84	28.92
Large Timing Pulley	2	8.5	17.00
60# Play Sand	2	4.15	8.30
5mm axle	2	5.99	11.98
9mm axle	2	7.09	14.18
ABS Sheet (18"x18"x1/4")	1	37.05	37.05
<b>TOTAL COST</b>			219.11

### Design Concept Drawings

## Pressure Plate/Drawstring



## Firing Mechanism



## Raising/Lowering Mechanism

