Objective

Design an automated process with the ability to cut polyester filaments safely and efficiently while not hindering production speeds with as little human interaction as possible.

Early Ideas

Rotating blades that would slowly chew apart the bale while a hydraulic press forced the polyester into the blades was looked into, but the safety constraints and required processing with hydraulics was out of both time and budget constraints for this project.

Chopping apart an entire bale at once was also looked into, but after confirming the idea with our sponsor, the need to be able to search through the bale while processing was taken away. So, the idea was scrapped and we continued on.

Wire Testing

A gauge 17 Nichrome wire without any additional coating was first used to get a baseline for what is required to cut through the polyester material.

The stand alone wire resulted with one main problem of the residual polyester burning onto the wire and transferring to freshly cut polyester after another pass.

The solution was to use the same wire type, but coated with Teflon to prevent any sticking.

After a single pass, there is some sticking of polyester material to the wire, but it quickly burns off and remains clean.

Design Concept

First step was to design an arm that would hold the Teflon coated wire and allow this wire to cut the polyester. It is a simple design where there is a cross beam off a main support column.

Next was to design the tension controller that would ensure constant tension throughout the wire, even if pressures were applied across the wire. This is done through a spring and pulley combination. The wire comes around the pulley and is attached to a plate at the bottom of the spring. This allows any force exerted on the wire by the polyester to be counteracted by the spring force. This design will go into the main support column.

Then we developed the design of the safety shroud that would enclose around the wire when not in use, and open out of the way when cutting. This device is activated through pressure on a handle that an operator will control.

Last was to attach our design to the table already at our sponsor’s location of work.

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