CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
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Project Number
J2121

Project Title
Cut It Out! Which Die Cut Machine Requires the Least User Interface & Effect of Design Intricacy on Machine Performance

Abstract

Objectives/Goals
The objective is to determine which die cutting machine (press, roller or electronic cutter) requires the least user interaction, resulting in most efficient use of time. I also determine how intricacy of design affects machine speed. I hypothesize that the press machine requires the least user time, because the platen plate exerts pressure evenly on the die to cut shapes. Intricate designs may take longer to cut, because they have more inches of steel rule embedded in the die than simpler designs.

Methods/Materials
I used 4 cutting machines: roller machine (plastic-coated roller), roller machine (steel roller), press machine, and electronic machine (with computer and eCAL software). I used 3 die designs: circle die, spiral die, and snowflake frame die. I also used necessary die tools, construction paper, and a timer. Each machine had a specific set-up and procedure, based on its mechanics. Stacks of paper were measured and cut in advance for each work station. I measured the amount of time I engaged with the machines to cut a sample size of 100 shapes per trial, excluding the amount of time the machines functioned independently. I ran three trials for each of the three die designs per machine, recording data in a chart. My experiment yielded 36 trials, with a total of 3600 shapes.

Results
Trial times were averaged for each design and recorded in units of minutes:seconds and hours:minutes:seconds. Circle, spiral, and snowflake frame results for the roller machine (steel roller) were: 11:41, 14:29, and 33:20. Results for the roller machine (plastic-coated roller) were: 6:36, 8:12, and 21:32. Results for the press machine were: 10:40, 10:54, and 1:21:03. Results for the electronic machine (with eCAL software) were: 11:57, 22:24, and 1:11:00.

Conclusions/Discussion
My product testing proved my hypothesis about the press machine to be incorrect. I found that the machine with plastic-coated roller demonstrated the least user interaction time for designs at each level of intricacy. Perhaps this is due to the mechanical advantage of the roller, distributing incremental pressure directly onto the blade of the die to cut the paper. My hypothesis about performance speed based on design intricacy was correct. The more intricate the design, the longer it took for all machines to cut the shape. Based on these results, I recommend the roller machine to users interested in cutting maximum shapes in a short period of time.

Summary Statement
In this study, I test the press, roller and electronic cutting machines to determine which machine saves the most user time overall, and at select levels of die design intricacies.

Help Received
I interviewed the Director of Research and Development at Ellison Educational Equipment, who provided me with the machines needed for my study.