Precision Pepper Mill

Beau Bryant, Paul Rousseve, Hyeon Wook Kim, Stephen Bayer, Yong-Min Kwon

Abstract

Current pepper mills have been designed to grind pepper and disperse the grindings over food. Many recipes require the measuring of discrete quantities of pepper. If a pepper mill is used to fill a measuring spoon, there is a large amount of waste since a large portion of the grindings do not make it into the measuring spoon (Figure 1). The purpose of this project is to address this problem by allowing the user to focus the grindings into a small region for filling a measuring spoon.

Benchmarking

A William-Bounds pepper mill was chosen as the benchmark for the shape and quality of its ceramic grinding mechanism.

Tests Performed:
• Area over which grounds are spread
• Coarseness of grounds
• Volume per turn

Benchmarking Methods:
Testing was performed by grinding from a height of five inches onto a target (Figure 3). The William-Bounds pepper mill deposited approximately 90% of its grounds into a 1.25 inch diameter circle, located directly below the pepper mill. It was determined that by focusing the grounds through a funnel with an exit diameter of 0.125 inch, that it was possible to get 90% of the grounds into a 0.750 inch diameter circle.

Design Goals

• Adjustable focusing of grounds
• Adjustable coarseness
• Robustness
• Ease of use
• Increased volume per turn

Market Analysis

Through customer feedback, it was discovered that there is a significant desire for a pepper mill which focuses the grindings for measurement. In order to evaluate the potential market, a blind survey of 100 potential customers was performed. The results show that 69% of respondents would be interested in the design (Figure 2). Furthermore, it was found that improvements in the aesthetic properties increased the amount consumers were willing to pay.

Design Evolution

Through brainstorming, design ideas for focusing the pepper grounds were generated, tested, and evaluated. Initial design ideas based on a camera iris (Figure 4) did not meet the design goals. However, it was determined that a funnel shape was effective for focusing the grounds. The final design utilizes the funnel concept.

Final Design

The final design incorporates a rotating base with four different focusing ranges and adjustable coarseness (Figure 5). An interlocking mechanism allows the user to switch between the four settings. A mechanical advantage was obtained by the use of gears, which increased the grounds per turn (as compared to other mills) and thus the ease of use. For their non-reactive properties and ease of cleaning, cast stainless steel has been selected for the body, and ceramic for the grinder. Steel and aluminum have been selected for the remaining components.

Results

• A reduction in the area of grounds dispersion from 1.23 in² to 0.442 in² was achieved, thereby meeting the main design goal.
• The mechanical advantage increased the volume per turn three-fold, to 0.0375 in³ (1/8 tsp).

Recommended Next Step:
The next step in the design process is to build an experimental model for further testing to ensure that the design goals have been met. Furthermore, this model will help address any problems with manufacturability and material selection.

Acknowledgments
• Mr. Stephen Laguette, ME 153 Instructor
• Emily Pfarrer, Survey

References
• McMaster-Carr Supply Company <http://mcmaster.com>
• USPTO Patent No. 6,948,672