

Single Drum Coffee Roaster

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Abstract—The goal of this project is to design and implement a low cost, effective coffee roaster with an innovative design of combining the heating and cooling drums into a one-piece design. This one-piece design will save material, bringing down the overall manufacturing cost and market price. Added is a touchscreen as the user interface that allows the user to set roasting cycle, followed by a cooling cycle while also numerically and graphically displaying roasting data.

I. INTRODUCTION

Coffee roasting dates back centuries from the early stages using simple pans held over a fire in the 15th century, evolving into commercial roasters used in the 19th century throughout the world. Throughout the 20th century, especially in the later half, coffee-houses were springing up and people were enjoying specialty coffee. At this point these coffee shops necessitated the specialty coffee roasting business [1]. Modern day coffee roasters help provide the necessary volume needed in most coffee shops. There are many varieties of coffee and several stages to the roast allowing for different flavor notes and strengths. Such examples of coffee roasts are New England Roast, City Roast, Vienna Roast, and French Roast.

The coffee roasting market is growing as people's need for coffee increases, especially special brews. The industry is valued at \$533 Million in 2020, with an expected increase to \$816 Million by the end of 2026. That is an increase of just over 50% in six years. This growth will require an increase of coffee houses and coffee roasters [2]. The goal of this project is to build a more economical coffee roaster to roast up to 10 lbs. of coffee per batch. The current price for comparable coffee roasters is in the \$8k to \$12k+ price range. The goal is to cut the final assembly and materials cost and therefore the market price by upwards of 30%, by cooling in the same drum that the coffee is roasted in. Undercutting the current competition within the marketplace. Currently, there are many types and sizes of two chamber bean roasters. The market is saturated with this style and at this price point. Having a single drum, that will roast the beans and cool them in the same chamber, will allow entrepreneurs entry into the market with a lower price point coffee roaster. Rock Valley Roasters innovative design that sets it apart from other commercial sized coffee roasters is the single drum design, seen in Figure 1 below. The design implements a modern look and techniques to achieve the perfect user-friendly coffee roasting experience at a much more affordable rate.

II. MATERIALS AND METHODS

The process of roasting coffee starts at the hopper. Raw coffee beans are loaded into a stainless-steel hopper which is seen in Figure 1. 304 Stainless Steel is used in any area with contact to the coffee beans per FDA guidelines. The hopper is attached to front door of the Drum Assembly. The beans fall through a gate which leads to the drum. The stainless-steel drum unit is a key portion of Rock Valley Roasters design that sets it apart from other competitors. The heating and cooling of the coffee beans is done within this singular drum. The Paddle Assembly, pictured in Figure 2, is mounted inside the drum assembly. The paddles rotate on a shaft pressed into bearings which are bolted to the ends of the Drum Assembly. The paddle then rotates the raw beans inside the drum. The drum, paddle, and hooper assemblies are mounted on 80/20 aluminum which provides a sturdy, modular frame.



Fig. 1. Rock Valley Roaster Design

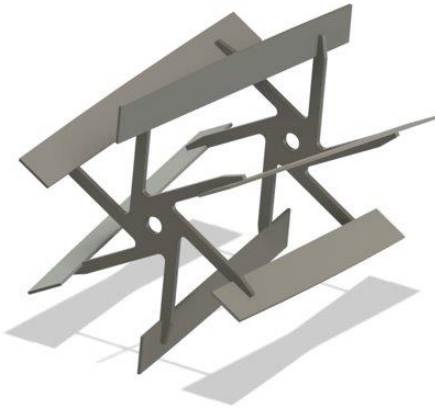


Fig. 2. Rock Valley Roaster Paddle Design

Hot air will be forced into the drum. With correct rotation speed the beans will fall into the stream of hot air, ensuring even cooking throughout the batch. Once the cooking is complete, cool air will be forced into the drum for cooling. The heat will be forced out of the unit with a positive stream of new cool air.

The user interface is a touch screen control allowing the user to control RPM and temperature set points. This interface allows easy control of important factors to roast.

III. MANUFACTURING DISCUSSION

There are a lot of components to the coffee roaster. Some of the components are off the shelf and some must be manufactured. The off the shelf parts should integrate with other parts of the system quite nicely. The manufactured components tend to raise the complexity of the build. Linking the drive unit and paddle will be a tight tolerance. A greater constraint is the tolerance in allow radial deflection between the paddle shaft and the bearing in the front and rear of the drum. There can be very a little run-out between the paddles and wall of the drum. Tolerance in manufacturing plays a big role in the cost manufacturing, and that goes for this project. Quality bearings must be used to minimize radial run-out.

IV. CONCLUSIONS

Rock Valley Roaster's innovative design of a single drum coffee roaster will create a change in the market. The all-in-one system with touch control will allow users to provide a quality product to their customers. As much as this system is designed for coffee houses, this system can be used

for your do-it-yourself for coffee connoisseur. This will allow people to provide an independent coffee that cannot be purchased from your local store or coffee house. These people then can share their coffee with friends and family.

The desire for coffee will continue to grow as new generations grow to become coffee drinkers. These coffee houses will require coffee roasters. Young entrepreneurs have a tough time entering the market due to the high cost of ownership in new business. Our project will help new entrepreneurs enter this market by allowing them to afford a low-cost quality coffee roaster. The coffee roaster must be easy to use and set up for novice coffee roasters to make a quality product.

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