Design of a Less Deafening Hair Dryer

Team 6

Kiet Ho Shawn Eckert Mark Johnson Peter Van Brussel

> Advisor: **Dr. Cattafesta** Sponsor: **Dr. Devine** Instructors: **Dr. Gupta Dr. Shih**

Presentation Date: October 22,2015

Presentation Overview

Project Scope

Design Considerations

- Concept Designs
- Future Plans

What's The Problem?

Hair Dryers are TOO LOUD!

- Average operating sound level of 85 dBa
- Noise induced hearing loss begins at 85 dBa
- Annoyance for those sleeping
- Adds to noise pollution in salons



Goal: Design and Build a Quieter Hair Dryer

Project Description

Objectives

- Design and build a working prototype
- Produce a business model for product

- Prototype Goals
 - Safe
 - Quiet
 - Effective
 - Inexpensive
 - Commercialization

Project Constraints

- Budget \$1,500
- Must generate less than 70 dba of sound pressure
- Heat that reaches user must be less than 120° F
- Weight must be less than 2 lbs
- Max Dimensions (10 in x 10 in x 4 in)
- Must contain ground fault circuit interrupter
- Components must withstand max temperatures

Hair Dryer Breakdown

Simple electromechanical device

Ground

Fault

Circuit

- Air Moving Component
- Motor
- Heating element
- Power Source
- Safety measures



Focal Points of Design

- Circuit
 - Power source
 - To the Motor
 - Heating element
 - Ground Fault
 Circuit Interrupt

- Body
 - Motor housing
 - Effective air flow
 - Switches

- Mechanical
 - Air mover
 - Motor



House of Quality

ENGINEERING CHARACTERISTICS

Correlation:	Customer Requirements	CI	Air Supply Source	Air Flow Rate	Convert Electricity to Heat	Temp Control	User Protection	Electric Supply	Motor	Material Selection
	Quiet	10	10	6	0	ο	0	0	6	3
	Dries Effectively	10	10	10	10	10	0	3	6	0
	Ease of Use	6	0	3	6	3	0	Ο	ο	0
	Operates Safely	10	6	0	3	3	10	6	6	0
	Lightweight	6	3	0	0	0	0	Ο	3	10
	Ergonomic	3	0	3	0	3	0	Ο	ο	3
	Variable Heat Settings	6	0	0	10	10	0	0	0	ο
10 – High 6 – Med	Variable Speed Settings	6	6	10	0	0	0	3	10	ο
3 – Low	Affordable	3	6	Ο	0	0	3	3	6	3
SCORE Relative Weight Rank			332	247	226	217	109	117	294	108
			20%	15%	14%	13%	7%	8%	18%	7%
			1	3	4	5	7	6	2	7

Table 1: House of Quality Matrix

Noise Sources

Motor

- Brushed vs. Brushless DC
- AC motors
- Vibrational Effects
- Air intake
 - Inlet cover
 - Turbulent flow
- Open casing
 - Openings allows for noise to escape more easily





Concept Design 1

- Bladeless fan design
- Centrifugal blade
- Flat heating element
- Plastic outer casing
- Two air way concentrator
- Sucks Air in through handle
- Motor in handle for vibration control & sound deadening
- Shoots sheet of air



Concept Design 2

- Straight through design
- Centrifugal blade
- Sucks air from bottom
- Controls on the side
- Radial heating element
- Condenser nozzle
- Motor in middle for vibration control & sound deadening
- Heat insulate cylinder for hand protection



Concept Design 3

- Air is sucked into top
- Utilizes radial blower wheel
- Motor in handle for vibration reduction & sound deadening
- radial heating element
- Compare to industrial floor dryer
- Shaft connects motor to air moving device



Shawn Eckert 12

Design Challenges

- Design for Manufacturability
- Design has Sufficient Safety Measures
 - Ground Fault
 - Bimetallic strip
- Ways of cooling AC & DC motor
- Sound insulate motor
 - Vibration control
 - Insulate motor



Gantt Chart

TACKS	Completion	Start Date	End Date	Oct 18	Oct 25	Nov 1	Nov 8	
IASKS				TWTFS	SM TW TF	S S M T W T F	SSM TW T	
i 💌				🔅 Q. 🕀, 7±				
Midterm Presentation I: Conceptual Design		10/16/15	10/22/15	Midterm	Presentation I: Conceptual [Design		
Midterm Report I		10/19/15	10/30/15			Midterm Report I		
Project Oriented Meeting		10/25/15	10/30/15			Project Oriented Meeting		
Create Circuit Diagram		10/25/15	10/30/15			Create Circuit Diagram		
Circuit Layout Structure		10/25/15	10/30/15			Circuit Layout Structure		
Determine Type and Quantity of Wiring Items for Selection		10/25/15	10/30/15			Determine Type and Quantity of Wiring Items for Selection		
Acquire Ohmmeter and Digital Caliper		10/25/15	10/25/15		Acquire Ohmmeter an	d Digital Caliper		
Motor Selection		10/25/15	10/30/15			Motor Selection		
Propose Ideas for Purchase		10/27/15	10/30/15		Propose Ideas for Purchase			
Peer Evaluation		10/30/15	11/03/15			Peer Evalua	ition	
Project Oriented Meeting		11/01/15	11/06/15				Project Oriented Meeting	
Test Circuits and Motor		11/01/15	11/06/15				Test Circuits and Motor	
Improve Fan Blade Design and Centrifugal Housing		11/01/15	11/06/15				Improve Fan Blade Design	
Simulate Fan on CAD; Gather Results		11/01/15	11/06/15				Simulate Fan on CAD; Gath	
Midterm Presentation II: Interim Design Review		11/05/15	11/19/15					
Project Oriented Meeting		11/08/15	11/13/15					
Design Motor-to-Fan Attachment		11/08/15	11/13/15					
Create In-Depth Layout of Hair Dryer Structure		11/08/15	11/13/15					

Upcoming Plans

- Commit to a Concept Design
- Create Schematic of Circuitry
- Layout and build circuit components
- Choose a Motor
- Propose Purchase Items
- Look into 3D printing (Blades & Body)



Resources Assignment

- Mark Team Leader
- Peter Treasurer and Web Design
- Shawn Lead ME
- Kiet CAD Design

Questions?

References

- http://www.nidcd.nih.gov/health/hearing/pages/noise.aspx
- http://www.cpsc.gov/en/Regulations-Laws--Standards/Rulemaking/Finaland-Proposed-Rules/Hand-Held-Hair-Dryers/
- http://www.petervaldivia.com/electrical-power/
- http://www.qhdreviews.com/
- http://www.lamasbeauty.com/beauty/articles/correa/trauma_hair_follicles.
 htm