Design Project 1

Disposable Camera Redesign

The Pennsylvania State University
Engineering Design 100 – Section 016 – Team 8
Prof. Jeonghwan Jin

TECHNICAL REPORT

Product Engineers

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ABSTRACT

Our team has designed a disposable camera that we believe will provide a higher level of customer satisfaction than that of our competitors. After completing some external research of what features the customer would like to see in a new design of a disposable camera, we decided to create several prototypes to include these requests. Among our initial designs were: a camera with rubber grip on the sides, a camera with an increase capacitor size, a camera with an increased filament size, a camera with no flash circuit, a camera with an on/off button for flash, and a camera with an inset shutter button. Following our design comparison we decided to create a product combining each of our initial designs and named it the GripMaster. This new product is not only visually appealing but allows the consumer a higher degree of control and quality previously incapable in preceding products.

- Gregory Borza

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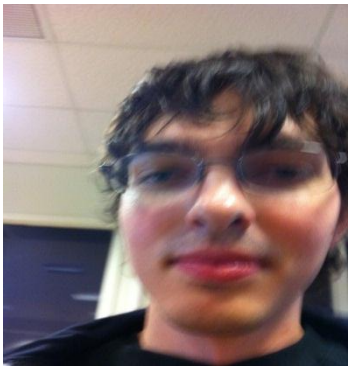
PROLOGUE

PROLOGUE

About the Engineers



Michael Babyk

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Michael is a junior graduate student majoring in electrical engineering, looking to be employed by Intel. He received a Bachelor's degree in chemistry as an undergraduate. He also enjoys bowling.

Gregory Borza

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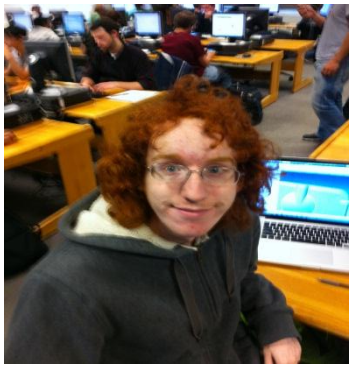
Greg is a freshman looking to double major in mechanical and nuclear engineering. He is aspiring to become a nuclear engineer for Westinghouse. He is a big fan of hockey and loves to play it even more.



Andrew Reiff

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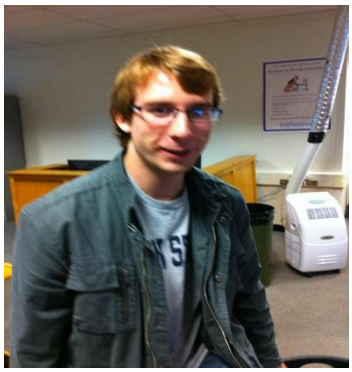
Andrew is a freshman who is strongly considering mechanical engineering. He wants to become an avid designer in the amusement park industry as an adult. He also likes the urban sport of parkour.



Richard Zang

rfz5006@psu.edu

Richard is a freshman who is strongly considering aerospace engineering as a major. He wants to work for a major corporation such as Boeing. He is on the men's club lacrosse team and he also loves music.

PROLOGUE

Our Introduction

In our Engineering Design 100 class, our first project was to essentially redesign the current form of a disposable camera.

Our professor, Jeonghwan Jin, gave us a Kodak "FunSaver" camera as a basis for our design and as a tool for understanding the overall design process. While we were not told directly to redesign the camera for Kodak, it was sort of implied.

After completing preliminary research and literally dissecting the Kodak camera, it was clear to us that we wanted to approach our design from the customer's perspective. Kodak's camera was already rather easy to assemble and create – and we did not want to tamper with a design that already worked well.

Our final design – which we lovingly call "GripMaster" – is a fresh take on the FunSaver's form factor. All four of us are exceptionally proud of how our final design turned out, and we personally hope that you will see the beauty of our design as well.

- The Members of Team 8

PROLOGUE

Our Mission Statement

Product Name: **TheGripmaster Disposable Camera**

For children or families with children who need to take photos quickly, easily and inexpensively, the GripMaster Camera is a disposable camera that has a high-intensity flash with a switch, a recessed shutter button, and rubberized grips.

Unlike the Kodak FunSaver Disposable Camera, our product is able to perform better in low light settings, does not take photos when dropped, and is easier and more comfortable overall to use.

Key Design Features:	Increased Capacitance and increased filament size for flash, added rubber grips, on-off switch for flash
Goals in the Design:	Ease of use, durability, and effectiveness in low light
Estimated selling price:	$5.61

PART 1

INITIAL ANALYSIS

All written work in part 1written by Andrew Reiff unless otherwise noted
Needs Statements and Hierarchy produced by Gregory Borza and Andrew Reiff
House of Quality created by Richard Zang
Patent research component written by Richard Zang
Product Dissection produced by the members of Team 8
Assembly Hierarchy produced by Andrew Reiff
Product Function Diagram created by Andrew Reiff
Force Flow Diagram created by Michael Babyk

PART 1 – INITIAL ANALYSIS

Analysis of Customer Needs

Our product is best described as a disposable camera that is drop-resistant, ergonomically sound, and that has a switchable increased-intensity flash. We chose these criteria because we really wanted to look at the camera from the consumer's perspective – they're going to be in possession of it for a much longer time than the manufacturer. They're also going to use it more. So, we looked at what consumers wanted.

We found that the primary market for our camera is families who travel with young children. Families travel all the time with their children and they expect a camera that they can essentially point, shoot, and move on. These families are also the ones who don't want to carry an expensive digital camera around with them because they would be afraid it would get lost or stolen.

Our secondary market is essentially two markets. The first of the two markets we consider secondary is the causal consumer market. These are the consumers who, like the families mentioned above, want a cheap camera that they can just point and shoot. Our other market is the young children themselves – mothers and fathers wouldn't be able to trust their eight-year old child with the family's expensive digital camera, so they go out and buy a disposable camera for the child. This enables the child to have a camera of his or her own at an inexpensive price.

There are lots of assumptions that people make about disposable cameras. People expect disposable cameras to have a flash, be durable, be recyclable (to an extent), be ergonomic, and be intuitive to operate. Those are pretty tall assumptions to place on such a lowly little camera, but unfortunately today's market is so adjusted to having everything imaginable for such a small price.

There are also multiple stakeholders in the disposable camera. First, there is the producer, who makes the camera. Then, there is the deliverer who takes the camera where it needs to go to be sold. The retailers and sales force make the camera look great to the consumer, who eventually goes out and buys it. With the camera being recyclable, the stakeholders essentially revolve in a cycle.

PART 1 – INITIAL ANALYSIS

External Research

Our first trial of external research took us out onto retail websites such as Amazon.com. We looked up the Kodak FunSaver camera, and we checked out what consumers had to say about it. We were completely baffled in the beginning of our research – we had no idea how we were going to redesign a product that Greg lovingly called "the best thing since sliced bread". However, we were able to find some complaints about the FunSaver camera's usage:

- Multiple consumers pointed out how the camera's flash was not bright enough. This came as a surprise to us because I actually complained about how the flash blinds me when it's used. I don't use a disposable camera anyway.
- Some consumers reported that pictures are accidentally taken when the camera is dropped. This wasn't as much of a surprise because other members of other teams were hitting their cameras against the desks and the flashes were going off.
- Some consumers said how the camera is very bulky. Only I agreed with those consumers because my hands are so small. Greg, Richard, and Mike's hands are larger than mine, and they didn't think it was bulky at all.
- Some consumers reported that turning on the flash each use is annoying. All four of us agreed.
- Finally, one consumer complained about how expensive the camera is.

Like the consumers, we personally found little to no flaws in the disposable camera's design. The flaws we actually found were as follows:

- Greg pointed out how there is no easy way to tell if the wind wheel is completely wound. The other three of us were originally skeptical about what he was talking about, but we eventually came to agreement. There is a flash indicator on the camera, but why isn't there a "ready" indicator like digital cameras have?
- Mike, Greg, and Richard thought that the flash wasn't bright enough, much like the consumers who reviewed the camera did. I eventually got on board with them.

So, using the consumer reviews and our own personal experiences, we came up with a few need statements. We also put together a needs hierarchy.

PART 1 – INITIAL ANALYSIS

Need Statements and Needs Hierarchy

Consumer Statement	Need Statement
"The flash isn't bright enough. It makes the pictures very dim."	The flash is intense.
"If I drop the camera, it takes a picture by itself, using up some of my film."	The shutter button is inset a few millimeters from the camera's exterior walls.
"The camera is kind of bulky – I can't fit it well in my pocket."	The camera's components are efficiently packaged, saving space.
"I hate it that I have to hold the flash button and wait until the flash charges every time I take a picture."	The flash has a function to charge itself automatically upon consumer request.
"The camera costs too much."	The camera is inexpensive.
"It's hard to tell if I've wound the film wheel all the way or not."	The camera can let the consumer easily tell if the film is wound or not.

Needs Hierarchy

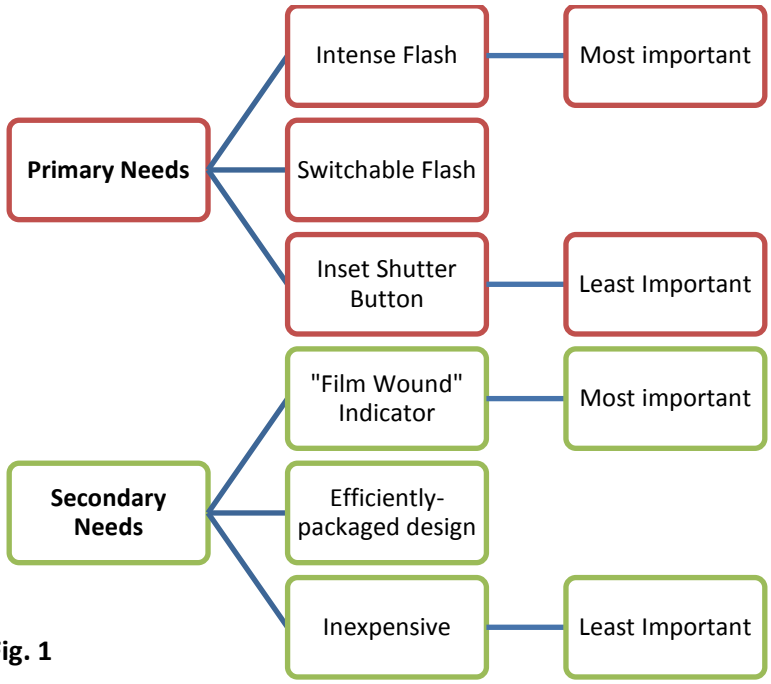


Fig. 1

Figure 1 – Needs Hierarchy

Using our need statements, we assembled a hierarchy of our primary needs and our secondary needs.

We found that of our primary needs, the intense flash is the most important and the inset shutter button is the least important.

We found that of our secondary needs, the wind indicator was the most important, and that being inexpensive is the least important.

Cost of the product is fittingly our least important need – it was the need the customers complained about the least.

While we found these needs through our consumer review research, we found that we needed to research further. We decided to look up some patents, and do some benchmarking.

PART 1 – INITIAL ANALYSIS

Patent Research

PART 1 – INITIAL ANALYSIS

Benchmarking

PART 1 – INITIAL ANALYSIS

House of Quality

Fig. 2

Figure 2 – The House of Quality.

PART 1 – INITIAL ANALYSIS

Product Dissection

Since Professor Jin gave us a Kodak FunSaver camera to analyze, we decided to tear it open and see what was inside. We have compiled a Bill of Materials of the FunSaver camera. Listed in our bill of materials is each part's designated name, quantity, function, mass in pounds, material, manufacturing process, and cost. We have also noted whether or not the part is absolutely essential for the camera to work (also known as the "S.O.P." effect).

In our bill of materials, each part is numbered. But, what use are numbers when you have no idea what the specific parts look like? Fear not – we have taken photos (using a digital camera) of each part with their respective numbers.

Part 1 – Front Cover

Part 2 – Back Cover

Part 21 – Centerpiece Framework

Part 22 – Inner Frame I

Part 23 – Inner Frame II

Part 24 – Shutter Mechanism Middle

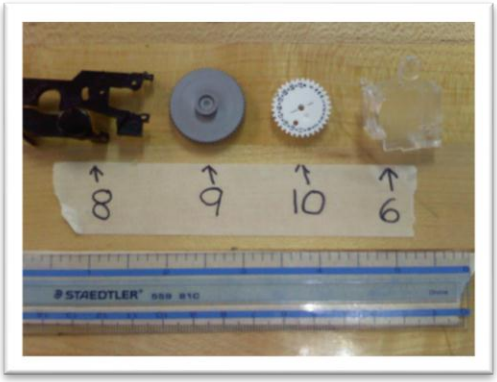
Part 20 – Film Canister

Part 3 – Rolling Pin

Fig. 3-4

Figures 3 and 4 – Dissection images.

PART 1 – INITIAL ANALYSIS

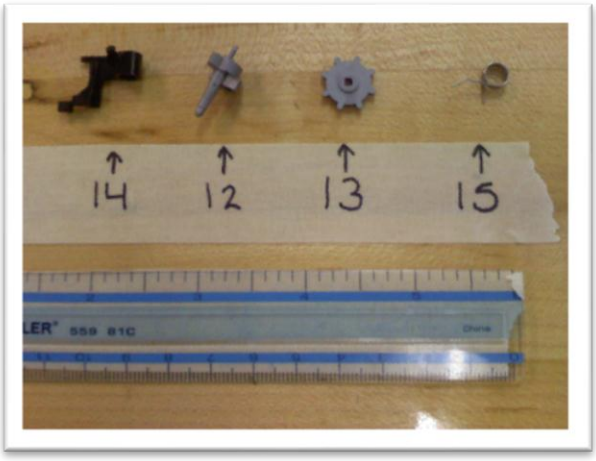


Part 6 – Viewfinder

Part 8 – Button

Part 9 – Wind Wheel

Part 10 – Counter

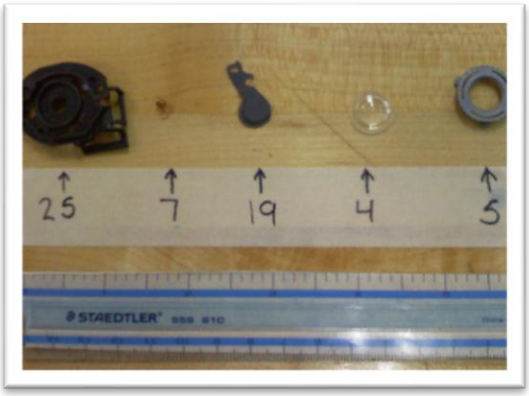


Part 12 – Shutter Mechanism II

Part 13 – Shutter Mechanism III

Part 14 – Shutter Mechanism IV

Part 15 – Spring (Tiny)



Part

Part

Part

Part

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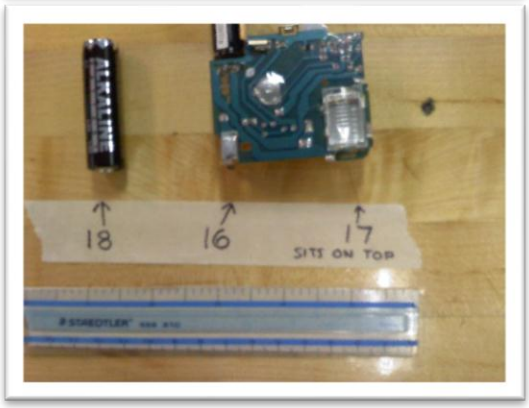

Part

Part

Part

Fig. 5, 6, 7, 8

Figures 5-8 – Dissection images.

PART 1 – INITIAL ANALYSIS

Bill of Materials

Bill of Materials									
Product Manufacturer/Model Number:									
Subtract & Operate Procedure (SOP) Yes or No. Force (Energy) Flow Diagram: Yes or No.									
	Part Name	QTY	SOP Effect	Function	Mass Lbs	Material	Manuf. Process	Dimensions	Cost
1	Front Cover	1	No	Packaging/ Protection	.030	Plastic	Injection molding		$0.05
2	Back Cover	1	Yes	Packaging/ Protection	.032	Plastic	Injection molding		$0.05
3	Rolling Pin	1	Yes	Move Film	.006	Plastic	Injection molding		$0.05
4	Lens	1	Yes	Viewing	.0001	Plastic	Grinding and polishing method		$0.15
5	Lens Frame	1	No	Holds Lens	.0005	Plastic	Injection molding		$0.05
6	View Finder	1	No	See what picture	.004	Plastic	Injection molding		$0.10
7	Spring	1	Yes	Open/close shutter	.0001	Metal	Heating and wrapping		$0.05
8	Button	1	Yes	Engage Shutter Mechanism	.004	Plastic	Injection molding		$0.05
9	Wind Wheel	1	Yes	Move Film	.002	Plastic	Injection molding		$0.10
10	Counter	1	No	Display Pictures Left	.001	Plastic	Injection molding		$0.10
11	Component 1 of Shutter Mechanism (black)	1	Yes	Shutter Mechanism to move shutter from pressing button	.0005	Plastic	Injection molding		$0.05
12	Component 2 of Shutter Mechanism (grey)	1	Yes	Shutter Mechanism to move shutter from pressing button	.0005	Plastic	Injection molding		$0.05

13	Component 3 of Shutter Mechanism (gear)	1	Yes	Shutter Mechanism to move shutter from pressing button	.0005	Plastic	Injection molding		$0.10
14	Component 4 of Shutter Mechanism (hits shutter)	1	Yes	Shutter Mechanism to move shutter from pressing button	.0005	Plastic	Injection molding		$0.08
15	Spring (tiny)	1	Yes	Provides Force of Advancement	.00001	Copper	Heating and wrapping		$0.01
16	Circuit Board	1	No	Provides Flash of Light	.034	Plastic/Silicon	Drilling, etching, and soldering		$1.80
17	Flash Cover	1	No	Covers Flash	.002	Plastic	Injection molding		-
18	Battery	1	No	Provides Power	.050	Alkaline	Die cast casing, acids poured inside		$0.25
19	Shutter	1	Yes	Expose Film	.0001	Metal	Injection molding		$0.05
20	Film Canister	1	Yes	Image Capture	.042	Varied	Injection molding		$0.50
21	Center Piece Frame work	1	Yes	Holds Camera Together	.046	Plastic	Injection molding		$0.20
22	Inner Frame 1	1	No	Inner Framework for camera	-	Plastic	Injection molding		-
23	Inner Frame 2	1	No	Inner Framework for camera	-	Plastic	Injection molding		-
24	Metal Shutter Mechanism Middle Piece	1	Yes	Moves Shutter	-	Metal	Injection molding		$0.05
25	Lens Base	1	Yes	Holds Lens	.002	Plastic	Injection molding		$0.10

PART 1 – INITIAL ANALYSIS

Product Assembly Hierarchy

Fig. 9

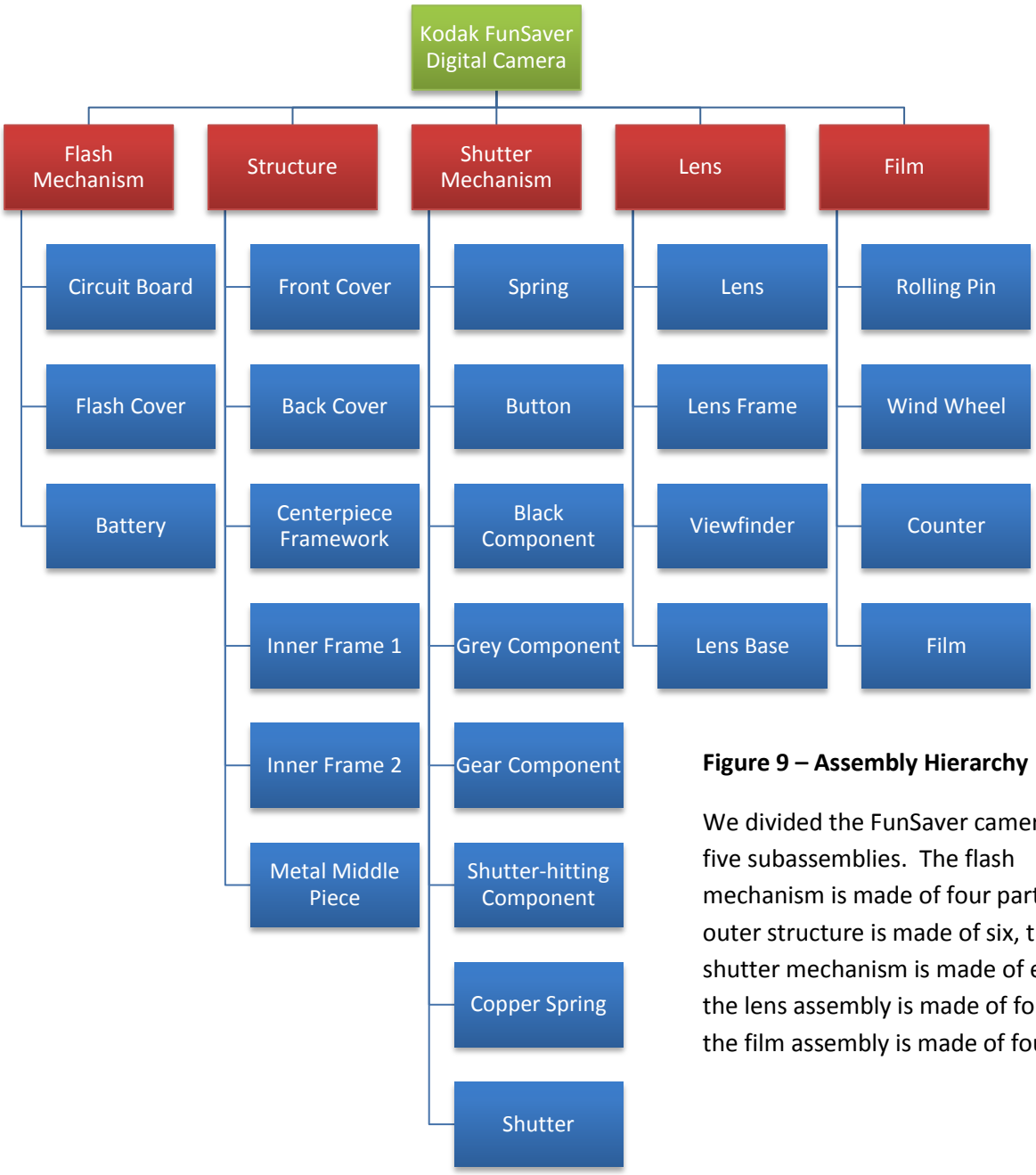

Figure 9 – Assembly Hierarchy

We divided the FunSaver camera into five subassemblies. The flash mechanism is made of four parts, the outer structure is made of six, the shutter mechanism is made of eight, the lens assembly is made of four, and the film assembly is made of four.

PART 1 – INITIAL ANALYSIS

Product Function Diagram

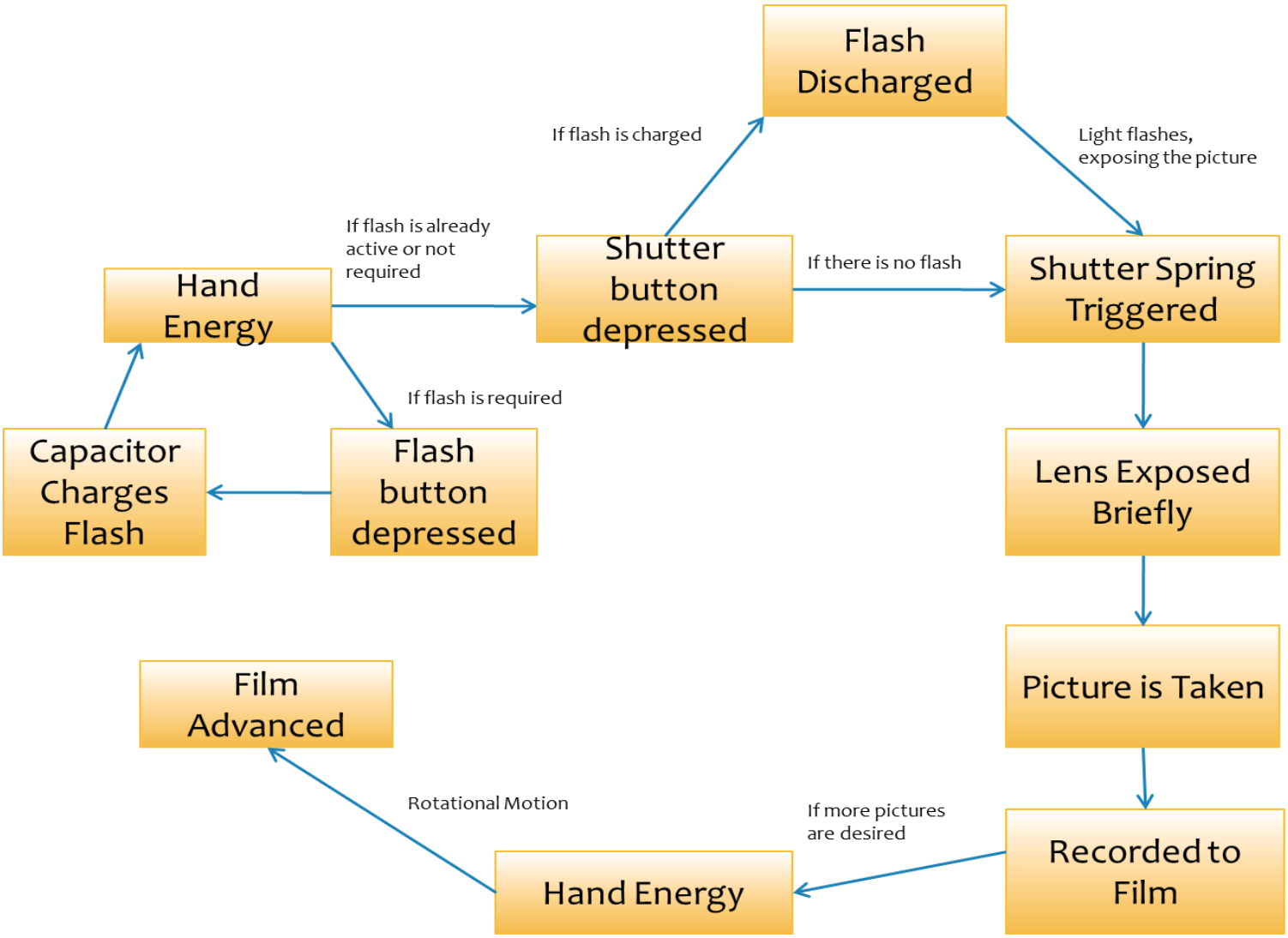

Fig. 10

Figure 10 – Product Function Diagram

This diagram shows how each function of the FunSaver camera works in its cycle and how the functions are carried out. The cycle itself can be changed based on whether or not you choose to charge the flash before taking a photo. The cycle is not at all complex. After the film is advanced, the cycle begins again in the "hand energy" box located above left.

PART 1 – INITIAL ANALYSIS

Force Flow Diagram

Fig. 11

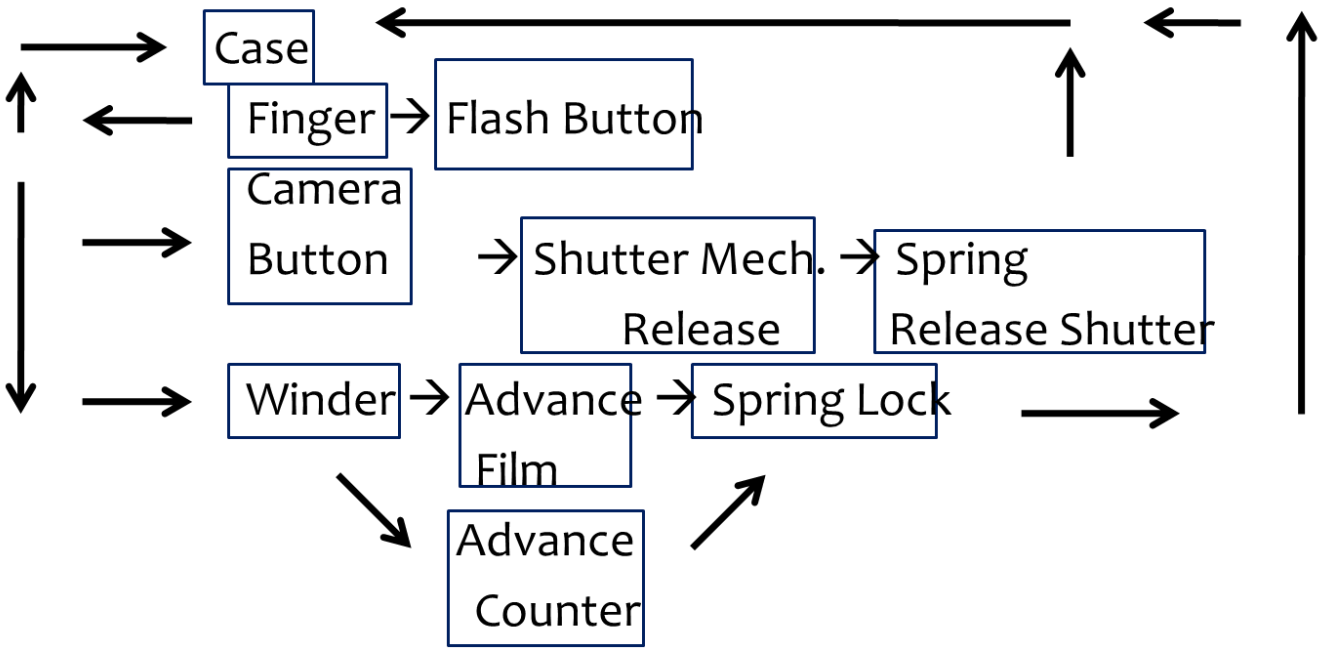

Figure 11 – Force Flow Diagram

The force flow diagram shows all the components that exert forces on one another and where the force goes. Like the product function diagram, the force flow diagram runs in a cycle. However, there are places where the cycle can terminate, such as when force is applied on the flash button. In that case, the cycle would have to restart from the top.

PART 2

THE CONCEPTS

All written work in part 2 written by Gregory Borza unless otherwise noted
Concepts generated by the members of team 8
Concepts scored by members of team 8
Weighted concept selection by members of team 8

PART 2 – THE CONCEPTS

Generation of Concepts

Concept Generation

Five different concepts:

- **Rubber grip**
  - **Generated from the customer need that the camera is hard to hold on to, a rubber grip on the edges of the camera would allow the customer to hold onto it must easier.**
- **Increased capacitor size**
  - **Generated from the customer need to increase the flash intensity, an increase in capacitor size will allow for an increase in potential energy which can be used to create a more intense flash**
- **Increased filament size**
  - **Generated from the customer need to increase the flash intensity, an increase in filament size will allow for more energy to be released quicker which should increase the intensity of the flash**
- **No Flash at all**
  - **Generated from the customer need to decrease the cost, removing the entire flash circuit from the camera, which creates the bulk of the cost, the cameras price should drop in half.**
- **On/Off switch for flash**
  - **Generated from the customer need that having to turn the flash on for each picture was annoying, proving an on/off switch for the flash will allow the consumer to have more control over their camera.**
  -

PART 2 – THE CONCEPTS

Weighted Scoring of Concepts

Concept Selection

Concept Scoring

After we generated our five possible designs for our camera, we decided to compare them to each other based on the four qualities that we thought were most important: cost, durability, ease of use, and effectiveness. For our reference we chose the current Kodak Funsaver design so we could see how our designs compared to it. In the end, each of our designs showed promising results so we decided to make combinations.

	Rubber Grip	Current Design (Kodak)	Increased Capacitor Size	Increased Filament Size	No Flash	On/Off Switch for Flash	
Cost	-	0	-	-	+	0	
Durability	+	0	0	0	0	0	
Ease of Use	+	0	0	0	+	+	
Effectiveness	+	0	+	+	-	+	
Total 0	0	4	2	2	1	2	
Total +	3	0	1	1	2	2	
Total -	1	0	1	1	1	0	
Total	2	0	0	0	1	2	
	Combine	No	Combine	Combine	Yes	Combine	

PART 2 – THE CONCEPTS

Selection of Concepts

Weighted Concept Selection

We decided to create two different designs from the four original to compete against the Kodak Funsaver in a weighted selection process. We assigned a number to each of the four qualities we had used in the previous selection process to denote its weight in this new process, four being the most important and one being the least important. We came up with these numbers base on our customer research. Since most customers wanted a better product we made the effectiveness have the greatest weight and so on. Our two designs were the GripMaster, which is a combination of all five of our original possible designs and the SuperFlash which only has the increased capacitor and filament size. Since each of our designs does not have an effect on any of the others, we were easily able to combine all our initial ideas into one design. In the end the GripMaster won out by a reasonable margin and we began to perfect its design further.

		Current Design (Kodak)	GripMaster	SuperFlash
	Weight			
Cost	2	4	2	3
Durability	1	3	5	3
Ease of Use	3	3	4	3
Effectiveness	4	2	4	3
Total		28	37	30

PART 3

THE FINAL DESIGN

CAD Model of the GripMaster Camera created by Andrew Reiff
Description of the model written by Gregory Borza
Price calculation calculated and written by Richard Zang

PART 3 – THE FINAL DESIGN

The Final Design –

The GripMaster Camera

Price Calculations

Price Calculations

The GripMaster essentially has the same basic parts as the Kodak FunSaver. The differences are the added rubber for the grip on the outer-casing, which some of the plastic was removed from the outer-casing for the rubber grip. Also, there is an increased filament size, an increased capacitor size for the increased filament size, and an on/off switch for the flash. Our estimate for the added rubber and the removal of plastic on the outer-casing is $0.15, which we estimated from the price of the same rubber material that is in pencil and pen grips. The increased filament, capacitor sizes as well as the added on/off switch is estimate to be $0.20. The total added cost is $0.35. However, the manufacturing cost of the FunSaver is $3.38 but sells for $5.20, which means that there is a 35% marginal cost of the selling price. As a result, we had to add this cost onto our estimated cost with our manufacturing cost of the added material. The 35% of $0.35 is $0.12. This is then added to get a total added cost to the FunSaver to be $0.47 plus the original price of $5.20 to get $5.67 as the estimated cost of the GripMaster. In other words:

Kodak Funsaver price = $5.20

$.35(extra parts)

+$.12(cost/price percentage margin)

GripMaster Price **$5.67**

PART 3 – THE FINAL DESIGN

Benefits of the Design and Supporting Images

EPILOGUE

Conclusion written by Gregory Borza
Works cited produced by the members of team 8

Conclusion

Conclusion

Our product, The GripMaster, is an excellent new one time use camera that surpasses the Kodak Funsaver camera in performance only adds a small amount to the price. The GripMaster allows its owner to achieve a much greater level of control over their camera. Not only is there an increase in the physical ability to hold the camera, from the rubber grip, but the consumer is now able to control the flash to a greater degree due to the On/Off switch. Also, the thickened filament and increased capacitor allow the camera to take higher quality pictures at night or indoors. We expect the GripMaster to exceed in the market and surpass Kodak in the upcoming years.

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Works Cited

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