

Button Maker

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1. Background

1.1 Introduction

The Hozhoni Foundation has been effective in assisting the development of designs that assist disabled people to be able to remain constructive and effective through the use of different types of machines. The foundation has been important in financing the production of such machines, which has had a great success rate over the years. Many disabled people have benefited from these inventions, which have allowed them to provide products and services to the community through creativity and assistance from the machines despite their conditions. Among these machines is the button maker, which is a machine used in the production of quality and well defined buttons.

The team has been given the task to make modification to the original button making machine and process that is currently being used at Hozhoni Foundation. The foundation usually uses the button making machine for to benefit their developmentally disabled clients to generate some income through the provision of services and the products they produce using the machine to the community.

The button making machine, however, has not be effective in sustaining the users of the machine, the Hozhoni's clients, and can only be operated by a single user, which are significant challenges for the button making process. Through making modification to the existing design of the button making machine, the end product may be able to accommodate more users, which will allow for effectiveness in the production of buttons and improve Hozhoni's rate of consumer satisfaction. The improved button making machine shall be beneficial to the users, where it shall accommodate use by more than one user, benefits the foundation through effectiveness of

products and service provision, and benefit the foundation's clients through providing quality products and services.

This project is of great importance to the team based on the advantages it shall have once it is complete. The machine is designed to improve the general button making process. The current machine and the process are not effective as only one operator is able to use the machine and that does not allow for the foundation to meet the demands by its clients as well as meet the desired quality. Based on the current design, the company seeks to make the machine smaller and lighter compared to the original machine, to make it manage to cut six circle patterns at once, should be able to cut out patterns without having ripped edges, should be able to cut patterns precisely, should be operational through the use of a single arm/hand, and must have a guide for purposes of positioning the papers exactly where they are supposed to be and not allowing them to move during cutting. The design shall be able to allow more individual to use it as well as improve the quality of products being sent to clients. This project is important as it allows for effectiveness in assisting disabled individuals to be able to make use of their abilities and earn a living out of working.

On the other hand, the project is important to Hozhoni's Foundation and its clients. The foundation usually provides vocational and education services to the communities with developmental disabilities. Through the need to provide assistance to disabled individuals within the community, the development of products that are able to facilitate the individuals with disabilities' abilities in the production of services and goods allows for assistance to the individuals by the foundation. This allows the foundation to satisfy the community as a whole, in addition to satisfaction of disabled individuals, it allows for satisfaction of the clients through

provision of on-time and better quality products. The team seeks to make a better button maker machine.

Functional Decomposition

The team aims at creating a Button Maker Machine design that is unique and an improvement of the existing design. The button maker is inspired by the current design. It seeks to make the design function better and in an effective manner through improving on it.

Planning:

The team began with the planning process, where all the team members were involved in setting up the schedule to be followed all through the project process. The planning process allowed for defining how the team will work and the timetable or schedule to be followed.

Rules and regulation:

The team then set rules and regulations that would assist in ensuring that it operate in an effective manner for purposes of getting the best end results at the end of the project.

Research:

The team defined its research process, where individuals were allocated different research topics and project parts to work on. This allowed for effectiveness in researching and diversifying the information gathered.

Brainstorming:

After the research processes, the team member came together regularly for team meeting for purposes of brainstorming on already completed tasks in order to improve on them and make them better.

Getting the project together and concluding:

The team then came together to get together all the information and research parts to create the end design. The report provided a definition and guide to completing the project. All the changes and improvement were also included in the process. In addition, the team concluded on the report and design once all the concepts had been incorporated.

1.2 Project Description

The project seeks to improve on the currently being used button cutter machine. The currently being used button making machine and the process followed has not be effective in sustaining the users of the machine, the Hozhoni's clients, and can only be operated by a single user, which are significant challenges for the button making process. This has caused significant negative impact to the foundation sustaining the demands by clients as well as being able to assist more individuals with disabilities. The team is tasked to improving the currently being used machine in order to ensure it accommodate more users as well as provide more products within a short time.

Through making modification to the existing design, the end product will accommodate more users, which will allow for effectiveness in the production of buttons and improving Hozhoni's rate of consumer satisfaction. The improved button making machine will benefit the users, where it will accommodate use by more than one user, benefit the foundation through

improved quality of products and service provision, and benefit the foundation's clients through providing quality products and services.

1.3 Original system

The original system is currently used at the Hozhoni Foundation for the creation of buttons. The machine has been used for quite some time despite its downsides, where it does not support multiple users as well as the quality and quantity of production are not as expected by the foundation. The original button maker is further described below:

1.3.1 Original structure of the system

The currently being used button cutter may be described as a cast iron made press. The button maker is made up of various parts, which include the press, two circular dies that allow for the placing of the button components, and where the general assembly occurs. The system allows for the activation of the press through a foot paddle, which when pressed using the foot exerts pressure on the buttons to cut them into the required shapes. The foundation has dies in different diameters that provide the option that allow for the making of various sized buttons. However, the options of the current button maker are limited, such as the making of only 2.25 diameter buttons and the use by only a single individual.



Press



Foot Lever

1.3.2 Original system operations

The current button maker being used by the foundation creates buttons that have a pin back and displays a logo, message, or image. To make the buttons, a sheet is printed with the various images to be displayed on the buttons. Each sheet that the images are printed only has the space to have six images. These patterns are then cut out pounding with a mallet since aligning the pieces to be cut may be a challenge. The components are then placed on the press with great care in order to make sure that the button backing with pins are aligned effectively. Further, the casting swivel and the other button components are then placed in the casting swivel. The user then presses the foot lever to capture the button backing that contains the pin within the press. Once the plastic and picture are added and well aligned, the lever is then pressed again for purposes of completely assembling the button.

1.3.3 Original System Performance

Currently, the performance of the machine is largely dependent on the skills of the individual operating it. The operator should be careful in positioning the components into their positions for purposes of providing quality products. Also, the strength of the user determines the quality of the end product, where more strength allows for better presses and well assembled end products. The users are doing their best to ensure that they maximize on the use of the single machine and maximize on their outputs in relation to consumers' requests.

1.3.4 Original system's deficiencies

The system being used currently has various deficiencies. One of the major weaknesses is it can be used by only a single user. The machine can only be used by one person at a time, which limits the time and quantity of production. The production process is quite slow due to this

factor, which need necessary improvements for purposes of accommodating more users. Also, the machine does not allow for fast production, where it requires too much concentration and only accommodates a single user, which makes it not meet the needs and demand by consumers. The machine is also quite heavy. It is usually difficult to move the machine from one point to another. However, this project is aimed at eliminating these weaknesses.

2. Requirements

The design team had a meeting with the customer to discuss the requirements. In the meeting, the client provided information on what and how he would like the button maker to be and the improvements to be made. The section below discusses the requirements that were generated in the meeting and their importance.

2.1 Customer Requirements (CRs)

The list shows the customer requirements that were generated in relation to the provided concerns and needs of the current machine as well as the client's wants. The list provided is preliminary and may be revised throughout the project.

1. The design should be smaller than last year's solution, which will allow for ease of portability as well as save on working space
2. The design should be lighter in comparison to last year's solution, which also will be significant in instances where it need to be moved, especially considering the situation of the users
3. The design should be able to cut out six circle patterns at once for purposes of encouraging effectiveness and efficiency in meeting demands through increased production

4. The design should cut out patterns in a clear and cleanly manner without causing ripped edges, which improves the quality of the end product
5. The design should allow for operation with one arm/hand based on the conditions of the users as well as to allow for effective management of the functions involved in the process
6. The design should guide to position the papers exactly and not let them change position, which shall allow for improved production process as well as quality of the products
7. The design should be safe to use
8. The design should be of low cost, both the purchasing cost and the maintenance cost

2.3. Engineering requirements:

From the customer requirement, these requirements may be translated into engineering requirement, which can be summed up in the following points:

- Size of the system
- Minimum weight of the system
- Ability to cut several designs
- Minimize range of motion of operation
- Cut six circle patterns at a time
- Stabilizing the paper while cutting to avoid it from moving

2.3 House of Quality (HoQ)

House of Quality (HoQ)

	Weight	Engineering Requirement	Size of the system	minimize weight	able to cut multipliable pages	cut six circle patterns	minimize range of motion of operation	stabilizes the paper while cutting or prevent paper form moving		
Customer Requirement										
smaller than last year's solution	4		9	6			3			
lighter than last year's solution	4		6	9			3			
cut out six circle patterns at once	4		3		9	9				
cut out patterns cleanly with no ripped edges	5				3	9		6		
operational with only one hand/arm	4		6	3			9			
guide to position the papers during cutting	4		3		6			9		
Absolute Technical Importance (ATI)			108	72	75	8	60	66		
Relative Technical Importance (RTI)			1	4	3	2	6	5		
Target(s), with Tolerance(s)			2x2x4	20ib	6 pages	6	60			
				-5	-4		-10			
Testing Procedure (TP#)										
Design Link (DL#)										

Approval (print name, sign, and date):

Team member 1: Abdullah Alajmi

Team member 2: Faleh Alajmi

Team member 3: Mutlaq Alajmi

Team member 4: Majid Alenezi

Client Approval:

3. Existing Design

The team took a look and reviewed the existing designs in detail. There are various industrial processes that are used in cutting out the buttons. The team was able to identify the button maker most relevant in relation to the button making machine used in Hozhoni, which is a small-scale commercial operation, as the type of button makers that are meant for home or personal use.

3.1 Design Research

The research that the team conducted on the existing designs was consisted of online research, which may be referred as benchmarking. The research was aimed at getting information that relate to button making machines that are available in the market for small scale or personal use. In addition, the team identified three areas of significant design for the sub-system level benchmarking, which included the alignment, cutting patterns, and actuation. In some areas, it was useful to make research on the products within the market and others were relevant researching processes.

3.2 System Level

The team performed benchmarking for the small-scale and personal button makers. Based on the research, the team found out that personal use button makers can either be electric (automatic) button makers or can be manually operated button makers. Since the automatic

button makers appear to exceed the client's requirements, the team decided to research on the small scale manually operated button makers.

3.2.1 Existing design #1

The figure below shows a button maker that is manually operated, which is meant for personal use or for small scale production. The design relies on level mechanism in transferring force provided by the operator. It may be mounted on workbenches or a desk in order to avoid major movements during the button cutting process. The design has a short arm length, which increases the amount of force applied or needed to operate. It features swivel motion of die cups, which is similar to that of the Hozhoni.



3.2.2 Existing Design #2

The second design is a product of Tecre Company, which is a button making company (Tecre Co.Inc). The design uses a swivel die design and lever. It is mounted on provided

platform featuring a graphic cutter. The design offers the benefit of cutting images using a similar equipment piece that is used in assembling the buttons.



3.2.3 Existing Design #3

The design shows a manually operated button maker made from USA Buttons, Inc. The system is a compact machine that has one distinct advantage compared to the above designs, where the lever changes its position instead of the dies, which eliminates swivel action that may cause complications to the alignment of the button components (USA Buttons, Inc).



3.3 Subsystem Levels

The team broke down the component of the button making process into different design areas, which included the cutting process, the die, and the component alignment (USA Buttons, Inc). The areas of focus provided for the subsystem level benchmarking and research.

3.3.1 Subsystem #1: Cutting

Based on the client's requirement, the design should be safe to use as well as effective in cutting images in relation to the sheet. The cutting process is quite important to the design based on the importance it has in providing quality cuts as well as providing six cuts at a time (USA Buttons, Inc). The existing design included:

3.3.1.1 Existing Design #1

The figure below shows a cutter that is made by Tecre Company. It is a cutter that is mounted on combination systems, though it may be purchased separately (Tecre Co.Inc). The sheet that contains the images should be cut in a manner that it slides to the cutter.



3.3.1.2 Existing design #2

The figure below shows a circle cutter that is made by Fiskars Company. The cutter is usually placed over the images that are to be cut and may be seen through the clear done. This cutter is advantageous since it is able to cut different diameters of circles. However, it only cuts a single image per sheet.



3.3.2 Subsystem #2

The subsystem consists of the type of alignment mechanisms that are available for dies and button components.

3.3.2.1 Existing Design #1

The figure shows a button maker that we got from badgeaminit.com. It has dies aligned in linear arrangement, which overcomes the problems that are caused by swivel motion. This type of system is not able to assist users in placing their components within the dies in a well aligned manner (Badgeaminit.com).



3.3.2.2 Existing Design #2

The design uses a die system arrangement that is stacked over each other in a vertical manner. Despite having an advantage over current swivel system, it has distinct lack of adequate space for working as well as adjusting button components.



3.3.3 Subsystem #3

For this subsystem, the team focused on the mechanism of the making process. The system at Hozhoni uses a foot lever. However, most of the current designs use hand-actuations. An example is shown in the existing design.

3.3.3.1 Existing Design #1

This button maker is air powered. The foot peddle is used in delivering the force from the existing air compressor. The set up appear to be complicated as well as requires air compressor. The foot pedal requires having a small limb force from user.



3.3.3.2 Existing Design #2

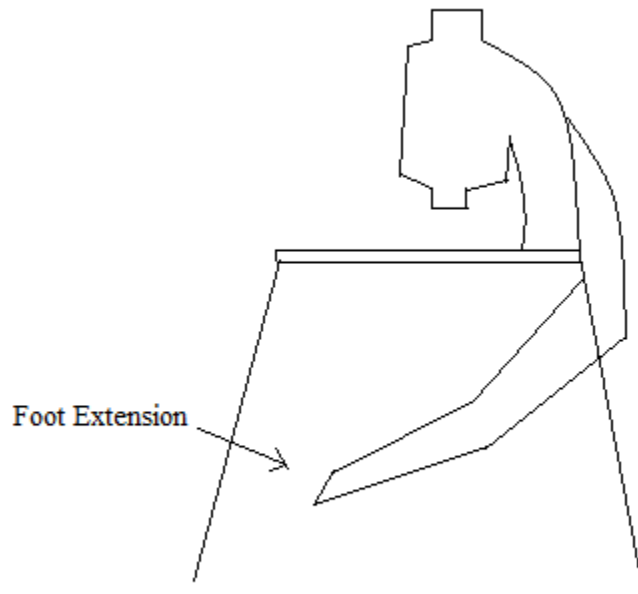
The Tecre Company also manufactured automatic button makers, which are electric. Despite the team not being interested with the electric design, it considered showing its benefits in the process, where there is minimal force used and the user is required to only make alignments of the components (Tecre Co.In).



4. DESIGNS CONSIDERED

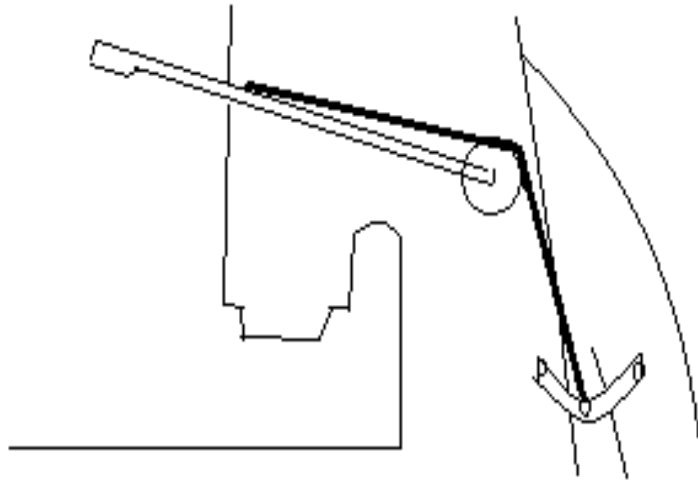
The team brainstormed on the best possible changes that would be made on the original system in order for it to meet all the requirements that were provided by the client. Each team member contributed their ideas and concepts, which we later brainstormed as a team to conclude on the final design.

4.1. Design #1: Foot Extension:



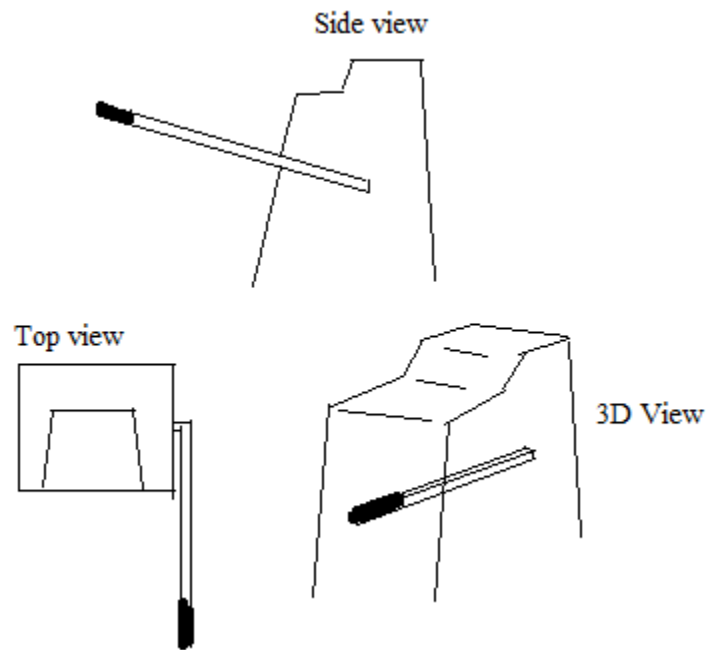
The first concept involved extending the foot lever in order to decrease the extension of the limb required to actuate the press. Further, it would improve on the ability to produce more force to cut the shapes accurately with good quality edges. This extension was selected since it is simple and is not expensive for the clients that would like to use their legs more compared to their arms in operating the machines.

4.2. Design #2: Arm lever system:



The arm lever system is an important aspect of the design. The system includes using of a steel wire thread that joins the arm system to the foot system. The wire thread allows for the foot and arm press to function using the same concept and have similar movements. It also includes using a roller and a connector that allows for effective movement of the wire. The design is advantageous as it allows for use of the arms similar to using the leg. The connection makes it easier to use both the arm and leg press simultaneously. On the other hand, a stronger rubber material would have worked better but would need regular replacement, thus increased maintenance cost.

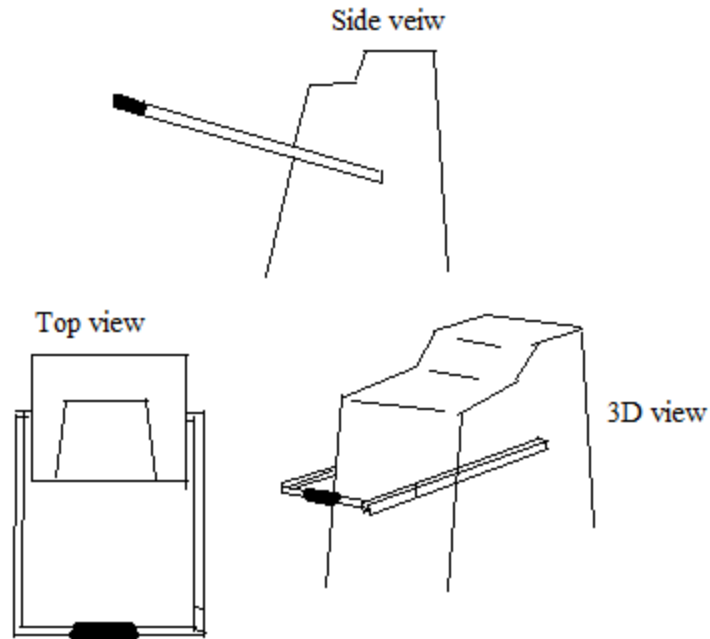
4.3. Design #3: Straight arm design:



The straight arm design is an arm press design that uses a straight bar attached to the side of the system, as shown above. The arm is approximately 30cm in length and has a rubber handle at its tip. It allows for both the use of one arm and the use of two arms.

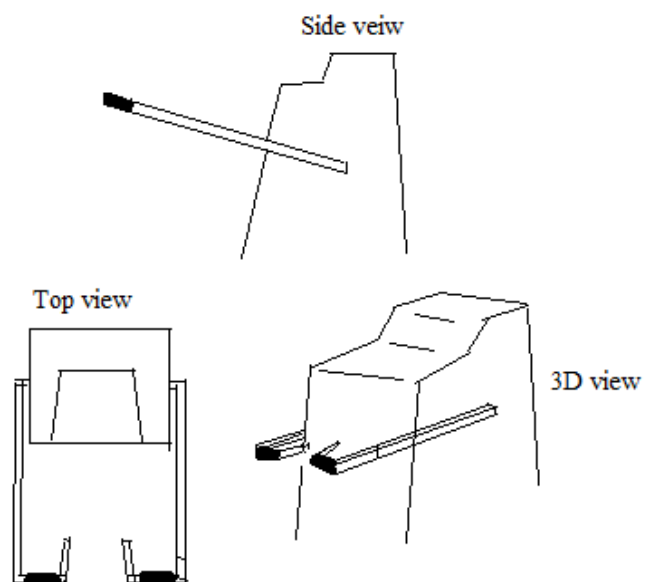
4.4. Design #4: U-shaped bar:

This concept involved attaching a U-shaped bar at the rear of the machine, where one end is fixed on one side of the machine's body and the other end on the other side of the machine's body. The bar will go round the front of the body in order to allow for hand using or pressing. The bar is then connected with a strong wire to the foot press. The system is also relatively simple to include to the original system. It provides the abilities to use the arm/hand to operate the system.

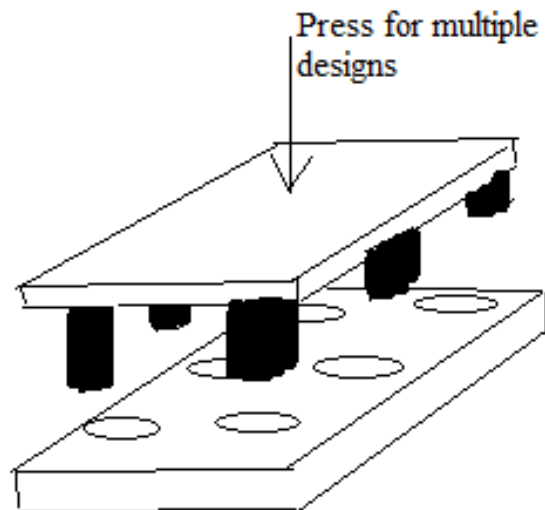


4.5. Design #5: Split arm design:

This design is placed in a similar design as the u-shaped bar, but has a space in between the front part of the bar. The space allows for the user to see the press plates and dye plates through the left out space, which allows for accuracy while in use.

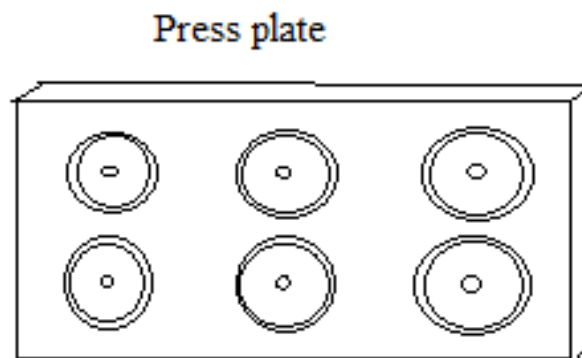


4.6. Design #6: Multiple design system:



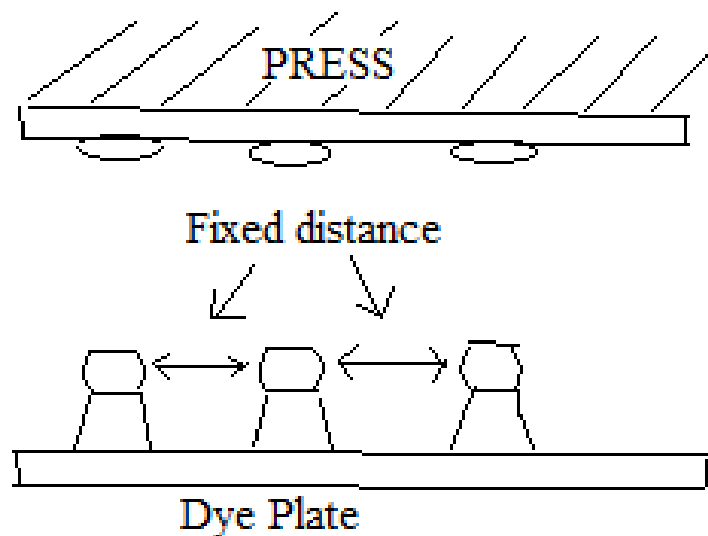
Further, the team modified the small arbor press through adding cutting stencils as well as board in order to allow for multiple cutting at a time. This allows for meeting of the client's needs to have the abilities to cut more cutouts at a time. It will allow for increased efficiency in the use of the machine. It may require careful constructions to allow for effective alignment with the images on sheets as well as include all possible safety issues.

4.7. Design #7: Multiple design plate:



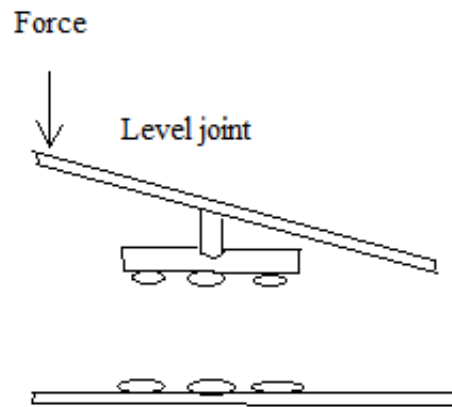
The design aligns the dye plates to the press. Aligning the design plates and press helps in reducing the struggle of having to adjust the press at all times for it to fit on the plates. The design sets the distance equally and constant for effectiveness of pressing. This allows for saving time that would otherwise be used in adjusting the press, which increases production. However, if the system does not function as expected, several buttons may be spoiled, which increases the expenses based on the spoiled buttons.

4.8. Design #8: Multiple design plate:



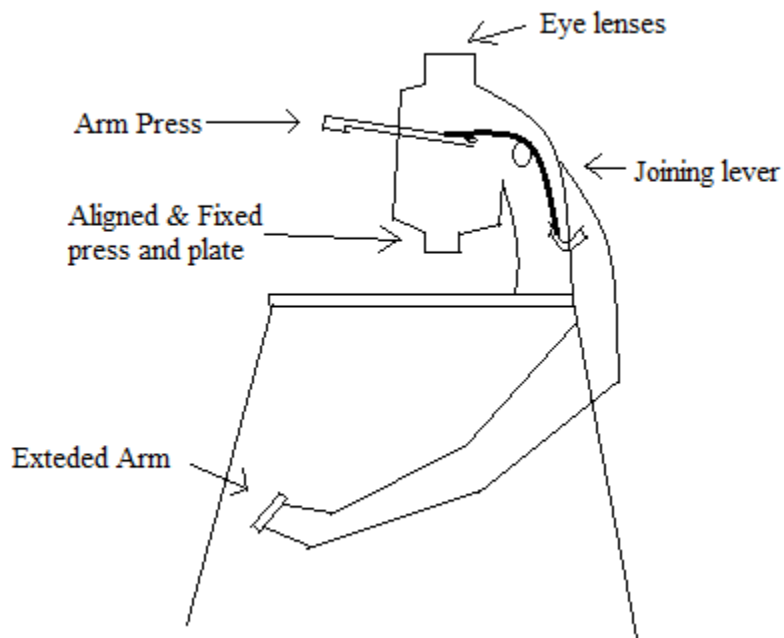
Further, the design shall have the dies and the presses in a layout that is linear instead of the angled layout currently being used. This shall allow for avoiding the swivel motion and eliminate the need to constantly adjust the alignment in order to allow for the swivel of the dies. In addition, the distance between the die presses and the plate holes shall be constant at all times.

4.9. Design #9: Multiple design plate:



This design will allow for use of different shapes and dyes for purposes of coming up with different types of button designs. The dies may be combined using color aids to assist with a better placement of components.

4.10. Design #10: Combination of multiple designs:



This design incorporates different design ideas into one. For example, it includes the use of an extended foot press, the use of an arm lever system, use of a press and plate that produces more designs, and use of an aligned press, and including an eye lens. The design is a combination of designs that allows it to be more effective.

5. DESIGN SELECTED

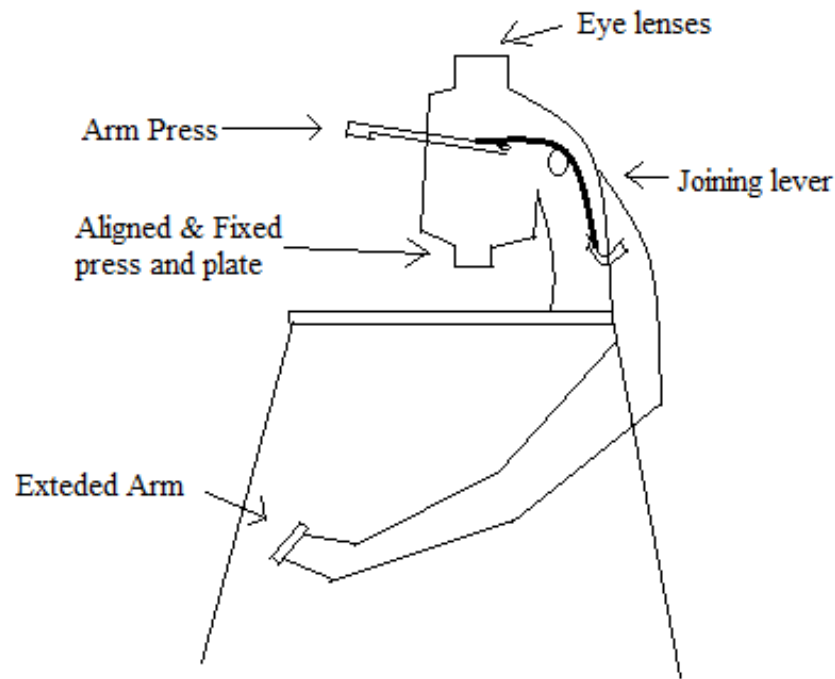
Button Maker								
	1	2	3	4	5	6	7	8
smaller than last year's solution	S	S	D	+	S	-	+	S
lighter than last year's solution	S	-		-	S	+	-	-
cut out six circle patterns at once	+	S	A	-	-	-	+	S
cut out patterns cleanly with no ripped edges	+	-		-	-	S	+	-
operational with only one hand/arm	+	S	T	S	+	+	S	-
guide to position the papers during cutting	+	-		-	-	S	S	S
S+	+4	+0	U	+1	+1	+2	+3	+0
S-	-0	-3		-4	-3	-2	-2	-3
S	4	3	M	1	1	2	2	3
Ranking	4	0		-2	-1	2	3	0

Table: Pugh chart

Designs	Safety	Cost	Efficiency	Meets client's demands	Total benefit Maximum points =20
<i>Design #1: Foot Extension</i>	5	4	3	2	14
<i>Design #2: Arm lever system</i>	5	4	3	2	14
<i>Design #3: Straight arm design</i>	5	4	3	2	14
<i>Design #4: U-shaped bar</i>	5	4	3	2	14
<i>Design #5: Split arm design</i>	5	3	3	2	12
<i>Design #6: Multiple design system</i>	5	3	3	3	14
<i>Design #7: Multiple design plate</i>	5	3	4	3	15
<i>Design #8: Multiple design plate</i>	5	3	4	3	15
<i>Design #9: Multiple design plate</i>	5	3	4	3	15
<i>Design #10: Combination of multiple designs</i>	5	4	5	5	19

Table: Decision matrix: Maximum point for each factor is equal to 5

The decision that has been selected meets the most factors that the client needed. The design incorporates the use of the arm press that is joined to the leg press using the lever system. The design allows for the use of arm and leg presses that press simultaneously or one at a time depending on the user's preferences. In addition, the design will include the aligned pallets and press, fixed distances between the pallets and also the presses, and an adjustable lens. The selected design meets the customer requirements, which makes it the best option given the other designs.



5.1. Rationale for selecting the design

The design that has been selected meets the various requirements and needs as provided by the client. These include:

1. The design is smaller in size compared to that of the previous years
2. The design is able to cut out six circle patterns at once, which was a specific request by the client's for purposes of encouraging effectiveness and efficiency in meeting demands through increased production
3. The design through the enhanced features, such as the lens and aligned press and pallets, is able to cut out patterns in a clear and cleanly manner without causing ripped edges, which improves the quality of the end product

4. The design, as requested by the client, allows for operation with one arm/hand based on the conditions of the users as well as to allow for effective management of the functions involved in the process
5. Based on the fixed distances of the pallets and the cutting press, the design positions the papers exactly and does not let them change position, which shall allow for effectiveness in the production process as well as quality of the products
6. The design is safe to use
7. The design is also of low cost, both the purchasing cost and the maintenance cost
8. It is also biologically inspired through using flexible foot press design. The flexible foot press design was inspired from insect legs. The foot press shall have two joints that allow for effective movement of the press. The energy used in such a press is minimal compared to the fixed press. The design shall allow for ease of use of the press.

6. PROPOSED DESIGN

The team will implement its proposed design through making different forms of concept and operational changes in its current design. The team's design seeks to make changes to the original and existing design. Through the concept involved in the original design, the team will make changes as per the requirements of the client as well as the concept defined by the team to meet these requirements. Some of the concepts of the original design will remain the same, such as the body housing all the components. Only minor changes will be made in order to accommodate for the changes in the press designs, the cutting design, and the die printing design. Since the design requires significant changes, the team will define a concept that explains the resources required and the process of implementing the design.

The team requires the use of various materials in order to complete and implement the concept.

The major materials include iron rods for the arm and foot presses, rubber for making the handle's grip, aluminum plates for forming the cutting and dye plates, and plastic material for the buttons, among other materials.

Further, the group will need various tools in completing the building process. Some of the tools will include gas heater for heating the metals during the molding process, cutting tools for cutting the materials in their required sizes, harmer for hammering the materials being used to into the shapes required, screw drivers and screws, and press for holding materials while work is in progress, among others.

The team will work as one unit in order to ensure that the building and implementation process is a success. The competence of each team member will enable for quality work and bringing out the design as expected. Working together with other parties will also allow for effectiveness in completing the work.

7. CONCLUSION

2.1 Contributors to Project Success

The main contributor to success for the project is having a team of active individuals. The selection of a team is important for the success of any project. The group members are quite effective and dedicated to the project. All the team members have been very active in completing the team's activities, which has made the team to complete their project based on the schedule it created at the beginning of the project.

In addition, a good planning process allowed the team to be effective in all that it did. At the beginning, the team members began by setting up of rules and regulation and the schedule to be

followed throughout the project. Having a schedule to follow made it possible for the team to work together and complete all the assigned responsibilities on time. It also allowed for the team to complete its project on time and have enough time to review and make changes to the project.

For any group to be successful, communication is an important aspect. The team, at the beginning, set the rules and regulations to follow in communication. The set regulation allowed for the team to communicate well and effectively, in addition, the team allowed for the team members to always communicate and assist each other in completing tasks. The communication between the team members made it possible to improve on all the processes and the end result of the project.

Research is also an important aspect for any group to be successful in completing a project. The team got information through intensive research through various research processes, which included online research, library research, interviews, and working together with other students. The research process made it possible to gather enough information for completing the project in a detailed and effective manner.

2.2 Opportunities for improvement

The team has various opportunities that may help in improving the end result of the project. For example, the team has the opportunity to use advanced technology in its design process. The current world has seen the improvement of technologies, such as computer technologies and software. The team relied solely on using basic designing processes in completing the project. However, it may be able to incorporate the use of technologies in order to ensure that it improves on the quality of its designs and in its decision-making processes. The use of advanced technologies may lead to improved end results by the team.

In addition, the team can seek professional assistance while making decisions. There are designs that the team had that did not work as expected. Seeking professional assistance may have allowed for these designs to work better. The team may have sought more assistance from the professor, who has diverse knowledge on these designs, which would have been a significant assistive factor for the team.

References

Button, G. (2013). *Technology in working order: Studies of work, interaction, and technology*.

London: Routledge.

Matheson, R. (2008). *Button, button: Uncanny stories*. New York: Tor.

Tecre. Co.,Inc. Button Maker Machine and Cutters.

<https://www.tecre.com/button-maker-machine.html>

USA Button INC. Make More than Just Great buttons.

<https://www.usabuttons.com/>

Badgeamint.com. Button Making Equipment and Suppliers.

<http://www.badgeaminit.com/>

APENDIX:**Bills of materials****Button Maker Machine**

Item Number	Item	Description	Manufacturer	Quantity	Total Cost
1	Iron metal rods	The metal rods should be of two different sizes: 2 cm and 5 cm diameters. The rods should be 50 cm long each	Nippon Steel & Sumitomo Metals	4 pieces total 2 pieced of 2cm diameter rods 2 pieces of 5cm diameter rods	\$200
2	Aluminum sheets	The aluminum sheet will be used in making the cutting and die plates	Nippon Steel & Sumitomo Metals	1 sheet of aluminum measuring 50cm by 50cm	\$125
3	Rubber	The rubber will be used for the presses handles	Vip Rubber and Plastic Manufacturer	50cm long stretch of flexible rubber	\$50
4	Plastic sheet	The plastic sheets will be used for making the buttons as part of the die plate	Vip Rubber and Plastic Manufacturer	Sheet of plastic: 30cm by 30cm	\$64