IMPROVEMENT OF THE ULTRASONIC JOINING PROCESS AT PRYM CONSUMER (M)

NUR RASHIDAH BINTI ISHAK

B051110350

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This report submitted in accordance of the University Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Robotics and Automation) with Honours.

by

NUR RASHIDAH BINTI ISHAK

B051110350

891229-02-5698

FACULTY OF MANUFACTURIGN ENGINEERING

DECLARATION

I hereby, declare this report entitle Improvement of the Ultrasonic Joining Process at Prym Consumer (M) is the result of my own research except as cited in references.

Signature	:	……..
Author's Name	:	NUR RASHIDAH BINTI ISHAK
Date	:	24 / 06 / 2015

APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Manufacturing Engineering (Robotic and Automation) with Honours. The member of the supervisor is as follow:

…….

(Dr.- Ing Azrul Azwan bin Abdul Rahman)

ABSTRAK

Projek ini adalah mengenai penambahbaikan terhadap proses penyambungan yang menggunakan mesin kimpalan ultrasonik di syarikat Prym Consumer (M). Produk yang terlibat dalam penggunaan mesin tersebut ialah penyambung bra lembut iaitu suatu produk yang berbentuk segi empat tepat di mana ia diaplikasikan dengan menghubungkannya pada hujung bra biasa. Ia digunakan untuk melegakan sesak atau menghapuskan pengecutan, berat badan pengguna, mengandung atau haid. Projek penambahbaikan ini dijalankan untuk mengatasi masalah yang dihadapi oleh syarikat itu di mana proses yang sedia ada untuk penyambungan bra dilakukan secara manual dengan menggunakan mesin kimpalan ultrasonic. Umum mengetahui bahawa proses manual akan meningkatkan masa pengeluaran dan pada masa yang sama ia akan mengurangkan kadar pengeluaran. Terdapat dua konsep yang dicadangkan iaitu Konsep A dan B. Konsep B ternyata lebih memenuhi kehendak yang diperlukan. Proses pembuatan Konsep B ini dijalankan untuk membuktikan bahawa ianya dapat memperaharui proses yang sedia ada. Berdasarkan keputusan eksperimen, masa yang diambil untuk menyelesaikan satu produk dengan menggunakan reka bentuk terkini lebih tinggi daripada proses yang sedia ada (18 saat) iaitu 19 saat dan pasti pada masa akan datang, ianya mampu menjadi lebih berguna jika fungsi automatik diaplikasikan.

ABSTRACT

This project is about the improvement of the ultrasonic joining process at Prym Consumer (M). The ultrasonic joining process at this company involves soft bra extender which it is a rectangular piece of material where it is apply by extends it to normal bra hooks. It is use to relieve tightness or eliminate shrinkage caused by bra, temporary weight gain, pregnancy or menstruation. This improvement project is done to overcome the problem that face by the company where the existing process to joining bra extender is done manually by using ultrasonic welding machine. In general, this process normally known will increase the production time and at the same time it will reduce the production rate. There are two suggested concept which are Concept A and Concept B. Concept B meets the requirement. Development process is carried out to prove that this new concept is able to improve the existing process. Based on the results of experiments, the time taken to complete one product by using the latest design is higher than existing process which is 19 second and surely in future, it can be more useful if an automatic function is apply.

DEDICATION

To my beloved husband, son, parents and all my siblings.

ACKNOWLEDGEMENT

Bismillahirrahmanirrahim,

I would like to convey my gratitude to Allah S.W.T for giving me strength and willingness to be able to complete this final year project report. I am indebted with many people during this development project. I would like to express my special gratitude, appreciation and thanks to Dr.-Ing. Azrul Azwan bin Abdul Rahman as my supervisor in this project where he taught me lot of knowledge that is new for me, helping me all the time. Not forgetting my beloved husband, Mohd Habib bin Halim; the one who helps me a lot about this project, giving ideas and so on.

Last but not least, I would like to say thousand thanks to my parents, Haji Ishak bin Man, Hajjah Rokayah binti Bakar, Halim bin Ahmad and Munirah binti Murad where without them, I won't be here. Their love and care are always in my heart.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CPM	-	Critical Path Method
EST	-	Earliest Start Time
CAD	-	Computer Aided Design
3D	-	3 Dimensional
Etc	-	Et Cetera
S	-	Second
(M)	-	Malaysia
mm	-	Milimeter
DC	-	Direct Current
a.m	-	Ante Meridiem
p.m	-	Post Meridiem

CHAPTER 1
INTRODUCTION

Prym Consumer is a company that produce product that been marketed in and out of the country and represented by four mainstays which are Prym Consumer USA, Prym Consumer Europe, Prym Consumer Malaysia and Prym Intimates Group. With comprehensive quality management, globally networked production facilities and total customer-orientation, this company fulfil their claim of always providing the best solutions with single-minded determination. This company is a subsidiary of Prym Consumer Germany that established in Melaka and engaged in manufacturing and distributions of sewing notions, garments accessories and craft accessories. They produce around seventeen type products such as safety pins, sew-on press fastener, pearl headed pins, bra back extender and etc ("Company of The Prym Group," 2014). Due to the project given entitle Improvement of The Ultrasonic Joining Process at their company in Malaysia, this company own two types of ultrasonic welding machine which are Ultrasonic Ltd. U (7014 A) from BRANSON and EGA 2014 and they would like to improve their joining process of soft bra extender using ultrasonic welding machine.

Ultrasonic welding machine is a machine that used to join or reform of thermoplastic through the use of heat generated from high-frequency of mechanical motion. It is happen by converting high-frequency electrical energy into high-frequency mechanical motion. When the force applied, that mechanical motion creates frictional heat at the plastic components mating surface so the plastic material will melt and form a molecular bond between the parts. It is commonly used for plastic and especially for joining dissimilar materials. In ultrasonic welding, there are no nails, soldering materials, connective bolts or adhesives necessary to bind the materials together. The

understanding of ultrasonic welding has increased with research and testing. The invention of more inexpensive equipment, sophisticated and increased demand for electronic components and plastic has led to a growing knowledge of the fundamental process. However, the ultrasonic welding need more study in many aspects such as relating weld quality to process parameters. The applications of ultrasonic welding are extensive and are found in many industries including electrical and computer, medical and aerospace, automotive and packaging (Staff, 2008)

1.1 Problem statement

Prym Consumer (M) has two shifts of working operation and the ultrasonic welding machine is control by a high skilled operator. In order to produce a complete product of soft bra extender, they need to joint all the parts by using ultrasonic welding machines. The existing process is quite slow because the operator needs too many steps to complete one product. Beside that each product required a lot of processing time because this joining process is done manually and it became critical when the types of jigs need to be changed.

1.2 Objectives

Here are several objectives of this project but the main objective is to improve the ultrasonic joining process in the Prym Consumer (M) in order to:

a) Reduce the processing time.
b) Minimize the human involvement in the process.
c) Helps operator to insert three parts at once.

1.3 Scope

This project that has been given by Prym Consumer (M) consists of an improvement of the ultrasonic joining process for soft bra extender. The existing joining process is done by manual and it takes much time to complete one product. For this project, a new jig will be developed to eliminate some steps of joining process for soft bra extender. The new jig is focus on soft bra extender with dimension 40mm only.

1.4 Thesis Structure

Thesis structure is a summary of every chapter. For ease of reading and comprehension, this project report is written by following the arrangement of chapter which has been decided. There are three chapters in this report which each of them consists of difference explanation according to the chapter.

Chapter one is about the introduction of company that involved in this collaborative project. This chapter explains the introduction of this project which including the basic theory, problem encounter and the main objectives of doing the thesis.

Chapter two is literature review. The aims of this chapter is to explain and describe the theoretical and information that unified, applied research and past research. With good reference, an overview comprising history, classification and applications progressively introduce the idea behind the technology.

Chapter three is methodology which known as a strategy that has been used to complete this project. This methodology is to inform the process flow.

Chapter four is about the process of designing concept, the selection concept and how that concept been developed. This chapter also describe about the data after implement the new design.

Chapter five is more to conclusion and some recommendation in order to improve the project in future.

CHAPTER 2
LITERATURE REVIEW

2.1 Description of Bra Extender

A lot of women do not know what is bra extender and they do not realize that it can be a vital accessory for their lingerie drawer instead it can save their money, insanity and their bra. A bra extender is a separate accessory that can help relieve or eliminate tightness caused by bra shrinkage, temporary weight gain, pregnancy or menstruation. These bra back extenders let women increase the size of their bra's band by 1-1/4 to 3-1/4" where it really became an urgent needed sometimes. It can be a great fix and better than sitting or walking in an uncomfortable state (What is a bra extender and why do you need one, 2014). This bra extender looks like a rectangular piece of material where at the ends of bras that has bra hooks. It latches on both ends of the bra, giving extra room, acting like a patch. Not all bra extenders are made with the same size. The spacing between the latches is not always universal.

2.2 Family Tree of Soft Bra Extender by Prym Consumer (M)

Prym Consumer (M) introduced five types of soft bra extender for customers. The bra extender have different dimension such as 20mm, 25mm, 40mm, 50mm and 75mm. They also produce the product with different colours which are beige, black and white colour. The different colours usually have different process which means before it become black colour, it should go through some process of colouring and other process

until it turn to black or beige colour. Below are some types of soft bra extender with different dimension and colours and it shown in the tree chart.

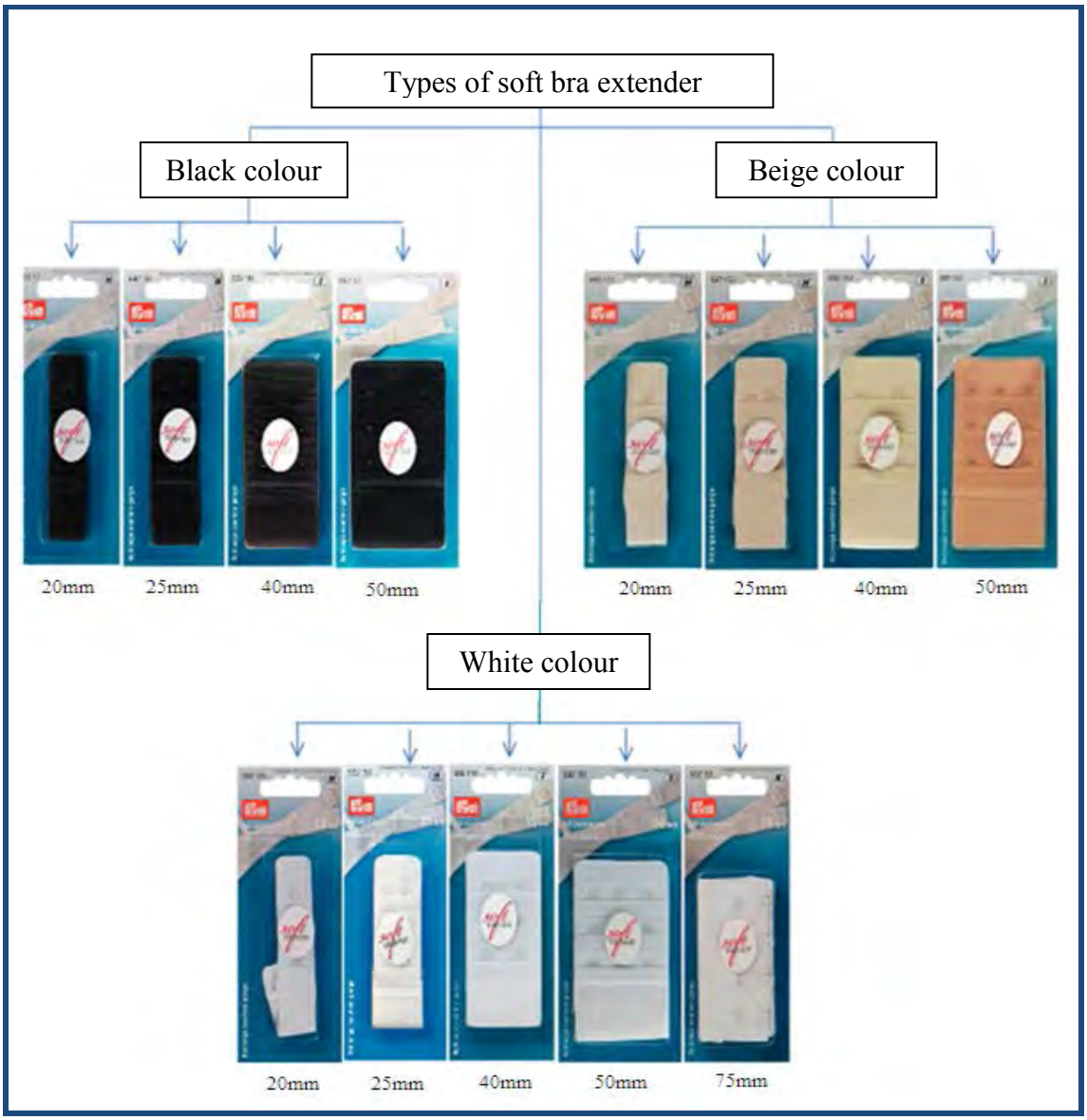

Figure 2.1: Family Tree of Soft Bra Extender

The product is produce from the combination of three components which are Part A, Part B and Part C. All these parts are shown in the figure below. Part A is known as eyes, Part B is elastic textile and Part C is a hook.

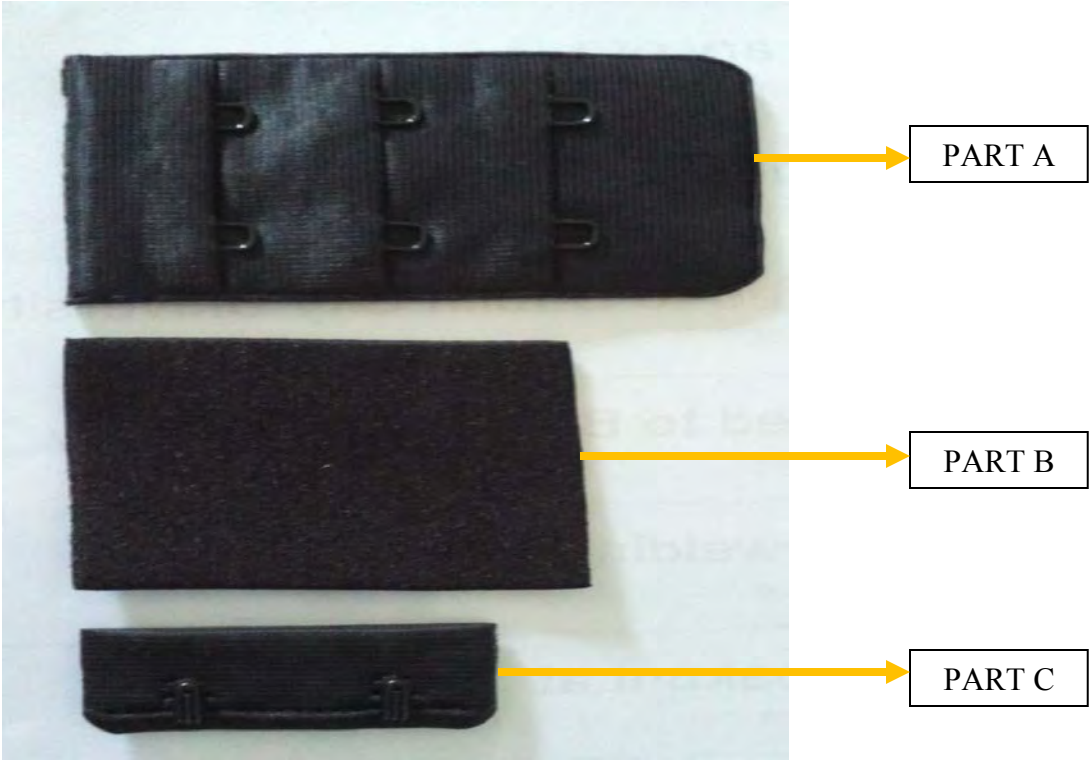

Figure 2.2: Soft Bra Extender Parts

2.3 Joining Process

Joining process is a process that included the material. Two or more parts of the materials are connected at their contacting surface by suitable heat and pressure (Robert W. Messler, 2004). In the field of manufacturing bra extender, there are two methods can be used to join each part which are using stitching method or welding method.

2.3.1 Stitch / Sew Process

Stitch or sew is a basic process that involves fastening of fabrics, leather, furs or similar other flexible material or textile with the help of needle and threads. Usually, sewing is mainly used to manufacture clothing and home furnishing and in fact, sewing is an important process in apparel making. Mostly the industrial sewing is done by an industrial sewing machine either it is an automatic machine or manual machine. The cut pieces of a garment are temporarily stitched at the initial stage and the complex parts of the machine then pierces thread through the layers of the cloth and interlocks the thread. Figure 2.3 is about parts of sewing machine that usually use for manual operation.

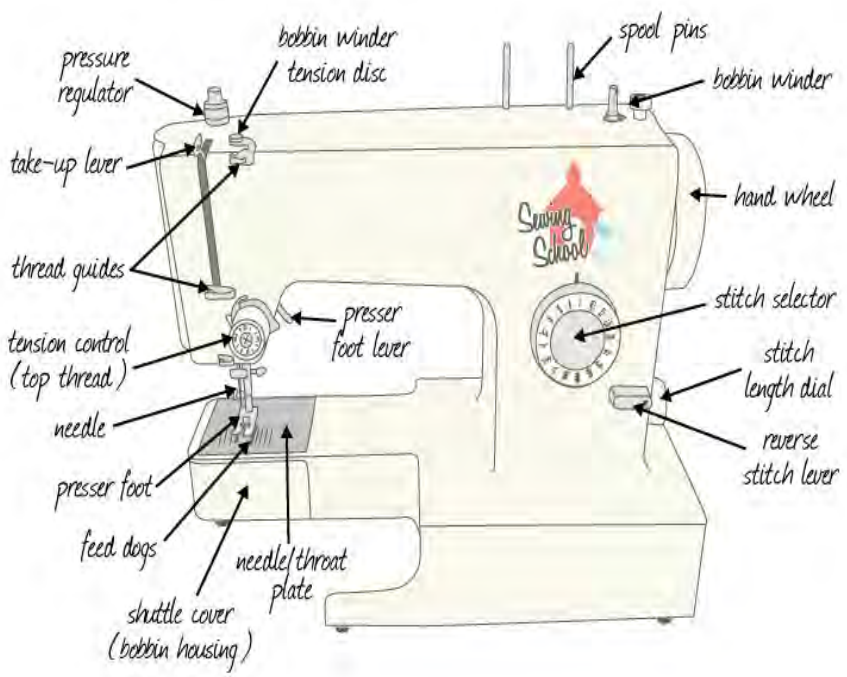

Figure 2.3: Sewing parts name

Sewing process seems to be a simple process but the industrial sewing is a complete process that involved many preparations and mathematical calculation for the perfect

seam quality. During the sewing process, the cloth must be held stiff and unwrinkled because the seam quality is very sensitive to cloth tension that varies from time to time in the whole sewing process. The fabric that lying on the working table needs to be guide towards the sewing machine needle along the seam line. In order to maintain the high quality seam, the attention must be focused on the control of appropriate tensional force (Appleby, 2009).

The interaction of needle with fabric is important where needle penetration force is one of the variables whose measurement is important for the quality monitoring. Some factors need to be considered such as the needle geometry that include the point angle and point length of the needle, the friction between needle and eye, the thread along with fabric's property and also the sewing conditions.

2.3.2 Ultrasonic welding Process

Ultrasonic welding is a joining process where high frequency ultrasonic acoustic vibrations are used to weld object together (Jeffrey L. Frantz, 2012). Usually the object used are plastic and especially for joining dissimilar materials. Ultrasonic welding of thermoplastic will cause local melting of the work piece due to absorption of vibration energy. It is happen by converting high-frequency electrical energy into high-frequency mechanical motion. When the force applied, that mechanical motion creates frictional heat at the plastic components mating surface so the plastic material will melt and form a molecular bond between the parts (Staff, 2008).

In case of Prym Consumer (M) soft bra extender, because of their product are wrapping with the lycra textile so it's much difficult to combine that parts by using sewing process because the lycra textile is very elastic, soft, smooth and light weight. Due to these properties they need to always use weight when knitting with lycra textile. So that Prym Consumer (M) used the ultrasonic welding machine to joining the parts of bra extender. After the operator push the two ON buttons, the horn (sonotrode as shown in Figure 2.5)