



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

IMPROVEMENT OF THE SNAP LOCK PIN ASSEMBLY MACHINE AT PRYM CONSUMER MALAYSIA SDN BHD

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

by

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DECLARATION

I hereby, declared this report entitled “IMPROVEMENT OF THE SNAP LOCK PIN ASSEMBLY MACHINE AT PRYM CONSUMER MALAYSIA SDN BHD” is the results of my own research except as cited in references.

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APPROVAL

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

.....
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ABSTRAK

Projek ini adalah mengenai kajian dan penambahbaikan mesin pemasangan kunci snap pin di sebuah syarikat bernama Prym Consumer Sdn. Bhd. Matlamat utama projek ini adalah untuk meningkatkan mesin dari segi kadar automasi serta meningkatkan pengeluarannya yang. Merupakan masalah yang dihadapi oleh mesin. Bagi mengatasi masalah tersebut, satu kajian terperinci telah dilakukan ke atas mesin untuk menganalisis masalah mesin dan juga untuk menjana idea-idea untuk konsep dan reka bentuk. Seterusnya, konsep-konsep yang dicipta keutamaan supaya konsep yang terbaik dapat difabrikasi untuk ujian. Kesimpulan telah dibuat untuk membandingkan prestasi konsep dengan bahagian-bahagian mesin yang sedia ada. Keputusan yang telah diambil dari beberapa aspek seperti kadar pengeluaran mesin sebelum dan selepas pelaksanaan konsep dan kadar penyekatan konsep. Akhirnya satu perbincangan telah dibuat untuk menentukan sama ada projek itu dijalankan dengan sewajarnya. Keputusan yang diperolehi daripada kajian yang dijalankan didapati bahawanya konsep tersebut dapat berfungsi dengan lebih baik daripada bahagian mesin itu yang sedia ada. Ini adalah disebabkan daripada konsep yang baik dan ia dapat meningkatkan lagi prestasi mesin pemasangan tersebut.

ABSTRACT

This project is about the study and improvement of a snap lock pin assembly machine in a company named Prym Consumer Sdn. Bhd. The main goal of this project is to improve the machine in its automation rate as well as increasing its production which were also the problems faced. To overcome the problems, a detailed study upon the machine have been done to analyze the machine problems as well as to generate ideas for concepts and designs. Next, the created concepts were ranked and the selected concept was fabricated for tests. A conclusion has been made in order to compare the performance of the concept with the existing machine parts. Results have been taken from a few aspects such as the production rate of the machine before and after concept implementation and the jamming rate of the concept were being compared. A discussion has been made in the end to determine if the project was being conduct accordingly. The results obtained from the study were being compared and it was made know that the concept is able to perform better than the existing part. It is due to the perks that the concept withholds that helps in the improvement of the assembly machine; improving the automation of the machine as well as increasing its production rate.

DEDICATION

To all who walked with me.

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I would like to thank for all who had involved in this project with me and brought it to an end. Thanks to the faculty for such organizing so that I may had the chance to write one for others reference in future. Great thanks to my supervisor and panels where they guided me throughout the report so that it can be done better. Thank you for the judgment as well as effort and time spent with me. Thank God and my family that supported me indirectly, as well as friends and strangers that watched over me.

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LIST OF ABBREVIATIONS

CAD	-	Computer Aided Design
CAM	-	Computer Aided Manufacturing
CNC	-	Computer Numerical Control
Etc.	-	Etcetera
GI Plates	-	Galvanized Iron Plates
ICT	-	Information and Communication Technologies
ROI	-	Return of Investment
Sdn. Bhd.	-	Sendirian Berhad
UTeM	-	Universiti Teknikal Malaysia Melaka

CHAPTER 1

INTRODUCTION

Prym Consumer (Malaysia) Sdn. Bhd. is manufacturing company where it produces pins and textile related products. The pins come in various sizes with different material. Raw material is being brought into be process into pins based on desired functionality in terms of material and design.

Safety pin manufacturing has been going on for decades. It is first being patented in 1849 by a New Yorker - Walter Hunt in Washington under the patent number #6281 for safety pin (Byars, 2012). Basically, a safety pin is made from a piece of wire which was coiled to have the ability of a spring. At one end holds the pin cap whereas another end is sharpened for piercing. To close, the pointed end is being forced into the cap where both end would be covered.

A snap lock pin would have an extra snap lock cap on the pin cap where it will act as a lock for the safety pin. It is to prevent the pointed end of the pin from being exposed. When it is lock, the pointed end would not be able to perform the clasp and unclasp action due its path to cap is block by the snap lock cap. However, unlocking the cap would reverse its function back as a safety pin without a snap lock cap. The snap lock cap is made of plastic. Prym Consumers outsource the cap because Prym Consumers does not do injection molding to produce the plastic cap.

Prym Consumer has different machines to process the pin and pin caps such as the pointing machine and stamping machine. It will then be assembled using an assembly

machine to join the coiled pin and pin cap. Smaller safety pins are able to be produced in just one machine where the pointing, stamping, and assembling process is being done simultaneously. Extra assembly process is taken to join snap lock plastic cap to the completed safety pin cap to produce snap lock pin. Previous as it had been done, the assembly process were being done by human workforce. The safety pin and snap lock cap were assembled using a jig and lever mechanism to make assembly process easier and effortless. Nowadays, due to high demand and expensive labor cost, Prym Consumer upgraded their equipment to cope with the current economy needs. The machine is known as the automated snap lock pin assembly machine.

1.1 Problem Statement

In this project, there are a few problems on the assembly machine. Problems where in the beginning was not being expected of its occurrence until it was fully built. The problems were being identified later when the machine is run and used. This causes a slow production and the aim of the company were not being able to achieve. Below shows the current occurrence of problems which is faced by the machine:

- (a) The machine have difficulties in mass production
 - (i) The pin is stuck at the pin rail
 - (ii) The pin is stuck at the pin chute
 - (iii) The cap is stuck at the cap chute
- (b) The need of automation of the machine
- (c) The machine cannot achieve proposed target

Therefore, in order to overcome all this problems, a robust upgrades and modifications are to be done.

1.2 Objectives

To ensure the improvement to be done correctly in its relativity, objectives of this project must be set. This is to prevent aimless upgrades and unrelated improvement which would be a time wasting action. The objectives will be discussed further in detail in following sub-titles.

1.2.1 To enhance the operability of the machine

In order to improve the operation of the machine, there are a few aspects to be noted. Following shows the possibilities of project directions to help achieving project objectives:

- (a) To change/modify pin rail to enable smooth sliding motion of pin from vibrator bowl into pin chute.
- (b) Replace the pneumatic system if it is proven as a distraction more than a system that moves the pin over the pin rail.
- (c) Identify other jamming issues on pin and cap chute and try to solve the issues.
- (d) Control and calibrate the whole assembly process in order for the machine to run at optimum rate to achieve target production IF and only if the machine has proven its ability to be fully automated.

1.2.2 To ensure the machine can achieve targeted production

Besides the improving of the machine operation, the results of the improvement should be able to generate better outcome where the production rate should be higher compared to the existing rail. Following shows the possible ways to obtain data to help proving the production rate increment:

- (a) To calculate the current production rate before and after improvement to ensure improvement is worthy of investment.
- (b) To optimize the functionality of the machine.

1.3 Scope

The scope of this project is the overall function of the snap lock pin assembly machine in pursuit of machine automation in Prym Consumer Malaysia Sdn Bhd. The improvement cost is to be kept on the lowest side to prevent further expenditure on the assembly machine. The project is to keep the major part of the system unless a satisfactory reason is being provided for replacement (which means wastage of part would occur which is not recommended). The rate of production is also a concerned data to study the production of the machine. It will be set as a benchmark of the machine production efficiency. The test will be compared using the data collected before and after the implementation of the concept. The improvement of the assembly machine is to be determined to overcome the problems faced and increase production output. This project will not cover the management, maintenance, or any business related field of the snap lock pin production. It is more onto the development of an improved concept or ideas to help future efforts in machine upgrading to a better, automated machine with high output capability.

1.4 Thesis Structure

In this report, there would be two more chapters after chapter 1: Introduction. In chapter 2, there will be discussions about the literature review of the project. The manufacturing involvement and evolvement in an industrial and factories business will be reviewed and discussed. Everything related from the improvement of manufacturing machine to the function of the snap lock pin assembly machine parts will be study upon. In chapter 3, it

will be the writing of methodology section of the project. Discussion will be made and the best solution will be determined. The steps to be taken in order to achieve project objectives will be stated. In methodology, the detail step-by-step and idea of improvement of the snap lock pin assembly machine from all aspect will be discussed in pursuit of making it a successful project.

CHAPTER 2

LITERATURE REVIEW

In this section part of the project, there will be more discussions about the product which is the snap lock safety pin and the assembly machine which put together the snap lock cap and the safety pin. This chapter will cover and explain more about safety pin such as the designs and functions of it and how the safety pin is improved by adding a snap lock cap to cope with market requirements. Besides that, this chapter will also include the components of the assembly machine such as the vibrator bowl designs and functions, and how it is able to become one of the most effective systems in separating operation. We also will cover the transportation of the pins and caps by using rails and chutes as a medium of travel to connect both vibrator bowl and the assembly jigs. The jigs designs and its assembly will be explained in order to help understands more about its importance in its usage. The pneumatics system which may be used as part of the moving forces along the chute and rail will be discussed as well as a surface explanation about control system in how both system can work together to gain desired results and function. The sensors and actuators chapter will include the working of sensors by transferring raw data to be compute by a system in order to actuate another mechanical system. It is crucial for the designs and types of sensors to be used in order to have the most cost effective and suitability working of the system. At the end of this chapter, we will cover what is the manufacturing assembly in the recent world and how the automation of the system may help mankind in developing an advance era of time. And finally, it will be concluded of this whole project before moving further into the next chapter which is methodology.

2.1 Safety Pin

Safety pin is equipment that helps to hold things together to prevent it from falling. It actually pins through or goes through a medium such as clothes or hole of an object that allows the safety pin itself and the object that follows hangs from the pinned or holed object. It has a rounded end that fits a sharp point. This is to prevent the pointed end of pin from causing bodily hurt or damaging to soft smooth object (Press, 2014). A very good example of safety pin would be as shown in Figure 2.1:

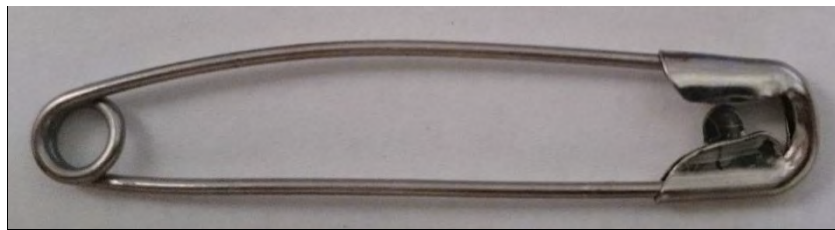


Figure 2.1: Safety pin

2.1.1 Pin Design and Material

Over the years ever since the invention and usage of safety pin within the community, the designs of safety pin had been altered by only a little bit from a curved or bended metal wire to a rounded end cap to enclose the pin when it is clasped together (as shown in Figure 2.2). The material used nowadays mostly were steel, brass and stainless steel according to a given internet article (Associates, 2014). Only those wealthy or ranked people used safety pins made of gold and silver to represent their status during the medieval times (Associates, 2014). The pins come in many sizes and designs nowadays. Each was to suit the purpose of its usage. For an example, curved safety pin is suitable to tack down a pieced top, battling, and quilt backing to hold the position before quilting and sewing it all together. Knitters can use coil-less safety pins as stitch markers (Designs, 2001). The pin to be inserted into the snap lock pin assembly machine is as in

Figure 2.2 and basically the pin is made of stainless steel to prevent it from rusting (Qiu, 1995). The design of the pin is the same as a normal safety pin, only that it is added with a snap lock plastic cap as shown in Figure 2.2. The snap lock will be discussed in the following part of chapter.

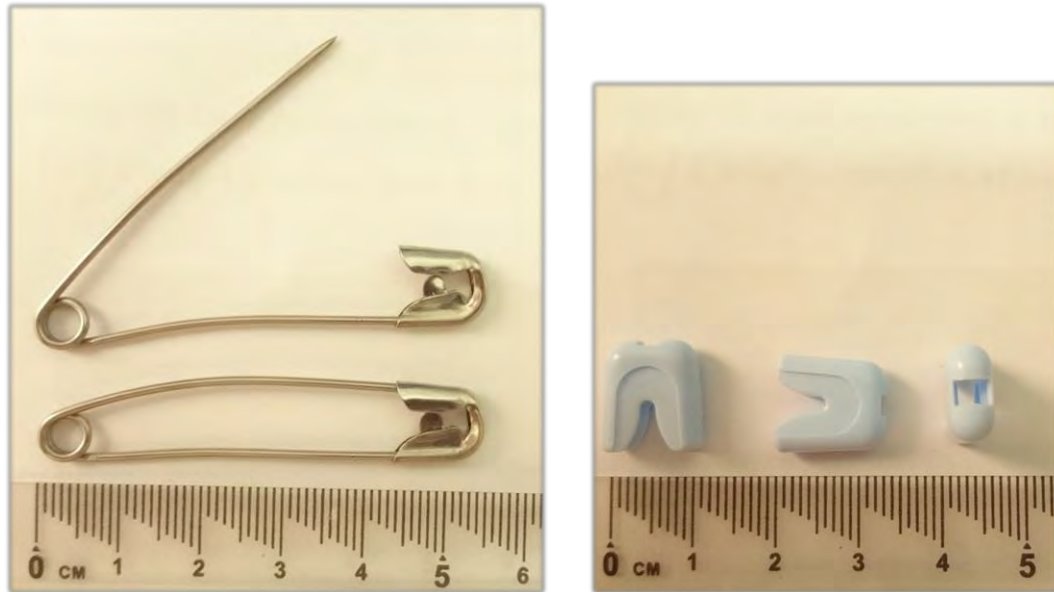


Figure 2.2: The safety pin mechanism and snap lock pin cap

2.2 Snap Lock

A snap lock or snap fit is an assembly method that is able to hold and joins two different parts together without the needs of using adhesive substances or any other components that fasten the two parts together (Tres, 2014). It can be made of different materials such as that one part is metal or stainless steel and another is made of plastics. The design of the snap lock mechanism varies from its holding power and requirements.

2.2.1 Structure Design

There are two main categories of designs that can differentiate types of snap lock where the first one is the permanent snap lock and the second is multiple snap lock. Permanent snap lock is a one-time assembly snap where it is widely used for recyclable products. It is meant to be fitted together and there is no way to remove it unless by force where it may damage the product or remove the permanent snap ability. As for multiple snap lock mechanism, it allows disassembling action after assembling for an example a cap of the pen. Both type of designs is widely used and is important in industries. Figure 2.3 shows one of the snap lock design using plastics.

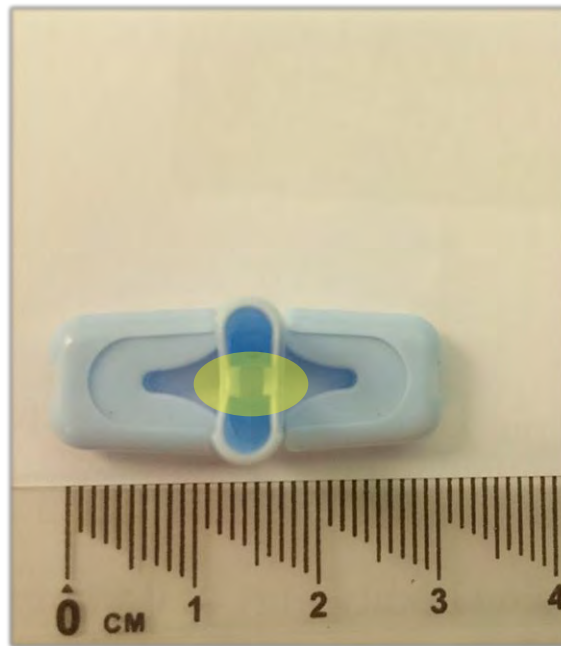


Figure 2.3: The fitting/snapping point of the snap lock cap to the safety pin

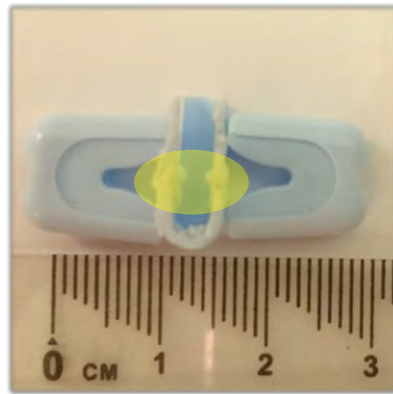


Figure 2.4: The cross section view of the snap lock cap

In this project, the snap lock safety pin by Prym Consumer have both the permanent and multiple snap locking mechanism in one snap lock cap which were made of plastic. The design of the snap lock cap were in such a way is to snap permanently onto the safety pin as shown in Figure 2.4 and the multiple snap lock mechanism is to enable the snap lock to move on the safety pin cap an act as an obstacle to block or unblock the pathway of clasping the safety pin. Below Figure 2.5 shows the assembled snap lock pin where the safety pin was joined to the snap lock plastic cap:

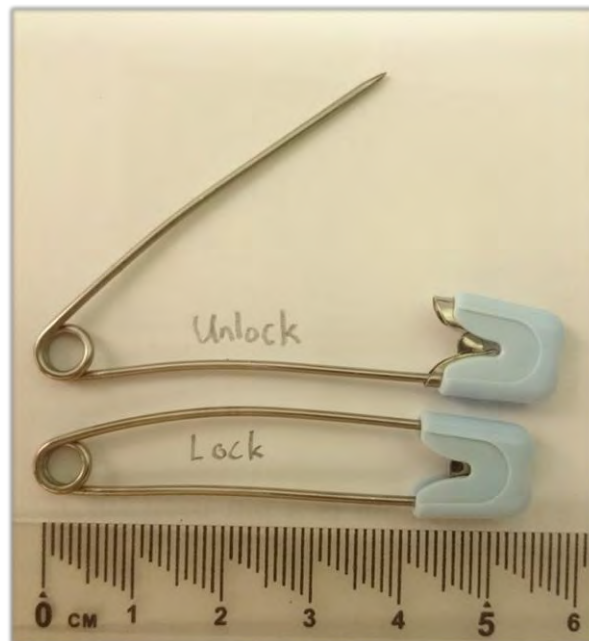


Figure 2.5: A snap lock pin.