Design And Development Of An Accurate Screwing Method For Fastening Vertical Position Screw

Thesis submitted in accordance with the partial requirements of the Universiti Teknikal Malaysia Melaka for the Bachelor of Manufacturing Engineering (Manufacturing Design)

By

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May 2007
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JUDUL: DESIGN AND DEVELOPMENT OF AN ACCURATE SCREWING METHOD FOR FASTENING VERTICAL POSITION SCREW


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DECLARATION

I hereby, declare this thesis entitled “Design and Development of an Accurate Screwing Method for Fastening Vertical Position Screw” is the result of my own research except as cited in the references.

Signature

Author’s Name: SHAHRIDZUWal B. MD JABARULLA

Date: 14th MAY 2007
ABSTRACT

This paperwork contains the report of a study on design and development of an accurate screwing method for fastening vertical position screw. The aim of this paper work is to investigate the factor effect the screw vertical fastening and provide the solution by designing the device to overcome the problem. Vertical screw fastening is correctly determine as 90° angle of rotation axis for the screw and the screw driver or any power tools used to fasten it. The investigation will focus onto the force system transfer during fastening operation to clarify the problem occur during vertical fastening operation. By using internal search as analysis using CAD-CAE software and external by research of past study, the problem then classified and used the information for product design stages. The design process utilizes step by step disciplines of product design and development for systematically invent the product. The outcome from this paperwork is finest design concept that selected using Pugh Method. Brief discussion also had been provide at the end of this paperwork onto project development activities and finally a suggestion for future development for the selected concept had been synthesize earlier.

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ABSTRAK

DEDICATION

Specially dedicated to: My beloved father, Md Jabarulla Bin Abd. Majied, My Mother, Jamaliah Binti Sabdin who are very concern, understanding, patient and supporting. Thanks for everything. To My Sisters, Norazrina Binti Md jabarulla, Norashikin Binti Md Jabarulla, My Brothers, Amirul Amin Bin Md Jabarulla and Muhammad Azri Bin Md Jabarulla and To My Brother In-Law Azahadi Bin Hassan for their support.

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## LIST OF SIGN AND SYMBOLS

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<td>Accurate Screwing Device</td>
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<td>CAD</td>
<td>Computer Aided Drafting</td>
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<td>CAE</td>
<td>Computer Aided Engineering</td>
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<td>FEA</td>
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CHAPTER 1
GENERAL INTRODUCTION

1.1 Overview

Eccentricity features during tightened the screw into screw hole in product can bring defect by increase reject and cost of the manufacturing company. How ever the type of defect can be prevent by using and controlled correct technique during the process. The task is how to make sure people can pretend to work by maintaining the performance and energy while working 8 hour a day. The factor of exhaustion, stress and different operator can be the major source of the defects.

In that case, it should be necessary to prepare developed the device that can fully controlled and minimize the eccentricity of the screw during insertion and tightened process to ensure the problems of misallocation can be eliminated or lower the defect. Human cannot pretend to work in same level of performance but machine or device can do it in long time period. Therefore, this chapter will introduce the eccentricity motion to screw fastening operation and how it would affect the production.
1.2 Problem Statement

The concept of ready to assemble fabricated in factory ready to deliver to customer is well known and it is commonly used to electrical industry. In an assembly line, fitting and assembly process of part with part to produce a product are continuously run and really need of high speed tool with fastener to reach efficient process. Most common fastener in order to connect this type of electrical hardware product is the screw and nuts and could be only the screwing method with the joining to the plastic frame.

This project focuses on common problems occurred in manufacturing lines in industry while using manual and mechanism device to insert and tighten the screw into plastic cover known as casing. Besides using manual screw driver, by using the power driven screw driver the process could be easier and faster. The condition should be extremely efficient to the process time and labors costing. However, there are some problems occur due to high speed motion, there are difficult to attain the rotation motion in single axis during screw fastening. This translation measure as eccentricity motion of screw, it have huge tendency of damaging the part as example crack, loose or damaging the other part.

The eccentricity of the screw meaning is how far the rotation motion of screw deviates from its initial circle centerline. As the screw not only simple shaft shape but also had the lead tapered shape along conic shaft, the translation of its center line of the screw will effect the threading both screw and work piece which lead to more types of damages.

Thus, to overcome the problems, this project will run through appropriate discipline and process to measure and investigate how the problems occur and provide the best solution by analysis and investigation to recommend if there any relevant parameter or device to be used during screw fastening in high speed motion to achieve efficiency and reduce defect.
1.3 Objectives

The objectives of this project have been identified and should be achieve to provide solution to current problems. Specific objectives of this report are:

1) To study the factors might affect the vertical screwing process.
2) To design appropriate device with functional to overcome the eccentricity problem in vertical screw fastening.

1.4 Scope

This section is intended to narrow the scope of the proposal objective. The scopes of Degree Project 1 are:

a) Literature review of screw joining and eccentricity
b) The identification of precision for joining screw in 90 degrees angle
c) Application on appropriate theory
d) Analysis and simulation for appropriate parameter
e) Product design
CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

By the word assembly, the used of joining method is compulsory to secure the part in the complete assemble product. Among the type of joining method, screw is most popular device. Screw commonly operates with the threading build in the material for joining. Unfortunately, how efficient the design it often occur some mistake and it is normal phenomenon in engineering world. The eccentricity issues bring problems as leakage; slenderness and misallocation of the screw thread relatively affect manufacturing as it related the quality and costing to the product respectively.

For this purpose, product development of screw eccentricity device has to take action due to surpass the problems. This chapter will fully describe the complete literature of related element that involved in this project. It will start with the background of assembly by history, type of common joining method and device exist. The root of the main problem will described to make more understand about the theory of eccentricity and how the feature effect to the mechanical applications.
2.2 Assembly Background

In manufacturing, the word assembly comes with the word fitting. Therefore there is such strong relationship between these practices. Fitting is where the secondary processes were made to the part after primary process to improve or allow product functionality. An assembly is where manipulation of finished part into meaningful spatial relationship. The assembly in manufacturing believed was developed throughout the nineteenth century and the person responsible was Henry Ford. In the early twentieth century, he popularized the concept of manual assembly by his famous initiative which led to assembly of the flywheel magneto for the Model T on the assembly line [1].

The working principle in assembly by Henry Ford is simple. The assembly content is divided in an acceptable sequence of assembly then into equal portions of work contents. The number of portions depends upon the production requirement. The used of operator will assemble the part by part to the complete product and this is the beginning of mass production era [1].

Nowadays, there are two basics classes of assembly process. There are manual or automated (mechanism). The use of joining, connections or fasteners method is common and must be considered precisely to retain the functionality, effective cost and easing to assembly of the product. Therefore considering an assembly design in the early conceptual of design is essential and by the way it often generates significant productivity and quality improvement.

![Figure 2.2a IBM Server Final assembly - Model 820: source publib.boulder.ibm.com/.../rzr5fruloc820.htm](image-url)
2.2.1 Joining Process

Joining process basically known as the process to combine two or more part by relevant element to maintain the functionality and reduce costing. Generally there are two major classification of joining methods, permanent and temporary. The permanent method may consist of diffusion of material between two or more part in the joining procedure as an example welding. The type of join that diffuse material together is called cohesive bonding. Other example of permanent joining is brazing and soldering which is called as adhesive bonding [2].

The temporary joining method has wide variety of selection and continuously improved. The most common temporary joining method is fastening device (fastener). The fastener is the easiest and clean joining process. It just made with addition of the fastening device to tie-up the separate parts together. This joining method can re-assemble at any time.

Fasteners big family is classified in three where it is fastener for shaft, non-threaded fastener and threaded fasteners. Therefore to support the need cause commonly different application required different type of fastener.
2.2.2 Fasteners

Fasteners are the device or medium used to ties or to bind two or more object to hold and secure from separation. The type of fasteners joining as stated earlier is non-permanent or temporary joining. However this doesn’t mean that all type of fastener can easily to re-assemble. This type of joining process designed to extremely satisfy the need of product that required replacement process or relative movement permission. In other word the type of joining made with fasteners proven it is reliable, fast and safe. There are three classes of fasteners itself today. There are fastener for shaft, non-threaded fastener and threaded fastener.

![Various Type of Fasteners](www.sz-wholesale.com/Other-Material.html)

*Figure 2.2b Various Type of Fasteners*

*Source: www.sz-wholesale.com/Other-Material.html*
2.2.2.1 Fastener For Shaft

A fastener for shaft has wide variety of shape depends to application and design. Commonly fastener for shaft is the keys which applied to the part to be join mostly on parts that attain axial motion. This device applied pair with a keyseat and keyways. Example of the product really used this type of fastener is the set of pulley and shaft. The design have intentionally has axial motion. A keyseat is the slot that is cut into the shaft and keyways is cut into the hole through the center of the pulley. The assembly is by aligning the keyseat and keyways and keys are inserted into both slot line simultaneously [2].

The other fastener that works more efficiently to shaft joining is the splines. The geometry for this fastener is toothed external and internal connectors that allow longitudinal motion on shaft. The teeth for splines work as many keys acting together and excellent for transmitting rotational forces [2].