UNIVERSITI TEKNIKAL MALAYSIA MELAKA

STUDY THE IMPACT OF TORSION BASED ON THE MATERIAL PROPERTIES FOR SIMULTANEOUS TYRE WRENCH

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Maintenance) with Honours

by

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Maintenance Technology) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Produk sepana serentak tayar adalah suatu kajian penambahbaikan, sebelum ini, ada satu produk yang dapat mengeluarkn nut dalam roda yang digunakan pada kereta PCD 100. Mekanisma yang telah digunakan untuk mengendalikan produk tersebut adalah menggunakan rantai. Masalah ketika menggunakan rantai adalah ia mudah tergelincir dan Ia perlu diselenggara dengan pantas supaya ia dapat berjalan dengan lancer. Jadi sepana serentak tayar dihasilkan dengan menggunakan mekanisme yang berbeza iaitu gear. Gear yang digunakan untuk produk ini adalah dari kotak gear motosikal. Sepana serentak tayar dihasilkan untuk membantu dan menyelesaikan masalah umum yang berkaitan dengan four-wheeler, yang mana ia boleh membantu semasa proses menukar tayar yang bermasalah dengan tayar gantian. Kadang-kadang untuk mengeluarkan tayar, ia mengambil masa kerana jumlah tork yang diperlukan agak tinggi. Sepana serentak tayar dapat melongarkan nut roda, kerana ia direka dengan ergonomik untuk menggunakan ia dengan begitu mudah untuk dikendalikan, dan tidak memerlukan ruang yang besar untuk menyimpannya. Produk ini lebih tertumpu kepada empat roda kereta yang mempunyai pitch circle diameter 100 atau PCD 100. Analisis produk ini pada dasarnya, ia akan melalui ujian tertentu. Sifat-sifat bahan ujian yang akan dilakukan adalah ujian kekerasan, ujian kesan dan ujian kilasan. Bahan yang telah dibandingkan adalah keluli tahan karat dan aci aluminum. Selepas produk yang dihasilkan, ia telah diuji pada kereta yang digunakan PCD 100. Produk ini juga telah diuji menggunakan sepana-L dan pistol udara untuk mengetahui had tork yang boleh digunakan di atasnya semasa proses penukaran tayar. Ujian kilasan, kesan, dan kekerasan menunjukkan bahawa keluli tahan karat adalah bahan yang kukuh dan sesuai untuk digunakan bagi produk STW kerana jumlah kekerasan adalah lebih tinggi berbanding aluminium dan keluli tahan karat yang tahan tork yang tinggi semasa ujian keupayaan berbanding aluminium. Selepas itu, STW telah diuji dengan menggunakan sebuah meriam penyaman dan ia menunjukkan bahawa jumlah maksimum yang boleh digunakan untuk itu, ialah 4 Nm kerana produk bergegar kuat dan menghasilkan bunyi yang tidak normal.

ABSTRACT

Simultaneous tyre wrench product is an improvement study, before this, there is a product that helps to remove the nut from the wheels that used PCD 100. The mechanism that been used to operate the product is using chain. The common problem using the chain is slipping and need to maintain rapidly to achieve its performance. The simultaneous tyre wrench is produced by using a different mechanism which is geared. The gear that been used for this product is from the motorcycle gearbox. The STW is produced to help and solve basically the common problem that related with the four-wheeler, which it can help during the process of changing the problem tyre with the spare tyre. Remove the tyre, it takes time due to the amount of torque needed is quite high. The simultaneous tyre wrench helps remove the wheel nut by it designed that ergonomic to use which is easy to handle, and do not require a large space to store it. This product is more focused on the four wheels car that has the pitch circle diameter 100 or PCD 100. For the analysis of this product basically, it will go through a certain test. The material properties test which are hardness test, impact test, and torsion test. The materials that been compared is stainless steel and aluminum shaft. After the product been produced it been tested on the car that used PCD 100. The product has also been tested using L-shaft and air gun to find out the limit of torque that can be applied to it during the process. Torsion, impact, and hardness test show that stainless steel is the strong and suitable material to be used for STW product because the hardness number is higher compared to aluminum and the ability of stainless steel that can withstand high torque during the test compared to aluminum. After that, STW has been tested by using an air gun and it shows that the maximum amount that can be applied for it, is 4 Nm because the product vibrates strongly and produce abnormal sound.

DEDICATION

This thesis writing is dedicated to my beloved father Sulaiman Bin Simat that always taught me to applied the knowledge for good things in daily life so it can benefit others in next time. Then, this thesis was also dedicated to my beloved mother Norizan Bte Osman that give moral support to finish writing this thesis at the right time. Besides, to all my siblings that always support and sharing knowledge or experience about writing this thesis is really helpful to me during the process of writing this thesis.

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LIST OF SYMBOLS

Mm	Millimeters
W	Watt
Nm	Newton meter
RPM	Revolution per minute
Fe	Iron
C	Carbon
Si	Silicon
S	Sulfur
Mn	Manganese
P	Phosphorus
LC	Gauge length
So	Initial cross section area
Al	Aluminum
Mg	Magnesium
V	Volt
CO_2	Carbon Dioxide

LIST OF ABBREVIATIONS

Pcd	Pitch Circle Diameter
Stw	Simultaneous Tyre Wrench
Mig	Metal Inert Gas
Dc	Direct Current
Egp	External Gear Pump
Lod	Local Oscillatory Characteristic Decomposition
Tvms	Time-Varying With The Mesh Stiffness
Emd	Empirical Mode Decomposition
Hl	Hydrodynamic Lubrication
Ehl	Elastohydrodynamic Lubrication
Bl	Boundary Lubrication
Fe	Finite Element

CHAPTER 1

INTRODUCTION

1.0 Background

This chapter basically explains the general concept of the simultaneous tyre wrench. The simultaneous tyre wrench is generally used to tighten and loosen the wheel nuts of the four-wheeler. The project overview, problem statement, objective and scope of this project will be covered in this chapter. Then, the organization of this report is stated below.

1.1 Project Overview

The simultaneous tyre wrench is produced to help and solve basically the common problem that related with the four-wheeler, which it can help during the process of changing the problem tyre with the spare tyre or new tyre.

This action relatively takes time and sometimes could be difficult for women or the elderly drivers to get this job done. Sometimes to remove the tyre, it takes time due to the amount of torque needed is quite high.

The simultaneous tyre wrench helps remove the wheel nuts by it designed that ergonomic to use which is easy to handle, and do not require a large space to store it. The reason this product should be an ergonomic designed because it can help to ease for women and elderly to operate it. When it comes to handling, this product gives a comfortable handling during operation and can be carried to any places that need this

product to do it job. This product can be safely put in the car boot due to, it not required a large space to store it.

This product is more focused on the four wheels car that has the pitch circle diameter 100 or PCD 100. PCD 100 is quite a common car that been driven on the road right now, this is the main reason why this product is produced. For the analysis of this product basically, it goes through a certain test. For example the material properties test, and efficiency or durability of the product.

1.2 Problem Statement

Based on the study, this product is produced with the consideration of the material properties and the economics of this product. For the simultaneous tyre wrench product is an improvement study, before this, there is a product that helps to remove the nuts from the wheels that used PCD 100. The mechanism that been used to operate the product is using chain. The common problem using the chain is slipping and need to maintain rapidly to achieve its performance. So the simultaneous tyre wrench is produced by using a different mechanism which is geared. The gear that been used for this product is from the motorcycle gearbox.

According to Foster City, Calif, (2014) explain that half of the female drivers in the United States have never changed a tyre, and some also said that they do not know how to change the tyre based on the survey that been done from the Insurance.com survey. From this survey shows that 33% of woman and 6% of man do not know how to change their tyre of the car. Besides, from this statistic, it shows that there is not that woman know how to change their tyre. Analysis of this statistic had been done and it finds out how the way to reduce the percentage of the woman that does not know how to change their tyre. The simultaneous tyre wrench product is the result of the analysis of the

statistics. This product could help the customer or mostly women, to facilitate, small storage, and easy to handle with the minimum time consumed to loosen and tighten their tyre.

The problem statement mainly focuses, on how to get the best performance based on the time with a comparison of using a simultaneous tyre wrench and only used a ratchet, L-shaft or air gun to tighten and loosen the wheel nuts. Then, analyze the performance or durability of the product based on material properties, torsion, and limit of torque that can be applied to this product.

1.3 Objectives

I. To analyze the performance of the simultaneous tyre wrench by comparing the time using L-shaft or ratchet and air gun to tighten and loosen the wheel nuts.

II. To investigate the toughness or strength of the simultaneous tyre wrench based on the material properties test.

III. To find out the limit of torque that can be applied for simultaneous tyre wrench based on the Test.

1.4 Scope

This product scope covers mostly in the automotive industry, workshop, and the automotive learning institution. This product was tested inside this area of scope to achieve its result and to analyze its performance. This product can make the process of tightening and loosening at the car that has the wheel specifications, which is PCD 100.

The application of Catia software in the design component of the simultaneous tyre wrench (STW), to know the performance and the limitation of this product. Besides using the Catia software also can help to produce the 2D and 3D design of STW product.

For the laboratory testing, the product component was tested with the destructive test to know the best material properties of this product and the nondestructive test was applied to know the limitation of this product and know the suitable torque for tightening and loosening at the PCD 100 of the car.

By using laboratory test to define the parameter, limitation, and the precision of the component to get the better result about the product. For the process of fabrication, the method was applied to it are cutting, lathe machining, milling machining, welding, bending machine, and painting. This fabrication was done in the FTK Utem laboratory.

CHAPTER 2

LITERATURE REVIEW

2.0 Background

This chapter, brief the information on the simultaneous tyre wrench was presented. Background of automotive, comparison of material properties, method or process of fabricating and data analyzation will be explained.

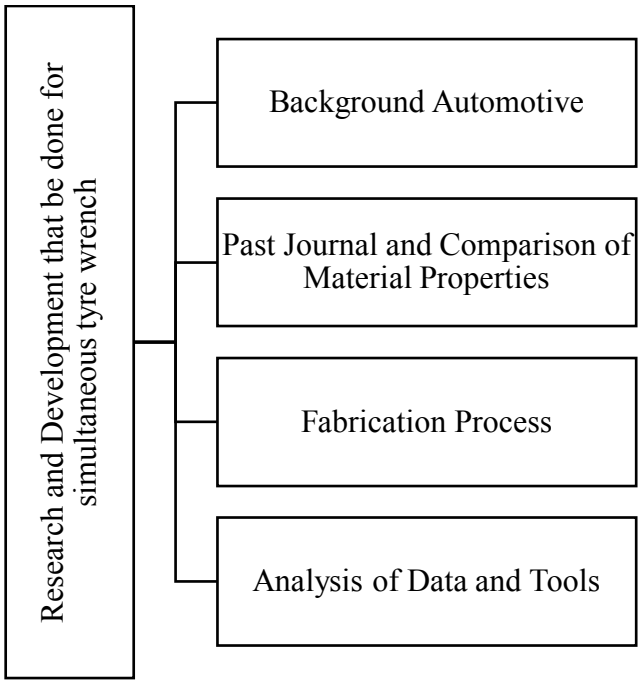

Figure 2.0.1 Flow Chart of Literature Review