IMPROVEMENTS OF WHEEL NUTS REMOVER

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SUPERVISOR'S DECLARATION

"I hereby declare that I have read this thesis and in my opinion this report is sufficient in terms of scope and quality for the 'Final Year Project' as required."

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IMPROVEMENTS OF WHEEL NUTS REMOVER

Nurfarahin binti Sulaiman

This report is submitted in fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering (Design and Innovation)

Faculty of Mechanical Engineering

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DECLARATION

"I hereby declare that the project is based on my original work except for quotations and citations which have been duly acknowledged."

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Date	:	28th of June 2013

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Special for

Beloved Parents

Sulaiman bin Osman

Rasiah binti Baba

Beloved siblings

Relatives and friends

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ABSTRACT

During the globalization era on the 21st century, transportation has become one of the most important needs in human's life. Almost every family has got at least one car to travel from one place to another. With the increased technology and the living standard, number of cars on the road each day has also been increased. This means that the needs and facilities for the repairing of the vehicles are also important. Car maintenance is of the major factor in keeping the life span of the car. Therefore, car manufacturers will equip the wheel nuts removing tools and a car jack for tire replacement in emergency case. The wheel nuts remover is design to help the users during the removal or loosen of the wheel nuts before tire replacement activity. The existing wheel nuts remover has been designed to remove all the four nuts together at a time. But, it is too heavy and the weight has reached up to 9.5 kg which is not convenience for the users to remove to wheel nuts. Therefore, a research has been done on the improvements of the existing wheel nuts remover in terms of the design, material used and also the weight of the wheel nuts remover. During the studies, 100 PCD wheel nuts size has been identified to be the most popular types of wheel nuts used by Malaysian's car. In this research, the wheel nuts remover has been designed by using the commercial CAD software with the 100 PCD wheel nuts size as reference. Life cycle analysis has also been done in this research to quantitatively assess the environmental impact of a product throughout its entire lifecycle.

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ABSTRAK

Dalam era globalisasi pada abad ke-21, pengangkutan telah menjadi salah satu keperluan yang penting dalam kehidupan manusia. Hampir setiap keluarga mempunyai sekurang-kurangnya satu kereta untuk bergerak dari satu tempat ke satu tempat yang lain. Dengan peningkatan teknologi dan taraf hidup, bilangan kereta di jalan raya juga telah meningkat setiap hari. Ini bermakna, keperluan dan kemudahan untuk membaiki kenderaan juga penting. Penyelenggaraan kereta adalah satu faktor utama dalam mengekalkan jangka hayat kereta. Oleh itu, pengeluar kereta akan melengkapkan alat pembuka nat roda dan jack kereta untuk penggantian tayar dalam kes kecemasan. Pembuka nat roda telah direkabentuk untuk membantu pengguna semasa membuka atau melonggarkan nat roda sebelum aktiviti penggantian tayar. Pembuka nat roda yang sedia ada telah direka untuk membuka keempat-empat nut roda pada satu masa yang sama. Walaubagaimanapun, pembuka nut tayar yang sedia ada adalah terlalu berat sehingga mencecah 9.5 kg dan sukar bagi pengguna untuk membuka nut roda. Oleh itu, satu kajian telah dilakukan dalam penambahbaikan pembuka nat roda yang sedia ada dari segi reka bentuk, bahan yang digunakan dan juga berat pembuka nat roda tersebut. Semasa kajian, saiz 100 PCD nat roda telah dikenal pasti sebagai jenis nat roda yang paling banyak digunakan pada kereta-kereta di Malaysia. Dalam kajian ini, pembuka nat roda telah direkabentuk dengan menggunakan perisian CAD komersial dengan berpandukan saiz 100 PCD nat roda sebagai rujukan. Analisis kitaran hidup juga telah dilakukan dalam kajian ini untuk menilai secara kuantitatif tentang kesan produk terhadap alam sekitar sepanjang keseluruhan kitaran hayat produk tersebut.

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TABLE OF CONTENTS

CHAPTER	CONTENTS	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xi
	LIST OF FIGURES	xiii
	LIST OF SYMBOLS	xvi
	LIST OFAPPENDICES	xvii
	LIST OF ABBREVIATION	xviii
CHAPTER 1	**INTRODUCTION**	1
	1.1 Introduction	1
	1.2 Problem Statement	2
	1.3 Objectives	2
	1.4 Scope	2
CHAPTER 2	**LITERATURE REVIEW**	3
	2.1 Introduction	3
	2.2 Wheel Nuts Remover	3
	2.2.1 Socket Wrench	4
	2.2.2 Ratchet	5

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	2.2.3 Cross Wrench, L Socket Wrench, Rim Wrench	7
	2.2.4 Impact Wrench	9
2.3	Wheel Technical Information	10
	2.3.1 Bolt Pattern	10
	2.3.2 Pitch Circle Diameter	12
	2.3.3 Offset	14
	2.3.4 Wheel Backspace	16
	2.3.5 Tyre Size	17
	2.3.6 Centre Bore	18
2.4	Safe Use of Hand Tools	22
2.5	Gear	25
	2.5.1 Helical Gear	26
	2.5.2 Worm Gear	26
	2.5.3 Spur Gear	27
	2.5.4 Bevel Gear	28
2.6	Gears Terminology	29
	2.6.1 Pitch Circle	33
	2.6.2 Pitch Point	33
	2.6.3 Pitch Diameter, DP	34
	2.6.4 Number of Teeth, N	34
	2.6.5 Circular Pitch	34
	2.6.6 Base Circle	34
	2.6.7 Base Diameter	34
	2.6.8 Face Width, F	35
	2.6.9 Addendum, a	35
	2.6.10 Dedendum, b	35
	2.6.11 Whole Depth, ht	35
	2.6.12 Diametral Pitch, Pd	36
	2.6.13 Module, m	36
	2.6.14 Clearance, c	36
	2.6.15 Pressure Angle, Ø	37

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	2.7	Basis of Gear Material	37
	2.8	Gas Metal Arc Welding (MIG)	39
		2.8.1 Usage	40
		2.8.2 Advantages	41
CHAPTER 3	**METHODOLOGY**		42
	3.1	Introduction	42
	3.2	Gantt Chart	42
	3.3	Flow Chart	44
	3.4	House of Quality	45
	3.5	Morphological Chart	51
	3.6	Conceptual Design	52
		3.6.1 Types of Design	53
		3.6.2 Weighted Decision Matrix	56
		3.6.3 CAD Drawings	62
CHAPTER 4	**ANALYSIS**		83
	4.1	Gear Ratio, MG	83
	4.2	Torque,τ	84
		4.2.1 Torque Calculation Method I	86
		4.2.2 Torque Calculation Method II	87
		4.2.3 Torque Calculation Method III	88
		4.2.4 Torque Calculation Method IV	89
		4.2.5 Torque Calculation Method V	90
		4.2.6 Torque Calculation Method VI	91
	4.3	Design Analysis	92
		4.3.1 Driver Gear Analysis on Single Acting Force	94
		4.3.2 Driven Gear Analysis on Single Acting Force	96
		4.3.3 Driver Gear Analysis on Double Acting Force	98
		4.3.4 Sample of Simulation Analysis	100
	4.4	Stresses and Safety Factor	104
		4.4.1 Theoretical Results	106
		4.4.2 Analytical Results	112

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4.5 Post Analysis 117
4.5.1 Manufacturing Region 117
4.5.2 Use Region 117
4.5.3 Air Acidification 118
4.5.4 Carbon Footprint 120
4.5.5 Total Energy Consumed 122
4.5.6 Water Eutrophication 124
CHAPTER 5 DISCUSSION 126
5.1 Introduction 126
5.2 Direction of Gear Rotation 126
5.3 Estimated Cost 127
5.4 Weight 128
5.5 Product Concept 128
5.6 Usage with an Air Gun 129
CHAPTER 6 CONCLUSION AND RECOMMENDATION 130
6.1 Conclusion 130
6.2 Recommendation 131
6.2.1 Cost and Weight Reduction 131
6.2.2 Electric Motor Integration 132
6.2.3 Power Transmission, Types of Gear and Gear Ratio 133
REFERENCES 134
APPENDICES 140

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LIST OF TABLES

NO.	TITLES	PAGE
2.1	Pitch Circle Diameter and the Bolt Arrangements	12
2.2	Offset	14
2.3	Gear Materials Criterion	38
3.1	Gantt Chart	43
3.2	House of Quality	48
3.3	Morphological Chart	51
3.4	Weighted Decision Matrix	58
3.5	Evaluation Scheme for Design Alternatives or Objectives	61
4.1	Torque Reading	85
4.2	Analysis Properties from Driver Gear Analysis on Single Acting Force	94
4.3	Analysis Results from Driver Gear Analysis on Single Acting Force	95
4.4	Analysis Properties from Driven Gear Analysis on Single Acting Force	96
4.5	Analysis Results from Driven Gear Analysis on Single Acting Force	97
4.6	Analysis Properties from Driver Gear Analysis on Double Acting Force	98
4.7	Analysis Results from Driver Gear Analysis on Double Acting Force	99
4.8	Analysis Properties	101

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4.9	Analysis Results	102
4.10	Value of Yield Strength for Each Material	105
4.11	Theoretical Stresses for Different Face Width	107
4.12	Theoretical Safety Factor Based on Normal Stress	109
4.13	Theoretical Safety Factor Based on Shear Stress	111
4.14	Analytical Results Based on the Simulation Analysis	113
4.15	Material Properties for Each Part	114
4.16	Total Mass Reduction for Different Types of Material	116
4.17	Air Acidification Analysis	119
4.18	Carbon Footprint Analysis	121
4.19	Total Energy Consumed Analysis	123
4.20	Water Eutrophication Analysis	125
5.1	The Estimated Cost of Each Component	127

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LIST OF FIGURES

NO.	TITLES	PAGE
2.1	Socket Wrench	4
2.2	Different Sizes of Socket Wrench	5
2.3	Ratchet Mechanism	7
2.4	Cross Wrench	8
2.5	L Socket Wrench	8
2.6	Rim Wrench	9
2.7	Impact Wrench	9
2.8	Wheel Specifications	11
2.9	Bolt Pattern with Four Wheel Nuts	11
2.10	Multi-Lug Socket Tool Pattern	13
2.11	Wheel Backspace	16
2.12	2", 3" and 4" Wheel Backspace	17
2.13	Tyre Identification	18
2.14	Centre Bore Position	19
2.15	Hub Centric	19
2.16	Wheels with Hub Centric and Lug Centric	20
2.17	Hub Centric Ring	20
2.18	Lug Centric	21
2.19	Wheel Nut Head Position According to the Types of Nut	21
2.20	The Center of Gravity of the Vehicle	24
2.21	Helical Gear	26
2.22	Worm Gear	27

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2.23	Spur Gear	28
2.24	Bevel Gear	29
2.25	Basic Terminology of Spur Gears	30
2.26	Terminology Definition for Spur Gears	31
2.27	Gear Tooth Size	32
2.28	Ordinary Gear Train	33
2.29	Gas Metal Arc Welding Installation	39
2.30	Gas metal arc welding	40
3.1	Flow Chart	44
3.2	Kano Diagram	46
3.3	Design 1	53
3.4	Design 2	54
3.5	Design 3	55
3.6	Weighting Factor	57
3.7	Socket Wrench	62
3.8	CAD Drawings of Socket Wrench	63
3.9	Casing	64
3.10	CAD Drawings of Top Casing	65
3.11	CAD Drawings of Bottom Casing	66
3.12	Gliding tube	67
3.13	CAD Drawings of Large Gliding Tube	68
3.14	CAD Drawings of Small Gliding Tube	69
3.15	Shaft of Driver Gear	70
3.16	CAD Drawings for Driver Gear Shaft	71
3.17	Shaft of Driven Gear	72
3.18	CAD Drawings for Driven Gear Shaft	73
3.19	Driver Gear	74
3.20	CAD Drawings of Driver Gear	75
3.21	Driven Gear	76
3.22	CAD Drawings of Driven Gear	77
3.23	Assembly Part of Socket Wrench Extension, Driven Gear Shaft,	

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	Driven Gear and Gliding Tube	78
3.24	Assembly Part of Driver Gear Shaft, Driver Gear and Gliding Tube	79
3.25	Gears Arrangement	80
3.26	Product Assembly from View 1	81
3.27	Product Assembly from View 2	81
3.28	Product Assembly from View 3	82
4.1	Wheel Nuts Torque Readings	84
4.2	Torque Calculation Method I	86
4.3	Torque Calculation Method II	87
4.4	Torque Calculation Method III	88
4.5	Torque Calculation Method IV	89
4.6	Torque Calculation Method V	90
4.7	Torque Calculation Method VI	91
4.8	Direction of Force	93
4.9	Driver Gear	100
4.10	Von Misses Stress	103
6.1	Material Density versus Price	132

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LIST OF SYMBOLS

D_b	=	Base Diameter
D_p	=	Pitch Diameter
h_t	=	Whole Depth
M_G	=	Gear Ratio
P_d	=	Diametral Pitch
$\emptyset$	=	Pressure Angle
a	=	Addendum
b	=	Dedendum
c	=	Clearance
F	=	Face Width
F	=	Force
m	=	Module
N	=	Number of Teeth
P	=	Circular Pitch
τ	=	Torque

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LIST OF APPENDICES

NO.	TITLES	PAGE
A (1)	Simulation Steps by Using SolidWorks 2012	140

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LIST OF ABBREVIATIONS

CAD	=	Computer Aided Design
CAE	=	Computer Aided Engineering
CG	=	Centre of Gravity
CO_2	=	Carbon Dioxide
CTQ CRs	=	Critical To Quality Customer Requirements
DC	=	Direct Current
EP	=	Electrode Positive
FWD	=	Front Wheel Drive
FYP	=	Final Year Project
GWP	=	Global Warming Potential
LCA	=	Life Cycle Assessment
MIG	=	Metal Inert Gas
MJ	=	Mega Joules
N	=	Nitrogen
PCD	=	Pitch Circle Diameter
PED	=	Primary Energy Demand
PO_4	=	Phosphate
RWD	=	Rear Wheel Drive
SO_2	=	Sulphur Dioxide

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Acquiring a car is now considered as one needs, compared to the past where it was considered a luxury. Vehicles are vital in today's fast-paced community. Without these vehicles for transportation, business will never grow, whereas the client demands will scarcely meet. Nowadays, more vehicles are manufactured to satisfy the increasing demand people and businesses from all around world (Corpeducar, 2010).

Every automobile owner occasionally go extra miles which give their automobile maintenance so desperately need. Since cars play a significant role in our life, it is extremely necessary for us to constantly and frequently maintain our cars and keeps them in a proper form that they may implement to our standards (Vishnu, 2012).

Whenever there is any problem happens on the car tyre, the wheel nuts might need to remove before changing the tyre. Virtually every car now has an L-shaped wrench and a car jack supplied by the car manufacturer. But it causes inconvenience to the users because it requires a lot of energy to remove each of the wheel nuts. According to Abd Rahim (2007), great care should be taken not to strip out the lug wrench socket. If the end of the lug wrench bent sleeve is not attached to the proper lug nuts, excessive force can damage the nut or socket.

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For this Final Year Project, the wheel nuts remover is designed with 100 pitch circle diameter (PCD). The device operates with the use of a gear system that will minimize the force needed to remove all the four nuts at a time. In Malaysia, the 100 PCD wheel nuts size is widely used. Therefore, the 100 PCD wheel nuts size is used as a reference for this project.

1.2 Problem Statement

The existing wheel nuts remover is too heavy and it is not convenience to be a portable wheel nuts remover. It is hard to be used because of the heavy weight. It cannot perform well to remove the car wheel nuts and some of the wheel nuts remover cannot remove all the four nuts at a time. Therefore, it is a problem to remove the wheel nuts when the equipment is not convenience to perform work. With all of the problems stated, it is vital to design a wheel nuts remover that only requires a small energy but can remove all the wheel nuts easily and the weight should also be appropriate so that it does not contribute to the difficulty in removing the wheel nuts.

1.3 Objectives

The main objective of this Final Year Project is to improve the existing wheel nuts remover in terms of the weight of the product. Besides, this project is carried out to improve the existing wheel nuts remover in terms of the design and also the material used for this product.

1.4 Scope

The scope of this Final Year Project is to design a 100 PCD wheel nuts remover by using the commercial CAD software. Besides, the scope is to analyse the CAD model by using the CAE software.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this project, the 100 PCD wheel nuts size is used as a reference. A new research and study should be done towards the previous researches regarding this topic, so that improvements can be made toward the wheel nuts remover. Research have been done on the tools needed in removing the wheel nuts, types of wheel nuts, wheels specification, types of gears, basic gears calculation and also the specification of material that is going to be used.

2.2 Wheel Nuts Remover

A wheel nuts remover is used to open and tighten the nuts on a car wheel. Wheel nuts serve to hold the tire on the axle so that the wheel rims are in a tight situation. The rod of a wheel nuts remover must be strong enough so that the consumers can easily tighten and loosen the nuts on the wheel due to the torque produced. Usually, most of the manufacturers will equip the vehicles with the wheel nuts remover as one of the important equipments. There are various types of wheel nuts remover in the market. Examples wheel nut remover available in the market at present are the impact wrench, cross wrench or L and also the socket wrench. Each wrench is used according to the size of the nuts on the wheel.

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2.2.1 Socket Wrench

Socket wrench is a wrench where the heads of the socket can be changed according to the sizing needed that will be used to open different bolts or fasteners. The most common form is known as the ratchet teeth that consist of a built-in unidirectional mechanism. Therefore, it can be turned around with the help of the rear movement and it is also can be used in a limited space. **Figure 2.1** and **Figure 2.2** shows the examples of socket wrench.

Figure 2.1: Socket Wrench (Pioneers, 2012)

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