UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND FABRICATE HAND CRANKED LIFTER FOR CAR ROOF COMPARTMENT

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A thesis submitted
in fulfillment of the requirements for the degree of
Bachelor of Mechanical Engineering Technology (Automotive Technology) with Honours

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DECLARATION

I declare that this project entitled "Design and Fabricate Hand Cranked Lifter for Car Roof Compartment" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

Name : Mohamad Najmi Bin Mohamad Nor

Date : 16/1/2022

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree Of Bachelor Of Mechanical And Manufacturing Engineering Technology (Automotive) with honours. The member of supervisor are as follow.

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Date : 16/1/2022

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DEDICATION

This project and research work is dedicated to all my families for their support and for those who have supported me throughout my education. Not to be forgotten, my project supervisor for his patience, advice and support during this project. And lastly, I am so grateful to ALLAH swt and thank you for the guidance, strength and giving me a healthy life. Also, thank you for giving me inspiration of idea to finish this research.

ABSTRACT

In this era, the advancement in production and management systems has changed the automobile industry very fast. The industry has witnessed the opening up and growth of several emerging markets. The automotive industry is now facing new and pressing challenges. Globalization, digitalization and increasing competition in the market are changing the face of the industry. Due to that, there are many types of cars that have been produced in this present era. Cars type has been classed by car segment. In Asia, the smallest category of car registered as regular cars is known as A-segment. The B-segment is the next larger category of small car. The largest category of small cars is called C-segment or small family car. Most popular car type in Malaysia is MPV or multi-purpose vehicle. This car type become popular because of the variety of seat combinations in the segment, it is the most flexible class among the others. There are MPVs that seat five people and others that accommodate eight people. However, most cars usually have seven seats. Next poular car type in Malaysia is SUV or Sport Utility Vehicles. This car type become popular because SUV offers better cargo capacity. The other reason why people choose SUV is because they want the off-roading capabilities to drive through untamed, unpaved terrain, and wild. The similarities for these two types of cars are they are usually equipped with a roof rack on their roof. Roof rack is an extra cargo storage for SUV and MPV type car. Because of the height of this type of car is taller than others car type, it makes it a little difficult for people to load and unloading their goods on the car roof rack. They need more energy or need more than one person to load and unloading the item on the roof rack. The purpose of this research to design and fabricate a hand cranked lifter to make it easier for people to load and unloading their goods on the car roof rack.

ABSTRAK

Di era ini, kemajuan dalam sistem produksi dan pengurusan telah merevolusikan industri automotif. Industri produksi di Malaysia telah menyaksikan. Industri kita telah menyaksikan pembukaan dan pertumbuhan beberapa pasaran baru. Industri automotif kini menghadapi cabaran baru dan lebih mencabar. Globalisasi, digitalisasi dan peningkatan persaingan di pasaran mengubah perjalanan industri. Oleh kerana itu, terdapat banyak jenis kereta yang telah dihasilkan pada zaman sekarang. Jenis kereta telah dibezakan mengikut segmen kereta. Di Asia, kategori kereta terkecil yang didaftarkan sebagai kereta biasa dikenali sebagai segmen A. Segmen B adalah kategori kereta kecil seterusnya yang lebih besar. Kategori kereta kecil terbesar dipanggil segmen C atau kereta keluarga kecil. Jenis kereta yang paling popular di Malaysia ialah kenderaan MPV atau kenderaan pelbagai guna. Jenis kereta ini menjadi popular kerana pelbagai kombinasi tempat duduk di segmen ini, ia adalah kelas yang paling fleksibel antara lain. Terdapat MPV yang boleh memuatkan lima orang dan juga ada yang boleh memuatkan lapan orang. Walau bagaimanapun, kebanyakan kereta MPV biasanya mempunyai tujuh tempat duduk. Jenis kereta poular seterusnya di Malaysia ialah SUV atau Sport Utility Vehicles. Jenis kereta ini menjadi popular kerana SUV menawarkan kapasiti kargo yang lebih baik. Sebab lain mengapa orang memilih SUV adalah kerana mereka mahukan keupayaan untuk melalui kawasan yang tidak berturap, dan liar. Kesamaan bagi kedua-dua jenis kereta ini ialah biasanya dilengkapi dengan rak atap di bumbung mereka. Rak atap adalah simpanan kargo tambahan untuk kereta jenis SUV dan MPV. Kerana ketinggian jenis kereta ini lebih tinggi daripada jenis kereta lain, ini menyukarkan seseorang untuk memuat dan memunggah barang mereka di rak atap kereta. Mereka memerlukan lebih banyak tenaga atau memerlukan lebih daripada satu orang untuk memuat dan memunggah barang di rak bumbung. Tujuan penyelidikan ini untuk merancang dan membuat alat pengangkat untuk memudahkan orang memuat dan memunggah barang mereka di rak atap kereta.

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LIST OF SYMBOLS AND ABBREVIATIONS

Φ	-	Pressure Angle
A	-	Addendum
aG	-	Addendum of Gear
aP	-	Addendum of Pinion
b	-	Dedendum
c	-	Clearance
C	-	Center Distance
D	-	Pitch Diameter
DG	-	Pitch Diameter of Gear
DP	-	Pitch Diameter of Pinion
DB	-	Base Circle Diameter
DO	-	Outside Diameter
DR	-	Root Diameter
F	-	Face Width
Hk	-	Working Depth of Tooth
Ht	-	Whole Depth of Tooth
mG	-	Gear Ratio
N	-	Number of Teeth
NG	-	Number of Teeth in Gear
NP	-	Number of Teeth in Pinion
p	-	Circular Pitch
P	-	Diametral Pitch

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CHAPTER 1

INTRODUCTION

1.1 Background

The automotive industry has been involved in the production of automobiles, including their components technology, such as engines and electronic component, but omitting tires, batteries, and fuel. Passenger cars and light trucks, such as pickups, vans, and sport utility vehicles, are the mainstays of the sector. Commercial vehicles (such as delivery trucks and huge transport trucks, commonly referred to as semis) are secondary in importance to the sector. The articles automobile, truck, bus, and motorcycle explore the design of modern automobiles, while gasoline engine and diesel engine describe automotive engines. The automobile was invented in Europe in the late 1800s.

The automotive industry in Malaysia began during the British colonial period. With its inception in Singapore in 1926, Ford Malaya became Southeast Asia's first automobile assembly facility. Malaysia's post-independence automotive sector was founded in 1967 to promote national industrialization.

Proton Holdings Berhad was the first Malaysian automotive manufacturer (PROTON). PROTON was founded in 1983, providing the groundwork for the automotive industry's national pride. 1985 was a watershed point in Malaysian history. The Proton Saga, the country's first national car, was released to the public. For most countries, this is an elusive dream, but PROTON made it a reality for Malaysia.

Malaysia's second national vehicle company, Perusahaan Otomobil Kedua Sendirian Berhad (PERODUA), was founded in 1992. In August 1994, PERODUA released their first car, the Perodua Kancil. Perodua initially focused on producing minicars segment A car, with no models competing with Proton in the same market sectors. However, in recent years, its target market sectors have begun to pass with Proton's market, particularly in the super small segment (A segment and B segment), where the Perodua Myvi has defeated the Proton Savvy and currently competes against the Proton Iriz.

There are numerous automotive companies in Malaysia nowadays, including Toyota, Honda, Mitsubishi, Suzuki, Volvo, Peugeot, BMW, Mercedes, and others. From a sector to a luxury segment, this corporation provides a wide range of automotive models. In Malaysia, the MPV class is the most popular. This is due to the fact that MPVs sacrifice style for functionality. Many MPV manufacturers construct automobiles with spacious, flexible cabins rather than sleek lines and aerodynamic curves. These cabins are frequently described as large boxes with sharp corners. This is exactly what MPV owners, many of whom are outdoor enthusiasts, are searching for. The bare-bones home is impenetrable to filthy camping gear. Aside from that, the boxy cabins offer for more functional seating and better flexibility. Most MPVs comfortably accommodate five or more people. It's also possible that where and how those passengers seat in the car will change. Many variants allow drivers to remove seats to make room for additional luggage, as well as slide from one side of the car to the other.

Malaysians prefer SUV cars since the country offers a diverse range of road conditions. Another reason Malaysians adore this class is that it offers Off-Roading capability. People who live near the forest love to buy this car segment since Malaysia has tropical rainforest habitats.

1.2 Problem statement

The MPV and SUV automobile segments are the two most popular car segments among Malaysians. Typically, cars in this sector come with a roof rack mounted on the car's roof. A roof rack is a set of bars that are attached to the roof of a vehicle. It's used to transport large objects like bags, bicycles, canoes, kayaks, skis, and other carriers and containers. This car segment has a higher height than other car segments, ranging from 1.8m to 2m.

Because of its height, this item makes loading and unloading items from a car roof rack difficult. Loading and unloading items requires two or more people. They must exert additional force in order to raise the item and load it onto the roof rack.

Muscle strains or ligament sprains in the lower back can result from this condition. When weak muscles are overstretched or damaged, a muscular strain results. Both strains and sprains, despite appearing to be minor injuries, can result in severe lower back pain.

1.3 Project objectives

The goal of this project is to design and build a hand-cranked lifter for the roof compartment of MPVs and SUVs. This can lessen the amount of energy and force required to load or unload items from a car roof rack. The following are the precise goals:

a) To design a hand cranked lifter

b) To fabricate and innovate a hand cranked lifter using kinetic energy.

c) To reduce the conservation of human force and energy to lift goods.

1.4 Scope of project

The scope of this research are as follows:

a) To invent a lifter by using gear and pulley concepts using CATIA V5 software.

b) The factors that affect the rotational kinetic energy generated of the lifter.

c) The type of material and component use to produce a durable hand cranked lifter.

CHAPTER 2

LITERATURE REVIEW

2.1 Background

This chapter review cranked lifter mechanism and types of material used. CATIA and Altair Hyperworks are used for design and simulation of the product. This chapter also briefs the description of type of car segment, material strength, product design specification (PDS) and types of back pain. These days, car is one of the most essential needed for every individual contrast with public transport. Now days, most car has roof rack on the top of the car roof especially SUV and MPV car segment.

Cars with roof rack has been a popular concept since 1950s and 1960s. 1950s to1960s isthe era of smallpickup truck. It was fairly simple to attach rack-type devices securely with the brace and support of the rain gutters in place. Commonly SUV and MPV car segment has this roof rack installed by the manufactured. This make a car with a roof rack have an extra storage space to carry more large items such as big luggage, big tent, kayaks and large container. The disadvantages of this features is a user has to lift an item higher to store it on the roof rack than the car boot which is less high. When we lift item higher than our height, this will make the muscles in your back will be strained beyond what they can handle. This could lead to a back pain problem.

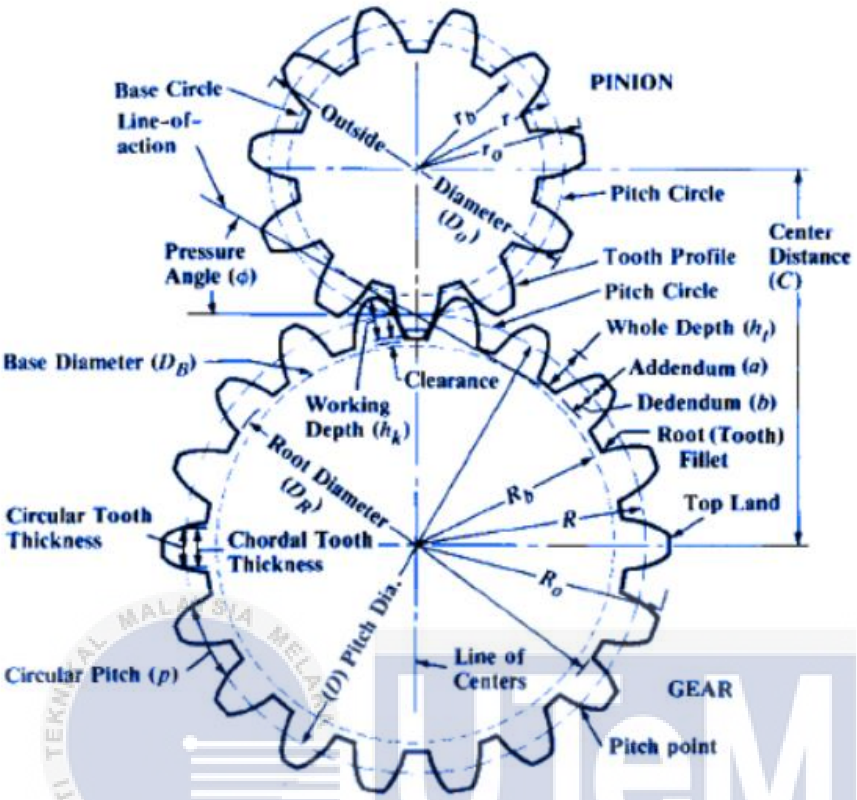
2.2 Hand Crank Winches

Winches have been utilised for millennia in a variety of applications, ranging from building construction to transporting military vehicles. Many of the original winches had to be operated by hand, and we now have a wide range of advanced winch technology, including electric and hydraulic winches. Hand crank winch has been invented for the first time during the Ancient Persian Empire.

It is a mechanical device that is used to lift and move large and heavy items. It winds wire rope around a drum (or a spool) and holds it firm until it has to be changed. This type of winch is operated by turning the ratcheting crank/lever to lift or pull a load. Hand crank winches are available in a variety of sizes and can pull weights ranging from 180kg to 1800kg.

Figure 2.1 Hand cranked winch

2.2.1 Gear Equation



Where:

φ = Pressure Angle

a = Addendum

aG = Addendum of Gear

aP = Addendum of Pinion

b = Dedendum

c = Clearance

C = Center Distance

D = Pitch Diameter

DG = Pitch Diameter of Gear

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DB = Base Circle Diameter

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F = Face Width