UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN OPTIMISATION OF CAR JACK SYSTEM FOR AN EMERGENCY USAGE USING PDS

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

by

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ABSTRAK

Kajian ini adalah untuk membincangkan pembangunan jack kereta untuk kegunaan semasa kecemasan. Objektif kajian ini adalah untuk mengenal pasti ciri-ciri sistem jack kereta yang mempunyai faktor ergonomik yang baik. Selain itu, untuk mengoptimumkan reka bentuk sistem kereta jack untuk kegunaan kecemasan menggunakan pds. Dengan menggunakan perisian catia untuk membuat lakaran dan untuk analisa dan pengoptimalan menggunakan perisian solidthinking. Reka bentuk itu kemudian direka menggunakan bahan-bahan terpilih yang ada. Proses seperti keratan, kimpalan dan menggerudi dilakukan dalam proses fabrikasi. Model akan dibina dan proses fabrikasi dijalankan di akhir dengan reka bentuk yang terbaik.

ABSTRACT

This study is to discuss the development of car jack for emergency use. The objective of this study is to identify the characteristics of car jack system which has the good ergonomic factor. Besides, to optimize the design of car jack system for an emergency usage using PDS. Using CATIA software to create sketches and for analysis and optimization using the SolidThinking software. The design is then designed using the selected materials available. Processes such as section, welding, and drilling are done in the fabrication process. The model will be constructed, and the fabrication process will run at the end of the best design.

DEDICATION

Special dedication to my beloved father and mother, my brother and sister and to all my friends

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INTRODUCTION

1.1 Background of Study

Most family cars today are equipped with spare tire in the boot. It can be used in case of emergency, such as if the tire is in low pressure or with a flat tire. Either man or woman with basic knowledge on changing tire still can perform the process. The problem occurs in the tire changing process is how much a space between tire and road surface that suitable for tires removed from its place. To get the free space between the tire and the ground, the vehicle should be lifted by using lifting equipment or lifting system. It will make it easier for the tire to be removed from the wheel hub.

Each vehicle that exist in the world especially family vehicle, have been supplies with a set of car jacks to be use on an emergency if the problem goes wrong. Car jack is a mechanical device used to lift the car. With the car jack, the vehicle user does not need to wait long for help to arrive. In addition, the process of using the car jack is very easy and can save time for us to reach a destination that we want to go.

Normally, we can see that the car is stranded roadside vehicle suffered a tire puncture or leak. However, the driver just sat in the car waiting for help to arrive. The possibility that the driver does not know how to use the lifter jack to change the tire. Majority gender in these circumstances is from women above reason. There are also of men who do not know how to use this tool lifter jack, but usually the elderly or disabled. Although the existing car jack in the boot of our car it is easy to use, but it is still difficult for most people and requires little time to spare to lift the vehicle

Technology is increasingly developing and becoming more sophisticated. Technology will always try and keep trying to reduce human labour and indirectly all kinds of human labour will be assist by technology. Car jack lifter is not immune to

contact with trace technology is constantly developing. The market now, there are many different types of car jack, how it works and more technology that has changed the car lifter jack to become a better product.

Which type of car jack of choice for automotive vehicle manufacturers put on every boot of the vehicle is a type of scissor jack. Among the factors to be preferred, it is low cost, small size, lightweight and does not use any power source. There is also the type of jack of choice for luxury cars generated by the electric power, hydraulic and much better then scissor jack. The size and strength of a car jack depending on the type of vehicle as well, so it is suitable for use in future emergencies.

In the last 5 years, maybe we will use a car jack found in car boot once. This is because the tire for leaks and punctures rare to happen. However, the car jack is very useful if it is need in an emergency. The scissor jack has different size and weight but the shape and the way it works is the same depending on the size of the vehicle. For vehicles of segments a, b and c usually has a scissor jack the same in size and weight. However, for vehicle pickup or 4x4 size scissor jack to two times the size and twice as heavy. It has created to be that way because it needs to function smoothly to lift vehicle that weighs nearly two tons or more.

A scissor jack has four main pieces of metal and two base ends. The four-metal piece have all connected at the corners with a bolt that allows the corners to swivel. A screw thread runs across this assembly and through the corners. As the screw thread is turned, the jack arms travel across it and collapse or come together, forming a straight line when closed. Then, moving back the other way, they raise and come together. When opened, the four-metal arms contract together, coming together at the middle, raising the jack. When closed, the arms spread back apart, and the jack closes or flattens out again.

1.2 Problem Statement

The existing car jack in the market is difficult to handle for the elderly and female due to the weight and size. In addition, to handle the car jack, users need to lower the body to reach to the jack. This means, to operate the jack which is not ergonomic to human body, it will give physical problems in course of time. Furthermore, available car jack has a screw thread. When that user rotates the screw thread, the jack can lift a vehicle that is several thousand kilograms.

The problem is if the screw thread, users will hard to rotate and need more force to overcome friction at the screw thread and load of the vehicle. The purpose of this project is to overcome all the problems faced with the existing car jack. Using the mechanism of the Formula 1 jack, the new design of car jack will be developed. Users need give a less energy without do a lot of movement for a long period to lift the vehicle.

1.3 Objective

i. To identify the characteristics of car jack system which not use any power source to operate for an emergency usage.
ii. To optimize design of car jack system using PDS.
iii. To fabricate the prototype of car jack model based on the selected design.

1.4 Scope

The project is about the designing, analysis and fabricating the car jack. The type of car jack system is fully mechanism, no external power supply used for this system. Users need do a simple movement to lift the vehicle. To develop a new concept of the car jack, some research will be done specially to identify, optimize and do some material testing to make sure it can function properly.

The scope of this project is lifting capacity for this car jack only 300-kilogram minimum. The car jack was designing to be use for cars that weight 1300kg and below.

Focus to car at segment a and segment b. The design of this car jack is need a car that have a small or medium luggage room to store it.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

The literature review is a summary of the scientific papers, including current or past knowledge, and comprise of theory and methodology for a topic. Literature review is a secondary source. Most often associated with academic-oriented literature, a literature review is found in academic journals, and is not to be confused with the review books can also appear in the same publication. Review literature is the basis for research in almost every academic area. With a literature review, we can find and make an assessment related to the topic or find a solution to a problem. Graduate and post-graduate students often do research literature to be use as part of the work in creating a final year project or thesis.

2.1 Overview of Car Jack System

Car jack system is a system used to lift vehicles especially cars. It will have used a mechanical device to lift heavy loads or to apply great force. The purpose of lifting the car is allowing the work to change a tire or do some maintenance and repairing.

2.2 Types of Car Jack System

There are two type of car jack system, using external power and fully mechanism.

2.2.1 External Power/Power Assist

2.2.1.1 Overview

In chapter 2.2.1, it will explain and list some examples of the car jack that were using external power as a power source for the system to function.

2.2.1.2 Post Lift

Post lift are design to lift the vehicle to easy for mechanics to make inspection, repair or change the tire. There is any type of post lift. Which is 1-post lift, 2-post lift, and 4-apost lift. They are similar in terms of design and it function. However, the difference is the numbers on each name. These numbers indicate the number of columns or pillars.

Figure 2.2.1.2(1): 1-Post Lift

Figure 2.2.1.2(2): 2-Post Lift

Figure 2.2.1.2(3): 4-Post Lift

Nevertheless, more popularly used in every car workshop is type 2-post lift. Post lift jack operated using hydraulic fluid as a medium for power transfer. When a button on are pressed, the hydraulic power unit will deliver a pressurized fluid to the hydraulic cylinder contained in each column. Hydraulic cylinder will push up the carriage assembly, which is connect with four adjustable

arms. The pressure of the hydraulic fluid is regulating by the factory preset pump valve.

Among the advantages of using this machine can lift the weight of the car up to 4000kg. We already know the hydraulic power capable of providing high power. Therefore, it can lift the weight of the car is great. Besides, the advantage of using this engine it can lift the four wheels of the car, which means it can lift the whole car. Therefore, we do not need to change the position of the car in the garage when repairs in progress.

Furthermore, we do not have to lie on the floor to get under the car if we want to make a check something on the bottom. This machine is also suitable for large conditioned service, such as pull down the gearbox or pull down the overall engine. Obvious advantages of this machine can see where it can lift the vehicle up to 1.8 meters high, and this advantage is not available on any other type of car jack. With these advantages, this machine gives plenty of space to mechanics, so they are easy to move when making inspections on each side of the vehicle.

However, there is also a disadvantage on the post lift machine. The first is very expensive by its type of material used and it requires technology and engineering expertise to build this machine. In addition, the size is quite large compared to another hydraulic powered jack. For small and medium-sized the workshop so hard to put into it because it requires a large clearance space in the workshop because this machine moves down and up. After all, this machine operates using electric power to move the hydraulic motor, if the electricity supply disconnected or blackout, then this machine cannot be use.

However, not all situations we have to use this machine to change the tire. This machine is suitable for use by mechanics who has his own workshop. It is not suitable for use in an emergency, while driving the highway, it is impossible to keep the machines in the car boot for use in future emergencies. Caused by this machine is installed

and bolted down on the floor, it cannot go everywhere to raise the car if you want to change. It always is in place it is install. As a safety precaution, this machine can only be used by adults and very dangerous if incorrectly used.

2.2.1.3 Electric Car Scissor Jack

Electric car jack is the one product that innovate from the scissors jack which is the scissors jack only using human power for it to operate, while the electric car jack which is added to an electric motor in place of a human hand to rotate the drive screw so that Jack can rise above or down. Electric car jack can plug into car's 12V DC power outlet which is most cars in this world has a 12v socket has a 12v socket. We can control the car jack up or down using a switch that has been provide.

Figure 2.2.1.3: Electric Car Jack

Electric car jack advantage is that it is a convenient tool that added external power to operate it, meaning they are relatively