

DEVELOPMENT OF CAR TIRE RACK

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ABSTRACT

This project is about designing and fabricating the car tire rack to help people store tire, transporting load or items more efficiently. This project involves the process of designing the car tire rack by considering the shape and also the ergonomic factor for people to use. After the design has completed, it was transformed to its real product where the design is used for guideline. The material of this design is easy to gain it, because it only using rectangular hollow steel and round steel. The process involves in this project is using welding process, using screws and nuts or threaded fasteners, grinding, drilling and the others process. This project also to make sure the product is safety for the user indeed of publishing. This project is mainly about generating a new concept of car tire rack that would make to store tire, transferring and transporting load or items become easier and more efficient.

ABSTRAK

Projek ini ialah mengenai merekabentuk dan mencipta rak tayar kereta yang berfungsi untuk membantu manusia menyimpan tayar, membawa beban atau sesuatu barang dengan lebih cekap. Objektif utama merekabentuk rak tayar kereta ini adalah sesuai dengan mengaplikasikannya pada kimpal rak tayar kereta di Makmal Fakulti Kejuruteraan Mekanikal. Projek ini melibatkan proses mereka bentuk rak tayar kereta dengan mengambil kira bentuk, fungsi, kemudah-alihan, dan juga faktor kesenangan ia digunakan. Bahan untuk membuat produk ini senang didapati kerana menggunakan besi berongga segiempat-tepat dan besi bulat. Proses yang terlibat dalam projek ini ialah proses kimpalan, penyambungan menggunakan skru dan nut atau kaedah pengikat, proses mengasah, mengerudi dan proses-proses yang lain. Projek ini juga memastikan keselamatan pengguna dipenuhi sebetulnya. Keutamaan projek ini ialah menghasilkan konsep baru mengenai rak tayar kereta yang akan membentuk untuk menyimpan tayar, memindahkan dan mengangkut berat atau sesuatu barang dengan lebih cekap.

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CHAPTER 1

INTRODUCTION

1.1 Project Synopsis

1.1.1 General Project Synopsis

The project involves development of car tire rack. This would be entirely different from existing car tire rack. Basically the entire car tire rack could be divided into 3 stages, which are concept review and development, designing and fabrication.

The car tire rack is equipped by using all necessary items and method for instance sheet metal, round bar steel, rectangular hollow steel, round hollow steel, board, skills in manufacturing process by perform arc welding to joint the parts and etc. The advantages of the proposed car tire rack is to store tires of varying sizes in tire warehouses, distribution centers, and retail stores and tire shop applications. This rack is user friendly trolley to be developed can be seen in its flexibility to be moved such that, man are offered to make their task easier since the trolley will facilitate them to transfer items for instance, computer and etc.

The process of development is initiated from designing the shape of the car tire rack by considering the function as well. In order to produce user friendly trolley product that is suitable to the consumer, consideration to the ergonomic factor is taken into account. It involves the measurement process before the materials are cut into pieces before joined together.

1.1.2 Specific Project Synopsis

The project involves small analysis of the car tire rack chassis or frame body and develops of car tire rack itself with concerns regarding strength, durability, ergonomic factor, dynamic resistance and convenience. New concept of car tire rack is required to improve its durability and functions. Test need to be done to verify the strength of the rack right before the fabrication process to avoid material and fund wasting. The projects prerequisites are Static, Dynamic and Strength of Material. Overall, the project will meet acquire skills of design, analysis, and fabrication.

1.2 Problem Statement

The concept of the car tire rack is to facilitate man to store tires. This rack will primarily help staff especially members of Faculty of Mechanical Engineering to store and move the tire, load and unload heavy items that's need trolley for convenience. Members are facing problem while the need to bring things from one place to another due to unavailability of trolley and can save the space area to other thing. Thus, with the development of this rack, it is hope that it can contribute to give them ideas how to overcome problem store tire and in loading items by choose the better way in facilitate their routine at University Malaysia Pahang especially for Faculty of Mechanical Engineering staff.

1.3 Project Objective

The objective of this project are:

- To design and fabricate car tire rack that is suite to its application especially to store car tire.

1.4 Project Scope

The specific scopes of this project are to design and fabricate car tire rack. The purpose of this rack is to store car tire and the maximum number of tire to be fit in the rack is 4 units. The rack is portable to use and also can keep screws and nuts. Besides that, the car tire rack is easy to use and user friendly trolley.

1.5 Planning Project

According to the Gantt chart from Table 1, the project briefing started followed by collecting literature review. These include a research a project title and gathering a raw data via internet, book and other source. The planning process is from week 1 until a week 4.

After that, this project was continued with design and measurement process at a week 3 and 4. This started with sketching 5 types of Car Tire Rack and then identifies the best product from analysis. Next, design the multi-function table that was chosen using solidwork software with actual dimension.

Then the material that will use must be suitable and ease to get. The specification when choosing a material includes strength, durability and light. This is an important for fabrication process.

The fabrication was started after finish a cutting material. This process is consists fabrication to part that has been designed by follow the dimension using various type of manufacturing process. The manufacturing process is determined from a literature review.

Evaluation stage has been implemented after fabrication stage. The evaluation is by considering the strength, durability, safety, and workability of the table. During the evaluation, if problem occur such as malfunction, modification will be done.

Next task is the final report writing and final presentation preparation. The report is guided by Universiti Malaysia Pahang Thesis writing guided and also the guidance from my supervisor.. All the task is scheduled to take about fourteen weeks overall.

Table 1: Project schedule

Project Activities	Weeks														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Literature Review	■	■	■	■	■	■									
Design & Measurement consideration			■	■											
Acquisition & Material preparation				■	■										
Methodology study					■	■									
Fabrication						■	■	■	■	■	■				
Evaluation & Improvement									■	■	■	■			
Report writing							■	■	■	■	■	■	■		
Presentation									■					■	
Meeting with supervisor	■		■		■		■	■	■		■		■	■	

CHAPTER 2

LITERATUR REVIEW

2.1 Introduction

Racks are commonly constructed from aluminum, steel, or some combination of the two. Components may consist of tubing, extrusions, or castings. They may be welded, riveted, or bolted together [1].

The car tire rack or sometimes use as a trolley is usually known as a large metal basket or frame on wheels that used for transporting heavy or unwieldy items such as purchases in a workshop or tire warehouse [2].

Tire rack is heavy-duty steel selective storage racking that is specially designed to store tires of varying sizes in tire warehouses, distribution centers, and retail stores and tire shop applications. In many cases new car tire rack and used tire racks are priced more economically and require less installation time than wood racks. Selective racking made of roll formed steel is a boltless storage rack that has beam levels that are fully adjustable with footplates that allow you to anchor to the floor. Selective tire racks offer greater selectivity and last many years longer than wood or lighter duty rivet shelving tire rack systems [3].

2.2 Types of Car Tire Rack

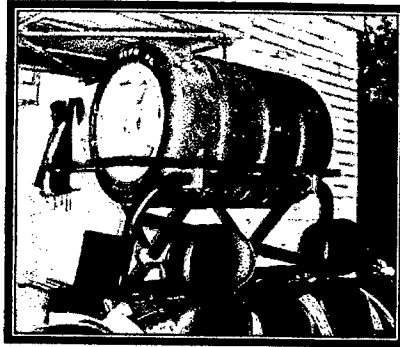


Figure 2.1: Car tire rack at the vehicle

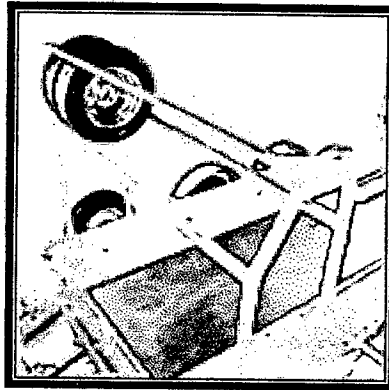


Figure 2.2: Car tire rack at the lorry

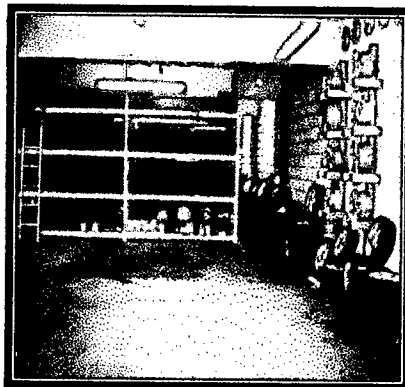


Figure 2.3: Car tire rack at the workshop

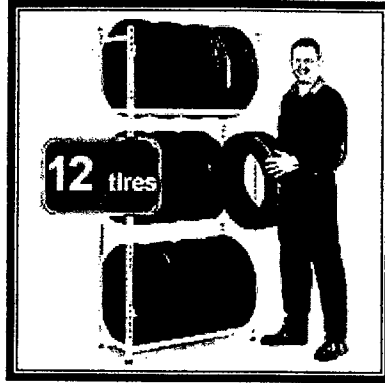


Figure 2.4: Car tire rack at the tire shop accessories



Figure 2.5: Car tire rack at the tire shop



Figure 2.6: Car tire rack at the warehouse

2.3 Functions

The functions of all car tire rack are to facilitate man to store tires. Besides that, this rack can use as a trolley to bring things from one place to another place. Many types of car tire rack sell in market now and their functions are the same for all types of car tire rack. Thus, with the development of this rack, it is hope that it can contribute to give them ideas how to overcome problem store tire and in loading items by choose the better way in facilitate

2.4 Joining Method

The joining method that used is the permanent joint that is welding joint. The welding machine that is used is from MIG or Metal Inert Gas Welding type. The method joining will be use to joint the washer and nut to assemble at the hollow rod bar.

2.5 Basic Theory of Metal Inert Gas(MIG) Welding

This car tire rack will be joined by using the permanent joint which is welding process. The method joining that be able to fabricate and assembled the frame is Metal Inert Gas (MIG) Welding [4].

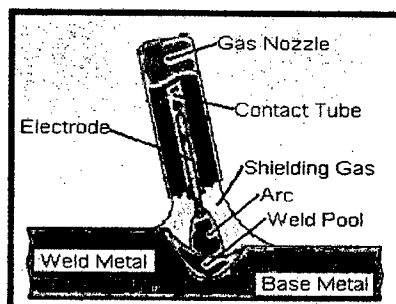


Figure 2.7: Basic structure of metal inert gas (MIG) welding.

Metal Inert Gas (MIG) Welding: An arc is struck between a consumable electrode and the sheet metal to be welded. The consumable electrode is in the form of continuous filler metal. An inert gas surrounds the arc and shields it from the ambient to prevent oxidation. Carbon steels, low alloy steels, stainless steels, most aluminum alloys, zinc based copper alloys can be welded using this process [4].

Gas Metal Arc Welding (GMAW) is frequently referred to as MIG welding. MIG welding is a commonly used high deposition rate welding process. Wire is continuously fed from a spool. MIG welding is therefore referred to as a semiautomatic welding process. The shielding gas, forms the arc plasma, stabilizes the arc on the metal being welded, shields the arc and molten weld pool, and allows smooth transfer of metal from the weld wire to the molten weld pool. There are three primary metal transfer modes which are spray transfer, globular transfer and short circuiting transfer [4].

2.6 Welding Gun and Wire Feed Unit

The Figure 2.8 shows the basic structure on the nozzle of the MIG welding.

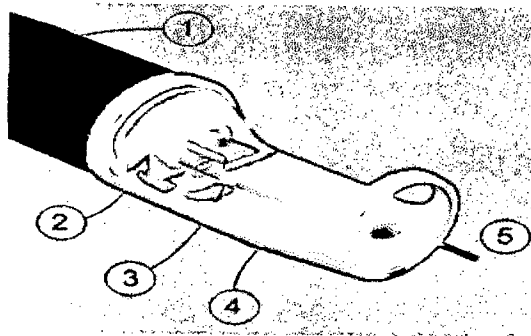


Figure 2.8: GMAW torch nozzle cutaway image. (1) Torch handle, (2) Molded phenolic dielectric (shown in white) and threaded metal nut insert (yellow), (3) Shielding gas nozzle, (4) Contact tip (5) Nozzle output fac.

2.7 Method joining of Mechanical Fastening

Two or more components may have to be joined or fastened in such a way that they can be taken apart sometime during the products service life or life cycle. Numerous products (including mechanical pencils, watches, computers, appliances, engines, and bicycle) have components that are fastened mechanically. Mechanical fastening may be preferred over other methods for the following reasons: ease of manufacturing, ease of assembly and transportation, ease of disassembly, maintenance, parts replacement, or repair, ease in creating designs that require moveable joints, such as hinges, sliding mechanism, and adjustable components and fixtures and lastly lower overall costs of manufacturing the product.

The most common method of mechanical fastening is by the use of bolts, nuts, screws, pins and a variety of other fasteners. These operations are known also as mechanical assembly. Mechanical fastening generally requires that the components have holes through which the fasteners are inserted. These joints may be subjected to both shear and tensile stresses and should be designed to resist these forces.

2.7.1 Threaded Fasteners

Bolts screw and nuts are among the most commonly used threaded fasteners. Numerous standards and specifications (including thread dimensions, dimensional tolerances, pitch, strength and the quality of the materials used to make these fasteners) are described. Bolts and screw may be secured with nuts, or they may be self-tapping-where by the screw either cuts or forms the thread into the part to be fastened. The self tapping method is particularly effective and economical in plastics products where fastening does not require a tapped hole or a nut.

If the joint is to be subjected to vibration (such as an aircraft, engines, and machinery) several especially designed nuts and lock washers are available. They increase the frictional resistance in the torsional direction and so inhibit any vibrational of the fasteners.

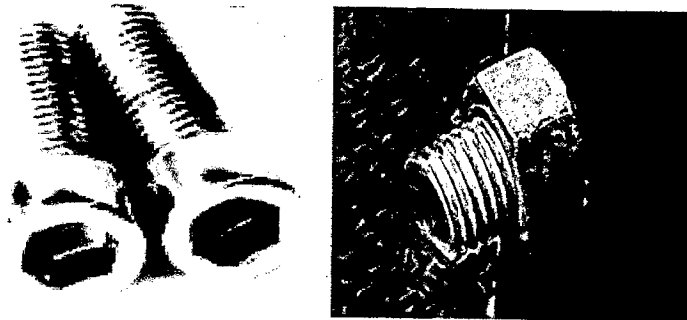


Figure 2.9: Screws and nuts

2.7.2 Hole Preparation

An important aspect of mechanical fastening is hole preparation. A hole in a solid body can be produced by several processes, such as punching, drilling chemical and electrical means, and high-energy beams. The selection of these depends on type of material, its properties and its thickness. For improved accuracy and surface finish, many of this hole-making operation may be followed by finishing operations, such as shaving, deburring, reaming, and honing. Because of the fundamental differences in their characteristics, each of the hole-making operations produces holes with different surfaces finishes, and surfaces properties.

The most significant influence of a hole in a solid body is its tendency to reduce the components fatigue life by stress concentration. For holes, fatigue life can be improved best by inducing compressive residual stresses on the cylindrical surface of the hole. These stresses usually are developed by pushing a round rod (drift pin) through the hole and expanding it by a very small amount.

2.7.3 Drilling Machines

Drilling machines are used for drilling holes, tapping, reaming, and small diameter boring operations. The most common machine is drill press, the major components of which are shown in Figure 2.10. The workpiece is placed on an adjustable table, either by clamping it directly into the slots and holes on the table or by using a vise, which in turn is clamped to the table. The drill is lowered manually by a hand wheel power or by power feed at preset rates. Manual feeding requires some skill in judging the appropriate feed rate.



Figure 2.10: Drilling Machine

Drills pressed usually are designed by the largest workpiece diameter that can be accommodated on the table and typically range from 150 to 1250 mm. In order to maintain proper cutting speeds at the cutting edges of drills, the spindle speed on drilling machines has to be adjustable to accommodate different drill sizes. Adjustments are made by means of pulleys, gear boxes or variable-speed motors.

The types of drilling machines range from simple bench-type drills used to drill small diameter-holes to large radial drills (Figure 2.11), which can accommodate different large workpieces. The distance between the column and the spindle center can be as much as 3 m. The drill head of universal drilling machines include numerically controlled three-axis machines, in which the operations are performed automatically and in the desired sequences with the use of turret punch.

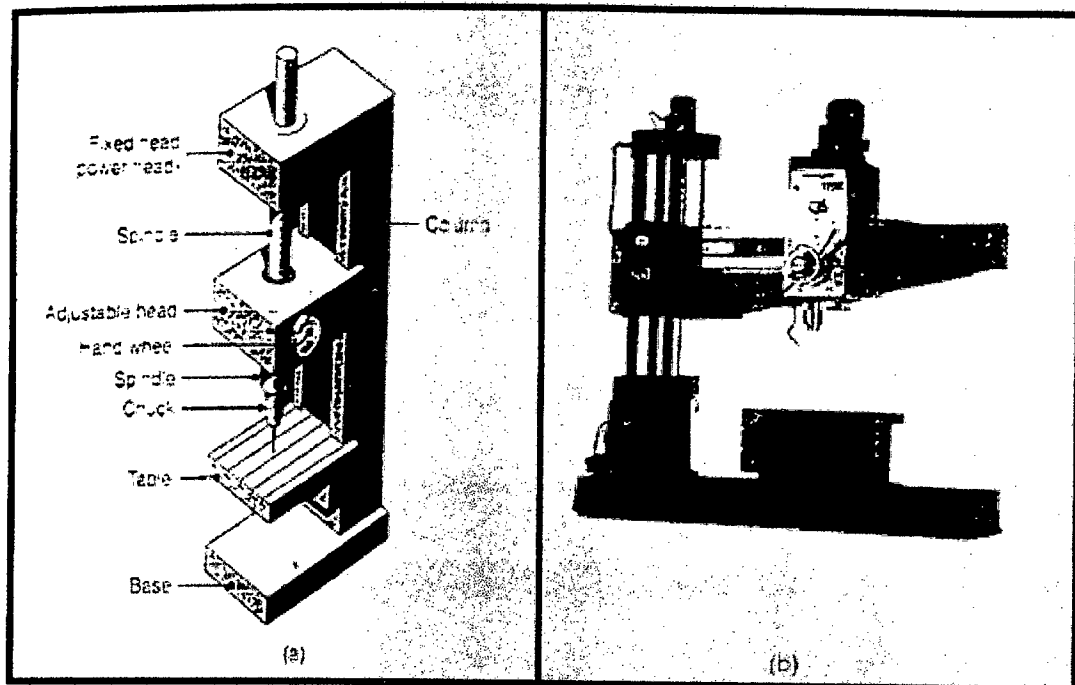


Figure 2.11: (a) Schematic illustration of the components of a vertical drill press machine. (b) A radial drilling machine.

CHAPTER 3

METHODOLOGY

3.1 Project Flow Chart

For the diagram shown in Figure 3.1, the project starts with literature review and research about the title. This consist a review of the concept of car tire rack, trolley, car tire rack features and type of car tire rack used in various fields such as workshop, car shop, tire warehouse and etc. These tasks have been done through research on the internet, books and others sources.

After gathering all the relevant information, the project undergoes design process. In this step, from the knowledge gather from the review is use to make a sketch design that suitable for the project. After several design sketched, design consideration have been made and one design have been chosen. The selected design sketched is then transfer to solid modeling and engineering drawing using Solidworks program. The materials and the measurement needed for the trolley listed down and calculated to give an ergonomic shape of the car tire rack.

Next, after the needed material is listed, acquisition step take places. There are only a few materials that need to bought such as wheels and others finishing product. Some of the needed material is well-prepared by the university.