

DESIGN AND FABRICATION OF REMOVABLE CONTAINER TROLLEY

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ABSTRACT

The study of manufacturing was very important in order to carry out this project to ensure that student understand on what are needs to do. Manufacturing is a process of converting raw material into product. It can be described the transformation of materials into items of greater value by means of one or more processing and/or assembly operations. This project is about designing and fabricating the Removable Container Trolley that can be used to helps people transporting load items more efficiently. The main objective in this project is to design a Removable Container Trolley. This project involves the process of designing the trolley by considering the shape, functionality, portability and the manufacturing cost for people to use it. The material of this design is easy to gain it, because it only using rectangular hollow steel and circular hollow steel. So that the method joining that can be compatible in assembled this trolley is welding processes. In assembled the wheel, fastening method is the best chosen because it's only use bolt and nut to bind the wheel with the base of this trolley. This project also required analysis to make sure the strength of the product to ensure the safety for the user indeed of publishing. After all the process had been done, this trolley may help us to understand the fabrication and designing process that involved in this project.

ABSTRAK

Pembelajaran dalam pembuatan penting dalam projek ini untuk pelajar mengetahui sesuatu yang dikehendaki. Pembuatan adalah proses penukaran daripada bahan mentah kepada sesuatu produk. Ia diklasifikasikan perubahan bahan kepada bahan yang lebih baik yang bermaksud melibatkan satu atau lebih proses penyambungan. Projek ini mengenai rekabentuk dan mencipta "Removable Container Trolley" yang berfungsi untuk memudahkan pengguna mengalihkan barang dengan lebih cekap. Objektif utama projek ini adalah merekabentuk "Removable Container Trolley". Projek ini melibatkan proses merekabentuk troli dengan mengambil kira bentuk, fungsi, kemudah-alihan, dan kos pembuatan bagi pengguna. Bahan untuk membuat produk ini senang didapati kerana menggunakan besi berongga segiempat dan besi berongga bulat. Oleh itu proses penyambungan yang sesuai untuk troli ini adalah proses kimpalan. Dalam penyambungan roda, proses terbaik adalah menggunakan kaedah pengikat kerana ia melibatkan penggunaan bolt dan nat bagi penyambungan roda pada tapak troli. Projek ini juga memerlukan analisis bagi memastikan kekuatan produk dan memastikan keselamatan pengguna dipenuhi sebetulnya. Selepas semua proses yang dijalankan siap sepenuhnya, rekabentuk troli ini mungkin boleh membantu sesiapa untuk memahami proses penghasilan dan rekabentuk yang berkaitan dalam projek ini.

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LIST OF SYMBOLS

Σ	-	Total
\times	-	Multiplication
\emptyset	-	Diameter

LIST OF ABBREVIATIONS

UMP	-	Universiti Malaysia Pahang
KUKTEM	-	Kolej Universiti Kejuruteraan & Teknologi Malaysia
FKM	-	Fakulti Kejuruteraan Mekanikal
kg	-	Kilogram
mm	-	Millimeter
GMAW	-	Gas Metal Arc Welding / Metal Inert Gas
MIG	-	Gas Metal Arc Welding / Metal Inert Gas
SMAW	-	Shielded Metal Arc Welding
e.g.	-	Example
kW	-	Kilowatt
3D	-	Three Dimension
PPE	-	Personal Protective Equipment
CAD	-	Computer Aided Design
V	-	Voltage
A	-	Ampere
Hz	-	Hertz
W	-	Watt
CO ₂	-	Carbon Dioxide
L	-	Litre
min	-	minute
Rpm	-	Revolution Per minute

CHAPTER 1

INTRODUCTION

1.1 Project Synopsis

1.1.1 General Project Synopsis

The project involves designing and fabricating a Removable Container Trolley. This trolley would be entirely different from existing trolley. As the Diploma final year project allocates the duration of 1 semester, this large man-hour project therefore requires significant efforts of the students to participate. Basically the entire Removable Container Trolley could be divided into 3 stages, which are concept review and development, designing and fabrication.

The Removable Container Trolley is equipped by using all necessary items and method for instance plastic storage box, rectangular hollow steel, circular hollow steel, skills in manufacturing process by perform gas metal arc welding to joint the parts and etc. The advantages of the proposed trolley to be developed can support and delivered the objects that have round shape, man are offered to make their task easier since the trolley will facilitate them to transfer items for instance, equipment and etc.

The process of development is initiated from designing the shape of the trolley by considering the function as well. In order to produce user friendly 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

Project title is Design and Fabrication of Removable Container Trolley. The project involves small analysis of the Removable Container Trolley chassis or frame body and fabrication of the trolley itself with concerns regarding strength, durability, ergonomic factor, dynamic resistance and convenience. New concept of trolley is required to improve its durability and functions. Test need to be done to verify the strength of the trolley 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 Removable Container Trolley is to facilitate man for loading items. This trolley will primarily help staff especially members of Faculty of Mechanical Engineering to load and unload heavy items that's need trolley for convenience. However, they are facing a problem where the trolley does not have a sidewall. This problem affected the delivery because equipment that has sphere or round shape can not delivered or move from one place to the another place safety. When they want to place the object or equipment into the trolley, they have to take one by one because the objects or equipments are scattered and not in batch when unloading. Thus, with the development of this trolley, it is hope that it can contribute to give them ideas how to overcome problem in loading items by choose the better

way in facilitate their routine at Universiti Malaysia Pahang especially for Faculty of Mechanical Engineering staff.

1.3 Project Scope

- i. Literature Review: Valuable data are searched and gathered. Considering the shape of the trolley in terms of its complexity and method to produce.
- ii. Sketching & Designing: Sketching and designing using Solidwork software in creating the design of the trolley.
- iii. Fabrication: Fabricate and produce the trolley by using all necessary manufacturing process such as welding, cutting, grinding and etc.
- iv. Testing & Evaluation: Simulate the mechanism of the trolley produce is in line with the expected function to be.

1.4 Project Objectives

1.4.1 General Project Objectives

Diploma final year project objectives is to practice the knowledge and skill of the student that have been gathered before in solving problem using academic research, to born an engineer that have enough knowledge and skill. This project also important to train and increase the student capability to get know, research, data

gathering, analysis making and then solve a problem by research or scientific research.

The project also will educate the student in communication like in a presentation and educate them to defend their research in the presentation. The project also will generate students that have capability to make a good research report in thesis form or technical writing. This project also can produce and train student to capable of doing work with minimal supervisory and more independent in searching, detailing and expanding the experiences and knowledge.

1.4.2 Specific Project Objectives

- i. To design removable container trolley.
- ii. To fabricate trolley that is suite to its application especially for loading items.

1.5 Project Hypotheses

The Removable Container Trolley have a sidewall and can support the objects, items or equipments that have sphere or round shape and delivered or move from one place to another place safety. The Removable Container Trolley has two container at lower and upper of the trolley and can be removed from the body of the trolley. This trolley can ease the user to lift up the items, objects or equipments in batch.

1.6 Project Schedule

Table 1.6: Project Schedule

Scope	Weeks															
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Literature Study																
Design & Measurement Consideration																
Acquisition & Material Preparation																
Methodology Study																
Fabrication																
Evaluation & Improvement																
Report Writing																
Presentation																

Planning Progress

Actual Progress

CHAPTER 2

LITERATURE STUDY

2.1 Introduction

The trolley is a mechanism that allowed man to transfer their heavy items such as computers, files and etc to other places. It's help man to do their work without having a problem due to the heavy loading. Its also helps to reduce pain in waist, back, hand and feet. No mater how light the loading is, people usually will suffocate a large pain in their body if lifting the items in many times. So, this is when the people rely upon a trolley that can do items transferring many times with just a little effort. From the statement above conclude that the trolley playing a major role as an items transferring mechanism for people without having a problem of doing that. A trolley also functioned as a helper to people to hold items orderly while transferring between rough surfaces.

2.2 Literature Review

2.2.1 Traditional Shopping Trolley

For supermarkets and stores where aisle width or storage are is confined. Stable design, double ball bearing castor head provides easy maneuverability, even when fully loaded. Comes complete with folding baby seat as standard. All shopping trolleys come with option handle color, Red, Green, or Blue at no additional cost.



Figure 2.2.1: Traditional Shopping Trolley

2.2.2 Rubbermaid Commercial Cleaning Trolley

With innovative features for improved efficiency. In addition to three shelves for supplies, and holders for mops, brooms and dust pan, the wire frame refuse bag holder has a cover with storage compartment for small tools and supplies. Also features a polyliner support shelf/drip pan. Uses replacement vinyl bag RCP 6183 YEL. Platform holds a 32-gallon container, standard-size bucket or Micro fiber Mop

Buckets RCP Q950 and RCP Q900-88. Non marking 8" rear wheels and 4" non marking casters. 21-3/4w x 46d x 38-3/8h.

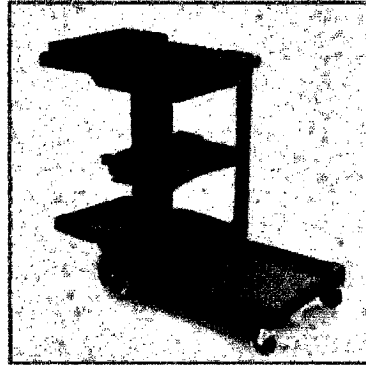


Figure 2.2.2: Rubbermaid Commercial Cleaning Trolley

2.2.3 Hospital Trolley

Hospital trolley is the standard square metal trolley with casters on each leg to assist in quick relocation of the trolley around the room or rooms. Hospital trolley is the most widely used item of furniture in the hospital. There are different types of trolleys in a hospital to serve different purposes. All trolleys come in different styles, sizes depending on the purpose it serves. For example, there is mayo trolley to carry medical equipments or stretcher trolley to carry patients or food trolley or cart trolley and so on.

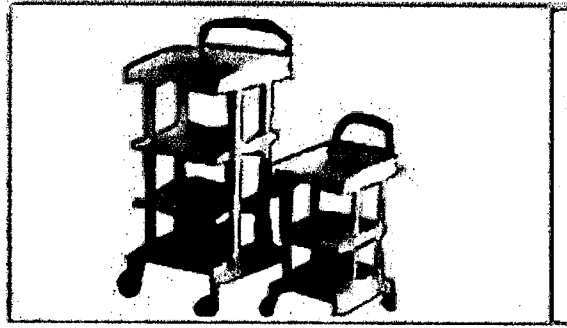


Figure 2.2.3: Hospital Trolley

2.2.4 Baby Trolley

The baby trolley is a mobile unit. It can be used under an infant radiant warmer or with stand type photo therapy unit and can be used as a baby receivable trolley in the delivery room. The art involves designing the unit for optimum functionality.

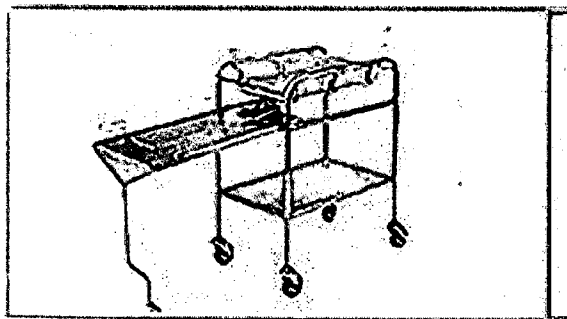


Figure 2.2.4: Baby Trolley

2.2.5 Multipurpose Trolley

Multipurpose trolleys made of stainless steel are available in two sizes. The multipurpose trolleys can optionally be used as equipment, dressing and anaesthesia trolleys, either with drawers and/or ring for bowl or waste bag.

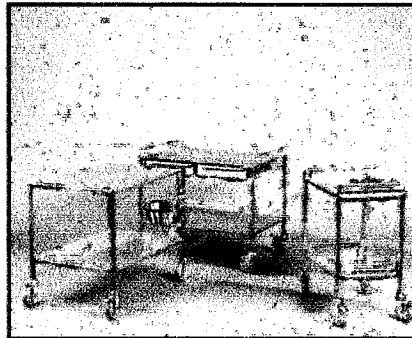


Figure 2.2.5: Multipurpose Trolley

2.2.6 Stanchion Trolley

4 corner pockets for holding rungs or end panels. 2 swivel castors and 2 fixed castors, swivel castors with wheel stops, solid rubber tyres, roller bearings. 1200 kg truck with fully elastic tyres on aluminium rims. Ball bearings. Powder coated, light blue RAL 5012 as standard.

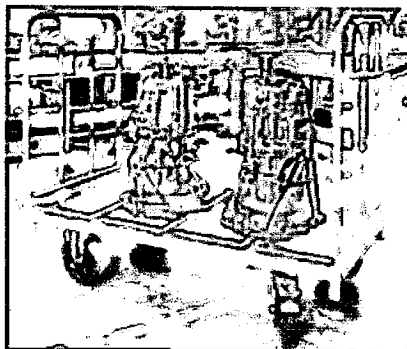


Figure 2.2.6: Stanchion Trolley

2.2.7 Multi-Functional Instrument Cart

The RiLab Instrument Cart is an excellent mobile workstation. Whether used as a mobile laboratory or test stand, a computer support point or an assembly trolley, it provides a secure location for the most sensitive equipment. It features four lock-in-place twin castors, an easy transport handle, a six-plug power strip and a height adjustable utility shelf. Support columns contain two vertical tapped strips for installation in 32 mm hole patterns. Numerous accessories allow for customization of the cart according to specific needs. All shelves feature raised safety edges and can support materials weighing up to 110 pounds.

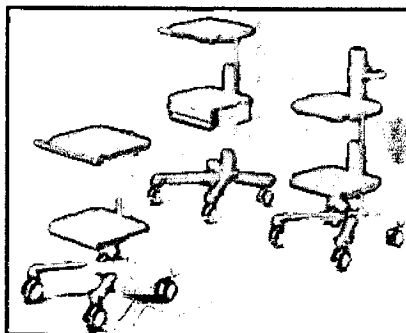


Figure 2.2.7: Multi-Functional Instrument Cart

2.2.8 Lightweight Portable Trolley

A platform on wheels for transporting wide and heavy items in workshop, office, warehouse and etc.

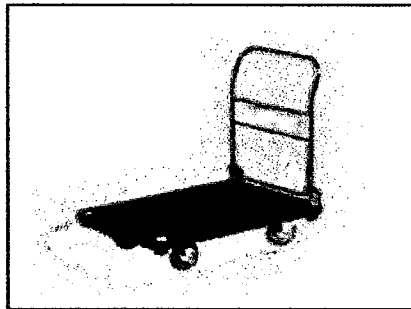


Figure 2.2.8: Lightweight Portable Trolley

2.3 Basic Parts

- i. **Body:** For outdoor use such as warehouse or workshop that requires full strength of body, wire frame or sheet metal body is used. Some trolley doesn't have any body on it on purpose, and some using wood frame as the body.
- ii. **Handle:** Usually all the trolley must have handled to provide less effort while using the trolley due to heavy it's loading. But the design and the place of the handle are flexible and differ from one another based on its center of force and design.
- iii. **Wheel:** Usually made from rubber that joined together with the bolt and nut with steel frame to ensure strength. Some trolley, food trolley for instance, only using wheels from wood because don't require strength for the purpose.

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 GMAW or Gas Metal Arc Welding type.

2.4.1 Introduction and Theory of Gas Metal Arc Welding (GMAW)

Gas metal arc welding (GMAW), also known as metal inert gas or MIG welding, is a semi-automatic or automatic process that uses a continuous wire feed as an electrode and an inert or semi-inert gas mixture to protect the weld from contamination. As with SMAW, reasonable operator proficiency can be achieved with modest training. Since the electrode is continuous, welding speeds are greater for GMAW than for SMAW. Also, the smaller arc size compared to the shielded metal arc welding process makes it easier to make out-of-position welds (e.g., overhead joints, as would be welded underneath a structure).

The equipment required to perform the GMAW process is more complex and expensive than that required for SMAW, and requires a more complex setup procedure. Therefore, GMAW is less portable and versatile, and due to the use of a separate shielding gas, is not particularly suitable for outdoor work. However, owing to the higher average rate at which welds can be completed, GMAW is well suited to production welding. The process can be applied to a wide variety of metals, both ferrous and non-ferrous.

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.