

DESIGN AND FABRICATION OF TOOLBOX

MOHD DZOHAIRY BIN MOHAMMAD MOHSAN

**A report submitted in partial fulfilment of the
requirement for the award of the Diploma
of Mechanical Engineering**

**Faculty of Mechanical Engineering
Universiti Malaysia Pahang**

NOVEMBER 2007

ABSTRACT

Development of this toolbox is for store a workshop's tool or a light tool like screw driver and hammer at home. With the bigger size, this toolbox can store more tools inside it. Even though the size of this toolbox is big, but it is light because this toolbox is made from an aluminium metal. This toolbox make easy to person to bring it anywhere because the first compartment can carryout from the toolbox and it has handle.

Whole of this project is particular involves the toolbox. Diploma final year project will allocate the one semester to complete a project. This project also required the adequate student to finish a task given. The tasks division need to apply, for the entirely two part will be make that is a process to development of parts and assemble the toolbox.

ABSTRAK

Penghasilan peti alatan ini adalah untuk digunakan sebagai tempat menyimpan peralatan bengkel atau peralatan yang kecil seperti pemutar skrew dan tukul di rumah. Dengan saiznya yang agak besar, peti ini dapat memuatkan lebih banyak alat di dalamnya. Walaupun saiz peti ini agak besar, tetapi ianya ringan kerana peti ini diperbuat daripada kepingan aluminium. Peti ini memudahkan mereka yang menggunakannya bawa ke mana kerana bahagian pertama peti ini dapat di keluarkan dan mempunyai pemegang.

Kesuluruhan projek ini adalah melibatkan mereka bentuk yang sesuai bagi peti peralatan ini. Projek tahun akhir diploma ini mempunyai tempoh satu semester untuk disiapkan. Projek ini juga melibatkan tenaga pelajar yang cukup untuk menyiapkannya. Di dalam projek ini, pembahagian tugas diperlukan. Secara kesuluruhannya, projek ini dipecahkan kepada dua bahagian iaitu proses menyediakan bahagian-bahagian peti dan mencantumkan peti itu.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	FRONT PAGE	i
	SUPERVISOR DECLARATION	ii
	DECLARATION	iii
	DEDICATION	iv
	ACKNOWLEDGEMENTS	v
	ABSTRACT	vi
	ABSTRAK	vii
	TABLE OF CONTENTS	viii
	LIST OF FIGURES	xii
	LIST OF TABLES	xvi
	LIST OF APPENDICES	xvii
1	INTRODUCTION	1
	1.1 Project Synopsis	1
	1.2 Problem Statement	2
	1.2.1 Problem Space	2
	1.2.2 Fixed Compartment	3
	1.2.3 Heavy	3
	1.3 Objective	3
	1.4 Scope of Project	3
	1.5 Project Planning	4

2	LITERATURE REVIEW	6
2.1	Introduction	6
2.2	History of Toolbox	7
2.2.1	Types of Toolbox	7
2.2.2	Material	8
2.2.3	Design	9
2.2.4	Alternatives to Toolbox	10
	2.2.4.1 Toolsets	10
	2.2.4.2 Tool Belts and Aprons	11
	2.2.4.3 Bucket Organizers	12
2.3	Equipment/Machining for Each Part	13
2.3.1	Bending Process	13
	2.3.1.1 Press Brakes	13
	2.3.1.2 Press Brake Dies	14
2.4	Assembly	16
2.4.1	Rivet	16
	2.4.1.1 Blind Rivets	16
	2.4.1.2 Drive Rivet	18
2.4.2	Drill	19
	2.4.2.1 Handheld Drill	19
	2.4.2.2 Operator Involvement	20
3	METHODOLOGY	21
3.1	Introduction	21
3.2	Material of Project	24
3.2.1	Handle	24
3.2.2	Compartment	24
3.3	Drawing	24
3.3.1	Sketching	24

3.3.2	Solid Works Software	25
3.4	Sketching and Drawing Selection	25
3.5	Computer Aided Design	28
3.6	Design Specification	31
3.7	Fabrication Process	32
3.7.1	Process Involved	32
3.7.2	Process Procedure	33
3.7.2.1	Selection Material	33
3.7.2.2	Measuring	34
3.7.2.3	Cutting	34
3.7.2.4	Bending Process	35
3.7.2.5	Joining Process	36
3.7.2.6	Scrapping	37
3.7.2.7	Finishing	37
4	RESULTS AND DISCUSSION	39
4.1	Introduction	39
4.2	Result	40
4.2.1	The Finished Each Part of the Toolbox	40
4.2.2	The Complete Fabrication of the Toolbox	41
4.3	Product Specification	45
4.4	Discussion	46
4.4.1	Types of Defected	46
4.4.1.1	Lock Broken	46
4.4.2	Project Problem	47
4.4.2.1	Literature Review	47
4.4.2.2	Designing and Sketching	47
4.4.2.3	Material Preparation	47
4.4.2.4	Fabrication Process	48

5	CONCLUSION AND RECOMMENDATION	49
	5.1 Introduction	49
	5.2 Recommendation	49
	5.3 Future Work	50
	5.4 Conclusion	50
	REFERENCES	51
	APPENDICES	52

LIST OF FIGURES

FIRGURE NO.	TITLE	PAGE
1.1	Little space of toolbox	2
1.2	No more space to store the tools	2
2.1	Metal's toolbox	8
2.2	Wood's toolbox	8
2.3	Plastic's toolbox	9
2.4	Toolbox that has more compartments	10
2.5	Toolsets	11
2.6	Aprons	11
2.7	Tool belt	12
2.8	Bucket organizer	13
2.9	Bending machine	15
2.10	Result of bending process	15

2.11	Blind rivet	18
2.12	Drive rivet	19
2.13	Handheld drill	20
3.1	Flowchart of the project methodology	22
3.2	Concept A (choice)	25
3.3	Concept B	26
3.4	Concept C	26
3.5	Concept D	27
3.6	Concept E	27
3.7	Hinge view	28
3.8	Lock view	29
3.9	Handle view	29
3.10	Full assembly view	30
3.11	Overall view of the design	30
3.12	Rectangular hollow steel	33
3.13	Sheet metal	33

3.14	Cutting the steel bar using disc cutter	34
3.15	Cutting the sheet metal using shearing machine	35
3.16	Bend the part of the toolbox	35
3.17	Drill the compartment to make the hole	36
3.18	Blind rivet and drive rivet	36
3.19	A sand paper	37
3.20	The equipment that used as finishing process	38
3.21	The painting process	38
4.1	Hinge and handle	40
4.2	First compartment	40
4.3	Second compartment	41
4.4	Front view (close)	41
4.5	Isometric view (close)	42
4.6	Back view	42
4.7	Front view (open)	43
4.8	Isometric view (open)	43

4.9	Front view (with compartment)	44
4.10	Isometric view (with compartment)	44
4.11	Full view	45
4.12	Broken lock	46
4.13	Bad result that produce from punching machine	48

LIST OF TABLES

TABLE NO.	TITLE	PAGE
3.1	Design specification	31
4.1	Product specification	45

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Gantt Chart	52
B	Design and Picture	53
C	Apparatus	54
D	Fabrication Process	55

CHAPTER 1

INTRODUCTION

1.1 Project Synopsis

Toolbox is a very important thing to store a tool. In order to make the toolbox, the project will design and analyze a toolbox model in market that can be used for make a new concept of toolbox. The toolbox must be easy to carry anywhere and store more tools. We can found lots of toolbox that available in workshop or home but usually this toolbox are fixed. It's hard to bring anywhere.

The project is to fabricate toolbox that can easy to carry and store a tool. The structure of this toolbox must be high strength and light. This toolbox can be easily to bring anywhere. The prototype is design based on this problem and to improve the design that available. The toolbox is consists of two compartments which the second compartment can carry out from the toolbox. Each compartment has its own function and what kind of tool can store inside it.

1.2 Problem Statement

1.2.1 Problem Space

Nowadays, there a lot of toolbox designed that available in the market. But almost all of the designs are cannot be store more tools. Some toolbox that available is like Figure 1 and Figure 2.

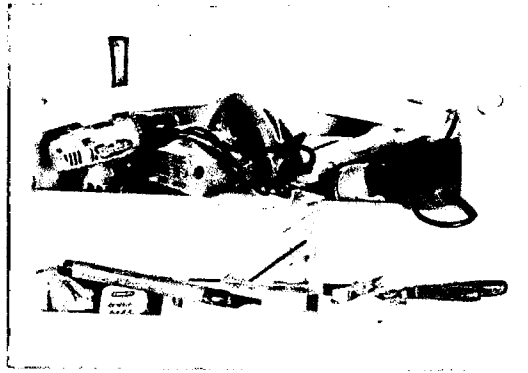


Figure 1.1: Little space of toolbox



Figure 1.2: No more space to store the tools

1.2.2 Fixed Compartment

Even though the toolboxes in market have more compartment, but it is fix. Just portable compartment we always see. Person can not carry out the first compartment outside from the toolbox.

1.2.3 Heavy

More toolbox is made from metal and this make the weight of the toolbox too heavy when we want to bring or carry it anywhere. Some factor that make the toolbox in market heavy because it produce by cast iron metal. Selection material of the toolbox is very important to know their weight.

1.3 Objective

There are two main objectives to achieve in this research which are:

- To design a toolbox that easily to bring anywhere.
- To fabricate the new concept of toolbox.

1.4 Scope of Project

In order to reach the objectives, there is the scope of project which is:

- The limit weight of tools that can put inside the toolbox is below 11.02 lb (5kg).
- The toolbox made from metal and it can be rust if the box place at a wet place.

- The toolbox is designed for store a light tools and/or automotive tolls only.
- A person can carry out the first compartment of toolbox.
- The first compartment of toolbox for place light tools and second compartment for place heavy or another tool.

1.5 Project Planning

This project started with made a research and literature review. It is from internet, books and my supervisor that related to my project title. All of this literature review takes about three week. I also do my schedule management for my project. This is done by using Microsoft Excel Worksheet using Gantt chart system. The next week I have been submit my project title acceptance form and continue detail research on toolbox and it takes a week to be done.

After all of literature review done, I must find out what is the problem about my project. The sketching of the toolbox takes about 2 weeks to be done. The sketching done using manual sketched at A4 size paper.

The fabrication process is started on week six. For the first fabrication is must fabricate the part of box using a sheet metal. After done the fabrication process, next process is assembly, testing, correction and finishing. This task scheduled takes several weeks to finish.

The next task is preparation of progress presentation and progress report writing, both of these tasks takes one week to be done. After that, the progress presentation week and progress report submission. On this week I have to prepare the speech for the presentation and double checked the report that has to be submitted.

Lastly, the final report has been written and prepared for presentation. This will take about one week to prepared and accomplish. A report is guided by UMP thesis format and also guidance from supervisor. Due to any problems that student face, the management has agreed to extend the time of submission of the report and presentation. All task scheduled takes around fourteen weeks to complete.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The design of toolbox varies from product to product and industry to industry. Before the design of a product can begin, the need for that product must be established. The main source for design projects or development of a new product idea is market demand. Without customer for the product, there is no way to recover the costs of design and manufacture.

Thus, the most important part in understanding the design problem lies in assessing the market which is establishing what customer wants in the product. Even though the resulting ideas may be innovative and clever, they are useless unless they can be matched to a market need or a new market can be developed for them.

Additionally, a design project for a new product or some feature of a product can be initiated by the desire to redesign it. Redesign is fostered by market demand for a new model or the desire to include a new technology in an existing product. Redesign can also be initiated to fix a problem with an existing product, reduce product cost, simplify manufacturing, and respond to a required change of materials or for many reasons. Often the desire to change the product design is the need of the product to be less expensive, to have new features or to last longer.

2.2 History of Toolbox

A toolbox, also known as a tool chest, varies with the craft of the owner. The purpose of the toolbox is to organize, carry, and protect the owner's tools of trade.

2.2.1 Types of Toolboxes

Modern toolboxes are predominantly metal or plastic. Wooden boxes built today are primarily intended for children's toolsets, although some wooden boxes are homebuilt creations of their owners. Many wooden toolboxes were created in the early 1800's but were discontinued in the last 20 years. A modern carpenters' toolbox is composed of a base, a pivotally-mounted top cover, and usually a rack-mounted inside for convenient access. The generic toolbox is usually red. Many toolbox and chests from a variety of trades can be seen at the Smithsonian Museum of American History.

A common modern design comprises a rectangular box with a hinged cover on top, a handle for carrying, and one or more latches securing the lid to the box. Smaller boxes may be open inside, but larger ones will often have a removable tote tray sitting on a flange inside the lip of the box, with a larger compartment below.

A second popular design, commonly labeled a tool chest, uses slide out drawers in lieu of the voluminous open space of the prior design. It is less common for these toolboxes to have the tote tray, although usually they still have a storage compartment above the drawers. Tool chests are primarily made of metal though some expensive models are made of hardwoods. Often they are sold as a set of a rolling bottom cabinet with a second, smaller chest on the top.

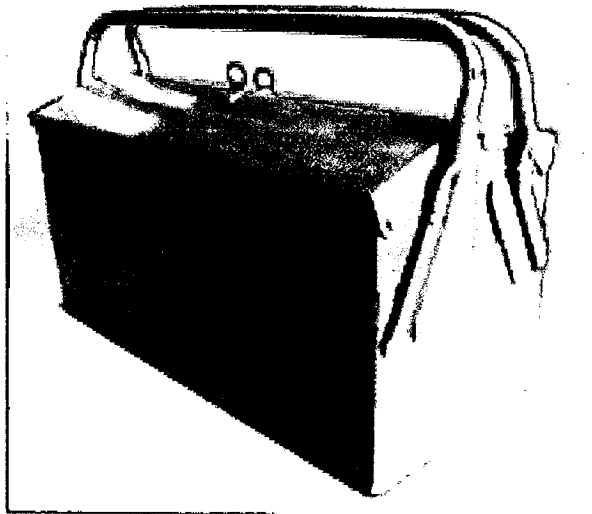


Figure 2.1: Metal's toolbox

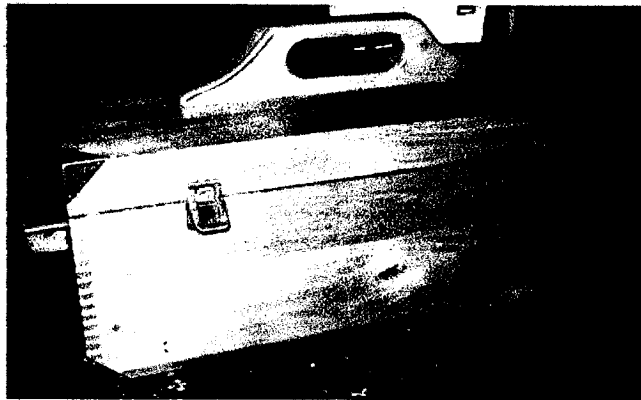


Figure 2.2: Wood's toolbox

2.2.2 Material

Metal toolboxes (typically steel) weigh more than plastic ones. A plastic toolbox laden with tools can weigh the same that a comparable steel box does when empty. Metal boxes are also subject to rusting and their sharp edges can mar the surfaces of things they are banged against. Metal is, however, known for being stronger than plastic,

so one should balance its disadvantages against the need to withstand abuse and support the weight of many tools.

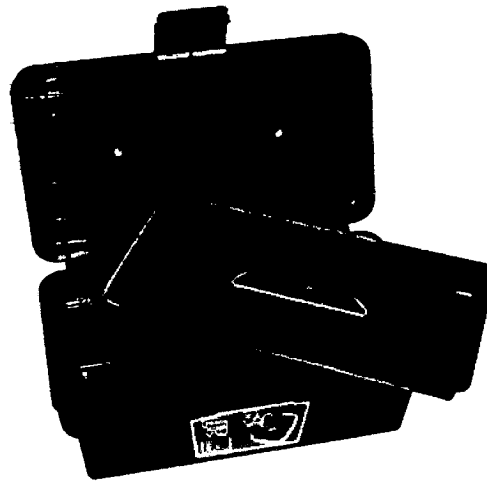


Figure 2.3: Plastic's toolbox

2.2.3 Design

The simple box with tote tray can be effective, but becomes less so as more tools are added. The tote tray helps in organizing, and some totes have dividers for segregating small tools. Some toolboxes even have compartments built into the lid for storing supplies such as nails and screws. Yet many tools still must be stored in the compartment below the tote. The large volume of space in this compartment makes this type of box easy to overfill, in terms of both weight and clutter. In addition to the trouble of finding things, there is a risk of heavier items damaging more delicate ones as the toolbox is moved around.

Hence the advantage of tool chests with drawers: heavy pliers and wrenches, for example, can be segregated from the magnifying lens and MultiMate's. Unfortunately, adding drawers adds weight. Tool chests with three or more drawers may be only semi-

portable because of their weight when full. Some may not even have a carrying handle and may be intended to sit atop a roll around tool cabinet.



Figure 2.4: Toolbox that has more compartments

2.2.4 Alternatives to Toolboxes

2.2.4.1 Toolsets

These are molded plastic cases typically containing a variety of household or automotive tools. Each item snaps into a designated spot in the case, which makes organizing tools much easier than with a conventional toolbox. They are very compact, lightweight, and inexpensive relative to purchasing tools and a toolbox separately. There are two major disadvantages: no ability to customize the selection of tools (sometimes the tools are of lower quality than what one might purchase individually); and little or no space to add new tools and supplies. Thus one still might need a toolbox in addition to the toolset.

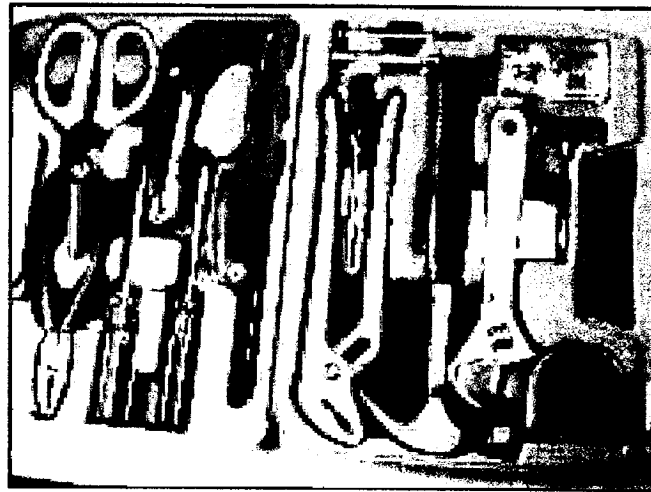


Figure 2.5: Toolsets

2.2.4.2 Tool Belts and Aprons

Though at the far extreme of portability, they are insufficient for storing a large number of tools. One might use a toolbox for permanent storage and a tool belt or apron to take just what is needed for a job.

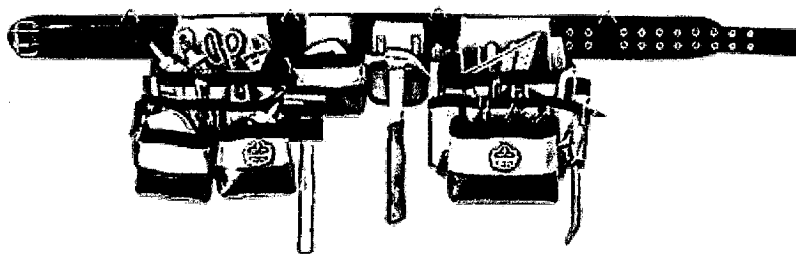


Figure 2.6: Aprons