DESIGN AND FABRICATION TRANSPARENT TROLLEY TOOLBOX

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ABSTRACT

This project is about designing and fabricating the toolbox that can store and keep the laboratory equipment. It also has portability and easy to see from outside of the toolbox. Another purposes this toolbox give the user the easy to see inside the toolbox with more directly. Numerous methods and process involve in this project for instance joining using welding process. The process to cut the sheet metal follows on their required dimension by using Turret Punch Machine. Besides that, the cutting laser Machine was use to cut the prospect. After all the process had been done, this Transparent Trolley Toolbox project will help us to understand the fabrication and designing process that involved in this project.

ABSTRAK

Projek ini adalah mengenai merekabentuk dan mencipta tempat untuk menyimpan peralatan-peralatan bengkel yang mudah alih serta mudah dilihat dari luarnya. Tujuan lain bekas peralatan ini dibuat adalah untuk memberi kemudahan kepada pengguna untuk melihat apa yang terdapat dalam bekas peralatan itu dengan secara langsung. Kebanyakan cara dan proses yang terlibat dalam proses penyambungan bagi projek ini adalah menggunakan proses kimpalan. Manakala proses untuk memotong kepingan besi mengikut ukuran yang dikehendaki adalah dengan menggunakan mesin "Turret Punch". Selain itu proses untuk memotong kepingan plastic lutsinar pula adalah dengan menggunakan mesin pemotongan laser. Setelah kesemua proses yang terlibat di dalam projek ini telah selesai, projek ini dapat membantu kita mengenal dan memahami setiap proses yang terlibat dalam pembuatan bekas peralatan ini.

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CHAPTER 1

INTRODUCTION

1.1 Project Synopsis

This project is about development of transparent trolley toolbox. It will show the differences of the toolbox at the current market product with the transparent trolley toolbox. In this semester (Semester 1 07/08), to complete this task, the CNC (Computer Numerical Control) Turret Punching and CNC Bending Machine need to be run perfectly. As the Diploma final year project allocates the duration of one semester, and the project must finish and achieve the target. This project also to make sure the student have knowledge and skills to operate the machine and know how to use their understanding to overcome the problem that have occur.

1.2 Problem Statement

Generally, the sheet metal toolbox is high mass than the plastic toolbox [1]. So by combining the sheet metal and plastic toolbox became one trolley toolbox that will call as name the transparent toolbox. This transparent toolbox has less mass than the sheet metal toolbox. The other toolbox also difficult to see directly inside of the toolbox because the obstacle from the sheet metal wall. However, the metal known for being high strength than plastic, so one should balance its disadvantages against the need to withstand abuse and support the weight of many tools.

1.3 Project Objectives

This project is to make the toolbox that has commonly in market normally is sheet metal to become the transparent at the certain side. The toolbox is combination of sheet metal and prospect plastic. This project is apply the lesson and knowledgeable that we learn before. It can practice the skill and solving the problem using academic study. This project also, to enhance a student skill and ability to work individually. It also gives me, an experience and knowledge. The project is aimed to improve productivity or yield. It is a continuous improvement activity of toolbox. So the objectives of this project are:

i. To design and development transparent toolbox.
ii. To store and to keep the laboratory equipment.
iii. To setting up and running CNC Turret Punching and CNC Bending Machine.
iv. The transparent toolbox allows people to see whatever equipment inside the toolbox.

1.4 Project Scopes

This project is aim to improve the transparent toolbox being something difference than has at the market nowadays. This product has their specification and feature. The scopes of the product are:-

i. Design and develop transparent toolbox.
ii. This toolbox has four drawers. The first one is top drawer. Another three is front drawer which is has different sizes.
iii. This toolbox is safe because there are no sharp edges.
iv. There is wheel that can make it moves everywhere.
v. This toolbox dimension is 750×450×850 [length (L) x width (W) x height (H)] in millimeter (mm).

1.5 Project Background

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 used for trade, hobby [1]. Most of the toolbox at the market product consist of sheet metal with different sizes and feature. But no one consist with transparent plastic that make easier to see inside the toolbox. Sometimes, the worker find it difficult to find any tool and equipment and according this transparent toolbox it also will make easier to find any tool and equipments. It also portable because it has wheel that make it moves everywhere.

1.6 Project Schedule

The project is the schedule planning for making the Transparent Trolley Toolbox. It was start from week 1 until week 14. The first activity is to search the information related to the toolbox whether in internet or the references book. The following activities were proceeding with the activities that showed in **Table 1.1**.

Table 1.1: Gantt chart

PROJECT ACTIVITIES	WEEK (S)													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Literature Review														
Design & Sketching														
Material Preparation														
Fabrication														
Report Writing														

CHAPTER 2

LITERATURE STUDY

2.1 Introduction

The transparent toolboxes also know as the transparent trolley toolbox because it functions is to use a trolley vehicle to go from one place to another. The basic of this toolbox is because of their post or their framework. The post is made same as the trolley because of that it calls the transparent trolley toolbox. This toolbox use the trolley as their basic component so that it can accommodate and allowed man to store whether their small or heavy items. This transparent trolley toolbox will help man to do their work without use much force to move the toolbox although have heavy load. This transparent toolbox is making especially for use in laboratory or workshop that has security escort that very tight and strong. It is because this toolbox make by transparent plastic at the certain side and it easy to crack and wreak. It also made the toolbox container easy to steal by someone. That why this toolbox mostly will be in workshop and laboratory. In this chapter, it will show the few toolboxes in market as their comparison.

2.2 Product review

2.2.1 Craftsman 4 Drawer Roll Away Tool Box Garage Storage

This item is dents on the right side, back side and a few dents on the front. There are some scratches and scuffs here and there. The dent's are only cosmetic flaws and does not affect the functions of this box. The lock and drawers are fully functional. This product comes with 1 key, top rubber material and the paperwork. It is does not include the 2nd key or the retail box. Shell and drawers have black baked enamel finish with platinum molded plastic handles, full-extension drawers, compound-action drawer slides, internal locking system with 1 over molded reversible key, a top rubber material with the Craftsman logo and 10x5 mm swivel casters. The toolbox dimension is 675W x 457D x 800H mm with casters. The product was showed in Figure 2.1. [2]

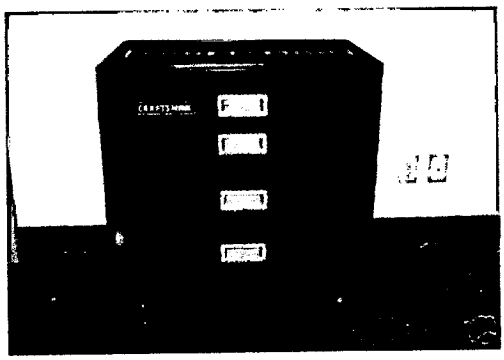

Figure 2.1: Craftsman 4 Drawer Roll Away Tool Box Garage Storage [2]

2.2.2 Draper 5 Drawer Roller Cabinet

Five drawer roller cabinets manufactured from sheet steel with powder coated finish. Fitted with two fixed and two braked swiveling castors. Drawers are fitted with anti slip mats and ball bearing runners for smooth operation and long life.

Secure integral locking system supplied with two keys. Carton packed on pallet. The configuration of this toolbox is 3 full width drawers with dimension 551 mm x 403 mm x 75 mm and has 2 full width drawers with dimension 551 mm x 403 mm x 155 mm. This Draper 5 Drawer Roller Cabinet was showed in Figure 2.2. [3]

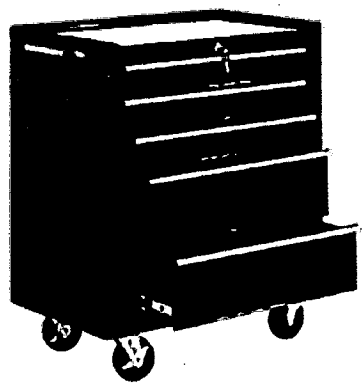

Figure 2.2: Draper 5 Drawer Roller Cabinet [3]

2.2.3 Sealey AP4362 Topchest 6 Drawer 2 Shelf Red

The Sealey AP4362 Topchest 6 Drawer 2 Shelf Red made from all steel construction and manufactured with steel inner walls for extra strength and durability. This product was showed in Figure 2.3. Ball bearing drawer and shelf runners provide superior performance and carry heavier loads. Drawers and concealed shelves for extra flexibility. Full height rear locking mechanism, locks drawers in multiple locations. Shelf door is locked independently of the drawers. Added security provided by cylinder locks. Supplied with two keys. Recessed handles permit units to be slotted in work environments where space is tight. Rust and solvent resistant powder coat paint finish. Clamshell lid construction of topchests provides improved access and visibility to the top tray. Gas damper within the lid allows it to pop up when key is turned and keeps it open for easy accessibility. Their specification (W x D x H) is:

Overall size : 1045 x 450 x 530mm

Small Drawer (x4) : 540 x 420 x 50mm

Medium drawer (x2) : 540 x 420 x 90mm

Shelf (x2) : 300 x 370 x 50mm [4]

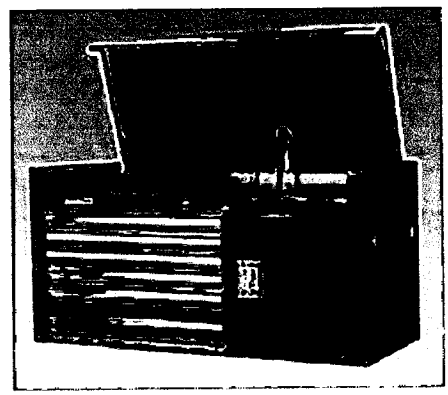

Figure 2.3: Sealey AP4362 Topchest 6 Drawer 2 Shelf R [4]

2.3 Basic Parts

i. Body

For workshop use that requires full strength of body. Normally, the frame or body was made by using sheet metal. Body of trolley toolbox usually consists of drawer with variation of sizes.

ii. Handle

Generally, all the trolley must have handled to provide less effort while using the trolley due to heavy loading. But the designs for each trolley toolbox is different from one another depend on the manufacturers.

iii. Wheel

Normally made from high quality rubber. The wheel can join together with the screws and nut with steel frame to ensure strength.

2.4 Machining Process

2.4.1 Punching Process

Punching in metal fabrication is the process of using a machine to press a shape through a sheet of metal and into a die to create that shape in the metal. This is most commonly done by use of a *turret*, a computer numerical controlled machine that houses tools and their corresponding dies in a revolving indexed turret. These machines use hydraulic, pneumatic, or electrical power to press the shape with enough force to cut the metal. This punching process was showed in Figure 2.4. [5]

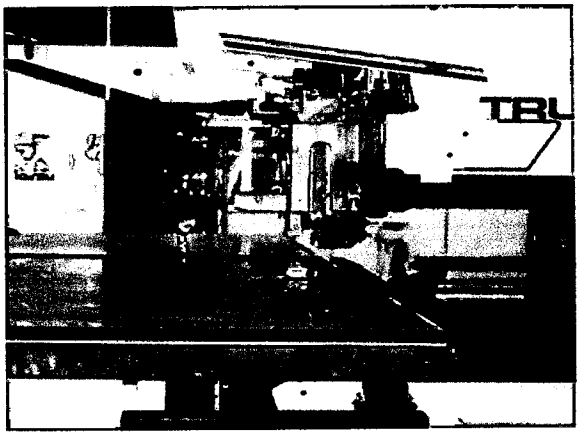

Figure 2.4: Punching Process

A misconception about punching is that the shape does the cutting, when in fact the shape presses the material into a die that cuts the metal. The die is also given a tolerance that is measured in thousands of an inch. [5]

Punching can be better understand as pressing the material against a die with a huge force, this force pushes the material into the die and shears off the waste material. The turret punch machine specifications that have in mechanical laboratory are:

Model	: Trumpf Trumatic 2020R
Type	: Tc 2020R
Fuse	: 3 x 40A
Power Supply	: 415V/50Hz
Connected load	: 22kVA
Control voltage	: 24 VDC
Max. Punch capacity	: 180kN

2.4.2 Welding Process

Welding is a fabrication process that joins materials, usually metals or thermoplastics. This is often done by melting the steels and adding a filler material to form a pool of molten material (the *weld puddle*) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld.

2.4.2.1 Introduction of GMAW

Gas metal arc welding (GMAW), sometimes referred to by its subtypes metal inert gas (MIG) welding or metal active gas (MAG) welding, is a semi-automatic or automatic arc welding process in which a continuous and consumable wire electrode

and a shielding gas are fed through a welding gun. A constant voltage, direct current power source is most commonly used with GMAW, but constant current systems, as well as alternating current, can be used. The MIG welding was showed in Figure 2.5. [6]

Figure 2.5: MIG Welding

2.4.2.2 Equipment of MIG Welding

To perform gas metal arc welding, the basic necessary equipment is a welding gun, a wire feed unit, a welding power supply, an electrode wire, and a shielding gas supply. The Figure 2.6 below showed the GMAW wire feed unit. [6]

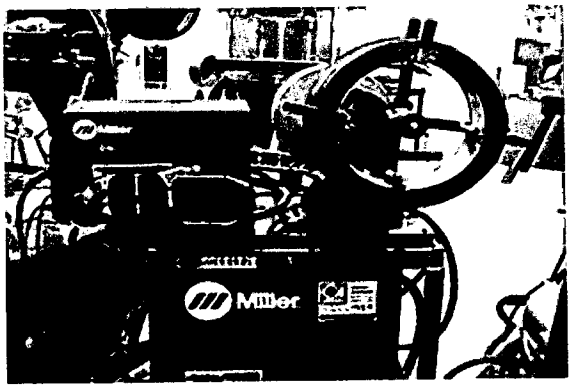

Figure 2.6: A GMAW wire feed unit

2.4.2.3 The Advantages and disadvantages of MIG Welding

The advantages of MIG welding are it can produce high productivity of product. It is because based on this machine the consumer no need to stop their work to change rods or chip and brush the weld frequently. MIG welding also easy to learn and makes great-looking welds. It also can weld various types of material such as stainless steel, mild steel, and aluminums. This welding process also can be weld in all positions. For their disadvantages, this MIG weld needs a lot of cost money that consumable such as tips and nozzles. The welding is not worth a dang on paint, rust, or dirty surfaces. This welding also not good for thick steel, because it does not get the proper penetration. It also make the surface of the material was damaged because their heat not suitable for the thick surfaces. [6]

2.4.3 Bending Process

The bending (also known as flexure) characterizes the behavior of a structural element subjected to a lateral load. A structural element subjected to bending is known as a beam. A closet rod sagging under the weight beam is being compressed while the material at the bottom is being stretched. There are three notable internal forces caused by lateral loads shear parallel to the lateral loading, compression along the top of the beam, and tension along the bottom of the beam. These last two forces form a couple or moment as they are equal in magnitude and opposite in direction. This bending moment produces the sagging deformation characteristic of compression members experiencing bending. The compressive and tensile forces induce stresses on the beam. The maximum compressive stress is found at the uppermost edge of the beam while the maximum tensile stress is located at the lower edge of the beam. Since the stresses between these two opposing maxima vary linearly, there therefore exists a point on the linear path between them where there is no bending stress. The machine was showed in **Figure 2.7**. [7]

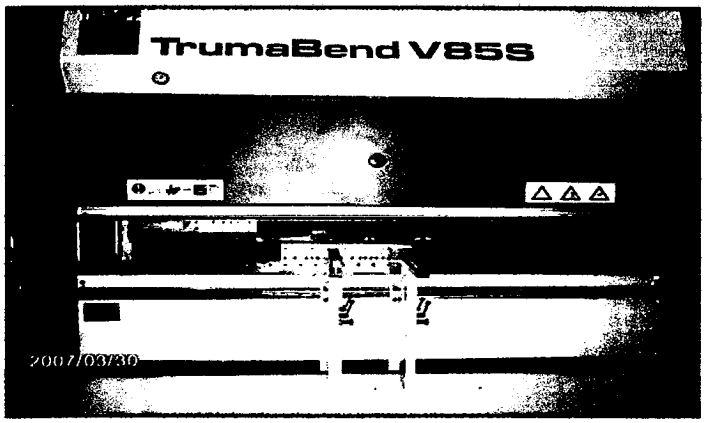

Figure 2.7: TrumaBend V85S machine

The locus of these points is the neutral axis. Because of this area with no stress and the adjacent areas with low stress, using uniform cross section beams in bending is not a particularly efficient means of supporting a load as it does not use the full capacity of the beam until it is on the brink of collapse. TRUMABEND V85S - TRUMPF's CNC bending machine with 4 axes, is a high productive and very flexible machine. Technical data and their specifications are [7]:

Model	: Trumpf
Type	: TrumaBend V85S
Hydraulic	: 80 ton
Power	: 230 volt
Tonnage	: 850kN
Working path	: 215 mm
Bending length	: 2550 mm

CHAPTER 3

METHODOLOGY

3.1 Introduction

Project methodology is a body of practices, procedures and rules used by those who work in a discipline or engage in an inquiry and a set of working methods. This chapter will be discussed about methods and machining that will be use to make the transparent trolley toolbox. All the methods that will be explained in this chapter are very important procedure to ensure it follow the entire project schedule so that it will be move smoothly. Effective methods will give clear view on how to do this project. These methods will be guidance in so that it will be finish at the right time as the planning. Whole process will be explained in this chapter also. So it will give general view of what are the steps should be taken.

3.2 Project flow chart

In fabrication of the transparent trolley toolbox there is a planning of the overall progress to assure the project can be finish follow on schedule.

For the diagram as shown **Figure 3.1**, the project starts with study and gathers some information about the literature review and research related to the title. This consist a review of the concept of trolley toolbox that have in market nowadays. These tasks have been done through research on the internet, books and others sources.