DESIGN AND FABRICATION OF THE ASSIGNMENT TRAY

MOHD SHAHRIL BIN KHAMIS

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ABSTRACT

Nowadays, assignment tray and paper rack was use widespread in whole world. Especially as a student, they use assignment tray to store their paper work and assignment sheet. However, there are some things that can't solve by existing assignment tray, for example, can't keep lots of paper, sheet of paper that kept on that uncovered, sheet of paper scatter in the air, can only kept the paper and not suitable for writing equipments, and so on. That's why we need the new concept of the assignment tray. The main feature of this projects assignment tray was the flexibility to become single stage and double-decker. The idea was appear because of the lack functionality in the existing assignment tray in market. The purpose of design this assignment tray was to ensure the documents or assignment sheet is being kept securely. Drawer was put as the additional feature to get the extra place to keep other items. There are several processes involved during the design and fabrication process of this assignment tray. The best feature and shape of assignment tray was designed in order to get the smart and modern look of product. Several aspects needed the full commitment in order to maintain this project run as same as project planning and finished on time.

ABSTRAK

Dewasa kini, bekas helaian tugasan dan rak kertas telah digunakan secara meluas di serata dunia. Terutamanya sebagai seorang pelajar, mereka menggunakan bekas helaian tugasan ini untuk menyimpan kertas kerja dan helaian tugasan-tugasan mereka. Walaubagaimanapun, masih terdapat sesetengah perkara yang tidak dapat ditangani oleh bekas helain tugasan yang berada di pasaran sekarang, contohnya, tidak dapat menyimpan helaian kertas dengan kuantiti yang banyak, helaian kertas yang disimpan di dalamnya terdedah, helaian kertas berterbangan di udara, hanya boleh menyimpan helaian kertas dan tidak sesuai untuk menyimpan peralatan menulis, dan sebagainya. Kerana itulah kita memerlukan bekas helaian tugasan dengan konsep yang baru. Ciri utama pada bekas helaian tugasan di dalam projek ini adalah kebolehannya untuk bertukar-tukar menjadi satu tingkat dan dua tingkat. Terhasilnya idea ini adalah daripada kekurangan fungsi yang terdapat pada bekas helaian tugasan yang sedia ada sekarang. Tujuan bekas helaian tugasan ini direka adalah untuk memastikan keselamatan dokumen dan helaian tugasan yang disimpan di dalamnya sentiasa terjamin. Laci diletakkan sebagai ciri tambahan untuk mendapatkan ruang yang lebih untuk menyimpan peralatan-peralatan lain. Terdapat beberapa langkah yang terlibat sepanjang kerja-kerja mereka dan membuat bekas helaian tugasan ini. Ciri-ciri dan bentuk yang menarik telah direka untuk mendapatkan hasil yang baik dan kelihatan moden. Beberapa aspek perlu diberi perhatian yang sepenuhnya bagi memastikan projek ini berjalan seiring dengan rancangan awal dan siap dalam masa yang sepatutnya.

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CHAPTER 1

INTRODUCTION

1.1 Project Synopsis

This project title is Design and Fabrication of the Assignment Tray. The project's prerequisites are types of material, strength of material, skills of design a product, skills of using CNC machine and cost of fabricate a product. With the newly designed and fabricated assignment tray, simple tests (which is load with some weight was placed on this product) are required to be conducted to verify the design. Overall, this project will acquire the skills of design, analysis, fabrication and testing.

1.2 Project Problem Statement

As a student, an assignment tray is needed to keep their assignment safely. However, there are some things that can't solve by existing assignment tray. For example, there is a limited function of existing assignment tray, such as can't store the writing equipments. Existing assignment tray also has been defined to be difficult in taking out the assignment sheet from it. Another problem is cover not provided in existing assignment tray that might flow away the paper.

1.3 Project Scope

The scope of the project is limited to the below parameter and material:

i. Material
   - Galvanized Iron (Sheet Metal 1.5mm thickness)

ii. Sketching and Drawing
   - Solid Work software
   - AutoCAD software

iii. Fabrication
   - CNC Turret Punch Machine
   - Bending Machine
   - MIG Welding

1.4 Project Objective

i. To design a new concept of assignment tray which will ensure the document is being kept securely.

ii. To produce an assignment tray with expandable cover on the top of the part.

iii. To design and invent an assignment tray with more space for other items to be placed.

1.5 Project Planning

This project started with made a research and literature review via internet, books, supervisor, and others relevant academic material related to the project title,

this literature review takes about a week. The reviews not stop there. It continues along the way of this project because knowledge is so many to learn.

At the same week I do some schedule management for this project which included schedule management. This is done using Microsoft Office Word using Gantt chart system. This also takes a week to accomplish.

Also in the same week, this project was started to sketch the hand free drawing for the project design. At the beginning, 6 concept of design were sketched for this project, and from this 6 concept, the best one was chosen to be fabricated. After the design that wants to fabricate was chosen, drawing process using AutoCAD and SolidWork software were started.

The next task is preparation of mid-presentation and progress report writing, both of these tasks takes one more week to be done. After that, comes the mid-presentation week and progress report submission. On this particular week commitment was more on the speech preparation for the presentation and double checked the report that has to be submitted.

The next week, drawing from AutoCAD format was converted into ToPs 300 format, software that used in Turret Punch Machine. By using this software, programming code was generated from the origin drawing. This code was saved in (*.lst) format and then read by Computer Numerical Control (CNC) Turret Punch Machine. After the process done, this project was reaching the fabrication process. The fabrication process involved in this project was punching process using turret punch machine, bending process using banding machine, joining process using MIG welding.

Next task is the final report writing and final presentation preparation. This take about one week to accomplished. The report is guided by UMP Thesis writing guided and also the guidance of my supervisor. All the task is scheduled to take about fourteen weeks overall.

1.6 Project Schedule

Table 1.1: Gantt chart for project schedule

PROJECT ACTIVITIES	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
Literature Review														
Design, Sketching, Measurement														
Draw use Solid Work & AutoCAD														
Convert drawing into CNC Format														
Material Preparation														
Mid – Presentation														
Fabrication														
Evaluation & Improvement														
Report Writing														
Final Check Report & Submit														
Final Presentation														

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A tray is a shallow platform designed for carrying things. It is larger than a salver, a diminutive version commonly used for lighter and smaller servings, and it can be fashioned from numerous materials, including silver, brass, sheet iron, wood, and melamine. Some examples have raised galleries, handles, and short feet for support.

Trays are flat, but with raised edges to stop things from sliding off of them. They are made in a range of shapes but are commonly found in oval or rectangular forms, sometimes with cutout or attached handles with which to carry them.

This project was given title 'Design and Fabrication of the Assignment Tray'. This project involve designing and fabricating an assignment box that entirely different from existing assignment box in market. Basically, this project will have 4 stages:

i. Article review, researching and gathering information
ii. Design, sketching by hand, and draw using computer software
iii. Produce the selected product, using machining process
iv. Writing the project report (Thesis)

2.2 Material – Sheet Metal (Galvanized Iron)

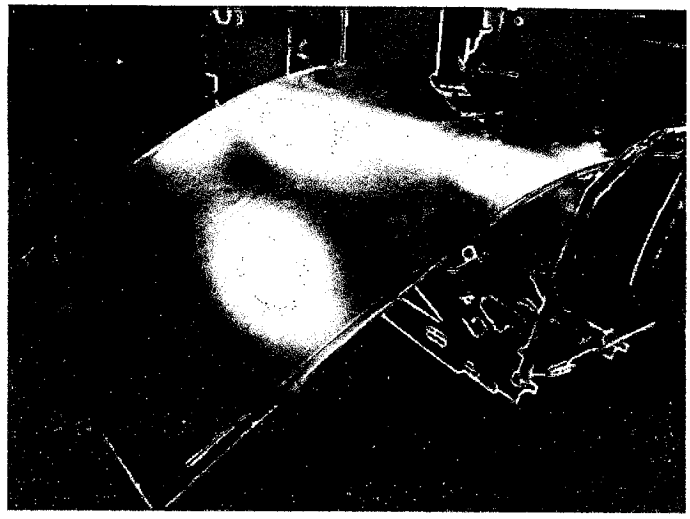

Figure 2.1: Sheet metal

2.2.1 Introduction to Sheet Metal

Sheet Metal is simply metal formed into thin and flat pieces. It is one of the fundamental forms used in metalworking, and can be cut and bend into a variety of different shapes. Thicknesses can vary significantly, although extremely thin pieces of sheet metal would be considered to be foil or leaf, and pieces thicker than ¼ inch or a centimeter can be considered plate [2].

Sheet metal is generally produced in sheet less than 6mm by reducing the thickness of a long work piece by compressive forces applied through a set of rolls. This process is known as rolling and began around 1500 A.D. Sheet metals are available as flat pieces or as strip in coils. It is characterized by its thickness or gauge of the metal. The gauge of sheet metal ranges from 30 gauge to about 8 gauge. The higher the gauge, the thinner the metal is. There are many different metals that can be made into sheet metal. Aluminum, brass, copper, cold rolled steel, mild steel, tin, nickel and titanium are just a few examples of metal that can be made into sheet

metal. Sheet metal has applications in car bodies, airplane wings, medical tables, roof for building and many other things [2].

Sheet metals are usually formed in rolling mills from large ingots of metal (large blocks formed by casting). The metal is run through a series of rollers which squeeze the metal thinner and thinner until it is the desired thickness. Sheet metals are widely used in the industry because they are easily shaped by cold working methods such as punching, shearing, bending, forming, and folding [2].

The thickness of a metal sheet is referred to as gauge. It is designated by a series of numbers which represent a decimal part of an inch. Gauge also refers to the tool used to determine the thickness of sheet metal. The gauge is marked with numbers which are opposite a series of slots. The measurement is taken by sliding the edge of the sheet metal into the various slots until the smallest slot it will fit in is reached [2].

2.2.2 Process of Sheet Metal

The main feature of sheet metal is its ability to be formed and shaped by a variety of processes. Each process does something different to the metal giving it a different shape or size [2].

2.2.2.1 Stretching

Stretching is a process where sheet metal is clamped around its edges and stretched over a die or form block. This process is mainly used for the manufacture of aircraft wings, automotive door and window panels [2].

2.2.2.2 Drawing

Drawing forms sheet metal into cylindrical or box shaped parts by using a punch which presses the blank into a die cavity. Drawing process can also be utilized to create arbitrary shapes with the help of soft punch.

2.2.2.3 Deep Drawing

Deep Drawing is a type of drawing process where the depth of the part is more than half its diameter. Deep drawing is used for making automotive fuel tanks, kitchen sinks, 2 piece aluminum cans, etc. Deep drawing is generally done in multiple steps called draw reductions. The greater the depth, the increased number of reductions required. Deep drawing may also be accomplished with fewer reductions by heating the work piece, used in sink manufacture for example.

In many cases, special material that has been rolled at the steel mill in both directions can aid in the deep drawing process. Material that has been rolled in both directions has a more uniform grain structure and is referred to as "draw quality" material. Draw quality material will often improve deep drawing (limiting tearing).

2.2.2.4 Cutting

Cutting sheet metal can be done in various ways from hand tools called tin snips up to very large powered shears. With the advances in technology, sheet metal cutting has turned to computers for precise cutting.

2.2.2.5 Bending and Flanging

Bending and flanging imparts stiffness to a sheet metal part or to form various shapes, such as 3 piece aluminum cans just form something in a form of a pipe.

2.2.2.6 Punching and Shearing

During punching or shearing, the sheet metal is cut by using a punch and die. This process can allow many different shapes and patterns, by a computer numerically controlled (CNC) punch machine.

2.2.2.7 Spinning

Spinning is used to make axis-symmetric parts by applying a work piece to a rotating mandrel with the help of rollers or rigid tools. Spinning is used to make rocket motor casings and missile nose cones and satellite dishes for example.

2.2.2.8 Press Brake Forming

This is a form of bending, used for long and thin sheet metal parts. The machine that bends the metal is called a press brake. The lower part of the press contains a V shaped groove. This is called the die. The upper part of the press contains a punch that will press the sheet metal down into the v shaped die, causing it to bend.

2.2.3 Galvanization

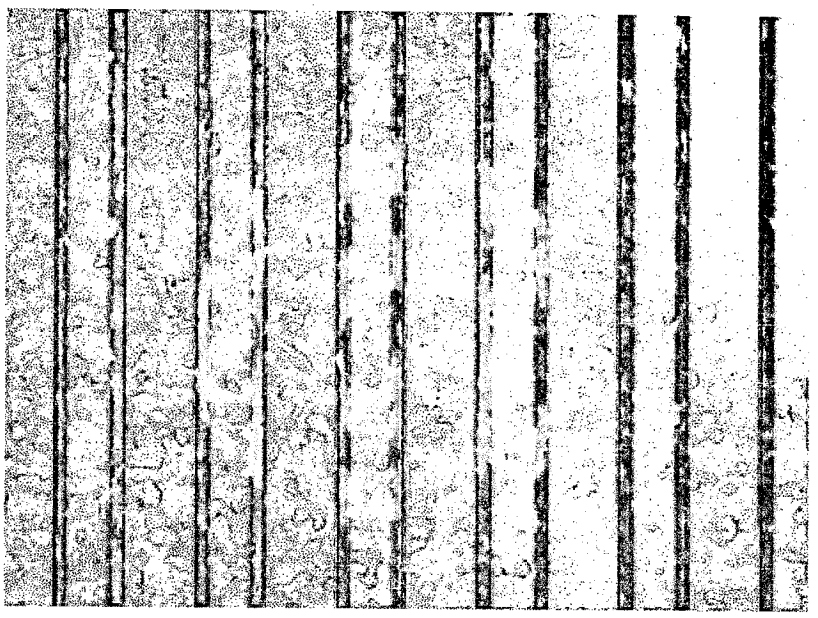

Figure 2.2: Galvanized iron sheet metal

2.2.3.1 History of Galvanization

Galvanization or galvanisation refers to any of several electrochemical processes named after the Italian scientist Luigi Galvani. Originally, galvanization was the administration of electric shocks (in the 19th century also termed Faradism, after Michael Faraday). It stemmed from Galvani's induction of twitches in severed frogs' legs, by his accidental generation of electricity. This archaic sense is the origin of the meaning of galvanic when meaning 'affected/affecting', as if by a shock of electricity; startled. It is claims to health benefits have largely been disproved, except for some limited uses in psychiatry in the form of electroconvulsive therapy (ECT). Later the word was used for processes of electrodeposition. This remains a useful and broadly applied technology, but the term "galvanization" has largely come to be associated with zinc coatings, to the exclusion of other metals [1].

In current use, it typically means hot-dip galvanizing, a metallurgical process that is used to coat steel or iron with zinc. This is done to prevent corrosion (specifically rusting) of the ferrous item; while it is accomplished by non-electrochemical means, it serves an electrochemical purpose [1].

Hot-dip galvanized steel has been effectively used for more than 150 years. The value of hot-dip galvanizing stems from the relative corrosion resistance of zinc, which, under most service conditions, is considerably better than iron and steel. In addition to forming a physical barrier against corrosion, zinc, applied as a hot-dip galvanized coating, cathodically protects exposed steel. Furthermore, galvanizing for protection of iron and steel is favored because of its low cost, the ease of application, and the extended maintenance-free service that it provides [1].

2.2.3.2 Zink Coating

Zinc coatings prevent corrosion of the protected metal by forming a physical barrier and by acting as a sacrificial anode if this barrier is damaged. When exposed to the atmosphere, zinc reacts with oxygen to form zinc oxide, which further reacts with water molecules in the air to form zinc hydroxide. Finally zinc hydroxide reacts with carbon dioxide in the atmosphere to yield a thin, impermeable, tenacious and quite insoluble dull gray layer of zinc carbonate which adheres extremely well to the underlying zinc, so protecting it from further corrosion, in a way similar to the protection afforded to aluminums and stainless steels by their oxide layers [3].

Hot dip galvanizing deposits a thick, robust layer that may be more than is necessary for the protection of the underlying metal in some applications. This is the case in automobile bodies, where additional rust proofing paint will be applied. Here, a thinner form of galvanizing is applied by electroplating, called "electrogalvanization". However, the protection this process provides is insufficient for products that will be constantly exposed to corrosive materials such as salt water. Nevertheless, most nails made today are electro-galvanized [3].

Galvanic protection (also known as sacrificial-anode or cathodes protection) can be achieved by connecting zinc both electronically (often by direct bonding to the protected metal) and ionically (by submerging both into the same body of electrolyte, such as a drop of rain). In such a configuration the zinc is absorbed into the electrolyte in preference to the metal that it protects, and maintains that metal's structure by inducing an electric current. In the usual example, ingots of zinc are used to protect a boat's hull and propellers, with the ocean as the common electrolyte [3].

As noted previously, both mechanisms are often at work in practical applications. For example, the traditional measure of a coating's effectiveness is resistance to a salt spray. Thin coatings cannot remain intact indefinitely when subject to surface abrasion, and the galvanic protection offered by zinc can be sharply contrasted to more noble metals. As an example, a scratched or incomplete coating of chromium actually exacerbates corrosion of the underlying steel, since it is less electrochemically active than the substrate [3].

The size of crystallites in galvanized coatings is an aesthetic feature, known as spangle. By varying the number of particles added for heterogeneous nucleation and the rate of cooling in a hot-dip process, the spangle can be adjusted from an apparently uniform surface (crystallites too small to see with the naked eye) to grains several centimeters wide. Visible crystallites are rare in other engineering materials. Protective coatings for steel constitute the largest use of zinc and rely upon the galvanic or sacrificial property of zinc relative to steel [3].

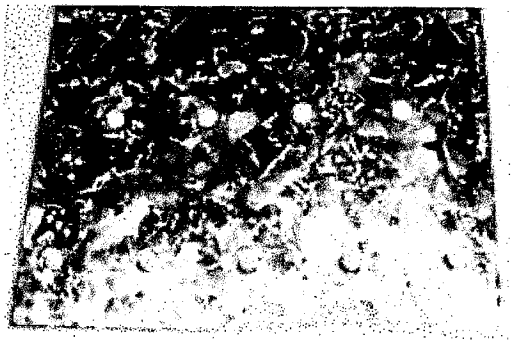

Figure 2.3: Zink coating (Galvanization)

2.3 Punching Process

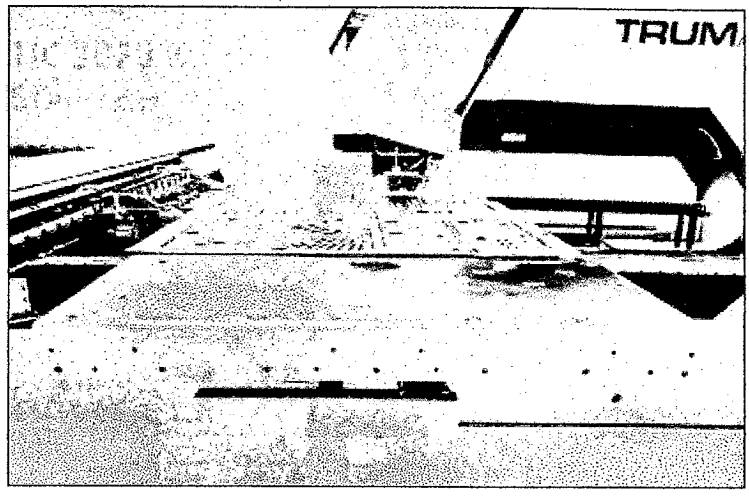

Figure 2.4: Punching process

2.3.1 Introduction

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 [5].

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.