DESIGN AND FABRICATION OF STATIONERY RACK

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ABSTRACT

Development of this stationery rack is for stationeries such as pen, pencil and ruler on the table. With more stationeries case, this rack can store numbers of stationeries and easy to find. This stationery rack is made from mild steel sheet metal. It has rotating boxes which is use as place to store stationeries. This rack will help to store stationeries in place and easy to take stationeries from it.

Whole of this project is particular involves the stationery rack. Diploma final year project will allocate one semester to complete the 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 stationery rack.

ABSTRAK

Penghasilan rak alat tulis ini adalah untuk digunakan sebagai tempat meyimpan alatan tulis seperti pen, pensil dan pembaris di atas meja. Dengan tempat menyimpan yang banyak, rak ini dapat menyimpan banyak alat tulis dan mudah dicari. Rak alat tulis ini dibuat dari kepingan besi dan karbon lembut. Rak ini juga mempunyai rak yang boleh diputar yang dijadikan sebagai tempat menyimpan alat tulis. Rak ini membantu menyimpan alat tulis dan memudahkan untuk mencari alat tulis.

Kesuluruhan projek ini adalah melibatkan mereka bentuk yang sesuai bagi rak alat tulis. Projek tahun akhir bagi diploma ini mempunyai tempoh satu semester untuk disiapkan. Projek ini juga memerlukan pelajar untuk menyiapkannya tugasan yang diberi. Di dalam projek ini, pembahagian tugasan diperlukan. Secara kesuluruhannya, projek ini dipecahkan kepada dua bahagian iaitu proses menyediakan bahagian-bahagian rak dan mencantumkan rak itu.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Project Synopsis

My project title is Design and Fabrication of Stationery Rack. The project involves small analysis of the Stationery Rack requirement and fabrication of the rack itself with concerns regarding strength, durability and ergonomic factor. New concept of stationery rack is required to improve its durability and functions. Overall, the project will meet acquire skills of design, analysis, and fabrication.

The concept of the stationery rack is to help user to store their stationeries in place. Thus, with the fabrication of stationery rack, it is hope that it can contribute to help them to store stationeries at exact places.

1.2 Problem Statement

The common problems that student faces with stationeries;

i. Mostly students put their stationeries anywhere they want.
ii. Since there is no specific place to store stationeries.

iii. Their stationeries cannot be found and lost.
iv. Stationeries mix with other items.

1.3 Project Scopes

The scope of the project as limited to the below parameter, equipments and materials;

i. Software that has been used to design the stationery rack is solidwork and autoCAD.
ii. Fabrication process will use all necessary manufacturing method including cutting, bending and welding.
iii. Material that has been used to fabricate this stationery rack are sheet metals and bearing.

1.4 Project Objective

There are two objective of this project;

i. Design a stationery rack that will help people to store their stationeries.
ii. Fabricate a stationery rack that is easy to handle and much better.

1.5 Project Planning

According to the gantt chart from figure below, this project start with briefing about the flow of the project from start till the end and followed by collecting literature review. These include research about project title and gathering raw data from internet, book and other source. The planning process is from week 1 until a week 5.

After that, this project continued with design and measurement process from week 3 to week 6. This includes sketching the design until the final design is chosen. The design then transfer to solidwork software to create 3D look of the design. This includes the actual dimension to fabricate the product.

From week 5 to week 8, material those needs to be use is search and gather. Each raw material will be cut into dimension before the fabrication process.

Methodology study about manufacturing process from start of project until finish fabrication is done by week 4 to week 7. It includes study on how to control machines and which machine is suitable to use.

Fabrication process starts from week 7 to week 10. In this period of time, raw material will undergo manufacturing process until the product is finish.

Evaluation stage has been implemented after fabrication stage. The evaluation counted by considering the strength, durability, safety, and workability factors of the rack. During the evaluation, if problem occur such as not functioning, modification will be done.

After the product is finish, report writing need to be complete before the period of time. The report start from planning of the project until the design is complete.

Finally, preparation slide for final presentation and show the project that produce.

Table 1.1: Gantt chart

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															

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Stationery rack basically used as a place to store stationeries. It will help to store stationeries in proper place and easy to find. Stationeries that usually use in daily include pencil, pen, ruler, rubber, staplers and paper clips. This is the basic meaning of stationeries rack and its function.

A stationery rack consists of 2 major parts. The parts are base and storage box or cases. The base is the bottom part of a stationery rack. It is used as the place to put the storage box or cases.

Most of stationery rack is put on the desk. Therefore, the design and size are really important and must be consider as the factors to create it. Too much space will limit the usage of a table. Stationery rack also used as something that could be made as decoration on the table.

2.2 Stationery Rack and Description

Study about stationery rack show that this product already exists in the market. However, based on the design, it only focused on it function to keep stationeries. Below are examples of the product that can be seen in the market;

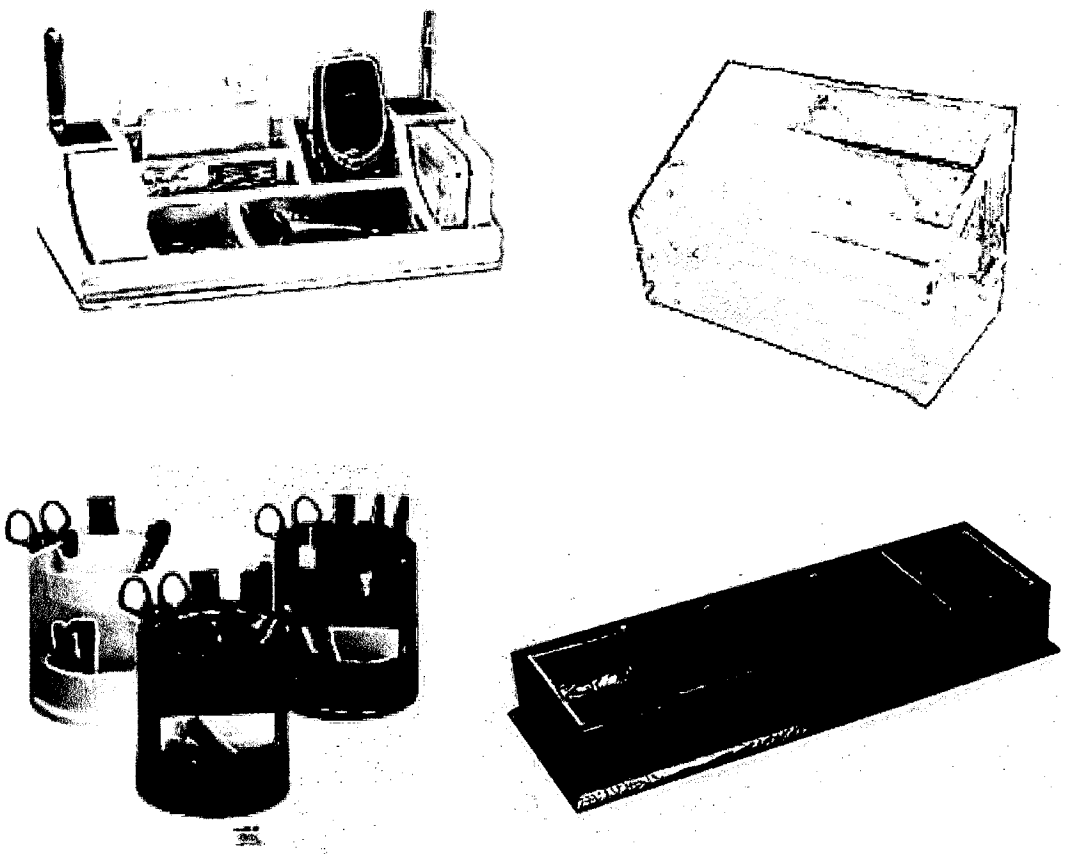

Figure 2.1: Typical stationery rack in the market

2.3 Manufacturing Method

Manufacturing method that is use to fabricate the product include punching process by using Turret Punch Machine. This process is to cut sheet metal into desired shape. Bending process using Bending Machine. This process is to bend sheet metal to part before joining process. Lastly joining process by using Metal Inert Gas (MIG).

2.4 Turret Punch Machine

In line with industry trends, producing quality parts, lowering costs and better scheduling of production to meet customer demands. At HSM Engineering we provide many such solutions. The Plasma/ Punch shop is equipped with the technological solutions to cater for this high productivity environment.

Boasting state of the art equipment such as the Turret Punch Press, designed for fast operator set-up and cycle times. With 58 tool stations 4 of which are indexible (with an accuracy of 0.01 degrees). A series of tool configurations can be set-up on the turret and only removed for maintenance, thus set-up time is drastically reduced. The machine equipped with a Fanuc 18PC Multi-Axis CNC Control, which is used to motion the carriage and table in the X, Y direction as well as T (tool selection) and C (tool rotation). With feed-rate, ram speed and ram position controls this machine can process jobs at a faster rate than others would take to set-up tooling alone. Using the PHNC (Power Hydraulic Numerical Control) feature to set depths of the form required can control specialised forming actions. Hence a single tool can be set-up to perform several different tasks using this feature. The high-speed brush type table has reduced noise levels and back scratch of sheets. This is just another feature, which will ensure the quality of component produced for this demanding global community in which we live.

The Turret Punch Press has a 30 tonne press capacity, can handle a sheet size of 1270mm x 4000mm with one reposition to a maximum of 3.2mm gauge material. A hit rate of 360 hits per minute based on a 3mm stroke @ 25.4mm pitch or 290 hits per minute based on an 8mm stroke @25.4mm pitch. This speed can be achieved while still maintaining a high level of accuracy 0.1mm.

The world renowned software, JetCAM being the package software used to program for this machine is able to interact with various CAD (Computer Aided Draughting)/ CAM (Computer Aided Manufacture) software packages. The flexibility of this software allows for geometric files produced in a DXF or IGES format to be imported, edited, tooled and output in a GCD format to the machine. This allows maximum production time for the machine to run, while other components are being programmed. A variety of material types and gauges can be processed, thus expanding its compatibility throughout many industries.

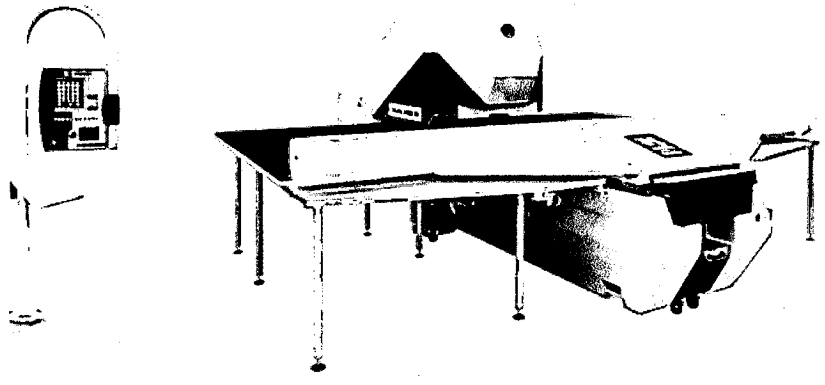

Figure 2.2: Turret punch machine

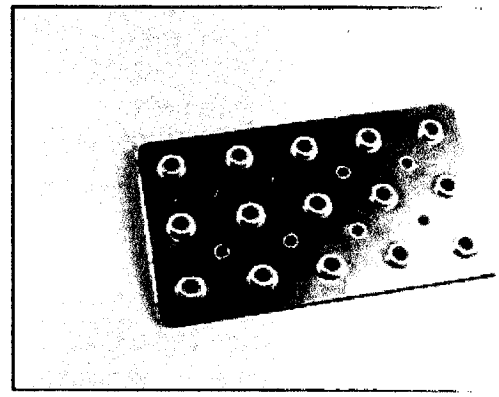

Figure 2.3: Example of punching product

2.5 Bending Machine

Press brakes and bending machines are used to bend and fold metal by pressing it into a die. There are several types of press brakes and bending machines. Examples include a hydraulic press brake, folding equipment, bending machine, press brake tooling, CNC brake press, and a sheet metal press brake. A hydraulic press brake is designed for both specialized sheet metal work and continuous production applications. A hydraulic press brake is designed to handle tough industrial production jobs from single-cycle operations to automated cell components. Folding equipment can be used to stiffen new metal panels that would otherwise flap around, and to put lips on pieces of sheet that would normally need screws passed through the front face. A bending machine forms angles in sheet metal. Press brake tooling is used in cold-forming metal sheets or strips into desired sections. A CNC brake press is a computer numerically controlled, fully automated brake press with extensive bending capacity and networking function. A sheet metal press brake is used to bend.

i. CNC Bending

Metal bending forms angles in sheet metal. A workpiece is positioned over a die block and formed by the punch as it is forced into the die cavity.

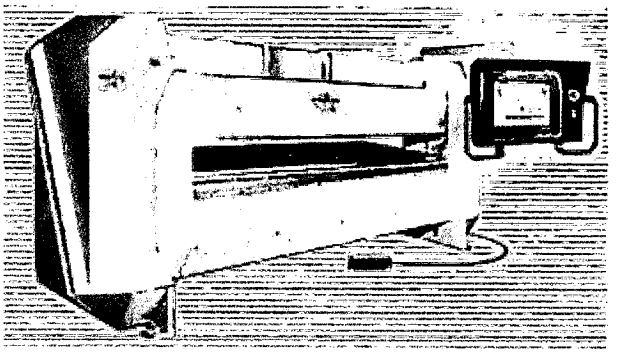

Figure 2.4: CNC bending machine

ii. Bending Design Guidelines;

- The minimum inner radius recommended is approximately one material thickness for most materials.
- The minimum flange width should be at least 4 times the material thickness plus the bending radius.
- Holes or slots should be located a minimum of 3 stock thickness plus the bend radius. If it is necessary to have holes closer, then the hole or slot should be extended beyond the bend line.

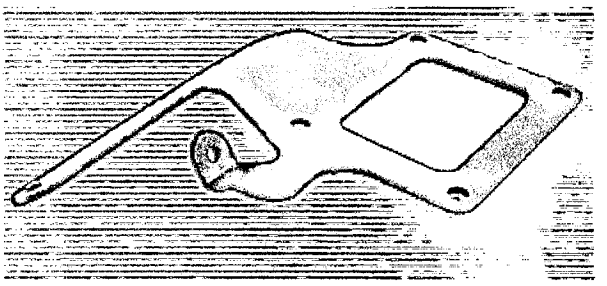

Figure 2.5: Example of bending product

iii. Specification for CNC Bending;

- Material - most ductile metals.
- Alternative machines - none.
- Tooling - CNC Bending requires only software program tooling. Intricate designs may require custom tooling to shape your part.
- Reducing costs - reduce the number of bends used in your design. Design parts to pack efficiently. For example, in designing a large box consider making the sides of the box separate with bolted flanges. Avoid complex bend combinations. You can avoid the cost of bending by adding slots in place of the bends. You can then bend the part manually. This lowers cost further because items are flat and take less shipping volume. Such parts also take less storage space.

2.6 Welding Process

i. Basic Theory of Metal Inert Gas(MIG) Welding

This stationery rack will be joined by using the permanent joint which is welding process. The method joining that be able to fabricate and assembled the part is Metal Inert Gas (MIG) Welding.

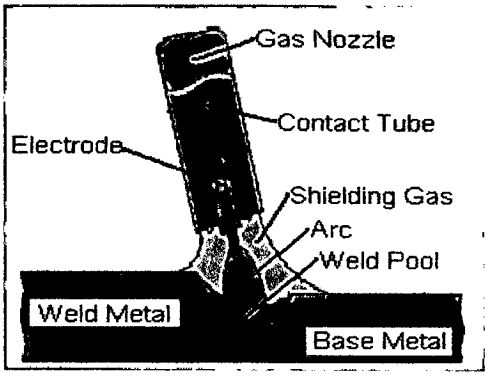

Figure 2.6: Basic structure of Metal Inert Gas (MIG) welding.

ii. 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.

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.