DESIGN AND FABRICATE A NEW CONCEPT RECYCLE BIN FOR GENERAL PURPOSE

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A report submitted in partial fulfilment of the requirements
For the award of the
Diploma of Mechanical Engineering

Faculty of Mechanical Engineering
UNIVERSITI MALAYSIA PAHANG

NOVEMBER 2008
SUPERVISOR DECLARATION

I hereby declare that I have checked this project report and in my opinion this project is satisfactory in terms of scope and quality for the award of Diploma in Mechanical Engineering.

Signature : ……………………………
Supervisor : HAZAMI BIN CHE HUSSAIN
Date : NOVEMBER 2008
DECLARATION

I declare that this report entitled “Design Fabricate a New Concept Recycle Bin for General Purpose” is the results of my own work and research. The report has not been accepted for any degree and is not concurrently submitted for award of other degree.

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ACKNOWLEDGEMENT

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I would like to thank all the staff in mechanical laboratory for their precious comments, sharing ideas, and knowledge during this project being carried out. I also want to acknowledge the assistance of everybody, especially students from Diploma of Mechanical Engineering, for spending their time in helping me share and solve the problem during my hard time in fabricating the project and finishing the report for this final year project. Finally, I would like to thank and express my gratitude for my family for their continuous support and confidence in my efforts.
ABSTRACT

This project is about designing and fabricating the recycle bin that can store rubbish such as can, glass and paper. To design and fabricated this recycle bin, it must be compare with other product that available in the market. First, get an idea from internet, magazine, newspaper or other from available data. Form there the information and idea to design and fabricated can be created.

Whole project involves various methods such as collecting data, concept design and fabrication process. The whole project involved various method and process that usually use in engineering such as concept design, analysis process and lastly fabrication process. Overall from this project, time management and discipline is important to make sure this project goes smooth as plan and done at correct time.
ABSTRAK

Projek ini adalah mengenai merekacipta dan membuat bakul sampah kitar semula yang boleh menyimpan sampah seperti tin, kaca dan kertas. Untuk merekabentuk dan membuat bakul sampah kitar semula, ia hendaklah dibandingkan dengan produk lain yang mungkin berada dalam pasaran. Langkah pertama, dapatkan maklumat daripada internet, majalah, suratkhabar atau daripada sumber yang lain. Daripada sumber tersebut, proses merekacipta dan membina bakul sampah akan dapat dihasilkan.

Keseluruhan projek melibatkan pelbagai cara atau kaedah seperti mengumpulan data, rekabentuk konsep dan proses membina. Kaedah yang selalu yang digunakan dalam kejuruteraan seperti proses analisis juga digunakan. Secara keseluruhan daripada projek ini, pengurusan masa dan disiplin adalah penting dalam memastikan projek berjalan lancar dan siap tepat pada waktunya.
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CHAPTER 1

INTRODUCTION

1.1 Project Synopsis

The purpose of the project is to design and fabricate a new concept recycle bin for general purpose to fulfill the requirement for home and office. This recycle bin would be different from another recycle bin that have in market. In this study, the new concept of recycle bin will be designed and fabricate and ensure these recycle comply with customer needs. As the Diploma final year project allocates the duration of 1 semester, this project is need skills to handle several machines such as punch machine, bending machine, MIG, drilling and grinder.

Title of this project is “Design and fabricate a new concept Recycle Bin for general purpose”. This project involves the fabrication of recycle bin with a specification regarding strength, material and cost. With the newly designed and fabricated this recycle bin, tests are required to be conducted and to verify the design. Overall, this project will acquire the skill of design and fabrication.
1.2 Problem Statement

The problems are common as below and faces by housewife and officer. The figure is showed in Figure 1.1:

![Figure 1.1: Current recycle bin](image1)

- No specific and systematic to store rubbish.
- Fly come closely to the rubbish because the rubbish is not covered.
- The rubbish not covered and look so disgust.
1.3 Project Scope of Work

- To develop the concept selection of a recycle bin.
- This recycle bin has two drawers and two barrels that have a 55,440 m$^3$ volume space for rubbish.
- To make the recycle bin uses a material such as rectangular hollow steel bar and zinc sheet metal.
- The process will use bending, punching, and joining like welding (MIG) and rivet and cutting.

1.4 Project Objective

The objectives of this project are to design and fabricate a new concept recycle bin for general purpose which it can give more better or systematic storage to store rubbish than other recycle bins in the market and the concept is applicable to use in the kitchen or office. The objective also to make an environment friendly recycle bin and design the product based on customer need.

1.5 Planning Project

According to the Gantt chart in Table 1.1, the project started by briefing by lecturer about PTA and include chooses the title of the project. After got the title at week 2, project briefing started followed by collecting literature review. These include gathering raw data via internet, book and other source. The planning process for literature review is from week 2 until week 3.
After that, this project was continued with make a research and sketch from week 3 until week 5. This is started with sketching 3 types of recycle bin and then identifies the best product from analysis. The finalized concept is includes detail drawing. So the design of recycle bin that was chosen using solidwork software with actual dimension.

After identifies finalized concept, finding a raw material to fabricate was started. Materials to be used must be suitable and easy to get. The specification when choosing a material is includes strength, durability and light. This is important for fabrication process.

The fabrication was started after finish finding a raw material and cutting the material. According the Gantt chart, the fabrication process is from week 6 until week 12. After finish the fabrication, we get the result and also do the discussion or conclusion.

Next task is the final presentation preparation and report writing. The report writing occurs during the finalized concept and fabrication. (from week 5 until week 13). Then, for week 14 i must present my project and submit report writing.
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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will show the recycle bin in market as the comparison and about fabrication process such as punching, bending, welding, drilling that use in making recycle bin.

Recycling has been a common practice for most of human history, with recorded advocates as far back as Plato in 400 BC. Recycle bins exist in various sizes for use in homes, offices, and large public facilities. Separate containers are often provided for paper, tin or aluminum cans, and glass or plastic bottles.

2.2 Comparison of Current Design

In this project, 3 current designs from market are selected to make a comparison. This comparison is specific to recycle bin function of way to storage the rubbish, material use, and design shape.
2.2.1 Suncast Recycle Bin Kit BH183PK

Figure 2.1: Suncast Recycle Bin Kit BH183PK

i. Advantage
   - Easy to move / Lightweight
   - Can be size of height
   - Have 3 barrel to storage more rubbish

ii. Disadvantage
   - Simple design
   - Not stable
   - Open and close up cover by manually

iii. Material use
    - Plastic
2.2.2 SamePaperPlayAgain Paper Recycle Bin

![SamePaperPlayAgain Paper Recycle Bin Image]

**Figure 2.2:** SamePaperPlayAgain Paper Recycle Bin

i. Advantage
   - Small design and do not need big space to locate the recycle bin in home or office
   - Easy to move / Lightweight

ii. Disadvantage
   - Have a small space to storage paper
   - Simple design
   - Not stable
   - Storage for paper only

iii. Material use
   - Plastic
2.2.3  3 in 1 Recycle Bin

![Image of 3 in 1 Recycle Bin]

**Figure 2.3**: 3 in 1 Recycle Bin

i. Advantage
   - Can move easily
   - Can open and close the top cover easily by push the pedal
   - Have 3 barrel to storage different in kind of rubbish

ii. Disadvantage
   - Have a small barrel (Cannot storage much rubbish)
   - Difficult to fabricate

iii. Material use
   - Stainless steel
   - Plastic
2.2.4 Basket Recycle Bin

![Basket Recycle Bin Image]

**Figure 2.4:** Basket recycle bin

i. Advantage
   - Light weight
   - Small (reduce of using space)
   - Simple design

ii. Disadvantage
   - Not covered the rubbish
   - Easily to inverted

iii. Material use
   - Plastic
2.3 Machining process

2.3.1 Turret Punch Machine

Figure 2.5: Turret Punch Machine

Boasting state of the art equipment such as 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 machined 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 rpm position controls this machine can process jobs at a faster rate than others would take to set-up tooling alone.
2.3.2  Bending Machine

![Bending Machine](image)

Figure 2.6: Bending Machine

Press brakes and bending machine 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.
2.3.3 Gas metal arc welding (GMAW)

Figure 2.7: Gas metal arc welding

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. There are four primary methods of metal transfer in GMAW, called globular, short-circuiting, spray, and pulsed-spray, each of which has distinct properties and corresponding advantages and limitations.

Originally developed for welding aluminum and other non-ferrous materials in the 1940s, GMAW was soon applied to steels because it allowed for lower welding time compared to other welding processes. The cost of inert gas limited its use in steels until several years later, when the use of semi-inert gases such as carbon dioxide became common. Further developments during the 1950s and 1960s gave the process more versatility and as a result, it became a highly used industrial process. Today, GMAW is the most common industrial welding process, preferred for its versatility, speed and the relative ease of adapting the process to robotic automation. The automobile industry in particular uses GMAW welding almost exclusively. Unlike welding processes that do
not employ a shielding gas, such as shielded metal arc welding, it is rarely used outdoors or in other areas of air volatility. A related process, flux cored arc welding, often does not utilize a shielding gas, instead employing a hollow electrode wire that is filled with flux on the inside.

### 2.3.4 Drilling

![Figure 2.8: Drill press](image)

A drill press (also known as pedestal drill, pillar drill, or bench drill) is a fixed style of drill that may be mounted on a stand or bolted to the floor or workbench. A drill press consists of a base, column (or pillar), table, spindle (or quill), and drill head, usually driven by an induction motor. The head has a set of handles (usually 3) radiating from a central hub that, when turned, move the spindle and chuck vertically, parallel to the axis of the column. The table can be adjusted vertically and is generally moved by a rack and pinion; however, some older models rely on the operator to lift and reclamp the table in position. The table may also be offset from the spindle's axis and in some cases rotated.
to a position perpendicular to the column. The size of a drill press is typically measured in terms of *swing*. Swing is defined as twice the *throat distance*, which is the distance from the center of the spindle to the closest edge of the pillar. For example, a 16-inch drill press will have an 8-inch throat distance. Speed change is achieved by manually moving a belt across a stepped pulley arrangement. Some drill presses add a third stepped pulley to increase the speed range. Modern drill presses can, however, use a variable-speed motor in conjunction with the stepped-pulley system; a few older drill presses, on the other hand, have a sort of traction-based continuously variable transmission for wide ranges of chuck speeds instead, which can be changed while the machine is running.

### 2.3.5 Shearing

![Shearing](image)

**Figure 2.9: Shearing**

Shearing is a metalworking process which cuts stock without the formation of chips or the use of burning or melting. Strictly speaking, if the cutting blades are straight the process is called shearing; if the cutting blades are curved then they are shearing-
type operations. The most commonly sheared materials are in the form of sheet metal or plates, however rods can also be sheared. Shearing-type operations include: blanking, piercing, roll slitting, and trimming. A punch (or moving blade) is used to push the workpiece against the die (or fixed blade), which is fixed. Usually the clearance between the two is 5 to 10% of the thickness of the material, but dependent on the material. Clearance is defined as the separation between the blades, measured at the point where the cutting action takes place and perpendicular to the direction of blade movement. It affects the finish of the cut (burr) and the machine's power consumption. This causes the material to experience highly localized shear stresses between the punch and die. The material will then fail when the punch as moved 15 to 60% the thickness of the material, because the shear stresses are greater than the shear strength of the material and the remainder of the material is torn. Two distinct sections can be seen on a sheared workpiece, the first part being plastic deformation and the second being fractured. Because of normal inhomogeneities in materials and inconsistencies in clearance between the punch and die, the shearing action does not occur in a uniform manner. The fracture will begin at the weakest point and progress to the next weakest point until the entire workpiece has been sheared; this is what causes the rough edge. The rough edge can be reduced if the workpiece is clamped from the top with a die cushion. Above a certain pressure the fracture zone can be completely eliminated.  

3.1 Introduction

Project methodology is a body of practices, procedures and rules used by those who work in a set of working methods. This chapter will discuss about methods and machining process that will be use to make the recycle bin. All the methods that will be explain in this chapter are very important procedure to ensure it follow the entire project schedule so that it will move smoothly. Effective methods will give clear view on how to do this project. These methods will guidance in so that the project will be finish at the right time as planning.
3.2 Project Flow Diagram

Start

Define Product (Recycle bin)

Data collection

Search how to make recycle bin

Yes

Make an idea

No

Define the product to design

Study the information about recycle bin

Make an idea from information
Figure 3.1: Project flow chart
From the flow chart above, this project was start with define the product title that the product is recycle bin. Then, collect the raw data from via internet, book and other source. After get the data, make a study and make a lot of research about recycle bin. This includes a study about concept of storage the rubbish, process to fabricate, and material to use.

Then the information gathered and the project is continued with the design process. It is important to make a best design for the project. After several design sketched, the best concept have been chosen for finalized recycle bin concept design. The selected design is then transferred to detail drawing by using Solidwork software.

After all the engineering drawing finished, analysis stage has been implemented. The evaluation is by considering the strength, durability, safety and others.

After that, all the data has been gathered and fabrication process will started. The manufacturing processes include in this process are welding, cutting, drilling, bending and others.

Then after all processes that mentioned above is done, all data for report writing are gathered. Preparation for final presentation also being made by finished the slide show. The project ended after the presentation and submission of the report.
3.3 Design

The design and fabrication of recycle bin of storage must be compliance to several aspects. The design consideration must be done carefully so the design can be fabricated and the parts are all functioning. The aspects that must be considered in designing the recycle bin are such as barrel carried strength. The barrel carried needs to have certain strength to ensure that it can load barrel and the rubbish like can and bottle glass. The second thing is material. Usually use the available material is one of aspects that have been considered. The materials used depend on their purpose and their function. Then another factor must be consider is cost. The cost of whole system must be not exceeding from budget and reasonable. It should reduce the cost to the minimum. Besides that the ergonomic factors also need to be considered. The recycle bin must be user friendly and give a pride to people to have it.

3.4 Drawing

The drawings are divided into two categories, which are:

i. Sketching – all the ideas for the recycle bin fabrication are sketched on the paper first to ensure that idea selection is good or not.

ii. CAD software – the selected design or concept sketched is transfer to solid modeling and engineering drawing using Solidworks software.
3.5 Sketching Drawing Selection

From the existing ideas, several sketching had been done to be considered to find the best design as the final ideas, which are:

3.5.1 Concept A

The Figure 3.2 below was showed about the design for concept A. Concept A design is simple design. This concept has a big barrel to store more rubbish. The design of product also makes it easy to store the rubbish. But it when the barrel is full, it very difficult to remove the rubbish inside it. The raw material need to use in this design is stainless steel. This design also has a small dimension that means it does not need a big space to keep it in home or office.

Figure 3.2: Concept A
3.5.2 Concept B

The Figure 3.3 below is showed about the design for concept B. Concept B design is round shape. The raw material need to use in this design is stainless steel. The design concept for this design is simple and has a good looking. The up cover for this design can open and close with push the button at the bottom product. At up cover also have a hole that the function is to make people put the rubbish like paper and can easily without open the top cover. But the disadvantages for this design is, it only have a one barrel that mean the rubbish store in it is mix together. This design also has a small dimension that means it does not need a big space to keep it in home or office.

Figure 3.3: Concept B
3.5.3 Concept C

The Figure 3.4 below is showed about the design for concept C. The raw material need to use in this design is stainless steel. This design concept has a two barrel that mean it has more space to store the rubbish. The concept to store the rubbish in the barrel is needed to pull the barrel carried to make the door opened. This concept also makes it easy to move the rubbish when the barrel is full. Besides that, it also has a drawer that the function is to store the plastic bag for the barrel or can store another thing like hardware tool. But the disadvantage of this concept is it difficult to move it because it doesn’t have the wheels. This design also needs a big space to keep it in home or office because it has a big dimension.

Figure 3.4: Concept C