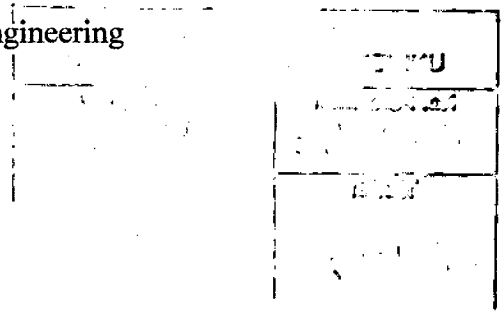


DESIGN AND FABRICATION OF ADJUSTABLE SIDE TABLE

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



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ABSTRACT

This project is about designing and fabricating the adjustable side table. This project involves the process of designing the side table by considering the shape and also the ergonomic factor for people to use. After the design has completed, it was transformed to its real product where the design is used for guideline. In this project, turret punch machine, bending machine, MIG welding machine and drilling machine are being uses. The method used is SolidWork software, AutoCad software and TOP300R software. After all the process had been done, this side table may help us to understand the fabrication and designing process that involved in this project.

ABSTRAK

Projek ini adalah mengenai merekabentuk dan menghasilkan meja sisi boleh laras. Projek ini termasuk proses merekabentuk semula meja sisi dengan mengambil kira aset bentuk dan faktor ergonomic untuk kegunaan manusia. Selepas proses merekabentuk selesai, proses menghasilkan produk dijalankan berdasarkan pada bentuk yang telah direka. Dalam projek ini, mesin menebuk, mesin pembengkokan, mesin penyambungan MIG, dan mesin menggerudi digunakan. Kaedah yang digunakan ialah perisian SolidWork, perisian AutoCad and perisian TOP300R. selepas selesai semua proses, meja sisi ini membantu memahami proses pembuatan dan merekabentuk untuk projek ini.

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CHAPTER 1

INTRODUCTION

1.1 Project Synopsis

The purpose of this project is to design and fabricate an adjustable side table. This side table would be entirely different from existing side table. In this study, we need to create the side table and make sure the side table can adjustable their height with two different height. This project wish to further improve the current design of side table. The current designs of the side table have many disadvantages or limitation and less of function. This project is design to overcome this problem for all used. This project involves the fabrication of the side table with concerns regarding strength and material. Modifications are required to improve the side table designs. The adjustable side table is equipped by using all necessary items and method for instance sheet metal, angle iron, rectangular hollow steel, and round hollow steel. This project is manufacture by turret punch machine, press break machine and MIG welding machine.

1.2 Problem Statement

Usually, the normal side table cannot be adjusting their height. It also difficult to move. Many side table in market are not suitable their material to use in

laboratory. Others side table also difficult to place at any area. Example the circle side table is not suitable to place at corner area. Existing side table also cannot change their shape.

In this project side table that have two different heights has been designed. This side table is suitable to use at two different heights. This side table is manufactured from steel and is portable. This table can change their shape from rectangular to triangle.

1.3 Project Objectives

The objective of this project is to design and fabricate an adjustable side table. The current designs of the side table have many disadvantages or limitation and less of function. This project wish to improve the current design. This project also to add the new feature on the side table.

1.4 Project Scopes

This project will only focus on circle side table that commonly use in laboratory. This side table must be made of high strength material. Material that uses to fabricate this side table is mild steel, cylindrical hollow steel, and rectangular hollow steel. The design of this project must made by SolidWork software.

This side table is manufacture using turret punch machine, press break machine, MIG welding machine and rivet pop. This is an adjustable side table. So, the height of this side table must have two different heights. First height is 350mm and the second height is 670mm. The dimension of this side table is 600mm x 600mm x 350mm and 600mm x 600mm x 670mm.

1.5 Project Planning

According to the Gantt chart from Table 1.1, this project is begun with using literature review via internet, books, supervisor, and others relevant academic material that related to this title, this literature review takes about 3 weeks. The reviews not stop there. It continues along the way of this project because knowledge is so many to learn.

On the week 3, design and sketching process was started .In this task, four designs of adjustable side table are sketched. This task takes time about 2 weeks. From the four design of adjustable side table, a new design is designed to improve the current design. Then, the new design is draw by using solid work software. This task finishes on week 6.

The progress is continues with material preparation. This task about find the suitable and strength material. This progress also involves buy material, measured structure and cutting process. This task takes time about 2 weeks.

The fabrication process is schedule to takes on the next week but because of fabrication process is have a lot of part to fabricate and cutting. The process is scheduled to take about four weeks. Next, this schedule comes with assembly, painting and finishing.

Next task is the thesis writing. This task will start on week 9 until week 14 to accomplish. The report is guided by UMP thesis writing guided and also the guidance of supervisor. Due to all problems we had when doing the project the management has agreed to extend the time to submit the report. All the task is scheduled to take about fourteen weeks overall.

CHAPTER 2

LITERATURE STUDY

2.1 Introduction

Table is a form of furniture composed of a horizontal surface supported by a base, usually four legs. Table specifically intended for working is a desk. Some tables have hinged extensions of the table top called drop leaves, while others can be extended with removable sections called leaves.

Tables come in a wide variety of shapes, height, and materials, depending on their origin, style, and intended use. All tables are composed of a flat surface and a base with one or more supports, or legs.

The basic material used at the early of table fabrication overall source using from wooden. The wooden is still used as the important source for nowadays table fabrication but it was known as plywood which have more toughness and strength compared with usual wood. The other material used in table fabrication such as aluminium, iron, solid rubber and etc. Iron and aluminium usually used as table stands and table frames that make the table more toughness in stacking although applying over load.

2.2 Product Review

2.2.1 STRIND side table

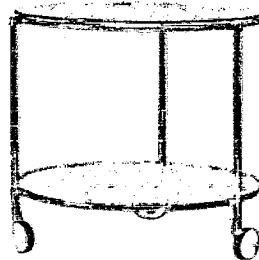


Figure 2.1: STRIND side table [2]

The designer of table shown in Figure 2.1 is Ehlén Johansson. It has Separate shelf for storing magazines and news paper while keeping your things organized and clears table space. This table includes casters so it is easy to move if required. The dimension of this product is 50cm of diameter and 64cm of height. The weight of this product is 15kg.

2.2.2 IKEA PS BÖLSÖ side table

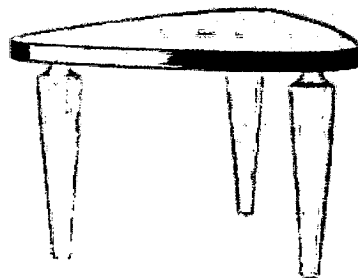


Figure 2.2: IKEA PS BÖLSÖ side table [3]

Figure 2.2 shows an IKEA PS BÖLSÖ side table which is design by Maria Vinka. The new feature of this table is it hollow legs. It can be filled to serve as decoration. This table is made by Recycled PET plastic. The dimension of this product is 51cm x 51cm x 41cm.

2.2.3 KLUBBO side table

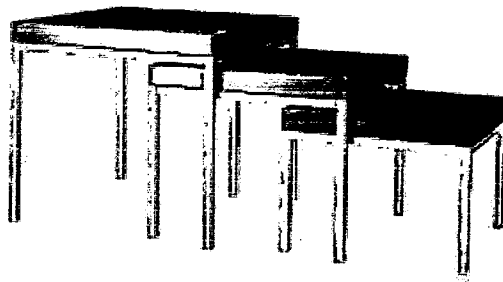


Figure 2.3: KLUBBO side table [4]

The KLUBBO side table shown in Figure 2.3 is design by Annika Grottell. This table can be pushed together to save space. The top table made by particleboard, fibreboard, clear acrylic lacquer, and ash veneer. It legs made by steel. The dimensions of this product are 16 x 16 x 14", 18 x 18 x 17", and 20 x 20 x 20".

2.3 Turret Punch Machine

The Turret Punch Press has a 30 tone press capacity, can handle a sheet size of 1270mm x 4000mm with one reposition to a maximum of 3.2mm gauge material. Tooling for a punch press consists of a punch, die and stripper. The punch is located in a guide mechanism that fits in the turret on a turret punch press. Turrets hold a

variety of tools and index to bring different punch tools into the work zone of the machine.

Each punch tool has a corresponding die that is located under the machine tool worktable. The size and shape of the hole created in the sheet metal is determined by the geometry of the punch. Clearance between the punch and die is adjusted to reflect the material thickness.

When the punch press is actuated, a ram descends, causing the punch to knock out the material creating a slug. The die is designed to allow the slug to fall through. The stripper holds the sheet metal in place until the punch is fully withdrawn from the sheet.

Most sheet metal punch tools used in shops today are self-stripping. Instead of using the ram to push the punch through the material and pull it out, these tools are built with an internal spring that automatically retracts the punch. The ram then only needs to work in one direction. This saves cycle time and wear on the turret punch press.

2.4 Press Break Machine

Bending is a process by which metal can be deformed by plastically deforming the material and changing its shape. The material is stressed beyond the yield strength but below the ultimate tensile strength. The surface area of the material does not change much. Bending usually refers to deformation about one axis. Bending is a flexible process by which many different shapes can be produced. Standard die sets are used to produce a wide variety of shapes.

The material is placed on the die, and positioned in place with stops and/or gages. It is held in place with hold-downs. The upper part of the press, the ram with the appropriately shaped punch descends and forms the v-shaped bend. Bending is done using Press Brakes. Press Brakes normally have a capacity of 20 to 200 tons to

accommodate stock from 1m to 4.5m. Larger and smaller presses are used for specialized applications. Programmable back gages, and multiple die sets available currently can make for a very economical process.

2.5 Gas Metal Arc Welding

Gas Metal Arc Welding is defined as "an electric arc welding process that produces coalescence of metals by heating them with an arc between a continuous filler metal electrode and the workpiece." Shielding is obtained entirely from an externally supplied gas. Gas Metal Arc Welding is also commonly referred to as Metal Inert Gas (MIG), or Metal Active Gas.

Gas Metal Arc Welding is used to weld all the commercially important metals, including steel, aluminium, copper, and stainless steel. The filler metal selection has a chemical composition that is closely matched to the base material being welded. The process can be used to weld in any position, including flat, vertical, horizontal, and overhead. It is usually recommended for use direct current electrode positive polarity. It is an arc welding process which incorporates the automatic feeding of a continuous, consumable electrode that is shielded by an externally supplied gas. Since the equipment provides for automatic control of the arc, the only manual controls required by the welder for semiautomatic operation are the gun positioning, guidance, and travel speed. It is usually easier to learn Gas Metal Arc Welding when compared to other welding processes.

2.6 Blind Rivet

Rivet is a mechanical fastener. Before it is installed it consists of a smooth cylindrical shaft with a head on one end. The end opposite the head is called the buck-tail. On installation the rivet is placed in a pre-drilled hole. Then the tail is

"upset" so that it expands to about 1.5 times the original shaft diameter and holds the rivet in place. To distinguish between the two ends of the rivet, the original head is called the factory head and the deformed end is called the buck-tail.

Blind rivets also known as Pop Rivets are tubular and are supplied with a mandrel through the center. The rivet assembly is inserted into a hole drilled through the parts to be joined and a specially designed tool used to draw the mandrel into the rivet. This expands the blind end of the rivet and the mandrel snaps. This gives the rivets their common name of pop rivet. Blind rivets are often avoided for critical structural joints because they generally have less load carrying capability than solid rivets. Furthermore, because of the mandrel they are more prone to failure from corrosion and vibration. A blind rivet consists of the rivet body and the setting device or the mandrel.

2.7 Drilling Machine

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.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter discussed about process and methods that use to produce the adjustable side table. The process on this project consists from design and sketching until fabrication process. All the process and methods explained in this chapter are very important procedure to ensure the follow of the study move smoothly.

3.2 Project Flow chart

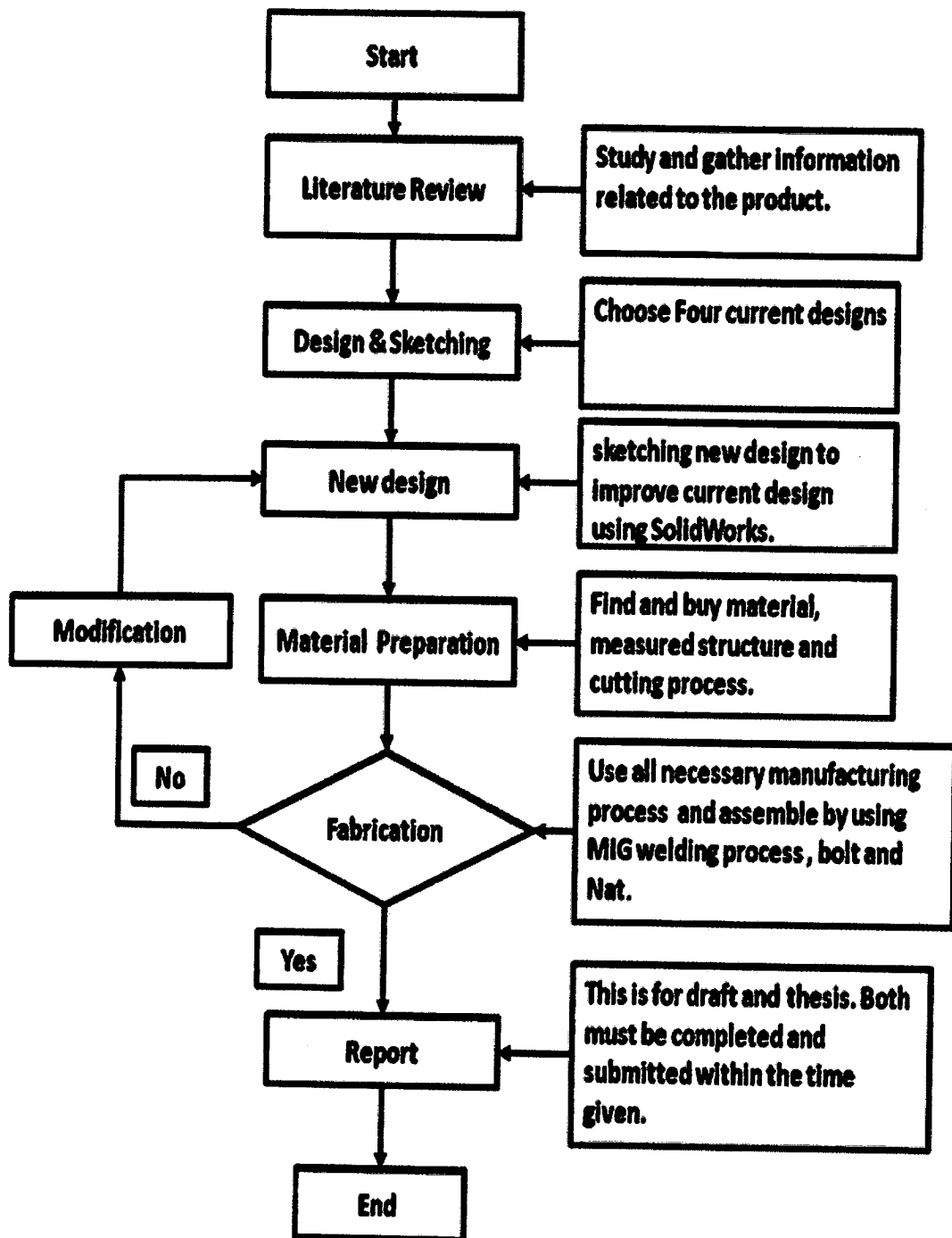


Figure 3.1: Project flow chart

From the flow chart on Figure 3.1, this project started with the literature review about the title. The main important of the project is determination the objective. Then, study and gather information related to the product. These tasks have been done through study on the internet, books and others sources.

After the information has been collect and gather, the project will be continuing with the design process. In this stage, the knowledge and lessons that have studied will be applied in sketching. This process needs four designs. After several design sketched, design consideration have been made and one new design is made to improve the current design. The new design will be transfer to engineering drawing by using SolidWorks software.

After all the engineering drawing finished, the drawing was used as a reference for the next process, which it is fabrication stage. Before the fabrication process start, the preparation of material will need done. That process is find the suitable and strength material. This progress also involves buy material, measured structure and cutting process. After the process material preparation done, fabrication process is start. This process is consists fabricate all the parts that have design before by following the entire dimension. During the fabrication process, if there is something wrong occur such as not balance dimension so the process stop and go back to previous step, check the design back and do the modification.

After all the process mentioned above is done. All the material for report writing is gathered. The report writing process will be guided by the UMP final year project report writing. This process also included the presentation slide making for the final presentation of the project.

3.3 Design and sketching

The Design of the adjustable side table must be compliance to several aspects. The design consideration must be done carefully so the design can be fabricated and the system functioning. The aspect that must be considered in

designing the adjustable side table is this table must have two adjustable different heights. From aspect material, that side table must have suitable strength. The toughness of adjustable side table will be the most important criteria in designing the adjustable side table. The cost of the whole system must not exceeded budget given and must be reasonable. The design cost must also efficient and reduce waste and losses.

3.3.1 Design Selection

The Design is separate into three phases. Firstly choose as many propose design can be produce. Then, choose four designs of it and make a new design to improve that current design. After that, the new design will be detail drawing and the engineering drawing by using SolidWork software.

3.3.2 Propose Design

From many design of the adjustable side table, only four designs have been choose to be considered.