

DESIGN AND FABRICATION OF PORTABLE APRON CLOTHESLINE

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ABSTRAK

Pembuatan adalah proses penukaran daripada bahan mentah kepada sesuatu produk. Ia diklasifikasikan perubahan bahan kepada bahan yang lebih baik yang bermaksud melibatkan satu atau lebih proses penyambungan. Pembelajaran dalam pembuatan penting dalam projek ini untuk pelajar mengetahui sesuatu yang dikehendaki. Projek ini mengenai rekabentuk dan mencipta Ampaian Kimpal Apron Mudah-alih yang berfungsi untuk mengampai apron selepas digunakan. Objektif utama merekabentuk ampaian apron ini adalah sesuai dengan mengaplikasikannya pada kimpal apron di Makmal Fakulti Kejuruteraan Mekanikal. Projek ini melibatkan proses mereka bentuk ampain dengan mengambil kira bentuk, fungsi, kemudahan-alihan, dan kos pembuatan bagi pengguna. Bahan untuk membuat produk ini senang didapati kerana menggunakan besi berongga segiempat-tepat dan besi bulat. Oleh itu proses penyambungan yang sesuai untuk ampaian ini adalah proses kimpalan. Dalam penyambungan roda, proses terbaik adalah menggunakan kaedah pengikat kerana ia melibatkan penggunaan bol dan nat bagi penyambungan roda pada tapak ampaian. Projek ini juga memerlukan analisis bagi memastikan kekuatan produk dan memastikan keselamatan pengguna dipenuhi sebetulnya. Selepas semua proses yang dijalankan siap sepenuhnya, rekabentuk ampaian ini mungkin boleh membantu sesiapa untuk memahami proses penghasilan dan rekabentuk yang berkaitan dalam projek ini.

ABSTRACT

Manufacturing process is a process of converting raw material into product. It can be described the transformation of materials into items of greater value by means of one or more processing and/or assembly operations. The study of manufacturing was very important in order to carry out this project to ensure that student understand on what are needs to do. This project is about designing and fabricating the Portable Apron Clothesline that can be used to hang the welding. The main objective in this project is to design an apron clothesline that is suite to its application special for welding apron in Faculty of Mechanical (FKM) Lab. This project involves the process of designing the clothesline by considering the shape, functionality, portability for people to use it and the manufacturing cost. The material of this design is easy to gain it, because it only using rectangular hollow steel and round steel. So that the method joining that can be compatible in assembled this clothesline is welding process. In assembled the wheel, fastening method is the best chosen because it's only use bolt and nut to bind the wheel with the base of this clothesline. This project also required analysis to ensure the strength and safety of the product meet the user need. After all processes had done, the development of this clothesline may help us to understand the fabrication and designing process involved in this project.

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LIST OF SYMBOLS

Σ	-	Total
\times	-	Multiplication
\emptyset	-	Diameter
<i>mm</i>	-	Milimeter
kg	-	Kilogram
kW	-	Kilowatt
V	-	Voltage
A	-	Ampere
Hz	-	Frequency
W	-	Watt
Rpm	-	Revolution Per Minute

LIST OF ABBREVIATIONS

UMP	-	Universiti Malaysia Pahang
KUKTEM	-	Kolej Universiti Kejuruteraan & Teknologi Malaysia
FKM	-	Fakulti Kejuruteraan Mekanikal
GMAW	-	Gas Metal Arc Welding / Metal Inert Gas
MIG	-	Gas Metal Arc Welding / Metal Inert Gas
CAD	-	Computer Aided Design
Etc	-	As/So on
e.g.	-	Example
3D	-	Three Dimension
PPE	-	Personal Protective Equipment

CHAPTER 1

INTRODUCTION

1.1 Project Synopsis

1.1.1 General Project Synopsis

This project involves designing and fabricating of Portable Apron Clothesline. This clothesline would be entirely different from other existing clothesline. As the Diploma final year project allocates the duration of 1 semester, this large man-hour project therefore requires significant efforts of the students to participate. Basically the entire Portable Apron Clothesline could be divided into 3 stages, which are concept review and development, designing and fabrication.

The Portable Apron Clothesline is equipped by using all necessary items and method for instance rectangular hollow steel, round steel, skills in manufacturing process by perform Metal Inert Gas(MIG) welding to joint the parts and etc. The advantages of the proposed apron clothesline to be developed can be seen in terms of their application which is design to provide facility for student for place of apron after using it.

The process of development is initiated from designing the shape of the clothesline by considering the function as well. In order to produce user friendly product that is suitable to the user, consideration to the ergonomic factor is taken into account. It involves the measurement process before the materials are cut into pieces before joined together by using welding processes.

1.1.2 Specific Project Synopsis

The title of this project is Design and Fabrication of Portable Apron Clothesline. The project involves small analysis of the Apron Clothesline chassis/frame body and fabrication of the clothesline itself with concerns regarding strength, portability, durability, ergonomic factor and convenience. This new design is required to improve its durability and functions. It is require more knowledge and skill of analysis. Skill how to solve problem is the most important and need to be improve when this project launched.

1.2 Problem Statement

This clothesline will primarily can help students especially members of Faculty of Mechanical Engineering to hang the welding apron after using it. The placement of welding apron is not compatible because it located on workbench. After using the welding apron student only folds the apron and so that, the arrangement of the apron is not regulated and scattered. Thus, the development of this clothesline is hope can provide better arrangement of the apron by store it at one place.

1.5 Planning Project

According to the Gantt chart below from (Table 1.0), project briefing started followed by collecting literature review. These include gathering a raw data via internet, book and other sources. The planning process is from week 1 until week 4.

After that, this project was continued with design and measurement process at week 3 and 4. These started with sketching 6 concepts of clothesline and then identify the best product from Pugh's Concept Selection Method table. Next, design the multi-function table that was chosen using SolidWorks software with actual dimension.

Material to be used must be suitable and easy to gain. The specification when choosing a material includes strength, durability and light. This important for fabrication process.

The fabrication was started after finish cutting material. This process consist fabrication to part that has been designed by follow the dimension using various type of manufacturing process. The manufacturing process is determined from a literature review.

Evaluation stage has been implemented after fabrication stage. The evaluation is to consider the strength, durability, safety, and workability of the table. During the evaluation, if problem occur such as crack or forcibly moved, modification will be done.

Next task is the final report writing and final presentation preparation. The report is guided by UMP thesis writing guided and also the guidance from my supervisor. All the task is scheduled to take about fourteen weeks overall.

Table 1.1: Gantt chart (Planning Project)

Scope	Week(s)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Literature Review	Actual	Actual	Actual	Actual											
Design & Measurement consideration		Actual	Actual	Actual											
Acquisition & Material Preparation				Actual	Actual										
Methodology study			Actual	Actual	Actual	Actual									
Fabrication						Actual	Actual	Actual	Actual	Actual	Actual				
Evaluation & Improvement										Actual	Actual				
Report writing					Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual		
Presentation										Actual					Actual



= Planning Progress

= Actual Progress

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The function of the clothesline as a place to hang clothing. An example its use to hang a clothes, pants, apron, blazer, coat and etc. This is a basic description about portable clothesline where the inventive device includes an elongate main housing and a control housing adapted for attachment to a structure [3].

A shaft extends between the top of the main housing and the lower end of the control housing. A portable clothesline consisting of an extendable rope line on a reel that is enclosed within a circular, cream coloured enamelled metal encasing. The use of the clothesline is dependent upon fair weather and as the powered clothes dryer has become more affordable and included in home automation. There is a winding handle on one side of the encasing with a chrome arm and wooden handle that has been painted high gloss green. Two enamelled metal brackets are located on the back of the encasing of each clothesline type [3].

More elaborate rotary washing lines save space and are typically retractable and triangular in shape, with multiple lines being used. These can be folded up when not in use, although there is a hazard of getting fingers caught in the folded up version, so there is usually a safety button involved. So that the clothesline can be in several functions and applications such as portable, expandable and retractable clothesline. The main parts of clothesline are frame/chassis, hanger and base [5].

2.2 Paper Review

2.2.1 Several Types of Clothesline and Description

- i. **Versaline Clothesline** - This clothesline is very unique and innovative design. Its consist of 4 or 6 lines that are fixed between two end brackets. This clothesline can be removed from the wall if necessary and any clothing can be hanged on it [4].
- ii. **Laundry Clothesline** - Laundry clothesline is a portable indoor and outdoor clothesline. All parts of this clothesline are fully assembled. This clothesline is ultra strong and very lightweight [4].
- iii. **Easy Reach Aluminium Portable Clothesline** – Design ideal for camping and caravan. Its can be pack into a carry beg and can be bring anywhere. This is an expandable clothesline where the hanger and the base can be fold up and down [4].
- iv. **Hills Clothesline** - This is a retractable clothesline. Its has huge line space. This design make a range of clothes lines that include retractable clothes line, rotary folding head clothes lines, rotary fixed head clothes lines and a complete range of folding frame clothes lines and washing lines [4].
- v. **Ezyline Clothesline** – Design ideal for camping, caravanning, fishing or just around the home. This clothesline design no pegs and washing clips [4].

2.3 Technical Review

2.3.1 Pictures

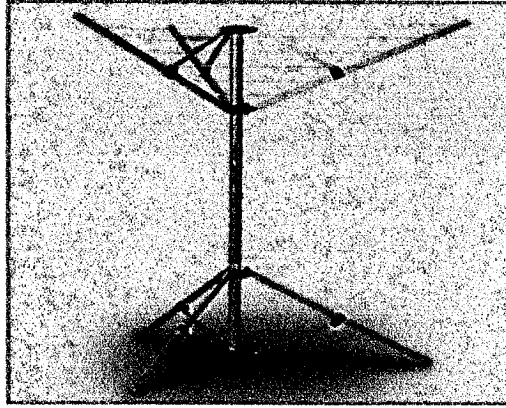


Figure 2.1: Easy reach aluminium portable clothesline [4]



Figure2.2: Laundry clothesline [4]

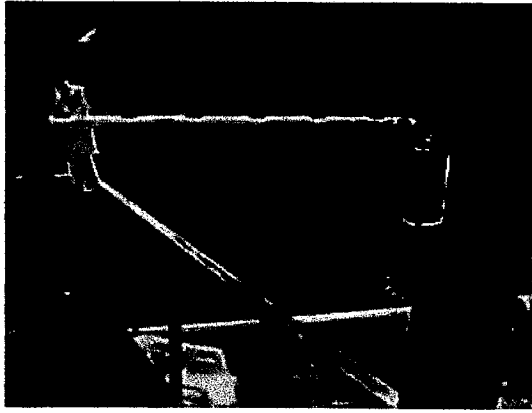


Figure 2.3: Versaline clothesline [4]



Figure 2.4: Hills clothesline [4]

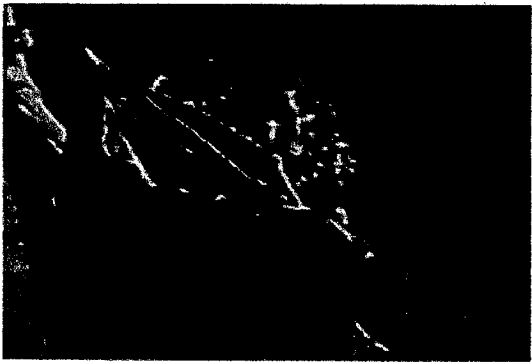


Figure 2.5: Ezyline clothesline [4]

2.4 Method Joining of Welding Process

2.4.1 Basic Theory of Metal Inert Gas(MIG) Welding

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

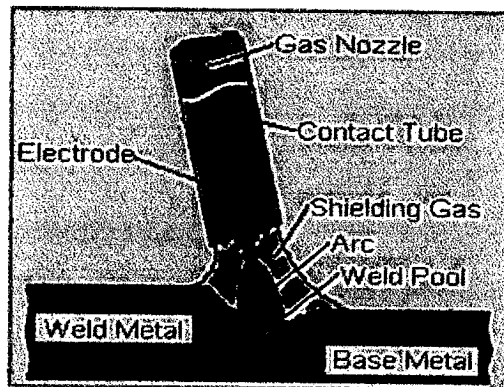


Figure 2.6: Basic Structure of Metal Inert Gas (MIG) Welding [2]

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 [2].

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 (Wayne C. Gramlich, 2001) [2].

2.4.2 The Advantages of MIG Welding

- i. High productivity, because based on this machine the user doesn't need to stop their work to change rods or chip and brush the weld frequently.
- ii. Easy to learn and makes great-looking welds.
- iii. Can weld on stainless steel, mild steel, and aluminium.
- iv. This welding process also can be weld in all positions.

2.4.3 The Disadvantages of MIG Welding

- i. Can not check watch, count money, smoke cigarette, or talk to buddy as often.
- ii. Costs money of consumable, such as tips and nozzles.
- iii. Is not worth a dang on paint, rust, or dirty surfaces.
- iv. No good for thick steel, because it does not get the proper penetration.

2.4.4 Welding Gun and Wire Feed Unit

The figure below show the basic structure on the nozzle of the MIG welding.

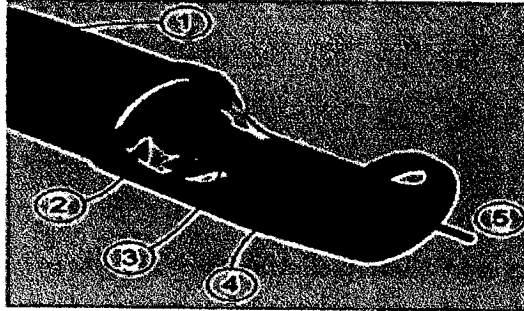


Figure 2.7: GMAW torch nozzle cutaway image. (1) Torch handle, (2) Molded phenolic dielectric (shown in white) and threaded metal nut insert (yellow), (3) Shielding gas nozzle, (4) Contact tip (5) Nozzle output fac [2]

2.4.5 Process of MIG Welding

In spray transfer, small, molten metal droplets from the electrode are transfer to the weld area at a rate of several hundred droplets per second. The transfer is spatter-free and very stable. High Direct Current (DC) and voltages and large-diameter electrodes are used with argon or argon-rich gas mixture used as the shielding gas. The average current required in this process can be reduced by using a pulsed arc, which superimposes high-amplitude pulses onto a low, steady current. The process can use in all welding positions [2].

In globular transfer, carbon-dioxide-rich gases are utilized, and globules are propelled by the forces of the electric-arc transfer of the metal, resulting in considerable spatter. High welding currents are used, making it possible for greater weld penetration and higher welding speed than are achieved in spray transfer. Heavier sections commonly are joined by this method. (Wayne C. Gramlich, 2001) [2].

In short circuiting, the metal is transferred in individual droplets (more than 50 per second), as the electrode tip touches the molten weld metal and short circuits. Low currents and voltages are utilized with carbon-dioxide-rich gases and electrodes made of small-diameter wire. The power required is about 2 kW. (Ladou Joseph ,2006) [2].

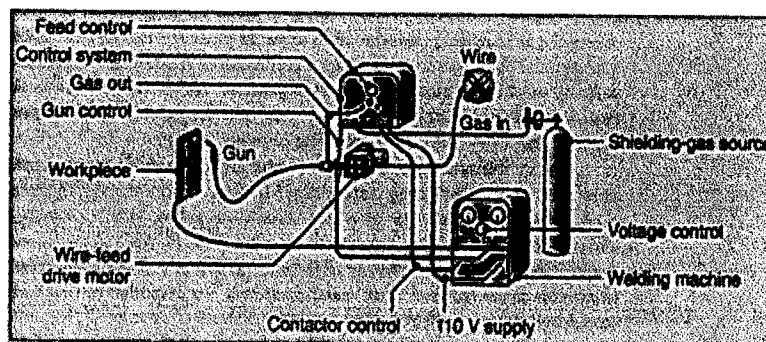


Figure 2.8: Basic equipment used in MIG operations [2]

2.5 Method joining of Mechanical Fastening

Two or more components may have to be joined or fastened in such a way that they can be taken apart sometime during the products service life or life cycle. Numerous products (including mechanical pencils, watches, computers, appliances, engines, and bicycle) have components that are fastened mechanically [1].