FABRICATION OF ON/OFF MAGNETIC CLAMP FOR WELDING PROCESS

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ABSTRACT

This thesis is regarding the final year project for diploma student in University Malaysia Pahang (UMP). The title is fabrication of on/off magnetic clamp for welding process. The student needs to design and fabricate a magnetic clamp for welding process. The magnetic clamp must low in cost of production and doesn't give damage to the workpiece. It is to overcome the problem that arise such as the current magnetic clamp are expensive and the other clamp such as table clamp and portable clamp can give damage to the workpiece. The student needs to use various fabrication processes in the making of this project. All the skill had been taught in previous lab courses in UMP. Firstly, the work must be plan well so the work can be finished in time. A Gantt chart is constructed in order to show the date and time for the specific work to be done. Moreover, a flow chart is also constructed to visualize the step-by-step process of making this project. Literature review is done early to give better understanding about what is magnetic clamp. Then the student makes the sketches of the magnetic clamp. All the sketches undergo screening process and only 3 that pass the screening. The 3 sketches are then refined before final concept is selected using scoring process. The final concept is then turned into 3D drawing. The 3D drawings are generated using computer software. After the detail of the drawing is finished, the project is fabricated. All the process is mainly done in the fabrication lab of UMP. However, the magnet that been use for this project booked at Load Technology Engineering (M) SDN BHD at Shah Alam, Selangor. Starting from the measuring and marking process until the assembly process is done using the tools and equipment in the lab. The machine such as milling machine, lathe machine and drilling machine are used to fabricate this project. Lastly the project is tested to make sure the magnetic clamp can function well. The project has work successfully. However, there is still has a low of the magnetizing power even the magnetic clamp in the off state.

ABSTRAK

Thesis ini berkenaan dengan projek tahun akhir untuk pelajar diploma Universiti Malaysia Pahang. Projek tersebut bertajuk pembinaan sebuah magnet pemegang untuk proses kimpalan. Pelajar perlu mereka dan membina sebuah magnet pemegang untuk proses kimpalan. Magnet pemegang harus kurang dari kos pembuatan dan tidak memberi sebarang kecederaan kepada bahan kerja. Projek ini untuk mengatasi masalah yang timbul seperti magnet pemegang mahal dan pemegang lain seperti meja pemegang dan pemegang boleh laras boleh mendatangkan kecederaan kepada bahan kerja. Pelajar perlu menggunakan pelbagai cara pembuatan yang telah dipelajari dalam kursus lain di UMP. Pertama sekali, kerja-kerja harus dirancang dengan teliti, oleh itu carta Gantt telah ditubuhkan. Kemudian carta aliran juga diadakan untuk menggambarkan langkah-langkah kerja dilakukan. Kajian awal telah dilakukan untuk mendapatkan lebih maklumat berkenaan dengan magnet pemegang. Banyak kajian telah dilakukan melalui sumber internet dan media lain. Kemudian pelajar memulakan lakaran awal idea magnet pemegang yang ingin dihasilkan. Kesemua lakaran melalui proses penapisan sehingga tiga lakaran melepasi proses penapisan tersebut. Selepas itu, lakaran tersebut diperhalusi dan melalui proses pemarkahan untuk menentukan konsep terakhir. Konsep terakhir tersebut akhirnya ditukar kepada lukisan 3D melalui perisian komputer. Selepas lukisan yang teliti telah disiapkan, kerja-kerja membuat magnet pemegang dilakukan. Walaubagaimanapun, magnet yang digunakan ditempah di Load Technology Engineering (M) SDN BHD di Shah Alam, Selangor. Bermula dari proses mengukur dan menanda sehingga proses penggabungan selesai menggunakan peralatan di dalam makmal. Mesin seperti mesin pengisar, mesin larik dan mesin penebuk digunakan untuk menghasilkan projek ini. Akhir sekali projek ini diuji untuk memastikan magnet pemegang berfungsi sepenuhnya. Projek berfungsi dengan jayanya. Walaubagaimanapun, masih ada sedikit kuasa magnet walaupun magnet pemegang dalam keadaan tertutup.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

For this chapter, it is about discussion of the project background, problem statement, objective of the project, and lastly scope of the project.

1.2 PROJECT BACKGROUND

Clamp is a holder to hold the workpiece while doing a process. It's very important to make the position of the workpiece in static position. The magnetic clamp is the better device to hold the workpiece because it is portable and heat resistant but it is very expensive to buy at the market. From there, the goal of this project is to reduce the cost of production of the magnetic clamp and try another method to demagnetize the power of the magnet.

1.3 PROBLEM STATEMENT

The conventional clamp can give damage to the workpiece. The clamp also difficult to remove after welding process because it's hot. Try to use magnetic system method to replace conventional clamp.

1.4 OBJECTIVE

- Study on current conventional magnetic clamp.
- Design and fabricate an on/off magnetic clamp to replace conventional clamp.

1.5 SCOPE

- Designing process use Solidworks Software.
- Fabrication process use basic engineering technique like milling, drilling and mechanical joint.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

For this chapter, it is about the introduction of magnet and the type of clamps that already have in the market and description of the clamps. This chapter also describe about material selection to produce the project.

2.2 INTRODUCTION OF MAGNET

Magnets are an important part of our daily lives, serving as essential components in everything from electric motors, loudspeakers, computers, compact disc players, microwave ovens and the family car, to instrumentation, production equipment, and research. Their contribution is often overlooked because they are built into devices and are usually out of sight.Magnets function as transducers, transforming energy from one form to another, without any permanent loss of their own energy. General categories of permanent magnet functions are:

- **Mechanical to mechanical** - such as attraction and repulsion.
- **Mechanical to electrical** - such as generators and microphones.
- **Mechanical to heat** - such as eddy current and hysteresis torque devices.
- **Mechanical to heat** - such as eddy current and hysteresis torque devices
- **Electrical to mechanical** - such as motors, loudspeakers, charged particle deflection.

The energy required to disturb the magnetic field produced by a magnet varies for each type of material. Permanent magnets can be produced with extremely high coercive forces that will maintain domain alignment in the presence of high external magnetic fields. Stability can be described as the repeated magnetic performance of a material under specific conditions over the life of the magnet.Factors affecting magnet stability include time, temperature, reluctance changes, adverse fields, radiation, shock, stress, and vibration.

Magnets should be kept away from sensitive electronic equipment.Modern magnet materials are extremely strong magnetically and somewhat weak mechanically. Any person required to handle magnets should be appropriately trained about the potential dangers of handling magnets. Injury is possible to personnel, and magnets themselves can easily get damaged if allowed to snap towards each other, or if nearby metal objects are allowed to be attracted to the magnets. (Edward P. Furlani, *Permanent Magnet and Electromechanical Devices:Materials, Analysis and Applications,* Academic Press Series in Electromagnetism (2001).)

2.3 TYPE OF CLAMPS

This subtopic shows the type of clamps that have been in the market and the sources of picture are from internet.

2.3.1 TABLE CLAMP

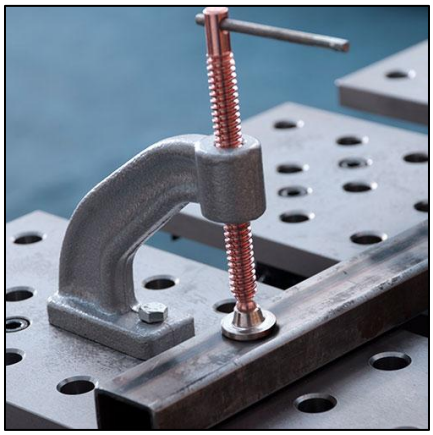

Figure 2.1 Table clamp

(http://www.stronghandtools.com/stronghandtools/products/holddownclamps.php)

Figure 2.1 shows the advantage of this clamp is this clamp can give strong hold to the workpiece, easy to get at hardware shop and the price is cheap. The disadvantage is the clamp can give damage to the workpiece. The clamp cannot change the position.

2.3.2 PORTABLE CLAMP

Figure 2.2 Portable clamp

(http://www.ebay.com/sch/Clamps-Vises-/20761/i.html?_dcat=20761&Brand=Kreg)

Figure 2.2 shows the advantage of this clamp is this clamp can give strong hold to the workpiece, easy to get at hardware shop, portable and the price is cheap. The disadvantage is it difficult to open the clamp after welding process because the clamp becomeshot.

2.3.3 MAGNETIC CLAMP

Figure 2.3 Magnetic clamp

(http://en.wikipedia.org/wiki/Magnetic_base)

Figure 2.3 shows the advantage of this clamp is it can give strong hold to the workpiece in horizontal and vertical position, easy to remove the clamp because it have switch to demagnetize the magnet so the clamp can easy to remove. The disadvantage is the clamp very expensive and it must store in specific place.

2.4 MATERIAL SELECTION

2.4.1 Cylindrical Aluminium

Figure 2.4 shows the cylindrical aluminium.Aluminium that has been choose because it's good magnetic insulator and can hold in high temperature. The critical magnetic field of the aluminium is about 100 gauss. Aluminium can hold at 660.32°C and the boiling point is 2519°C. Aluminium also has light in weight.

Figure 2.4 Cylindrical aluminium

2.4.2 Mild SteelPlate

Figure 2.5 shows the mild steel plate. Mild steel plates are chosen because if it bends, it can withstand the bend for a long time period.

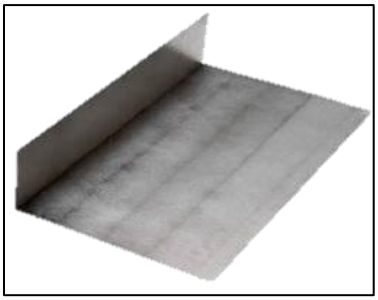

Figure 2.5 Mild Steel plate

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

For this chapter, it is about explanation of flow chart, sketching of design product, concept screening to select the best design and performance. This chapter also show the finalized design and the specification of the final design that have been selected. Fabrication process of the project is shown in this chapter.

3.2 FLOW CHART

The flow chart starts with the introduction. This is where the first plan work is constructed. The supervisor explains the scope of the project and requested for understanding of the project and makes some finding about the project. Student makes project synopsis, objective, scopes, problem statement and work planning. Then the problem statement is following down the steps. Here problem are generated by the observing and research on the project.

Next the literature review of the project is done thoroughly to get the better understanding of this project. The literature review covered all the aspects regarding the build of magnetic clamp. Student gets the information via internet and books. Additional information comes from lecturer and other student.

After the literature review was done, conceptual design like a few raw sketching were done to fulfil the objective and the problem statement of the project. Four sketches were made with 3-dimensional and clear understanding. Sketching is done to make a clear view for designing process after this.

After all the sketches are prepared, a comparison among the sketches is made to give the advantage and this advantage for the sketches. This is to make sure the best sketches will be produced.All the sketch must be scoring depend on the characteristics and the higher score can be the finalized design. The best sketch will draw using Solidwork software to get the full feature of the product.

After the drawing is done, the material can be selected. The material that ave been selected must base on the objective of this project which is must not give damage to the workpiece while welding, heat resistant and low in cost. The first step is getting material from the Faculty of Mechanical Enginering store. Cylindrical aluminium is used to make a casing for the magnet. The sheet metal is used to make a head of the casing. The magnet has been order at Load Technology Engineering (M) SDN BHD company at Shah Alam, Selangor. The aluminium is cut into various lengths according to the drawing. After that drilling process is needed to make a hole to put the magnet inside the cylindrical aluminium. After that, shape the sheet metal in round shape with diameter according to the drawing the combine it with a bolt using welding process. Shape another sheet metal as a holder and joint the holder to the aluminium cylinder using a screw.

As all the parts had been joined together, it comes to the result and discussion section. In this section, the report and the product are shown and tested. The draft report and the entire related article are handed over to the supervisor for checking. If the project doesn’t work, the project must return to the fabrication process to make some modification.

For the conclusion, all the recommendations are stated to get the best quality product. The project and the report are also checked to make sure no mistake and flaw in the end report.

Lastly, when the report and the project are approved by the supervisor, the project will be finally published and handed over to the supervisor, the coordinator and the Faculty of Mechanical Engineering. All presentation slides were also made and ready to be presented. Figure 3.1 shows the figure of the flow chart.

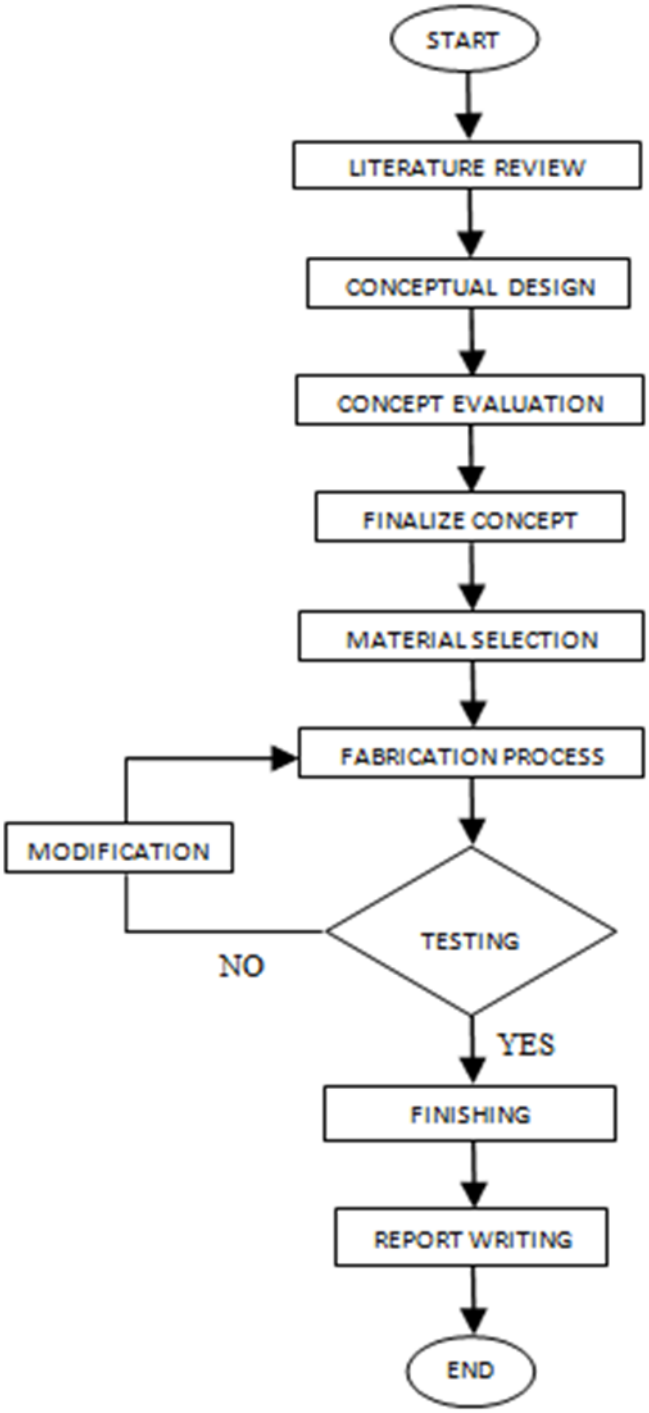

Figure 3.1flow chart

3.3 SKETCHING

There are three design sketching and one for reference in this subtopic. The sketching was made base on the reference.

3.3.1 First Design

Figure 3.2 shows the first design. The first design is very effective but the weight and the size are heavy and look bulky. This design can give more damage to the workpiece. So the first design are rejected because low in safety factor.

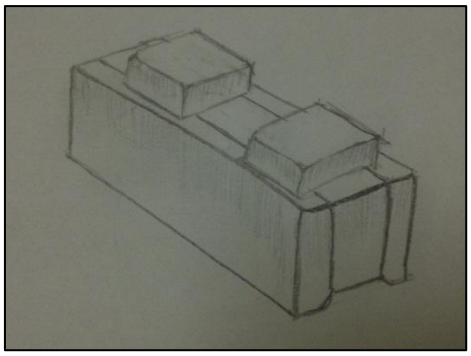

Figure 3.2 First Design

3.3.2 Second Design

Figure 3.3 shows the second design. The second design is small and portable but the assemble process are difficult. Thus, the second design are rejected because difficult to assemble and maintenance it.

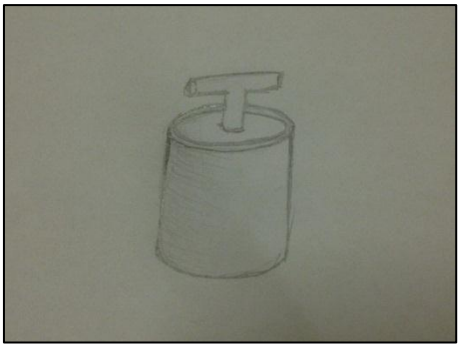

Figure 3.3 Second Design

3.3.3 Third Design

Figure 3.4 shows the third design. This design is accepted because it easy to assemble and the cost of production are low. Thus, this design is according to the objective of this project.

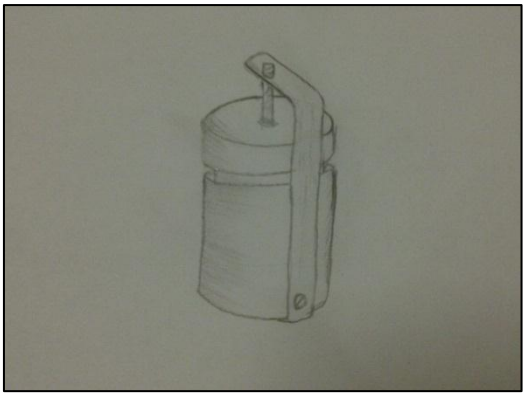

Figure 3.4 Third Design

3.3.4 Four Design (reference)

Figure 3.5 shows the fourth design. This design is already have in the market. This product is so effective but the price was so expensive. This design had been chosen as a reference to this project.

Figure 3.5 Fourth Design

(http://en.wikipedia.org/wiki/Magnetic_base)