DESIGN AND FABRICATION OF CYLINDER HEAD TURN TABLE (ROTATE 360 DEGREE)

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ABSTRAK

Projek ini mengenai rekabentuk dan mencipta Meja Kepala Silinder yang dapat membuat pusingan 360 darjah digunakan untuk menggantung kepala silinder supaya dapat membaiki apa- apa kerosakan dengan mudah. Objektif utama mereka bentuk meja ini adalah untuk memberi pengalaman dan pengetahuan kepada pelajar dalam menghasilkan produk atau kerja yang mempunyai hasil yang memuaskan. Projek meja ini adalah model pertama untuk universiti ini dan sesuai diaplikasikan atau digunakan untuk menggantungkan kepala silinder di Makmal Fakulti Kejuruteraan Mekanikal. Projek ini melibatkan proses mereka bentuk meja dengan mengambil kira bentuk, fungsi, kemudah-alihan, dan kos pembuatan bagi pengguna. Bahan untuk membuat produk ini senang didapati kerana menggunakan besi berongga segiempat-tepat dan besi bulat berongga. Oleh itu proses penyambungan yang sesuai untuk meja ini adalah proses kimpalan. Dalam penyambungan roda, proses terbaik adalah menggunakan kaedah pengikat kerana ia melibatkan penggunaan bolt dan nat bagi penyambungan roda pada tapak meja. Selepas semua proses yang dijalankan telah siap sepenuhnya, reka bentuk meja ini mungkin boleh membantu sesiapa untuk memahami proses penghasilan dan reka bentuk yang berkaitan dalam projek ini.

ABSTRACT

This project is mainly concerned on designing and fabricating the cylinder Head Turn Table (360 degree) that can be used to hold the cylinder head for easy repair. The main objective in this project is to give an experience and knowledge for student to make the project and activity successfully. This table is the first project for this university and suitable as an application to hold the cylinder head in Faculty of Mechanical (FKM) Lab in automotive section. This project involves the process of designing the table by considering the shape, functionality, portability and the manufacturing cots for people to use it. The material used is easy to gain, because it only using rectangular hollow steel and round steel hollow. So that the method joining that can be compatible in assembled this table is welding processes. 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 table. After all the process had been done, this table may help us to understand the fabrication and designing process that involved in this project.

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CHAPTER 1

INTRODUCTION

1.1 Project synopsis

1.1.1 General Project Synopsis

The purpose of this project is to design a cylinder head turn table that can rotate 360 degree, fabrication and test withstand the load from weight of the cylinder head. In this project, the machine tools are mostly use to do the metal cutting, grinding, drilling and moving. The most important is the knowledge about welding because in this project there were many welding processes involved. The purpose of welding is to join inseparably every component of the product. Basically, this product is to help user repair the cylinder head easily. Besides that, it helps to minimize the user movement in the repairing process. The process of development is initiated from designing the shape of the table by considering the function as well. In order to produce user friendly product the ergonomic factor is taken into account.

1.1.2 Specific Project Synopsis

My project is to design and fabricate a table to hold the cylinder head. This table can be rotated 360 degree. Its movement can either be rotated to the left side, right side, the upper side and lower side of the table. The flexibility of this table can hold the cylinder head from falling. This table can hold the cylinder head that have the different sizes, shapes and weights. This table was designed where it able to face the pressure and pressing and it is also built with high quality material and durable. Besides rotating, the height of the table also can be adjusted based on the user requirement. User can either adjust the height of the table to become higher or lower. It is fabricated as an experiment equipment/material to assist the learning process of automotive class in Faculty of Mechanical Engineering.

1.2 Project Background

At this moment, this product is not yet being sold in the market. Most of the workshop still doesn't have this kind of table. In workshop, the mechanic only used the ordinary table to hold the cylinder head when they wanted to repaired it. Sometimes they hold the cylinder head by putting them on the ground or floor. I came with this idea when I saw this table that was used to hold the engine in my faculty's laboratory. From my observations, that table actually doesn't have various functions. But this table can hold an engine with high strength. This table inspired me a lot in making my project where from it I can gain many ideas to help me to develop and design my project based on this table. I want to modify this table to be more firmly fixed, useful and have variety of function. This modification helps the user a lot in doing their works done especially during overhaul the cylinder head. This also helps the user to save their time and energy.

1.3 Project Objectives

1.3.1 General Objective

Diploma final year project objective is to practice the knowledge and skill of the student that have been gathered before in solving problem using academic research, to born an engineer that have enough knowledge and skill. This project also important to train and increase the student capability to get know, research, data gathering, analysis making and then solve a problem by research or scientific research.

1.3.2 Specific Project Objective.

The objectives of this project are:

i) To design a table that can rotate 360 degree where its function was as a holder to the cylinder head.

ii) To fabricate and introduce the new concepts and ideas for future prospect of cylinder head rotating table.

iii) To test the model of designed system.

1.4 Problem Statement

The problem encountered during the literature review is this table is not currently or available yet in market for today. As a result, mechanic is not to use the product that

can done their work with fast, easy and outcome the result is very well. Currently, during top overhaul mechanic just hold the cylinder head on the ordinary table to repair it. Sometime, mechanics just hold the cylinder head on the ground or floor. Both this method has their own problem not only with the cylinder head but to our self too. As we know, the environment in the workshop is dirty, oily and dusty. So is not suitable to put the cylinder head and maybe it will affect the floor or ordinary table surface is not flatted. Beside that, when mechanic use this method, there will faced the difficulties when repairing the cylinder head especially when to separate and assemble the cylinder head. Furthermore both this method will cause the back pain and exhausted to mechanic.

1.5 Project Scope

The scopes for this project are:

i) Design of structure with given specification.

ii) Sketching and designing : sketching and designing using the solid work Software

iii) Fabrication: Fabricate and produce the table by using all necessary manufacturing process such as welding, cutting, griddling, and etc.

iv) Assemble all parts of the table refer from the drawing before doing the welding and fastening joining method (bolt and nut).

v) Engine size: Amount of cylinder use, multi type of cylinder (V type or in-line type etc), weight below from 1.6 cc (12.5 kg) of the cylinder.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The cylinder head turn table may help mechanic during the top overhaul it's also help mechanic to do their work without having a problem heavy loading of cylinder head. Before this, mechanics just repair the cylinder head on the ordinary table. Sometime they hold the cylinder head on the floor. This situation lead to many problem like a pain, environmental mistake and many more. So when this table is created, this table able to helps mechanic to reduce pain in waist, back, hand and feet. Furthermore this table achieves to avoid the cylinder head expose from dusty and dirt. So repairing process of cylinder head like to skimming which need a flat surface is easier. Beside that this table may help mechanic to hold at just one place during repairing process. It's because this table can rotate 360 degree upper to lower or lower to upper and right to left or left to right. So mechanic can reduce their movement in the process of changing the valve, change seat valve is easier.

2.2 Basic Part

i) Wheel: Usually made from rubber that joined together with the bolt and nut with steel frame to ensure strength and easier to movement any where.

ii) Center Body: This part to is combine between rectangular and round mild steel to get rotating right to left or left to right (360 degree) to skimming cylinder head with easier.

iii) Above body: This part combines with bearing to rotating upper and lower or lower to upper. Beside that this part joins with shaft that combine with G cramp to fix the cylinder head and long screw as a shaft to avoid from free rotating.

2.3 Method Joining of Welding Process

2.3.1 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.

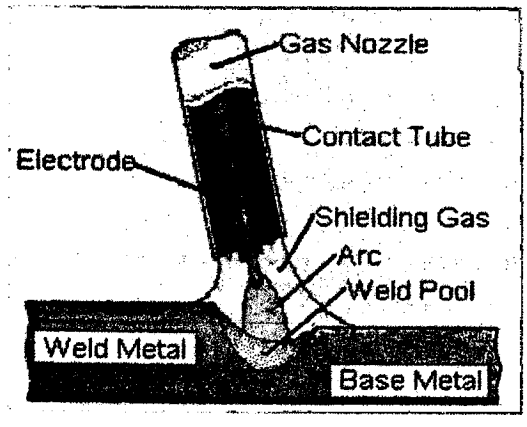

Figure 2.0: Basic Structure of Metal Inert Gas (MIG) Welding.

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.

2.3.2 The Advantages of MIG Welding

i) High productivity, because based on this machine the consumer no 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 aluminum.
iv) This welding process also can be weld in all positions.

2.3.3 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.

2.3.4 Welding Gun and Wire Feed Unit

The figure shows the basic structure on the nozzle of the MIG welding.

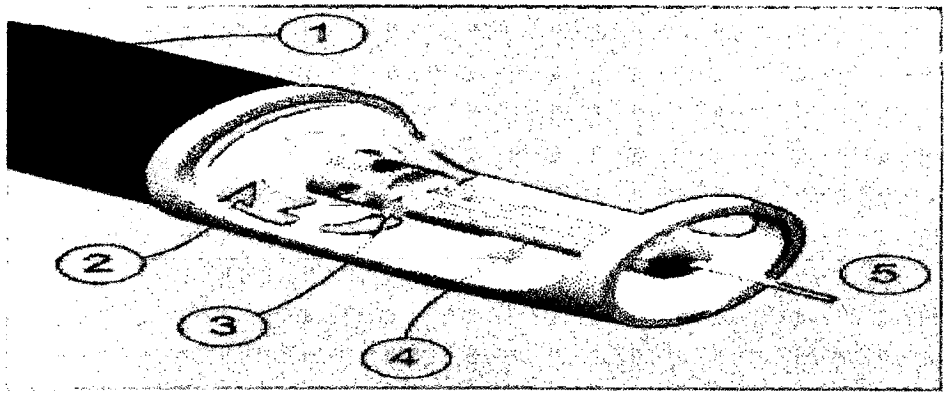

Figure 2.1: GMAW torch nozzle cutaway image. **(1)** Torch handle, **(2)** Molded phenolic dielectric (shown in white) and threaded metal nut insert (yellow), **(3)** Shielding gas nozzle, **(4)** Contact tip **(5)** Nozzle output fact.

2.3.5 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.

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.

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

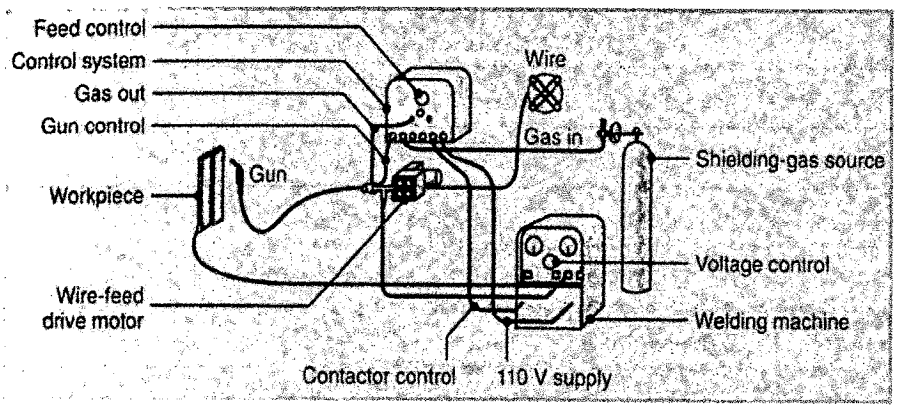

Figure 2.2: Basic equipment used in MIG operations

2.4 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. Mechanical fastening may be preferred over other methods for the following reasons: ease of manufacturing, ease of assembly and transportation, ease of disassembly, maintenance, parts replacement, or repair, ease in creating designs that require moveable joints, such as hinges, sliding mechanism, and adjustable components and fixtures and lastly lower overall costs of manufacturing the product.

The most common method of mechanical fastening is by the use of bolts, nuts, screws, pins and a variety of other fasteners. These operations are known also as mechanical assembly. Mechanical fastening generally requires that the components have holes through which the fasteners are inserted. These joints may be subjected to both shear and tensile stresses and should be designed to resist these forces.

2.4.1 Hole Preparation

An important aspect of mechanical fastening is hole preparation. A hole in a solid body can be produced by several processes, such as punching, drilling chemical and electrical means, and high-energy beams. The selection of these depends on type of material, its properties and its thickness. For improved accuracy and surface finish, many of this hole-making operation may be followed by finishing operations, such as shaving, deburring, reaming, and honing. Because of the fundamental differences in their characteristics, each of the hole-making operations produces holes with different surfaces finishes, and surfaces properties.

The most significant influence of a hole in a solid body is its tendency to reduce the components fatigue life by stress concentration. For holes, fatigue life can be improved best by inducing compressive residual stresses on the cylindrical surface of the hole. These stresses usually are developed by pushing a round rod (drift pin) through the hole and expanding it by a very small amount.

2.4.2 Threaded Fasteners

Bolts screw and nuts are among the most commonly used threaded fasteners. Numerous standards and specifications (including thread dimensions, dimensional tolerances, pitch, strength and the quality of the materials used to make to make these fasteners) are described. Bolts and screw may be secured with nuts, or they may be self-tapping-where by the screw either cuts or forms the thread into the part to be fastened. The self tapping method is particularly effective and economical in plastics products where fastening does not require a tapped hole or a nut. If the joint is to be subjected to vibration (such as an aircraft, engines, and machinery) several especially designed nuts and lock washers are available. They increase the frictional resistance in the tensional direction and so inhibit any vibration of the fasteners.

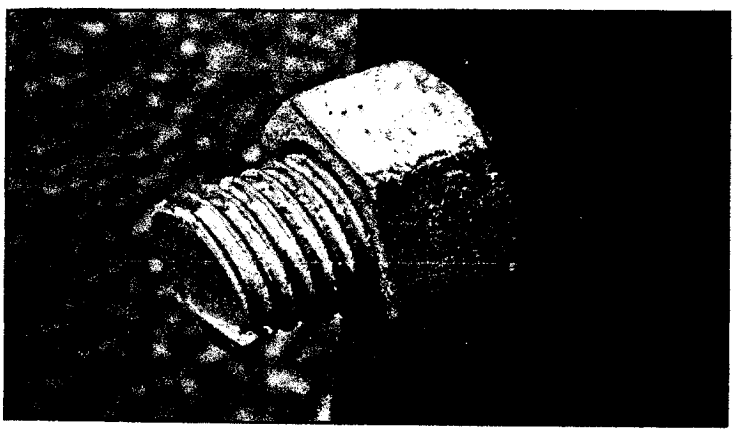

Figure 2.3: Threaded fasteners (Bolt and Nut)

2.5 Drilling Machines

Drilling machines are used for drilling holes, tapping, reaming, and small diameter boring operations. The most common machine is drill press, the major

components of which are shown in (Figure 2.11a). The work piece is placed on an adjustable table, either by clamping it directly into the slots and holes on the table or by using a vise, which in turn is clamped to the table. The drill is lowered manually by a hand wheel power or by power feed at preset rates. Manual feeding requires some skill in judging the appropriate feed rate.

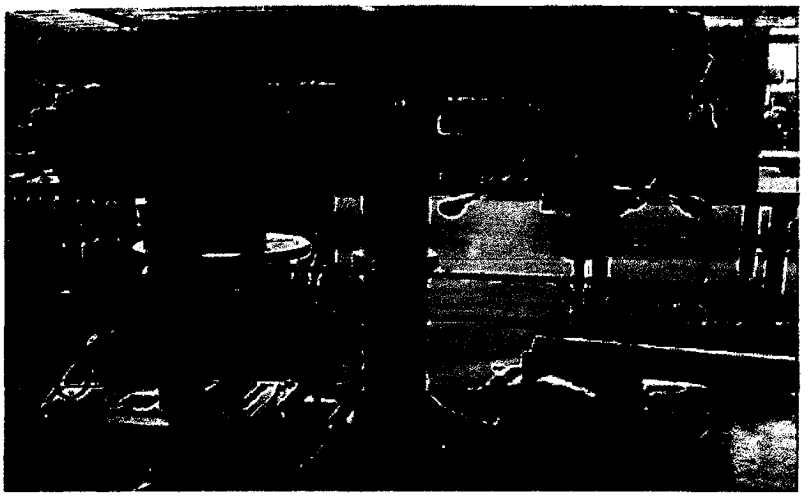

Figure 2.4: Drilling Machine

Drills pressed usually are designed by the largest work piece diameter that can be accommodated on the table and typically range from 150 to 1250mm. In order to maintain proper cutting speeds at the cutting edges of drills, the spindle speed on drilling machines has to be adjustable to accommodate different drill sizes. Adjustments are made by means of pulleys, gear boxes or variable-speed motors.

The types of drilling machines range from simple bench-type drills used to drill small diameter-holes to large radial drills (Figure 2.11b), which can accommodate different large work pieces. The distance between the column and the spindle center can be as much as 3m. The drill head of universal drilling machines include numerically controlled three-axis machines, in which the operations are performed automatically and in the desired sequences with the use of turret punch.

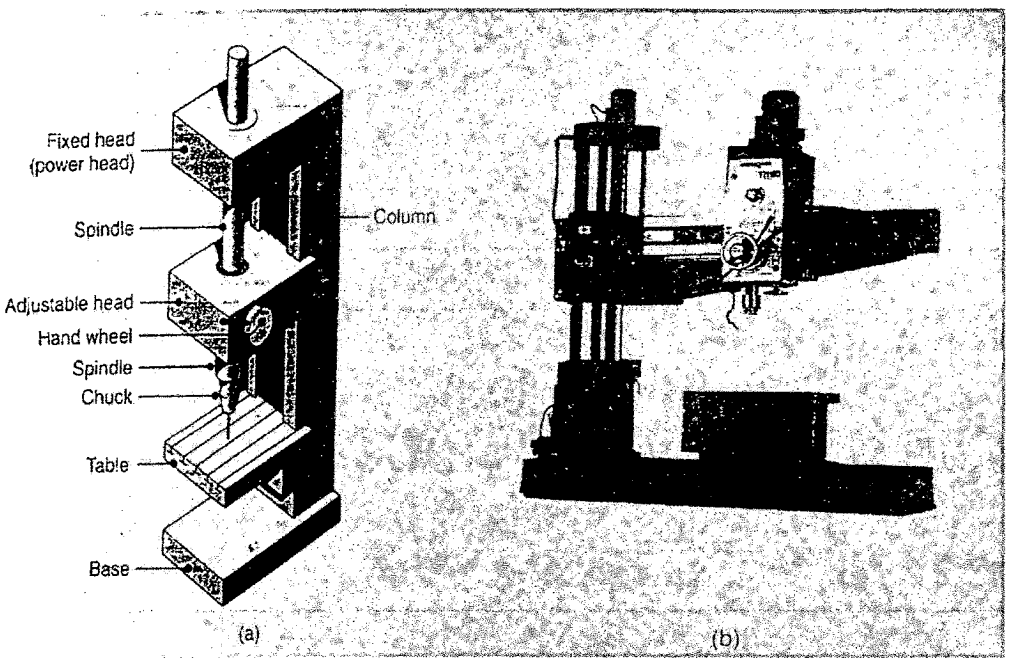

Figure 2.5: a) Schematic illustration of the components of a vertical drill press machine.

b) A radial drilling machine.

CHAPTER 3.0

PROJECT METHODOLOGY

3.1 Project flow chart

In fabrication of the cylinder head turn table, there is a planning of the overall progress to assure the project can be finish on a schedule.

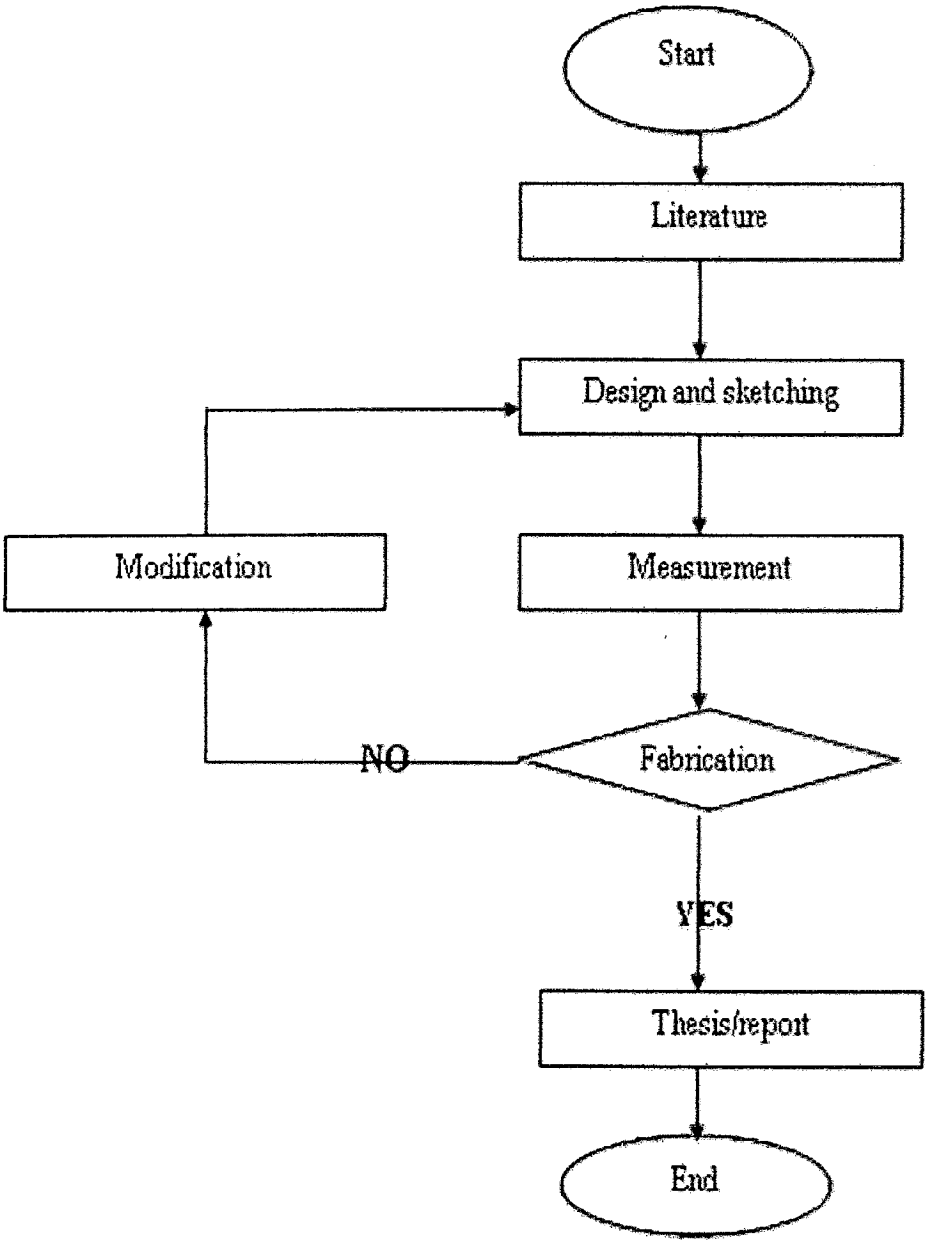

Figure 3.0: Project Flow Chart

Refers to the Figure 3.0, this project started with the literature review and research about the title. The main important of this project is determination the objective. Then, study and make a lot of investigation about cylinder head turn table (360 degree) concept. These tasks have been done through research on the internet, books and other sources.

Then the information has been collected and gathered, after that, the project will be continued with the design process. In this stage, the knowledge and lessons that have studied will be applied in sketching. After several design sketched, design consideration have been made and one of the design have been chosen. The selected sketch will be transfer to engineering drawing by using Solid works program.

After all the engineering drawing finished, the drawing was used as a reference for the next process, which it is fabrication stage. This process is consists fabricate all the parts that have been designed before by following the entire dimension. During the fabrication process, if there is something wrong occur, such as not balance dimension so the process will be stop and go back to previous step, make a modification again. Testing stage has been implementing after fabrication stage. The testing is to gather information about strength and the durability of the cylinder head turn table (360 degree).

At the end, when all the process mentioned above is done, the material for report writing is gathered. The report writing process will be guided by the UMP final year report writing guide. This process also included the presentation slide making for the final presentation of the project. The project ended after the submission of the report and the presentation slide has been presented to the panels From the flow chart above, this project started with the literature review and research about the title. Then, study and make a lot of investigation about cylinder head turn table. This is including a study of the concept of cylinder head turn table, process to fabricate, and material. These tasks have been done through study on the internet, books and others sources.