



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF PORTABLE MAGNETIC CLAMPING

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Manufacturing Engineering Technology (Process and Technology) with Honours

by

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2017

DECLARATION

I hereby, declared this report entitled “Development of Portable Magnetic Clamping” is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor's in Manufacturing Engineering Technology (Process and Technology) (Hons.). The member of the supervisory is as follow:

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ABSTRAK

Sesuatu mesin adalah alat pengikat yang digunakan untuk memegang bahan kerja dengan selamat ketika mengendalikan alat mesin, seperti mesin gerudi atau mesin penggilingan. Walau bagaimanapun, terdapat keterbatasan pada ketebalan bahan nipis dengan menggunakan pengikat yang terdapat dalam mesin penggilingan. Pengikat itu boleh mengetatkan ketebalan minimum 3mm dan ke atas. Tujuan pengembangan pengikatan magnetik adalah untuk mengetatkan bahagian nipis dan kecil bahan magnetkan sahaja. Objektif kajian ini adalah untuk mengembangkan pengikatan magnetik untuk mesin penggilingan. Kerja ini difokuskan untuk membangunkan pengikatan magnetik, mengubahsuai produk sedia ada di mesin lathe yang telah dibangunkan oleh pelajar terdahulu ke dalam aplikasi penggilingan. Seterusnya, pilih bahan yang betul dalam mengembangkan pengikatan magnetik. Diharapkan hasil pengikatan magnetik dapat melekatkan bahagian kecil dan nipis di atasnya. Oleh itu, pengikatan magnet ini hanya boleh memegang sebahagian kecil dan nipis dari bahan magnet seperti keluli. Perkembangan ini adalah corak magnetik baru di fakulti. Hasil pemotongan parameter dan kekasaran permukaan, Ra diperolehi, dan data tersebut disusun ke dalam jadual.

ABSTRACT

Machine vice is a clamping device used to hold a workpiece securely when operating a machine tool, such as a drill press or milling machine. However, there are limitation on the thickness of thin material by using the vice that are available in milling machine. The vice can clamp the minimum thickness 3mm and above. The purpose of development of magnetic clamping is to clamp the thin and small part of magnetize material only. The objectives of this study are to develop the magnetic clamping for milling machine. This work is focused on develop a magnetic clamping, modify the design of existing product in the lathe machine that had been develop by the previous student into the milling application. Next, choose the right material in developing the magnetic clamping. It is expected that the results of magnetic clamping can attach the small and thin part on it. Thus, this magnetic clamping can only attach small and thin part of magnetize material such as steel on its. This development is a new pattern of magnetic clamping in the faculty. The result of cutting parameter and the surface roughness, Ra was obtained, and the data was tabulate into the table.

DEDICATIONS

I dedicate my dissertation work to my family and all my friends, A special feeling of gratitude to my loving parents, Noor Hamizon binti Mustafa and Jalil bin Ismail whose word of encouragement and always give positive vibes whenever me in depress. My sister Nurul Ashikin binti Jalil that always support and give encouragement to proceed with thesis. I also dedicate my dissertation to all my friends that support and contributed some of the ideas for this research. Thank you for everything.

ACKNOWLEDGMENTS

I would like to express deepest gratitude to my supervisor Dr. Norfariza binti Abd Wahab for her full support, expert guidance, understanding and encouragement throughout my study and research. Without her incredible patience and timely wisdom and counsel, my thesis work would have been a frustrating and overwhelming pursuit. In addition, I express my appreciation to Mr Khahar bin Nordin for become the co-supervisor. His thoughtful question and comments were valued greatly.

Besides, not to forget technician who always help me solve some of the problem while doing my thesis who are Mr Azimin, Mr Zulkifli, Mr Hisyam, Mr Basri and all JTKP technician.

Thanks also go to my fellow friends at the Faculty of Technology Engineering of University Teknikal Malaysia Malaka. Special thanks go to my team who helped me throughout this academic exploration.

Finally, I would like to thank my parents, sisters and brother for their unconditional love and support during the last two years. I would not have been able to complete this thesis without their continuous love and encouragement.

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CHAPTER 1

INTRODUCTION

This chapter explain the overview of the study and the purpose of this study. The chapter includes the background of the study, problem statement, objectives that is expected to be achieved and the scope of the study that is going to be conducted.

1.0 Background of the study

Milling is the machining process of using rotary cutters to remove material from a workpiece by advancing in a direction at an angle with the axis of the tool. It covers a wide variety of different operations and machines, on scales from small individual parts to large, heavy-duty gang milling operations.

Magnetic clamping usually used for fixturing of ferromagnetic material in perfection of switching functions. This magnetic clamping typically uses an electromagnet or permanent magnet to hold the material or workpiece during machining. (Felix and Melkote, 1999)

The main advantage for this magnetic clamping is to make it easy to attach and detach the workpiece and it able to clamp small and thin workpiece. Magnetic clamping can be applying in lathe and milling application. Also, it offers several advantages over conventional clamping methods such as three-jaw chucks and vice. Compared with the three-jaw place and vice, magnetic clamping produces very little flexible deformation of the workpiece and thus enable limited perspective and form specifications to take place.

This magnetic clamping is in a round with the flat working area on the top and an on/off change or key place on the side. Inside the chuck is a sequence of places that are organized to increase the flux along the outer lining area of the system. Flux is

optimized and makes it possible to secure any ferrous materials placed on top of the system by organizing the place in a similar design.

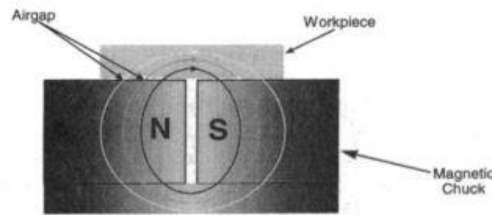


Figure 1. 1: Working principles of magnetic chucks

This project is mainly focus on developing and improve the existing magnetic clamping for the lathe machine to the milling machine by using the entire convectional machine that available. The design of magnetic chuck is based on the previous development of the student and modified to the milling machine that available at JTKP Machining Technology Laboratory since the surface of magnetic clamping is flat. Furthermore, the magnet that will be use on this magnetic chuck is permanent magnet which it's do not involve any electrical system. Then, for effectiveness a few analyses on the cutting parameter will take place.

1.1 Problem Statement

This project is focusing on development of the magnetic clamping for the milling machine that are available in our laboratory. From our survey that had done, most of the project or research that involve in thin and small material unable to proceed due to the limitation of vice clamping at the JTKP Machining Technology Laboratory.

Besides, we want to develop and improve an existing magnetic in lathe application to milling application as this product are referring the JTKP Machining Technology Laboratory. Then, we want to analyse a few cutting machining parameters on the magnetic chuck to observe its effectiveness.

1.2 Objectives

The main objectives of this project is to develop a new magnetic clamping for milling machine The specific purposes for this project are summarized as follows;

- i. To develop a magnetic clamping for milling machine
- ii. To design the existing magnetic clamping for milling machine application.
- iii. To analysis the results base on the developed magnetic clamping in term of surface roughness.

1.3 Scope

Scopes for this project is based on objectives that have stated and there are the several scopes that be carrying out:

- i. Development of the magnetic clamping by using the convectional machine that available at the laboratory.
- ii. Design and improve the existing magnetic clamping based on milling machine in the laboratory.
- iii. Material that used for developing magnetic clamping are aluminium, mild steel, and PVC plate.
- iv. The results of surface roughness are conducting to evaluate the Ra.

CHAPTER 2

LITERATURE REVIEW

This chapter explains about all findings obtained from many literature reviews, which may come from the internet, journals, article and books about the topic related to this study. This section includes findings about the overview of manufacturing process, turning machine, magnetic clamping method and effect of cutting parameters.

2.1 Manufacturing Process

Manufacturing processes are the stages through which raw materials are transformed into a final product. The manufacturing process starts with the creation of the materials from which the design is made. These materials are then modified through manufacturing processes to become the required product. Manufacturing processes can include treating (such as heat treating or coating), machining, or reshaping the material. The manufacturing process also includes tests and checks for quality assurance during or after the manufacturing, and planning the production process prior to manufacturing.

Manufacturing is the backbone of industrial community. The person that involved in industry must know the variety production procedures, materials being prepared, tools and apparatus for production with proper precautionary feature to avoid injuries. Beside above, a few consideration of workshops practices relating the basic working knowledge such as different technological innovation materials, resources, accessories, production procedures, uses of various testing instruments and inspecting products manufactured in the industry. (Singh, 2006)

2.1.1 Conventional Machining

Traditional or conventional machining processes, are used with a sharp cutting tool to remove material to achieve a desired geometry. The

conventional techniques that most frequently used are milling, edge trimming, drilling, turning, sawing, countersinking, and grinding. Conventional forming operations are performed with the energy from electric motors, hydraulics and gravity. Also, material joining is conventionally accomplished with thermal energy sources such as burning gases and electric arcs.

a) Milling process

A milling process is a machining operation in which a work part is fed past a rotating cylindrical tool with multiple cutting edges. For cutting operation, the workpiece is fed against the rotary cutter. As the workpiece moves against the cutting edges of milling cutter, metal is removed in form chips of trochoid shape. Machined surface is formed in one or more passes of the work. The work to be machined is held in a vice, a rotary table, a three jaw chuck, an index head, between centres, in a special fixture or bolted to machine table. The rotatory speed of the cutting tool and the feed rate of the workpiece depend upon the type of material being machined.

Milling is the process of cutting away material by feeding a workpiece past a rotating multiple tooth cutter. The cutting action of the many teeth around the milling cutter provides a fast method of machining. The machined surface may be flat, angular, or curved. The surface may also be milled to any combination of shapes. The machine for holding the workpiece, rotating the cutter, and feeding it is known as the



Figure 2.1: Milling machine

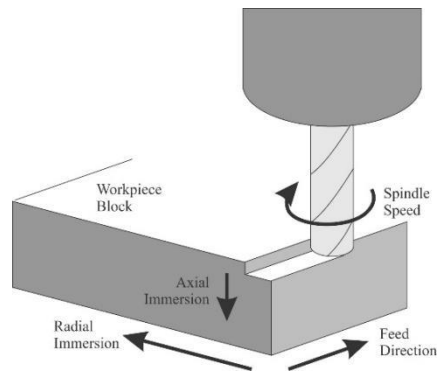
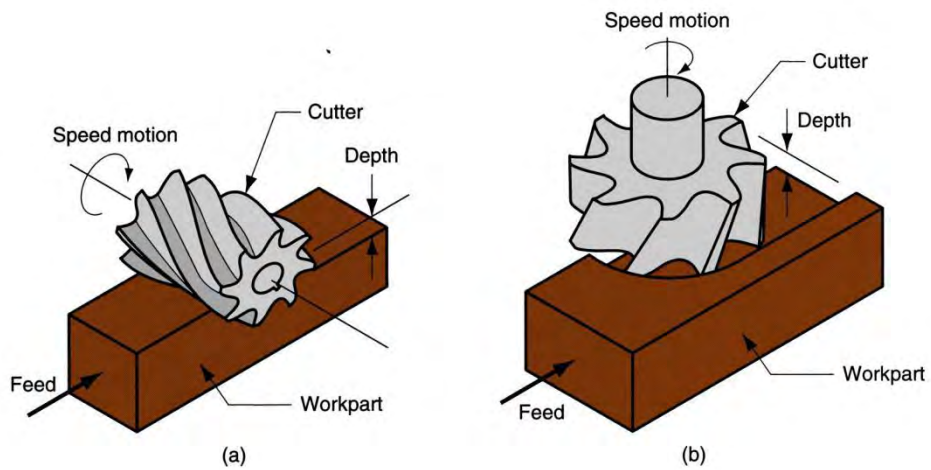


Figure 2.2: Overview milling operation

(<http://article.sapub.org/10.5923.j.ep.20130305.02.html>)



Two forms of milling:

Figure 2.3: (a) peripheral milling, and (b) face milling

(<https://www.slideshare.net/MuhammadMuddassir1/2-machining-operations-and-machine-tools>)

b) Drilling Machine

Drilling is a commonly working as hole-making process that uses a drill as a cutting tool for producing round holes of various sizes and depths. Drilled holes may be subjected to additional operations for better surface finish and dimensional accuracy, such as reaming and honing, described later in this section. Drilling machines are intended for drilling holes, tapping, counter boring, reaming, and general boring operations. They may be classified into a large variety of types.(Madsen et al., 2016)

Drilling is the process of cutting or originating a round hole from the solid material. There are many ways of classifying drills. The tool (drill) and not the work piece is revolved and is fed into the material along its axis. For example, according to material, number and types of flutes, drill size, type of shank (straight or taper) and cutting point geometry etc. However the most common type of drill is the fluted drill shown in figure 2.4.

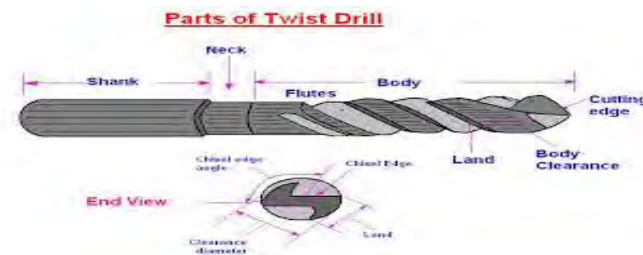


Figure 2.4: Tool drill

<http://engineeringhut.blogspot.my/2010/11/drilling-and-parts-of-twist-drill.html>



Figure 2.5: Drill machine

<http://www.tapping-slottingmachines.com/HighSpeedDrillingMachine.html>

c) Grinding machine

Grinding Machines are also regarded as machine tools. A distinguishing feature of grinding machines is the rotating abrasive tool. Grinding machine is employed to obtain high accuracy along with very high class of surface finish on the work piece. However, advent of new generation of grinding wheels and grinding machines, characterized by their rigidity, power and speed enables one to go for high efficiency deep grinding (often called as abrasive milling) of not only hardened material but also ductile materials. (Gregory, 2001.)

A grinding wheel consists of abrasive particles and bonding material. The bonding material holds the particles in place and establishes the shape and structure of the wheel. These two ingredients and the way they are fabricated determine the five basic parameters of a grinding wheel which is abrasive material, grains size, bonding material, wheel grade, and wheel structure. (Walker, 2000)



Figure 2.6: Grinding machine

(<http://www.scantool.com/media/15067/kraftige%20industrislibemaskiner.png>)

2.1.2 Advance Machining

Non-traditional machining refers to advance machining that removes excess material by various technique involving mechanical, thermal, electrical, or chemical energy (or combinations of these energies). They do not use a sharp cutting tool in the conventional sense. (Walker, 2000)

a) Abrasive Water Jet Machining (AWJM)

In abrasive-jet machining (AJM), material is removed by fine abrasive particles (aluminium oxide or silicon carbide) carried in a high-velocity stream of air, nitrogen, or carbon dioxide. The gas pressure ranges up to 120 lb/in² (800 kPa), providing a nozzle velocity of up to 1,000 ft/s (300 m/s). Nozzles are made of tungsten carbide or sapphire. Typical applications are in drilling, sawing, slotting, and deburring of hard, brittle materials such as glass.

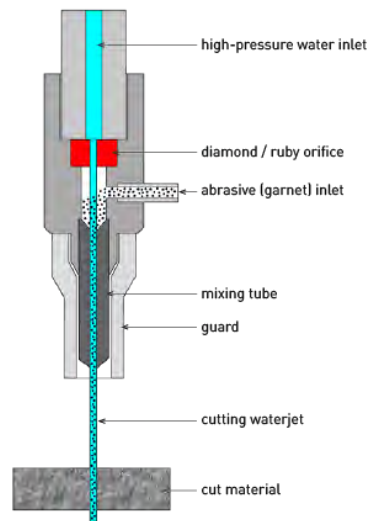


Figure 2.7 : Schematic diagram of the Abrasive Water Jet Machining process.

(http://www.hcs.harvard.edu/~gsdfablab/robot_tutorial/image/waterjet/waterjetcomponents.png)