UNIVERSITI TEKNIKAL MALAYSIA MELAKA

OPTIMIZATION AND ANALYZE OF FIXABLE CLAMPING JIG FOR MILLING MACHINE

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Process and Technology) (Hons.)

by

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DECLARATION

I hereby, declared this report entitled "Optimization and Analyze of Fixable Clamping Jig for Milling Machine" is the results of my own research except as cited in references.

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Date : 12 DECEMBER 2017

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 Degree of Engineering Technology (Process and Technology) with Honours. The member of the supervisory is as follow:

……

(Dr. Norfariza Binti Ab. Wahab)

ABSTRAK

Jig menyediakan alat pembuatan bahagian yang boleh ditukar ganti kerana ia menjalin hubungan dengan toleransi yang telah ditetapkan, antara kerja dan alat pemotong. Jig digunakan pada penggerudian, reaming, mengetuk, penggilingan dan mengetuk. Objektif projek ini adalah mengoptimumkan dan menganalisis jig pengikat yang boleh diperbaiki untuk mesin penggilingan. Kaedah ini adalah mekanisme pengapit yang telah diubahsuai pada jig sebelumnya, mengoptimumkan reka bentuk jig pengikat yang boleh dikendalikan untuk mesin penggilingan, dan menganalisis hasil jig pengikat yang boleh diperbaiki dari segi kekasaran permukaan. Hasil uji kaji akan menilai asas kekasaran permukaan dengan menggunakan Penguji Permukaan Permukaan Portable, SJ-401. Kemudian, hasilnya akan dibandingkan dengan hasil naungan semasa dan hasil penjepit yang dapat dikendalikan. Dari hasil yang diperolehi, purata nilai Ra menggunakan vise semasa sebagai kaedah penjepit adalah lebih tinggi daripada menggunakan pengikat yang boleh diketepikan sebagai kaedah penjepit yang 3,468 apabila menggunakan vise semasa dan 1.657 apabila menggunakan penjepit halus untuk delrin sebagai sekeping kerja. Sedangkan untuk aluminium sebagai sekeping kerja, purata nilai Ra menggunakan vise semasa sebagai kaedah penjepit adalah lebih rendah daripada menggunakan pengikatan yang dapat dikendalikan sebagai kaedah penjepit menggunakan vise semasa adalah 3.069 berbanding menggunakan penjepit fleksibel adalah 5.908.

ABSTRACT

Jigs provide a means of manufacturing interchangeable parts since they establish a relation with predetermined tolerances, between the work and the cutting tool. Jigs are used on drilling, reaming, tapping, milling and tapping. The objective of this project is optimize and analyze of the fixable clamping jig for milling machine. The method are modified clamp mechanism of the previous jig, optimize the design of the fixable clamping jig for milling machine, and analyze the result of fixable clamping jig in term of surface roughness. The result of the experiment will be evaluate base of surface roughness by using Portable Surface Roughness Tester, SJ-401. Then, the result will compare with current vise result and fixable clamping result. From the result that have get, the average of Ra value using current vise as a clamping method is higher than using fixable clamping as a clamping method which are 3.468 when using current vise and 1.657 when using fixable clamping for delrin as a work piece. While for aluminum as a work piece, the average of Ra value using current vise as a clamping method is lower than using fixable clamping as a clamping method using current vise is 3.069 compared to using flexible clamping is 5.908.

DEDICATION

To my beloved family especially my father and mother, En. Onn Bin Pangkat and Pn. Norzanar Binti Samsuri, I would to express my appreciation to my parents for their continuous support to me in performing this difficult task, and the journey does not end here.

To my supervisor, Dr. Norfariza Binti Ab. Wahab and Encik Khahar Bin Nordin for being receptive and critical, and challenging me to be a better student.

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CHAPTER 1
INTRODUCTION

1.1 Background

Over the past century, manufacturing has made huge progress. New machine tool, high-performance cutting tools, and present day producing forms empower the present businesses to improve parts speedier and then at any other time. A standout amongst the most tedious and work broad procedures in the assembling of a mechanical part is the procedure of work holding or jig. Jigs are uncommon reason apparatuses which are utilized to encourage creation like machining, assembling and inspection operations.

Large scale manufacturing of work-piece depends on the idea of compatibility as indicated by which each part delivered inside a built up resistance. Jigs give a methods for assembling compatible parts since they build up a connection with predetermined tolerances between the work and the cutting tool. Once the jig is appropriately set up, any number of copy parts might be promptly delivered without extra set up .Although jig strategies have additionally progressed significantly, the essential standards of bracing and finding are as yet the same particularly processing machine. Jigs are utilized on boring, reaming, processing and tapping. There are many points of interest for utilizing jigs underway. Jigs take out individual making, situating and visit checking. This diminishes operation time and increment efficiency.

The fixture designing and developed is well-thought-out as complex process that demands the understanding of dissimilar areas, such as geometry, tolerances, dimensions, procedures and manufacturing processes. While designing this work, a better number of literature and titles written on the subject by well-known authors are bring up. All outcomes and conclusions gained from the literature review and the interaction with fixture designers are used as guide to design the current research work.(Goutham.N and Ramesh Babu.K, 2007)

Milling process can be find in almost all industries, from a small scale industry which is conventional milling machine to big companies which is Computer Numerical Control (CNC) milling machine. It can be defined as the machining process of using rotary cutters to remove material from a work piece by feeding in a direction at an angle with the axis of the tool. Thus, the milling process requires a milling machine, work-piece, fixture and cutter. The work-piece is a pre-shaped material and it is located at the clamping vice.

1.2 Problem Statement

Most of the industry are use milling machine to produce die, aerospace, automotive and machinery. As a basic learning system for milling machining operation, most of the individual trained by convectional milling machine before they use the CNC milling machine.

The problem that have from previous jig show that the angle of the clamping have some error which is lifted up 4 degree error of clamp for this problem, the result for the of the clamped product and quality of the product will be reduce.

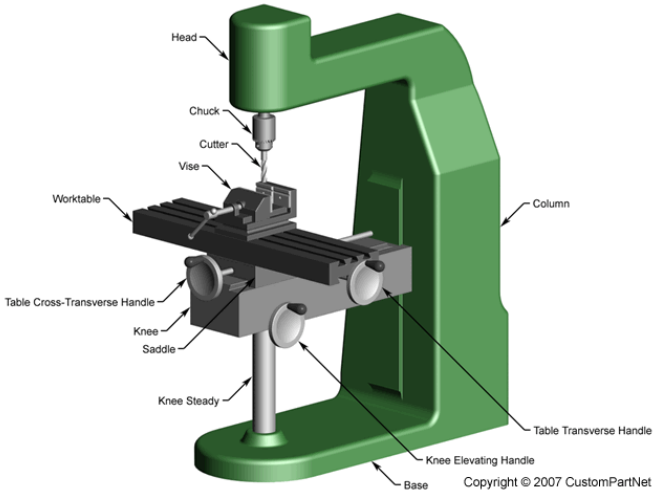

Figure 1.0: Manual vertical milling machine

Second problem from the previous jig is the thickness of the base jig. The base of the jig is too thick which is 50 mm refer Figure 1.1 below. When the thickness is high the weight of the jig will be increase and make the jig difficult to remove to other machine. The cost for making the jig also will be lower.

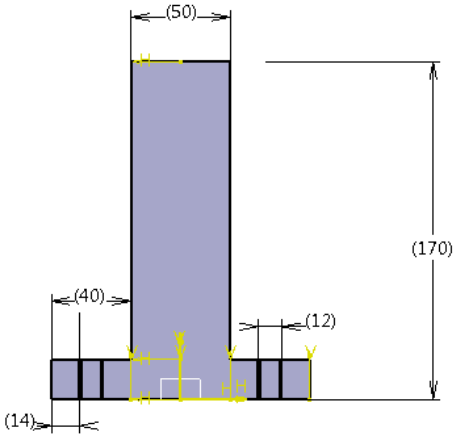

Figure 1.1: Side view of the previous base of the jig

The other problem that the previous jig have is the diameter rod that hold the clamp small. The safety will be lower when the diameter is too small. The rod also cannot extend the high force when doing the machining. The diameter of the rod is 20 mm refer Figure1.2 below.

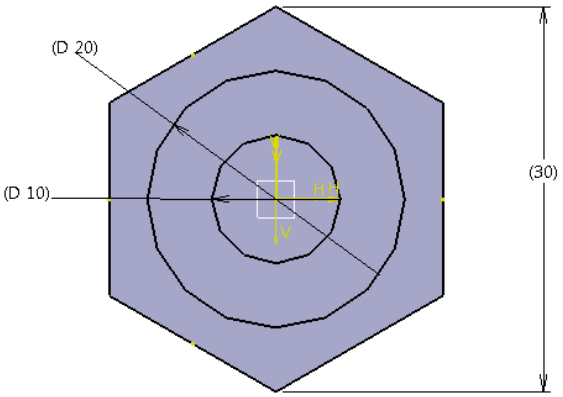

Figure 1.2: Diameter of the previous rod

1.3 Objective

i. To modified clamp mechanism of the previous jig.
ii. To optimize the design of the fixable clamping jig for milling machine.
iii. To analyze the result of fixable clamping jig in term of surface roughness.

1.4 Scope

The scope of this project will cover base on the objective, the scope are:

1) Change the clamp mechanism of the previous jig
2) Reducing of material usage from previous jig
3) Analyze the result of the fixable clamping jig in term of surface roughness.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction of Machining Process

The machining processes have important place in the traditional manufacturing industry. Cost effectiveness of all machining processes has been considered. This is for the most part influenced determination of right machining parameters like cutting speed, feed rate and depth of cut base on cutting tool and workpiece material. The choice of best machining parameters impact in extended tool life, well surface finish and higher material removal rate. During machining process, erosion between workpiece-cutting tools and cutting tool-chip crossing point to high temperature on cutting tool. The impact of this issue delivered heat that declines tool life, builds surface roughness and decreases the dimensional affectability of work material.(Çakīr et al., 2007)

The processes that have basic subject to controlled material removal are known as subtractive manufacturing. While in adjustment from processes of controlled material spreading out, and are known as addictive manufacturing. There are numerous sorts of machining operations. The example of the machining operations are turning, drilling and milling.

2.1.1 Conventional Machining

Conventional machining process is there may be a physical tool existing during machining process. It can be define that all conventional machining are connecting with machining process. It is because, conventional machining includes the direct

contact of tool and work-piece. There are numerous sorts of machining operations that fit for creating specific part geometry and surface composition which is milling, turning and drilling. Besides that, there are different operations that falling into incidental classifications incorporate shaping, sawing, boring and broaching.

2.1.1.1 Milling Machine

A milling machine is a machine instrument that take away metal as the work is accommodate against a rotating multipoint cutter. The milling cutter rotates at rapid and it take out metal at a quick rate with the assistance of multiple cutting edges. At least one number of cutters can be mounted in the meantime on the arbor of milling machine. This is the reason that a milling machine finds fluctuated application in production work. Milling machine is utilized for machining flat surfaces, contoured surfaces, surfaces of revolution, external and internal threads, and helical surfaces of various cross-sections. Run of the mill segments created by a milling are given in Figure 3 .In numerous applications, due of its higher production rate and accuracy, milling machine has even changed shapers and slotters.(Singh, 2006)

Figure 2.1: Component produced by a milling

Type of milling machine

Most of the milling machines are made of "column and knee" structure and they are classified into two main types namely Horizontal Milling Machine refer Figure 4 and Vertical Milling Machine refer Figure 5. The name Horizontal or Vertical is given to the machine by orientation of its spindle axis. Horizontal machines can be more classified into Plain Horizontal and Universal Milling Machine. The main difference between the two is that the table of a Universal Milling Machine can be set at an angle for helical milling while the table of a Plain Horizontal Milling Machine is not.(Professional and Series, 2009)

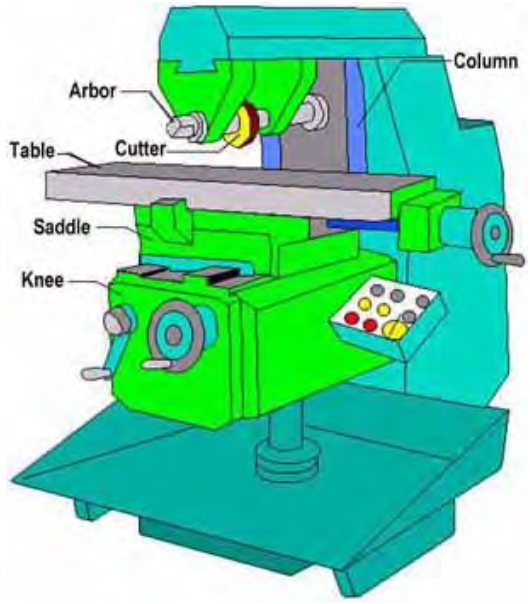

Figure 2.2: Horizontal Milling Machine

Figure 2.3: Vertical Milling Machine

2.1.1.2 Turning Machine

Lathe base on Figure 6 is a standout amongst the most flexible and broadly utilized machine apparatuses all in overabundance of the world. It is usually known as the mother of all other machine apparatus. The main function of lathe is to take away metal from a job to give it the required shape and size. The job is securely and rigidly held in the chuck or in the middle of focuses on the lathe machine and after that turn it against a single point cutting tool which will take away metal from the activity as chips. A engine lathe is the most basic and least complex type of the lathe. It gets its name from the early lathes, which got their energy from engines. Other than the basic turning operation as characterized above, lathe can be utilized to do different operations additionally, for example, drilling, reaming, boring, taper turning, knurling, screw- thread cutting, grinding etc.(Singh, 2006)

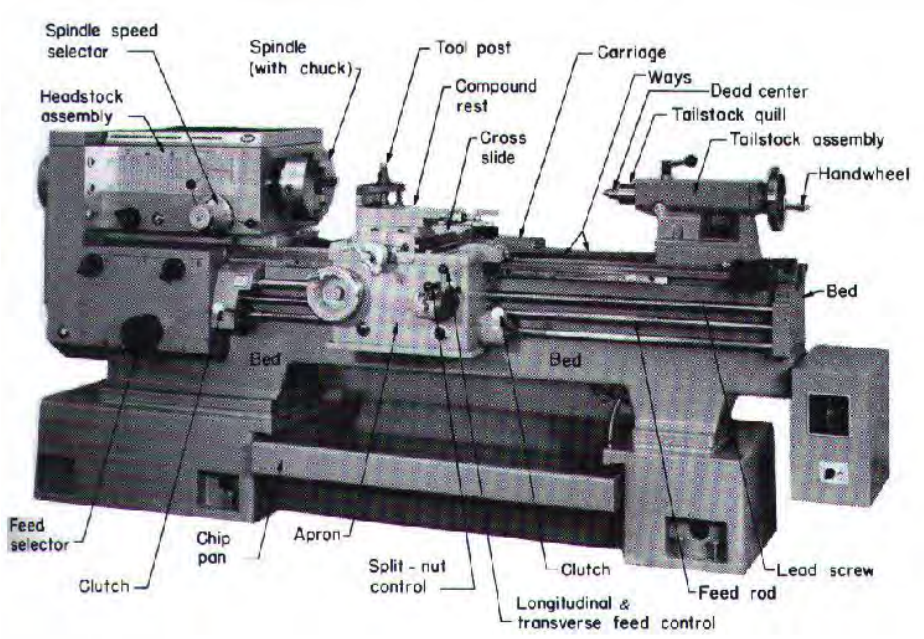

Figure 2.4: Lathe machine with name of part

Accuracy hard turning, characterized as single point cutting of part pieces with hardness of material in overabundance of 45 HRC under feed rate and fine depth of cut conditions, has turned into an alluring contrasting option to conventional grinding in numerous Industrial applications. It offers extremely considerable advantages, for example, ecological amicable and ability to fabricate complex workpiece geometry. In accuracy hard turning, the dimensional precision can achieve IT5 when wrapping up by accuracy hard turning with a CNC machine equipped with high-exactness movement control, high static and dynamic stiffness, and thermal stability systems. (Revel et al., 2016)

2.1.1.3 Drilling Machine

Drilling is an operation of making a rounded hole by take away a volume of metal from the activity by cutting tool called drill. A drill is a turning end-cutting device with at least one cutting lips and typically at least one flutes for the entry of chips and the affirmation of cutting liquid. A drilling machine is a machine device intended for drilling holes in metals. It is a standout amongst the most vital and flexible machine devices in a workshop. Other than drilling round

holes, numerous different operations can likewise be performed on the drilling machine, for example, counter- boring, countersinking, honing, reaming, lapping, sanding etc.(Singh, 2006)

2.1.1.4 Type of Drilling

2.1.1.4.1 Bench Drill

- Bench drill presses can be used to drill holes in small workpieces, Figure 7. These presses do not have as many abilities as the floor model.(Tinley Park and Illinois, 2000)

Figure 2.5: Bench drill

2.1.1.4.2 Hand Drill

- Hand drill are used to drill small holes in relatively thin material. It are inexpensive and suitable to use. There are two type of hand drill which are electric hand drill and cordless hand drill. See Figure 8. (Tinley Park and Illinois, 2000)

Figure 2.6: Cordless hand drill

Figure 2.7: Electric hand drill

2.1.1.4.3 Radial Drill

- A radial drill press is make to manage very large drilling work. The drill head is mounted in a way that allows it to be moved back and forth on an arm that spread out from the huge machine column. The arm can be moved up and down and pivoted on the column, Figure 10.(Tinley Park and Illinois, 2000)