



**Faculty of Mechanical and Manufacturing
Engineering Technology**

**DESIGN AND DEVELOP THE ADJUSTABLE BORING HEAD
FOR CONVENTIONAL MILLING MACHINE**

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Bachelor of Manufacturing Engineering Technology (Process & Technology)

2018

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FOR CONVENTIONAL MILLING MACHINE**

Muhammad Zairul Naim Bin Zakaria

**This report is submitted in accordance with the requirement of the Universiti
Teknikal Malaysia Melaka (UTeM) for Bachelor of Manufacturing Engineering
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**Faculty of Mechanical and Manufacturing
Engineering Technology**

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BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: Design and Develop the Adjustable Boring Head for Conventional Milling Machine

SESI PENGAJIAN: 2018/2019 Semester 2

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DEDICATION

To my lovely mum and dad,

Zakaria Bin Othman and Che Zarah Binti Senik,

With loving sacrifices and their unconditional support in my life,

To my siblings and friends,

Who always who always help me prepared and completed this report.

And

For those I love very much

For the lectures, my supervisors, assistant engineers who are given

much guidance to me without expecting any reward.

ABSTRACT

In this project, adjustable boring head for milling machines will be designed and fabricated. This tool is one of the basic tools used for milling machines. This tool is designed to improve the existing boring head tool. Among the improvements made is to produce a tuner on the tool and it can bore a hole with the decimal value. The existing boring head is only able to do a hole with the rounded value. So, by creating of this product, the operator no longer needs to clamp and unclamp the workpiece repeatedly if wants to do the machine work on surfaces other than those that have been suppressed. This will prevent the surface of the workpiece from being scratched or damaged especially if it has a screw thread. The boring head of this designed milling machine will be produced using various types of manufacturing process. To achieve the objectives of this project, concept generation will be initiated by producing the required design. The boring head design will be described using Solid Works software. The simulation will be based on the existing boring product to ensure the size and measurement of the product referring to the standard milling machine. It also aims to ensure the boring head that will be produced safely used by the operators. Among the processes involved in producing this product are lathe processing, milling process, grinding process, drilling process and taping process. It is hoped that when this product is produced, it will help ease the coordination work and will also improve the product's performance

ABSTRAK

Dalam projek ini, *boring head* boleh laras untuk mesin *milling* akan direka dan direka. Alat ini adalah salah satu alat asas yang digunakan untuk mesin *milling*. Alat ini direka untuk memperbaiki *boring head* yang sedia ada. Antara penambahbaikan yang dibuat adalah untuk menghasilkan penala pada alat dan ia boleh menanggung lubang dengan nilai perpuluhan. *Boring head* sedia ada hanya mampu melakukan lubang dengan nilai bulat. Oleh itu, dengan membuat produk ini, pengendali tidak perlu lagi mengepal dan mengikat bahan kerja berulang-ulang jika ingin melakukan kerja mesin pada permukaan selain daripada yang telah ditindas. Ini akan menghalang permukaan bahan kerja daripada tercalar atau rosak terutama jika ia mempunyai benang skru. *Boring head* untuk mesin *milling* yang direka ini akan dihasilkan menggunakan pelbagai jenis proses pembuatan. Untuk mencapai matlamat projek ini, penjanaaan konsep akan dimulakan dengan menghasilkan reka bentuk yang diperlukan. Reka bentuk *boring head* akan diterangkan dengan menggunakan perisian *Solid Works*. Simulasi ini akan berdasarkan produk yang membosankan untuk memastikan saiz dan pengukuran produk merujuk kepada mesin *milling standard*. Ia juga bertujuan untuk memastikan *boring head* yang akan dihasilkan dengan selamat digunakan oleh pengendali. Antara proses yang terlibat dalam menghasilkan produk ini ialah pemprosesan *lathe*, proses *milling*, proses *grinding*, proses *drilling* dan proses *tapping*. Diharapkan apabila produk ini dihasilkan, ia akan membantu mengurangkan kerja penyelarasan dan juga meningkatkan prestasi produk

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LIST OF ABBREVIATIONS, SYMBOL AND NOMENCLATURES

C	-	Celsius
CNC	-	Computer Numerical Control
CS	-	Cutting Speed
D	-	Diameter
F	-	Feed per Tooth
FTK	-	Fakulti Teknologi Kejuruteraan
IPM	-	Inches per Minutes
N	-	Number of Teeth
PSM	-	Projek Sarjana Muda
RPM	-	Revolution per Minutes
SFM	-	Surface Feed per Minutes
UTeM	-	Universiti Teknikal Malaysia
°	-	Degree

CHAPTER 1

INTRODUCTION

1.0 Background

Manufacturing is a process of producing raw materials, part or components into finished goods that what a customer needed of a specification. In order to produce a product, different manufacturing processes need to be combined and work on the raw material to form the desired shape of a certain product. There are various processes in manufacturing industry such as casting, molding, forming, machining, and others. Milling is one of the machining processes where it cuts away various type of material with feeding a workpiece using a rotating multiple tooth cutter.

The manufacturing industry is getting advance gradually over past century as new machine tools with high-performance technologies were invented and refined. Modern manufacturing processes enable today's industries to produce the variety of product with higher efficiency and quality.

The boring head had the basic functions from then till now which is fits the milling machine spindle and make sure most drilled holes to have a good and right diameter accuracy. Besides that, boring head are used to create the large hole when tolerance does not allow for a drill bit or do not have a large enough drill or reamer and can be used to enlarge the hole or adjust hole centerline in certain instances.

1.1 Objective

The objectives of this project are defined as below:

- To generate concepts and develop a boring head based on problem and the need of the user.
- To produce an adjustable boring head that is suitable for work and machining process.
- To produce a boring head that can bore in decimal value of hole.
- To analyze the prototype of boring head.

1.2 Problem Statement

Milling operation removes workpiece material from workpiece surface to form certain shape. A usual machine boring head enables operators or machinist to work only the no decimal value of the hole measurement. However, some of the shapes need to perform milling operation on the decimal value of hole. While operators wanted to work at the complex size of the hole, the workpiece needs to be unclamped, change clamping direction and install again to the machine. The process of unclamping and clamp again will longer the time of machining process. Besides that, the dimension might run off slightly after the clamping position was change. Furthermore, there are sometimes requiring clamping on finish surface and the clamping continuously will scratch the finish surface.

1.3 Scope

The scope of this project will be focus on the improved design of the boring head for the milling process. Concepts will be generated and best concept will be illustrated out in detail. The material will be chosen for the boring head and machining process will be run to produce the adjustable boring head.

CHAPTER 2

LITERATURE REVIEW

This chapter stated the review of theory, technique, patents and any scholar article that are relate to this project.

2.1 Milling machine

2.1.1 Introduction of Milling Machine

Milling machine is a machine type where the material and workpiece is removed by revolving cutter with single or multiple cutting edges. [Rajput, 2007] Workpiece will be secure on the work holding device that mounted on the workbench of the machine then it will be moving into contact with the spinning cutter. Milling machine is basically classified into two type which is horizontal and vertical milling machine where it is differentiated by position of the spindle where the spindle is either in vertical or horizontal position. [Krar, Gill, Smid, 2011]

A vertical milling machine is build up with a combination of vertical spindle of a drill press where the milling table can be move in longitudinal and transverse movement. The spindle of the vertical milling machine is moving in a vertical position and therefore several operations such as milling, drilling, boring and others can be done by a vertical milling machine. Meanwhile, a horizontal milling machine contains spindle

that mounted horizontal parallel to X-Y table. A horizontal milling machine can perform operations almost the same with the vertical milling machine. However, a vertical milling machine can perform better operations than horizontal milling machine. Besides that, vertical milling machine is categories as few types such as knee-type, ram-type, bed-type and also planar-type. Various spindle speed is also available and can be adjusted by a machinist to spindle speed that is suitable based on different material and operation. A vertical milling machine is constructing with a few major parts which include base, knee, column, table, and head. [Krar, Gill, Smid, 2011]

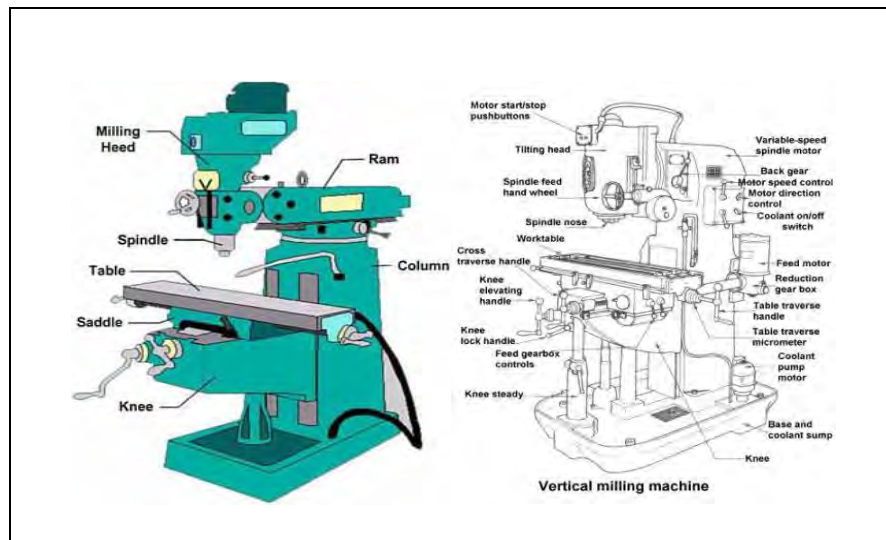


Figure 2.1 Part of a vertical milling machine

(source: <http://mmu.ic.polyu.edu.hk/handout/0103/0103.htm>)

a) Base

The base is made up of grey cast iron and plays a role as a basis for other parts to rely on it. It carries the column of the machine as well. Some of the bases also has a dent in the middle of the base so that coolant is deposit inside for easy cleaning.

b) Column

The column is basically a 'backbone' of a milling machine. The mechanism of the milling machine including a driving mechanism for spindle and table feed are cage inside the column. The column also provides rails for vertical movement of machine knee. The top part of the column is functioning for hold the ram that extends outward of the machine.

c) Knee

The knee is used to support the saddle and the milling table where it can be adjusted in vertical movement along the rail on the machine column as well. The mechanism that used for movement of table is stored inside the machine knee. Those mechanisms can be operated by using different controller available either in manual or automatic.

d) Table

The table is placed on top of the saddle which is rest on top of the knee of the milling machine. It travels longitudinally. The milling machine table is top with T-slots rails that are used for clamping for vises and fixtures. The movement of the table can be adjusted either in manually or automatically.

e) Head

The head of the machine is connected to machine column with a ram. The head of the milling machine is extending outward from the column. It can be revolving transverse as well while needed during the machining process. The motor that used to operate the spindle is set at the head of the milling machines. Motor usually used v-belt to operate spindle where the spindle speed can be adjusted.