



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Development Drill Press Stand for Portable Electric Drill

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

by

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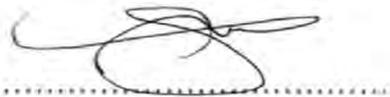
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ABSTRAK

Kebiasaannya , pelajar baharu terutama daripada kejuruteraan teknikal akan mengalami satu masalah iaitu dalam mengendalikan mesin seperti mesin gerudi elektrik mudah alih. Akhirnya mereka akan tercedera atau mengalami kemalangan kerana tidak biasa menggunakan mesin gerudi elektrik. Tujuan dalam mengendalikan projek ini adalah untuk membuat tempat pemegang gerudi untuk gerudi elektrik mudah alih. Kaedah berikut dalam menjalankan projek ini adalah untuk mereka bentuk berdasarkan konsep generasi.Konsep terbaik reka bentuk akan menjalani simulasi menggunakan Von Mises Stress selepas reka bentuk terperinci yang telah selesai. Proses fabrikasi melibatkan pengilangan dan kimpalan dan produk akan diuji berdasarkan kebolehpayaannya. Keputusan yang dapat dijangkakan dalam projek ini akan membantu pelajar untuk menggunakan gerudi elektrik mudah alih dan mempunyai proses penggerudian dengan tepat pada projek atau bahan kerja mereka.

ABSTRACT

Normally, first year students of University Teknikal Malaysia Melaka (UTeM) especially from the technical engineering will intend to have problem in handling power tools such as the portable electric drill. Eventually they will get injured or accident because of unfamiliar of using the power tools. The limitation of the drill press at the fabrication lab will cause the task or project to be delayed and not completed. The aim of this project is to make a drill press stand for portable electric drill at Makmal Fabrikasi JTKP. The following method for conducting this project is to design a drill press based on the concept generation. The best concept of the design will undergo simulation using Von Stress Mises after the detail design is been completed. After the simulation process is implemented , the fabrication process will be run that involves milling and welding. The product also will be tested based on its functionality. As an expected result, the project will help the students on easy handling on the portable electric drill , achieve accurate drilling process at their workpiece and avoid from getting injured.

DEDICATION

Specially dedicated to my beloved family and friends...

Dedicated to my lovely family

Ghulam Shabir Bin Mobarak Ali

Khairul Bariyah Binti Hassan

Muhammad Syazmeer Bin Ghulam

Dedicated to all my lecturers and friends...

Thank you for the good times...

The days you filled with pleasure.

Thank you for fond memories,

And for feeling I will always treasure...

Thanks for all your love and support...

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

CNC	Computer Numerical Control
JTKP	Jabatan Teknologi Kejuruteraan Pembuatan
MIG	Metal Inert Gas
mm	millimeter
0_i	Objective Parameter
QFD	Quality Function Deployment
FOS	Factor of Safety
Kg	Kilogram

CHAPTER 1

INTRODUCTION

1.1 Background of Study

The drill is one of the common tools that are mainly used in the household and construction. From the very first hand drills that act as a very useful purpose, and as the day past to the modern days, and have largely been replaced by the cordless model. The main function of a drill was to make a hole in the stone, metal or wood therefore the use has been expanded over the years. There are many types of drills, and one of them is the bore drill which the function is simply drills a hole. At the Roman and Medieval ages, the auger was created and still been used today. The very first electric drill was made in 1889 and created by the Arthur James Arnot and William Blanch Brain (James, 2009). The electric drill that created later on is been developed by making the connection and combining the drill with an electric motor. After a few year past after the first electric drill has been made, the Germans designers Wilhelm and Carl Fein have generated an idea to take the electric drill and design it to fit into users hand and for the portable use. At 1917, the company Black and Decker have made the electric drill that attached trigger-switch operated and pistol handle drill (Eric, 2015).

Since then, the electric drill have been evolved as many type of design are been made and the attachment that can be used for the electric drill. Thus, this would increase its functionality such as auxiliary handle and also can be used for sander. Rather being used by the woodworkers, the electric drill has been a good use for the plumbers, electricians and also for the students to do their projects or tasks. As for the students that taking engineering course, certain university or the college have focused on the hands on for the students to be familiar on using the power tool such as grinder, lathe machine, welding machine, drill press and also on using the portable

electric drill. In their certain subject such as the manufacturing or fabrication subject , the students will given a task and project that needed to be completed in a certain time given by the lecturer. In University Teknikal Malaysia Melaka (UTeM), the students from first and the second year will needed to take the manufacturing practice subject and they will needed to do a project in a group. The majority project or task that been made by the students will involving drilling process which is the student will have to use drill press or the portable electric drill.

1.2 Problem Statement

Mainly the students from the first year student that taking the manufacturing practice subject are not familiar and feeling clumsy on using the power tool such as electric portable drill. Without a practice or a safety precaution taken by the students, accidents may happen when using the electric drill. Besides that, the limitation of the drill press machine that available in the fabrication lab will make students to take a turn to drilling their work piece or project and time will be wasted. Therefore, this also will lead to the bottle neck which causes the entire project or task to be delayed or slow down.

1.3 Objectives

This subject embarks on the following objectives:

- Design a drill press stand for portable electric drill for the use at fabrication lab of the Department of Manufacturing Engineering Technology (JTKP).
- Fabricate the drill press stand for portable electric drill based on the develop design.
- Perform testing based on the functionality of the drill press stand

1.4 Scope of Project

This project is narrowed down to certain scopes that been identified based on project objectives. Among the scopes that been emphases are:

- Develop multipurpose drill press stand based which is have 90 degree of drill position and the depth stop setting.
- The drill that will be used for the drill press stand must be in the fabrication lab
- Testing the new develop design and make static analysis by using Solid Works simulation.
- Fabricating the product by using CNC Milling Machine.

1.5 Expected Result

There are 3 expected results that will achieve by conducting this project:

- The result of this study expected on the development of design drill press stand that improving its productivity and efficiency during fabrication process.
- This prototype can help the students for easier handling and prevent injury when using portable electric drill.
- The prototype of this study is for the students to use a drill press stand that can perform drilling a straight through hole and setting the drilling depth.

CHAPTER 2

LITERATURE REVIEW

2.1 Drilling Process

Drilling is one of the most common used in machining process that uses multi tooth cutting tools called drills or drill bits to make a hole and enlarging a hole of circular cross-section in solid materials such as metal or wood. There are several design parameter are included in a typical drill such as cutting lip length, tip angle , chisel edge angle , helix angle , chisel edge length and cutting lip length. From these parameters, the cutting forces and the drilled hole qualities are all affected. In a drill also consists of two main cutting edges which is the chisel edge and the cutting lips. Contributing substantially to the thrust force, the chisel edge extrudes into the workpiece material while the cutting lips cut out the material. This will lead to the majority of the drilling torque and thrust is formed. The chips are formed along with the cutting lip and moved up following the drill helix angle during the drill operation. The drill geometry has a complicated effect on the cutting forces. These cutting forces are being relying on the tool, material properties of the workpiece and also the conditions when machining. (Pirtini, 2005)

The cutting forces are the major reason of the problems related to drilling process. For example form, surface errors, vibration, tool wear and many more. There are some previous researchers that have developed mathematical models of drilling to estimate thrust and torque produced. According to Williams, 1974 showed that during cutting there are three identifiable zones of interest at the drill point, the main cutting edges, the secondary cutting edges at the chisel edge and an indentation zone about the drill center. Besides that, the model from Zhang, 2001 stated that based on mechanics of vibration and the continuous distribution of thrust and torque along the lip and the chisel edge of the twist drill. As the feed increases

under the constant vibration parameters, the mean thrust and torque increased as the feed increases. Another model was presented for drilling processes by Yang, 1998 which is the model that presented has four parts which is the force model for the cutting lip, the force model for the chisel angle, the dynamic model for the machine tool and the regenerative correlation between the force and machine tool vibration. In addition, Elhachimi, 1999 assumed that the chisel edge model results are very small compared with where the cutting process takes places and they found that the thrust force is not sensitive to the variation of the spindle rotational speed. Therefore, the spindle speed effect cannot be ignored on the torque as the power and the torque are proportional to the rotational speed. Moreover, with the increasing of the feeding process, the thrust force, torque and power will also increase.

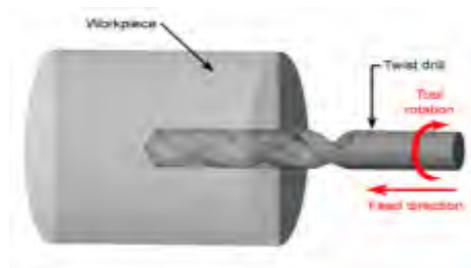


Figure 2.1: Drilling Process

Source: <http://www.custompartnet.com/wu/turning>

2.2 Type of Drill

There are many drills based on its types and sizes, each are designed to undergo a specific job to its best advantages. They are also categorized based on different parameters like manual drills and automatic drill. Manual drills mostly known as hand pressure on the device to drilling a hole. Therefore, as the automatic drill is mostly powered by the electric source or motor equipped which can reduce on the effort while in drilling process. Basically, there are three common type of drill which is the corded drill, cordless drill and the drill press.

2.2.1 Corded Drill

Corded drill is a drill where the electric supply needed for it to operate. This type of drill has two sizes available in the market which is three eighth inch drill and the half inch drill. For the three eights inch drill, the size is small enough to be held comfortably in one hand. Most of this model of this chuck size has a pistol grip and practical for a great many uses. This model has two very useful options that is controlled variable speed and also the reverse direction in which the drill turns. This controlled variable speed makes easier on starting holes, drive screws, and drilling wood or metal from slow to medium speeds. For the reversibility option helps on reverse drills out of holes and removes screws. This model of drill is available with more or less power of one-half horsepower about average with various maximum speeds from between twelve hundred and twenty five revolutions per minute.

As for the half inch drill is more powerful model, typically with a three-quarter horsepower motor (Bob, 2016) .This model of drill are also available in pistol-grip configurations, but for some demanding drilling to which this drill is well-suited, a bulkier configuration that features a closed handle at the rear plus the auxiliary grip on the side of the drill's body is probably most helpful. While drilling, the added handholds allow not only to steady the tool as it drills, but to apply additional pressure while drilling. This will ensure that if the drill becomes caught in the work the drill will not twist itself out of your grip. Most of this type of model are designed to turn at fewer revolutions per minute , but have more power that will makes them indispensable for drilling large diameter holes through dimension lumber and timber or heavy-duty tasks. According to the Walker 2014, most model of the corded drill or either cordless drill have maximum chuck size capacity is mainly 3/8 to 4/0 inches.



Figure 2.2: Corded Electric Drill

Source: <http://www.garagejournal.com/forum>

2.2.2 Cordless Drill.

There is the other type of electric drill which is the cordless drill. This type of drill is one of the tools which are convenient that can carry and use it anywhere without relying on the electric source. Therefore, the cordless drill may have certain disadvantages. One of them is most of the model of cordless drill are heavier than corded drill. This is because the power sources of this type of drills are rechargeable battery that adds weight. Eventually this added weight from the rechargeable battery will make the user feel strange when held. This type of drill also have less power available to them that the bit will stop turning and the clutch clicking will heard. Other than that, despite of having the mobility and can do drilling work on any place, therefore it is only works only as long as its battery is charged. The charge will last surprisingly long time but it will still need to keep a spare battery on hand especially on a professional keep. Most of the cordless drill model recharge in approximately an hour. The other functions of the cordless drill are all same as the corded drill, from the reversible to the variable speed control which is functions by depressing the trigger gently for low speeds, medium and high. Some of the cordless drill models just have one or two speeds which are roughly five hundred revolutions per minutes and twelve hundred revolutions per minute are typical and also have a speed-control switch (Bob, 2016).