

JIG FOR MAKING CIRCLE & CURVE SHAPE BY USING PORTABLE ROUTER

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Abstract

In furniture making production, traditionally circle and curve shapes are cutting by using jigsaw. The problem with old method have been identified involved many processes such as sketching on the work piece, sanding and cutting this the production time will be increased. Besides, the product of circle and curve shape were not very smooth and accurate. Therefore, the objective of this study is to produce jig to form circle and curve shapes by using portable router. The jig is proposed for small manufacturers (SME) in wood based manufacturing industry, technical lecturers or teachers for their teaching aids and for technical students. The recommended size for making circle and curve shape is between radiuses of 6" inch to 2'ft 11"inch. From the result obtained, jig produced can makes circle and curve shape more accurate and smooth compared than using a jigsaw. Thus, production time, cost and processes can be reduced. From this project, it can be concluded that jig for making circle and curve shape was completed successfully and will help the wood based industry especially for SME and for technical lectures and students as well.

Keywords : jig, circle and curve shape, portable router

1.0 Introduction

Today, furniture production has reached a level of pride in producing highly innovative furniture with the appearance of creative and full of artistic characteristics. This has led the furniture manufacturers to compete with each other in producing furniture with variety forms of furniture to meet consumer demand. The most forms and characteristics of art that are in high demand from consumers are rounded and curve art. Normally this form applied in the manufacture of furniture such as coffee tables, tables and chairs. This is because these forms produce unique and exciting condition. However, to produce a rounded shape and curve, high technology machines are needed to get the accurate and suitable sizes of the circle and curve shape of the product.

There are many types of machine invented in order to make work easier and produce high quality product. However, problems still faced by the small manufacturers and SMEs. The factor comes from the machine inventors that gives lack of focusing in suitable tools for the small manufacturer, small entrepreneur, SMEs, educational institute and the new students that just involve in wood working. Usually, SMEs, technical lecturers and technical students at educational institute use jigsaw to make circle and curve shapes. This particular jigsaw need many work process to get a

nice and end smooth shape. It has to sketch the circle or curve shape on the work piece before cutting process. After cutting process, the edge of work piece need to refine to be in accurate measurement, smooth end and fine circle or curve shape.

CNC machine is the famous machine for making circle and make curve shapes. It functions well, accurate, less work and save time. It also makes work easier. However, not all SMEs and educational institutes can afford to buy CNC machine due to its high cost and high maintenance cost. SME and educational institute has problem in getting high technology machine due to the particular. The common problems that always happen to the workers, technical lecturers and technical students when using jigsaw is during the process of cutting, shaping, and making the circle shape. In addition, they are also facing with difficulties of handling the machine or router. Therefore, jigsaw providers should see the features of suitable jig for making the circular shape.

Router is one of the hand tools that is portable and easy to use. Router machine is frequently used in wood manufacturing product by all woodworkers. A router can cut a groove, fancy shape moldings, rebate, or cut a tongue and groove. Therefore, the use found that jig for making circle and curve shape by using portable router can help to overcome those problems. The work processes to make circle or curve shape can be reduced compare to conventional method. The jig can skip the process of sketching the shape on the work piece because it is already have the meter scale for measurement. Besides, sanding work will be eliminated because the edge of work piece produced gives a smooth edge cutting. Therefore, the jig can reduce work process in making circle or curve shape.

Hence, this study is to enhance better understanding on making circle and curve shape easier. With this jig, it can make producing of furniture more quickly and less time consuming. Not only that, the work process to make circle or curve shape also can be reduce compare to the conventional ways. It also helps to save costs in many ways such as the ability of producers to obtain cheaper machines and innovative use of work during the cutting process. Another advantages and benefits resulting from the jig are to help the user to operate and control the machine, especially for those who are involved in the production of furniture. Besides that, the results of cutting can be more accurate, smooth end and nice. In addition, this jig is easy for the maintenance by the user and easy to repair without the high cost and easy to carry anywhere to ease of use.

1.1 Statement of the Problem

For making or cutting the circle and curve shape, usually using jigsaw, but if using jigsaw, it will comes with many other steps to make the cutting. First, the circle or curve shape must be sketch on the work piece. After cutting process, the work piece must be sanding to get an accurate and smooth shape. To make the work process less and easier, the jig for making circle and curve shape by using portable router can replace the jigsaw to make circle or curve shape.

1.2 Significant of Study

The jig for circle and curve shape is for making some work more easily. The aim of this study was to try to make a jig that facilitates cutting jobs to make a circle or curve shape. This is because to try to help students in the learning process, for equipment and teaching aids for technical lecturers and for SME that cannot afford to buy expensive machinery. Information obtained from the present study will provide a baseline understanding on the behavior of personal use in making circle shape using jigsaw need many work processes and not accurate in measure. Primarily, the present study will gain the knowledge about the jig and its suitability

used in industries and educational institute. Additionally, this study will provide an understanding of the problems that the workers, technical lecturers and technical students faced and knowing the problems and solve it. Finding from this study may be useful to various people, including technical students, technical lectures and SME manufacturer.

1.3 Objective

To produce jig for making circle and curve shapes.

1.4 Scope

This jig is proposed for small manufacturers and SME which are involved in wood manufacturing products, technical lecturers or teachers for their learning guide and for technical students. The recommended size for making circle and curve shape is between radiuses of 6" inch to 2'ft 11"inch.

2.0 Literature Review

2.1 Introduction

Jig is one the of hand tools that are used for woodworking. The jig is designed to make work easier and a little bit faster than using manual hand tools. It takes solid woodworking knowledge and some problem solving skill, with a good close of inspiration. Most jigs can be used for more than one operation. It is more productive to assemble basic element and jig to work whatever tools (Sandor, 1994).

Generally speaking, based on Sandor,(2006), jigs are the devices that help to cut, shape, drill and sand parts quickly and accurately, while fixtures are devices that hold parts firmly during machining and assembly. Used separately or together, these essential woodworking aids help us do everyday tasks like cutting boards to accurate length and width, as well as complex operation like pattern routing parts or sawing three-dimensional shapes.

With all the tools in an average workshop, why do we need jigs and fixtures at all? For starters, some tools are nearly useless without them: Imagine ripping or crosscutting on a table saw without a rip fence and a miter gauge. By using a variety of other jigs, you can greatly expand a table saw's basic repertoire and cut a variety of joinery, shape moldings and panels, and more (Sandor, 2006).

In simple word, jigs are the things that help to make the work easier. Jigs are widely used in woodworking industries. The commercially made jigs are miter gauges, router edge guides and others. Jigs are not only made from wood, but also can be in metal, steel, plastic, aluminum and others materials that are suitable for each uses.

The jig router is designed to make the circle shape easier and more accurate. Nowadays, industries for furniture sector are widely expanded. Customers like to request a variety or shapes of furniture due to their favorites. Circle or curve shapes are the example of the furniture shape. Therefore, the jig router for make circle shape can aids the woodworkers to cut the circle shape easier and time consuming.

Before, there are a few steps to make or cut a circle shape. For example, circles and arcs can be laid out directly on the work, using dividers or a pencil compass. For large circles, you can use the trammel points or a piece of string. The coping saw, compass saw, and keyhole saw are hand tools used to cut curves (Willis & Clois, 2006).

Jig router is easy to handle and operate. Besides that, it can make cutting more accurate than using jigsaw or other manual ways. This is because, if using jigsaw, it not cuts accurately and needs to go through the sanding process for make it accurate. Jig router easy in maintenance by the user and easy to repair without need high cost.

2.2. Materials

The main material that used to make the jig router is MDF Board. MDF board was chosen because of its properties suitable for making jig. MDF is a much better jig-building material than underlayment particleboard because MDF's core is at least 85% as dense as its faces. This makes for clean, smooth edges that are strong and dense enough to hold screws and other fasteners. Because of its exceptionally smooth, dependably flat surface, many woodworkers prefer MDF over even premium-grade plywood for making jig bases or jig table surfaces (Sandor, 2006).

There are many advantages of MDF board. It is less expensive than natural woods. Besides that, MDF isotropic. Its properties are the same in all directions as a result of no grain, so no tendency to split. MDF is one of the Engineered wood that easy to paint and consistent in strength and size.

MDF does not contain knots or rings, making it more uniform than natural woods during cutting and in service. However, MDF is not entirely isotropic, since the fibers are pressed tightly together through the sheet. Like natural wood, MDF may split when woodscrews are installed without pilot holes, and MDF may be glued, doweled or laminated, but smooth-shank nails do not hold well.

The another material to make jig are PVA Glue, screws, double-sided tape and bolt and nut. PVA glue are used for assemble the parts of the body of jig. Double-sided PE foam tapes are used for holding the base of jig on the work piece. A double-sided tape was chosen because it has high initial tack. It is proven to be reliable problem solvers in the industrial bonding technology due to rational, design-friendly and emission free applications. Besides that, it has fewer tendencies to defects on work piece.

PVA glue was chosen because it is suitable and strong enough for general woodworking. PVA are frequently called white glues. They are very popular with both the do-it-yourself and industry. PVA's are non-toxic, have a rapid setting time, fair gap-filling qualities, are slightly flexible, and have long shelf life. They are an excellent choice for general woodworking (Willis and Clois, 2006). There are other advantages of PVA Glues. They are water-based and clean up with warm soapy water. It is only toxic to ingest, it does not emit any harmful fumes, and is not hazardous to touch. Besides that, PVA is not gap filler; in some cases you can add sawdust to it to increase its gap filling ability.

Screws and bolt and nut were chosen to assemble the center parts of jig. The part is for adjusting the bearing and to hold the jig with work piece. Screw is one of the best bonding to assemble parts. Based on Floyd, (2010), wood screws are used when greater holding power is needed and when the work being fastened must at times be removed. Next, bolts are also needed for bonding or assemble something. It is very suitable to use for

bearing in this jig. Bolt are often used by the carpenter in attaching one unit or member to another. There are many different designs and type for specialist jobs (Don, 2006).

The finishing processes are important in almost all woodworking. It is because this will enhance natural beauty of wood's grain texture and surface markings. Not only that, finishing process is to protect the wood from a wide variety of things that will destroy, damage or disfigure it some way (Hosker, 1993).

Materials used are lacquer thinner, NC sealer, NC clear and wood stain. The professionals still regard lacquer as the best all-around finish for wood because it dries fast, imparts an incredible depth and richness to the wood, exhibits moderate to excellent durability and rubs out well. (Jeff, 2006)

In finishing processes, spraying method is chosen. This is because, spraying gives the best results. A spray gun allows you to apply a full, even coat over an entire piece in a manner of minutes. The finish dries so quickly that, in most cases, you will be able to apply several coats in one day (Jeff, 2006).

3.0 Methodology

A. Materials.

MDF board is the main material used for jig making. The other materials used include screws, bolt and nut, measuring tape and PVA glue.

B. Tools and Machines.

There are a few hand tools and machines used in the process of making the jig. For hand tools, they are measuring tape, L-square ruler, screwdriver, pliers and G-clamp. Machines that are used included table saw, boring, jigsaw, cordless, and hand drill machine.

C. Design of Jig

The design of jig are drawn by using AutoCAD Software as shown in figure 3.1.

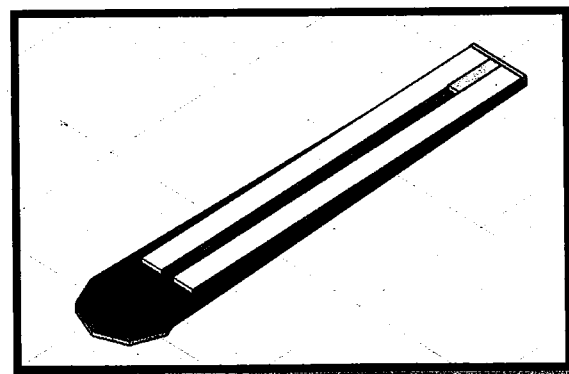


Figure 3.1: Design of jig.

Flowchart for the making Jig process.

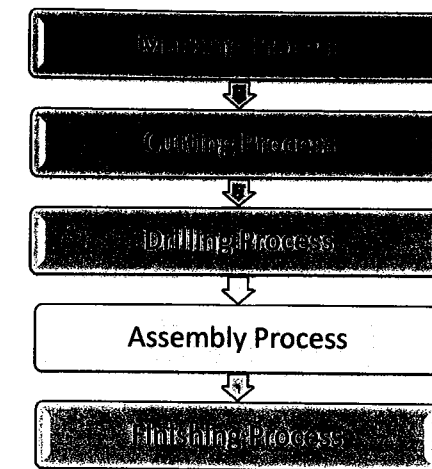


Figure 3.2: Process of jig making

i) Marking Process.

In marking process, the sizes of each part of jig are measured and marked before through cutting process. In this process, the pencil, compasses, L-square ruler and eraser are used. Firstly, for the Core part, sketch a rectangle shape with sizes $41\frac{1}{4}'' \times 7\frac{1}{2}''$ on the board size $4' \times 8'$. Sketch the round shape with diameter $3\frac{1}{4}''$ to make hexagon shape by using geometry concept for Base part. After the cutting process of hexagon shape, trace the hexagon shape on the board that sizes $41\frac{1}{4}'' \times 7\frac{1}{2}''$ at the one of its end board. Next, draw a centre line on the board sizes $41\frac{1}{4}'' \times 7\frac{1}{2}''$ next to the hexagon shape. Last step, sketch 2 rectangle shapes that sizes $33\frac{1}{2}'' \times 2''$ for the Top part. Refer to figure 3.3.

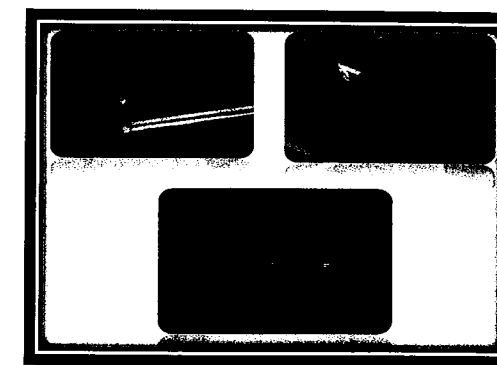


Figure 3.3: The marking process on the MDF Board

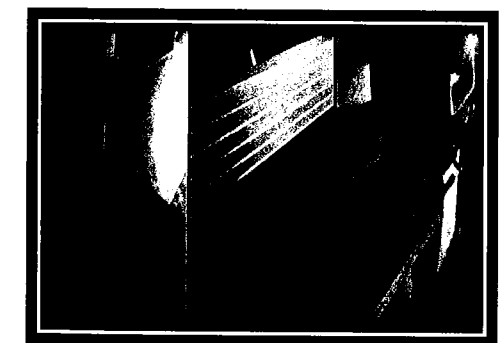


Figure 3.4: The cutting process by using table saw machine and portable jigsaw

ii) Cutting Process

Second step is cutting process. After finished the marking process, the materials are cut into its sizes and shapes. In this process, table saw machine, portable jigsaw, and portable

router are used to cut the Core part, Base part (hexagon) and Middle parts. Refer to figure 3.4.

ii) Drilling Process

Next, continue with drilling process. Drilling processes are done by using drilling machine and portable hand drill. The parts that involve in drilling process are at the hexagon part. This is because the part acts as the base for the portable router. Therefore, the base are drill for assemble the portable router with jig by using screws. Before drilling process starts, the base of portable router must be trace to get the accurate holes to avoid the difficulties during assembly the router with jig. Refer to figure 3.5.



Figure 3.5: The drilling process by using drilling machine and portable hand drill.

iii) Assembly Process

After marking, cutting and drilling process, it is time for assembly all the parts. PVA Glue, screws, bolt and nut are used to assemble the parts. For bearings, welding process is used to assemble them. PVA Glues are used because it is suitable, strong, long lasting and dry faster. PVA Glues are spread at the surface that will be assembling by using brush for better spreading. Then, the parts that are assembling are clamp by using G-clamp for better assembly. Refer to figure 3.6 and figure 3.7.



Figure 3.6: The process of assembly the bearing of the jig.



Figure 3.7: The assembly process of the parts of jig.

v). Finishing Process

Lastly, it is the finishing process. The materials used are NC sealer clear, lacquer thinner and Rosewood stains. Besides that, sandpaper grit 320 is used also. For finishing process, spraying method is used because it is easy and dries faster. Therefore, spray gun with air compressor is used.

First step is sanding the jig surface by using sand paper grit 320. Next, mix the NC sealer and lacquer thinner by ratio 1:1. Spray the mixture to the jig uniformly. After that, sands the jig with sand paper grit 320. Repeat steps spraying the mixture and sanding the jig with sand paper grit 320 for smooth surface. Then, mix 30ml NC clear and lacquer thinner with ratio 1:1. Finally, the finishing completed when the jig were dried.



Figure 3.8: The pictures show the finishing process of the jig.



Figure 3.9: The jig after completed finishing process



Figure 3.10: The jig with measuring scale.

4.0 Result And Discussion

The results obtained from this project is the jig for make circle and curve shape completed. After the comparison between manual ways by using jigsaw and the jig router, it is found that jig router can reduce the work processes to cut the circle shape. This is because, if using jig router, did not required a sketching process on the work piece, it can just done by set the measurement required and cut it by router machine. The end product shown a fine and accurate circle or curve shape.

Jig is the aids of hand tools in wood working. Jig is the most important things in every manufacturing works especially in wood working. Without jigs, it seems not completed and the work cannot be done smoothly.

Before the innovation of the jig, there are many manual ways on how to make circle or curve shape. For example, people use compasses with pencil, trammel for large circle or by using a piece of string to sketch the circle or curve shape on the work piece. Therefore, it shows that it will take more time to sketch and cutting. In addition, by using jigsaw, the cutting of circle shape will not accurate and have to sanding it again to get the real measurement of circle shape required.

To overcome the problems, jig router make works become easier and faster in making the circle and curve shape. Experimental have been done and there are some errors for this jig. The router's blade is easy to blunt when used frequently, only can cut work piece with thickness maximum 9mm, the error of adjustable bearing is 0.10cm ~ 0.20cm, and weakness on its base for holding the jig with work piece. This is because double-sided tape used to hold the parts will leave some defects of stickers on the work piece and due to vibrator of the router, the required product sizes is hardly to achieve.

5.0 Conclusion

From this project, it can be concluded that jig for making circle and curve shape was completed successfully. The objectives has achieved where the jig router can produce to make circle and curve shape. Besides, the problem statements also can be overcome whereas the results of cutting circle by using jig router is more accurate and it is also less time consuming rather than using jigsaw. Therefore, the scopes for the end user of jig router are suitable for SME, technical lectures and technical students.

The entire project began with the planning until the finishing of the jig. The jig router completed but there is a weakness that has been identified which is the problem on its base for holding the jig with the work piece. Therefore, to overcome the problems, double-sided tape will be replaced by using screw or bolt and nut for better jig holding on the work piece.

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