International Journal of Engineering Research And Advanced Technology (IJERAT)
ISSN: 2454-6135 [Special Volume. 02 Issue.01, May-2016]

DESIGN AND FABRICATION OF a DRILL JIG FOR AN END COVER OF a LOW PRESSURE VACUUM PUMP

Natraj[1] Mr Shivasharana Yalagi[3]
Research Scholar [1,] Asst. Professor [3]
Department of Industrial Engineering & Management
JSS Academy of technical education, Affiliated to VTU Belgaum
Bengaluru, Karnataka
India

ABSTRACT

A jig may be defined as a device which holds & locate a work piece and guide, controls one or more cutting tools with respect to the work. It ensures that a hole to be drilled, tapped or reamed in a work piece will machine in proper place. Basically it consisting of clamping device to hold the part in position under hardened steel bush through which drill passes during the drilling operation. Jigs are used to manufacture a number of duplicate pieces. It is one of the most important production tools as it saves time of lying. It eliminates individual marking, positioning, & frequent checking & thus reduces time & increases productivity. A jig facilitates inter changeability, that is uniform quality in manufacturing any of the parts made by the jig will fit properly in assembly& all similar components are interchangeable. The quality of the equipment in the technical sense depends on the rate of production. Its purpose is to maintain low manufacturing costs & thus increasing the industrial efficiency & productivity.

In this work, a turnover jig has been designed & developed for a vacuum pump end cover component. The scheme of design has been developed taking into account the precondition of the component in terms of machining already performed. The scheme for location & clamping has been developed looking into convenience of the operator. The depth of the design & fabrication is explained in detail.

Key Words: *Design, Interchangeable Part Concept, Jigs, Mass Production*

---

1. INTRODUCTION

Mass production targets on increasing productivity and increasing accuracy by reducing the setup cost and manual fatigue. One of the common practices to achieve the goals of mass production is to use jigs. Let us consider an example that one gets an order of 1000 product in such a way that three holes are to be drilled in a work piece. In such situations, designer will lay out the position of each hole with the help of square, straightness, scribers, centre punch etc. Generally, trial and error method is practiced until the axis of hole is properly aligned with the axis of drill. Thus, a lot of time will be consumed to maintain the accuracy. Ultimately it increases operator's fatigue. Thus, instead of laying out the position of each hole on each work piece with the aid of square, straightness, scribers, centre punch etc., the operator uses a jig to position and guide the drill into proper place. Drill jig increases productivity by eliminating individual marking, positioning and frequent checking. Interchange ability is one of the advantages of jigs. There is no need for selective assembly. Any of the parts will fit properly in the assembly and all similar components are interchangeable. In addition, a jig reduces the repetitive nature required for drilling a hole, as the locating, clamping and guiding are done by jig itself. The tool-guiding element helps in setting of tool in correct position. Hence, skilled workers are not required. Drill jig makes it possible to drill, ream and tap holes at much faster speed and with great accuracy as compared to holes produced by conventional hand methods. The responsibility for accuracy of hole location is taken from the operator and given to the jig.

Jig can be defined as a work piece holding and locating device that positions and guides or controls the cutting tool. Drill jig is device to ensure a hole to be drilled, tapped or reamed in the work piece at proper place.

Drill jig consists of a clamping device to hold the part in the position under hardened steel bushings. Drill passes through the steel bushings during drilling operation. The drill is guided by these bushings. Generally work piece is held by jig and the jig is arranged in such a way that the work piece can be quickly loaded and unloaded.

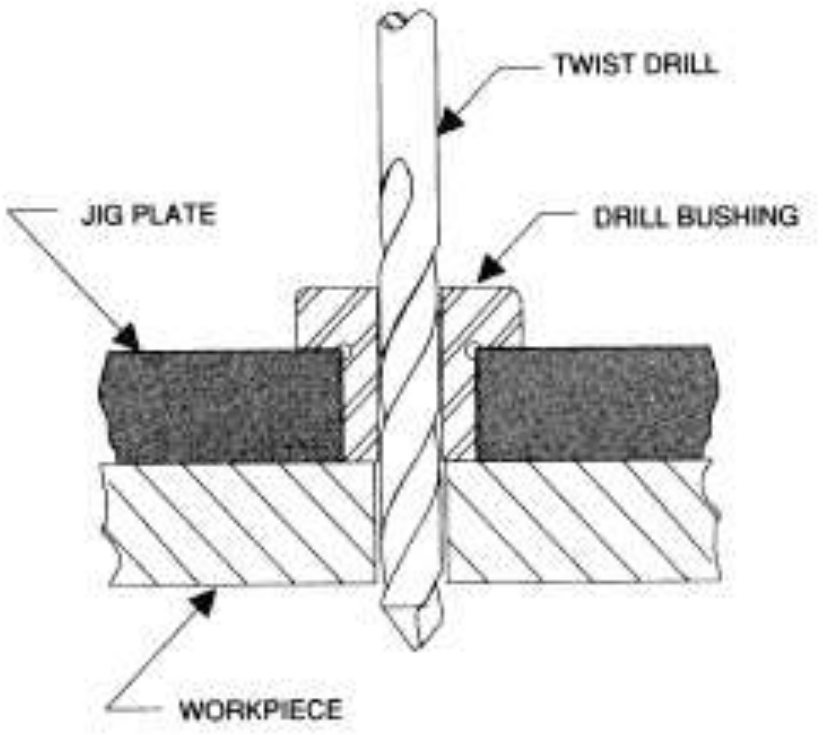

Figure1.1: Drill jig principle

2. Part list

Table 2.1 Part list

SL.NO	PART NAME	MATERIAL	HEAT TREATMENTT	QUANTITY
1	Base plate	Mild steel	-	1
2	Locating plug	Unalloyed carbon steel	-	1
3	Jig foot	Alloy steel	-	1
4	Bushes	Alloy steel	Hardened	4
5	Bottom plate	Mild steel	-	1
6	Bushes	Alloy steel	Hardened	4
7	C washer	Mild steel	-	1
8	Caps	Unalloyed carbon steel	-	4
9	Locating pin	Alloy steel	-	2
10	Grub screw	Mild steel	-	1

3. Design Consideration in Jigs

1. The main frame of jig must be strong enough so that the deflection of jig is as minimum as possible. This deflection of jig is caused due to the forces of cutting, clamping of the workpiece or clamping to the machine table. The mainframe of the jig should have the mass to prevent vibration and chatter.

2. Frames should be built from simple sections so that frames can be fastened with screws or welded, whenever necessary. Those parts of the frame that remain intact with the jig may be welded. The parts needing

frequent changing may be held with the screws. Where the body of jig or fixture has complex shape, it may be cast from good grade of cast iron.

3. Clamping should be fast enough and require least amount of effort.
4. Clamps should be arranged so that they are readily available and may be easily removed
5. Clamps should be supported with springs so that clamps are held against the bolt head wherever possible.
6. If the clamp is to swing off the work, it should be permitted to swing as far as it is necessary for removal of the workpiece.
7. All locators, clamps should be easily visible to the operator and easily accessible for cleaning, positioning or tightening.
8. Provision should be made for easy disposal of chip so that storage of chips doesn't interfere with the operation and that their removal during the operation doesn't interfere with the cutting process.
9. All clamps and support points that need to be adjusted with a wrench should be of same size. All clamps and adjustable support points should be capable of being operated from the fronts of the jig.
10. Workpiece should be stable when it is placed in jig. If the workpiece is rough, three fixed support points should be used. If workpiece is smooth, more than three fixed support points may be used. Support point should be placed as farthest as possible from each other.
11. The three support points should circumscribe the centre of gravity of the workpiece.
12. The surface area of contact of support should be as small as possible without causing damage to the workpiece. This damage is due to the clamping or work forces.
13. Support points and other parts are designed in such a way that they can be easily replaced on failure.

4. Assembled 3D view of jig

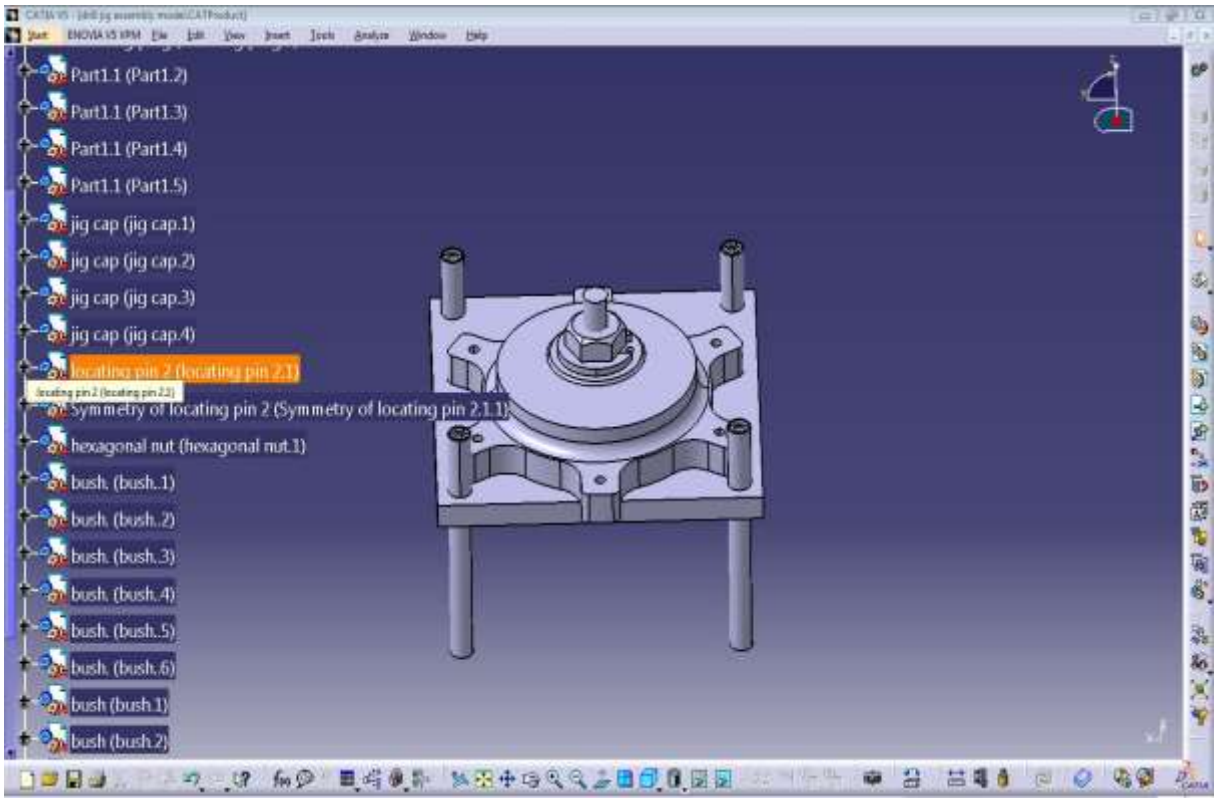

Figure4.1: Top view of drill jig.

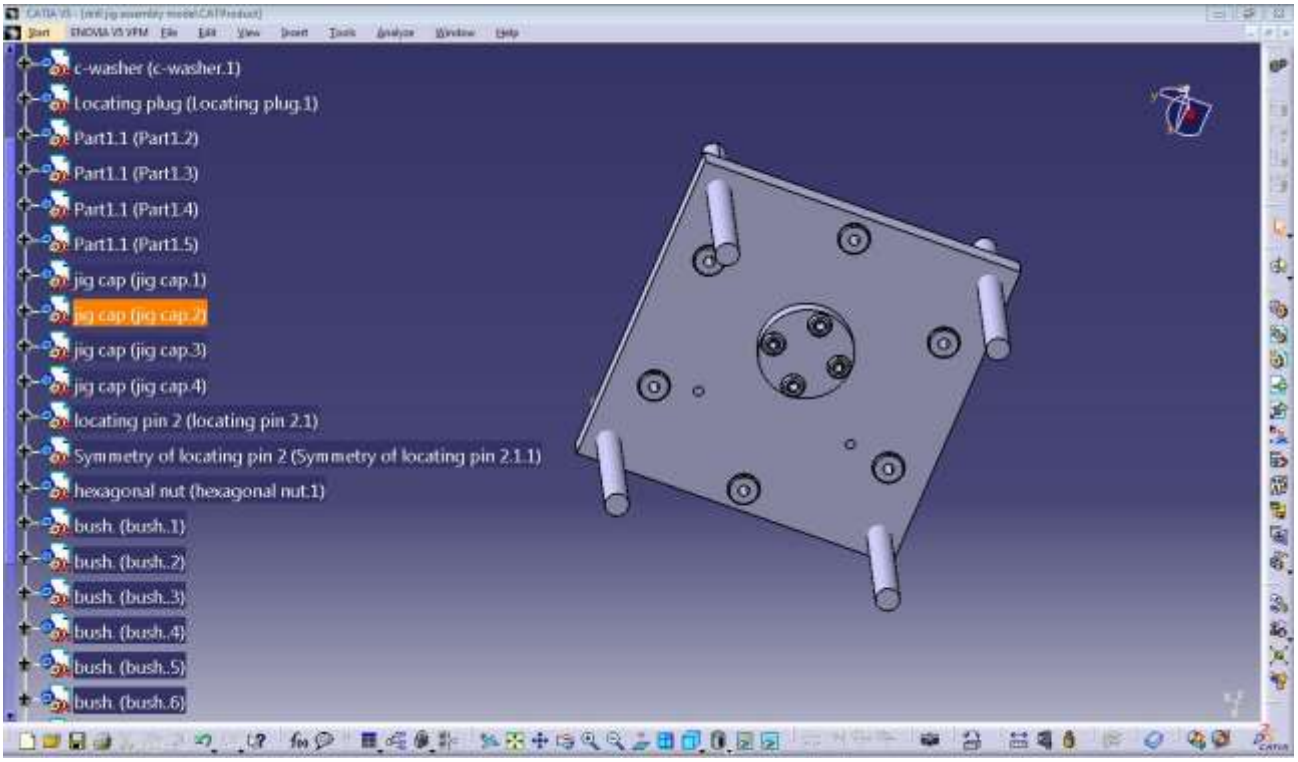

Figure4.2: Bottom view of drill jig.

5. Conclusions

Since time has become precious in today's industrial environment. It is necessary to save the valuable time by all possible means.

There is always scope for improvement in a design. Clamping can be increased by making use of hydraulic or pneumatic device. Since the cutting force are acting on the clamp & bolt. This project can be improved by transferring this force other than these elements.

Here we have an attempt to reduce the time consumed, reducing manufacturing cost, increasing productivity & to get desired accuracy.

By using jig processing time is reduced from 60min per part to 15min per part compared to conventional drilling method.

ACKNOWLEDGMENT

I owe sincere gratitude to my guide Mr. Shivasharana Yalagi, Associate Professor, Department of Industrial Engineering and Management, JSS Academy of Technical Education, Bangalore, for continuous support, encouragement and insightful suggestions which helped me successfully complete this project work.

I'm thankful to Dr. B P Mahesh Head of the Department of Industrial Engineering and Management, JSS Academy of Technical Education, Bangalore, for being supportive and enabling me to carry out this project work.

It is pleasure to acknowledge and extend my gratitude to those who made the project work possible. I take this opportunity to thank Dr. Mrityunjaya V. Latte, principal, JSS Academy of Technical Education, Bangalore, for his moral support and continuous encouragement during this project work.

I take this opportunity to express our profound gratitude and deep regards to our **Mr. Shivakumar R Guttal QE in Quality Department** for his exemplary guidance, monitoring constant encouragement throughout the course of this project work. The blessings help and guidance given by him time to time shall carry us a long way in journey of life on which we are about to embark.

I also obliged to staff members of **Chaitanya Preci-Tech (P) Ltd for** the valuable information provided by them in respective fields. We are grateful for co-operation from **CPPL** during the period of our Project work.

REFERENCES

[1]. P H Joshi, "Jigs and fixtures" Tata McGraw-Hill Education, 2010
[2]. Edward Hoffman "Technology & Engineering" Cengage Learning, 21-Aug-2003
[3]. Cyril Donaldson, V. C. Goold Machine-tools -Tata McGraw-Hill Education, 1976