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DESIGN & MANUFACTURING OF DRILLING JIG

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Abstract

Jig on drilling machine performs various functions such as providing methods to correctly locate the work piece with respect to tool, securely clamp and rigidly support the work piece during the operation, guide the tool, position or fasten the jig on a machine. For different jobs having different hole sizes of drill we require different and separate jigs, then there might be rejections of parts due to shifting of PCD, while performing drilling operation and a lot chances of increase in production time as well cost of using various different jigs. The problems occurring due to above reasons are solved by designing a drilling jig to eliminate the rejections of parts which will be able to perform drilling operation of different hole sizes on one jig itself. Four jobs having different dimensions can be settled in one jig and can be drilled efficiently which enhances the productivity and reduces the production time of job during machining. It reduces the fatigue on worker as it eliminates repetition of different working cycles for different jobs having different PCD.

Key Words: PCD-Pitch Circle Diameter, Jig, CDD, EN8

1. INTRODUCTION

Over the past century, manufacturing sectors has made considerable progress. New machine tools, high performance cutting tools, standardization and modern manufacturing processes enable today's industries to make parts faster and better than ever before. Although work holding methods have also advanced considerably, the basic principles of clamping and locating are still the same. Jigs and fixtures form an important category of equipment that goes a long way in achieving productivity. A jig, however, guides the cutting tool. A fixture references the cutting tool. The differentiation between these types of work holders is in their relation to the cutting tool. As shown in Figure 1, jigs use drill bushings to support and guide the tool. Fixtures, Figure 1, use set blocks and thickness, or feeler, gages to locate the tool relative to the work piece.

In the manufacturing industries, drill jigs are the most-widely used form of jig. Drill jigs are used for drilling, tapping, reaming, chamfering, counter boring, countersinking, and similar operations. Jigs are further identified by their basic construction. The two common forms of jigs are open and

closed jigs. Open jigs carry out operations on only one, or sometimes two, sides of a work piece. Closed jigs, on the other hand, operate on two or more sides. The most common open jigs are template jigs, plate jigs, table jigs, sandwich jigs, and angle plate jigs. Typical examples of closed jigs include box jigs, channel jigs, and leaf jigs etc.

2. DESIGN CONSIDERATIONS

The points that are taken into consideration for designing a product are as following:

- a) Jig must be so strong that the deflection in the jig should be as less as possible. The deflection that is mentioned includes the forces of cutting, clamping of work piece to the machine table. The frame of the fixture should have sufficient mass to prevent vibrations during the machining of the job.
- b) The clamping which should be fast enough and require less amount of effort.
- c) Clamps should have the arrangement for easy removal.
- d) Swinging of clamp system is provided for removal of work piece, it must swing as far as possible for unclamping the device.
- e) There should also be provision for easy removal of chip. This will prevent the interference of the chip with the operation on the work piece.

- g) The surface area of clamping must be as small as possible so as to avoid damage of work piece.
- h) Parts must be easily replaceable on failure.
- i) It should always be preferred that there is maximum operation in a single setting of the work piece.
- j) The movement of the work piece must be restricted i.e. there is zero degree of freedom of the work piece after clamping the work piece.
- k) The design must possess enough rigidity and robustness to prevent vibration.

3. LITERATURE REVIEW

1. Mujaffar Momin¹, Sanket Lokhande², Pradip Gunavant³, Narendra Kokil⁴ [1], in this paper author made the study of DESIGN AND MANUFACTURING OF ACRYLIC JIG they did study of design and developed the Acrylic jig with the help of Acrylic material. Also they had designed the Common Modular Acrylic Jigs i.e. two PCD on a single jig.

2. Mr. Premodh Leonarld¹, Mr. G.Jerome Nithin Gladson², Mr. Sunil Kumar A S3 [2] Design and Optimization of Drill Jig. This report deals with the design and fabrication of drill Jig and the detailed drawing of the components and assembly. The project carried out by us made an impressing task in drilling works. It is very useful industries for mass production of identical parts. Jigs are used to hold and locate the work piece that positions and guides or controls the cutting tool. In jigs, drill bush is used to guide the tool. In conventional jigs we can't change the diameter of drill bush. Main objective of this project is to vary the diameter of the drill bush based upon the application. Drill jig is used to ensure a hole to be drilled, tapped or reamed in the work piece at proper place. Jigs are generally used for mass production. Jig reduces operators fatigue and increases productivity. Jig consists of locating, clamping and tool guiding elements.

3. NBV Lakshmi Kumari¹, G.Prasanna Kumar² [3] in this paper author made the study of Design and Analysis of Indexing Type of Drill Jig They have visualized and conceptualized many designs and success of their designs and concepts is the materialization of their designs.

4. J. C. Trappey [4] in this paper author made the study of research done on jigs and fixture 1980s. They did study of different principle used for design of jigs and fixtures. The major principle includes supporting, locating and clamping automated fixtures design.

5. Taufik, R.S.[5]This paper shows study made in design of jigs and fixtures for hydraulic press machine in manufacturing company. The problems were occurring at industry. It is facing the utilization of hydraulic press machine. When the demand has increased it occurs on the gripping or holding the work piece tightly. The main objective is to give a new design of jigs and fixtures for hydraulic press so as to carry out the gripping problem from existing design. Several new design concepts were given and analyze using ANSYS software. The design parameters were presented are maximum deformation, maximum shear stress, number of contact faces, and maximum holding force. Based on the analysis result, the improvement of new jigs and fixtures design for hydraulic press machine was done.

6. Sawita D. Dongre [6] this paper is about the design and analysis of Jigs and fixture which is used in the manufacturing of chassis bracket of Bajaj car RE60 (passenger car). The main purpose of the jigs is to provide strength, holding, accuracy and interchange ability in the manufacturing of the product. Also the analyzing stress and strain developed in jigs and fixtures and chassis bracket is done.

4. PROBLEM DEFINITION

1. Rejection of parts due to shifting of PCD, while performing drilling operation of different hole sizes on jobs.
2. In industry on exhaust pipe components (flanges) drilling operation is performed by manual marking. Hence manual error occurs in marking for drilling operation .Also we observed that production cycle time is maximum.

4.1 Problems in existing method

1. Error observed in PCD's of component at drilling operation.
2. Spacing between equi-spaced holes is not maintained.
3. A problem occurs in assembly of such components.
4. Rework and rectification is required for such components.
5. Production idle time is increased.
6. Production cost increased.
7. CDD (Contractual Delivery Date) is not maintained.

4.2 Problem Solution

Design and Manufacturing of common modular Jig for a drilling machine to eliminate the problems of rejection of parts, which will be able to perform drilling operation of different hole sizes on different PCD's on one jig itself.

5. MATERIAL SELECTION

5.1 Product Description

EN8 is an unalloyed medium carbon steel which is used in applications where better properties than mild steel are required. By heat treating EN8 can provide good surface hardness and moderate wear resistance by hardening process. EN8 has wider applications in automobile trade in various industries.

5.2 Chemical Composition (weight %)

	C	Si	Mn	P	S
Min	0.36	0.10	0.60		
Max	0.44	0.40	1.00	0.05	0.05

5.3 Key Features

5.3.1 Availability:

Round bar, square bar, hexagon and plate

5.3.2 Engineering Steel:

1. Unalloyed medium carbon steel
2. Reasonable tensile strength
3. Can be flame or induction hardened

4. Moderate wear resistance
5. Good machinability , weldability

5.4 Applications

1. Automotive parts
2. Connecting rods
3. Studs, bolts
4. Axles, spindles
5. General engineering components

6 JIG DESIGNS

6.1 Working of old existing jig in industry

Sponsored industry produces exhaust pipes of various generators which require bending and drilling at various locations and as each flange is having different size of hole as well PCD's of drill. In existing method for drilling operation of flanges operator has to use various jigs for each flange, every time for drilling of a single hole particular jig has to fix up firstly with proper setting and job has to drill. For drilling of second hole again the complete setting has to change and again set with proper adjustment. So in this continuous repeating process job takes large non-productive time and as the process produces fatigue on operator there are high chances of errors which shifts the PCD of drill.



Fig.1 Existing jig



Fig.2 Drilled Flanges



Fig.3 Job adjustment on drilling machine

The above fig shows the traditional jig which has single PCD. Also the metallic step which takes the guide with the job while drilling operation.

6.2 Working of modified Jig

Design consists of following parts:

1. Jig plate
2. Centre plate
3. Bushes
4. Base plate

The jig plate is manufactured with holes on different PCD's. For drilling of number of holes on a particular PCD manual indexing is used. The marking of angles is done on periphery of jig plate. After drilling of first hole the jig plate has to just rotate in required angle for second drilling operation. Hence the ultimate result is after setting one job, all the drilling operations on that job can be performed without changing the setting or removing of job every time. We have used renewable bushes for different hole diameter. The steps are created in base plate for work pieces with different outer diameters so number of work pieces can be set having that particular PCD. We have used centre plate with shafts on both sides. The work piece is inserted in one side and jig plate is inserted on another side. We can change centre plate for different internal diameter work pieces hence we can use various work pieces having different hole sizes.

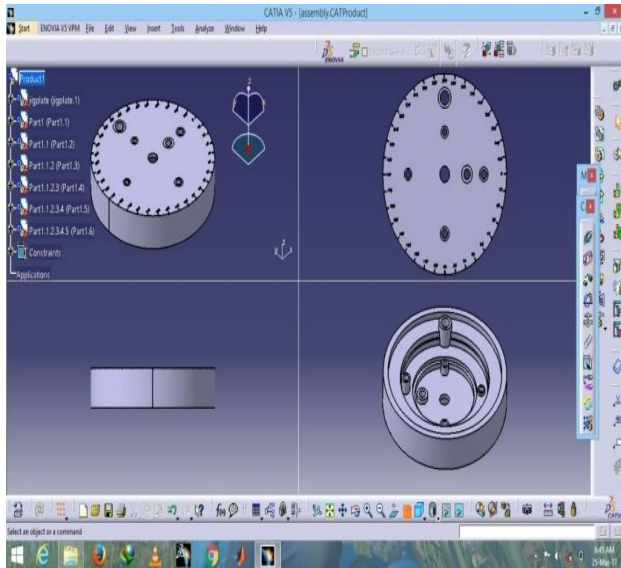


Fig.4 CATIA design of modified jig

1684,P-Issn: 2320-334x, Volume 12, Issue 2 Ver. I (Mar - Apr. 2015), Pp 46-51 Wwww.Iosrjournals.Org

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[4] Trappey, J. C. And C. R. Liu, (1990): A Literature Survey of Fixture Design Automation, *Int J Adv Manuf Technol* 5. (240-255)

[5] Taufik, R.S.; Hirmanto, S.; Sivarao, Hambali, A. and Tajul, A. A., (2012): Design of Jigs and Fixtures For Hydraulic Press Machine Malikussaleh *Industrial Engineering Journal* Vo.1 No.1 (19-24) Issn 2301 934x.

[6] Nbv Lakshmi Kumari, G.Prasanna Kumar *Iosr Journal of Mechanical and Civil Engineering (Iosr-Jmce)* E-Issn: 2278-1684,P-Issn: 2320-334x, Volume 12, Issue 2 Ver. I (Mar - Apr. 2015), Pp 46-51

Text Books:

[1] R.S. Khurmi and J.K.Gupta (2005), "A Textbook Of Machine Design", Eurasia Publishing House.

7. FUTURE SCOPE:

1. We can change the material to reduce cost and weight of jig.
2. We can increase number of PCD's, holes and bushes at different angles on same PCD's.
3. Automation can be employed for clamping, undamping, indexing and drilling operation.
4. Accuracy of drilling operation can be increased by using effective indexing methods.

8. CONCLUSION

We designed and manufactured the common modular drilling jig using EN8 material which ultimately results into:

1. Elimination of the Error observed in PCD of component at drilling operation
2. Spacing between equi-spaced holes is maintained.
3. Production idle time is reduced.
4. CDD (contractual delivery date) is maintained.

REFERENCES

[1] Mujaffar Momin¹, Sanket Lokhande², Pradip Gunavant³, Narendra Koki⁴ Design and Manufacturing of Acrylic Jig Volume: 03 Issue: 05 | May-2016

International Research Journal of Engineering and Technology (Irjet) E-Issn: 2395 -0056

[2] Mr. Premodh Leonarld¹, Mr. G.Jerome Nithin Gladson², Mr. Sunil Kumar A S3 Design and Optimization of Drill Jig. *International Journal of Scientific Research Engineering & Technology (Ijsret)*, Issn 2278 – 0882 Volume 5, Issue 8, August 2016

[3] Nbv Lakshmi Kumari¹, G.Prasanna Kumar² Design and Analysis of Indexing Type of Drill Jig *Iosr Journal of Mechanical and Civil Engineering (Iosr-Jmce)* E-Issn: 2278-