

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 11, November 2018

# Design and Fabrication of a Drill Jig for Circular Disc Brake Using Sliding Tray Mechanism

Joyson Sam Devapaul P <sup>1</sup>

B.E Scholar, Dept. of Mechanical Engineering, DMI College of Engineering, Chennai, India <sup>1</sup>

**ABSTRACT:** The main aim of the paper is to design a jig for drilling machine to perform drilling operation accurately for a flat circular work pieces. While making holes on the circular work pieces lot of problems encountered such as inaccuracy, misalignment ,high time consumption etc. These problems cause rejection of finished jobs, productivity losses. And using the same during drilling the holes on circular work pieces will eliminate the problem faced during conventional drilling. This procedure of jig using tray type work piece holder helps in increasing the production rate, accuracy, perfect alignment, reducing operators fatigue etc. In this procedure a drill jig guides the drill bit to the correct position on the work piece .In this process, time consumption is less compared to the existing model for replacing the work piece.. The drill jig has been designed carefully by considering the design principle and design procedure, without any movement or shake to work piece, we can drill the work piece with accuracy. Using AutoCAD techniques, jig is designed with holes of their top layer so that dye is created and it is useful for guiding the tool to drill holes on the work piece without any defects.

**KEYWORDS:** Work holding devices, work piece, drill jigs, sliding tray-like work piece holder , drilling machine

### I. INTRODUCTION

In the previous years, production is considerably good with innovative ideas. New inventive cutting tools, and manufacturing processes enable today's industries to make product better than ever before. Even though work holding methods and devices have also improved efficiently, the basic methodology of clamping and locating are still the same. The manufacturing process is done one by one at first. This process varies in quality and accuracy based on the individual worker .Further invention leads into the introduction of mass production idea to increase the productivity and increase the accuracy by reducing the setup time, labour cost and manual operations .This Mass production concept leads to reduction in working craftsman .It needs only skilled workers .Then templates are made and layout makes standards in production principles. The result got by templates gives better improvement. The jigs are introduced to reduce the same process to be done one by one on different work piece. In recent days, there are many technologies available for making effective drill jigs and some of these inventions are there in continues process of development. But in those the process with more accuracy is high consumptive and costlier .This technique of using tray like work piece holder eliminates the above defects by previous methodologies. The main aim of all the machining process is to increase the productivity rate and eventually the time consumption and also the accuracy in dimension .It can be achieved by using this kind of drill jig.

### II. LITERATURE SURVEY

J. C. Trappey and C. R. Liu [1] - This paper gives a review of fixture-design research, most of it done in the 1980s. the major topics of the review are the fixturing principals (supporting ,locating and clamping), automated fixtures design (configuration, assembly and verification) and fixtures hardware design (delicated, modular and electric /magnetic type). Taufik, R.S.\*, Hirmanto, S., Sivarao, Hambali, A., and Tajul, A [2].-This paper presents the design of jigs and

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 11, November 2018

fixtures for hydraulic press machine in manufacturing industries. The current problem in industry is facing the utilization of hydraulic press machine when the demand has increased which occurs on the gripping or holding the work piece securely. The main objective of this study is to propose a new design of jigs and fixtures for hydraulic press to carry out the gripping problem from existing design. Several design concepts were generated and simulated to analyze using ANSYS software. The design parameters such as maximum deformation, maximum shear stress, number of contact faces, and maximum holding force were presented. Based on the simulation result, the improvement of new jigs and fixtures design for hydraulic press machine was achieved. Shrikant.V.Peshatwar\* L.P Raut [3]- This paper present a fixture design system of eccentric shaft for ginning machine.. Fixture is required in various industries according to their application. Designer design fixture according to dimension required by industry to fulfil our production tar gate. In traditional manufacturing process performing operation on eccentric shaft is critical. so holding a work piece in proper position during a manufacturing operation fixture is very necessary and important. Because the shaft is eccentric so for this requirement of manufacturing process Designer design proper fixture for eccentric shaft. Fixtures reduce operation time and increases productivity and high quality of operation is possible

### III. MODIFICATION OF EXISTING MODEL

In [1] author gives a review of jigs-design research, In early method, the work piece are placed into the jigs by opening the top surface and then it is closed. For opening, the top surface we need to move the drill tool in upward motion in-order to avoid the interference between the tool and jigs. To overcome, the defects in the existing model. we introduced a new design with tray as a holding device for the work piece. Using this type of tray, work piece can be easily replaced without any misalignment on the drilling tool. In this process, time consumption is less compared to the existing model for replacing the work piece.

### IV. DESIGN

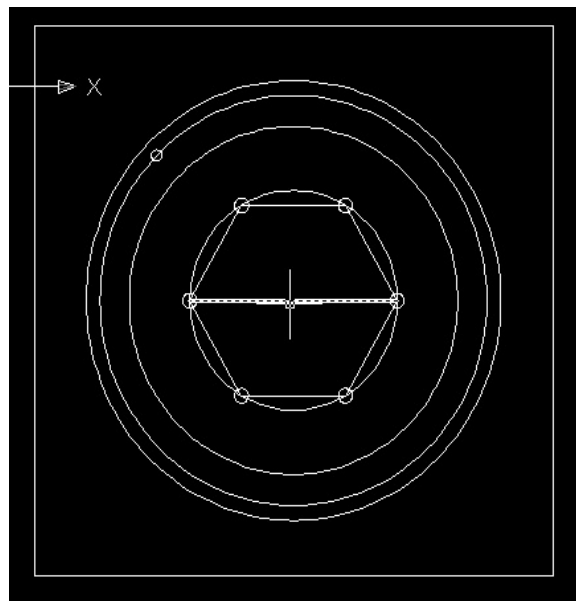


Fig [1] Line generation

Design of jig is done by using AutoCAD software. While comparing with the other materials used for fabrication, mild steel have the capacity to withstand high load. This is the reason we are using mild steel for fabrication process. Area of

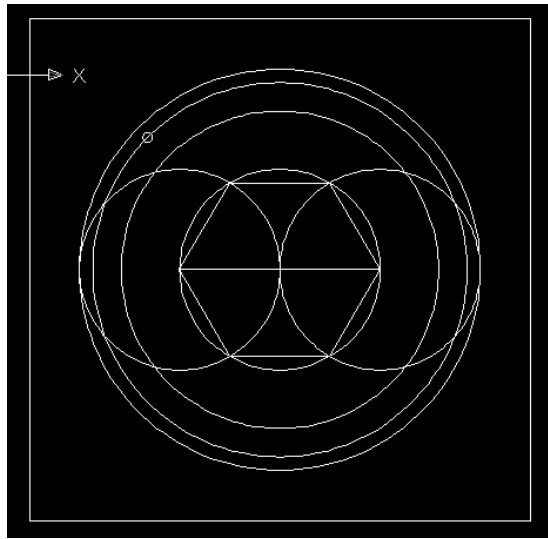
## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 11, November 2018

the jig body is  $90000\text{mm}^2$  and its a square. The side of the disc is 240mm. At first Fig[1] shows the first process line generation. In this process ,the circle is drawn with 120mm diameter and correspondingly, and another circle is drawn with 112mm. And then with 95mm diameter another circle is drawn with same midpoint .Then 60mm diameter is drawn which is having same midpoint.



Fig[2] Boundary Generation

Fig[2] shows the stud circle at an angle of 60 six holes were marked and drilled with an drill bit of 8mm diameter. Then in the 95mm circle at an angle of 20, 18 holes were ,marked and drilled with an drill bit of 6mm diameter.

Fig [3] Hole Generation

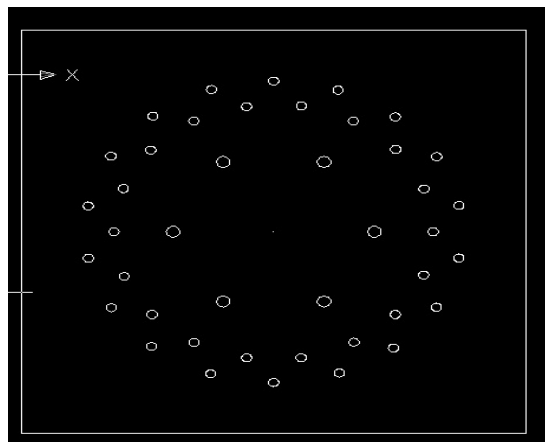


Fig [3] shows the 112 mm circle at an angle of 10, the number of holes were marked and drilled with the drill bit of 2mm diameter. After fabrication the above design, the drilling of holes is done by LASER CUT method. Then the tray with the same area is taken and the size of the disc is cut and removed. Thus, the work holding device design and we

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 11, November 2018

can insert the circular work piece on the trap and lock it and fix the jig in drilling table and adjust the cutting tool based on the top most opening holes with suitable rpm.

### Design Calculation:

**Mild steel:** PSG D.D.B Pg no.1.7

Carbon steel casting -  $\sigma_b=520 \text{ N/mm}^2$

PSG D.D.B Pg no.1.42  $\sigma_b=0.46*520 =239.2\text{N/mm}^2$

$b=130\text{mm}$ ,  $d=10\text{mm}$ ,  $x=80\text{mm}$

$y=d/2 =10/2 =5$

$I=bd^3/12$

$m_b/I=\sigma_b/Y$

$P*80/10833.33 =239.2/5$

**P=38,870N**

### CAST IRON:

PSG D.D.B Pg no.1.4 GCI =8-15mm Bending=3kgf/mm<sup>2</sup>

$\sigma_b =30 \text{ N/mm}^2$

$m_b/I=\sigma_b/Y$   $m_b = p * x =p*80$

$b=130\text{mm}$ ,  $d=10\text{mm}$ ,  $y =5\text{mm}$

$I=bd^3/12$

$p*80 /10833.33 =30/5$

**p=812.5N**

### Selection Of Jig Body:

Area of jig= 90000mm<sup>2</sup>. Diameter of the work piece =240mm.

Thickness of work piece = 2 mm. Total thickness of jig = 4 mm.

Jig body is made up of Medium Carbon Mild steel.

### Material Details:

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 11, November 2018

Sl. No.	Components	Materials	Quantity	Grade
1.	Template	M.S.	1	EN24
2.	Base plate	M.S	1	EN24
3.	Work piece	M.S.	1	Medium Carbon
4.	Key	M.S	1	-

### V. EXPERIMENTAL RESULTS

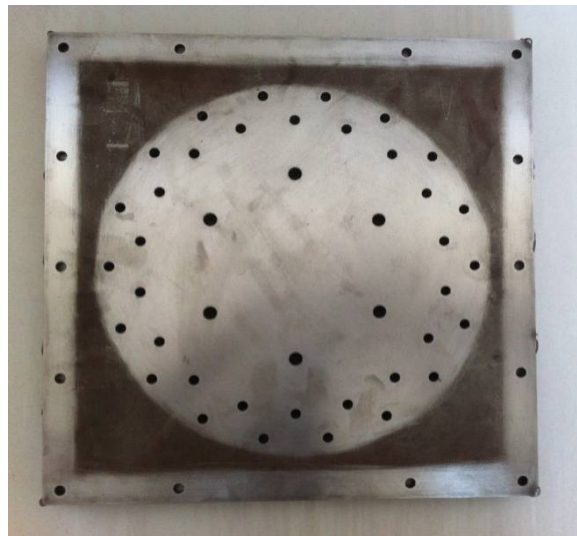


Fig [4] Top view of sliding tray drill jig

Fig [4] is the top view of the drill jig fabricated .This diagram shows the holes cut by laser cut method .Through this hole, drill bit is launched to drill holes on circular plates. Mainly these kind of jigs are used for manufacturing disc brake plates which are having multiple holes.

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 11, November 2018



Fig [5] Side view of Sliding tray drill jig

Fig [5] is the side view of the jig having tray type sliding mechanism used for holding circular work piece.



Fig [6] side view of jig with opened sliding tray for holding the work piece

Fig [6] is the opened position of tray having circular cutting for fixing circular job. I am designing this for circular work piece but using this procedure we can use multiple dimensional work pieces with different cutting in work holding layer.

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 7, Issue 11, November 2018

## Working Procedure:

The Drill Jig is fixed properly on the work table on the drilling machine. Then the drilling tool of 0.8mm and 0.6mm diameter is taken and fixed one by one. Now place the disc brake material of 240mm diameter on the tray of the jig. Then the C Clamp is fixed on either side of the tray to overcome error. Then by using Mandrill drilling tool, drill 6 studs of 8mm diameter and then 16 holes of 6mm diameter at a radius of 60mm from the centre and then 16 holes of 95mm and then 16 holes of 6mm at a radius of 112mm from the centre. Then the disc is taken away and another disc is replaced and Machined .Thus, we can done mass production by not changing the drill bit location and work piece location. It will give good finished material and consume less time and energy .But the jigs requires surface plate for aligning the work piece with the jig and for clamping. It requires magnetic V-block for locating the jig rigidly.

Our project eliminates the marking out measuring and other setting methods before machining, It enables identical parts which are interchangeable, this facilitates the assembly operation It increases the machining accuracy because the work piece is automatically located and the tool in guided without making manual adjustment. It consumes less time. And it helps in fast and accurate finish of the work. It is used to lesser the manpower. It is very cheap and is portable as it is not that heavy. It minimise the remaining misalignment in running operation to maximize power transmission and to maximize machine runtime (coupling and bearing and sealing's lifetime).

## VI. CONCLUSION AND FUTURE ENHANCEMENT

The newly designed drill jig helps to simplify the operation and reduces the risk of the operator during loading and unloading. Therefore even unskilled workers can operate the machine to produce accurate holes on the work piece. The replacement of skilled worker also proves cost effective. It drills the holes on the components with accurate alignment and hence loss of rejections will be minimized. It also protects the work piece surface free from scratches, damages, etc. formed by the chips generated during machining.

In future, we can modify the sliding tray for complicated work piece rather than circular work material.ie we can use different shapes whether regular or irregular work piece materials. We can use automatic drilling using this jigs using CNC, VMC machining.

## Applications:

Jigs provide disconnection for repairs or alterations. They are used for misalignment of the shafts or to introduce mechanical flexibility, protection against overloads and to alter the vibration characteristics of rotating units. Mainly these type of jigs are used for Internal Machining namely Drill Jigs, Boring Jigs & Electric Discharge Machining.

## REFERENCES

- [1]. Trappey, J. C. and C. R. Liu., " A Literature Survey of Fixture Design Automation ", Int J Adv Manuf Technol 5. (240-255),1990.
- [2]. Taufik, R.S.; Hirmanto, S.; Sivarao., Hambali, A., and Tajul,A. A., " Design of Jigs and Fixtures for Hydraulic Press Machine" Malikussaleh Industrial Engineering Journal Vo.1 No. 1 (19-24) ISSN 2301 934X,2012.
- [3]. Peshatwar S.V., and Raut L.P., "Design and Development of Fixture for eccentric shaft: A Review, International Journal of Engineering Research and Applications (IJERA)" ISSN: 2248-9622 www.ijera.com Vol. 3, Issue 1, January –pp.1591-1596, Feb,2013.
- [4]. Hoffman.,and E. G., " Jig and fixture design". United State of America: Delmar Learning,2013.
- [5]. Nee, A. Y.; Tao, Z. J., and Kumar, A. S., " An advanced treatise on fixture design and planning"., Volume 1. Singapore: World Scientific Publishing,2004.
- [6]. Gandhi, M., and Thompson, B., (1986), " Automated Design of Modular Fixtures for Flexible Manufacturing Systems". Journal of Manufacturing Systems, 1986, (243-252).
- [7]. Jiang, W.; Wang, S., and Cai, Y. (1988); " Computer-aided Group Fixture Design Annals of the CIRP". (145-148).
- [8]. Markus, A., (1988); " Strategies for the Automated Generation of Modular Fixtures"; ASME Proc. Manufacturing International '88 Symposium Manufacturing Systems: Design, Integration and Control, (97-103).
- [9]. Alavosius MP, Sulzer-Azaroff B; " An on-the-job method to evaluate patient lifting technique". Appl Ergo 16:307-311,1985.