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DESIGN AND MANUFACTURING OF JIGS FOR DRILLING MACHINE

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Abstract - *Mass production aims at high productivity to reduce unit cost, and interchange ability to facilitate easy assembly. It could be achieved by the use of jigs. Jigs are provided with tool guiding element such as drill bushes. In this project attempt is made to design drill jig plate. Basically this project will show drill jigs plates that are going to be manufactured and for that analysis too. So for drilling operation at different angle and different position such jigs are made for accurate, precise drill operation in this project. Drill jig increases productivity by eliminating individual positioning, marking and frequent checking. Also jig reduces the repetitive nature required for drilling holes, because the locating, clamping and guiding of the tool is done by the jig itself.*

Key Words: **Design, Manufacturing, Total Deformation Analysis, Maximum Principle Stress, Acrylic material**

1. INTRODUCTION

Mass production aims at high productivity to reduce unit cost and interchangeability to facilitate easy assembly. This necessitates production devices to increase the rate of manufacture and inspection device to speed-up inspection procedure.

The most common jigs are frilling and boring jigs. These jigs are almost same but differ in size, shape and placement of drill bushing. Normally, Boring jigs have larger bushes than drilling jigs. These bushings may also have internal oil grooves to keep the boring bar lubricated. Often, boring jig has more than one bushes to support the boring bar throughout the machining operation.

Jigs are further classified as the construction:

1. *Open jigs*- It carry out drilling operation in only one side of workpiece. Template jig, plate jig, table jig, sandwich jig are the open jigs
2. *Closed jigs*- It can carry out work on more than one side of workpiece. Channel jig, box jig, leaf jig are the examples of closed jig

Jigs are special purpose tools which are used to facilitate the production like machining, assembling and inspection operation. The mass production of the workpiece is based on the concept of interchangeability according to which every part produced within an established tolerance. Jigs provide a means of manufacturing interchangeable parts since they establish a relation with predetermined tolerances between the work and the cutting tool. Once the jig is properly setup, any numbers of duplicate parts may be readily produced without additional setup.

2. LITERATURE REVIEW

K.rama Subba Reddy [1] This paper shows the static structural and MODAL analysis on DRILL JIG for 3 completely different materials and results are achieved. in line with the results stress is nearly shut for 3 materials however considering deformation is a smaller amount for steel compared with grey forged iron and aluminum alloy. Thus the steel is best material for the producing for such type of the drill jig.

R.S. Taufik [2] 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.

Midhun.R, Vignesh,A [3] From this paper we can make our drilling operation in the work piece as very easy and comfortable and without geometrical error occurring while drilling and it avoids human error also.

Sawita D. Dongre, Harshal C. Kuttarmare [4] 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). It shows us analysis of jigs and fixtures from which we find out stress acting on jigs and

fixtures and bracket. So it shows the design jigs and fixtures while manufacturing of chassis bracket and analyzing stress and strain developed in jigs and fixtures and chassis bracket.

Shivanand Vathare, Shrinivas L Gombi, Darshan M Katgeri [5] In this paper deals with work of the drill jig is successfully designed for cylinder head and cover part of the actuator. The drill jig provides interchangeability to head and cover parts. The critical part of the drill is the clamping system. The stress, strain and deformation of clamp plates are well below the allowable limits in this paper.

In all the papers above shown, the material is not focused so here we tried to make a jig of acrylic material with two different steps for two sides.

3. PROBLEM IDENTIFICATION

Previously, the jigs were made of mild steel, aluminum, etc. material. These materials are very heavy to carry if the size of jig if big. It can cause back pain or stress to the workers. It also reduces the energy of worker.
Due to heavy material following problem occurs:

- Stress to the worker
- Handling of jig
- Increase in set up time
- Reduce productivity

PROBLEM SOLUTIONS

- We have manufactured a jig of acrylic material.
- We have manufactured a jig of two steps, which will be used for drilling of two different diameter faces.
- We have manufactured a jig by which we can make a hole in two perpendicular directions.
- We have manufactured a jig which can fit the work piece and jig doesn't come out while drilling.

3.1 ACRYLIC JIG DESIGN

Acrylic jig models is made in Solid Edge ST8 and analysis of both is done in ansys 16.2

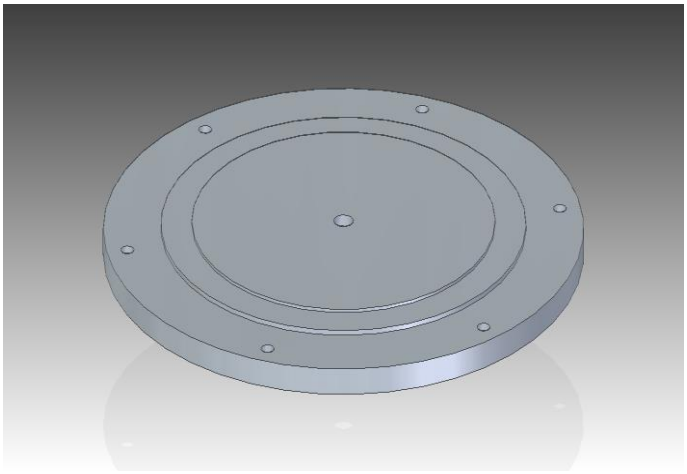

Fig.3.1.1 Model of first jig

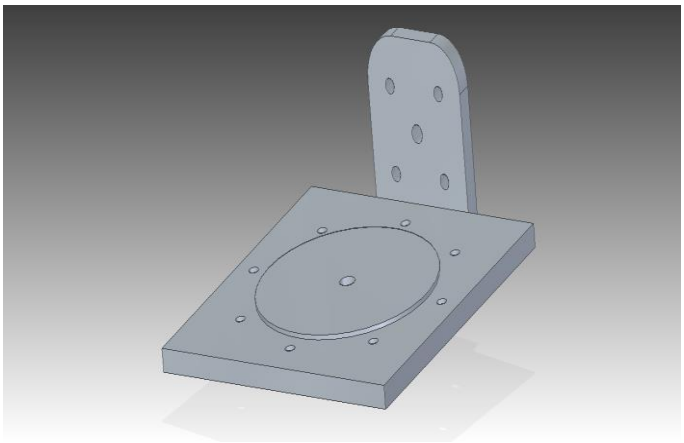

Fig.3.1.2 Model of second jig

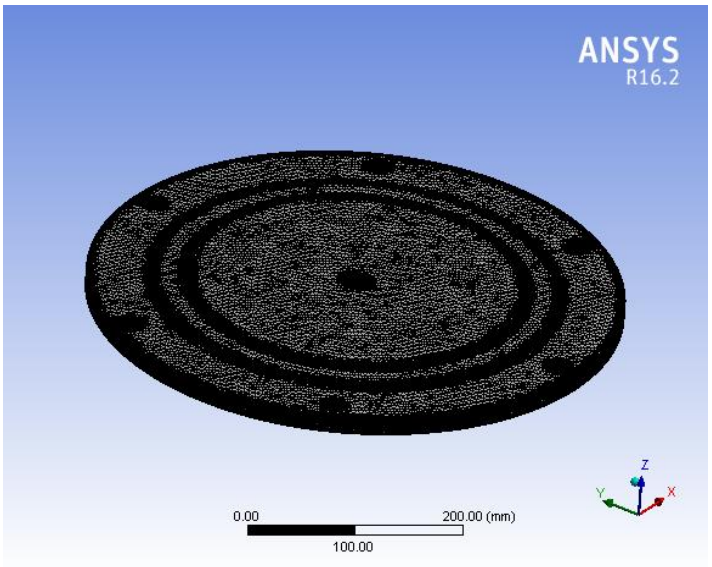

Fig.3.1.3 Model after applying meshing

Nodes	528243
Elements	334308

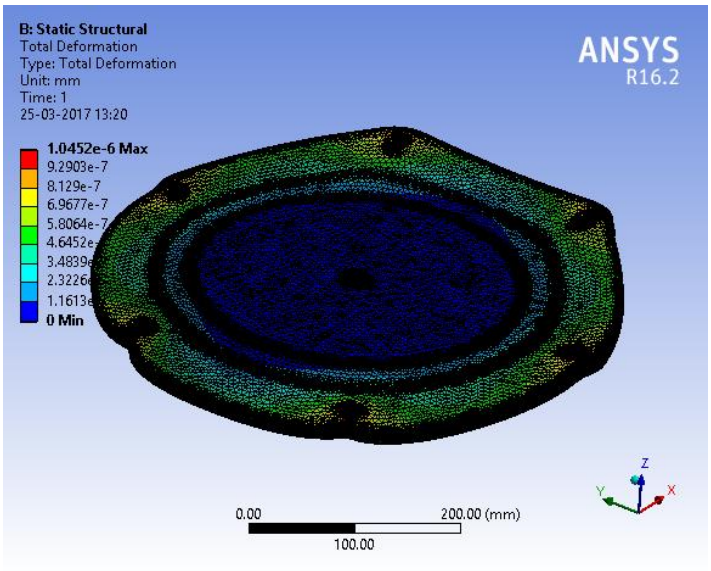

Fig.3.1.4 Total deformation analysis of first jig

Minimum	0. mm	-8.6845e-004 MPa	6.8957e-015 mm/mm
Maximum	1.0452e-006 mm	4.7831e-003 MPa	2.5685e-008 mm/mm

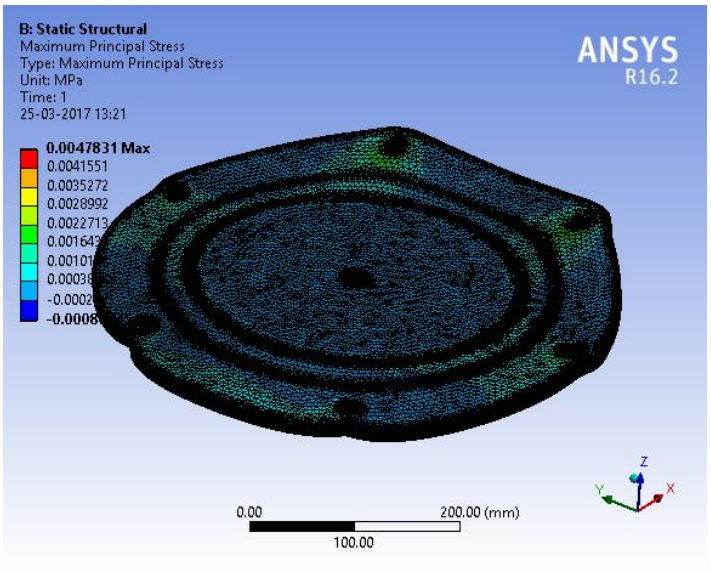

Fig.3.1.5 Maximum principle stress of first jig

Minimum	0. mm	-8.6845e-004 MPa	6.8957e-015 mm/mm
Maximum	1.0452e-006 mm	4.7831e-003 MPa	2.5685e-008 mm/mm

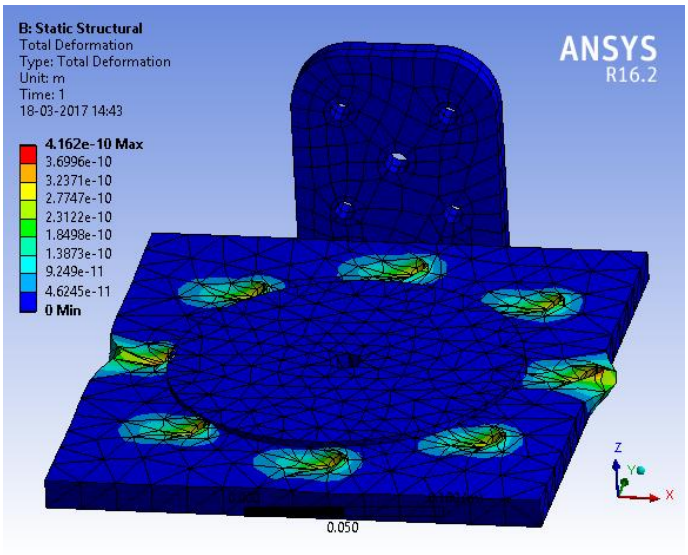

Fig.3.1.6 Total deformation of second jig

Minimum	0. mm	-1.3504e-003 MPa	3.3232e-013 mm/mm
Maximum	4.162e-007 mm	7.6909e-003 MPa	4.6962e-008 mm/mm

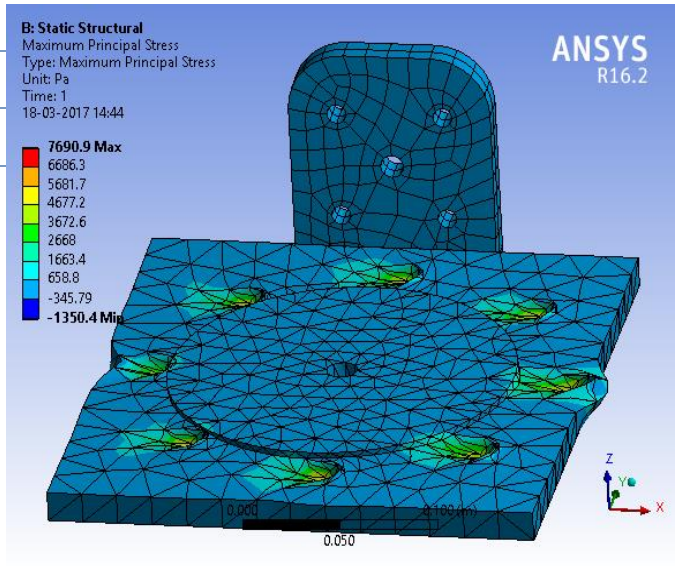

Fig.3.1.7 Maximum principle stress second jig

Minimum	0. mm	-1.3504e-003 MPa	3.3232e-013 mm/mm
Maximum	4.162e-007 mm	7.6909e-003 MPa	4.6962e-008 mm/mm

3.2 MANUFACTURING

Following pictures shows the Acrylic jig. It also shows jig manufacture for primary flange with steps provided on

one side of the plate. Photos were taken at Shreeji Engineers, Makarpura GIDC, Vadodara.

Properties	Acrylic Material
Density	0.69 g/cm^3
Tensile Strength	69 M Pa
Poisson ratio	0.35
Shear modulus	1700 M Pa
Yield Strength	79.8 M Pa

4. CONCLUSION

In this project, we have made the jig of drilling machine of different material rather than mild steel to reduce the weight and to ease the work handling. By manufacturing of these jigs we can reduce the setup time of raw material on machine. The weight of jig comes out to be 3.5 kg after manufacturing that is less compare to mild steel jig plate which was 25 kg.

FUTURE SCOPE

- This cheaply available material can also be replaced with polypropylene (PP) material.
- We can use other material rather than acrylic material.
- More weight can be reduced by drilling holes on jig at unwanted space.

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