International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.01, March 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

Design ,drafting and manufacturing of fixtures for surface finish and boring operation on Gauge Frame

Mr. Amol M. Pandhare[1], Mr. A.P. Kadam[2]

[1,2]*Mechanical Engineering,*

BharatiVidyapeeth's College of Engineering, Kolhapur(India)

ABSTRACT

The target of the mass production is to increase the productivity and increase the accuracy. This is done by reducing the set up cost and manual fatigue. Thus mass production can be achieved by the use of fixtures. For large scale production of different materials a lot of time is wasted in set up of the device and clamping the device. Trial and error method is usually practiced until the axis of the hole is properly aligned with the axis of the drill. In such a situation a lot of time is being wasted to maintain the accuracy. Eventually it increases the operator's fatigue. Thus fixture increases productivity by eliminating individual positioning, marking and frequent checking. We are used fixture for gauge frame so increasing the productivity. Now using conventional lathe machine for operation on gauge frame.These project have to methodology of performing operation in number of order to increase the rate of production by using Fixture. There are manufacture Fixture for three operations such as surface finish , boring and drilling. In that surface finish is the first operation which is performed on first fixture, and boring operation is done on second fixture.

Keywords:- Deign, Fixture, Material, Plate, Shape.

I.INTRODUCTION

1.1 Introduction

A key concernfor a manufacturing company is the ability to design and produce a varietyof high quality products in as short a time as possible. Quick release of a new product into the market place, ahead of any competitors, is a crucial factor in being able to secure a higher percentage of the market place and a higher profit margin. As a result of the consumer desire for variety, batch production of products is now more the norm than mass production, which has resulted in the need for manufacturers to develop flexible, agile manufacturing practices to achieve a rapid turnaround in product development.

Fixture are the device which help in increasing the rate of production of identical parts and simultaneously reducing the human efforts required for producing these parts. It has already been emphasised earlier that a centre lathe is a suitable producing machine tool for producing individual parts of different shape and sizes, but for producing similar articles in great number its use will not be economical .Against this, a capstan or turret lathe can be easily adopted for repetition work on account of the multi tooling arrangement and the use of traverse stops. This increase the rate of production . However the involve use of drilling, milling, planning and grinding machines, etc. If such article are to be produced identical shape and size on mass scale , suitable device

have to be used for holding and locating purpose so that the repetition work can be done economically. These devices are the fixtures.

1.2 Basics Of Fixtures

A fixture does more or less the same work as a jig it holds and locates the successive workpieces in identical positions, but differs from a jig in that it does not guide and locate the tool. The tool has to be adjusted separately. A fixture or bolted to the machine to ensure proper rigidity. The above comparatively study of the two shows that the jig holds and locates the workpiece, guide the cutting tool to the work and normally is not fixed to the machine table. Against this, a fixture only holds and locates the work piece, does not guide the tool, and is fixed to the machine table.

1.3 Job specification:-

●Part Name- Gauge Frame ● Material –Cast Iron.● Weight- Two kg.

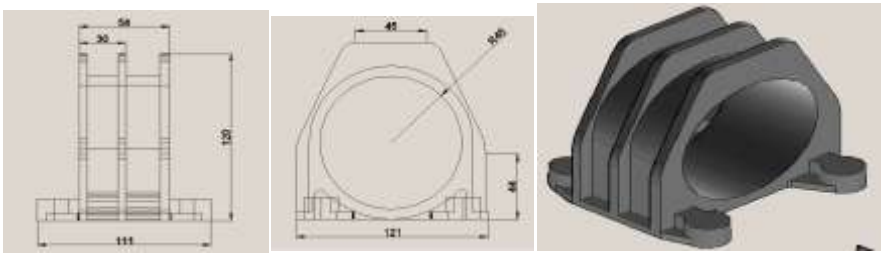


Fig 1.1.gauge frame 2-D viewFig 1.2 gauge frame 3-D View

There is need to learn, practices and work on fixture, also need to setup improvement and minimum cost. Large scale industry has to demanded collect part by number of small scale industry. There are first to make fixture minimum time with minimum cost. So reduce size light weight robust design and sustain their shock and vibration.

Following work is carried for enhancing production rate and reduction down time.

1. Pre implementation study and cost analysis done.
2. Based on the above study design of fixture.
3. Use of CAD/CAM software for drafting and manufacturing of fixture.
4. Optimizations of tool wear to down time reduction.
5. Manufacture and practically testing of Fixture. Operation on Gauge Frame.

The aim of project work improving plant equipment attaining maximum efficiency through revamping of existing equipment and by minimizing the life cycle of tool considering new job and minimizing their run uptime.

II. LITERATURE REVIEW

In fixture design, accessibility is discussed in two senses. Loading / unloading accessibility indicates the easiness to load the workpiece into or detach the workpiece from the fixture, while surface accessibility tells if a fixture unit (locator / clamp) can access the fixturing surface easily. In machining process, accessibility also

takes on other meanings. It can be the accessibility for a machine tool to a machining feature, or to a group of machining features.

Komal Barge et.al,(2015),In his work the C framed Power Press was studied and the design was done as per the dimensions. The model of the power press was done in PRO/ENGINEER software. The 3D model of the power press is analyzed in static condition to find the stresses and deflections in the structure. The analysis of the power press is carried out using ANSYS package. Analysis was done for power using ANSYS package. Analysis was done for power bed thickness. The result obtained from analysis package is within the limit[2].

ChristophGmeiner, (2015), He improved design optimization system of an exhaust manifold of a car engine had been developed. The initial configuration of the manifold was taken from an existing high power engine with four cylinders. At first, the manifold shape was optimized by three merging points on the pipe centrelines, assuming the pipe radius constant. The present system found optimal solutions mainly improved in the charging efficiency. This result suggests that the merging configuration was very effective to improve the charging efficiency.The second case optimized both the pipe radius and merging points. Not only the charging efficiency but also the exhaust gas temperature was improved in this case. This result suggests that the pipe radius is important to improve the exhaust gas temperature. The present system has successfully found solutions that have less environmental impact and more engine power simultaneously than the initial design[3].

Shailesh.S.Pachbhai1et.al,(2014), They used optimum design approach to providing comprehensive analyses and determine an overall optimal design. Fixture layout and dynamic clamping forces optimization method based on optimal fixture layout could minimize the deformation and uniform the deformation most effectively.The proposed fixture will fulfilled researcher production target and enhanced the efficiency, Hydraulic fixture reduces operation time and increases productivity, high quality of operation, reduce accidents[4].

III. DESIGN OF FIXTURE FOR GAUGE FRAME

3.1 Introduction

We are introduced to our job core information for gauge frame. Gauge frame fitted in Tata Motor on axle by nut and bolt arrangement. Gauge frame has mainly three operations such as surface finish, turning and drilling. So, we are explained step by step project design part details.

A Fixture is a work holding device used in the manufacturing industries. Fixtures are used to securely locate the position or location and to support the work, ensured that all parts produced using the fixture will maintain conformity and interchange ability. Using this fixture improves the economy of production by allowing smooth operation and quick transition from part to part production.

The Fixtures having some essential features, They are;a. Reduction of Idle time. b. Cleanliness.

c. Standardization.d. Hardened surfaces. e. Position of clamps.

Fundamental principles of fixture. i.Locating Points ii. Fool Proof.iii. Clamping Device.

iv. Reduction of idle time. v. Weight of Fixture.

3.2 Calculations

3.2.1 Design of Fixture Plate

International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.01, March 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

Selection of Fixture● Number of jobs - 1 no ● Material - mild steel, Selection Location method

From the part drawing, a = 68 mm ,b = 245 mm, dmax= 24 mm, Select diameter = 8 mm

Selection of Clamping Method:

To select required clamping device the clamping force should be calculated for which the cutting force is required.

Cutting force Fc = (405 x k x f x b x d) / Cg

Material constant forHigh carbon steel,k = 8.5, Feed f = 75 mm/min, Cutting speed Cg=15 m/min.

Cutting force Fc= (4.5 x 8.5 x75 x 3 x 3)/15= 1721.25N.

Design of Fixture Body:Width of the fixture plate = Ww + clearance on both sides.

Where,Ww - work piece width = 100 mm, Clearance on both sides = (31+4) mm.

Width of fixture plate = 100 + (31+4) = 135 mm, Length of the fixture plate =Lw + clearance on both sides.

Where,Lw- Length of work piece - 70 mm, Clearance on both sides - (15+15) mm.

Length of fixture plate - 70+30 = 100 mm

Force Calculation:Drilling force = 1.16x k x d(100s)0.85

Where,k = material factor – 1.5 for mild steel, S= feed = 0.19 mm/rev, D= diameter of drill = 12 mm

●Thrust force = 1.16 x 1.5 x 25 (100x0.19) = 531.39 KgfThrust force =5313.9 N

Force acting on each lip:(Pz) = (Ks x d x s) /4 M Kgf= d x s/4 mm2 = 25 x 0.19/4= 1.188 mm2 Ks = 250 kg/mm2

for mild steel(Pz) = 250 x 2.288 kgf= 297 kgf= 2970 N

Torque, M = (Pz x d)/20 = (2970 x 25)/20M = 3712.5 N-mm

●Clamping force (Q) = drilling force x factor of safety= 3712.5 x 3= 11137.5 N

3.3 Design and Drafting For Fixture 1 For Surface Finish Operation

Fixture one designed for bottom surface finish of gauge frame. With help this surface finish reference s for locating for turning and drilling operation.

1. Supporting plate1and 2(with clamping system) 2.Supporting bar 1 and 2. 3.Chuck plate.4. Resting pad.
5. Supporting strip.6.Nuts and bolts.7.Assembly fixture .






Fig 3.3.1 supporting plate 1 and 2 Fig 3.3.2 supporting bar 1and 2 Fig 3.3.3 Chuck plate Fig 3.3.4 Resting pad

3.3.1 Assembly fixture

Assembly fixture is used for operation of surface finish of bottom surface of GAUGE FRAME. All details parts are assembled with help of welding and nut bolt on chuck plate.

International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.01, March 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

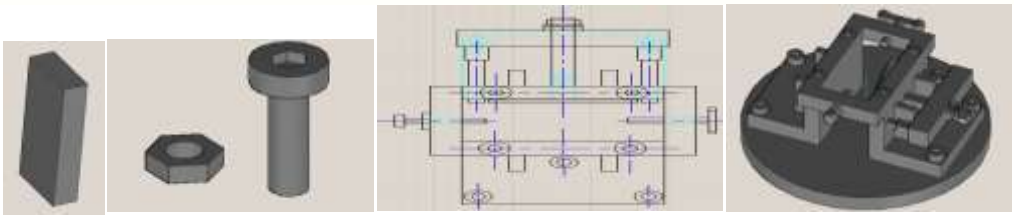


Fig 3.3.5 Supporting strip Fig 3.3.6 Nuts and boltsFig 3.3.7 Fixture - 1 assembly, (2-D and 3-D drawing).

3.4 Design and Drafting For Fixture 2 For Boring Operation

Fixture second designed for boring operation of gauge frame locating for drilling operation also for considered principle of fixture design. It consist of

1. Supporting plate 1 and 2(with clamping system) 2. Supporting channels.3. Chuck plate.
4. Spring loaded stopper 5. Supporting strip.6. Nuts and bolts.7. Assembly fixture

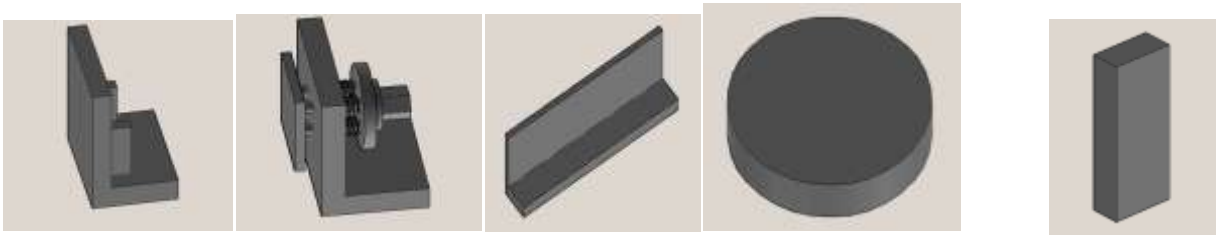


Fig 3.4.1 supporting plate 1 and 2 Fig 3.4.2 supporting channel Fig 3.4.3 Chuck Plate Fig 3.4.4 Supporting strip

3.4.1 Assembly fixture - 2

Assembly fixture is used for operation of surface finish of bottom surface of GAUGE FRAME. All details parts are assembled with help of welding and nut bolt on chuck plate.

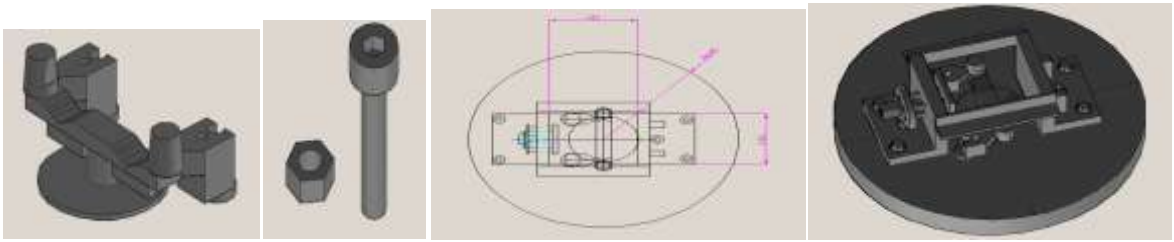


Fig 3.4.5 Spring loaded stopper Fig 3.4.6 Nuts and bolts Fig 3.4.7 Fixture - 2 assembly, (2-D and 3-D drawing).

IV.MANUFACTURING

4.1 Manufacturing –

Production or manufacturing can be simply defined as value addition processes by which raw materials of low utility and value due to its inadequate material properties and poor or irregular size, shape and finish are converted into high utility and valued products with definite dimensions, forms and finish imparting some functional ability.

A lump of mild steel of irregular shape, dimensions and surface, which had almost no use and value, has been converted into a useful and valuable product like bolt by a manufacturing process which imparted suitable features, dimensional accuracy and surface finish, required for fulfilling some functional requirement.

Manufacturing Science and technology are growing exponentially to meet the growing demands for;

(i) Increase and maintenance of productivity, quality and economy specially in respect of liberalisation and global competitivenessValue added.

(ii) Making micro and ultra precision components for the modern electronics, computers and medical applications

(iii) Processing exotic materials, coming up with rapid and vast advent of science and technology like aerospace and nuclear engineering.

4.3 Experimental setup (photo)

Fig 4.3.1 Fixture 1.for surface finish.Fig 4.3.2 Fixture 2 Boring operation.

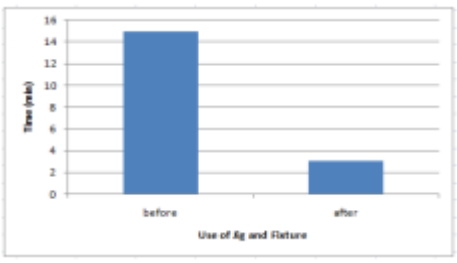
V.RESULT

5.1 Experimental Result

5.2.1 Loading and Unloading time for Gauge Frame Period required preparing process or system for it to be ready function or accept a job. It is subset of loading and unloading time. This is the time needed to prepare for the operational and may include time to study. It shows occupies less space and are more rigid as the chuck plate is supported the helps in reducing setting time.

5.2.2 Impact of Gauge Frame on Accuracy

Productivity improvement both quantitative and qualitative the productivity increases by decreasing the lead time of component, increasing production rate. There is no special need of tooling requirement; therefore rejection of component is reduced. With use of Fixture shows the accuracy result of Gauge Frame within 5 microns and previously the accuracy level on lathe machine without use of Fixture within 20 microns , it clears that the better effect on the quality level.



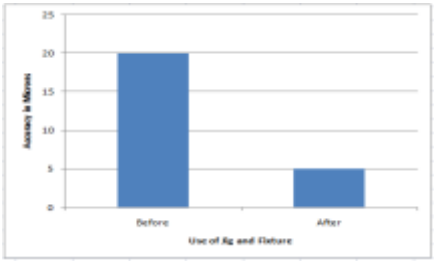


Fig 5.1 Loading and Unloading Time Fig 5.2 Accuracy

VI.CONCLUSION

1. The newly designed fixture 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.

2. Thus the fixture is designed and fabricated. The fixture reduces time consumption in lathe for mass production. Using this fixture edge preparation operation like grooving, facing, turning can be performed easily.

3. The efficiency and reliability of the fixture design has enhanced by the system and the result of the fixture design has made more reasonable. To reduce cycle time required for loading and unloading of part, this approach is useful.

4. If modern CAM/CAD are used in designing the systems then significant improvement can be assured. To fulfil the multifunctional and high performance fixturing requirements optimum design approach can be used to provide comprehensive analyses and determine an overall optimal design.

6. The proposed Fixture will fulfilled researcher production target and enhanced the efficiency, Fixture reduces operation time and increases productivity, high quality of operation, reduce accidents.

REFERENCES

Books

[1] B. S. Raghuwanshi, Workshop Technology,2013.

[2] V. B. Bhandari , Design of Machine Elements, Tata MCGrae Hill Education prv. Ltd, 2012.

[3] V. D. Kodgire and S. B. Kodgire , Material Science and Metallurgy , Everest Publishing House , 2011.

[4] O. P. Khanna , Material Science and Metallurgy , DhanpatRai , Publication , 2013.

Journal papers

[1] Iain Boyle,ManufacturingEngineering,Worcester Polytechnic Institute,2006.

[2]Komal Barge and SmitaBhise,Design& Development of Hydraulic Fixture for VMC, International Journal for Research in Applied Science &Engineering Technology (IJRASET),2015.

[3]ChristophGmeiner,Automatic Fixture Design Based on Formal Knowledge Representation, Design Synthesis and Verification,2015.

[4]Shailesh S.Pachbhai1, LaukikP.Raut, A Review on Design of Fixtures, International Journal of Engineering Research and General Science Volume 2,2014.

[5] D. Ravi, Computer Aided Design and Analysis of Power Press, Middle-East Journal of Scientific Research,2014.

[6] SatyajeetsinhRaijada and AmitDudhatra, Design of a Fixture of Connecting Rod for Boring Operation, International Journal for Scientific Research & Development-Vol. 2,2014.