

Design And Manufacturing of Hydraulic Fixture For Mounting Bracket

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Abstract- *The fixtures are the economical ways to produce a component in mass. So, fixtures are used and serve as one of the most important facility of mass production system. These are special work holding device. Quality of the performance of a process largely influenced by the quality of fixtures used for this purpose. What makes a fixture unique is that each one is built to fit a particular part or shape. The main purpose of a fixture is to locate and, in the cases, hold a work piece during an operation.*

This project deals with “Design and Manufacturing of Hydraulic fixture for “mounting bracket” for VMC with the help of Solid Works. The Fixture is designed by applying proper design procedure.

I. INTRODUCTION

1.1 Background

Fixtures are of great use in the manufacturing process. Especially if we consider the VMC, CNC, HMC, etc. the cycle time reduces if one uses the fixture. The fixture can be divided into sub parts as a. Manual Fixture, b. Pneumatic Fixture and c. Hydraulic Fixture. Under this project our group will design and develop a hydraulic fixture. Manual fixture consumes more time compared to Hydraulic fixture.

A fixture is a workpiece-locating and holding device used with machine tools.

The fixture is a device which sets work piece in proper position during manufacturing operation. Frequent checking, positioning, individual marking and non-uniform quality during manufacturing process is eliminated by fixture. This increase productivity and reduce operation time. Fixture is widely used in the industry practical production because of feature and advantages. To locate and immobilize work pieces for machining, inspection, assembly and other operations fixtures are used. A fixture consists of a set of locators and clamps. Clamping must be appropriately planned at the stage of machining fixture design. The design of a fixture is a highly

complex and intuitive process, which require knowledge. Fixture design plays an important role at the setup planning phase. Proper fixture design is crucial for developing product quality in different terms of accuracy, surface finish and precision of the machined part

1.2 Motivation

For the project, we have got a chance to do a sponsored project of fixture designing & manufacturing in “ARATI ENTERPRISES” in Parvati Industrial Estate, Yadrav (Ichalkaranji), Dist. Kolhapur. This industry uses the up to date machines and trades to produce superior products of quality. This industry is also looking forward to international standards by applying the quality circle. This industry has a great reputation in market, which supplies hydraulic fixture to various industries.

1.3 Problem statement:

Due to loading the component on the manual fixture and adjusting it with the proper dimensions, consumed more time. So, to reduce the work of operator and to increase the productivity by reducing the cycle time, we came to conclusion to opt for a hydraulic fixture.

1.4 Objective

1. The traditional process of machining consumes a lot of time.
2. Desired level of machining accuracy cannot be achieved by fully manual work operation.
3. To learn the designing and manufacturing process of a hydraulic fixture.
4. To learn the calculation of various clamping as well as other forces acting on the fixture.
5. To design the best optimized hydraulic fixture which will reduce the cycle time.

1.5 Scope of work

- A fixture is a production tool that locates, holds and supports the work securely so the required machining operations can be performed. A fixture should be securely fastened to the table of the machine upon which the work is done.
- Besides, this project shall concern with the basic rules for locating, such as positioning the locators, part tolerance, fool proofing and mistake proofing.
- For Hydraulic Fixture, require to calculate cutting force which is used for selection clamping cylinder.
- Generate a detailed drawing with assembly of fixture proposed and provides alternatives material recommended.

II. LITERATURE REVIVEW

1. Shailesh S Pachbhai :-

A fixture is a device used to locate, clamp and support a workpiece during machining, assembly or inspection. The most important criteria's for fixturing are workpiece stability, position accuracy and workpiece deformation. A good fixture design is one that minimizes workpiece geometric error. Workpiece location principles are defined in terms of 3-2-1 fixturing which is widely used workpiece location method for prismatic parts.

2. Chetankumar M. Patel,Dr.G.D.Acharya :-

There is an increasing need for improved methods of determining the reliability and predicting the lifetime of machines and production systems more accurately. The paper presents unique design of & manufacturing of 8 cylinder hydraulic fixture for boring YOKE on VMC – 1050 with expanding customised collet.

3. Abhijeet Swami& Prof. G.E. Kondhalkar :-

A fixture consists of a set of clamps and locators. Locators are used to determine the orientation and position of a workpiece, and clamps exert clamping forces on the workpiece so that the workpiece is pressed against locators and resting pads. The recent trends in industry are towards adopting the hydraulic and pneumatic techniques, because it save time generates accuracy and it is having some flexibility. Designing of hydraulically clamped fixture was considered to be lengthy and complicated procedure. Because it needs a good knowledge about, dimensioning and tolerances, manufacturing processes, clamping and cutting forces during operations.

4.Sagar P. Durge, Dr. S. B. Jaju :-

All manufacturing industries uses automatic system to reduce the manufacturing time and resources. We are using hydraulic fixture to automate the clamping. More parts will fit within machine and it uses high pressure liquid to fix parts in proper location with small hydraulic components hence get more productivity. For controlling hydraulic system, it uses actuator. An actuator is used in hydraulic system for moving and controlling system, for example by opening a valve.

5. Komal Barge, Smita Bhise :-

Fixtures are one of the mean that it accomplishes this need effectively. Fixture is a special purpose tool which is used to facilitate production (machining, assembling and inspection operations) when workpieces are to be produced on a mass scale. Fixtures provide a means of manufacturing interchangeable parts since they establish a relation, with predetermined tolerances, between the work and the cutting tool.

6. Asada :-

Asada and By (1985) established the Jacobian Matrix to formulate the workpiece-fixture relationship in 3-D space. The degrees of freedom (DOFs) constrained by the fixture can be easily derived from the rank of the Jacobian Matrix. Deterministic locating is then equivalent to full rank (rank = 6) of the Jacobian Matrix

7 . Choudhuri and DeMeter :-

Choudhuri and DeMeter (1999) presented a model that relates datum establishment error to locator geometric variability. However, its model is limited to dimensional and profile tolerances applied to spherical tip locators, planar workpiece datum features, and linear, machined features that are bounded by planar workpiece surfaces.

III. DESIGN, MECHANISM AND FABRICATION

Design

The General rules for designing are as follows:

- Compare the cost of production of work with present tools with the expected cost of production, using the tool to be made and see that the cost of buildings is not in excess of expected gain.
- Decide upon locating points and outline clamping arrangement.

- c. Make all clamping and binding devices as quick acting as possible.
- d. Make the fixture fool proof.
- e. Make some locating points adjustable.
- f. Avoid complicated clamping arrangements.
- g. Round all corners.
- h. Provide handles wherever these will make handling easy.
- i. Provide holes on escapes for chips.
- j. Locate clamps so that they will be in best position to resist the pressure of the cutting tool when at work.
- k. Place all clamps as nearly as possible opposite some bearing point of the work to avoid springing action.

Working:

We designed the hydraulic fixture for a specific component “**Mounting bracket**” which will be used in an assembly, made by casting process. The operation to be performed on the component is Drilling.

- Drilling
- Spot Facing

So. The components are carried on a trolley towards the machine on which the fixture is mounted. The operator put the component on the rest pad.

After placing the component on the fixture, the operator presses clamp/de-clamp button, which actuates the pusher, clamps and adjustable work support. So that the pusher pushes the component against the stoppers and clampers are hold the component. Hence the component gets perfectly positioned on the fixture. After that the Drilling & and spot facing operation is carried out. Then the 4 th axis of the VMC turn the table and facing of other area is carried out.

After completion of the process All the completion of operation the operator de-clamps the component, removes it and places another component.

IV. COST ESTIMATION

Cost of Manufacturing Of Fixture

| SR. NO | PART NAME | MTRL | QTY | COST |
|--------|-------------|------------|-----|-------|
| 1 | BASE PLATE | MS | 1 | 2000 |
| 2 | Clamp arm 1 | MS | 1 | 500 |
| 3 | Clamp arm 2 | MS | 3 | 150 |
| 4 | REST Pin 1 | C45 | 2 | 200 |
| 5 | REST Pin 2 | C45 | 1 | 250 |
| 6 | Locator | C45 | 1 | 2500 |
| 7 | Plate | MS | 2 | 300 |
| 8 | Riser 1 | MS | 1 | 450 |
| 9 | Riser 2 | MS | 1 | 350 |
| 10 | Block | MS | 1 | 200 |
| 11 | CYLINDER | STD | 2 | 14000 |
| | | TOTAL COST | | 20900 |

V. RESULTS AND DISCUSSION

Result

1. As a result, the rate of manufacturing of the component increased because of the reduction in cycle time.
2. Rate of Rejection totally become zero like shifting hole.
3. By using this fixture cycle time reduced by 9 minute. Cycle time on manual fixture was 40 min because the loading and unloading condition is manually.
4. So the reduce the production time

Discussion

1. We all know using the manual fixture consumes a lot of time. This affects the production rate.
2. This traditional manual fixture is replaced by a hydraulic fixture. The hydraulic fixture reduces the cycle time which ultimately results in higher productivity.
3. The efforts of the operator are also reduced with the help of a hydraulic fixture.
4. The risk of job rejection is less in hydraulic fixture as the job is positioned accurately.
5. Because of a smaller number of jobs are rejected, the company will earn more financial benefit.

VI. CONCLUSION

- By using the hydraulic fixture, the non-productivity time i.e. the time for clamping and de-clamping is reduced because of automatic operation.
- The machining accuracy is increased.

- Productivity is increased.
- Because of automation cycle time is reduced.
- The suggested system helps in achieving precise, reliable, safe as well as accurate production method.
- Also ensure accurate production and efficient clamping of parts.

REFERENCES

- [1] Shailesh S Pachbhai “DESIGN AND DEVELOPMENT OF HYDRAULIC FIXTURE FOR MACHINING HYDRAULIC LIFT HOUSING”Vol. 3, No. 3, July, 2014.
- [2] Chetankumar M. Patel,Dr.G.D.Acharya” Design and manufacturing of 8 cylinder hydraulic fixture for boring yoke on VMC - 1050” vol. 4, Pages 405-412, 2014.
- [3] Abhijeet Swami& Prof. G.E. Kondhalkar”Design, Development and Analysis of Hydraulic Fixture for machining Engine cylinder block on VMC”Volume: 03 Issue: 08 | Aug-2016.
- [4] Sagar P. Durge, Dr. S. B. Jaju, “AUTOMATION OF FIXTURE USING HYDRAULIC POWER PACK: A REVIEW” Volume 6, Issue 8, April-2019.
- [5] Komal Barge, SmitaBhise , “Design & Development of Hydraulic Fixture for VMC” Volume 3 Issue IV, April 2015.
- [6] Navya K.R., S. Pradeep, “Automation of Fixtures Using Hydraulic Power Pack for A Bogie Underframe”IOSR Journal of Mechanical and Civil Engineering e-ISSN: 2278-1684, p-ISSN: 2320-334X, Volume 10, Issue 1 (Nov. - Dec. 2013).
- [7] S.D.V.V.S.B.Reddy, P.Satish Reddy, V.Subrahmanyam, “Design And Analysis Of Machining (Hydraulic) Fixture For AVTEC Transmission Case Component” International Journal of Science Engineering and Advance Technology IJSEAT, Vol 2, Issue 7, July - 2014 ISSN 2321- 6905
- [8] Vekttec, “Fundamental Technical Hydraulic Clamping information” Aug 2009 Rev D. P.C.Sharma, “A Textbook of Production Engineering”, S.Chand&Company Limited, ISBN 81-219-0111-1, 2011