International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 06 | June 2019 www.irjet.net p-ISSN: 2395-0072

Design and Modification in Clamping System

Khole Gourav[1], Londhe Sagar[2], Uttarwar Pratiksha[3]

[1]Sudent, RSCOE IIND Shift Polytechnic, Pune
[2]Lecturer, Mechanical Engineering, RSCOE IIND Shift Polytechnic Pune, Maharashtra, India
[3]Lecturer, Mechanical Engineering, RSCOE IIND Shift Polytechnic Pune, Maharashtra, India

---

Abstract – *In clamping System/ Bench vice we can adjust the part vertically or horizontally. When we can turn or adjust the part in angle then chance to bend the part or change the shape of part. In this paper we change the design of system so that we can adjust the part 90^0 to 140^0 for cutting or welding part. Due to this system we can reduce the reworking, save the man power at the time of welding or cutting rod and also increase the rate of production. It is used in Fabrication of control panels and Making grills, Railings, windows, Door, Frames.*

Key Words: Nut, Screw, Friction Angle, Base plate and Locating Plate

1. INTRODUCTION

A fixture is a special purpose tool which is used to facilitate production (machining, assembling, and inspection operations.) Fixtures provide a means of manufacturing interchangeable parts since they eliminate the necessity of a special setup for each individual part. Fixture is bolted or clamped to the machine table. It is usually heavy in construction.

To fulfill the basic function a fixture should possess the following components:

- A sufficiently rigid body into which the work pieces are loaded.
- Locating elements
- Clamping elements.

Elements for positioning or fastening the fixture on the machine on which it is used.

2. Literature Review

Mr. R. M. Rupanawar [01] a bench vice or fixture is a production tool. The main aim is to locate, support and hold the work securely so we can perform the required machining operations. Feeler or thickness gauges and set blocks are also used to provide reference of the cutter with the work piece. A bench vice must be easily fastened with the machine and the table. As a result, the work can be done. It can be used for the other operations on most of the standard machining tools like drilling machine. Bench Vices are available in different size and shapes ranging from cheap and simple devices to very expensive and complicated devices. Bench Vices can also help to simplify the metalworking operations which are performed on the special equipment. Considering the advantages of fixture and jigs, a fixture was designed to cater to our needs.

B.Logesh [02] reduction of human Effort and enhancing safety plays a vital role while designing and fabricating the Machine vice which is used to hold the components during heavy machining works. In an ordinary vice the human power requirement is more to tighten the heavy jobs, but in this machine vice the cam is used in order to tighten automatically. In Normal machine vice the human labour involves in turning the handle to hold the component tightly by giving more human effort which eventually results in damage on work piece due to over tightening of the handle. This may be avoided by involving cam acting machine vice in which the work piece is cannot gets damage while clamping where the operation can be monitored by the operator. A lever rotates a cam lock movable jaw their using spring type puss back ram to forward and reverse movement of the vice jaws to remove the work piece and to hold the work piece.

P.Sivasankaran [03] in recent times there are many modern advancements came in the area of fixture design and assembly. In this paper attempt has been made to design and analyze the modern screw less machine vice using CATIA and ANSYS APDL package. The drawbacks of existing vice were overcome by new screw less machine vice. In the existing system of machine vice, the lead screw will tend to undergo frequent wear and tear due to abrasion resistance problem as a result jaw of vice lose its grip to hold the work component. In order to overcome such type of problem dowel pin type movable jaw was designed in such a way in order to incorporate into the base block of movable jaw.

2.1 PROBLEM DEFINITION

During assembling operations, securing a quick and accurate fixturing of mating parts and components of product assembly is absolutely essential. If the operator has to make a joint by holding the mating parts by hand; he needs to check & align the relative position time and again for each individual job. This makes the process extremely hectic & time consuming. More over the joints are not precise, further leading to misalignment, rework, time loss, making the process uneconomical. Hence the need for design of a special purpose assembly fixture for quick and accurate assembly of mating parts & components of product assembly. Such

fixtures are commonly used in welding, brazing, soldering, riveting, gluing etc. One such problem that commonly occurs in making welding frames and structures from angles, channels, square or round pipes etc. Hence it is required to make a "*PERFECT RIGHT ANGLE JOINT*".

2.2 Methodology

1) Literature Review

2) Problem Definition

3) Approach to Solve the Problem

4) System Design

5) 2D/3D Drawing

6) Part & Material Selection

7) Fabrication

8) Test the Model

9) Conclusion

3. Design

Design consists of application of scientific principles, technical information and imagination for development of new or improvised machine or mechanical system to perform specific functions with maximum economy and efficiency.

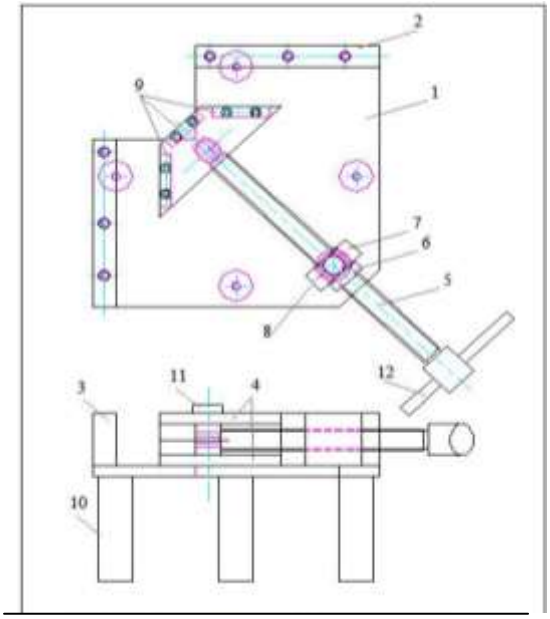

Fig 01-Assembly of clamping System

3.1 System Design

System design mainly concerns with various physical constraints ergonomics, space requirement arrangement of various components etc.

1) In system design we mainly concentrated on following parameters;
2) System selection based on physical constraints.
3) The mechanical design has direct norms with system design hence system is designed such that distinctions obtained after mechanical design can be well fitted into it.
4) Arrangement of various components made simple to utilize every possible space.
5) Ergonomic consideration in,
   - Design of screw handle.
   - Energy expenditure in hand operation.
6) Ease of maintenance and servicing is achieved by means of simplified layout that enables quick disassembly of components.
7) Scope for future improvement.
8) Optimum height of mounting table / workbench.
9) Reduced weight of machine / system.

3.2 Mechanical design

In mechanical design the components are listed down and stored on the basis of their procurement design in two categories namely,

- Designed parts.
- Parts to be purchased.

For designed parts, detailed design is done and distinctions thus obtained are compared to next highest dimensions which is readily available in market. This simplifies the assembly as well as post production and servicing work. The various tolerances on the work are specified. The process charts are prepared and passed on to the manufacturing stage. The parts which are not to be purchased directly are selected from various catalogues and specified so that anybody can purchase the same from retail shop with given specification.

Design of Screw

Power screw is mechanical device meant for converting rotary motion into translation motion and for transmitting power.

- To clamp a work piece e.g. Vice, etc.
- Power screws are simple to design,

Easy manufacture and give smooth & noiseless service. They provide large mechanical advantage and highly accurate motion. Square thread profile is favorably used in applications like vices;

clamps etc., due to its property of maximum efficiency and minimum radial or bursting pressure on nut.

Design of Nut

In design of nut the major dimension is the height or length of the nut. It is decided by considering the bearing criterion. Nut is also required to be safe under shearing. The failure of nut in shearing takes place at its core diameter and the area of core diameter of screw resisting shear is less than the area at the core diameter of nut.

Material Selection

Material	Allowable tensile stress N/mm²	Allowable shear stress N/mm²
C45	420	180

$$f_{bearing} = \frac{W}{\frac{\pi}{4}(d^2 - dr^2) \times n}$$

$$n = \frac{5 \times 10^3}{\frac{\pi}{4} \times (20^2 - 16^2) \times 17.5}$$

$$n = 2.52$$

$$n \cong 3$$

AS ; n = no of the threads in contact.

Ln = length of nut, P = Pitch.

$$n = \frac{Ln}{P}$$

$$\Rightarrow \quad Ln = n \times P$$

$$= 3 \times 4$$

$$Ln = 12$$

Normally it is recommended that ratio of length or height of nut (n) **to core** diameter (dc) should be between 1.2 to 2.5 for solid nuts.

$$Ln = 1.5 \times 16$$

$$= 24mm$$

Shear stress due to axial load.

$$fs_{nut(act)} = \frac{W}{\pi \times dt \times (\frac{Ln}{P})}$$

$$= \frac{5 \times 10^3}{\pi \times 20 \times (\frac{24}{4})}$$

$$fs_{nut(act)} = 6.63 \text{ N/mm}^2$$

As $fc_{act} < fc_{all}$; the nut is safe in shear.

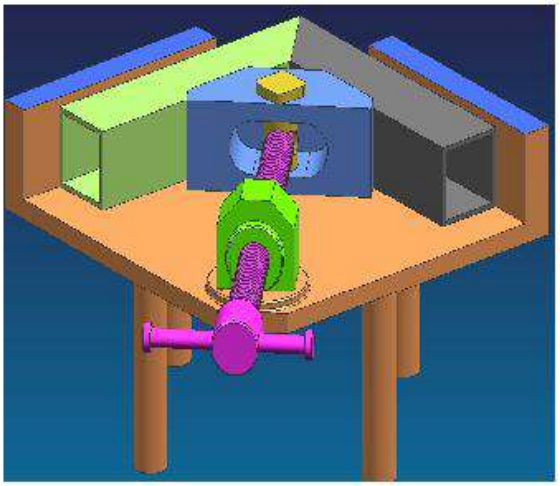

Fig.02 standard view of Clamp the same dimension square bar.

4. Working

First keep the clam on the plain surface then open the clamp to fit the job. So next step is put the two work pieces in the clamp and right the clamp and right the clamp slightly. Check the Level the other ends of the work-pieces. Adjust the ends to be joined to required position by hand or right hammer. Tighten the clamp by hand, make tag welding. Adapt the same procedure for the next joint. For fast production use two or four Clamps at a time.

5. Conclusion

'Precision Clamping System', was designed and fabricated bearing in mind its use in small scale industries, so we adopted and choose all the channels that reduced the overall cost. Therefore, the fixture fabricated by us can well meet the economic demand and multiple tasks of small-scale industries due to its low initial cost. The present fixture we fabricated is capable of making perfect right angle joints so also accommodate varying angle between 90^0 to 140^0.

6. REFERENCES

[01]. Mr. R. M. Rupanawar, Design and modification of Bench Vice by Increasing the Degree of freedom, GRD journal, Volume 1, Issue 11, October 2016, ISSN :2455-5703.

[2]. B.Logesh, A Systematic Design, Development and Fabrication of Safe Cam Operated Machine Vice, IJRESM, Volume-1, Issue-1, February 2018.

[3]. P.Sivasankaran, Design and Analysis of Modular Fixture For Machine vice, International journal Of Industrial & Production Engineering & Technology, Volume-8, Number-1, ISSN: 2249-4219