Holding and Welding Fixture For Casing Wear Ring

Mr. Shubham Asabe[1], Mr. Rutwik Chitnis[2], Mr. Atharva Kulkarni[3], Mr.Atharv Deshapande[4]
[1, 2, 3, 4] Dept of Mechanical Engg
[1, 2, 3, 4] Pimpri Chinchwad Polytechnic.

Abstract- *During the machining process ring will become oval due to clamping forces. The existing problem for first step of product Casing Wear Ring is setup time too long. The differences between each technique were explained to decide the best method for setup time reduction. A high demand product was selected for setup improvement. The setup procedures were studied carefully and analyzed to identify underlying problems of current setup. After the new jig fabrication, an improved analysis was conducted again. Few suggestions were proposed to simplify or eliminate the bottleneck procedures. Time study of redesigned jig showed that the machine setup time was improved. Objectives of this research were achieved by redesigning the current jigs and fixtures. Three recommendations for future research are proposed in the last section of thesis.*

Keywords- Fixtures, Sai Industries

I. INTRODUCTION

Increasing the productivity and accuracy are the two basic aims of mass production. As we know the solution to this is by reducing the set-up cost of the machine and also reducing the manual fatigue. In this case the device that caters our needs is the use of fixtures. Let us take one example. Let us consider that one gets an order of say 1000 products. There need to be three holes drilled on this product. In such a case the designer tries to draw out every single hole with the help of square, straightness, scribers, and center hole. In order to align the axis of the hole with the axis of the drill we generally go for trial and error method. Accuracy is the main problem in such cases. In doing so it increases the workload on the operator. Hence using of jig to position and guide the tool to its right path is preferred rather than using scribers, square, straightness or center punch etc. Thus the productivity is increased which is done by eliminating individual positioning, marking and frequent checking. Interchangeability is the chief advantage here. All the parts fit in properly except only the similar components are interchangeable. One does not need to repeatedly clamp and unclamp the object for various purposes like positioning as the locating, clamping, and guiding of the tool is done by the jig itself. Bushing which is a tool guiding tool is used. So it reduces the presence of skilled laborer. Drill jig helps to drill, ream and tap at a much faster speed and with great accuracy as compared to holes done conventionally by hand. The responsibility of maintain the accuracy of the hole is now shifted from the operator and given to the jig. May it be a drill jig or a drill fixture the necessity of a clamping device is inevitable. In case of a drill jig bushings are used. These drill bushings guide the drill bit during the drilling operation. Generally work piece is held by a fixture and the fixture is arranged in such a way that the loading and unloading of the job is quick. As we all know a fixture is a production tool which is mainly used to locate, hold and support the work piece firmly to the table. Set blocks and feeler are sometimes used to provide reference of the cutter to the work piece. The main concern is the fastening of the fixture. The fixture should be so chosen that the fastening of the job to the table is done quickly. It is mainly used in milling operation. But nevertheless it can also be used extensively in drilling machine also for holding the job during the drilling operation. The size of the fixture varies from being simpleto expensive and complicated. These fixtures also help in simplifying the network operations which are performed on special equipment.

II. TYPES OF CHUCKS

A chuck is a specialized type of clamp. It is used to hold an object with radial symmetry, especially a cylinder. In drills and mills it holds the rotating tool whereas in lathes it holds the rotating workpiece. On a lathe the chuck is mounted on the spindle which rotates within the headstock. For some purposes (such as drilling) an additional chuck may be mounted on the non-rotating tailstock.

1) Four-Jaw Independent Chuck
2) Three- Or Six-Jaw Scroll Chuck
3) A Vacuum Chuck
4) Electrostatic chuck

III. PROBLEM STATEMENT

Product Casing wear Ring is a major product of Vijaya Manohar Industries and its production operated first time. This product is consists of three machining steps, where the first step is the welding. The existing problem for first step of product Casing wear Ring is setup time too long. Thus, different methods for improving the setup processes are sought after. Initially, two machines are allocated for Casing

wear Ring. However, this solution is not effective during peak season of customer orders as Vijaya Manohar Industries needs more machines to support other products. Furthermore, a more experienced operator is assigned to conduct the machine setup of product Casing wear Ring. Similarly, it is not a good solution since the result obtained does not shows a significant improvement on setup time. The last method is to buy a more efficient machine tool from different suppliers to simplify the setup procedure. This method does not offer a significant improvement and often, the new machine tool increases the setup time of product Casing wear Ring. Generally, setup operations time is depends on the experiences and skills of workers on the production floor. Vijaya Manohar Industries realized that the lack of technical expertise is the major reason of longer setup time for product Casing wear Ring and had assigned their most skilled and conscientious workers to work on this product. During the setup process, the operator used too much time to load the fixture onto the machine, and a lot of time consumed to adjust the location of work piece while in contact with the fixture. Due to the insufficient information in the fixture design, the workers are unable to create a new fixture and are forced to satisfy the current production with the existing fixture. Another problem of the current fixture for product Casing wear Ring is related to geometrical errors on the positioning of the work piece, which may results ininaccurate machining of the work piece dimensions and some ovality issue. In order to overcome this issue, the operator applied leveling and alignment techniques onto the work piece. It is to ensure the work piece was located in parallel and perpendicular directions to the fixture and machine table respectively. Generally, the operator will repeat the leveling and alignment procedures twice to increase the accuracy of work piece position. However, it is possible to have one instead of several procedures. Therefore, the proposed solution is redesign the machine fixture to reduce loading time and improve leveling and alignment procedures.

IV. PROPOSED WORK

The process of the welding will generate high amount of heat in work piece because it is necessary for melting the Inconel 625 metal to provide so short layer on the casing wear ring . The TIG welding will generate the temperatures of distorting or changing shape of ring as well as to reduce welding time we couldn't place ring on rotating platform . If we put the ring on rotating platform directly it will hamper it's accuracy . If we don't use rotating platform it will be time consuming for company as well as for the worker ,thus it will affect on the cost of the manufacturing of product. In traditional method we directly put the work piece into chuck or holding device but in order to overcome the extra cost and maintain more accuracy we use fixtures. During machining process our work piece will get oval shaped due to excessive amount of force offered by hydraulic chuck of cnc machine. To overcome this we have to provide some strength to our material but it is not possible so we are adding fixture to sustain the excessive load offered by hydraulic chuck jaws during machining process. We have options for using of using the magnetic chuck but it is not possible due to our work-piece is made from the stainless steel. 5.2 Analysis of current machine setup procedure In this section, the current machine setup operation was analyzed and discussed. Product casing wear ring is consists of three machining steps, where the first step is the bottleneck among the others. Based on the data collected, the total setup time for product casing wear ring is more and all the time consuming procedures are related to the available fixture. The setup steps are involved: machine cleaning, load and position fixtures onto the machine, lifting work piece onto fixtures, conduct alignment along x and y-axis and set a center point of work piece. The highest time consumed in current setup method is loading and adjusting the distance between two holes of fixtures onto the machine chuck to fix the position and length of the work piece. After the fixtures loading, the operator conducted work piece levelling in z-axis direction and ensured the correct alignment along x and yaxis positions. This process repeated several times until the work piece was located correctly. All the steps listed above are potentially to simplify or eliminate in this researchThe suggestion for a new fixture is consists of six locators and , and each locator is placed on equally inclined to each other. Since there is no changing part of the fixture, all the components are welded on the base plate according to the dimensional requirements. Due to the locating problem of fixture on machine bed, step clamp, step block and flange nut were used to clamp the fixture in a precise location onto the machine table..

V. CALCULATIONS

1.Clamping force calculation

Loosening of a screw (clamping/unclamping the work piece) is equivalent to the movement of a weight on a inclined plane. The actuating force Pacts horizontally (tangent to the threads) to result in the holding or clamping force F. These two forces are connected as.

$$P = F. \tan (\alpha + \Phi)$$

Where,

α = Helix angle of the threads
p = pitch of the threads (lead in case of multi start threads)
dm = mean or pitch diameter of the threads

Φ = angle of friction = tan-1 μ
μ = co-efficient of friction between nut andscrew.
For unclamping,

$$P = F. \tan (\alpha - \Phi)$$

If the end of the screw touches the work-piece directly, it can damage the surface of the work piece, the work-piece can get displaced or the screw can get bent.

To prevent this possibilities, swivel pad or collar is provided.

Total torsional moment needed to apply the clamping force
= Screw torsional moment + collar frictional torsional moment
= P +μcF
μc = of friction between collar and work piece
Dc = friction diameter of the collar

Total torsional moment needed to clamp the work

$$Mt = F \quad \tan (\alpha+\Phi) + \mu cF$$

The actuating force at the nut/screw head is usually applied with the help of a spanner or wrench, If this force T, is applied at a distanceL , from the axis of the screw, thenTL = M_t = Ftan (α+Φ) + μ_cFClamping force

$$TL = M_t = F\tan (\alpha+\Phi) + \mu_c F$$

Clamping force,

$$F = \frac{\frac{dm}{2}(.\tan\alpha+\Phi) + \mu c.\ \frac{Dc}{2}}{}$$

$$F = \frac{80 \times 10^3 \times 5.5}{\frac{6}{2}(.\tan 29+\tan^{-1}0.23) + 0.15\times \frac{20}{2}}$$

F =104843.356 N
F =104.843 × 10 KN

The main drawback of screw clamp is that lot of time wasted in clamping job in right position.

VI. ADVANTAGES

The elimination of the individual marking, positioning and frequent checking enables jigs and fixtures to reduce operation time, during which productivity and efficiency will increase. The high clamping rigidity also bring about an increase in speed, feed and depth of cut.

Facilitating mass production of components without the need for selective assembly, jigs and fixtures perform their functions with high degree of accuracy and uniform quality. Along with a competitive cost, all similar components are interchangeable.

VII. DISADVANTAGES

1. It can wear away over time
2. It can have complicated designs.
3. It have high initial set up costs (and time).
4. It can use a lot of material and be bulky.

VIII. CONCLUSION

In a modern manufacturing environment, organizations must be responsive to the requirements of the customers and their specific needs and to fluctuating global market demands. To maintain its competitiveness in market share, the manufacturing firms must be conducted with a minimum amount of wasted resources. The main focus of this research is to reduce the setup time for the first machining step of a high accuracy product, Casing Wear Ring. The proposed solution is redesigns the current fixtures to simplify the setup procedures. And improve welding and machining process.

REFERENCES

[1] Smash Enterprises
[2] Vijaya Manohar Industries
[3] Sai Industries
[4] R.S.Khurm's book Design Of Machine element
[5] Www.Kalukaka.tk
[6] www.engineersedge.com
[7] Shrikant.V.Peshatwar, L.P Raut "Design and development of Fixturefor Applications
[8] Nanthakumar, K. and Prabakaran, V. (2014). "Design and
[9] Fabrication Testing of Combined Multipurpose Jig and
[10] Fixture" IOSR Journal of Mechanical and Civil Engineering.
[11] Kakish, J., Zhang, P.L. and Zeid, I., 2000. Toward the design and development

.