

Development of Assembly Fixture for Reduction of Set up Time

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ABSTRACT

A fixture is a work-holding or support device used in the manufacturing industry. Fixtures are used to securely locate and support the work, ensuring that all parts produced using the fixture will maintain conformity and interchange ability. Using a fixture improves the economy of production by allowing smooth operation and quick transition from part to part, reducing the requirement for skilled labour by simplifying how work pieces are mounted, and increasing conformity across a production run. Fixtures must always be designed with economics in mind; the purpose of these devices is to reduce costs, and so they must be designed in such a way that the cost reduction outweighs the cost of implementing the fixture. It is usually better, from an economic standpoint, for a fixture to result in a small cost reduction for a process in constant use, than for a large cost reduction for a process used only occasionally. This assembly fixture helps to reduce the assembly time with reduction of the worker fatigue.

Keyword:- Fixture, Cost Reduction, Assembly Fixture

1. INTRODUCTION

Fixture is required in various industries according to their application. Design of new fixture is a modified over the old fixture due to some drawback. The fixture setup for component is done manually therefore more cycle time is required for loading and unloading the material. So, there is need to develop system which can help in improving productivity, accuracy and reduction of time. Over the past century, manufacturing has made considerable progress. New machine tools, high-performance cutting tools, and modern manufacturing processes enable today's industries to make parts faster and better than ever before. The work holding methods have also advanced considerably, the basic principles of clamping and locating are still the same. Mass production methods demand a fast and easy method of positioning work for accurate operations on it. Jigs and fixtures are production tools used to accurately manufacture duplicate and interchangeable parts. Jigs and fixtures are specially designed so that large numbers of components can be machined or assembled identically, and to ensure interchange ability of components. The economical production of engineering components is greatly facilitated by the provision of jigs and fixtures. The use of a jig or fixture makes a fairly simple operation out of one which would otherwise require a lot of skill and time. Both jigs and fixtures position components accurately; and hold components rigid and prevent movement during working in order to impart greater productivity and part accuracy. Jigs and fixtures hold or grip a work piece in the predetermined manner of firmness and location, to perform on the work piece a manufacturing operation. A jig or fixture is designed and built to hold, support and locate every component (part) to ensure that each is drilled or machined within the specified limits. The correct relationship and alignment between the tool and the work piece is maintained.

2. LITERATURE REVIEW

Kulkarni Kaustubh A. [1] studied that the fixture is required in various industries according to their application Design of new fixture is a modified over the old fixture due to some drawback. Kiran Valandi et al [3] aimed at designing a fixture used for performing machining operations at certain angle (102.5 degree) on the Crank case used in commercial vehicles. Kumara B et al [4], Design of new fixture is a modified over the old fixture due to some drawback. The old fixture is not suitable for drum having slot on top face current fixture is complicated in design

and there is more work in fitting the button to fixture ring. Aditya Rao et al [5] provided a solution on a solution to the difficulties faced in making keyways in various types of gears: Spur, Helical, and Bevel. It focuses on developing an adjustable fixture mechanism which incorporates versatility as its main feature. Gopal Bharat Patil [6] reduced the weight of suspension components also improves the vehicle's handling performance. Therefore, topology optimization should be implemented to obtain a minimum weight with maximum or feasible performance. Among the vehicle structural components, the steering knuckle is prominent part in the suspension system which plays major role in many direction control of the vehicle linked with other linkages and supports the vertical weight of the car. N. P. Maniar [7] reviewed some of the developments in fixture design and proposes directions for future research initiatives. With growing need of fast production to meet the requirements of industry, mass production machines are conceived. Ranjot Singh [8] studied on the defects of the steering nut which was rejected due to incorrect setting up of machine tool on special purpose machine and mishandling of component during heat treatment stage. M. Fathil C. Ibrahim [9] presented the capability of 3D software to assist in generating and improving innovative product. This work helped the mechanics to remove pin component; distributor pin and piston pin. Apoorva M.V.[10] studied that fixture is required in various industries according to their application. This can be achieved by selecting the optimal location of fixturing elements such as locators and clamps.

3. SYSTEM MODELING

While taking the new product for the manufacturing the industries have to cope up with the varying demand of jigs and fixtures for different components. The company is engaged with such scenarios where knuckles of the rear axle are manufactured and it requires some complicated assembly for completing the task. The separate workstations are required for manufacturing of both these axles as assembly differs. This requires more manpower, machines, space requirements, set up time for performing the activities.

Any such system like assembly fixture which will reduce the worker fatigue, reduces space requirements and set up time prove to be beneficial to the industry and it creates opportunity to compete the current manufacturing problems. The fixture should be able to take two different types of knuckle that is right hand and left hand knuckle on the same set up. The assembly should take place without error.

3.1 Fixture Requirements

- [1] Base of the fixture should be such that it must accommodate Disc Brake Plate
- [2] Its base plate must be rotary to adopt both type of knuckles
- [3] Base plate must be rigid
- [4] Easy to construct with less cost
- [5] Loading and unloading of the component must be easy
- [6] Less number of steps needs to be required for assembly
- [7] Fixture must be economical in use and maintenance
- [8] It should be handled by any operator and should not require training to use it

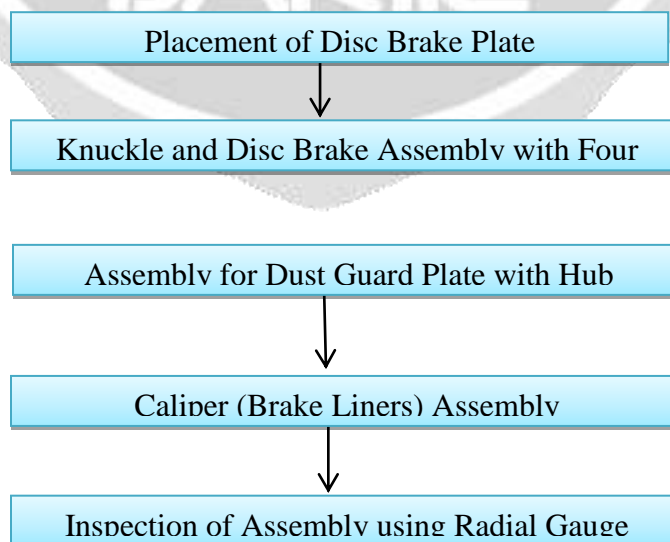


Figure 1.1:- Steps in Knuckle Assembly

3.2 Fixture Development

The task is to build a model of fixture which will satisfy all the requirements of the component which is to be assembled.

- [1] According to Disc Brake Plate Size Base of the fixture must design.
- [2] Also it must ensure knuckle fitment and assembly with disc brake plate.
- [3] Fool proof arrangement must be provided so as to obtain rejection free output
- [4] It should accommodate and make arrangement for dust guard plate with hub
- [5] Calliper assembly must be supported

[A] **Base Plate** is the foundation of fixture which is attached to rectangular fixture plate for its rigidity

[B] **Rotary Base Plate** is attached to the base plate in such a way that it can rotate as a result whole fixture rotates. A lever is provided for the rotation purpose on the base plate.

[C] **Lower Control Arm** gives support to the heaviest part in assembly i.e. LCA Lower control arm is rested on the support and join to the knuckle

[D] **Locking Pins and toggle Pins** are provided on circular plate. With the help of these pins knuckle is rested on the fixture without any wrong feeding

4. PERFORMANCE ANALYSIS AND TESTING

Work-study forms the basis for work system design. The purpose of work design is to identify the most effective means of achieving necessary functions.

Table No.1.1:- Time Study for New Method

| Sr. No. | Motion Sequence | Time Required (Seconds) |
|--------------|-------------------------------|-------------------------------|
| 1 | Loading of Knuckle | 5 |
| 2 | Assembly of Dust Plate & Hub | 15 |
| 3 | Assembly of Disc Plate | 10 |
| 4 | Checking for Proper Tightness | 10 |
| 5 | Caliper Assembly | 12 |
| 6 | Assembly of LCA | 18 |
| 7 | Final Inspection | 14 |
| Total | | 84 Sec (1 min. 24 Sec) |

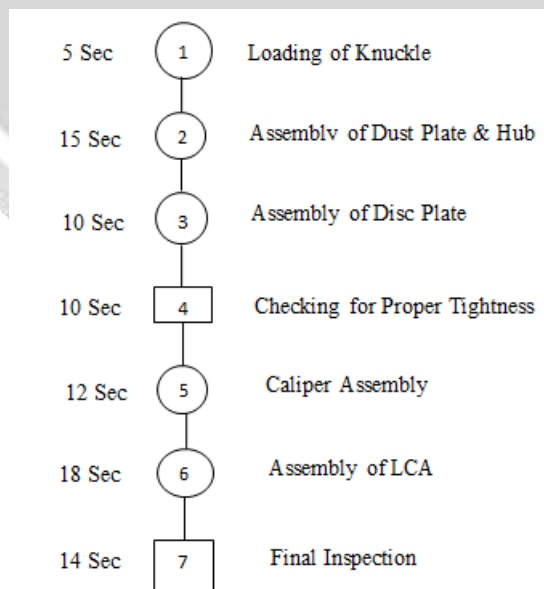
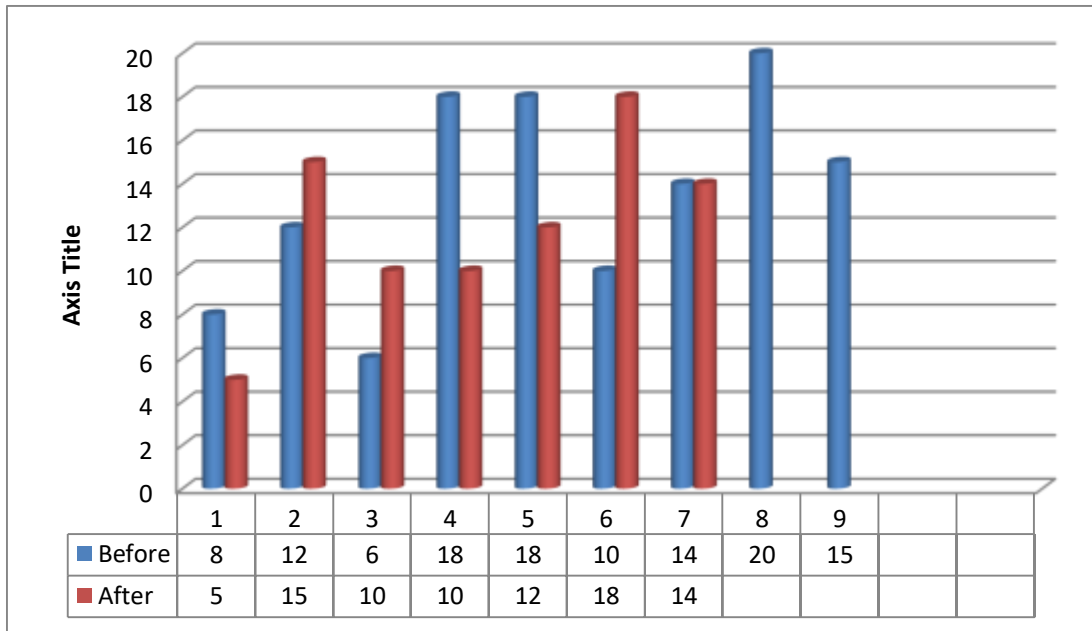


Figure No. 1.2:- Outline Process Chart for New Method

5. RESULTS AND CONCLUDING REMARKS

The assembly time required for earlier was of quite large and due to introduction of the fixture for the same it substantially reduced. The overall time is reduced by reducing number of steps for assembly and by combining several operations in it. The fixture developed provides the rigid support to the knuckle assembly and helps to reduce the manufacturing lead time.

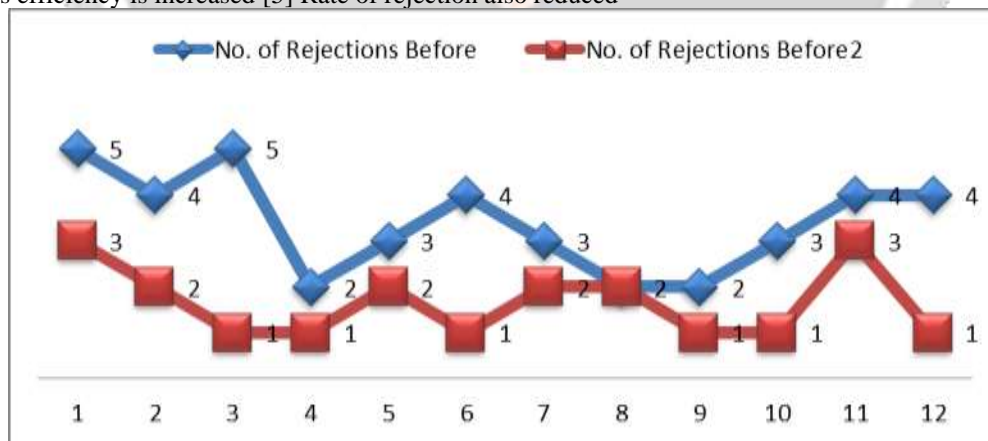


Graph No.6.1:- Comparison between Before and After Number of Activities

From this comparison it is clearly seen that number activities after implementation of the fixture is reduced substantially. Also the Time require after fixture implementation is reduced.

As the numbers of activities are reduced company gets the indirect benefits such as

- [1] Manufacturing lead time reduced
- [2] Worker fatigue reduced
- [3] Better ergonomics is achieved
- [4] Workers efficiency is increased
- [5] Rate of rejection also reduced



Graph No.6.2:- Rate of Rejections

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