Review on Jigs and Fixtures

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Abstract— In today modern and fast industries has increased d demand of products day by day. An in olden time's manufacturers would made products but not fast and efficiently so to minimize the time for production of any product figs and fixture were introduced. Jigs and fixture are tools which minimizing the work load on worker. Jigs and Fixtures reduce operation time and increases productivity and high quality of operation is possible. The jigs and fixtures are the most easy and economical ways to produce a component in mass. It serves as one of the most important facility in mass production system. These are special type of machine tools for work holding and tool guiding device. A jig differs from a fixture it guides the tool to its correct position.

Key words: Jigs, Fixtures

I. INTRODUCTION

Jigs and fixtures are machine tool which is used to facilitate production (machining, assembling and inspection operations). This eliminates the necessity of a special set up for each individual park. The use jigs and fixture makes possible due to rapid and more accurate manufacturing at reduction of cost. The purpose of these machine tools is to locate and immobilize workpiece for machining, inspection, assembly and other operations fixtures are used.

A fixture consists of a set of locators and clamps. Locators are used in machine tools to determine the position and orientation of a work piece, where the clamps exert clamping forces so that the workpiece is pressed firmly against locators. Clamping plays an important role on fixture that the force of clamps should not deform the material. Fixture and jigs design plays an important role at the setup planning phase. Proper design of jigs and fixture are crucial in terms of developing the product quality.

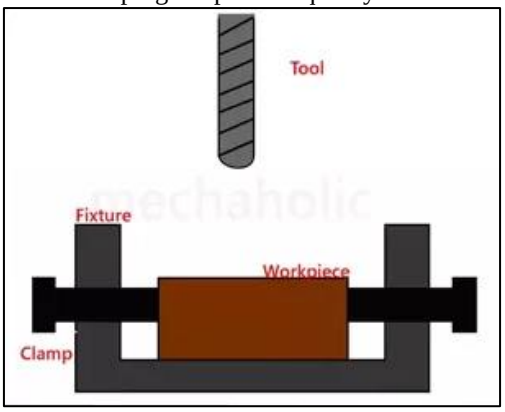

Fig. 1: Fixture

The jigs are tools which are used various operation such as drilling, reaming, tapping and boring operation. Jigs are not used to the drill press table until and unless large diameters to be drilled and there is a necessity to move the jig to bring one each bush directly under the drill. Frequent checking, positioning, individual marking and non-uniform quality in manufacturing process are eliminated by jigs and fixture.

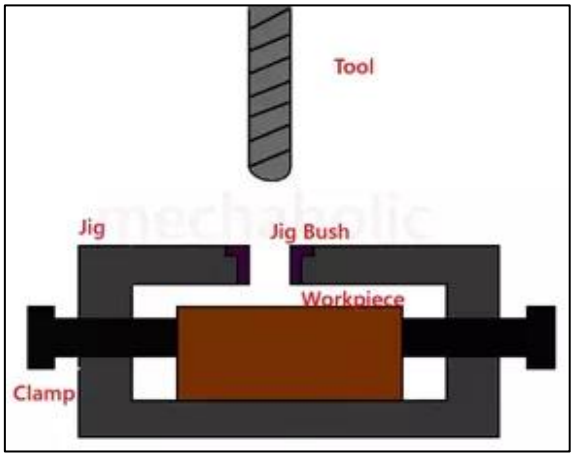

Fig. 2: Jig

II. LITERATURE SURVEY

A. *Prof. Raut .M*

A Review on Design of Fixtures in which the efficiency and reliability of the fixture design has enhanced by the system and the result of the fixture design has made more reasonable.

B. *Prof. Smita Bhise*

Design & Development of Hydraulic Fixture for VMC Implemented that this project eliminates the need of human operator for clamping of manifolds. It reduces the cycle time. It gives an economically feasible design.

C. *Prof. Anbarasan I.*

Design and fabrication of jig and fixture for hollow cylindrical component in drilling machine concluded that the project design and fabrication of a jig and fixture holding and indexing of the circular job is made easy.

D. *Prof. Girish V.*

Design of Welding Fixtures and Positioners are used to the process of conducting operations related to welding fixture and positions help in gaining a deeper understanding as well as effective project process.

III. FUNDAMENTAL PRINCIPLES OF JIGS AND FIXTURES DESIGN

A. *Locating Points*

Design of jigs and fixtures should such that the job to be machined must be easily inserted and quickly taken out. There should be no time wasted in placing the workpiece in position to perform operations. The work piece position of should be accurate with respect to tool guiding in the jig or setting elements in fixture.

B. Weight of Jigs and Fixtures

It should be easy to use, transport & smaller in size and low cost.

C. Clamping Device:-

It should be as easy as possible without any effort. The clamp should be strong enough in not only to hold the workpiece firmly in place but also to take the strain of the cutting tool without springing when designing the jigs and fixtures.

D. Jigs Provided with Stand:-

Jigs sometimes are provided with stand so that it can be placed on the table of the machine.

IV. Essential Features of Jigs and Fixtures

A. Safety

The design should assure perfect safety of the operator

B. Rigidity and Stability

It should remain perfectly rigid and stable during operation. Provision should be made for proper positioning and rigidly holding the jigs and fixtures

C. Position of clamps

In jigs and fixture the clamping should occur easily and smoothly clamp directly above the points supporting the work piece to avoid distortion.

D. Economic Soundness

Equipment should low in cost of design and manufacture should be in proportion to the quantity and price of producer

E. Replaceable Part or Standardization

The locating and supporting surfaces should be replaceable, should be standardized so that their interchangeable manufacture is possible.

V. Factors to be Considered for Design of Jigs and Fixtures

A. Clamping Arrangements

Quick acting clamps must be used as far as possible. The clamping should not cause any deformation or damage to the workpiece it should always be arranged directly above points supporting the work. Power driven clamps are favoured as they are quick acting, controllable, reliable and operated without causing any fatigue to the operators.

B. Loading and Unloading Arrangements

There should be enough clearance for loading and unloading of components. Hence process becomes quick and easy. Size variation must be accepted. It should be hardened material.

VI. Materials Used for Jigs and Fixtures

A. High speed Steel:

Cutting tools like drills, reamers and milling cutters.

B. Die steels:

Used for press tools, contain 1% carbon, 0.5 to 1% tungsten and less quantity of silicon and manganese.

C. Carbon steels:

Used for standard cutting tools.

D. Cast Iron:

Used for odd shapes to some machining and laborious fabrication CI usage requires a pattern for casting Contains more than 2% carbon.

VII. Principles of Locations

The principle of location is being discussed here with the help of a most popular example which is available in any of the book covering jigs and fixtures. It is important that one should understand the problem first.

For a fixture design, the major portion of design time is spent deciding how to locate the work piece in the fixture.

You know that any free body has a total of twelve degrees of freedom as below:

6 translational degrees of freedom: +X, -X, +Y, -Y, +Z, -Z and 6 rotational degrees of freedom:

- Clockwise around X axis (CROT-X)
- Anticlockwise around X axis (ACROT-X)
- Clockwise around Y axis (CROT-Y)
- Anticlockwise around Y axis (ACROT-Y)
- Clockwise around Z axis (CROT-Z)
- Anticlockwise around Z axis (ACROT-Z)

You must fix all the 12 degrees of freedom except the three transitional degrees of freedom (-X, -Y and -Z) in order to locate the work piece in the fixture. So, therefore 9 degrees of freedom of the work piece is need to be fixed.

A. 3-2-1 method as shown below:

Rest the work piece on three non-collinear points of the bottom surface (XY), and you will be able to fix the +Z, CROT-X, ACROT-X, CROT-Y and ACROT-Y degrees of freedom.

So now, rest the work piece at two points of side surface (XZ), and you will be able to fix the +Y and ACROT-Z degrees of freedom.

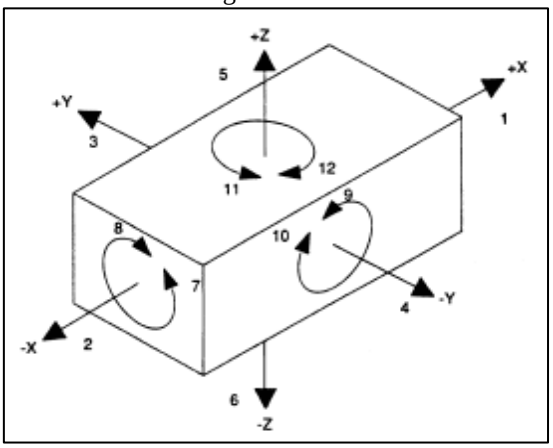

Fig. 3: Locations

VIII. USES OF JIGS AND FIXTURES

- Reduces quality control expenses.
- Improve work safety
- Enable to manufacture heavy and complex parts.
- Ensure high accuracy in parts.

IX. ADVANTAGES OF JIGS AND FIXTURES

- Jigs and fixtures in production plays an important role in with high degree of accuracy, uniform quality and interchangeability at a competitive cost.
- Jigs and fixtures increase the productivity by eliminating the individual marking, positioning and frequent checking on job. The operation time is also reduced due to increase in speed, feed and depth of cut because of high clamping rigidity.
- Due to low variability in dimension assembly operation becomes easy, low rejection due to less defective production is observed.

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