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Nail Nest Fixture For Irregular Bodies

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***Abstract*—Nail Nest Fixture is a smart mechanical fixture which facilitates the clone cavity formation of irregular shaped bodies. In the current scenario the fixtures are limited with the shape restriction made by the irregular shaped objects. Here arises the need for a better fixture design which facilitates the arrest of five degrees of freedom possible. Traditionally the fixtures are limited to consider mainly the basic shaped materials. Even though some mechanical inventions like the cavity fixtures allows the arrest of five degrees of freedom, there is a limitation in acceptance of various shaped materials for machining purposes in the same fixture. Many special purpose fixtures will stay idle when the variation of shape is introduced to it due to the low elastic nature of usage. Frequent change in fixtures is needed by considering the change of shape possessed by them that have to be machined. The "Nail Nest Fixture" is a mechanical fixture which can be considered as special purpose fixture that could accept various shaped irregular bodies in a single fixture. Multiple rows and columns of needles are arranged which rambles a bed that allows the cavity formation of the fixture. This facilitates the maximal arrest of freedom of movement of a solid body as a fixture.**

***Index Terms*—Needle Bed, Fixture, Irregular Shape, Arrest of Freedom**

I. INTRODUCTION

Fixtures are special mechanical device which facilitates the firm holding of bodies that have to be machined. A fixture aims in the arrest of degrees of freedom and avoids the formation of vibration or other disturbances. They should check that no shifting of position is been made by the body, so that proper and accurate machining operation could be done. Various types of fixtures are available in the industry that allows the firm holding of bodies.

They can be broadly classified into two types, namely the General type fixtures and Special type fixtures. The general type fixtures are those which accommodate various bodies of similar category. But the special purpose fixtures are those allows only one type of fixture with same shape and dimension. Even though, there is a need for a perfect fixture that could accommodate any shaped materials, even the complex irregular shaped materials that arrest the maximal degrees of freedom possible.

Traditionally the fixtures are limited to consider mainly the basic shaped materials. The surface of the body that could be easily holded by a regular fixture are mainly plain or cylindrical. The more variation in complexity of irregularity, lesser are the options of fixtures available. The arrest of degrees of freedom also becomes less effective in increase of irregularity in the surface of the body.

Even though there are some exceptional fixture like the cavity fixture there remains a limitation in acceptance of various shaped materials for machining purposes in the same fixture. Many special purpose fixtures will stay idle when the variation of shape is introduced to it due to the low elastic nature of usage. In case of special purpose fixtures there exists a limitation of accepting only the identical shaped bodies for holding purpose.

The "Nail Nest Fixture" is an mechanical fixture which can be considered as special purpose fixture, that could accept various shaped irregular bodies in a single fixture. They consist of multiple rows and columns of needles that are arranged in such a way which rambles a bed. When an irregular shaped body is been placed in the bed a cavity is made induced by the change of equal displacement of the needle in its position.

This new innovative concept allows the acceptance of complex irregular shaped body very easily. It makes the cavity of placement automatically at the instant of placing the body. A locking arrangement is made to arrest the to and fro movement of the needle through the bed. A simple push button is installed for this purpose.

Once the movements of needles are arrested there remains a cavity even after removal of the body from the surface. This could be thus introduced as the best way for production in the large scale since it facilitates the arrest of five degrees of freedom of a solid body as a fixture.

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STUDY OF SUBJECT

INTRODUCTION TO FIXTURE

Fixture is a work piece - locating and holding device used with machine tools. It is also used in inspection welding and assembly. Fixture does not guide the cutting tool, but is always fixed to machine or bench. By using fixture, responsibility for accuracy shifts from the operator to the construction of machine tool.

When a few parts are to be machined, work piece clamp to the machine table without using fixture in many machining operations. However, when the numbers of parts are large enough to justify its cost, a fixture is generally used for holding and locating the work.

TYPES OF FIXTURE

Vise Fixture

It is easy to clamp work piece with regular shape and parallel sides in a vise. However, work pieces with round or irregular shapes are very difficult to clamp properly. Hence, special jaws are created to hold work pieces with irregular shape properly and at the same time, it also avoid damage to the important surfaces. Various types of vise fixture are available in the industry as per the industrial needs.

Milling Fixture

This holds the part in correct relation to the milling cutter. Fixture is attached to milling machine table. Milling fixture consists of the base, clamps, rest blocks or nest, locating points and gauging surfaces.

The base of milling fixture consists of a base plate. A base plate has a flat and accurate undersurface and forms main body on which various components are mounted. This surface aligns with the surface of the mill table and forms the reference plane with respect to the mill feed movement. It may be constructed of steel plate or cast iron, depending upon the size and complexity of the part. The slots are provided in the base for clamping the fixture to the mill table. The base plate also has keyways along with length of the base for two keys. These keys are used to align the fixture on the milling machine table. The keys are pressed into the keyway at both ends of fixture and held there by socket head caps screw.

Boring Fixture

According to the type of boring operation, boring fixture are used. Boring Fixture may have characteristics of a drill jig or a mill fixture. The work piece always has an existing hole which is enlarged by the boring operation. It may be final or may be preliminary to grinding and other sizing operation.

Face Plate Fixture

It can be used conveniently for machining of simple and small components. Addition of locators and clamps on face plate help in quick location and clamping of work piece. Face plate fixture is useful for facing number of work pieces simultaneously on the lathe.

Turning Fixture

These are generally special face plates. Their swing should be lesser than the swing of the machine. These are used for quick location and clamping. The work piece rests on angle plate and its boss is centralized with machine axis by sliding *v*-block which can be operated with knurled screw. The overhang of turning fixtures should be minimum bare necessary for the operation. Fixture should be balanced with work piece in position.

Grinding Fixture

The standard magnetic tables are used to rest work piece such that resting surface will be parallel to the surface to be ground. However, for light work piece with lesser resting area, the resting area tends to tilt and fly off the magnetic table due to high speed of grinding wheel and due to high feed, also. Hence, it is necessary to provide additional support by nesting the work piece.

This can be done by placing the solid plates around the work piece as shown in Figure 4.8. The nest plates are held firmly by the magnetic force of table with more weight and more resting area. The nest plates surround the work piece from outside and arrest its movement in the horizontal plane. Thus, this arrangement will help in preventing it from flying off and tilting due to high speed and feed in grinding operation.

CAVITY OR NEST FIXTURE

A special purpose fixture which has a cavity to fit the body inside is known as a cavity fixture. This is made in the shape of the body to place the body inside firmly, to arrest the maximal degrees of freedom possible. The advantage of this cavity or nest fixture is when machining in large scale, but the disadvantage about the cavity fixture is that only identical shaped bodies are accepted by the cavity fixture.

FUNCTIONS OF FIXTURES

The clamping arrangement should be capable of withstanding the various forces developed during operation.

(a) Cutting force tangential to cutting circle.

(b) Axial force and radial force due to feed of tool.

(c) Bending forces due to pressure of tool on work piece.

(d) To arrest maximal Degrees of Freedom

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PROPOSED METHODOLOGY

PRINCIPLE USED

An equal displacement is made by the needle when an object is placed in the surface. The bed of needle heads comprises of tiny needles help in the surface graphing possible.

When considered single, one needle will make only a to and fro motion between the three layers. Two among the three layers a capable of motion in a horizontal direction to the needle which is used in arresting the needles from movement from its displaced position

PARTS OF A NAIL NEST FIXTURE

A nail nest fixture consist of several parts, but the needle is the major part when it comes to this case. There are mainly three arrangements for a Needle Clamp, namely:

01. Locating Arrangement
02. Locking Arrangement

LOCATING ARRANGEMENT

The locating arrangement is specialized with its ability to accept any complex irregular shaped objects. Complex irregular shaped bodies are also easily accommodated by this new and innovative arrangement that is made. This arrangement consist of mainly two parts namely:

01 The Needle
02 Needle Bed

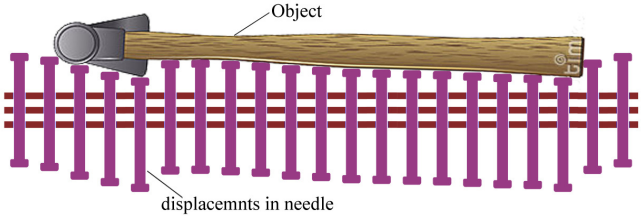

FIG-02

Needle : In locating of an object the needle places a major role. When an object is placed on the Nail Nest Fixture each needle will make the corresponding displacement to the area of contact, creating a cavity which suits the object in.

Needle Bed : Needles are arranged in rows and columns to resemble the shape of a bed, and thus the whole arrangement could be called as the Needle Bed. The small contact area displacement made by every needle together contribute in the formation of cavity which arrest the five degrees of freedom easily

Spring : A spring arrangement could be made if needed. Even if in the absence of spring there will be no change in the working condition of the nail nest fixture. In the absence of spring it is advised to place the object from the bottom of bed so that the cavity could be made. The arrest of needle from the future movement by a push button makes it a fixture.

LOCKING ARRANGEMENT

This is a smart arrangement that is made for arresting them to and fro movement of the Needle. This arrangement consists of two parts namely:

01 The Needle
02 Locking layers

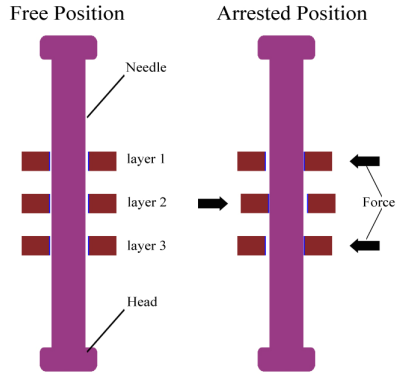

FIG-01

Needle : The needle passes equally through three of the layer and makes the displacement according to the object made. Now the movement of the needle should be made arrested by locking the position of needle

Locking Layers : The two of the layers have the freedom to move relatively considering the other layer. A push button makes a displacement of the layers, making the arrest of the needle possible.

WORKING PROCEDURE

In the initial phase the needle bed is checked to be align in a regular manner. The object is introduced to a flat plane and the needle bed is place just above it. The relative areas would make displacements according to the surface of the object. The push button is pushed to arrest the motions are made by the needle.

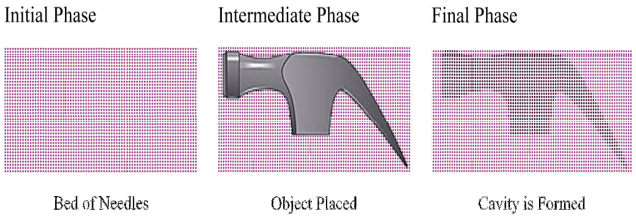

FIG-03

Now remove the object from bottom and place the nail nest fixture in the upright position. Now we could observe a cavity that is made according to the surface of the object placed initially. Thus it serves as a nest or cavity fixture that allows all type of irregular shaped objects. This could be used in large scale industries for proper machining of bodies.

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CONCLUSION

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