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Investigation for Generation of Flat Contour Using Constant Width Geometry with CATIA V6/ Taguchi method

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ABSTRACT
In today's life we have to make square hole on various material like wall, wood etc. Making square hole one of the major problem. There is various technique for making square hole but it is found that no one can make perfect square. In this paper we suggest technique to make square hole. The system design consider modification to existing system for satisfying the requirement of making square whole. The system is modify by imparting Universal coupling and Reuleaux triangle. We have perform operation on various material which are based on their composition. We have identified idea in this paper for generating square hole by using drilling system. To make square hole we have to convert circular motion into square motion. The idea is to use Reuleaux triangle which rotate in square motion, as it rotate it trace a path that eventually covers each part of square.

Keywords: Reuleaux triangle, Eccentric mounting, Square motion,Universal Coupling,Guiding Mechanism,Cutting Tool.

1 INTRODUCTION

Producing square holes in the industry, is very common and useful and at the same time along with problems such as high cost complexity of manufacture.Using a drill with non-coaxial couplings, in addition to easier manufacturing, also reduces the costs of production. The Mechanism of the drill is designed by using the mathematical model.Square holes are used widely in industry. Examples of these applications are used in some of the couplings. Since the square shape of the hole and shaft, will lead to full involvement of couplings, accordingly prevent freewheeling. There are a variety of methods for creating square holes. One of these methods is making a square hole by CNC machine. Using CNC machine, despite the high accuracy, it costs too much. Another metods used are Electrical Discharge Methods, Machining and Broaching which all come with a set of limitations.[1]

To overcome these limitations use of Constant Width Geometry like Releaux Triangle was proposed.The main aim of our project is to investigate how a circular motion can be converted into a square motion by purely a mechanical linkage; an application of which is to construct a special tool that drills exact square holes. A geometrical construction that fulfills the laid objective is Reuleaux Triangle. Additionally, for this geometry to work from a rotating drive (such as a drill press) one must force the Reuleaux triangle to rotate inside a square, and that requires a square template to constrain the Reuleaux triangle as well as a special coupling to address the fact that the center of rotation also moves.[5]

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Square locus and this can be turned into a working square-hole drill. The developed design had a success rate of98.7% i.e it removed approximately 98.7% area of the desired square. The fab-

rication of the developed design in this paper has been done on Steel tha is ideal for soft surfaces but if harder materials are used, hard surfaces application is also possible.[3]

2 PROBLEM DEFINITION:

The assembly in industries for generating square hole uses Floating Chuck as a device to support the revolving Cam Centre of rotation and guide the boundaries of the Releaux Triangle.But this leads to dependency of the mechanism on an instrument and reduces the flexibility. Also the instrument is heavy and limitations in terms of dimension generations.
Hence to rule out these limitations the project aims to replace the floating chuck with an Universal Coupling Joint and design a mechanism accordingly.

2.1METHODOLOGY:

The design and simulation of the parts will be carried out on Solidworks Software Considerations in Design and analysis in Ansys Software.

- Types of load and stresses.
- Selection of material and factors like strength , durability,weight, corrosion resistance, machine ability are considered.
- Form and size of the components.
- Convenient and economical in operation.
- Use of standard parts and facilities available for manufacturing.
- Cost of making mechanism.

3 Design:-

3.1Spindle Shaft –

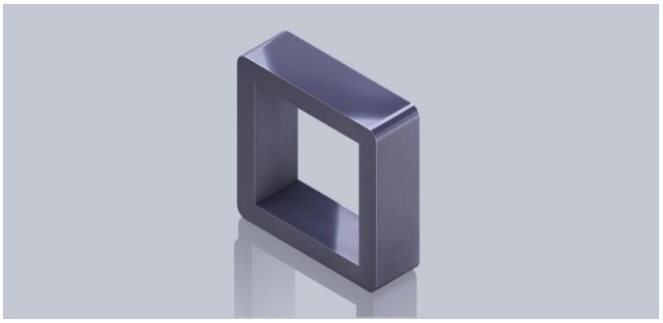
This is the rear portion of the tool which is directly attached to the normal chuck in a drill press or lathe. It provides the base for the longitudinal placement of tool with accuracy as its axis would be the defining axis of the tool whose placement will confine the overall tool movement. It will take the rpm as given by the machine and drives the tool.

3.2 Universal Coupling –

This is the base of the revolution movement necessary for the tool to follow square path and generate the required dimension. The primary function of this coupling is to provide the rotational motion as output which it is getting as an input form the machinery. The secondary but equally important function is to provide a link which allows for the centric movement of the reuleaux guiding triangle which inturn will guide the square cutting tool. These two basic functions are fulfilled by using this coupling whose first extruded part is attached with spindle shaft and the second grooved part from both side is free to move inside the casing but keeping both extruded parts always in contact for proper transfer of rpm. The third part of the coupling forms the secondary shaft that will take the cutting tool on it.

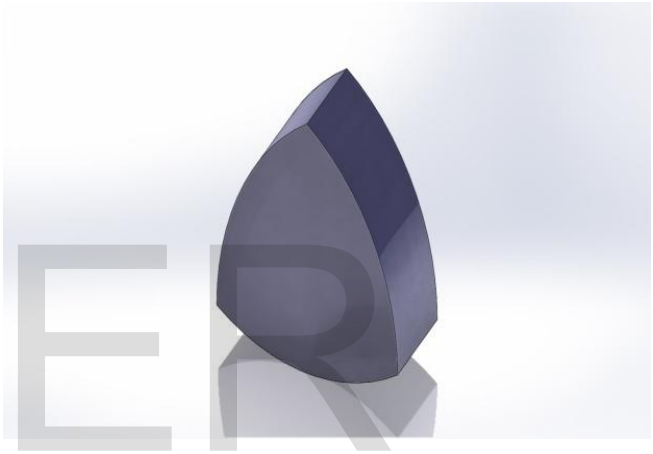
3.3 Guiding Mechanism–

This mechanism consist mainly of a boundary which constraints the motion of the the Releaux Triangle, thereby retracing the exact replica of the square onto the Job. This guide plate may or may not be inscribed into an additional plate for increased support to handle



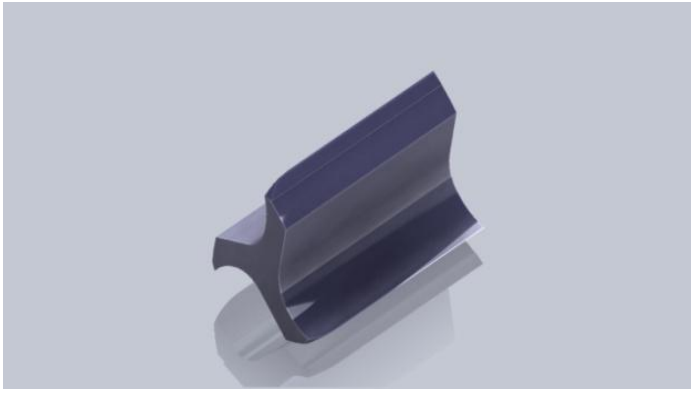
3.4Releaux Triangle –

This is the heart of entire mechanism which actually facilitates drilling square hole. On one side this triangle is the shaft from universal Coupling and on the other side the drill bit require to drill the hole is attached. The releaux triangle is placed within the guiding mechanism.



3.5 Cutting Tool–

This is the main component on which the working of the whole mechanism is dependent because it is that part which has to actually trace the square and cut the material while following the traced path. The base figure for the cutting tool is same as the guiding Reuleaux but it is further modified to keep a factor of safety for certain cutting parameters. The profile is based for the maximum removal of chip without disturbing the geometry of the tool. A taper is provided in the inner side of the cutting edge for maximum metal removal without hampering the edge. The edge is made sharp for proper cutting to take place. If a key way is



attached to

fit this part into the main assembly, then, different dimensions and depth can be achieved just by changing the required configuration of this part and not the whole tool. But for the purpose of simplicity and safety, it has been taken of the same dimensions and thickness as the guiding part as explained above.[2]

3.6 Final Part-

4.WORKING-

The rotary motion of motor drives the shank of the chuck. The motion is transmitted to the shank of the tool through the floating chuck. The special fully floating chuck is designed to take up the driving and floating motions and allows the drill to operate as free as ordinary twist drill. The floating driver in this operation is a mechanical device which allows the drill perfect freedom to cut the corners of the square hole. The cam guides the tool according to the cutting profile. Its own cam controls the cutting edge of the hole being drilled. The design of cam is according to the drill. The drill rotates with this cam and cut a square hole of exact size. The elements comprising the floating driver are designed in such a manner that they allow it to be held in a fixed position. Yet the drill is not prevented from rotating and following the path of hole being drilled.[4]

The drill has one less flute then the no. of side of hole to be drilled i.e. square drill has three flutes. The first two flutes of drill help to cut the material and third flute helps to make the corner of the square hole. The center of drill will not follow a circle, but a series of minute cycloidal like curves whose chords are parallel to the sides of hole being drilled. The rotary motion simplifies the operation of the drill but the depth of hole attained is limited the maximum being three times the drill distance across flats.

5.BENEFITS OF MECHANISM

1. It works in a single operation.
2. The time required to complete a square hole drill is almost similar to that of drilling a circlular hole.
3. It is more beneficial than broaching due to less manufacturing cost.
4. It is used to drill square hole in socket wrenches, spring collets.
5. It can be even used to drill blind through hole.
6. It gives quite accurate size of square hole with the use of shorter and stiffer drill.
7. Square hole drill can be used where high production is required.
8. By using square drill, the mechanical properties of work piece do not change.

6.CONCLUSIONS

This type of new techniques for drill a square hole has found its place in manufacturing due to various improved result.

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