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Review on Reuleaux drilling machine

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Abstract: In 21st century, there is huge expansion in the manufacturing industry and the need for economical methods for manufacturing. Square hole plays a vital role in the manufacturing sector. There are various mechanisms for square hole drilling by the use of Reuleaux triangle and Universal Coupling. In this paper the various machinery is been reviewed to achieve more efficient and economical method.
Keywords: Reuleaux triangle, Universal coupling, Drilling machine, Square hole, eccentric

I. Introduction

In the modern trends of manufacturing, there is a rise in demand for intricate shapes. Square hole find application in various machine guards, air conditioning guards and various architectural design.

Square hole has gained are importance in manufacturing and production sector. The design and construction of square hole drilling machine tends to b complex and efficiency to get proper square hole possess a challenge. Inorder to get proper square hole various methods are been used like Laser cutting, Square press, Broaching are being used over the years. Since the year 1875 the distinguished German Mechanical Engineer Franz Reuleaux, proposed the concept of curvy triangle it has been observed to be the most economical means to obtain a square hole. The setup of reuleaux triangle and universal coupling tends to provide efficient method to drill square hole.

Reuleaux triangle is a shape formed from an equilateral triangle by the intersection of three circular disc. Construction of reuleaux triangle, firstly considering an equilateral triangle of side 's' then taking the vertices as the centre and radius as 's' of the three circles. The arcs formed on the sides of the equilateral triangle in whole gives rise to reuleaux triangle.

Considering reuleaux triangle geometry and its trajectory when rotated eccentrically in square guide following equation are obtained considering constant variable 't'

$$X(t) = (\cos 3t + 9)\cos t + 3\sin 3t * \sin t$$
$$Y(t) = (\cos 3t + 9)\sin t - 3\sin 3t * \cos t$$

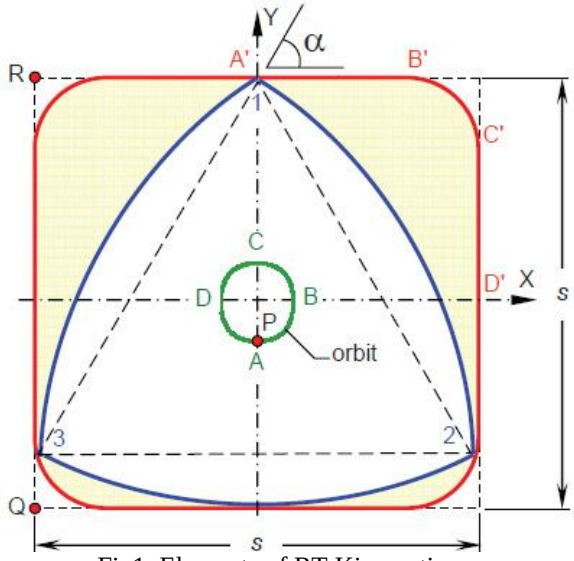

Fig1. Elements of RT Kinematics

For reuleaux triangle the centre of rotation is not fixed as the circular path of rotation is not followed. Thus, co-axial coupling that is universal coupling is used. Universal couplings are used for transmitting rotary motion in any direction irrespective whether the parts are aligned or not with each other.

Fig2. Universal coupling

II. Literature Review

A. Shahramhosseini Chaleshtori [1] :-

In this paper it is discussed about the square hole drilling, that is the process which has significantly recognised in the manufacturing firms. This drilling process adds on to the comfort and reduction in complicated process of producing square drill. Using of square drill also make the square drilling process economical. For the drill and cam mechanism geometrical models are designed and constructed. As there is no fix centre of rotation, circular path is not followed thus limiting the use of square drill. Thus the co-axial couplings such as Oldham couplings, Universal couplings are needed to make drill follow circular path.

1) Conclusion:

- Considering reuleaux triangle geometry and its trajectory when rotated eccentrically in square guide following equation are obtained considering constant variable 't'

$X(t) = (\cos 3t + 9)\cos t + 3\sin 3t * \sin t$

$Y(t) = (\cos 3t + 9)\sin t - 3\sin 3t * \cos t$

- From above equation the reuleaux triangle rotates within the desired square trajectory. As the centre of rotation is not fixed, co-axial couplings are used so that they helps in transmitting the torque appropriately from drill to cam.

B. Rohit G. Kamble [2] :-

This paper discusses how to make a square hole in economical manner, by guiding the circular motion of drilling machine to square profile. By using flexible coupling and Reuleaux triangle, flexible coupling helps Reuleaux triangle to rotate in eccentric manner so that it can drill square profile by following a square path.

1) Conclusion:

- Square hole drilling machine helps to produce square hole in economical manner.
- With the help of this machine, it can generate approximate 97.72% area of actual square.
- 2.28% of area remains enough in form of arc in the corner of the square.

C. John Thomas [3] :-

The mechanical design of Reuleaux triangle is used for a square hole producing tool. This paper will investigate the process of converting circular motion to square motion. This will be done by a special tool made up of mechanical linkages that will drill exact square holes. The motion of Reuleaux triangle is the laid objective for the appropriate geometrical construction. The geometrical construction o Reuleaux triangle will be forced to rotate inside a square guide. Apart from this a special coupling will be introduced so as to show that the centre of rotation will also move within the same constraints of the square guide. A perfectly square locus will be obtained only when the end of the triangle in the guide will be restricted and the driving end is in the drill press.

1) Conclusion:

- It is capable of producing ergonomic and aesthetic square holes with correct fabrication.
- The square hole drilling machine is compact and simple in construction.
- It has lots of future scope or obtaining constant working feed.

D. Shailesh S. Sengar [4] :-

This paper discusses the design of square hole drilling machine.In 21st century with advancement in technology, research has been carried out for different manufacturing methods and alteration to the existing one.

Square hole has been used in wide areas of field due to its importance of shape consideration, drilling machine have been modified to produce square directly. Reuleaux triangle is used as the basis for the design consideration for this drilling machine.

The reuleaux triangle geometry was not widely used or its importance was not realised in mechanical system before 1875. After 1875 the German engineer Franz Reuleaux discussed its geometry and started using it in various mechanism. This paper is concerned with the drill bit that could produce square hole using the reuleaux triangle geometry. As when the reuleaux triangle rotates in square guide eccentrically , then the profile traced by the centre of the reuleaux triangle is square with curved corners.

1) Principle and working:

The main principle of working is conversion of rotating motion of shaft to the coupling which provides eccentrical rotation of reuleaux shape tool in a square shape which produces a square profile with curved edges

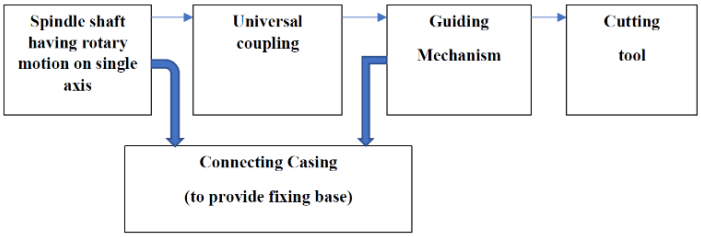

Fig3. Block diagram of whole mechanism

1) Conclusion:

- The cutting designed has accuracy of 98.77% to produce square hole. The tool is verified for drilling in wax.
- The tool can also be made of hard cutting materials HSS, carbide etc, to drill in different hard materials.

III. Conclusions

This review paper has been focused on the design of square hole drilling machine, using reuleaux triangle geometry and universal coupling to produce square holes.

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