Square Drilling Attachment for Lathe Machine

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Abstract - *A modern manufacturing process has found more attention towards time effective work. The manufacturing processes should consider time, work and cost effectiveness. This kind of technique is of interest due to capabilities shown in terms of time, work and cost effectiveness. It is not convenient to use modern processes e.g. wire cutting method for drilling a square hole. These processes are time and work effective but not cost effective because this leads to tremendous manufacturing cost. Due to this reasons, the square drilling attachment is of more interest. A mechanism for drilling square holes has to turn circular motion into square motion. This mechanism works on the principle of REULEAUX TRIANGLE. The property of REULEAUX TRIANGLE is that, as this triangle rotates ina square, its corners will follow a path along a square with rounded corners. This property REULEAUX TRIANGLE is utilize in this mechanism to get the hole of square shaped. This attachment will definitely play a very important role in future study.*

Key Words*: *REULEAUX TRIANGLE, Square Drilling

1.INTRODUCTION:

A specialist is constantly engaged towards difficulties of breathing life into thoughts and ideas. In this way, advanced machines and current systems must be continually created and actualized for prudent assembling of items. In the meantime, we should take mind that there has been no trade off made with quality and precision.

A bore is an apparatus fitted with a cutting instrument connection or driving device connection, for the most part a boring tool or driver bit, utilized for boring openings in different materials or affixing different materials together with the utilization of clasp. The connection is held by a hurl toward one side of the bore and pivoted while squeezed against the objective material. The tip, and now and again edges, of the cutting device takes every necessary step of cutting into the objective material. This might cut off thin shavings (bend drills or twist drill bits), granulating off little particles (oil boring), squashing and expelling bits of the work piece (SDS workmanship penetrate), countersinking, counter drilling, or different operations.

Drills are generally utilized as a part of carpentry, metalworking, development and ventures. Uniquely planned drills are likewise utilized as a part of medication, space missions and different applications. Drills are accessible with a wide assortment of execution attributes, for example, power and limit.

The objective of this undertaking is to examine how one can transform round movement into square movement by an absolutely mechanical linkage; an application is to the development of a bore that drills correct square gaps.

Often, openings should be bored utilizing the machine before other inner operations can be finished, for example, exhausting, reaming, and tapping. In spite of the fact that the machine isn't a penetrating machine, time and exertion are spared by utilizing the machine for boring operations as opposed to changing the work to another machine. Before penetrating the finish of a workpiece on the machine, the conclusion to be bored must be spotted (focus punched) and afterward focus bored so the bore will begin legitimately and be effectively adjusted. The headstock and tailstock axles ought to be adjusted for all penetrating, reaming, and shafts ought to be adjusted for boring, reaming, and tapping operations with a specific end goal to create a genuine opening and keep away from harm to the work and the machine. The reason for which the gap is to be bored will decide the best possible size bore to utilize. That is, the bore measure must permit adequate material for tapping, reaming, and exhausting if such operations are to take after. Opening fills different needs in all machine components. These openings might be round, square, rectangular or some other shape contingent upon the prerequisite or outline. For round gaps, the machines are accessible in the market. Be that as it may, for square or some other sort of gaps, the Methods as of now utilized are introducing, cathode release machine (E.D.M.), and electro-substance machine. These are especially costly and require uncommon apparatuses or machines. The reuleaux triangle is one case of a wide class of geometrical disclosure by germam mechanical specialist Franz Reuleaux , talked about the popular thrilling triangle that is begun being utilized as a part of various instruments Watts Brother Tool Works. In spite of the fact that Franz Reuleaux was not the first to attract and to consider the shape framed from the convergence of three circles at the sides of an equilateral triangle .But the utilization of this bend and its exceptional properties for delivering polygonal openings was given by Sir James Watts in 1914 and the geometry has been always developing from everyday precisely duplicate the square in which it rotates. The Reuleaux Triangle is case of a wide classes of geometrical revelations like Mobius strip that did not discover numerous down to earth applications until generally late in humankind‟s intellective improvement. Not until around 1875, when the recognized German mechanical designer Franz Reuleaux talked about the renowned breathtaking

Reuleaux triangle, that it began being utilized as a part of various systems by Watts Brothers Tool Works.

1.1 Problem Statement:

Material evacuation in electrical release machining which includes the age of flotsam and jetsam in the working hole that contains dissolved with anode particles and results of dielectric deterioration. Consistently conveyed hole sullying of a specific edges is attractive in light of a legitimate concern for release .However inordinate flotsam and jetsam focus limited to detached areas in the hole due to inadequate flushing prompts rehashed limitation of the release in a specific area. This will have horrible consequences on process quality, soundness, geometry and uprightness of the machined surface. Sufficient hole flushing is subsequently critical as far as both machining profitability and the nature of the machining surface. Flushing could be proficient by constrained stream of the dielectric liquids through openings in the apparatus, however flushing gaps leaves their impressions on the machined surface, as the work shape delivered in EDM is integral to that of the instrument. Flushing could on the other hand be through small scale gaps, which is extraordinarily manufactured in the device . In the occasion that it is infeasible to give flushing openings in both of the cathodes, the dielectric could be coordinated and controlled at the hole as a stream from outside the machining zone. This system isn't viable when the machined profundity or the frontal machining zone is extensive.

2. LITERATURE REVIEW:

A mechanism for drilling square holes has to turn circular motion into square motion. In one early attempt to create such a device, James Watts had the idea of rotating a Reuleaux triangle within a square. A Reuleaux triangle, named after mechanical engineer Franz Reuleaux (1829–1905), has the same width all the way around. Its shape is made from arcs of circles centered at the vertices of an equilateral triangle.

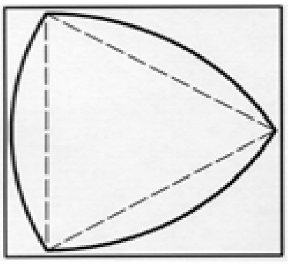


Figure No. 14

To make a Reuleaux triangle, draw three arcs of circles, with each arc having as its center one of an equilateral triangle's vertices and as its endpoints the other two vertices. Like a circle, this rounded triangle fits snugly inside a square having sides equal to the curve's width no matter which way the triangle is turned. As it rotates, the curved figure traces a path that eventually covers nearly every part of the square. Watts started a company, Watts Brothers Tool Works in Wilmerding, Pa., to make square-hole drills based on this idea. The company is still in operation today. However, the resulting drilled shape is not a perfect square. Its corners are slightly rounded. Rotated inside a square, a Reuleaux triangle traces a curve that is almost a square.

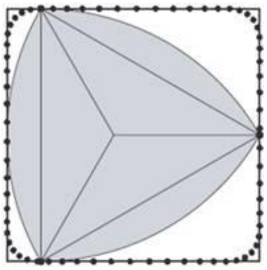


Figure No. 15

Barry Cox (University of Wollongong) and Stan Wagon (Macalester College) have recently explored geometric solutions to the problem of drilling exact square holes. They describe their investigations in the article "Mechanical Circle-Squaring," published in the September College Mathematics Journal. Cox and Wagon begin with a mechanical device originally presented in an anonymous 1939 article in the magazine Mechanical World. John Bryant and Chris Sangwin (University of Birmingham) revisited the design in their book How Round Is Your Circle? Where Engineering and Mathematics Meet (Princeton University Press, 2008) and built a physical model of the drill. The geometric key is to use a variant of the classic Reuleaux triangle in which one vertex is rounded off. The starting point is an isosceles right triangle. In the completed construction, the vertex at the right angle traces out a small square when the entire figure rotates within a larger square.

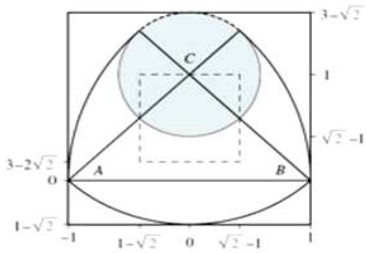
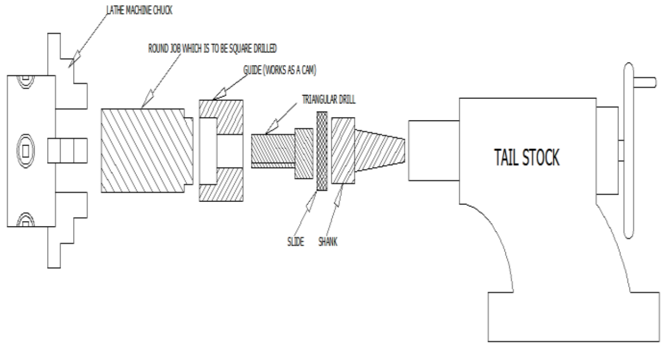


Figure No. 16

In this variant of the classic Reuleaux triangle, the vertex C traces out the inner square (dashed lines) when the rotor, a curve of constant width, rotates so that it always lies within the outer square. "If one places a cutting tool at point C . . . and turns the rotor so that it stays inside the large square, then C traces out an exact square and the cutting tool stays inside the larger square," Cox and Wagon write."Thus the device can be viewed as a drill that drills an exact square hole, though we need to bring the construction into the third dimension to get a working model."

3. CONCEPT ASSEMBLY:



1. The chuck:

This is the work holding device in the lathe machine.

2. Round job:

This is the job which is to be square drilled. The initial shape of job is round while the square hole will be drilled in the negative X axis i.e. from right to left.

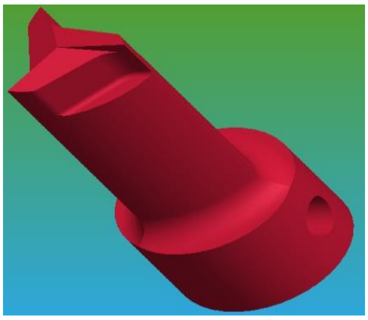
3. Guide:

The guide is as shown in figure.

The drill will pass through the square hole guide which will cause the squared drill in the job.

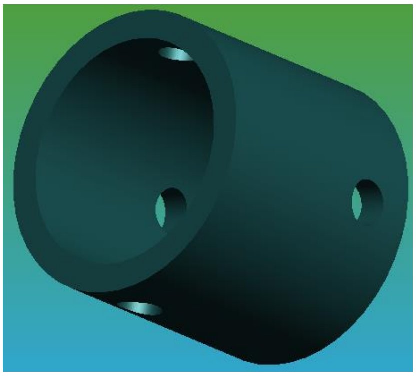
4. Triangular drill:

This is the heart of the project. The shape and outer profile of the drill is very important and difficult to design. The shape of the drill will be as follows.



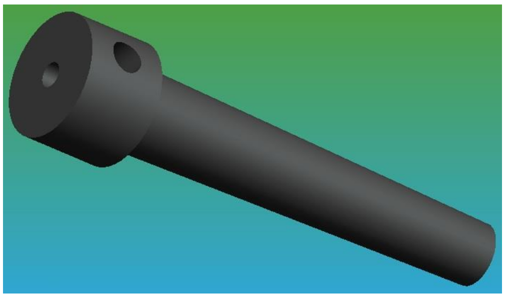
5. Slide:

The component will allow the drill to slide in Z and Y axes when the feed is given in the X direction.



6. Shank:

Shank holds the slide and hence the drill in the tail stock.

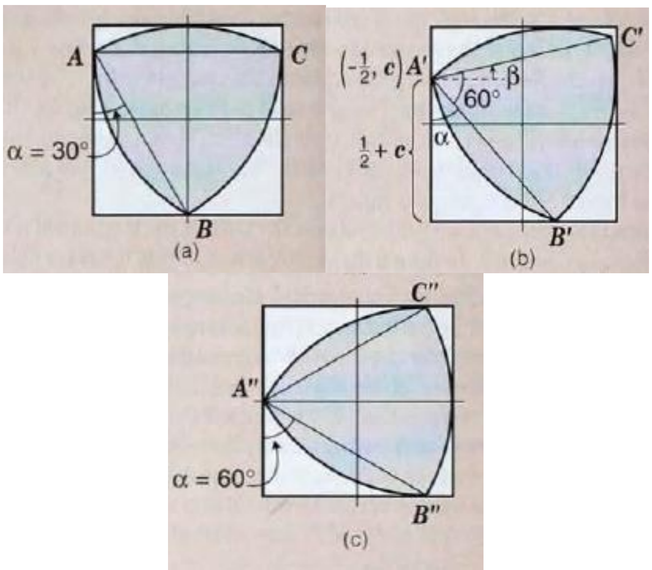


7. Tail stock:

It helps the drill feeding in the X direction.

4. DESIGN:

Design of Tool:



Reuleaux triangle rotating within a square Trying to show that the triangle should be centered at the end of a rotating shaft, I stuck a pen through the triangle's center, and while a student manually rotated the Jiangle within the square, I traced the center's path on paper. "It's definitely not a single point," I had to admit, holding up the traced curve, "but it sure looks like a circle!" Falsehood 4. Just what is the path of the centroid of a Reuleaux triangle while it is boring a square hole? Assume that the square and the equilateral triangle have sides of length 1. Center the square about the origin and position the Reuleaux triangle so that vertex A is at 1-1/2, OJ, as in figure 6a. Using (1), the tiangle's centroid will be P(-1/2 + ..f313, OJ. Next imagine rotating the triangle clockwise through the position in figure 6b, ending up in figure 6c, where the centroid is P"(O, -112 + ..J3/3). The path from P to P" lies in quadrant I. In figure 6b let a be mLMA'B; ~be the counterclockwise angle formed by A'P' and a horizontal line through A; and c be they-coordinate of point A'. We are interested in the coordinates of P'. Note that cos a= 1/2 + c and that~= 270 + a+ 30° = 300° + a. Also note that during this rotation from figures 6a through 6b, a goes from 60 degrees to 30 degrees. Si nee A 'P' =.f3!3, if we measure from the coordinates of A'(-1/ 2, c), the x and y coordinates of P' can be found:

$$x = \frac{-1}{2} + \frac{\sqrt{3}}{2}\cos(300° + a)$$

$$= \frac{-3+\sqrt{3}\cos\alpha + 3\sin\alpha}{6}$$

$$y = c + \frac{\sqrt{3}}{2}\cos(300° + a)$$

$$= (\cos\alpha - 1/2) + \frac{\sqrt{3}}{3}\sin(300° + a)$$

$$= \frac{-3+3\cos\alpha + \sqrt{3}\sin\alpha}{6}$$

as a goes from 60 degrees to 30 degrees. Finding the path of the triangle's center in the other three Path of Reuleaux triangle centro1d 1ns1de a Circle quadrants is similar in procedure and produces

Equations those are symmetric to the 01igin and both axes. Quadrant II:

$$x = \frac{3-\sqrt{3}\cos\alpha - 3\sin\alpha}{6}$$

$$y = \frac{-3+3\cos\alpha + \sqrt{3}\sin\alpha}{6}$$

Quadrant III:

$$x = \frac{3-\sqrt{3}\cos\alpha - 3\sin\alpha}{6}$$

$$y = \frac{3-3\cos\alpha - \sqrt{3}\sin\alpha}{6}$$

Quadrant IV:

$$x = \frac{-3+\sqrt{3}\cos\alpha + 3\sin\alpha}{6}$$

$$y = \frac{3-3\cos\alpha - \sqrt{3}\sin\alpha}{6}$$

But these equations do not describe a circle. In equations (2) and (3), when a = 30°, Pis on the

x-axis at approximately (0.07735, 0). But when a = 45°,

$$x = y = \frac{-6+\sqrt{6}+3\sqrt{2}}{6}$$

which makes the distance from P' to the origin about 0.081 68. This noncircular situation is also shown by graphing the foregoing four parametric equations with a circle whose radius is slightly smaller or larger. In figure 7, the circle is the outer curve. Note that the centroid's path is farther from the circle at the axes than at the mid quadrant point.

Design of shaft:

Material used -M.S.

Tensile strength- 700N/mm^2

Yield strength- 350 N/mm^2

Torque- (π /16) x d3xT

Torque of shaft-1

$$P = \frac{2\pi NT}{60}$$

$$3.75\times103 = \frac{2\times3.14\times2950\times T)}{60}$$

T = 12.138Nm = 12.138×103 Nmm.

Shear stress t=ultimate strength /factor of safety FOS=4.

t =700 /4=175N/mm^2

$$T = \frac{\pi}{16} \text{ x d3 x t}$$

$$= \frac{\pi}{16} \text{ x d3 x 175}$$

d = 7.06mm

Normally we use shaft of diameter 20-25mm.

5. CONCLUSIONS

Created square opening penetrating machine and it is discovered that it is equipped for boring square gaps on different wooden materials (pre-boring is essential).The venture is basic in development and minimized in measure for utilize. With less establishment cost and less work ability square openings can be penetrated utilizing this course of action, consequently it can be utilized as a part of little scale businesses. The future extent of undertaking is to cinch the machine on seat bore to get steady working food and furthermore the measure of bore can be made minimized utilizing Oldham coupling rather than widespread joint.

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