Design and Analysis of Paper Cutting Machine works on Geneva Mechanism

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ABSTRACT

This paper presents a kinematic study of a mechanism incorporating a Geneva wheel and a gear train to achieve intermittent motion. Presented is a comparison of the position, velocity, acceleration, and jerk between the classical Geneva wheel mechanism and the proposed mechanism. The motion of the non-circular gear pair is determined by reducing the extreme jerk of the Geneva wheel. The design and fabrication of paper cutting machine using Geneva mechanism is useful to cut papers in equal and accurate dimension. Geneva drive is an indexing Mechanism that converts continues motion to intermittent motion, Due to which paper is moved between the intervals of cutting period. Then the paper cutting is achieved by crank& lever mechanism. The cutter will be back to its original position by spring effect.

Keyword:- *Geneva wheel, paper Cutter,* Sprocket.

INTRODUCTION

A 4-bar mechanism is a basic 1-dof (degree of freedom) mechanism. A 4-bar is created by selecting four link lengths and joining the links with revolute joints to form a loop. A wide variety of paths are possible by arbitrarily choosing a point on the coupler curve. These different curves can be obtained by constructing a physical model of the mechanism and viewing the path of various points without detailed mathematical analysis (e.g. see [1]). It is also possible to develop a mathematical model of the mechanism in terms of its four link lengths. The analytical expressions for these paths are algebraic and require many computations to determine the coordinates for points on the path. Handbooks were developed to catalogue many curve forms, their instantaneous properties, and the corresponding mechanism used to produce them. Burmester [2] developed a procedure to determine the link lengths of a 4-bar mechanism that will guide its coupler curve in a prescribed manner. The mathematical formulation of this procedure for designing a 4-bar mechanism is referred to as Burmester theory. Freudenstein introduced the use of a computer for the design of 4-bar mechanisms [3]. This activity precipitated much interest in creating additional analytical approaches to specify mechanisms capable of satisfying a desired task. Much of the work fostered by Freudenstein is highlighted by Erdman [4]. The methodology developed by Freudenstein and Sandor [5] for path generation consists of specifying a finite number of points (precision points) on the desired curve and results in a 4-bar mechanism where a point on the coupler curve passes through the specified precision points. Interestingly, the number of points is usually three, four or five. This methodology of path generation is referred to as an exact method.
Geneva mechanism is an ancient mechanism which is used to convert continues mechanism to intermittent motion. Geneva are available on an off the shelf basis from several manufacturers in an wheels and have adequate to good performance depending upon load factors.

There are three types of Geneva; (1) External, Which is the most popular, and which is represented by the device shown in fig; (2) Internal, which is also very common and is illustrated in fig; (3) Spherical, fig which is extremely rare

1. EXTERNAL GENEVA MECHANISM: In this type of mechanism, the Geneva cross is connected with cam drive externally which is the most popular and which is represented by the device below fig 1.

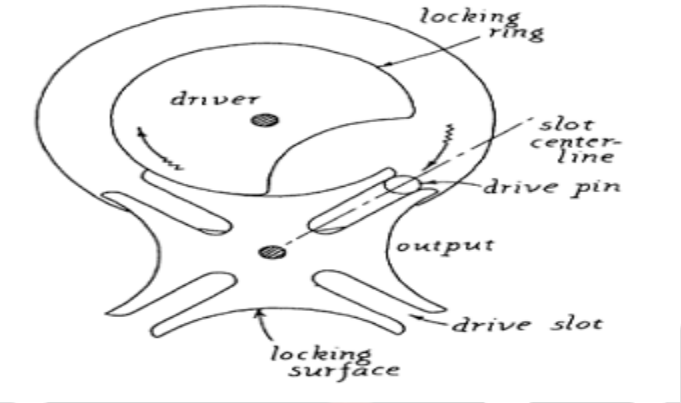


Fig.1 four slot external Geneva

2. INTERNAL GENEVA MECHANISM: In this type of mechanism, the Geneva cross and cam drive are connected internally in the closed box, which is also common and is illustrated by below fig. 2.

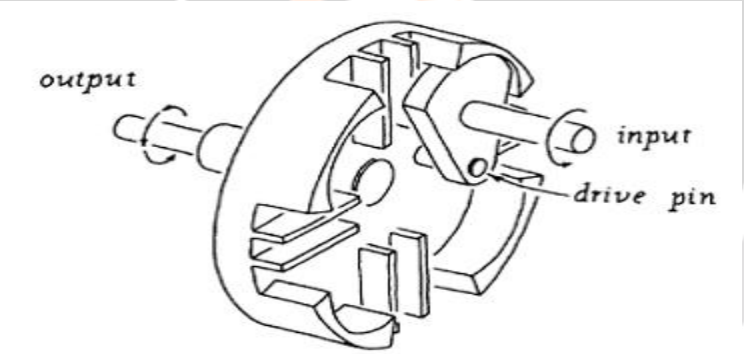


Fig.2 four slot internal Geneva

3. SPHERICAL GENEVA MECHANISM: In this type of mechanism the Geneva cross is in spherical shape and cam drives are connected in externally, which is extremely rare and is illustrated in below fig. 3.

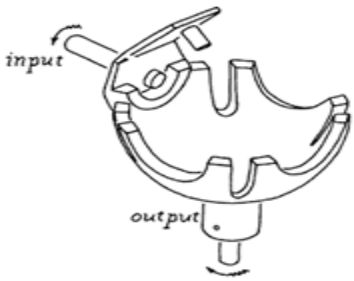


Fig 3 four slot spherical Genevaa

CRANK SLIDE MECHANISM:-

Here Sprocket (crank) is connected to lever by a connecting link when the crank rotates this rotation is converted in oscillating motion. Hence cutter gets oscillating motion to cut paper.

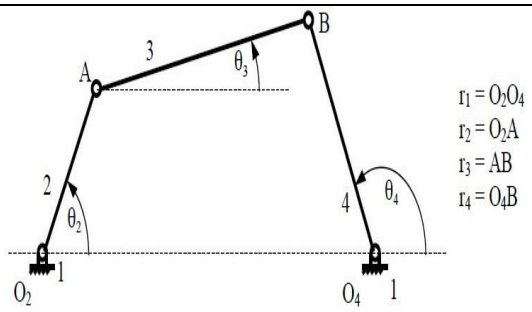


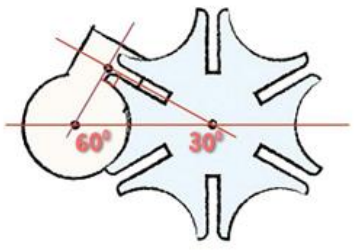
Fig. 4 Four bar mechanism

COMPONENTS USED FOR PROJECT:-

1. Geneva Wheel
2. Sprocket
3. Roller chain
4. Paper cutter or cutting blade
5. Coil Spring
6. Paper Roller Shaft

THE GEOMETRY OF THE GENEVA MECHANISM:-

In the four slot Geneva stop, both wheels are the same size. In Geneva drives with different numbers of slots a little geometry soon reveals the relative sizes of the wheel. For example, in the six-slot design, left, the slots are sixty degrees apart. The drive pin needs to enter the top of the slot at an angle of ninety degrees. With the angles fixed, working out the dimensions is straight forward. In the six slot example, construct a right angled triangle with one the angles being sixty degrees.



The radii (radiuses?) of the two wheels are the lengths to the two shortest sides of the triangle and the wheels are separated by the length of the longest side. The Geneva drive is named after the city of its invention where it was used in the construction of clocks. Originally the Geneva mechanism was used as a way of preventing springs from being wound too tight. One of the slots would be blanked off so the winder could only be turned a fixed number of turns. This mechanism is

known as a Geneva stop or Geneva stop works. In this case the spring would be connected to the smaller wheel; the slotted wheel is there to limit the number of turns. After five turns, the pin hits the blanked out slot, arrowed, and the spring is prevented from being over wound. The Geneva drive is used to provide intermittent motion, the drive wheel turns continuously, the pin on the drive wheel then turns the cross shaped piece quarter of a turn for each revolution of the drive wheel. The crescent shaped cut out in the drive wheel lets the points of the cross pass; the rest of the circle locks the slotted wheel into place while it is stationary. Drive motion can be changed by changing the number of slots in the slotted wheel. The Geneva drive mechanism is used commonly in film projectors to move the film on one frame at a time then hold it stationary as the bright projector light is shone through it.

Specialized Mechanisms GENEVA WHEEL Mechanism:-

The Geneva driveor Maltese cross is a gear mechanismthat translates a continuous rotation into an intermittent rotary motion. The rotating drive wheel has a pin that reaches into a slot of the driven wheel advancing it by one step. The drive wheel also has a raised circular blocking disc that locks the driven wheel in position between steps.

The name derivesfrom the device's earliest application in mechanical watches, Switzerland and Genevabeing an important center of watch making. The *Geneva drive* is also commonly called a Maltese cross mechanism due to the visual resemblance when the driven wheel has four spokes. They are used in watches and for the main reason of being made small and can withstand mechanical stress. In the most common arrangement, the driven wheel has four slots and thus advances for each rotation of the drive wheel by one step of 90°. If the driven wheel has *n* slots, it advances by 360°/*n* per full rotation of the drive wheel.

CONCLUSION:-

The design and analysis of paper cutting machine using Geneva mechanism is will be very useful for small scale industry. There are machine based on paper cutting but it has demerits like large in size, costly, need skilled labours to operate and it need electrical input. But we have our machine which will overcome this demerit by compact size, less cost no need for skilled people and there is no need of electrical input. The main aim of this machine is to reduce timing for paper cutting and neglect the time for marking the paper. This aim can be achieved by our machine.

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