Design and Fabrication of Paper Cutting Machine Using Geneva Mechanism

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Abstract

The design and fabrication of paper cutting machine using geneva mechanism to cut the paper as per the fixed and required dimension of people.The objective of this project is to make automatic paper cutting machine. Geneva drive is an indexing Mechanism that converts continuous motion into intermittent motion, due to which paper is moved between the equal intervals of cutting period. This machine is used to reduce the manual work of paper cutting, and also saving time..This machine very useful for paper cutting industries and also we can avoid the human effort.Also we can use this for paper store and stationaries.

Keywords: *Geneva Mechanism, Lever Crank Mechanism, Paper Cutter, Paper Roller, Sprocket.*

1. Introduction

Now a day's peoples use the paper as per their need and requirement in various size.So we introduce paper cutting machine by using geneva mechanism.In this machine we can get paper as per their need and required dimension .Based on the size of geneva wheel, we can change the size of paper.And also by the automatic movement of this machine we can reduce human effort. So there is need of developing a new method or process for effective manufacturing. That process or methods should fulfill the requirement about accuracy Productivity. This paper represents the automatic paper cutting machine by using Geneva mechanism. This equipment is very accurate to cut the papers. This concept will be mainly used in the paper manufacturing industry to cut the papers in huge numbers. The equipment is fabricated in less cost and good efficient.The aim of this concept is to reduce the human fatigue and time savings in industries by eliminating the paper marking time. Here it has analyzed to use Geneva Mechanism. This is the mechanism used to get intermittent motions. The paper cutting machine is designed, in order to reduce the time for marking and cutting the papers. Geneva mechanism is commonly used indexing mechanism where an intermittent motion is required. The fabrication of conventional Geneva mechanism is generally simple and inexpensive because there is no special curved profile on any of the components except straight lines and circular arcs. The paper cutting is done by crank and lever mechanism. After cutting, the spring connect to the cutter will bring the cutter back to its original position. The main purpose of this machine is to reduce time for marking the papers. Hence, this is working fully based on timing.

2. Literature survey

The design and analysis of paper cutting machine based on Geneva was analyzed by Vijayetal.They presented a comparison of the position, velocity, acceleration, and jerk between the classical Geneva wheel mechanism and the proposed mechanism. This analysis presents a kinematic study of a mechanism incorporating a Geneva wheel and a gear train to achieve intermittent motion and was declared as a designated analysis and succeeded largely due to its positive economic factors. The design and fabrication of

paper cutting machine using Geneva mechanism is useful to cut papers in equal and accurate dimension. The analysis and synthesis of Geneva mechanism with elliptical crank has been studied by Han Jiguang Yu Kang . Hrones and Nelson, in their paper on Analysis of the Four-Bar Linkage gives review that 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. In the Force analysis of the Geneva wheel and face cam in automat, Madhoo et al., driven the automat using single motor for different operations. Here they focus on two main parts they are Geneva wheel and Face cam which are used for their respective operations. The analysis and synthesis of Geneva mechanism with elliptical crank has been studied by Han Jiguang Yu Kang [2],it has been analyzed that for both internal and external Geneva mechanism, the kinematics coefficient of the Geneva mechanism is a constant if the groove number of the Geneva wheel is a constant. The elliptic crank using as the drive crank of the Geneva wheel is equal to the mechanism which has a variable length and a variable speed along the elliptical moving crank. Therefore the kinematics coefficient of the Geneva mechanism can be changed.

The analysis and modeling of Geneva mechanism was studied by Georgata and Elena [3], the paper presents some aspects theoretical and practical based on the finite element analysis and modeling of Geneva mechanism with four slots, using the CATIA graphic program. This type of mechanism is an example of intermittent gearing that translates a continuous rotation into an intermittent rotary motion. It consists of alternate periods of motion and rest without reversing direction. Also it gives some design parameters with specify a Geneva mechanism will be defined precisely such as number of driving cranks, number of slots, wheel diameter, pin diameter, etc. Finite element analysis (FEA) can be used for creating a finite element model (preprocessing). The paper focus on the modeling and finite element analysis of Geneva mechanism with four slots. This technique has the ability to change the shape of Geneva mechanism with changing any kinematic properties.

3. Working principle and components used

The Geneva drives shaft is coupled with the motor shaft hence when power is supplied to the motor rollers rotate with a certain time delay according to the Geneva drive and the chain drive moves along the rollers. Motor connecting to the chain sprocket and sprocket connecting to the Geneva mechanism. Motor has been on to rolling the Geneva so that start to the paper roll. One roller has fixed on the try another roller connecting in Geneva wheel. This model parts are Geneva mechanism, motor, chain sprocket, roller, cutter and spring. Two rollers are mounted according to the required distance the belt is mounted on the rollers on which the paper is placed. The rollers shaft is coupled with the Geneva drive. Cutter fixed to the spring connecting to cutter. Motor shaft connect to cutter wire motor has been rotating cutter is upon down motion then cutting to the paper this is the automatic paper cutting machine by using Geneva mechanism. The following steps are followed for conduction.

- When cam pin is in extreme right position i.e. engage position, the crank shaft will be at extreme bottom position. Hence the cutter is in full open position.
- When cam pin is in extreme bottom position i.e. disengage position, the crank shaft will be at extreme left position. Hence the cutter is in partial cutting position.
- When cam pin is in extreme left position i.e. disengage position, the crank shaft will be at extreme top position. Hence the cutter is in full cutting position.

3D Model of proposed view

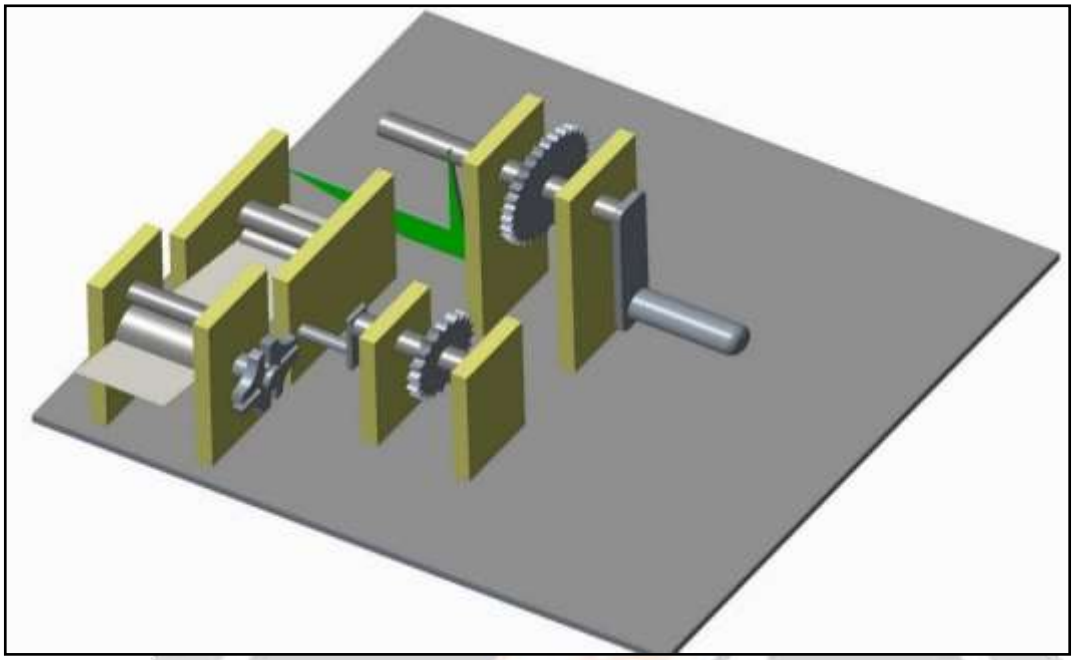


Figure: 3D Model of Automatic Paper Cutting Machine by using Geneva mechanism

4. Objectives of the Project

- To reduce man power
- To reduce the work load
- To reduce the production cost
- To reduce the production time
- To reduce the material handling
- To reduce the fatigue of workers
- To achieve good product quality
- Less maintenance

5. The Main Components are used to fabricate the Model

- Geneva wheel
- Sprocket
- Roller chain
- Paper cutter or cutting blade
- Paper roller shaft
- Motor
- Power supply

Geneva wheel

Four Slot driven wheel, we are using thus its advances by one step of 900 for each rotation of the drive wheel. Hence the intermittent motion is achieved for ¼ of the 3600. A mechanism that translates a continuous rotation into an intermittent rotary motion, using an intermittent gear where the drive wheel has a pin that reaches into a slot of the driven wheel and thereby advances it by one step, and having a raised circular blocking disc that locks the driven wheel in position between steps.

Sprocket

A sprocket is a profiled wheel with teeth, cogs, or even sprockets that mesh with a chain. The sprockets are used for the power transmission between two shafts through the roller chain. A sprocket is a profiled wheel with teeth that meshes with a chain, track or other perforated or indented material. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth. Sprockets are used in bicycles, motorcycles, cars, tracked vehicles, and other machinery either to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track.

Roller chain

A roller chain is the type of chain driven most commonly used for transmission of mechanism power between two sprockets. It consist of a series of short cylindrical rollers held together by side links. It is driven by a toothed wheel called a sprocket.

Paper cutter or cutting blade

A paper cutting is a tool, designed to cut paper with a straight edge paper cutters vary in size. This paper cutter is used as the oscillator in the four bar crank and lever mechanism.

Paper roller shaft

It is the element which we are using to feed the paper whiles the intermittent motion. Paper roller used to feed paper without any damage.

Motor

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.The specification of motor used is 12 Volts, 4.5 Amps with 30 rpm.

Power supply

The ac voltage, typically 220V, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units. fig.1. shows the block of power supply.

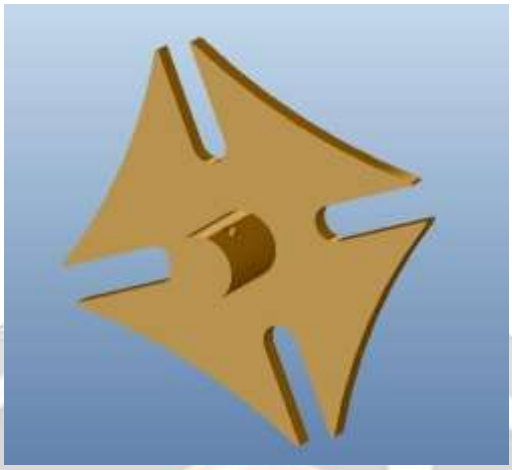
6. Design of Geneva Mechanism

Geneva mechanism is a mechanism that translates a continuous rotation into an intermittent rotary motion, using an intermittent gear where the drive wheel has a pin that reaches into a slot of the driven wheel and thereby advances it by one step, and having a raised circular blocking disc that locks the driven wheel in position between steps. The Geneva wheel or Maltese cross, is a cam like mechanism that provides intermittent rotary motion & is widely used in both low and high-speed machinery. Although originally developed as a stop to prevent over winding of watches, it is now extensively used in automatic machinery

Analysis of Geneva Mechanism Design

Observation

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. [1]

The Bottle filling machine based on Geneva mechanism project was analysed by Thakare Tushar, Kudale Nikhil, Pangare Ankur, Kolpe Hrushikesh, Prof. D.U.Patil. It was discussed about the design and implementation of automated multiple water filling machine using Geneva mechanism. Generally, the function of the machine is to fill the water automatically into bottles through a moving bottle plate. This project is the combination of Geneva and electrical synchronous motor system. This project is divided into four sections, the loading section, the bottle plate section and filling section, where the whole sections is controlled by Geneva. The entire system is more flexible and time saving. [2]

The analysis and synthesis of Geneva mechanism with elliptical crank it has been studied by Han Jiguang Yu Kang. Here it has been analysed that for both internal and external Geneva mechanism, the kinematics coefficient of the Geneva mechanism is a constant if the groove number of the Geneva wheel is a constant. The elliptic crank using as the drive crank of the Geneva wheel is equal to the mechanism which has a variable length and a variable speed along the elliptical moving crank. Therefore the kinematics coefficient of the Geneva mechanism can be changed. In this paper the analysis method of the combined Geneva mechanism is presented. The synthesis method of the combined Geneva mechanism is put forward based upon the kinematics coefficients. The calculation method of the extreme kinematics coefficient is proposed. [3]

Cutting mechanism by giving feed through Geneva

In Cutting mechanism by giving feed through Geneva mechanism, P.Kalisindhur, Y.karthik, T.vijay, Y.Sasikanth and G.Sri Harsha designed a mechanism for cutting by giving intermittent feed. This intermittent feed is given by continuous rotation of circular disk in Geneva mechanism. We have designed a belt drive with the help of Geneva mechanism which is used for giving feed and gives smooth operation and smooth movement of the feed at required time interval. The feed from the Geneva drive was cut by using slotted lever mechanism which was designed using slider crank mechanism. [4]

Observation

From Cutting mechanism by giving feed through Geneva mechanism, it has been observed that the feed which come from the Geneva mechanism carried by the belt drive and it will cut by the slotted lever mechanism which is at the end of the belt drive. With this model we can get the equal length of feed at equal interval of time. The length of the feed can be managed by changing the depth of the slots in Geneva wheel

and the path length of the slider can be increased by increasing the radius of the crank and the length of the slot on the slider.

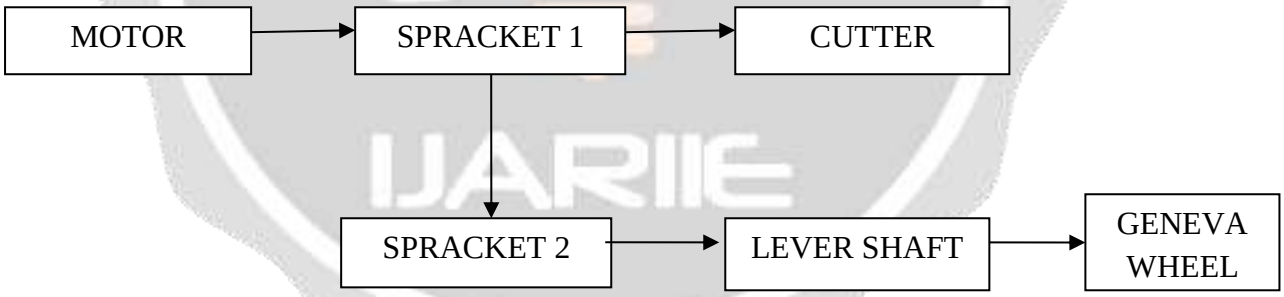
Conclusion

This can be carried out as an impressing task in the field of small scale industries and automobile maintenance shops. It will reduce the cost involved in the concern. It can be designed to perform the entire requirement task at the shortest time available. It can be used for positive displacement of the mechanism for different purposes. According to the need of the user, the design and the specification of the Geneva mechanism could be changed and the required sizes of the wheels could be selected. Lubrication is not necessary. The high pressure is achieved in this wheel and the crank reduces the fluctuation of pin, so the best output can be achieved.

7. Methodology

Geneva wheel drive is a indexing mechanism that converts continues motion into intermittent motion.Due to this motion paper moved between the equal interval of cutting period. At the same time, cutter also cut the paper at required and fixed dimensions. Automatically the process is repeated. Two rollers are mounted according to the required distance the belt is mounted on the rollers on which the paper is placed. The rollers shaft is coupled with the Geneva drive. The Geneva drives shaft is coupled with the motor shaft hence when power is supplied to the motor rollers rotate with a certain time delay according to the Geneva drive and the chain drive moves along the rollers. Motor connecting to the chain sprocket and sprocket connecting to the Geneva mechanism. Motor has been on to rolling the Geneva so that start to the paper roll. One roller has fixed on the try another roller connecting in Geneva wheel. Cutter fixed to the spring connecting to cutter. Motor shaft connect to cutter wire motor has been rotating cutter is upon down motion then cutting to the paper this is the automatic paper cutting machine by using Geneva mechanism.

- Higher material handling time and manufacturing lead times
- Reduced safety for the worker



8. Merits, Demerits and Future Scope of the proposed Machine

Merits:

- It will reduce the time for marking the paper.
- The dimension of the paper will be accurate.
- Manufacturing cost is less.
- No noise pollution.
- Can be used for small scale industries.

Demerits:

- The disadvantages are as follows:
- Not able to cut the papers above 15 cm width.

- Not able to cut bunch of papers i.e. more than 5 papers.
- Not be used for large scale industries.

Future scope:

- Implementation for large industries is possible.
- By changing cutter shape we can cut paper with different designs.
- By modifying Geneva slots we can cut different standard size paper.
- Machine can be modified to cut lather and other thick sheets.

9. Conclusion

The design and analysis of paper cutting machine using Geneva mechanism 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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