

DESIGN AND FABRICATION OF AUTOMATIC PAPER CUTTING MACHINE

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Abstract: The objective of this project is to make automatic paper cutting machine for the industries with the help of DC motor, bearing, cutting tool. The cutting process is done by Geneva mechanism and lever crank mechanism in order to cut papers in equal and accurate dimensions. 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 is very useful for paper manufacturing industry also we can avoid the human efforts and also we can use this equipment also in institutes, stationary shops, paper stores, etc.

Key Words: Geneva Mechanism, Lever Crank Mechanism, Paper Cutter, Paper Roller, Sprocket.

1. INTRODUCTION:

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.

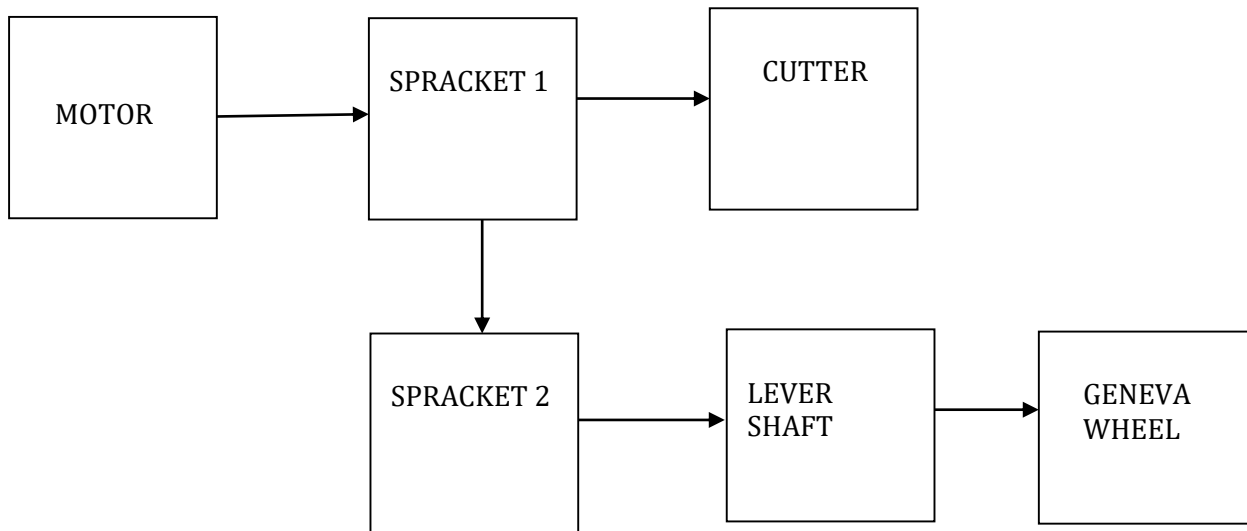
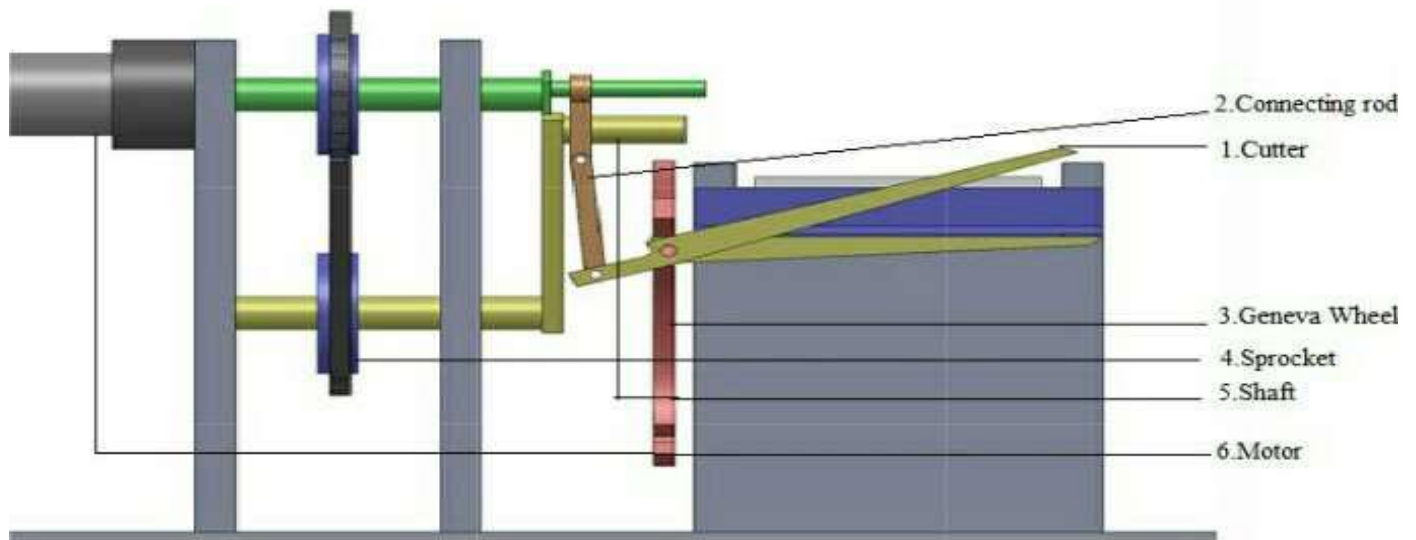
2. LITERATURE REVIEW:

The design and analysis of paper cutting machine based on Geneva was analyzed by Vijay et al. , 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. Geneva Wheel is used to index the drum which consists of 96 spindles. Due to this Geneva mechanism each of the spindles will hold the ceramic body when the drum is being indexed. Due to which there is a force which is generated in the Geneva wheel is in maximum and minimum position in Cutting mechanism by giving feed through Geneva mechanism.

3. 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

4. PAPER CUTTING MACHINE:



1. Layout diagram

The main components used to fabricate the model are:

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

4.1. Geneva wheel:

Four Slot driven wheel, we are using thus its advances by one step of 90° for each rotation of the drive wheel. Hence the intermittent motion is achieved for 1/4 of the 360°. 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.

4.2. Sprocket:

A sprocket is a profiled wheel with teeth, cogs, or even sprockets that interlock with a chain. The sprocket are used for the power flow between two shafts through the roller chain. A sprocket is a profiled wheel with teeth that interlock with a chain, track or other perforated or indented material. It is distinguished from a gear in that sprockets are never interlock 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 convey rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track.

4.3 Roller chain

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

3.4 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.

4.5 Paper roller shaft

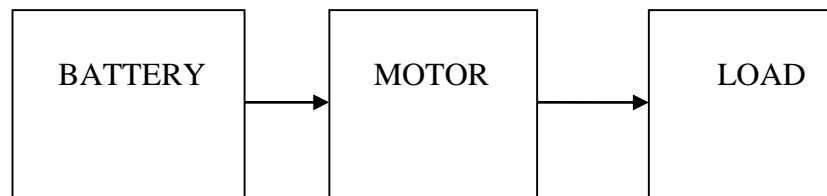
It is the elements which we are using to feed the paper while the intermittent motion. Paper roller used to feed paper without any damage.

4.6 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.

4.7 Power supply

The ac voltage, typically 12V, is connected to a battery, which steps that dc voltage down to the level of the desired dc output. A rectifier then provides a 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.



5. FINDINGS:

Motor calculation:

Specification and calculation:

- 30 rpm
- 12 V
- 18 W

$$\begin{aligned} \text{Torque of motor: } \zeta &= (P \times 60) / (2 \times 3.14 \times N) \\ &= (18 \times 60) / (2 \times 3.14 \times 30) \\ &= 5.72 \text{ Nm} \\ &= 5.72 \times 10^3 \text{ Nmm} \end{aligned}$$

The shaft is made of MS and its allowable shear stress = 42 MPa

$$\begin{aligned} \text{Torque: } \zeta &= 3.14 \times fs \times d^3 / 16 \\ 5.72 \times 10^3 &= 3.14 \times 42 \times d^3 / 16 \\ d &= 8.85 \text{ mm} \end{aligned}$$

The nearest standard size is $d = 9 \text{ mm}$.

6. METHODOLOGY:

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

7. 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 lab ours 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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