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Development of Mini Conveyor Using Genva Mechanisms

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ABSTRACT

The Development of mini conveyor using Genva Mechanisms described in this project is designed primarily to carry one person according to the specifications of the client. The development of mini conveyor using Genva Mechanisms is moved by an battery powered machine that drives hardened steel traction sheave over which the ropes are suspended. It has advantages is one part travel to another side . They used in all conveyor belt . Geneva mechanism is a method to transform continuous circular motion into intermittent/fixed step circular motion i.e. a circular motion produced in equal intervals of time and resulting in the same displacement. The name "Geneva" is derived from Geneva, Switzerland where in its earliest days the device was used in mechanical watch making. The Geneva drive is also called a Maltese cross mechanism due to their visual similarity. A conveyer belt is basically a linear belt usually made up of rubber or plastic compounds (of high strength) combined with one or more layers of fabrics such as nylon, polyester, neoprene, or nitrile. It has a basic function of transporting material from one point to another. A simple Geneva mechanism consists of a drive wheel (connected to motor) and a driven wheel (connected to belt pulleys). The drive wheel is a disk with a pin or a shaft near its circumference. The driven wheel consists of several slots. The drive wheel is kept next to the driven wheel in such a way that when the drive wheel is rotated, the pin or shaft fits inside the slot of driven wheel. As it reaches the inner most point of the slot, the pin exerts a force on the driven wheel. As the driven wheel is pivoted from the center, a moments produced which causes the generation of

a torque, leading to the rotation of the driven wheel and the pulley attached to it. Hence, there is an intermittent circular motion in them resulting in the movement of the belt. There are several types of Geneva rotator such as external Geneva rotator, internal Geneva rotator and spherical Geneva rotator. The mechanism that I will be using for the conveyer belt is of an External Geneva rotator in which the rotating drive wheel interacts with the driven wheel externally.

Keywords : Remote Sensor Network, Wireless Sensor Network Framework, WSN, Microcontroller

I. INTRODUCTION

In this section, a comprehensive account of the fundamental materials and equipment used in the fabrication of a mini-conveyer belt using Geneva mechanism is given below:

i) Frame/Stand:

Purpose:

This is the part which bears the load of all other components as they are mounted on it. The frame material must have the capability to endure the load and offer minimum deformation. It will consist of a rectangular base with 6 vertical rectangular columns (one column for the Geneva drive wheel, one for the driven wheel and four for the belt and pulleys to be fixed on).

Material:

Wood (Oak wood) will be used instead of any metal as it is cheaper, lighter in weight yet strong and durable, and if the wirings between motor and drive wheel get exposed and touch the frame, there will be no dangers of getting electric shock.

Design:

Base: 13 mm thick with a cross-section of 600 mm x 400 mm Column: 205 mm tall with a cross-section of 50 x 25 mm

CAD Model :

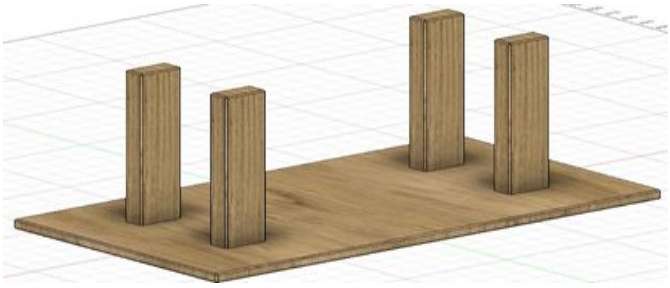

Fig 1

ii) Geneva Mechanism:

It will consist of a Drive Wheel and a Driven wheel.

Purpose:

It will change continuous circular motion into fixed step circular motion. The rest of its mechanism has been explained earlier.

Material:

Wood (Oak wood) will be used. Reasons of preferring wood have been stated earlier.

Design:

The driven wheel has 4 slots. By changing the number of slots, we can alter the time of rotation of the wheel. Rest of the dimensions are discussed later.

CAD MODEL of a simple Geneva Mechanism :

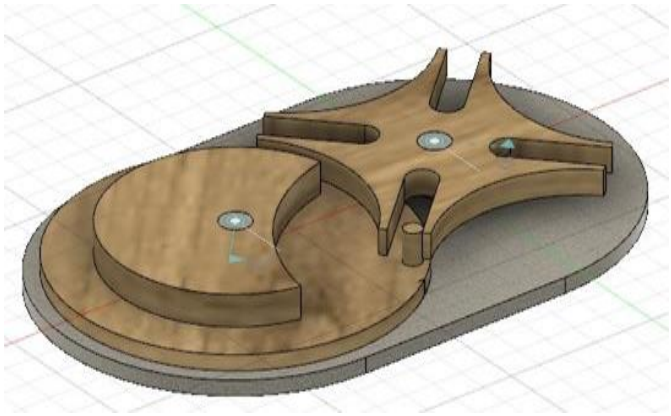

Fig 2

iii) Flat Belts:

Purpose:

It will be used for transporting objects from one location to another.

Material:

Polyurethane Rubber is used in flat belts.

Design:

It is discussed later.

Image:

Black polyurethane belt shown below:

Fig 3

i) Crowned Pulleys:

Purpose:

Flat belt pulleys are used in transmission systems that are driven by flat belts, usually for high-speed and low-power applications. The driven Geneva wheel transmits torque to pulleys which in turn apply kinetic power on the belt. The purpose of a crowned pulley (or tapered pulley) is to assist belt tracking. In most operating conditions, a belt follows the path of highest tension, due to which the diameter of the pulley is greater in the center compared to the ends. Tension on a flat belt is usually established to stretch the belts a little and it is achieved by adjusting the distance between pulleys.

Material:

Mild Steel (polished) is used in pulleys.

Design:

It is discussed later.

CAD MODEL :

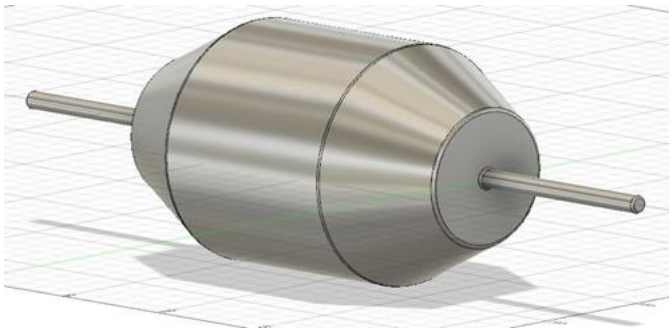

Fig 4

II. LITERATURE SURVEY

P.Kali Sindhur proposed to design a mechanism for cutting by giving intermittent feed. This intermittent feed is given by continuous revolving of circular disk in Geneva mechanism. A design of a belt drive with the help of Geneva mechanism is used for giving feed and gives smooth operation and movement of the feed at required time interval. The feed from Geneva drive was cut by using slotted lever mechanism. It was designed using slider crank mechanism. It is placed orthogonally at the end of the Geneva mechanism and overall analysis is calculated at each link.

David B Dooner wrote about kinematic study of a mechanism incorporating a Geneva wheel and a gear train to achieve intermittent motion. The goal was to eliminate the acceleration jump at the beginning and end of the Geneva wheel motion. An epitrochoidal path replaces the circular path for the driving pin in a classical Geneva wheel drive. The epitrochoidal path is generated using a gear train and results in zero velocity, acceleration, and jerk at the beginning and end of the Geneva wheel motion. It presents a comparison of the position, velocity, acceleration and jerk between the classical Geneva wheel mechanism and this proposed mechanism. Afterwards, the motion of the Geneva wheel is modified by introducing a non-circular gear pair to alter the timing of the epitrochoidal path. The motion of the noncircular gear pair is determined by dropping the extreme jerk of the Geneva wheel.

Han Jiguang Yu Kang wrote that for both inner and outer Geneva mechanism, the kinematics coefficient of the Geneva mechanism is stable if the groove number of the Geneva wheel is a constant. The elliptic crank used as the drive crank of the Geneva wheel is equal to the mechanism which has a variable length and 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 combined Geneva mechanism is put forward based upon the kinematics coefficients. In addition, the calculation method of the extreme kinematics coefficient is proposed, and a design example is also given.

R. C. Johnson also explained how to utilize Geneva wheel into a gear train.

Ji Shun Song, Yong Shi Song describes the different types of Geneva mechanisms; external Geneva mechanism, internal Geneva mechanism and spherical Geneva mechanism.

Utilization of Geneva stop for material inspection has produced numerous advantages to the industries such as reduced labor costs, increased production rates, minimized distances moved between operations, saving time and reducing noise.

E. Sanjay S. Pratheep Kumar explains the use the Geneva conveyer for 'Material Inspection & Noise Reduction'.

III. METHODOLOGY

1. Ensure that main power supply and benchtop DC power supply are switched off while the apparatus is being set up.
2. It should be ensured that the wires being used are not damaged (their insulation is intact) so that there is no risk of electric shock.
3. Do not put extreme loads on the belt so that it does not snap (tearout) or get damaged by friction and heat up.
4. Ensure that no eatables and drinks are placed near the experiment.
5. Ensure that the frame/structure is intact with all fasteners tightenedsufficiently so there is no risk of collapse during operation.
6. Ensure that the pulleys are lubricated sufficiently so that there is a smooth and quiet operation without any risk of damage.
7. Do not apply high values of voltage to the DC motor so that it doesnot get damaged. Adjust the value accordingly.

IV. Working Principle

The working of Geneva mechanism was stated earlier; a continuous rotary motion is converted into the intermittent rotary motion. The 5V DC Motor is connected with the Geneva drive wheel. The voltage of the motor is being monitored and supplied by the benchtop DC power supply. To control the direction of the rotation of motor, without changing the way that the leads are connected, an H-Bridge circuit can be used. An Arduino microcontroller or a regulator (rheostat) can be used to vary the speed of motor. The Geneva drive wheel consists of a pin and the Geneva driven wheel consisting of 4 slots. When Voltage is applied to the motor, it rotates, making the drive wheel rotate as well. When the pin of drive wheel inserts in a slot of the driven wheel, it causes the latter to rotate. The Geneva driven wheel is coupled to a crowned flat belt pulley. When the driven wheel rotates, this pulley also rotates and as the pulley at the other end of the belt is free to rotate as well, motion is induced in the belt. Hence, an object placed on the belt can now be transferred from one position to the other.

CAD MODEL :-

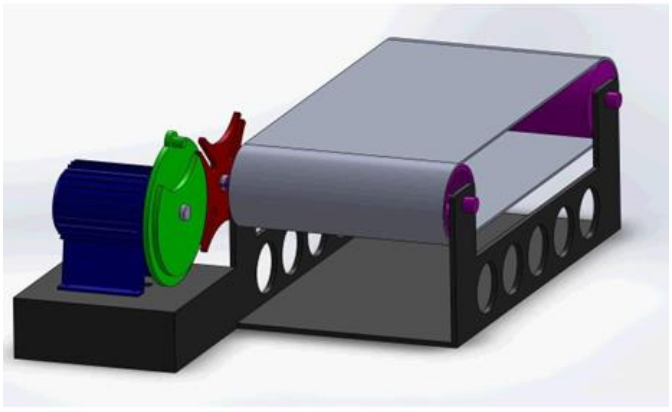

Fig 6

Actual Image:

Fig 7

V. RESULTS AND DISCUSSION

The theoretical values obtained can then be applied practically for the experiment. Some experimental values may slightly differ from theoretical values due to the varying environment/surrounding conditions and the rounding off of values in the theoretical part. By and large, the system would work properly. The Geneva drive pin would smoothly insert in the Geneva driven slot. One of the crowned pulleys will be welded to driven wheel, due to which the pulley will able to rotate along with the driven wheel. The second pulley will be set on the other end of the belt. This results in the movement of the belt which might be a little jerky so proper lubrication between pulleys and belt should be ensured.

Following are the advantages of Geneva Mechanism Conveyor Belt:

i) Available in a wide variety of sizes

ii) Maintains good control of its load at all times

iii) Minimal wear and tear leading to a long life span

iv) Cheap cost

However, there are some drawbacks:

i) Difficult to change timing once design is finalized

ii) Not a versatile mechanism

iii) Once the number of dwells per revolution has been selected, the ratio of dwell period to motion is also established.

iv) All Geneva acceleration curves start and end with finite acceleration & deceleration which means they produce jerk

VI.CONCLUSION

In this monitoring and management for green environment.

Cite this article as :

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