Design and Fabrication of Automatic Water Filling Machine using Geneva Mechanism

Velmurugan M[1], Gopinath K[2], Ramprasanna M [3], Hariprasath R[4]
[1]*Assistant Professor, Dept of Mechanical Engineering, Krishnasamy College of Engineering and Technology, Cuddalore*
[2,3,4] *UG Scholar, Krishnasamy College of Engineering and Technology, Cuddalore*

***Abstract*- The main objective of our project is to fill water automatically by using Geneva mechanism. Geneva or Maltese cross mechanism is an indexing mechanism that converts continuous motion into intermittent motion. In our project we are using modified six slotted Geneva drive to fill water automatically without the usage of sensor. The rotating drive wheel is usually equipped with a pin that reaches into a slot located in the driven wheel. The driven wheel or Geneva drive consist of six slot that advances it by one step at a time. This mechanism is to control the rotating table slowly. And the cam is used to control the flow on & off of water automatically instead of using sensors. Geneva drive and cam are connected in the same shaft to obtain the process efficiently. Finally the rotating table which contains the water bottle container which receives the water at a periodic time without any usage of sensor.**

Index Terms- Geneva mechanism, Sensors, Modified Six Slotted Geneva, Intermittent Motion.

1. INTRODUCTION

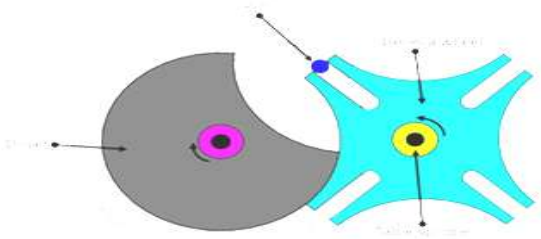


FIGURE 1.1 GENEVA DRIVE

The Geneva drive is a gear mechanism that translates a continuous rotation into intermittent motion. The main wheel also has an elevated circular blocking disc that "locks" the rotating driven wheel in position between steps. In the most common arrangement of the Geneva drive, the client wheel has four slots and thus advances the drive by one step at a time (each step being 90 degrees) for each full rotation of the master wheel. If the steered wheel has n slots, it advances by 360°/n per full rotation of the propeller wheel.

The driven wheel always under a full control of the driver wheel. It can be reduced by designing the pin. The main parts of geneva wheel is driver wheel & driven wheel. Driver wheel is one which is connected to the power source in case of driver wheel the power source may be motors. Like that power source varies with type of applications. Driven wheel is one which is meshed with the driver wheel. Driven wheel rotates with the help of the power source connected to the driver wheel .Driven wheel should be at same module with the driver wheel irrespective of number of slots. The main application of the Geneva drive is in film movie projectors and movie cameras, where the film is pulled through an exposure gate with periodic starts and stops.

2. DESIGN & CALCULATIONS

2.1 DESIGN SOFTWARE-CREO PERAMETRIC 2.0

We used Creo as designing software to design Geneva mechanism. Creo is a family or suite of Computer-aided design (CAD) apps supporting product design for discrete manufacturers and is developed by PTC. The suite consists of apps, each delivering a distinct set of capabilities for a user role within product development. Geneva wheel geomentry is shown below.

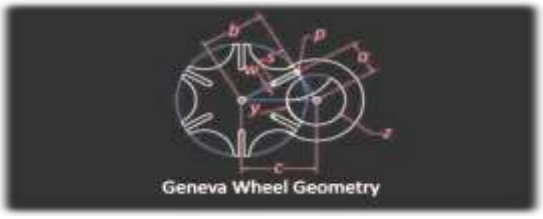


FIGURE 2.1GENEVA WHEEL GEOMENTRY

2.3 FORMULA USED

1. c = Centre distance
   = a/sin(180/n)
2. b = Geneva wheel radius
   = √c2-a2
3. s = Slot center length
   = (a + b)-c
4. w = Slot width
   =(p+t)
5. y = stop arc radius
   = a - (p *1.5)
6. v = Clearance arc
   = b z/a
7. z = Stop disc radius
   = y-t

2.4 DESIGN CALCULATION FOR GENEVA MECHANISM

a = drive crank radius = 86.60mm
n = driven slot quantity = 6
p = drive pin diameter = 20mm
t = allowed clearance = 1.5mm
c = Centre distance
= a/sin(180/n)
=173.21mm
b = Geneva wheel radius
=√c2-a2
=150mm
s = Slot center length
= (a + b)-c
= 63.40mm
W = Slot width
= (p + t)
= 21.50mm
y = Stop arc radius
= a - (p *1.5)
= 56.60mm
V = Clearance arc
= b z/a
= 95.44
z = Stop disc radius
= y-t = 55.10

2.5 DESIGN OF GENEVA MECHANISM

FIGURE 2.2 GENEVA WHEEL 3D DESIGN

FIGURE 2.3GENEVA WHEL 2D DESIGN

2.6 DESIGN OF DRIVER WHEEL

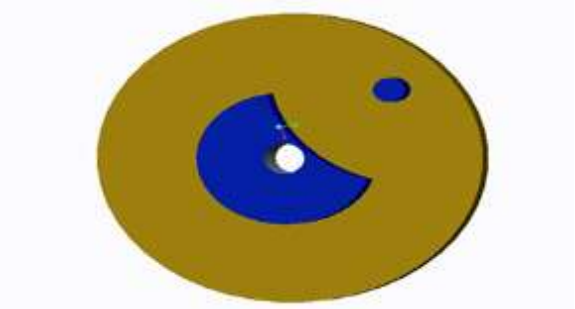


FIGURE 2.4 DRIVER WHEEL 3D DESIGN

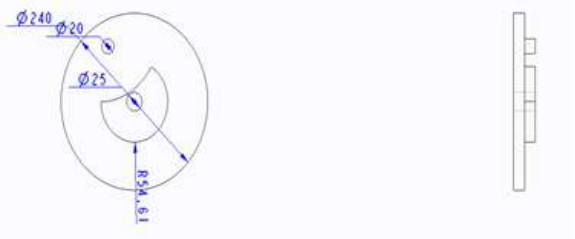


FIGURE 2.5 DRIVER WHEEL 2D DESIGN

2.6 DESIGN OF CAM

FIGURE 2.6 DESIGN VIEW OF CAM

Inner Diameter=25mm & Radius of Arc 4mm

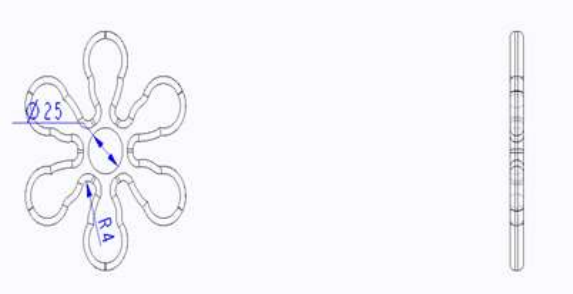


FIGURE 2.7 CAM 2D DESIGN

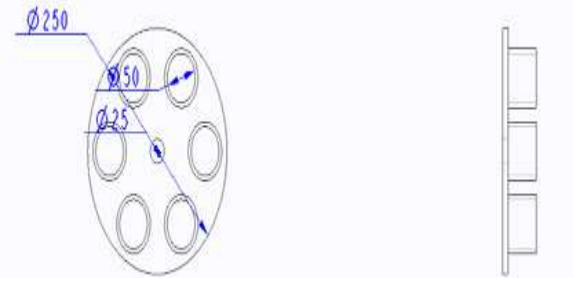
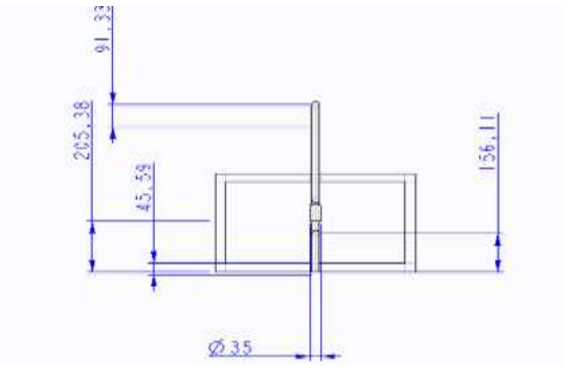


FIGURE 2.9 ROTATING TABLE 2D DESIGN



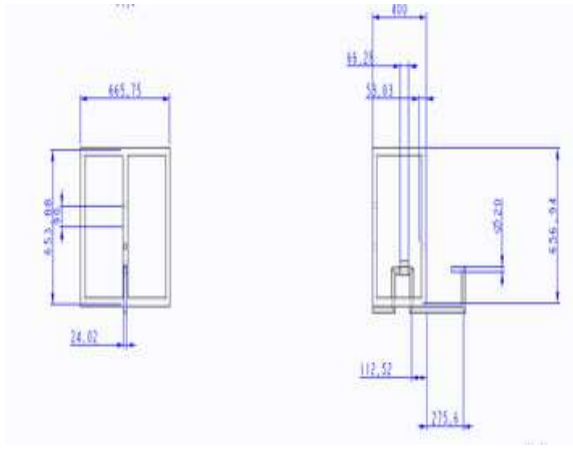


FIGURE 2.10 FRAME 2D DESIGN

2.8 ASSEMBLY DESIGN

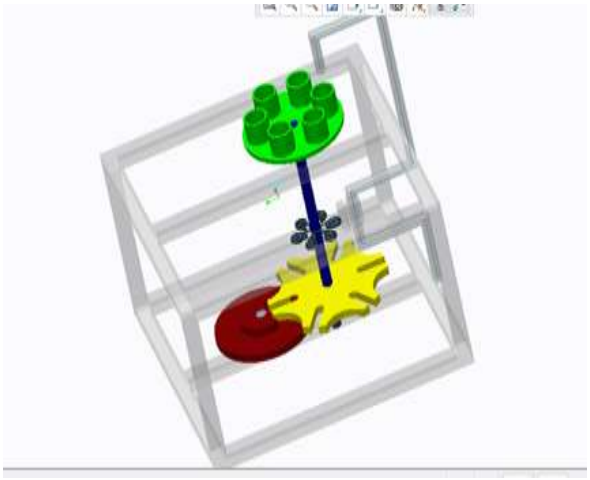


FIGURE 3.15 ASSEMBLY DESIGN

MACHINING OF GENEVA MECHANISM

For making the Geneva mechanism the best material is mild steel. We used a mild steel of 18mm thickness and we want to cut the Geneva wheel and driver wheel. So we used laser cutting process for getting a smooth surface finish and for accuracy.

FIGURE 3.1 GENEVA DRIVE

FIGURE 3.2 DRIVER WHEEL

3.1 LASER CUTTING

Laser cutting is a technology that uses a laser to cut materials, and is typically used for industrial manufacturing applications, but is also starting to be used by schools, small businesses, and hobbyists. Laser cutting works by directing the output of a high-power laser most commonly through optics. The laser optics and CNC (computer numerical control) are used to direct the material or the laser beam generated.

3.2 ASSEMBLY

The Geneva wheel, cam and rotating table are connected in the single shaft to give the turning moment for the cam and the rotating table. It occurs when the driven wheel moves by the force of the driving wheel. The driver wheel and the pulley are connected to another small shaft. Various components are used to fabricate this mechanism.

The two bearings are attached to the center of the frame and it is placed at a distance of 173.3mm between the driver wheel The primary shaft with the Geneva wheel, cam and rotating table are placed at the second bearing then the secondary shaft with the drive wheel and pulley are placed at the first bearing the pin of the driver wheel is must connects the Geneva wheel slot. Then the upper part (c-shaped structure) of the driver wheel is must be face the bottom of the Geneva wheel.

The flow of water must be strike the any one of the holder at the time so the pipe whose flow the water are placed to the nearer and center of the water bottle holder.

The motor is placed at on the bottom of the frame it is connected to the driver wheel by pulley with help of the belt and the tension of the belt. The pressing tap is mounted nearer to the cam to cut off and flow on of the water.

To control the speed of the motor the voltage is reduced by the auto transformer, so the autotransformer is also connected to the motor. And the entire design was shown in design chapter.

Photographic view of mechanism

4. CONCLUSION

1. The main of our work is design and fabricate the Geneva mechanism to fill the water automatically without usage of sensor.
2. Using designing software CREO it easily designed and shown clearly.
3. The main modification is four slot Geneva drive is converted into six slot Geneva drive.
4. It is the easiest and economic method to produce an automatic filling machine.
5. It is one of the best method used to water refilling in commercial oriented work without using sensors.

REFERENCE

[1] US: Jet propulsion laboratory, Nasa. Christopher Russell; Carol Raymond (2012).
[2] The Dawn Mission to Minor Planets 4 Vesta and 1 Ceres. Springer.
[3] Bickford, John H. (1972). "Geneva Mechanisms". Mechanisms for intermittent motion.
[4] Design and fabrication of Geneva conveyor for material inspection & noisereduction.Sanjay,S.PratheepKumar,P.RanjithKumar,S.NandhaKumar,M.Mohamed Ajmal Mahasin
[5] Design and analysis of Geneva mechanism with curved slots. : Sunil H V(1), Ankit Yadav(2), Shivu L(3), Santosh Choudri(4)
[6] Design of Geneva wheel based auto-roll punching machine. R. Syam Sudhakar Rao(1), A. Hari Tej(2), C. Siva Sai(3), A. Rupesh Kumar(4), A. Narayana Reddy(5), B. Sai Krishna(6)
[7] Automatic paper cutting machine using Geneva mechanism. Jung-Fa Hsieh Department of Mechanical Engineering, Far East University, Tainan, Taiwan.