Analysis of the Application Of Geneva Mechanism In Packaging Machine For Timing And Indexing Mechanisms

Visveshwar Nagarajan
Department of Mechanical Engineering
SSN College of Engineering

Abstract-*Geneva mechanism is similar to a cam mechanism, which provides sporadic rotary and commonly used for low speed, high torque applications. Its indigenous application in watches was as a stop which prevent the over winding. It is now commonly used for automatic indexing mechanisms such as turret and spindles and projectors for providing an intermittent picture advances in a movie. This paper deals with the application of Geneva mechanism in a packaging machine for the timing and indexing mechanisms. A double Geneva mechanism actuated by textile belts, is used for constant interval motion for packaging operation. One of the driven wheel is coupled to the conveyor roller and the other to the rollers for plastic spewing. The exercise of this mechanism in the packaging machine proved to be successful and can be used under various working conditions.*

Keywords-Timing mechanism, Indexing Mechanism, Packaging Machine, Transmission system

I. INTRODUCTION

The design and fabrication of conventional double Geneva mechanism is characteristically straightforward as its assembly consists of a crank or a rotating drive wheel with a pin and driven wheels with straight slots. This timing and indexing mechanism has a wide range of applications such as weaving looms, film projections, mechanized packaging, precision measurement and printing machinery [1].

When the roller pin enters and exits the slots, there is a surge in the impact load during the beginning and the end of the operation. Hence, the application is limited to low speed operations and in those applications where resulting noise and vibrations wont have any significance [2].

Several researchers have proposed the application of Geneva mechanism for indexing. R.G.Fenton [3] has presented a double Geneva wheel mechanism, which is used to convert uniform rotary motion to an intermittent rotary motion. The mechanism is uncomplicated and the kinematic characteristics were amicable. Further, problem of impact and shock loads are eliminated by this mechanism. Kusekar Sambhaji K[4] has elucidated the usage of Geneva mechanism for bottle indexing and filling mechanism. By using the mechanism, the rate of filling and the overall efficiency were increased multi fold. This gives a picture on application of Geneva mechanism in an indexing system.

Based on several research works on usage of Geneva mechanism for indexing and timing mechanisms, it was incorporated for a packaging machine. This paper explains about the structure of the packaging machine setup and the testing of Geneva drives for its application in the same.

II. WORKING

A small motor is used to drive the machine. This motor is coupled to the main shaft. The motor is used only for providing the required initial power to start the operation. A flywheel is attached across the main shaft. Its sole purpose is to store the excess energy and supply it to the shaft as and when required. It is this shaft, which is responsible for driving all other mechanisms.

The hopper is designed in the shape of rectangular prism with varying cross-section area (when viewed along the axis). The powder and small grains, which are to be packed using this machine, are stored in this hopper before they are allowed to flow to the conveyor belt. The hopper is provided with an actuating lever to regulate the flow of the material. Conveyor belt guides the material to the packaging section.

Quantification of material is done at this section. Power from motor is given to the main shaft, which is responsible for driving the conveyor belt. The conveyor is driven my two rollers; one of the rollers is stationary or idle while the other receives power from the driving shaft and in turn rotates the conveyor belt. A pulley and it's subsequent belt drive is used to transmit power from the driver to the driven shaft.

A Geneva mechanism is connected to the conveyor belt for obtaining the quantification by providing the rotation only at calculated regular intervals and executing the sealing

operation on a timely basis. This is used to trigger the sealing operation only at specific intervals, after the material is filled into the packet. The packets in which the materials are to be filled are fixed as rolls over the roller axle. The main driving shaft drives these roller axles. The flow of sheets for packets is continuously flowed. It flows over the packet profile for obtaining the required shape.

The packet profile is suitably chosen based upon the packet size requirement. A funnel connected to a pipe takes the material to sealing section. The packets are sealed using cam mechanisms whose timings are calculated and operates only after the required amount of material is filled into the packet. A horizontal shaft support is provided to house the camshaft. There are two sealing operations. One is the vertical continuous sealing, and other is horizontal sealing, which is done on a timely basis.

So, for every packet, there are three seals: one is the vertical seal by the continuously operating sealer and other two are by the horizontal sealer, one before filling and other is after filling.

III. SETUP

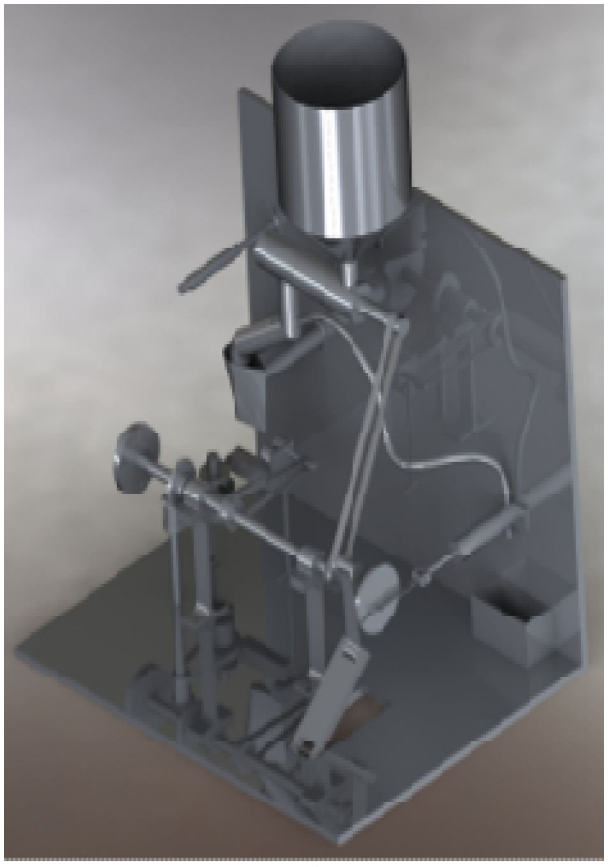


Figure 1 SETUP

III. GENEVA MECHANISM IN PACKAGING MACHINE

Specification of Geneva Mechanism used in the Packaging Machine

Number of Slots	4
Radius of Crank	50 mm
Distance between centres of Crank and Geneva Wheel	80 mm
Outer Radius of Geneva Wheel	60 mm
Slot Width	10 mm
Length of Slot	25 mm
Shaft Diameter	15 mm

Manufacturing of Geneva Mechanism:

The manufacturing process began with the turning operation of a mild steel plate to the set external dimensions. For reference, punching on the mild steel plate marks the profile. The plate was then set in an indexing milling machine and the profile made by the punching was milled to the required dimensions. The milling operation is continued for making the slots. Similarly, locking wheel was milled and fabricated based on the required dimensions. Turning operation processed other components. The pin was fitted at a distance of 5 cm from the centre of the crank. The shafts were turned into suitable dimensions considering the factor of safety. Drilling was done at steps from 5 mm to 15 mm for making the center holes.

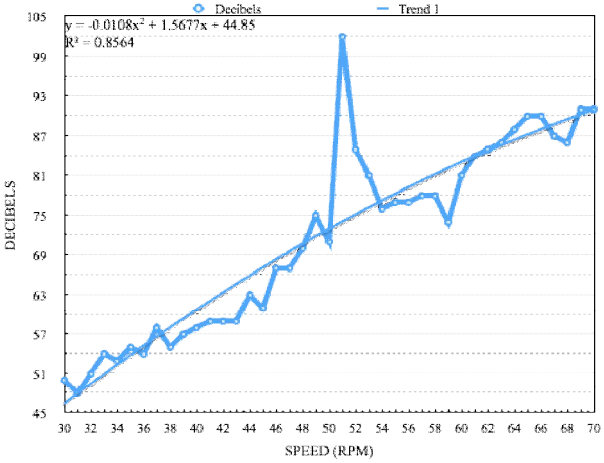
Components Manufactured

Geneva Wheel	2
Locking Wheel	2
Shaft pins	2
Crank pin	1
Spacing Blocks	2
Dowel pin	4
Holding bars	2

Figure 2 GENEVA MECHANISM

Speed Vs. Noise

The Speed Noise characteristics were obtained for studying the optimum working conditions of the Geneva Machine in the packaging machine. The speed was measured using a non-contact Tachometer and the Decibel was measured using the software decibel reader. The sudden peak in decibels in the middle was due to the frequency equivalence between the rotating wheel and the material.



IV. CONCLUSION

Based on the above analysis and experimentation, the application of the Geneva mechanism in a Packaging machine was found to be successful for low speed operating conditions. The timing of the conveyor roller and plastic spewing were complementary and the required torque for moving the respective actions was attained. For varying the timing, the diameters of the cylinders attached to the driven wheels are changed according to the requirement.

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