Design and Manufacturing of Geneva Mechanism

Prof. Ravikiran V Aadat[1], Mr. Akshay A. Thorat[2], Mr. Vaibhav N. Pawar[3], Mr. Aniket D. Pawar[4]
[1]*Assistant Professor, Mechanical Engineering, SMSMPITR AKLUJ (MS).*
[2,3,4]*B Tech Students, Mechanical Engineering, SMSMPITR AKLUJ (MS).*

***Abstract*—The Geneva mechanism is a widely used mechanical indexing device that converts continuous rotary motion into intermittent rotary motion. Due to its simplicity, accuracy, and reliability, it is extensively employed in automated production systems, packaging equipment, indexing tables, and machine tools. This paper presents the design, manufacturing, and performance evaluation of a Geneva mechanism developed for intermittent motion applications. The mechanism was designed using standard machine design principles and fabricated using conventional manufacturing processes. The developed prototype successfully demonstrated precise indexing motion with minimal operational errors. The study highlights the design methodology, material selection, manufacturing process, assembly procedure, and experimental observations. The results indicate that the Geneva mechanism offers an economical and efficient solution for controlled intermittent motion in industrial applications.**

***Index Terms*—Geneva Mechanism, Indexing Drive, Intermittent Motion, Manufacturing, Mechanical Design, Automation.**

I. INTRODUCTION

Modern manufacturing industries require mechanisms capable of converting continuous motion into accurately controlled intermittent motion. Such motion is essential in assembly lines, packaging systems, machine tools, and automated production equipment. Among various indexing mechanisms, the Geneva mechanism remains one of the most reliable and economical solutions.

The Geneva mechanism consists of a continuously rotating driver wheel fitted with a pin and a driven wheel containing radial slots. During operation, the pin engages the slots and rotates the driven wheel through a predetermined angle. Between engagements, the driven wheel remains stationary, creating the desired intermittent motion.

The objective of this work is to design, manufacture, and evaluate a Geneva mechanism capable of providing accurate indexing motion while maintaining simplicity and low manufacturing cost.

II. OBJECTIVES

The major objectives of the project are:

- To design a Geneva mechanism for intermittent rotary motion.
- To select suitable materials for fabrication.
- To manufacture the mechanism using standard machining operations.
- To analyze the performance of the developed prototype.
- To study the practical applications of indexing mechanisms in automation.

III. DESIGN METHODOLOGY

The design process was carried out systematically to achieve smooth operation and reliable indexing performance.

3.1 Selection of Number of Slots

A six-slot Geneva wheel was selected to obtain an indexing angle of 60° per cycle. This configuration provides adequate dwell time and smooth operation.

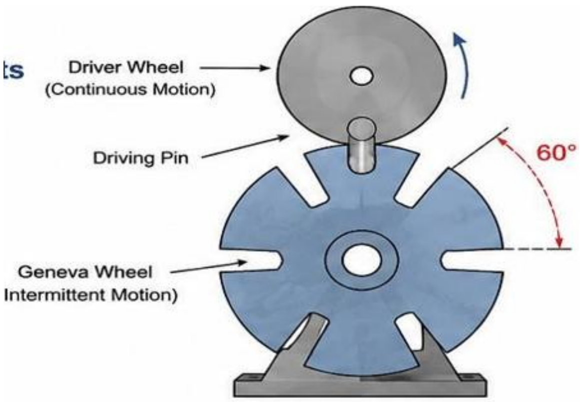
The indexing angle is determined by:

$$\Theta = \frac{360o}{N}$$

Where:

θ = Indexing angle

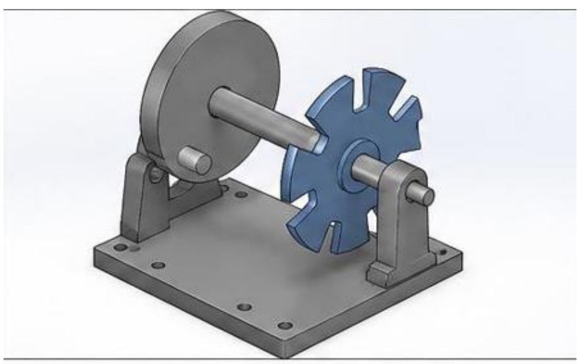
N = Number of slots



3.2 Material Selection

The materials were selected considering strength, machinability, wear resistance, and cost.

Component	Material
Driver Wheel	Mild Steel
Geneva Wheel	Mild Steel
Shaft	EN8 Steel
Pin	Hardened Steel
Base Frame	Mild Steel



Complete Assembly

3.3 CAD Modeling

The complete assembly was modeled using CAD software to verify dimensions and ensure proper engagement between the driver pin and Geneva wheel slots.

IV. MANUFACTURING PROCESS

The fabrication process involved several machining and assembly operations.

Material Preparation: Raw materials were cut according to design dimensions using power hacksaw and cutting machines.

Turning Operations

Lathe operations were performed to manufacture:

- Driver wheel
- Shafts
- Bushes
- Mounting components

Milling Operations: The slots of the Geneva wheel were accurately machined using a vertical milling machine.

Drilling and Finishing: Holes for shaft mounting and fastening were drilled and reamed. Surface finishing operations were carried out to improve dimensional accuracy.

Assembly: All components were assembled on a rigid base frame. Bearings were installed to minimize friction and ensure smooth rotation.

V. EXPERIMENTAL SETUP

The fabricated Geneva mechanism was tested under various operating conditions.

Test Parameters

- Motor Speed: 60–150 rpm
- Number of Slots: 6
- Indexing Angle: 60°
- Load Condition: No-load and moderate-load The system was operated continuously and observations were recorded.

VI. RESULTS AND DISCUSSION

The fabricated Geneva mechanism successfully achieved intermittent rotary motion as intended.

Performance Observation

Parameter	Observed Value
Number of Slots	6

Indexing Angle	60°
Driver Rotation	Continuous
Geneva Wheel Motion	Intermittent
Positioning Accuracy	Good
Operational Stability	Satisfactory

The mechanism produced accurate indexing motion with consistent positioning at each cycle.

Motion Analysis: The driven wheel remained stationary during the dwell period and rotated only when the driving pin engaged the slot. This behavior confirms the successful conversion of continuous motion into intermittent motion.

Manufacturing Accuracy: The accuracy of slot machining significantly affected indexing performance. Proper alignment between the driver pin and slots reduced vibration and impact loading.

Cost Analysis: The project was fabricated using locally available materials and conventional machine tools. As a result, the overall manufacturing cost remained economical compared to commercially available indexing systems.

Advantages Observed
- Smooth intermittent motion
- Accurate indexing
- Simple construction
- Easy maintenance
- Low manufacturing cost
- Reliable operation

VII. APPLICATIONS

The developed Geneva mechanism can be used in:
- Packaging machines
- Rotary indexing tables
- Conveyor systems
- Pharmaceutical machinery
- Automated assembly lines
- Printing machines
- Material handling equipment
- Food processing industries

VIII. CONCLUSION

The design and manufacturing of the Geneva mechanism were successfully completed. The fabricated prototype demonstrated effective conversion of continuous rotary motion into precise intermittent rotary motion. Experimental observations confirmed accurate indexing performance, smooth operation, and satisfactory mechanical reliability. The mechanism proved to be cost-effective, easy to manufacture, and suitable for various industrial automation applications. The project successfully achieved all design objectives and demonstrated the practical importance of indexing mechanisms in modern manufacturing systems.

FUTURE SCOPE

Future improvements may include:
- CNC-machined precision components
- Integration with servo motors
- Automated speed control systems
- Wear-resistant surface coatings
- Sensor-based position monitoring
- Lightweight composite materials

These enhancements can improve efficiency, accuracy, and operational life for advanced industrial applications.

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