

# Fabrication of Auto Roll Punching Machine

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**Abstract**— This paper presents the concept of Auto roll punching machine mainly carried out for production based industries. Industries are basically meant for Production of useful goods and services at low production cost, machinery cost and low inventory cost. Today in this world every task have been made quicker and fast due to technology advancement but this advancement also demands huge investments and expenditure, every industry desires to make high productivity rate maintaining the quality and standard of the product at low average cost, but still we are using a separate machines for separate operations. This is a time and power consuming process, it need maintenance as well as more space.

Our project is to overcome above listed problems. In our project two operation are built as a one machine tool i.e. punching and feeding of work materials

In auto roll punching machine consists of two sections. One is automatic feeding mechanism and the second section is punching section. The first section consists of Geneva wheel disc keyed with a shaft at one end and the other end is connected with chain sprocket wheel. This sprocket wheel transmits the rotary motion from the Geneva wheel to the metal sheet feeding rollers through a chain drive. Hence, when the Geneva wheel is rotated. So, the metal sheet also moved for punching operation.

**Keywords**—Geneva Mechanism, Gear Box, Punching Ram, Feeding Rollers.

## I. INTRODUCTION

Industries are basically meant for production of useful goods and services at low production cost, machinery cost and low inventory cost. Today in this world every task have been made quicker and fast due to technology advancement but this advancement also demands huge investments and expenditure, every industry desires to make high productivity rate maintaining the quality and standard of the product at low average cost. In an industry a considerable portion of investment is being made for machinery installation. So in this paper we have proposed a machine which can perform operations like Punching, Automatic feeding operations simultaneously which implies that industrialist have not to pay for machine performing above tasks individually for operating operation simultaneously. Economics of manufacturing: According to some economists,

manufacturing is a wealth-producing sector of an economy, whereas a service sector tends to be wealth-consuming. Emerging technologies have provided some new growth in advanced manufacturing employment opportunities in the Manufacturing Belt. Manufacturing provides important materials support for national infrastructure and for national defence.

## I. OVER VIEW OF PUNCHING MACHINE

Punching Machine is one of the principle machines in paper cutting industry & sheet metal industry. It is mainly used as the name indicates to cut strips. So we are going to make a machine for “PUNCHING INDUSTRIES” and make it multipurpose & should be used to cut the card board, asbestos sheets, papers, foam, thin plastic sheets. The machine is simple to maintain, easy to operate. Hence we tried our hands on “automatic punching machine.” Automatic punching machine is working on the principle of Geneva mechanism. This type of punching machine is used to punch basically card board, asbestos, sheets, papers, foam, and thin plastic sheets. Punching is depend on feed rate which done manually.

## PROBLEMS IDENTIFICATIONS

- 1). In manual punching machine, the job is to be marked before punching operation.
- 2). The entire process takes more time for making Series of punching operation.
- 3). In this project Geneva wheel is intermittent drive, the job is feeding automatically during the return stroke of punching operation.

## SCOPE OF OUR PROJECT

- 1). Operation is very smooth and in this system we can get more output by applying less effort.
- 2). Simple construction by Geneva wheel disc drive transmission.
- 3). The job is feeded automatically.

- 4). Low cost automation.
- 5). Less maintenance.

## II. LITERATURE REVIEW

Kundan Kumar explained this project we are fabricating Automatic roll punching machine. This project is specially designed for automatic punching in work piece. This project is to introduce automation in industries. The major components involved in this project are dc motor, CAM arrangement, conveyor arrangement and punching tool. In this project we are using two rollers, for winding and unwinding the sheet during operation. A DC motor is connected with the winding roller. A chain driver is used to transmit the power from the motor to the punching tool. The sprocket connected with the punching tool has CAM arrangement. The CAM arrangement is to convert the rotary motion of the chain drive to linear motion. The CAM provides the linear movement to the punching tool, the punching tool moves through the guide provided. After placing the work piece in the roller, the motor will be switched ON. As the motor rotates the winding roller connected to it also rotates, providing the required movement for the work piece. The CAM also starts working and the punching operation will be done automatically with equal intervals.

Ujammiven the Manual washing of beverage bottles does not give the desired productivity requirement of industrial setting and in the effort to reduce the environmental impact of waste from industrial production, there is an increasing deeply felt need to recover empty glass and plastic containers. This paper therefore aims at developing a Rig (Geneva Mechanism) for bottle washing in a typical brewery or beverage industry. A test rig was designed, fabricated and employed for a performance evaluation. The rig operates on the intermittent rotary motion from a four slot external Geneva Mechanism and requires manual loading and unloading of bottles. The bottles are loaded on subsequent indexing part of the rotating table and are washed one after another. The analysis of design gave the following results: Centrifugal force on the driven pulley (FR) = 0.158N; Bearing reaction at an end, B, RB = 403.42N; Bearing reaction at an end, C, RC = -152.42N; Radial load due to inertia of driver, FR = 20.90N; Axial load due to weight of Pulley, Wa = 61.70N; Equivalent dynamic load on the bearing, We = 349.31N; Bearing load capacity, WC = 2306.80N. These forces were related to generate shear force and bending moment diagrams. This work presents a practical application of Geneva mechanism for worktable indexing and bottle washing.

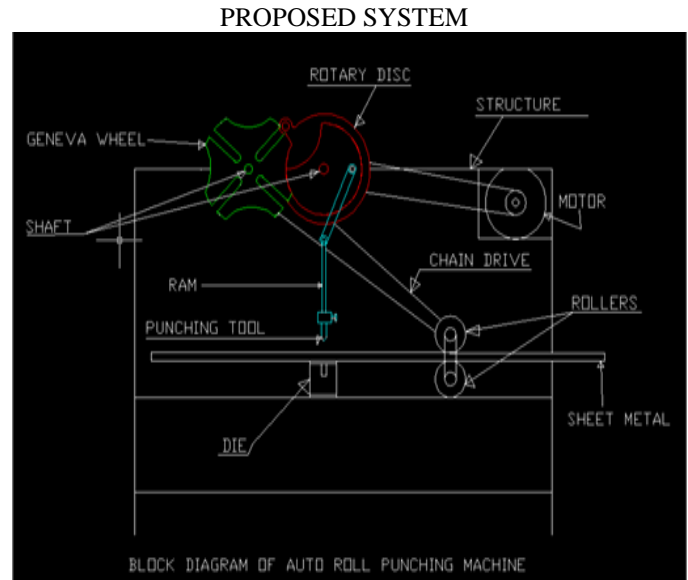


Figure 1 proposed system

Auto roll punching machine consists of Motor, gear box (to reduce speed), Geneva mechanism (rotary disc and Geneva wheel with the correct dimensions), Punching ram (universal joint, flat metal and stripper to guide the ram), Belts and pulleys, chain and sprockets and rollers (to pass sheet metal).

The rotary disc faces have a pin which touches the slot in the Geneva wheel and also rotates the Geneva wheel. Due to the rotation of rotary disc the punch will slide up and down. Due to the rotation of a Geneva wheel, the metal sheet feeding rollers are rotated by the chain drive mechanism and hence the metal sheet is fed automatically.

## ADVANTAGES

- 1) job setting time is reduced.
- 2) Mass production is increased.
- 3) Less automation cost.

## III. IMPLIMENTATION

Basic components of Auto roll punching machine is as follow

1. Motor: In any electric motor, function is based on simple electromagnetism. A current-carrying conductor generate a magnetic field; when it is placed in an outer magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the outer magnetic field.



Figure 2 AC motor

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 intended to harness the magnetic interaction among a current-carrying conductor and an external magnetic field to generate rotational motion.

2. Gear box: Worm drive can reduce the rotational speed or transmit higher torque. The image shows the section of gear box with a worm gear driven by a worm. A 60 tooth worm gear reduces the speed by the ratio of 60:1

It is a special case of spiral gears in which angle between the two axes is generally right angle. The smaller of the two gears is called worm which has large spiral angle.

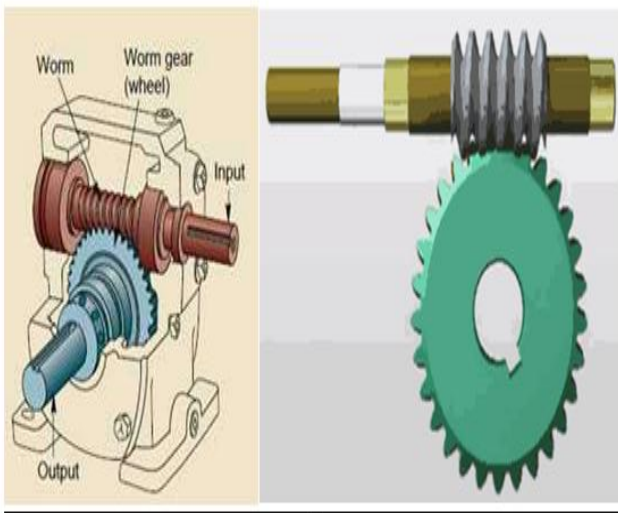


Figure 3 gear box mechanism

3. Geneva mechanism: Geneva mechanism is a simple and widely used timing mechanism that provides intermittent motion from a continuously rotating input. It consists of a rotating drive wheel (Driver) with a pin that reaches into a slot of the driven wheel (Geneva wheel) advancing it by one step.



Figure 4 Geneva mechanism in metal plates

They are cheaper than cams, have good motion curve characteristics compared to ratchets and maintain good control of its load at all times. In addition, if properly sized to the load, the mechanism generally exhibits very long life.

A mechanism that transform a continuous rotation into an intermittent rotary motion, using an intermittent gear where the drive wheel has a pin that reach 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.

Geneva mechanism, is otherwise called as Geneva Stop, one of the most commonly used devices for producing intermittent rotary motion, characterized by alternating periods of motion and rest with no reversal in direction. It is also used for indexing (i.e., rotating a shaft through a prescribed angle). The driver carries a pin that fits in the four radial holes in the Geneva. Between the slots there are four concave surfaces that fit the surface on the driver and serve up to keep the Geneva from rotating when they are fully engaged. In the position shown, the pin is toward the inside one of the slots, and, on further rotation of the driver, it will shift into the hole and rotate the follower through 90°. After the pin leaves the slot, the driver will rotate through 270° while the Geneva dwells—i.e., stands still. The lowest practical number of holes in a Geneva mechanism is 3; more than 18 are seldom used. If one of the hole positions is uncut, the number of turns that the driver can make is limited.

4. **Punching ram:** Punching is performed by moving the sheet metal between the top and bottom tools of a punch. The top tool (punch) mates with the bottom tool (die), cutting a simple shape (e.g. a square, circle, or hexagon) from the sheet by using punching ram and die.



Figure 5 punching ram

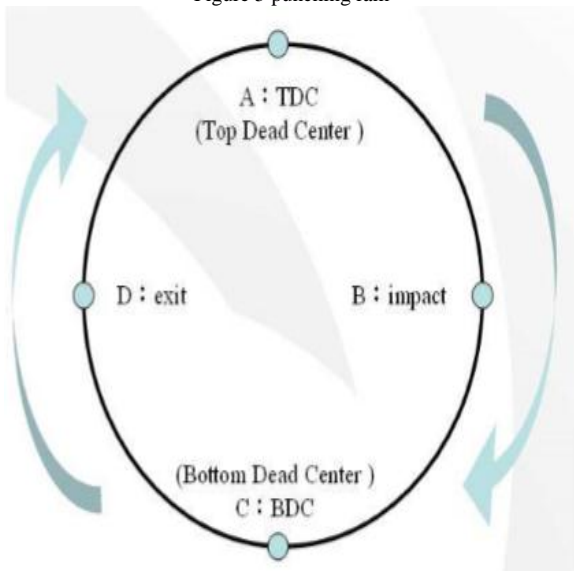


Figure 6 principle of ram working

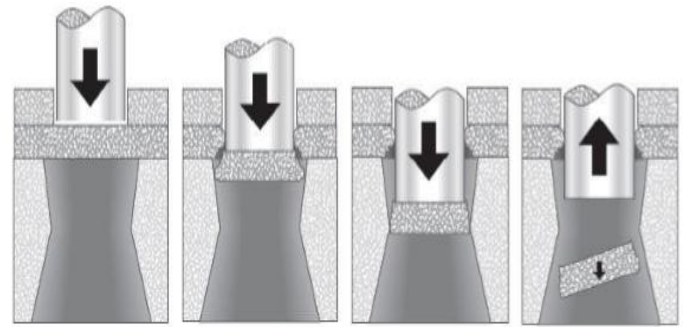


Figure 7 punching process

5. **Feeding rollers:** Rollers means a cylinder that rotates about a central axis and is used in various machines and device to move flatten or spread something. The two rollers used in Auto roll punching machine are driving and driven roller. Driving rollers are rollers or cylinders upon which something is rolled along.



Figure 8 feeding rollers

#### Working of rollers

1) Feeding mechanism consists of two sprockets, chain drive, and two rollers.

2) One sprocket is placed in Geneva wheel shaft, another shaft is placed in roller shaft and both the sprockets are engaged with chain drive.

3) Due to the intermittent rotation of Geneva wheel the rotational power is transmitted with the help of chains & sprockets to the one of feeding rollers. Hence, the sheet metal will be feeded.

#### WORKING OF ARPM

Auto roll punching machine consists of Motor, gear box (to reduce speed), Geneva mechanism (rotary disc and Geneva wheel with the correct dimensions), Punching ram(universal joint, flat metal and stripper to guide the ram), Belts and pulleys, chain and sprockets and rollers(to pass sheet metal).



Figure 9 working of ARPM

When the switch is ON, the motor rotates the gear box. The gear box is connected to the rotary disc with the help of belt. Hence, the punching slide with punching tool moved up and down and makes a punch on the metal sheet.

The rotary disc faces have a pin which touches the slot in the Geneva wheel and also rotates the Geneva wheel. Due to the rotation of a feeding Geneva wheel, the metal sheet rollers are rotated by the chain drive mechanism and hence the metal sheet is feeded automatically.

So, at last the sheet metal is feeded and punched automatically. By this we reduced the power consumption, less floor area and less automation cost.

#### 4. EXPERIMENTATION

Testing have been conducted for different sheet metal thicknesses and the results are as follows

Table Evaluation of various thicknesses of sheet metals

s.no	Thickness of sheet metals In (mm)	Rotating speed of rotary disc In (RPM)
1	1	1040
2	2	920
3	3	800

Table Evaluation of punching

s.no	Thickness of sheet metals in mm	Punches per minutes
1	1	30
2	2	22
3	3	15

The distance between two punches is 2cm

#### Advantages

- Job setting time is reduced.
- Production is increased.
- Less cost of automation.
- Less maintenance.
- Skilled labour is not required.
- Both punching and feeding operations are done simultaneously.
- The distance between two holes is equal.

#### Disadvantages

- Designing and arrangement of Geneva wheel is complicated.
- While performing operation it produces noise.
- It is used only in small scale industries.

#### Applications:

- Auto mobile industries.
- Aerospace industries.
- Kitchen applications.
- Mass production of sheet metal components.

#### CONCLUSIONS

The project carried out by us is very much useful in the field of small scale industries. It is also useful for the workers to carry out a number of operations in a single machine. Our project is to ultimately reduce the power consumption and manufacturing cost and also to reduce the floor space.

This project has a very good scope in the future because we are combining two machining operations such as punching and feeding of metal in a single module. It ultimately reduces the power consumption and occupies less floor area and also portable. Compared to the individual machining operations this combination of various operations into a single machine, ultimately reduces the overall budget.

This kind of Machines is mostly suited for the small-scale industries. The following operations also possible by ARPM,

- Piercing
- Blanking
- Bending
- Forming
- Drawing

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